July 6, 1973

Dr. Joseph Nelson Department of Zoology University of Alberta Edmonton, Alberta, CANADA

Jul

Dear Joe:

Thank you for the recent reprints. I can provide you some additional abservations on hybrids between white and longnose suckers. In Colo., both species are naturally sympatric in the Platte and Arkansas drainages of the Missouri basin. Both species are now well established in the Colorado River drainage from introductions. I have never seen a hybrid from their native waters, but the two species hybridized extensively in Blue Mesa Reservoir on the Gunnison River. In looking over the contents of a gillnet in 1968 from Blue Mesa Reservoir, I estimated about 40% of the catch as hybrids (no native species were present). In the Gunnison River below the reservoir I have found hybrids between the white sucker and flannelmouth sucker (C. latipinnis) and between the white and bluehead sucker (C. discobolus).

Enclosed are some reprints and a preliminary report on "westslope" cutthroat trout. As you'll note, I would like to learn more **boat**t the cutthroat trout native to the South Saskatchewan drainage and compare them with upper Columbia and upper Missouri samples.

Does the University of Alberta collection have any samples from essentially pure populations of the cutthroat trout native to South Saskatchewan drainage--or from the upper Columbia or Kootenay drainages of B.C.? If so, I would like to arrange a loan of the specimens.

Sincerely,

Robert Behnke

RB:vv

July 6, 1973

Dr. C. W. Andrews Department of Biology Memorial University St. John's Newfoundland, CANADA

Dear Dr. Andrews:

Dr. Ron Ryder requested some of my reprints on salmonid systematics for you. I had misplaced his letter and apologize for the delay.

Sincerely,

Robert Behnke

RB:vv

## July 6, 1973

Dr. Carl B. Schreck Division of Forestry and Wildlife Sciences Virginia Polytechnic Institute Blacksburg, Virginia 24061

Dear Carl:

Dr. McConnell passed this job announcement to me. I don't know how urgent is your desire to leave V.P.I., but you might consider a position such as the one at South Dakota State as an interim possibility until a more ideal opportunity arose.

I know that Bob Raleigh wants to transfer and Jim Zuboy has written here about coming back to C.S.U. which I interpret as sign of trouble in Blacksbury.

We're all going out to Berkheey on July 16, for two weeks. Are you and the family going to be in San Francisco this summer?

Sincerely,

Robert Behnke

RB:vv

# July 6, 1973

Dr. Anthony A. Echelle University of Oklahoma Biological Station 730 Van Vlect Oval Norman, Oklahoma 73069

Dear Tony:

Enclosed is a copy of a letter to Clark Hubbs and some reports on Texas fishes.

Can you bring me up-to-date on the status of Etheostoma lepidum? I know you were working on a Publication describing subspecies. How many subspecies should be recognized and how rare or restricted is each?

Also enclosed is a reprint from Systematic Zoology. I don't believe I had yet received them from the publisher last fall when we 1 last communicated.

Sincerely,

Robert Behnke

RB:vv

July 6, 1973

Mr. Fred Eiserman Wyoming Game and Fish 188 Dahlia St. Casper, Wyoming 82601

Dear Fred:

Enclosed is a copy of a letter to a rancher concerning his offer of his ponds for experimentaliintroductions. Also enclosed is his letter to George Dern which I believe Dern sent to you previously.

The red-banded trout in Nevada was recently transplanted to a near-by stream and other barren waters should be stocked this year which would at least give this threatened population a reprieve. However, no suitable ponds have been found in Nevada to provide for the development of a brood stock, and I would very much like to have a source of fry or fingerlings for experimental introductions and evaluations, in warm-water situations. I believe that any trout that was persisting in good condition, would be caught on a fly and flight vigorously in 83°F water, has some potential for innovative fisheries management.

If some suitable brood stock ponds can be found in Wyoming, I suggest you consider the idea of obtaining some of these trout from Nevada.

I don't know what is going on at Burlah. Evidently they dropped the idea of field evaluations this year. I suspect they want to do their own thing without any ideas or influence from me. When I was there in April, there seemed to be the dawn of a new era of federal-state cooperation. Perhaps the best thing the federal government could do would be to abolish the Bur. Sport Fish. and Wildlife and start all over.

Also enclosed is another report on a rare Wyoming fish--the Kendall dace.

Sincerely,

Robert Behnke

RB:vv

## July 6, 1973

Mr. Allen O. Fordyce NX Bar Ranch Big Horn, Wyoming 82833

Dear Mr. Fordyce:

Mr. George Dern of the SCS Casper office requested that i answer your letter concerning the use of your ponds for experimental purposes.

My own interests are in the area of saving rare species, subspecies and local races of trout from extinction. One of the methods I have proposed is to hold brood stocks in private ponds to develop a source of eggs for artificial propagation. The decisions on stocking private ponds, and what fish they are stocked with, however, is entirely under the jurisdiction of the state fish and game agency.

No suitable ponds have been found in Nevada to hold the red-banded trout, but a transplant has been made to a previously barren stream.

I would very much like to see some red-banded trout moved from Nevada to Wyoming to develop a brood stock for experimental stockings in ponds considered too warm for trout.

I will call your offer to the attention of Wyoming fisheries people. I suspect that one of the regional biologists is familiar with your ponds.

Sincerely,

Robert Behnke

RB/vv

cc: Mr.George Dern Mr.Fred Eiserman

July 6, 1973

Mrs. Barra L. Gots Department of Zoology University of Guelph Guelph, Ontario, CANADA

Dear Mrs. Gots:

Please do not worry about a deadline for the FAO Atlantic salmon synopsis manuscript. I have my doubts that it will ever be accomplished unless a new group of contributors can be found.

When I agreed to edit the synopsis a list of names were provided of persons who had agreed to write certain sections. During the last few years, some changed jobs, got involved in new projects, etc. until now only a few femain on the active participant list--but no manuscripts have been reaceived to date. I will write the FAO office and relate these problems and suggest new participants be found if they expect a synopsis.

In your case, however, I believe the information you are compiling will be used in a publication on world distribution of Atlantic salmon, so your efforts will not be wasted no matter what is the euentual fate of the FAO synopsis. But for the present, disregard any previous deadlines for your M.S.

Enclosed is a sample of a FAO synopsis--on croakers. The information you have developed is undoubtably more thoroughly detailed and would deserve considerably more text. The synopsis vary in extent and depth of content of each section.

Thanks for keeping me informed on your progress.

Bincerely,

Robert Behnke

RB/vv

Region II Rare and Endangered Species Team Attention: Bob Azevedo

July 6, 1973

Bob Behnke

More reports

Enclosed are more reports.

I received the comments on the Rio Grande, Colorado River and Yellowfin trout reports. I caught broad stock (for brood stock) right after it was sent. The inference to a stock of broods was not a manifestation of my subconscious but rather a typing error.

Also received the correspondence and memos on Apache trout and logging, which allowed the completion of that report.

Region II Rare and Endangered Species Team Attention: Bob Azevedo

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Dr. James E. Deacon Department of Biological Sciences University of Nevada, Las Vegas Las Vegas, Nevada 89109

Dear Jim:

Enclosed are reports on three Virgin River fishes. The information is derived almost entirely from the material you sent. I didn't want to bother you on every detail, so I would appreciate your comments on accuracy and points I've overlooked, which should be included.

Do you have any data on Gila robusta of the Moapa River--is it seminuda, jordani or an undescribed subspecies?

Also enclosed is a report on a rare trout from Nevada.

Many thanks for the reprints received this week.

I expect that the incorrect common names for <u>seminuda</u> and Pantosteus clarki in your M.S. on fishes of the Virgin River has been already called to your attention. I also suspect that the reported 45°C temperature recorded for <u>seminuda</u> habitat is in error.

I couldn't have completed these reports without your assistance, and I think it important that the precarious existence of <u>Lepidomeda</u> <u>mollispinis</u> and the Virgin R. chub be called to the attention of the U.S.B.S.F.W. people at the regional level. You may receive further inquiries from Albuquerque or Salt Lake City on these fishes.

> Thanks again, Sincerely,

Robert Behnke

RB/vv

Mr. Al Lopinot Department of Conservation 605 State Office Building Springfield, Illinois 62706

Dear Mr. Lopinot:

Enclosed are a few more reports on some rare fishes of the Southwest. Some, such as the Virgin River chub and spinedace, have not yet been officially recognized at the federal or state level, but they should be.

When available, I would appreciate a copy of the 1973 list of threatened fishes, recognized by the various states.

Sincerely,

Robert Behnke

RB/vv

Mr. Frank Richardson USBSFW Region IV Denver

Dear Frank:

Enclosed are a few more reports concerning fishes with distributions in your region. Three of these fishes are endemic to the Virgin River drainage (Utah) and the other - the warm springs dace is a Wyoming fish. The woundfin and the warm springs dace are on the USDI endangered species list. The Virgin River chub and spinedace have hot previously been considered as threatened fish, but you can gather from the reports that they are highly vulnerable to extinction and certain people in the region should at least be aware of them.

Sincerely,

Robert Behnke

RB/vv

Mr. Chuck Kennedy U.S. Forest Service 517 Gold Ave. S.W. Albuquerque, New Mexico 87101

Dear Chuck:

Enclosed is a report on the Apache trout along with those of a few other rare fishes which may have some relevance to your region.

I plan to up-date the information during the year and would appreciate any input on plans, activities, etc. as they relate to any of the fishes discussed in this spries of reports.

Sincerely,

Robert Behnke

RB/vv

Mr. Paul Holden Utah Cooperative Fishery Unit Utah State University Logan, Utah

Dear Paul:

Enclosed is a copy of "Fishes of Colorado." I hadn't forgotten about it, but it was a frustrating experience trying to find someone who knew about this publication and could obtain a copy.

Also enclosed are copies of reports on Virgin River fishes.

Sincerely,

Robert Behnke

6

RB/vv

July 9, 1973

Dr. Clark Hubbs Department of Zoology University of Texas Austin, Texas 78712

Dear Clark:

Enclosed are some of the reports completed on Texas fishes. I would appreciate your comments and any additional information.

Besides fishes officially recognized as endangered by the USDI, I have been attempting to emphasize those species that are in need of special recognition and consideration by federal agencies.

I would like your opinions on Etheostoma lepidum and Percina macrolepida. These species weren't included in your list of rare and endangered Texas freshwater fishes. Both species consist of disjunct populations, and perhaps the species as a whole is not threatened, but some of the geographical isolates, such as E. lepidum in the Rio Grande basin, may be. I will need some input from you and Tony Echelle on how to properly handle the reports on these species.

I also have a question on Gila pandorae - G. nigrescens. I note in the paper by you and Tony Echelle on Rio Grande fishes you used the name G. nigrescens. Also the A.F.S. checklist mentions only G. nigrescens. The data in the 1962 publication you wrote with Bob Miller on G. nigrescens and G. pandorae and the data in a thesis on Gila by Rinne (1970, Ariz. St.) demonstrate clearcut differences between nigrescens and pandorae. Because nigrescens and pandorae are allopatric, the validity of the taxa are dependent on evaluation of degree of differences, but the differences appear to be as great as between other geographically isolated groups of Gila that are recognized as full species.

If current opinion treats pandorae as a subspecies of nigresens, then is it correct to consider G. <u>nigrescens</u> nigrescens as extinct in the USA and G. m. pandorae as greatly depleted?

Sincerely,

Robert Behnke

RB:vv cc: Dr. Anthony Echelle Enclosures

#### July 9, 1973

Mrs. Anthony Anable 219 Old Long Ridge Rd. Stanford, Connecticut 06903

Dear Mrs. Anable:

I came across some notes I prepared to send to you several months ago regarding changes in the new edition of "Flora and Fauna of the Mianus Gorge."

I apologize if they are too late for inclusion. I have been writing reports on rare and endangered fishes and my desk became so cluttered with material that items have been lost and misplaced for the last six months.

There are no mamor revisions but to conform to currently accepted common names, the "yellowbelly" should be changed to redbreast sundish (Lepomis awritus).

A reference might be added for those readers interested in Connecticut fishes. Whitworth, W.R., P.L. Berrien and W.T. Keller. 1968. Freshwater fishes of Connecticut. St. Geol. and Nat. Hist. Surv. Conn., Bull. 101: 134p. Available from State Librarian, Hartford 06115. \$1.50 + tax.

I noted in this publication that the stoneroller, <u>Campostoma anomelum</u>, the bluntnose minnow, <u>Pimephales notatus</u>, and the pearl dace, <u>Semotilus</u> <u>margarita</u>, were found in the Byrum River-although I did not find these species in the Maanus River during my surveys.

I was most happy to hear of the new additions to the nature area. Enclosed are three reprints dealing with some recent trends in ichthyology and a copy of an article I wrote for the forthcoming edition of Encyclopedia Britannica which includes some references and illustrations of fishes you may have recoldections of.

Sincerely,

Robert Behnke

RB:vv

#### July 9, 1973

Mr. Brian W. Coad Department of Biology University of Ottawa Ottawa, Ontario, CANADA K1N6N5

Dear Mr. Coad:

Under separate cover I am sending 5 specimens of Gila alvordensis, 2 specimens of Relictus solitarius and a specimen of Lepidomeda vittata. I remember collecting a few Lepidomeda albivallis last summer in springs near Preston, Nevada. I thought I preserved 2-3 specimens, but they are not with my samples from the White River area.

I have only 4 specimens of L. vittata and relatively few Relictus, Unless I need material for a specific study, I take only a few representative specimens from populations of rare fishes (I agree with the views of Professor Vladykov, who has spoken against promiscuous "over-collecting" by ichthyologists).

You may keep these specimens for dissection.

Dr. Clyde Barbour was the ichthyologist at the University of Utah, but I heard that he is no longer there.

The University of Michigan (Museum of Zoology) has the most comprehensive collections of all the fishes you desire, but getting specimens from Drs. Bailey or Miller may be another matter. Perhaps Dr. Qadri could make the request for you.

I have written reports on some of the rare fishes you plan to work with. Enclosed are examples of Lepidomeda and Plagopterus.

Sincerely,

Robert Behnke

RB:vv

#### July 10, 1973

Mr. Pat Coffin Nevada Fish and Game P.O. Box 1087 Elko, Nevada

Dear PatA

Thanks for checking the S.C.S. ponds. I had expected that very few of the ponds offered would be suitable. The S.C.S. came up with a list of ponds in Wyoming also which Wyoming Game and Fish people are checking. I believe a viable population should get going in Winters Creek, but the low flows, grazing and temporary situation with beaver ponds also m makes Winters Creek vulnerable to periodic elimination of fish.

If a few more barren streams could be found for Chino Creek transplants their future should be secured. This would be an ideal project for the BLM to get someefavorable publicity. They have an automated slide show on Goshute Creek, which is set up at various meetings around the country.

I would like very much, however, to get a brood stock established of Chino Creek fish for a source of eggs for experimental stockings and subsequent evaluations (also for Humboldt cutthroat trout). This is why I have been so interested in S.C.S. ponds.

The Hanks Creek cutthroat appear to be pure humboldtensis. You sent only specimens, however, and I must hedge a bit on my decision. The characteristics of the 5 specimens ideally conform to my diagnosis of humboldtensis with no evidence of hybridization. The actual values are: gillrakers, 19-24 (21.0); scales in lateral series, 127-139 (134.5), vertebrae, 61-62 (61.3) pyloric calca, 55-69 (65.3); and basibranchial teeth, 5-12 (7.0). The respective mean values for these same characters of 16 specimens we obtained from the headwaters of the Marys R. are: (20.8) (134.6) (61.3) (57.6) (6.0)--no statistical differences.

I would much appreciate any information your field man can contribute on native trout in the Virgin Creek-Thousand Creek drainage. The specimens I have were collected in 1934 near the junction of the two streams. These two streams represent a relatively large drainage basin, but in that arid country I suspect there are very few permantly flowing waters. I also note that Big Springs Reservoir is on the head of Thousmad Creek. There is no doubt that a distinctive cutthroat trout was once native to Virgin and Thousand Creeks and this same form also occured in Trout Creek (NW of Demio) but hybridization with rainbow trout was well underway in Trout Creek in 1934 and in 1972, evidence of native cutthroat was virtually absent in the specimens we collected from Trout Creek. I would like some word from a knowledgeable field man that there are no native trout now in the Virgin-Thousand Creek dmainage (or that there may be in some isolated stream). Also, what is the probability that rainbow trout were stocked in the Virgin-Thousand Creek drainage prior to 1934?

Thanks for the information on Hughboldt cutthroat in Jiggs and Willow Creek reservoirs.

Tell Nisbet that my family and I plan to take the train from Cheyenne to Oakland on July 16. He can take Mathew down to the Elko station and wave to us. I may even get the urge to stay awhile.

Sincerely,

Robert Behnke

RB

#### July 13, 1973

Professor V.D. Vladykov Department of Biology University of Ottawa Ottawa, Ontario KlN6N5 CANADA

Dear Vadim:

Many thanks for your note on the common names of Acipenser nudiventris. I am constantly faced with the problem of venacular names of Russian fishes that have no logical English translation. I admit I have allowed both "ship" (the phoenetic translation) and "spring" (the more literal translation) for translated articles in Voprosy Ikhtiologii.

For publication in the English edition your M.S. would have to first appear in the original Russian edition. However, I may make a footnote reference to your M.S. in the next article on <u>A.</u> nudiventris in V.I.

I have a copy of a new Russian book-"Dictionary of names of freshwater fishes of the USSR"- by G. U. Lindberg and A. S. Gerd, 1972, Navka, Leningrad: 368p.

Many dialect names are included for all the species and I note several for A. nudiventris.

If you prepare other articles on Russian-English names of fishes I would greatly appreciate copies. Enclosed are some recent reprints.

Do you have **extra** copies of your 1964 FAO report on Iranian fisheries? If so, I would like to obtain one.

I sent some cyprinid specimens to Mr. Coad who related that you are about to retire. What are your plans for the future?

I am quite certain that lampreys have not occurred in Colorado in historical times. The nearest occurrence is probably that of <u>Ichthyomyzon</u> castaneus in eastern Kansas

Sincerely,

Robert Behnke

July 13, 1973

Mr. Gary Wernsman R.R. 1, Box 61 Fleming, Colorado 80728

Dear Gary:

I will be away until August 1. I have made the revisions and corrections in the thesis and left it with the typist. The final version should be ready for proofreading when I return. Then, as rapidly as possible, duplications for the committee and the graduate school will be made and we can have your final exam.

Let me know if you can't be here on August 1.

Sincerely,

Robert Behnke

RB:vv

August 2, 1973

Dr, John Hopkirk Department of Biology Sonoma State University Rohnart Park, California

Dear John:

Enclosed is a copy of Moyle's check list of California fishes. You can see he has used your thesis and other unpublished sources.

Also enclosed is a copy of a letter to Steve Nicola re. California's list of threatened fishes.

My recent reprints should bring you up-to-date on what's going on in ichthyology.

I would much appreciate a copy of the thesis on the Eagle Lake trout and the name and address of the person who made chromosome preparations of rainbow and steelhead trout.

Sincerely,

Robert Behnke

RB:vv

August 2, 1973

Mr. Steve Nicola California Department of Fish and Game 1416 Ninth Street Sacramento, California 95814

Dear Steve:

I have no new information regarding rare and endangered California fishes, but enclosed are reports on some of the species on your list plus one on the humpback chub which may have once occurred in the California part of the Colorado River.

Have you sent a copy of the threatened fish reports to Dr. John Hopkirk (Dept. Biology, Sonoma State) for his comments? John, and Mr. Follette (Calif. Acad. Sci.) have the most comprehensive and detailed information on California fishes.

Hopkirk's work on Clear Lake fishes will be published in the U.C. Publ.in Zool. within a year. In this work, a new genus of minnow, <u>Endemichthys</u> (now extinct) is described. Also a new species of <u>Pognnichthys</u> and subspecies of <u>Hystero-carpus traski</u> and <u>Archoplites interruptus</u> from Clear Lake will be described-all rare or endangered fishes which your committee should be aware of.

Sincerely,

Robert Behnke

RB:vv

Enclosures: 4 peports

cc: John Hopkirk

Mr. Rick Sherman Rt. 1, Box 2-C Gunnison, Colorado 81230

Dear Rick:

The "golden" trout specimens you brought from the Silver Springs trout Farm are, in reality, Salmo gairdneri and not S. aguabonita (the true golden trout). The genetics of the "golden" rainbow trout are similar to Albino trout--double recessive genes governing color. All of the characters (except coloration) of these "golden" trout are identical to S. gairdneri.

You should be aware of the correct classification of the Silver Springs golden trout as <u>S</u>. gairdneri and not <u>S</u>. aguabonita because anglers may bring them in for identification. If, for example, an angler enters a specimen in the Field and Stream contest, as <u>S</u>. aguabonita, it could be embarassing for the biologist who provided the erroneous identification.

Enclosed is a reprint on the taxonomy of S. aguabonita. If you are faced with a problem of identification you can send the specimen to me.

Sincerely,

Robert Behnke

RB:vv

Enclosures:

cc: Wayne Seaman Dick Klein

Dr. James B. Shaklee Department of Zoology University of Illinois Urbana, Illinois 61801

Dear Dr. Shaklee:

I have been absent from my office for three weeks and found your letter of July 7 on my return.

I saw your application folder and was impressed with your credentials. I look forward to a mutwally stimulating association. I regret that your plans for post-doctoral studies weren't known to me earlier so that we could have attempted to obtain some financial support for you. Because I prefer to be personally involved in research with which I am associated, I have avoided applications for large grants, leading to time consuming administrative details. The modest funds I have available for the coming year are committed to support three graduate students and myself for integrated research projects on trout management and systematics. Hopefully, some opportunities may develop while you are here to offer some assistance.

Enclosed are some reprints and miscellaneous items to provide you with some background on my views and opinions, particularly in relation to biochemical data and ichthyology.

Sincerely,

Robert Behnke

RB:vv

Mr. Allen O. Fordyce NX Bar Ranch Big Horn, Wyoming 82833

Dear Mr. Fordyce:

I would like to thank you for your kind offer to assist in the propagation of red-banded trout.

There is legal point involving transportation of fish into Wyoming from another state without approval of the Wyoming Game and Fish Commission, which could lead to trouble.

Fortunately, Nevada Fish and Game people have made a successful transplant from the single remaining population of red-banded trout in that state, and the population, which appeared doomed, now has a new lease on life.

I haven't recieved a response from Wyoming Game and Fish pet on my suggestion that they import a stock of red-banded trout for experimental purposed and I suspect they will decline to do so. It is sometimes frustrating to deal with a public agency but I must sympathize with their problems of avoiding some action which might offend some sector of the public. In Colorado, I have been involved in experimental stockings of the cutthroat trout native to the Snake River of the Jackson, Wyoming area. Despite some very promising results, the only way to establish a brood stock of this trout in Colorado was for my students and I to raise them and stock them in private ponds. It was not strictly a matter of disinterest on the part of the state agency, but mostly one of inertia and lethargy--attributes which appear to be unavoidable in any large organization.

Sincerely,

Robert Behnke

RB:vv

Mr. Keith Bilby 2 South Gay Drive Longmont, Colorado 80521

Dear Keith:

Enclosed is a letter regarding a photo of a greenback trout and a copy of my reply.

I have a copy of one of your slides but they are your pictures and you should decide on their use and receive any credit for their publication.

I believe I talked on the phone with Mr. Willers last month and I think he is writing a book entitled "The angler as a naturalist." A local writer, John Gagnon, has submitted an article on the greenback trout to Trout Magazine (Trout Unlimited publication). He went up to Black Hollow Creek to get a picture of one and to write some first hand background for the story.

Your article in Colorado Outdoors looked good.

Sincerely,

Robert Behnke

RB:vv

Dr. William B. Willers Department of Biology University of Wisconsin--Oshkosh Oshkosh, Wisconsin 54901

Dear Dr. Willers:

Your request for a photograph of a greenback cutthroat trout was forwarded to me.

The only known pure population of greenback cutthroat occurs in a small stream called Como Creek (transplants to two other streams have been made). The only photos (color slides) of these fish that I know of were made by Mr. Keith Bilby, 2 South Gay Drive, Longmont, Colorado 80521.

Mr. Bilby is an ardent trout fisherman and had an article on cutthroat trout published in the latest issue of Colorado Outdoors. He should be willing to supply you with a picture for your book.

Sincerely,

Robert Behnke

RB:vv

cc:K. Bilby

## August 14, 1973

Ms. Johanna Reinhart American Fisheries Society Fourth Floor Suite 1319--18th Street, N.W. Washington, D.C. 20036

Dear Ms. Reinhart:

Enclosed are two copies of the revised version of the manuscript, "Management implications of ecological segregation between two introduced populations of cutthroat trout in a small Colorado lake," and the marked copy of the original. Figures 1 and 2 are omitted as you suggested and other corrections and comments have been incorporated. My impression is that the reviewers revealed a higher level of competence than has been typically evidenced in the past with T.A.F.S. reviews.

Thank you for your critical attention to sentence structure and the over-all handling of the manuscript.

Sincerely,

Robert Behnke

RB:vv

Region VI (Denver) attn. Frank Richardson

Bob Behnke

Colorado cutthroat trout

Enclosed is a copy of a thesis on the native trout of Colorado, on 4 subspecies previously treated in reports sent to you.

Also is a copy of a manuscript on Snake River cutthroat trout and some ideas on its use in fisheries management. This MS. has been accepted for publication in the Trans. A.F.S. A current research project is being conducted on the Snake River cutthroat in lakes on the Uinta Reservation in Utah.

Dr. James B. Shaklee Department of Zoology University of Illinois Urbana, Illinois 61801

Dear Dr. Shaklee:

I was discussing your plans to attend CSU with Dr. Dave Pettus of the Zoology Dept. Dr. Pettus may have some funds from consulting work and I may receive some small funding from the Forest Service for trout identification services. The amount of money involved will only be in the range of \$500-1500, but it could be used to help provide you with some financial support in the fall or winter quarters.

The Zoology Dept. has a new building with some good equipment, including a B & L Spectrophore I, which you may find useful in some research projects I have been contemplating--such as determining gene flow between cutthroat trout and rainbow trout in the Poudre River, correlated with selective pressures and elevation.

Sincerely,

Robert Behnke

RB:vv

Dr. Richard Wallace Department of Biological Sciences University of Idaho Moscow, Idaho 83843

Dear Dick:

Dr. James Shaklee, who received his Ph.D. degree at Yale on LDH enzymes in fish plans to spend the coming year with us and this should be a good opportunity for you (and I) to learn the latest techniques of biochemical systematics. Are your plans for the sabbatical still on go? Hopefully, I will be able to set aside some limited funds from the Park Service and Forest Service (perhaps around \$1000) to help cover your expenses while here.

Any possibilities to get free for a few days in September for some field work in Idaho? I'd like to check some places in the Snake River drainage around Twin Falls.

I received museum specimens (some collected in 1895) from the Snake R. drainage and the South Saskatchewan. This material should be a great help in determining the systematic status of the westslope cutthroat.

Sincerely,

Robert Behnke

RB:vv

Dr. Carl Schreck Division of Forestry and Wildlife Sciences Virginia Polytechnic Inst. Blacksburg, Virginia 24061

Dear Carl:

Enclosed is a copy of Gary Wernsman's thesis which may be of interest in that some of your golden trout data is used in table 1B to evaluate environmental influence on characters. You'll probably recognize some sentences and paragraphs from your thesis. Gary has a problem in expressing his ideas in writing and has liberally borrowed sections from your thesis and my reports.

Also enclosed is a list of topics from one of the symposia at last weeks meetings of the International Congress of Symptematic and Evolutionary Biology in Boulder. I talked with Howard Bern after his talk. I haven't seen him in years. It was a large meeting with 1600 registered. Wolfgang Villwock from Hamburg was there. Also saw Pierre Legendre.

I really appreciated receiving the translations of Henking's and Berg's classic papers on salmonid systematics. Many thanks.

I don't plan to attend the AFS meetings this year. I have to get some field work in yet and I'm afraid I couldn't go to Disneyworld without the family and that would bankrupt me.

We had a pleasant vacation in Berkeley. I got together with John Hopkirk. He claims his work on Clear Lake fishes with descriptions of a new genus, 2 new species and a few symbspecies should come out in Cal. Publ. Zool. within a year. In case I haven't sent one previously, enclosed is the Encyclopedia article on Salmoniformes, reproduced from the proofs. Warren Freihofer wrote the Perciformes. If we could assemble all of these major articles they would make an excellent text for an ichthyology course.

Sincerely,

Robert Behnke

RB:vv

## MEMORANDUM

TO:	Wayne	Seaman
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FROM: Bob Behnke

RE: Thesis on Colorado native trout

Enclosed is a copy of a thesis on the native trout of Colorado for the library. If additional copies are wanted for regional offices and the central office let me know and I'll send them out.

Rare and Endangered Species Team, Attn. Bob Azevedo

Bob Behnke

Reports, thesis and manuscript

Enclosed are copies of reports on amphibians and reptiles. Also a copy of a thesis on the native cutthroat trout of Colorado which includes more comprehensive information on 4 subspecies treated in previous reports. The manuscript on the management application of Snake River cutthroat trout has been accepted for publication by the Trans. A.F.S. and is included for your general interest. The final statement in the MS. makes a plea for the preservation of rare forms of cutthroat trout.

August 16, 1973

Mr. Gary Reinitz Department of Zoology University of Montana Missoula, Montana

Dear Gary:

Enclosed is an uncorrected copy of the thesis on the native cutthroat trout of Colorado. You may be particularly interested in the section on environmental influence on characters (p. 7-14) and tables 1A-1D and 2.

I believe you have a copy of my report on westslope cutthroat trout, but in case you do not, one is enclosed.

I would appreciate a summary of your progress to date--the populations you have sampled, the techniques used, degree of separation etc.

Did you receive some financial support from T.U.? I remember there was some confusion concerning my recommendations to Mr. Van Gytenbeek.

Sincerely,

Robert Behnke

RB:vv

## August 16, 1973

Dr. Nils-Arvid Nilsson Institute of Freshwater Research Drottmingholm SWEDEN

Dear Nils:

I have a copy of your paper on cutthroat trout which reminded me that you may be interested in the enclosed manuscript on cutthroat trout and ecological segregation (further data now convinces me that the case discussed is an example of interactive segregation). The manuscript will be published in the Trans. Amer. Fish. Soc.

I received specimens of Norwegian char and plan to prepare a manuscript on their contribution to the systematics of Scandanavian <u>Salvelinis</u>. The logical publication for such an article would be the Drottningholm Reports. Does your laboratory accept manuscripts from authors not associated with the institute? As might be surmised, there are several points in the article by Nyman in the latest issue on <u>Salvelinus</u> taxonomy, with which I disagree.

Sincerely,

Robert Behnke

RB:vv

# August 16, 1973

Mr. John Trojnar Department of Conservation Fernow Hall Cornell University Ithaca, New York 14850

Dear John:

I received the comments of the reviewers and the editor on the manuscript. To avoid any further delays I incorporated most of the monor alterations and omitted figures laand 2. I expect it should appear in the next 2-3 issues.

Enclosed are the comments received and a copy of the final version.

Paul Sekulich has been making regular samples of Snake River cutts in Utah and is compiling voluminous data. Crawfish have appeared in abundance in Towave Reservoir and a 51b. cutthroat was taken during the last sampling in early August.

Hope things are going well for you.

Best regards,

Robert Behnke

RB:vv

August 17, 1973

Region II Rare and Endangered Team Attn. Bob Azevedo

Bob Behnke

Another report

I found these copies of the Texas blind salamander report on my desk and I suspect I forgot to send this report along with the others. You should have reports on 5 species of amphibians and reptiles.

## August 17, 1973

Mr. Ladd S. Gordon New Mexico Department of Game and Fish State Capitol Santa Fe. New Mexico 87501

Dear Mr. Gordon:

In reply to the inquiry on the value of a second rare and endangered wildlife symposium, my belief is that such a symposium could substantially add to the first one held last September. Since that time, many agencies and groups have held meetings, established teams and conducted research and surveys. I am preparing a book on information on rare and endangered southwestern fishes for the Albuquerque region of the U.S.B.S.F.W. Enclosed are two samples of reports on New Mexican trouts. All rare, depleted and threatened fishes are being considered. I would suggest a date perhaps in the spring of 1974 for such a symposium.

Sincerely,

Robert Behnke

RB:vv

August 20, 1973

Mr. M.M. Stevenson Department of Zoology University of Oklahoma Norman, Oklahoma 73069

Dear Mr. Stevenson:

Enclosed are copies of some reports I've completed on Texas fishes. I have outlines for several Cuprinodon species and the personal information your provided to me at Boulder will be most helpful. When the <u>Cyprinodon</u> reports are completed I'll send copies for your revies.

If you see Tony Echelle, inquire on the status of his manuscript with R.R. Miller describing the Tularosa Cyprinodon.

Sincerely,

Robert Behnke

RB:vv

August 20, 1973

Mr. Fred Eiserman Wyoming Game and Fish Commission Casper. Wyoming

Dear Fred:

Enclosed is a copy of a thesis on native Colorado trout. It includes data on the Green River cutthroat, <u>S. c. pleuriticus</u>, and the greenback cutthroat, <u>S. c. stomias</u>.

Allen Fordyce wrote to me expressing his enthusiastic cooperation for any plans to hold a brood stock of a rare trout. He also expressed his opinion that he didn't expect much action from the Wyoming Game and Fish Commission and we might make the introduction ourselves. I pointed out the legal implications of transporting fish across state lines.

The trout we have discussed--the red-banded trout of Chino Creek, Nevada-has nothbeen transplanted outside of Nevada. Nevada Fish and Game made a transplant into the headwaters of a barren, neighboring stream this year and, hopefully, the population will expand. I doubt they can hold on much longer in Chino Creek--there was virtually no water in the stream bed last summer and the cattle had destroyed the vegetation and eroded the watershed.

If a suitable pond can be found, I believe an arrangement can be made with Nevada for the Chino Creek trout. There is a great potential for the development of a trout suited for warmer, eutrophic ponds and lakes. The S.C.S. and the Utah Coop. Fish. Unit stocked fingerlings of the Donaldson rainbow and a rainbow raised at the Jones Hole National Fish Hatchery into two farm ponds. On May 31, 1973, after one year in the two ponds--the rainbow trout from the Jones Hole hatchery, averaged twice the size of the Donaldson rainbow (281 vs 140 gm). The genetic heritage of a trout such as the Chino Creek red-banded trout might provide the basis for innovative fisheries management yielding some striking results.

A 5 lb. Snake River cutthroat turned up in a lake on the Uinta Indian Reservation during Paul Sekulich's sampling in early August. They appear to be trriving in this lake, mainly on a diet of damsel fly larvae. The Trans. A.F.S. has accepted the manuscript. I wrote with John Trojnar on Snake River cutthroat in North Michigan Lake, Colorado.

Sincerely,

Robert Behnke

RB:vv

#### August 20, 1973

Dr. Pierre Legendre Centre de Recherche écologique Université du Québec 'a Montréal Case Postale 8888 Montreal 101, Quebec, CANADA

Dear Pierre:

I would appreciate a copy of your directions for chromosome preparation. In Voprosy Ikhtiologii, 1972, 12(3), an article appeared on techniques for fish chromosome preparation by V.N. Ivanov. The English translation of this publication is called "Journal of Ichthyology" and the article is found on pp. 389-395 of the English edition.

If you have any recent reprints of your work available I would like to receive them.

It was good to see you again in Boulder.

Sincerely,

Robert Behnke

RB:vv

#### August 20, 1973

Mr. Bob Saile The Denver Post 650 15th Street Denver, Colorado

Dear Bob:

I read your column last week criticizing the confused news release on the Poudre River trout study by T.L. Marshall. Perhaps your background in police reporting made your suspect something fishy about the release. The confusing statement released by the Division of Wildlife is somewhat of a distortion of the actual facts found in Marshall's Ph. D. thesis. I have a copy of the thesis and enclosed are copies of the abstract and condlusions and an article to be published in Colorado Outdoors based on the thesis.

Basically, Marshall set out to place a dollar value on the wild trout fishery and the catchable trout fishery. Some of the significant points he discovered were: Fishermen are willing to pay more for the opportunity to fish for wild trout than for catchables. About 10% of the fishermen who fish for catchables catch 60% of the fish caught and 32% of the fishermen catch all of the fish caught (2/3 of the fishermen get nothing, which refutes the notion that catchables provide trout for the buld of the inexperienced anglers).

The catchable area in the Poudre River studied by Marshall is heavily fished and the catchables are removed quickly (probably 75-80% in the first week). Less than 1% of the catchables remain in the river by October and carry-over to the next year is essentially zero. In contrast the wild rainbow and brown trout populations in the same area actually increase in total biomass during the height of the fishing season--that is their accumulated growth is greater than the loss due to the fishermen's catch. The fact that intensive stocking of catchable cused no apparant harm to the wild trout population (in contrast to the Madison River study in Montana) is most likely due to the rapid removal of the catchables by fishermen in the Poudre River. The rights and wrongs of the catchable program in the Poudre are open to individual interpretation. It is clear that the wild trout population (at no cost to the state) is not over-exploited by heavy angler pressure and can sustain a considerable high quality fishery. It is also clear that fishermen who fish exclusively for wild trout are subsidizing the catchable fishermen, particularly the 10% who take 60% of the catch. Many wild trout fishermen are willing to pay this price to concentrate the bulk of fishermen in catchable sections resulting in less competition in the wild trout areas. In any event, the cost-benefit ratios of wild trout vs catchables should be made known and Marshall's thesis is a significant contribution on the subject.

There is no question about the necessity of fish hatcheries in the fisheries management program in Colorado, but the pertinent point in need of thorough evaluation and incisive thought concerns the proportion of the license dollar used to support a catchable program.

Also enclosed is a copy of a thesis on native Colorado trout. Data from collection from Brown's Creek is included in table 6 (p. 50).

Have you found any other interesting populations of cutthroat trout this year?

Sincerely,

Robert Behnke

RB:vv

Bob Azevedo

Bob Behnke

Apache trout information

Most of the fish specimens I have from the reservation were collected by Anderson up to 1966 and during a collecting trip we made together in 1966. A series of correspondence concerning the significant points of my findings on the relative purity of the populations in the various streams were sent to Anderson but evidently have been lost.

I will attempt a concise summary of this information and enclose two maps showing the localities discussed.

My judgement on relative purity of Apache trout and the detection of the effects of hybridization with rainbow trout is based on the following diagnosis of the two species. Morphological characters: head and jaws longer on Apache trout; Apache trout with longer dorsal fin and deeper body; Apache trout coloration typically dull olive-yellow on body, with dorsal, anal and pelvic fins tipped with white or yellow and red band absent, yellow cutthroat mark present; rainbow trout with more silvery color, red band present, cutthroat mark absent and white tips on fins, if present, not so pronounced. The spots on Apache trout are larger, more rounded and pronnunced in outline in comparison with the more irregular and diffuse spots of rainbow trout. Hybrids exhibit intermediacy depending on the degree of hybridization. The above can be used for your request for a key for field identification. To make these characters more meaningful I would suggest that 6-8 specimens of both Apache trout (pure stock from Ord Creek, Firebox Creek, Deep Creek, etc.) and hatchery rainbow trout of about 6-12 inches be frozen or preserved for field men to become familiar with these diagnostic traits.

There is good separation between Apache trout and rainbow trout in wheir meristic characters--scales, vertebrae and pyloric caeca, but for these counts the specimens would probably have to be sent to me.

Also enclosed are two pages from a student report which lists the 18 samples used in my Apache trout studies. You will note that although individual sample size is often small, the specimens from the Bonito Creek drainage (Little Bonito, Big Bonito, Crooked, Flash, Squaw and Hughey Creeks), as a whole, are consistant in their characters, ideally approximates the diagnosis of S. apache. From this data I concluded that the Bonito Creek watershed holds the greatest concentration of pure Apache trout. Included in the table are data from museum collections revealing that Apache trout were in the headwaters of the Little Colorado River on Mt. Baldy and in Tonto Creek in 1915. What is there today?

I personally collected only in upper Ord Creek, Firebox Creek and Deep Creek. I do not know the precise locations of the other collections. I would suspect that in situations such as the East Fork of the White River, Diamond Creek and probably Bonito Creek a gradation will be found from essentially pure populations in undisturbed headwater areas to hybrids at lower elevation. If this is the case, I predict that the zone of extensive hybridization will extend upstream in the Bonito Creek watershed environmental disruption from logging.

I am not certain what was requested in your question 4 . . . "where a game link may exist between S. gilae and S. apache." If you mean was there any area where the two species may have occurred together, the answer is not known. If they did it would have been in the San Francisco or Verde drainages. Miller claimed that trout collected in 1915 from K.P. Creek, tributary of the Blue River (San Francisco drainage) are Apache trout. I have seen these specimens and agree they are more like Apache trout than Gila trout but the original field notes claimed t they had a red band (which Miller claims was from hybridization with rainbow trout). Early collections in Oak Creek (Verde drainage) have spots like Gila trout but a body shape like Apache tpout. It would be a real find if a native trout population could be found in an isolated tributary of the Verde or Blue rivers. For identification of dubious specimens from a particular stream I would suggest that 10-15 specimens (6 inches and larger) be preserved and sent to me. If hybridization is well underway it will be apparant by gross observation in the field. If the effects of rainbow hybridization is slight and subtle it can only be detected by internal examination.

August 21, 1973

Dr. Gunnar Naevdal Havforskningsinstituttet Fiskeridirecktoratet Bergen, Norway

Dear Dr. Naevdal:

The specimens of <u>Salvelinus</u> were received in good condition and I want to express my sincere gratitude for your efforts on my behalf.

I plan to prepare a manuscript for publication on these specimens and their contribution toward the systematics of Scandanavian Salvelinus.

The labels with the three samples were in poor condition and I am not certain that I have the correct names of the lakes. My interpretation from the labels are: Bogetveitvatn, Eidesvatn and Vangsvatnet. I assume that these are lakes in the Bergen area.

I would like your comments on the following important points which will assist me in preparing a publication. Are the populations known to be indigenous or have introductions been made? The fish faun fauna of these lakes must have been established from the sea perhaps about 8,000 years ago. What other indigenous fishes occur in the lakes around Bergen? Do indigenous populations of whitefish, <u>Core-</u> gonus, occur in these lakes?

I would also appreciate any available reprints, reports or notes pertaining to the char, the fishes or the lakes of the Bergen area.

Again, many thanks.

Sincerely,

Robert Behnke

RB:vv

Professor Y. Yasue Ohara Institute for Agricultural Biology Okayama University Kurashiki, Japan

Dear Dr. Yasue:

Many urgent matters diverted me from the more interesting project concerning the systematic problems of some Japanese salmonid fishes.

I can find no record of sending you a report on the valuable specimens you sent to me eight months ago. If I have not communicated with you sonce that time, I sincerely apologize--I did not realize how rapidly the time has passed this year.

To refresh your memory and to summarize the situation for Dr. Kimura and Dr. Yoshiyasu (who will receive copies of this letter) the following points are reviewed. When it becaue apparant to me that there were two distinct salmonid species in Formosa--the original Salmo formosanus (S. saramao) plus 0, masou, I was interested in comparing the "iwame" (O. iwame of Oita Pref., Kyushu and the iwame-like trout of the Mikuni Valley, Mie Pref., Honshu) with data I have from the original S. formosanus of Formosa to check on the possibility that the Japanese iwame might represent relict populations of formosanus.

The results of my examination of the three specimens of iwame you sont have caused me to reject the possibility that the iwame is actually S. formosanus. The iwame specimens lack basibranchial teeth and could not be separated with any authority from Oncorhynchus rhodurus. (I leave open the question on the status of rhodurus--as a full species or as a subspecies of O. masou. Its determination will depend on their degree of reproductive isolation when rhidurus and masou live together--do they freely hybridize or not? The evidence thus far is conflicting and not well documented.)

Evidently, only the first few specimens obtained by Mr. Takeo Aoki in 1917 from the Taiko (or Daiko or Ta Chia) River near Saramao, Formosa were of the species S. formosanus (a fish with basibranchial teeth and probably closer to Salmo than to Oncorhynchus.) All specimens collected since that time apparently have been O. masou. S. formosanus is now evidently extinct and only two or three specimens are known to exist. Dr. Watanabe and Dr. R.R. Miller (Univ. Michigan) are preparing a manuscript on S. formosanus and they have given me permission to cite their opinions.

Although I have examined only three specimens of iwame I am convinced that they are not S. formosanus, which now leaves the problem of the taxonomic status of 0. iwame to be clarified. I believe that the twommost probable explanations of the origin of iwame are: 1) It is the result of polymorphism within local populations of 0. rhodurus. That is, different alleles govern coloration and the combination of certain recessive genes is manifested as "iwame." If this is the case, then the "iwame" are part of a freely interbreeding population of 0. rhodurus and 0. iwame is a synonym of 0. rhodurus. Such color variants are well known in hatchery trout such as albinos and the so-called "golden" rainbow trout. These color variants, however, are seldom found in nature, but a mutant color phase of the northern pike have a relatively high incidnece in some areas. 2) The iwame represents a distinct species, probably close to and derived from a common ancestor of 0. masou--0. rhodurus. If this assumption is correct then the iwame are reproductively isolated from O. rhodurus and the result of this genetic separation should be manifested in statistical differences in the characters analyzed from iwame and amago from the same locality. Unfortunately, clear-cut differences were not apparant between the two iwame and one amago from Mikuni Valley (except for the coloration and spotting.) The iwame from Kyushu has a low number of pyloric caeca (28-Kimura and Nakamura reported 26-36) whereas the Mikuni iwame have 41 and 45 caeca and the Mikuni amago 43.

What is needed now to help clarify the taxonomic status of iwame is 10-15 specimens each of iwame and amago taken from the same localities in Mikuni Valley and from Oita Pref., Kyushu. The information obtained from examination and comparison of specimens should be supplemented by observations in nature concerning possible separation in time and/or place during the spawning season of the iwame and amago.

I note in a reprint, kindly sent by Dr. Yoshujasu, that he found identical hensoglobin patterns between the iwame of the Ono River and Mikuni Valley compared with the amago, O. rhodurus. This is not convincing evidence that the iwame and amago are identical, however, There are many examples, such as between <u>Salmo gairdneri</u> and <u>S. clarki</u> and <u>Salvelinus malma</u> and <u>S. alpinus</u>, specificity cannot be demonstrated in the homoglobin pattern.

If it would be possible for you and Dr. Kimura to obtain and ship to me the specimens of amago and iwame from Mikuni Valley and Oita Pref. I would make the examinations and comparisons and prepare a manuscript for the Japanese Journal of Ichthyology on the taxonomic status of iwame. If agreeable with you and Dr. Kimura, the three of us would be co-authors of the paper.

Such a publication would be a beginning towards the solution of the taxonomic problems of the salmonid fishes of Japan, but much further work would yet be necessary. For example, you sent a picture of the

"mumon" amago from the Tyoski River, Mie Pref., a form with some red spots but without other markings--what is the mumon amago? There is also the case of the "mumon" iwame (Salvelinus leucomaenis?) which may be the result of color polymorphism in S. leucomaenis or might represent an undescribed species. The determination of which alternative is correct could be made as with the iwame and amago phenomenon--the comparison of specimens of both typical S. leucomaenis and the mumon iwame. Dr. Yoshiyasu reported both forms occur in Kanzaki River of Kamisuisho Valley (Dr. Yoshiyasu uses the name "muhon" iwame for the form without parr marks or spots) and pointed out the relationship between the two forms appears to be comparable to the iwame and amago phenomenon. As with the iwame and amago, Dr. Yoshujasu found no difference in the hemoglobin pattern between the "muhon" and normal iwame.

Then there is the report of "iwame" on Hokkaido by Hikita (1963, Sci. Rept. Hok. Fish Hatch., 18). From the low numbers of gillrakers and pyloric caeca listed for the Hokkaido "iwame" (13-17 and 22-24 respectively), I would suspect that Hikita examined "muhon" or (mumon) iwame (Salvelinus) and not Oncorhynchus. The above mentioned publication does reveal however, that the phenomenon of distinct, phenotypic, variant salmonid fishes occurs in Kyushu, Honshu and Kyushu. The cause of these phenotypic varients in Oncorhynchus and Salvelinus in Japan is yet to be determined. Are they due to the combination of recessive alleles in a polymorphic population, or do they represent distinct species?

Hopefully you, Dr. Kimura, Dr. Yoshiyasu and I can make a significant contribution toward the clarification of the problem.

Thank you most kindly for a copy of the book on natural history and ecological studies with Prof. Imanishi's article on Salvelinus. I hope I had aknowledged its receipt before, but in my commitment to complete a book of information on rare American fishes, I had to put aside all other tasks and now realize I may have neglected to thank you for this fine gift.

Sincerely,

Robert Behnke

RB:vv

cc:Dr. S. Kimura Dr. K. Yoshiyasu

Dr. T.G. Northcote Institute of Fisheries Research University of British Columbia Vancouver, B.C., CANADA

Dear Ted:

I am involved in a graduate student thesis topic on the systematics of the interior forms of cutthroat trout native to the Columbia River basin. I am attempting to locate specimens of Columbia River basin cutthroat from British Columbia to borrow for the study.

Enclosed is a preliminary report on the systematic problems of Columbia basin cutthroat, which I hope to solve. As you may note I believe more than one form (subspecies) is native to the upper Columbia basin. The cutthroat trout commonly called the Montana westslope cutthroat apparently occurs in the Flathead-Clark Fork drainage and in the Salmon and Clearwater drainages of Idaho. A very similar cutthroat is native to the upper Missouri and South Saskatchewan drainages. The trout described by Dymond as Salmo clarki alpestris from B.C. seems to be quite a different fish, but so little is known about it.

When Lindsey was at U.B.C. he told me he was planning a graduate student project on alpestris and Columbia basin cutthroat trout. I believe some collections were made but the study was never completed. If samples of B.C. cutthroat trout (interior forms) are in the U.B.C. fish collection I would much appreciate a list of the collections so that a loan request for selected samples could be made.

The manuscript on segregation of two populations of cutthroat trout sent to you for review earlier this year has been accepted for publication in the Trans. A.F.S. Your helpful comments were incorporated into the final version.

Sincerely,

Robert Behnke

RB:vv

Dr. Clare Stalnaker Utah Cooperative Fishery Unit Utah State University Logan, Utah

Dear Clare:

Enclosed is a copy of a letter I wrote to Don Duff last year which outlines my thoughts on Utah cutthroat trout in regards to possible sources of native stocks.

I'll tentatively plan to come to Utah the week of Sept. 11, and you can let me know the precise details when you contact the various participants.

Sincerely,

Robert Behnke

RB:vv

Bob Azevedo

Bob Behnke

Reply to memo on Rio Grande trout

1) Indian Creek cutthroat trout on Mescalero Reservation. The significance of this trout is that it represents the most likely pure stock of S. c. virginalis native to the Pecos drainage. Certainly the Indian Creek habitat should receive special recognition and protection against any introductions, but to capitalize on this trout and at the same time, expand its abundance, the possibility of finding or constructing a small lake (with an inlet stream for natural reproduction) where this trout can be introduced to establish a unique fishery should be considered.

2) Jemez Pueblo trout. I have data on two specimens of trout collected by Jack Dean, August 18, 1966, from: "N.W. Conchiti Pueblo." Is this Jemez Pueble? One of the two specimens lacked basibranchial teeth, but other characters are typical of virginalis. I would need a larger sample for an authorative opinion on their status.

3) Frijoles Canyon on Bandeleir National Monument. I believe this trout is represented by two specimens sent by Jack Dean from: "Peralta Canyon." As with "Conchiti Pueblo" the sample size is too small except to say that both specimens appear to be typical Rio Grande cutthroat. A larger sample would be needed for accurate determination.

There were many samples from the Rio Grande basin that were not included in Wernsman's thesis because the sample size was too small or the specimens were in poor condition. The Forest Service has provided some funds for examination of specimens collected this year so this would be an opportune time to make collections of Rio Grande trout and get them to me to include in a report. I'll write this fall or winter.

85

finding

Mr. Donald A. Duff: B.L.M., Federal Building P.O. Box 11505 Salt Lake City, Utah 84111

Dear Don:

I am tentatively arranging a collecting trip in Utah during the week of September 11. Clare Stalnaker of the Utah Coop. Fish. Unit is arranging for representatives of the Fish and Game Dept. and Forest Service to get together with me and obtain samples from possible native trout populations from various areas. If you or a BLM representative would like to join us, contact Dr. STalnaker at Logan. If you can't make it, do you have may suggestions on areas which we should check?

Sincerely,

Robert Behnke

RB:vv

Dr. S. Kimura Fisheries Laboratory Faculty of Agriculture Kyushu University Hakozaki, Higashi-ku Jukuoka City, Japan

Dear Dr. Kimura:

Enclosed is a copy of a letter to Dr. Yasue concerning isame, amago and related problems.

As discussed in the letter, I would like the opportunity to make detailed comparisons of both iwame and amago specimens from Oita Pref. and Mie Pref. The results of such a study would be published as a joint paper, if agreeable with Dr. Yasue and you.

Do you have any further information on the iwame since your description of O. iwame in 1961? Has it been found beyond the confines of Mennotsura Valley? You wrote that there were little differences in meristic characters between the iwame and amago but published no data on amago specimens from the Ono River drainage. The number of pyloric caeca (26-36) is low in your iwame specimens, but I have no comparable data on O. rhodurus from Kyushu.

I would appreciate your comments and opinions on the points raised in my letter to Dr. Yasue.

Have you received my reprints (through 1972)? As mentioned in the letter to Dr. Yasue, I have had to neglect my ichthyological investigations in recent months and left many matters unattended to. If I have forgotten to send my reprints to you, let me know and a series will be forwarded.

Sincerely,

Robert Behnke

RB:vv

Dr. K. Yoshiyasu Shin-Mori, 5-7-14 Asahi-Ku Osaka, Japan

Dear Dr. Yoshiyasu:

Enclosed is a copy of a letter to Dr. Yasue regarding Japanese salmonids. As you'll note in the letter I have been diverted from my basic ichthyology studies in recent months. Have you received my reprints?

I found your reprints on hemoglobin analysis in Salvelinus and Oncorhynchus most interesting. If the iwame and amago (Oncorhynchus) and the muhon iwan and normal iwana (Salvelinus) are distinct species, differences in some proteins should be apparant.

Do you have the preserved specimens of the fish you sampled for your hemoglobin comparisons? If so, or if you will preserve future specimens, an interesting publication could result comparing your biochemical approach and my morphological comparisons of the identical specimens. Let me know your thoughts on the matter. I would like the opportunity to examine further specimens of iwame and amago from the same stream and likewise muhon and normal iwana. I would also be very interested to see specimens of the mujabei iwana from Lake shikoribetsu, Hokkaido, which I have suggested may represent a relict population of Salvelinus alpinus.

I would like to receive any comments, opinions, or questions you may have on the taxonomic problems of Japanese salmonid fishes.

You may be interested in a paper published in the latest issue of the Annual Report of the Institute of Freshwater Research, Drottningholm (Sweden) (for 1972), by L. Nyman, entitled: "A new approach to the taxonomy of the Salvelinus aplinus species complex." Nyman studied esterase patterns in many different chars. He suggested that my interpretation of Salvelinus taxonomy is in error, but his data does not support this assumption.

Sincerely,

Robert Behnke

August 28, 1973

Ms. Janet Paden 705 Muldoon Road #203 Anchorage, Alaska 99504

Dear Ms. Paden:

Your questions on the Apache trout, Gila trout and Lahontan cutthroat trout has been forwarded to me for a reply.

I am presently compiling a series of reports on rare southwestern fishes for the Albuquerque region of the U.S. Bureau of Sport Fisheries and Wildlife. Enclosed are reports on the Gila and Apache trouts. I do not have a report available on Lahontan cutthroat trout, but I have a comprehensive file of information on this trout and can provide some comments on its status.

Apparantly, you are most interested in documenting the effects of logging practices on fish fauna and what federal agencies are doing to protect rare fishes from environmental degradation.

In the past, there is no doubt that forest cutting contributed to the decline of all of the trouts mentioned in your letter. Poor logging practices cause erosion, siltation of the gravel and warming of the water. In most situations, the degraded habitat does not eliminate the rare native trout directly, but indirectly by stimulating hybridization with introduced rainbow trout or displacement by introduced brook or brown trouts. The details of why this occurs is subtle and complex but essentially is due to the breakdown of niche separation that existed between species under the pristine conditions of a stream. This situation is discussed in the Apache trout report but is treated in more detail in the enclosed report on Gambusia heterochir. Where two species are capable of hybridization (as is typically the case between species of the same genus of freshwater fishes), they avoid hybridization by niche separation. With Gambusia heterochir and G. affinis and with Salmo apache and S. gairdneri, man-induced changes in the environment causes a breakdown of niche separation and a zone of hybridization is created.

In answer to your question on threats from logging to the Gila, Apache, and Lahontan cutthroat, only the Apache trout is presently in danger of further decline due to logging. The Gila trout persisted in its pure form only in three small streams. All are in National Forests and are protected against logging. Also, the Forest Service has cooperated in making transplants into two formerly barren streams to expand the numbers of this species.

The Bulk of Apache trout are found on the White River Apache Indian Reservation. Unfortunately the major stronghold of Apache trout is in virgin forests of the Bonito Creek watershed. The tribe has sold the timber and logging is underway. Mr. Richard Baldes and Mr. Richard Painter, biologists with the U.S. Bureau of Sport Fisheries and Wildlife and advisers to the tribe on fish and game matters, strongly urged that the Bonito Creek watershed be left in its virgin state, but their advice was not followed.

Other federal agencies such as U.S. Forest Service and the Bureau of Land Management, in most regions, are concientiously trying to protect rare species of fish and wildlife where they occur on their lands.

The Lahontan cutthroat trout occurs as pure populations in only 7 known waters. One stream in California is on private land and was threatened by logging and real estate development. The Forest Service and California Fish and Game actively cooperated to mitigate environmental damage and made a transplant of the Lahontan trout into a stream barren of fish. A population of Lahontan control the oat trout in Summit Lake, Nevada, was under a potential threat from mining operations in the watershed of the only spawning stream tributary to the lake. The watershed is on B.L.M. land and the B.L.M. withdrew the watershed from any use which might endanger the trout. They did this over fierce opposition.

For your request for literatire on the subject of logging and fish protection I am enclosing a copy of a set of guidelines, developed by the Society of American Foresters (Mr. Baldes, the U.S. Bur. Sport Fisheries biologist, urged that these guidelines be followed in the logging operations on the Apache Indian Reservation).

A booklet entitled "Guidelines for Stream Protection in Logging Operations," by R.L. Lantz, is available from the Oregon State Game Commission, P.O. Box 3503, Portland 97208.

I hope that this information has answered your questions and provided you with an introduction to the problems of habitat preservation in relation to the preservation of rare fishes.

Sincerely,

Robert Behnke

RB:vv

Enclosures

cc: R.E. Putz

August 29, 1973

Mr. Gorden Haugen Lolo National Forest 2801 Russell Street Missouri, Montana 59801

Dear Gorden:

We have made good progress in the examination of westslope cutthroat trout specimens (there are now well over 500 specimens on hand), but all of the data on all of the specimens will not be completed until this fall or winter. The diagnosis of westslope cutthroat trout found in my report of last January is holding up quite well. The samples that best conform in their spotting pattern and have no evidence of hybridization with rainbow trout, typically have the following values: mean vertebral counts of 61.0 or less, gillraker counts between 18.0-19.0, scale counts between 160-170 any pyloric caecae of 35 + 3. Westslope cutthroat samples from widely different geographical locations exhibit a high degree of concordance in their characters and when certain values appear abnormal, there is reason to suspect hybridization with rainbow trout and/or Yellowstone cutthroat trout and then other characters are critically analyzed.

From your list of August 15, the following samples have been completed: Big Rock Creek, Chippy Creek, Congdon Creek, Little Stoney, Arrasta Creek, Moose Creek, Overwhich Creek, and Straight Creek. Only vertebral counts have been completed on the other samples but some comments can be made on them based on vertebral number and spotting pattern. I can not find any specimens from three sites on your list--Murr, Bear and Carp Creeks. There are no color slides on fish from these creeks and I don't believe samples from Murr, Bear and Carp creeks were sent to me (your color slides are a real asset to help detect hybrid influence).

Of the 8 samples analyzed, all are typical cutthroat trout, but none of samples appear to be from pure, uncontaminated populations--that is, all have one or more characters aberrant from my diagnosis of westslope cutthroat trout. The major influence appears to be from Yellowstone cutthroat trout.

There is just too much total variability among these samples from a limited geographical area to be explained by natural variation between local populations. In order of judging the 8 samples from best

(least amount of hybridization) to worst, I would rank them as follows: Straight, Chippy, Ross, Big Rock, Moose, Arrastas, Congdon, Little Stoney and Overwhich Creeks.

From the 12 samples which have had only the vertebrae counted, only two samples average more than 61.0 vertebrae (Lolo Crk., 61.2; and Bear Trap Crk., 61.3). In looking over the color slides of some of these fish, the spotting pattern on the trout from Poorman's Creek best conform to my idea of the typical westslope cutthroat.

I have arranged to borrow specimens of cutthroat trout from the Columbia River drainage of Canada and also some ancient museum specimens which should help to determine the range of variability and how many distinctive groups of cutthroat trout are native to the Columbia River system.

I met Mr. Reinitz recently at a meeting in Boulder, Colo., and we discussed his research. I'll send him a copy of this letter for his information.

Sincerely.

Robert Behnke

RB:vv

cc: Mr. Henry McKirdy Mr. Gary Reintz COLORADO COOPERATIVE FISHERY UNIT COLORADO STATE UNIVERSITY FORT COLLINS, COLORADO

August 29, 1973

Dr. Clark Hubbs Department of Zoology University of Texas Austin, Texas 78712

Dear Clark:

Thanks for your comments and corrections of my reports on rare fishes.

These reports are being prepared for region II (Albuquerque) of the U.S.B.S.F.W. to supply a source of consise information on rare, depleted and threatened fishes mainly of Texas, Oklahoma, New Mexico and Arizona. A major purpose is to have information available prior to the initiation of projects by the Corps of Engineers, Bur. Reclamation, highway construction, etc., which may effect rare fishes. As you may note tha fish section of the 1973 red book on threatened wildlife is poor and sufficient detailed information is not provided for the fishes covered.

I had written to Al Lopinot, the A.F.S. chairman of the rare and endangered fish committee, suggesting nation-wide coverage of rare fishes in a comparable manner to my reports would be a valuable contribution. The problem would be of finding competent people to volunteer their time.

I met Mr. Stevenson recently at a meeting in Boulder Colorado and learned more about a species of Texas Cyprinodon.

Sincerely,

Robert Behnke

RB:vv

September 6, 1973

Dr. Gunnar Naevdal Institute of Marine Research Directorate of Fisheries 5011 Bergen, Norway

Dear Dr. Naevdal:

Thank you for your informative letter and the booklet on char. I will ask Mr. Wespestad to make a translation for me. Your data on the allelic frequencies for esterase for the four populations sampled are quite variable. As I wrote previously, I have strong reservations on Nyman's interpretation of esterase data published in the last Drottningholm report.

I counted the gillrakers of the char specimens you sent and found them to be 23-27 in 10 specimens from Bogetveitvatn, 24-27 in 4 specimens from Vangsvatnet and 22 and 23 in 2 specimens from Eidesvatn. These counts are similar to counts I have for char from Sweden.

I would very much appreciate further samples of (5-10 fish per sample) from other lakes and perhaps 6-8 more specimens from Vangsvatnet to investigate the possibility that more than one form of ancestral char established lacustrine populations in Norway in post glacial times.

Do you know if any of the Norwegian lakes are reputed to have two distinct char populations, comparable to the drawf ("tita") and normal chars found together in several lakes in Sweden? If so, samples from such populations would be most valuable.

Samples from Breimsvannet (where all 117 fish had FF esterase) and Rodlivannet (with a predominance of the SS gene would make an interesting comparison of morphological characters with esterase data.

Again, many thanks for your kind assistance.

Sincerely

Robert Behnke

Beptember 6, 1973

International Activities Staff (Translations) National Marine Fisheries Service, NOAA U.S. Department of Commerce Interior Bldg., Rm. 8015 Washington, D.C. 20235

Dear Sir:

I request a loan of the English translation of the two papers cited in the enclosed references from Current Fishery and Oceanography Translations.

Thank you,

Robert Behnke

RB:vv

September 6, 1973

Fisheries Research Board of Canada Biological Station P.O. Drawer 100 Nanaimo, British Columbia Canada

Dear Sir:

If available, I would greatly appreciate a copy of F.R.B.C. Translation Series 1476: Tuunainen, P. 1970. On the relationships of salmon fish. 11 p.

Thank you,

Robert Behnke

RB:vv

September 7, 1973

14

Dr. Harold E. Malde U.S. Geological Survey Denver Federal Center Denver, Colorado 80225

Dear Dr. Malde:

I received the package of reprints you sent and I express my sincere appreciation. You mentioned you were in short supply of your Professional Paper 596 and if you desire its return let me know and I'll make a Xerox copy for myself.

I will make a field trip next week to obtain trout samples from the Bonneville basin and the upper Snake River drainage. At present, it appears that one form of cutthroat trout in the upper Snake River has its affinities with the Bonneville trout, whereas the other form has no counterpart in the Bonneville basin. The sequence of geological events explaining the present distribution of two distinct types of cutthroat trout in the upper Snake River will require some thought. I will probably direct a few specific questions to you later this year when my thinking on the matter is sharpened from persuing the geological literature.

Sincerely,

Robert Behnke

RB:vv

September 7, 1973

Mr. Allen O. Fordyce NX Bar Ranch Big Horn, Wyoming 82833

Dear Mr. Fordyce:

Evidently, Mr. Fred Eiserman, the Fisheries Management Coordinator for Wyoming Game and Fish, is interested in the possibility of obtaining the red-banded trout from Nevada. Enclosed is Mr. Eiserman's letter to me on the matter. The problem of getting fish from one state to another can be complex and the simplest and most direct way to accomplish this would be between the Wyoming and Nevada Game and Fish department to arrange the collection and shipment.

The red-banded trout in Nevada however, has additional significance in that any agency promoting its perpetuation would gain favorable publicity because of the rareness of the red-banded trout. This fact would suggest to me that both the Bureau of Land Management(the newly introduced population in Wolf Creek is on BLM land) and the Soil Conservation Service (which besides being inclined to protect rare species is also interested in finding a trout better adapted to farm pond conditions) may want to get into the act of initiating experimental transplants of the red-banded trout.

The people I have dealt with on the subject of the red-banded trout-its perpetuation and for its possible use as a farm pond tmout, besides Mr. Eiserman of Wyoming Game and Fish, are: Mr. Pat Coffin, Nevada Fish and Game, P.O. Box 1087, Elko, Nevada 89801; Mr. E.A. Moore, District Manager; Bureau of Land Management, 2002 Idaho St., Elko, Nevada 89801; and Mr. Dean Marraige, Regional Biologist, Soil Conservation Service, 209 Federal Bldg., 511 N.W. Broadway, Portland Oregon 97209.

If Wyoming cannot arrange a transplant of the red-banded trout from Nevada, and if your ponds are deemed suitable, perhaps Wyoming could use it to develop a stock of one of their native cutthroat trouts. I am particularly interested in learning more about the performance of the Snake River cutthroat trout in ponds. So far the results have been promising.

I am enclosing a manuscript that will be published in a technical fisheries journal, prepared by a graduate student and I, on the Snake River cutthroat trout in a lake in Colorado. The article is written in a technical style for fisheries biologists, but I believe it will reveal my thoughts on the subject of evaluating different species and races of trout and the need to preserve the various types that still exist.

Sincerely,

Robert Behnke

RB:vv

September 6, 1973

Division of Fisheries Research Attn. Mr. Dan Rasovich

Robert Behnke Colorado Cooperative Fishery Unit Colorado State University, Fort Collins, CO 80521 Travel Authorization

I request authorization to attend the annual meeting of Desert Fishes Council, November 13, 14, Tempe, Arizona.

This meeting is most important for obtaining and exchanging information on rare and endangered fishes of the Southwest.

No Bureau funds will be used for travel expenses.

September 22, 1973

Mr. Robert W. Scott 1593 South 75 East Bountiful, Utah 84010

Dear Bob:

Thank you for the sample of cutthroat trout from Archie Creek. The specimens have not been examined yet but superficially look like typical S. c. pleuriticus. If they are a pure population, their characters should be virtually identical with a collection I have from the Little West Fork of the Black Fork, Simmit Co., Utah, which appear to be essentially pure pleuriticus.

I was collecting cutthroat specimens in Utah and Wyoming last week, I was most interested in obtaining specimens of the cutthroat native to the Bonneville basin, but also checked some tributaries to the upper Green River.

I believe I mentioned to you about my interest in the cutthroat trout in the South Fork of Sheep Creek in Ashley National Forest. A note in 1950 in the Progressive Fish Culturist revealed that many of these trout lacked a dorsal fin, and I wonder if this condition still persists or even if cutthroat trout still inhabit Sheep Creek.

Sincerely,

Robert Behnke

RB:vv

September 24, 1973

Mr. Don Dexter Wyoming Game and Fish Commission P.O. Box 1589 Cheyenne, Wyoming 82001

Dear Don:

I just returned from a field trip and found a copy of your letter to Mr. Fordyce in which, you expressed annoyance at my reference to lethargy and inertia in fish and game agencies.

Actually, the words were taken out of context from one letter to Mr. Fordyce, and Wyoming Game and Fish people were specifically exempted from the taint of lethargy and inertia, which referred to a malady endemic to large and growing bureaucracies.

The situation was that Mr. Fordyce wanted to take the matter of fish introductions into his own hands because evidently he has an antipathy toward state and federal agencies. During our correspondence, I pointed out to him that such action not be feasible and that fish transplants could only be carried out by the game and fish department. I also pointed out the problems faced by a public agency in its relations with various and diverse segments of the public. I wrote that the problems of lethargy and inertia become built into the system as an administrative organization grows, which, in turn, makes the acceptance of new and innovative ideas more difficult. The specific example cited, however, referred to my problems of propagating Snake River cutthroat trout in Colorado. Despite the demonstrated potential this trout has for fisheries management in Colorado, a grad student and I had to hatch and raise the trout ourselves this year in makeshift facillities, to keep the research program going.

No one, to my knowledge, in the Colorado Division of Wildlife was antagonistic to the Snake River cutthroat project--on the contrary, everyone seemed favorably inclined and 15,000 eggs were obtained. No hatchery wanted to handle them however, and no one could or would assume the responsibility of ram-rodding through the layers of research-management-hatcheries and central office to regions to get the fish reared and stocked, establish a brood stock and keep the ball rolling. My stated or implied comments in one letter was to the effect that Wyoming Game and Fish had not reached the critical mass necessary for lethargy and inertia to be a problem and, in my opinion, was one of the most progressive and innovative fish and game agencies. Because of this, I prefer to initiate such projects as experimentation with red-banded trout in cooperation with Wyoming Game Mr. Don Dexter 9/24/73 page 2

and Fish rather than in Colorado or as part of a federal project--you are a dynamic and action oriented organization and I hope you can stay that way.

In any event, Mr. Fordyce seems determined to raise some rare or interesting trout in his ponds and I hope something can come of his enthusiasm even if the red-banded trout can't be obtained from Nevada.

Concerning warm-water trout, you and Fred Eiserman may be interested in the most recent results from stocking Snake River cutthroat trout in warmer, atypical, cutthroat waters in Utah and Colorado.

One assumption Dick Klein (Colorado biologist) and I want to test is the possibility that a reasonable sport fishery can be developed for advanced anglers (mainly fly fishermen) in an intensively fished, catchable lake by fingerling plants of such trout as Snake River cutthroats and brown trout. The basic idea is that the behavioral differences of brown trout and Snake River cutthroat from the hatchery rainbow are distinct to a degree that will allow them to avoid heavy exploitation by bait fishermen concentrating on the catchable rainbow. This would provide increased angling opportunity, support greater fishing pressure and make use of food resources untapped by hatchery rainbows. Creel census data from Utah and New Mexico where Snake River cutthroat have been stocked with rainbows demonstrate that bait fishermen preferentially exploit the rainbow, allowing a trophy fishery to be established for the cutthroat.

On July 10, 1973, we stocked 1900 Snake River cutthroat trout (2-3 inches;  $\overline{x}$  3.9 gm) in West Lake, a 20 acre pond managed as a put and take fishery west of Fort Collins. The water temperature of the lake was 72° when the fish were stocked and I had reservations about their survival (we had difficulties raising them in our makeshift hatchery and they were not in particularly good condition). On Sept. 14, a seine hall turned up 29 of these cutthroats from 3.5-6.0 inches ( $\overline{x}$  4.5), all in excellent condition. Also in the seine hall were 13 brown trout from a plant of 3,000 3-4 inch fish made in May.

The trout in West Lake should enter the fishery next summer and we should have an indication how our assumption will work out.

In Utah, two lakes on Hill Creek, in a warm, arid climate have been stocked with Snake River cutthroat trout. The lakes are about 40 acres and quite productive. Under these conditions rapid growth is expressed and 2+ fish (3 growing seasons, one in hatchery, two in lake) are 14-17 inches. Fish of 3+ are 17-22 inches, but rapid growth shortens their life span and few survive beyond age III.

I was in Utah and Wyoming last week gathering material for comparing Snake River cutthroat with Bonneville cutthroat and trying to establish the demarcation between the large-spotted and fine-spotted cutthroat trouts of the Snake River drainage. John Erickson provided some good help. Mr. Don Dexter 9/24/73 page 3

I plan to have a grad student thesis completed on the systematics of Snake River cutthroat by next June.

Sincerely,

Robert Behnke

RB:vv

cc:Fred Eiserman

September 24, 1973

Mr. Gary Reinitz Department of Zoology University of Montana Missoula, Montana 59801

Dear Gary:

I cannot assign the Yellowstone Lake trout to any subspecies with any authority at present. Unfortunately the name Salmo clarki lewisi and Yellowstone cutthroat have become synonymous in the literature. According to the rules of nomenclature, the name lewisi is assigned to a cutthroat trout taken at Great Falls, Montana in the Missouri River-thus the name applies to all native cutthraot of the upper Missouri RR River basin (above Yellowstone drainage) and any other geographical groups of cutthroat trout which are taxonomically similar to a degree that no consistant differences can be demonstrated in any characters (which would probably include the westslope cutthroat with S.c. lewisi). As you and I have noted, there are consistant differences between Yellowstone cutthroat and S. c. lewisi. I attribute this to their different origins. The cutthroat trout gained access to the Yellowstone drainage via the upper Snake River, bnot the Missouri River. An early cutthroat trout ancestor must have become established in the upper Snake River before the formation of Shoshone Falls. From here it enterred the Bonneville basin via a former connection with the Bear River, where it further differentiated. Later, Lake Bonneville overflowed back into the Snake River and subsequent to that event--probably about 8,000 years ago -- the cutthroat invaded the Yellowstone drainage from the Snake River, probably over Two Ocean Pass. The upper Yellowstone drainage trout and the cutthroat trout in the headwaters of the Snake River are virtually identical, and they seem to be quite similar to the Bonneville cutthroat trout, S. c. utah. The upper Missouri trout was derived from the upper Columbia system.

I collected fishes in the Bonneville basin and upper Snake River drainage last week to obtain more detailed data on my assumption that the cuthroat trout of the upper Snake River and Yellowstone system are closer to S. c. utah than to S. c. lewisi. That is where the matter now stands, and you may quote my opinions if you want. In any event, the name Salmo clarki clarki is restricted to coastal cuthroat trout Mr. Gary Reinitz 9/24/73 page 2

(which are differentiated from all other subspecies by their karyotype), and it would be erroneous to use this name for the Yellowstone trout.

The Yellowstone trout is not listed as endangered. It is abundant in Yellowstone Park and well protected. Outside the Park, however, it is very rare in the Yellowstone system of Montana and Wyoming.

Sincerely,

Robert Behnke

September 25, 1973

Mr. Roger R. Fliger Montana Dept. of Fish and Game Box 39 Red Lodge. Montana 59068

Dear Mr. Fliger:

If you are conducting research on the biology of golden trout in Montana, it would be important to know if your data pertains to S. aguabonita or to hybrids--S. aguabonita X S. gairdneri, S. aguabonita X S. clarki or combinations of all three species.

If the population is a typical hybrid swarm, particularly with S. gairdneri, the hybrids can be recognized from gross phenotypic appearance. A slight degree of hybridization with S. clarki, however, is not easy to detect unless a series of 10-15 specimens are critically examined for several characters.

You can send your sample to me for examination. I can give you a tentative opinion right away based on cursory examination, but complete examination would have to wait until we are set up to run samples trhough our X-ray process for vertebral counts, which should be in about two months.

The first record I have found for golden trout in Montana (in repts of U.S. Bur. Fish.) is 9000 fingerlings given to the Forest Service and 21,000 fingerlings planted in a virgin lake near the Continental Divide in Glacial National Park in 1929. In 1930 and 1931 the Bozeman hatchery handled golden trout eggs and a spawning run or golden trout was noted in Gallatin National Forest in 1931. In lakes with natural reproduction, the only way golden trout could have maintained their purity, is if no rainbow or cutthroat trouts were ever stocked into these waters. That is, the golden must be completely isolated from rainbow and cutthroat trout to protect them from hybridization. Stocking records are not always adequate and many lakes were stocked by the Forest Service, particularly during CCC times, which were never recorded by the fish and game department.

Sincerely,

Robert Behnke

September 25, 1973

Bob Azevedo

Bob Behnke

Apache trout

Many thanks for Ron Gurntows helpful comments and a copy of Anderson's 1965 report. I have several of Andy's memos and reports but I haven't previously seen this particular one which has some significant remards on Bonito Creek trout.

In the report Anderson mentioned he observed obvious hybrids in lower Bonito Creek in 1960 and 1961 and in upper Bonito Creek in 1961 and 1964. The specimens I have examined from the Bonito Creek watershed consist of samples from Bonito Creek (exact locality not stated) collected by Anderson in 1963 and from Several tributaries in 1964. The specimens are in poor condition, but when I look over all the data from all the specimens, I must conclude that no contamination is apparant--they appear to represent pure <u>S. apache</u>. This has always baffled me because I was told by Dick Baldes and others that rainbows were regularly stocked in lower Bonito Creek and no known barrier prevented them from mixing with the Apache trout upstream. Anderson recommended that a barrier be installed in Bonito Creek but evidently this was not done. I would like to know more about any reputed barrier to upstream migration.

Anderson judged hybrids on the development of parr marks, which I find not a reliable indication. I suspect that he was mistaken in his assumption that hybrids were in upper Bonito Creek--there is no evidence from the specimens he collected in 1963 and 1964 from the watershed.

It would be important to obtain new samples from the Bonito Creek watershed to monitor the influence of the logging operations. If possible, 10-15 specimens from each of the tributaries and from upper, middle and lower Bonito Creek should be collected and preserved this year. My students and I will be involved in other studies, but these collections can be part of yearly samples to detect hybrid influence correlated with habitat alteration, and would be most valuable in that respect.

You might give some thought to funding a graduate student project with rare and endangered species funds on the Apache trout. The problem is too great to adequately handle on a sporadic basis. Let me know if you think this would be feasible, because we begin to receive applications for graduate school in November-December and the better applicants are usually picked up early Hank McKirdy in Missoula said the Forest Service will supply me with some funds to complete a study on the westslope cutthroat trout, so I'm planning to finish up pfojects on Columbia River basin cutthroat trout, including the Snake River trout, this fiscal year.

You may be interested in out Snake River cutthroat project. One of my students has been working with Jim Mullen this year gathering data form the U and O lakes where Snake River cutts were stocked. They are flourishing in Towave Reservoir, with fish up to 22 inches and 5 lbs. at age 3+. Reports from fishermen claim 7-8 lb. fish.

A studnet and I hatched and reared a few thousand Snake River cutthroat this year and we stocked 1900 2 inch fingerlings on July 10, in a 20 acre pond west of Fort Collins. The water temperature was 72°F. when they were stocked and I had doubts on their survival. On Sept. 14, a single seine haul turned up 29 of them from 3 1/2-6 inches, all in excellent condition. The idea I'm testing is that a quality fishery can be established in a catchable put-andtake lake by stocking Snake River cutthroat fingerlings along with hatchery rainbows--based on the assumption that the cutthroat will not be vulnerable to heavy exploitation by bait fishermen concentrating on the catchables, thus enhancing the over-all value of the fishery.

In reference to quality fisheries, I was heartened by Ron Gumtows remards emphasizing the development of a quality fishery (Apache trout management) rather than quantity (hatchery rainbows) on the reservation, and selling the tribe on the economics of such a change in emphasis.

I had urged Andy Anderson to consider this alternative several years ago. Andy was dedicated to preserving pure populations of Apache trout, but mainly as unique curiosities. His big emphasis was developing more catchable lakes to attract more visitors. It seemed logical to me that properly promoted and managed, the Apache trout, as a unique recreational experience, would be tremendously more valuable than the rainbow trout which can be caught anywhere. The type of fishermen attracted to such a fishery would most likely spend more money and cause less environmental impact on the reservation, reducing the costs of maintaining the fishery. It makes good sense to me.

Rocky Mountain Park is going ahead with a greenback trout restoration project which should provide a limited fishery for a rare and beautiful fish and I hope the tribe can be sold on a similar philosophy.

Mr. William Markham Morton Fishery Biologist Emeritus 4700 N.W. Barnes Road Portland, Oregon 97210

Dear Mark:

I am still at C.S.U. in Fort Collins, but am in the process of moving into a new building on campus and my files are not available at present to give you a comprehensive critique of your manuscript.

I would have many comments on such things as writing salmonid in place of salmonoid and confusion arising from common names as "iwana" (= <u>S. malma</u>) pluvius), "kundsha" (= <u>S. leucomaenis</u>) and "blattyen" (= most likely <u>S.</u> alpinus).

Mainly, however, I suspect that you'll get a hard time from the editor over the length of the paper. With page costs what they are, the emphasis is on brevity.

I note a major discrepancy in gillraker values for S. aureolus in table 5-a Stanford Univ. collection is listed with a mean of 18 and a collection from Maine with 22, which is just about the greatest difference of any of the charrs you discuss. It is important to count rudiments on the gill arch because the rudiments on small specimens often become developed as the individual grows and different counts would be obtained for small and large fish from the same population if rudiments are ignored. I use alizarin-red stain on gillrakers and basibranchial teeth to pick up all rudiments.

Your caecal counts on the Swedish "blattyen" (from Lake Ovre Bjorkvattnet?) are probably too low (25-37 in table 6). My counts on the normal and drawf charr from Ovre Bjorkvattnet are 29-50 (42.0) and (39.9) respectively for 19 specimens. Six other samples of Swedish charr (N = 30) ranged from 30-57 caeca.

I don't believe your sample from Lac Leman is a typical example of European Alpine charr. The charr of the Alps typically have 26-32 gillrakers, which would readily separate them from oquassa or aureolus.

I wouldn't make too great a fuss over the common names of <u>oquassa</u> and <u>aureolus</u> because the A.F.S. list of common and scientific names ignores subspecies anyway. I agree with your opinion that charr is more authentic than char and I used the rr spelling in my glacial lakes paper but the editor struck them out. Mr. William Markham Morton October 2, 1973 page 2

I believe you place too much emphasis on lake vs stream spawning as evidence of phylogenetic affinities. It is obvious that stream spawning brook trout (fontinalis) were stocked into the Rocky Mountain region where they have developed thousands of strictly lacustrine populations--spawning on lake bottoms. Everhart indicated that some of the oquassa populations are likely lake spawners because some of the lakes appear to lack suitable spawning tributaries. Salvelinus, as a whole, seems well adapted to spawn in either streams or lakes and I'm sure, as with the Rocky Mountain fontinalis, different populations opportunistically utilize the available spawning areas in either lakes or streams and no phylogenetic significance can be attached to it.

Enclosed are copies of a few things you might find useful. These include correspondence, pages from the 1883 and 1884 U.S. Fish Comm. Repts. (note the hybridization between alpinus and fontinalis) and a report of new discoveries of oquassa [?] in Maine in 1972. I tried to get specimens, of these Maine fish, (I heard that two distinct populations were found in one lake), but a subsequent trip ended in a helicopter crash, killing one of the persons and no collections were made.

I have some oquassa from Wadleigh Pond, Maine and aureolus from Flood's Pond, Maine. I observe neuro-sensory pores on top of the heads on specimens from both samples.

Good luck with the manuscript, I found a wealth of historical data in it.

Sincerely,

Robert Behnke

RB:vv

Enclosures:

Mr. Jack Lermoyeux U.S. Bureau Sport Fisheries and Wildlife 711 Central Ave. Billings, Montana 59102

Dear Jack:

Enclosed are copies of a report on golden trout on the Wind River Reservation and contiguous areas and a few other items which may be of interest. The first major publication on the use of intraspecific variability in fisheries management will be published in the Transactions A.F.S. next year (April or July issue) and concerns the dynamics of a Snake River cutthroat trout population and another race of cutthroat stocked in the same lake in Colorado.

I have a graduate student project now underway on westslope cutthroat trout. The emphasis is on clearing up the taxonomic confusion but we will include information on biology, management and culture. You mentioned the success that the Bureau has had in the propagation of the Arlee stock and if any notes or reports are available I would appreciate receiving them. Do you know where the Bureau plans to stock westslope cutthroat?

I will keep you informed of my finding on Montana golden trout if and when the specimens are received. The person who wrote to me on the matter of identification was Roger Fliger.

Sincerely,

Robert Behnke

RB:vv

Enclosures: several

National Technical Information Service U.S. Department of Commerce Springfield, Virginia 22151

Dear Sir:

I am reporting an error in the books that were shipped to me.

The enclosed copy of my order of September 6, requests two books. The first book listed (TT 71-50112) was received. The second book (TT 70-50164) evidently was confused by the person filling the order and the book received is TT 70-50146--on the subject of hydraulic engineering.

Please advise how to correct this error.

Sincerely,

Robert Behnke Cooperative Fishery Unit Colorado State University Fort Collins, Colorado 80521

RB:vv

Enclosure

Mr. Allen O. Fordyce NX Var Ranch Big Horn, Wyoming 82833

Dear Mr. Fordyce:

I was glad to hear that your ponds were judged to be suitable. As you have seen in a letter to you from Mr. Dexter, he is a bit upset over my implications of lethargy. Actually, Wyoming Game and Fish is one of the more progressive and dynamic fish and game agentices. They have some find and dedicated people and are small enough to avoid the problems associated with a large bureauracracy. This is why I prefer to initiate cooperative research projects in Wyoming.

I wrote to Mr. Dexter and Mr. Eiserman urging that some action be taken to capitalize on this opportunity to use your ponds to establish a bood stock of a rare form of trout. I was told that an attempt will be made to obtain some red-banded trout from Nevada--which would be my first choice. However, the entire population of red-banded trout in the tiny, intermittant Nevada stream is probably only 100-200 fish.

I suggested that if the red-banded trout could not be obtained from Nevada an alternative trout could be selected, such as the cutthroat trout native to the Big Horn River drainage of Wyoming, which now is known from only a single population in South Paint Rock Creek, between Ten Sleep and Buffalo.

You can write to Mr. Dexter or to Mr. Fred Eisermann (Wyoming Game and Fish Office, Casper) to find out the latest developments on their efforts to arrange for red-banded trout from Nevada and what alternatives they are considering if red-banded trout cannot be obtained.

Sincerely,

Robert Behnke

October 9, 1973

Mrs. Candace Ryan Larimer County Department of Public Welfare

Dear Mrs. Ryan:

Mr. James Roscoe is employed by me as a graduate research assistant with funds supplied by the National Park Service and the U.S. Forest Service.

These funds are not adequate to cover the normal full graduate student stipend and Mr. Roscoe has agreed to accept a salary of \$200.00 per month from September, 1973 to June, 1974. This renumeration is not adequate to meet Mr. Roscoe's expenses and other financial assistance will be necessary for completion of his graduate program.

Sincerely

Robert Behnke Associate Professor Fisheries Biology Colorado STate University

Dr. George Weisel Department of Zoology University of Montana Missoula, Montana 59801

Dear Dr. Weisel:

Enclosed is the reprint you requested. Many thanks for the reprints you sent. I have been accumulating information on Montana fishes as part of a study on the systematics of cutthroat trout. The enclosed reports summarizes the present status of the "westslope" cutthroat trout.

I find the cutthroat trout native to the upper Missouri (above Great Falls), the upper Columbia and the South Saskatchewan river basins to be very similar to each other, but distinct from the Yellowstone drainage cutthroat. I attribute this to relatively recent (C2. 8,000 yrs. B.P.) transfers between the Columbia, South Saskatchewan and Upper Missouri drainages via lakes formed by the retreating glaciers. The trnasfers were likely of the **ff**ilter bridge" pattern because apparantly only a few species made it to all three drainages. Cutthroat trout in the Yellowstone drainage undoubtably came from a stock isolated by Shoshone Falls in the upper Snake River--and probably long separated from the cutthroat of the upper Columbia. This migration route (Snake, Yellowstone, or Missouri) was likely used by <u>Cottus bairdi</u> and <u>Catostomus</u> platyrhynchus also.

The enclosed sheet on distribution of Montana fishes was prepared to provide some indications of zoogeographical patterns and invasion routes. I would appreciate any corrections or comments.

Sincerely,

Robert Behnke

RB:vv

Enclosure

Mr. GAry Reinitz Dept. of Zoology University of Montana Missoula, Montana 59801

Dear Gary:

Permission is not required to reproduce a table or figure from a scientific journal (no copyright is involved), you merely cite the reference. For example: "Meristic variation in western North American trouts (from Schreck and Behnke [1971, Table 1])."

You may be interested in a study just started with Dr. James Shaklee, a former student of Clement Markert, and an authority on LDH of fishes. We are goint to examine gene frequencies between cutthroat trout and rainbow trout in a single river system to evaluate hybridization and gene flow. We made our first cutthroat trout collection last week at an elevation of 10,000 ft. and next week will sample the rainbow population in the lower reaches of the river at about 6000 ft. Protein variability will be compared with morphological variability.

You will be interested in an article in the most recent issue of Systematic Zoology, 22(3):257-270 by Utter, Allendorf and Hodgins--"Genetic variability and relationships in Pacific salmon and related trout." I discussed this paper with Utter on the phone and he told me they have not yet found qualitative differences between rainbow and cutthroat trout for any protein with the possible exception of creative kinase, which so far has exhibited a 3 banded pattern in rainbows and 2 bands in **u**utthroat. He also mentioned the enzyme AAT is highly polymorphic in cutthroats.

Sincerely,

Robert Benke

Dr. William Gould Montana Cooperative Fishery Unit Montana STate University Bozeman, Montana

Dear Bill:

Enclosed is a copy of a letter to George Weisel concerning Montana fishes. I would also appreciate your comments on the distribution list.

I have all the data on trout specimens on loan from you and photos have been made of them. They will be returned soon. I want to check spotting patterns once more and make some final notes.

Sincerely,

Robert Behnke

RB:vv

Enclosures

Dr. Bruce B. Colletti Natinal Marine Fisheries Service Systematics Laboratory U.S. National Museum Washington, D.C. 20560

Dear Bruce:

Enclosed is a reprint of my **0**972 salmonid systematics paper, plus several others published in recent years. Extra copies of 1971-72 papers are for Dan Cohen, who requested a reprints exchange two years ago. Dan provided some good help on the Encyclopedia article on Salmoni**f**ormes.

I should point out that I have had to neglect several office amenities such as mailing lists for reprints, because my Bureau of Sport Fisheries "Systematic Lab" is pretty much a one man operation with no budget. Last year I was officially trnasferred from the Coop Unit program, ostensibly to allow more time and freedom to pursue ichthyological work and provide info to federal agencies on various fishes. But no job position has been created and I must scratch up funds from the National Park Service, U.S. Forest Service, etc. to support students, hire a part-time secretary and pay expenses. I have an office and lab in a new Zoology-Amatomy building on campus, but still use the Coop Unit for my address.

Actually I am quite happy with the situation, but a certain emphasis on relevance and application for fisheries management may be noted in my work, influenced by the source of funds I obtain.

I am enclosing a copy of a manuscript accepted for publication in the Transactions of the American Fisheries Society which exemplifies this point. My original interest in this project was to gather data on the mechanisms of coexistence between two closely related populations. That is, can two populations derived from a melatively recent phyletic divergence (during or since the last glaciation have sufficient differentiation in ecological and hehakoiral traits to allow them to occur sympatrically without direct competition? Much of my speculation in my 1972 paper on sibling species was based on the assumption that they could. The results obtained from the two races of cutthroat trout verified my assumption and would have made a suitable article for Systematic Zoo or Evolution but the project was supported by Colorado Fish and Game, thus the change in emphasis on what its all about. In any event, I think it is an Me. Bruce B. Colletti October 12, 1973 page 2

interesting paper, and reprints won't be available for another year, so I'll send you a copy now--and point out that the real significance is that the data supports my speculations on the origin of salmonid sibling species.

Sincerely,

Robert Behnke

RB:vv

Enclosures

Dr. Nils-Arvid Nilsson Drottningholm Institute for Freshwater Research Drottningholm, SWEDEN

Dear Nils:

If you can find the specimens of Ovre Bjorkvattnet char (or from any other lake) I would certainly be most grateful to receive them for more detailed study. Dr Naevdal wrote that he will attempt to obtain more specimens for me from Norway.

I hope to develop a manuscript on Scandanavian char, regarding my viewpoint on their systematics.

My major objections to Dr. Nyman's article are that esterase is a poor choice of enzymes on which to base taxonomic or phylogenetic deductions--it is too labile (evolutionarily unstable), and his data on allelic frequencies of sympatric pairs fully supported my opinion on their close relationships and recent origins--are quite contrary to his interpretation of his results.

I would be greatly interested in your unpublished data and observations on interactions of rainbow trout and cutthroat trout in British Columbia. I have a continuing study on interactions of these two species in lakes in Colorado and Utah.

I would appreciate copies of your notes and data if you would be willing to release the unpublished material.

Sincerely,

Robert Behnke

Mr. Bill Jackson 2674 N. Victoria Roseville, Minnesota

Dear Mr. Jackson:

Your letter of October 16, was not received until October 22, You mentioned you planned to be in Fort Collins on the 19th and would visit me. I was tied up all last Friday afternoon in a Ph.D. exam, and was unavailable if you dropped in during that time.

I was collecting in the upper Snake River drainage in September but failed to find cutthroat trout in the Buffalo Fork drainage. We did make some collections from the Snake River drainage and the Bonneville basin of Utah.to test the assumption that the Bonneville trout and the large-spotted cutthroat of the upper Snake and Yellowstone drainages are of common and recent origin.

I'm sorry I missed you last week, but let me know when you expect to be in the area again.

Sincerely,

Robert Behnke

RB; VV

Mr. Osborne Casey Fisheries Biologist Flathead National Forest Kalespill, Montana 59901

Dear Osborne:

Your latest collection from Griffin Creek has not been analyzed yet, but I can provide opinions on the other collections on your list.

Of those in the North Fork of the Flathead drainage -- Big, Coal, Hay, Whale, Tuchuck, Spotted Bear, Bunker, Harrison and Upper Twin Creeks-most look like good westslope cutthroat--that is the spotting pattern is similar and the mean values for meristic characters fall within the following range--vertebrae, 61 + 0.5; gillrakers, 19 + 1.0; pyloric caeca, 35-40; scales, 165 + 7.0 and basibranchial teeth present in all specimens. The following exceptions are noted: Whale Creek --- spots large, sparse, round and pronounced in outline (atypical of westslope pattern). Also scale counts and vertebrae counts are higher (182.7 and 61.8) than expected. I doubt that the Whale Creek cutthroat population represents a pure, native stock. The fact that 4 of 10 specimens from Bunker Creek lack basibranchial teeth and the mean scale count is 193 for this sample, leads me to the conclusion that Bunker Creek trout have been influenced by hybridization. The other samples are quite uniform but there is some variability in vertebrae and gillraker numbers which leads me to suspect that slight introgression has occurred in the migratory stocks. The samples from Spotted Bear River, Harrison Creek and Upper Twim Creek look like the best bets for pure populations. Only 2 specimens make up the Tuchuck Creek sample and I can't say much about them except that there is nothing to indicate a hybrid influence in these 2 fish.

The Middle Fork Flathead drainage samples (Puzzle, Miner, Clack, Trail, Gateway and Basin Creeks), are generally similar to the North Fork samples. Clack Creek and Basin Creek appear to have the strongest hybrid influence. Puzzle Creek has a high number of gillrakers (20.5) for westslope cutthroat.

Good Creek and Griffen Creek (of Stillwater drainage); Good Creek trout have suspiciously large, round spots and 1 of 8 specimens lack basibranchial teeth, otherwise, the characters are typical of westslope Mr. Osborne Casey October 23, 1973 page 2

cutthroat. The 3 specimens from Criffen Creek appear to be typical westslope cutthroat but I'll await the analysis of the new, larger, sample before giving you an opinion on them.

One point is obvious from the samples discussed above and that is that many of the samples are from migratory populations which most likely intermingle in the main rivers, but return to their home tributary for reproduction, and this results in different degrees of hybrid influence in the separate stocks. I hope you will be able to obtain samples from the Kuotenai drainage.

Sincerely,

Robert Behnke

RB:vv

cc: Mr. Henry McKirdy Jim Roscoe

1

Mr. Chuck Birkemeyer Dixie National Forest Pine Valley Ranger District St. George, Utah

Dear Chuck:

Enclosed are the reports on the Utah cutthroat trout which I mentioned to you during our collecting trip out of Pine Valley last month.

Although the analysis of specimens is not completed, I believe the cutthroat trout in Water Canyon are identical to those in the headwaters of Reservoir Canyon and represent a pure population of Salmo clarki utah.

I would appreciate any new information you may come across concerning other locations with populations of native trout.

Sincerely,

Robert Behnke

RB:vv

Enclosures

Mr. Bob Hart Utah Division of Wildlife Resources 712 E. 600 S. St. George, Utah

Dear Bob:

Enclosed are the reports on the Utah cutthroat trout which I mentioned to you during our collecting trip out of Pine Valley last month.

Although the analysis of specimens is not completed, I believe the cutthroat trout in Water Canyon are identical to those in the headwaters of Reservoir Canyon and represent a pure population of Salmo clarki utah.

I would appreciate any new information you may come across concerning other locations with populations of native trout.

Sincerely,

Robert Behnke

RB:vv

Enclosures

Dr. W.R. Gould Cooperative Fishery Unit Biology Department Montana State University Boxeman, Montana 59715

Dear Bill:

Thanks for your comments on Prosopium coulteri. You are correct that there are no records of pygmy whitefish in the South Saskatchewan drainage of Montana, but it was recently described from Wasterton Lakes, Alberta, just over the border, by Lindsey and Franzin (1972. Jour. Fish, Res. Bd. Can., 29(12):1772-1775). Evidently the species is indigenous to the South Saskatchewan drainage, and might turn up in one of the lakes on the Montana side one day. Weisel, et. al., (1973. Fish. Bull., 71[2]:587-596) list several new discoveries made in recent years of this secretive fish in Montana.

Sincerely,

Robert Behnke

Bob Azevedo

Bob Behnke

Apache trout research

Your memo of October 15, was encouraging in regards to funding a graduate student research project on Apache trout. I want to call to you attention an opportunity to obtain the services of an outstanding person for this project. I have a student, Mr. Paul sekulich, currently working on the evaluation of the Snake River cutthroat trout in three lakes on the U.O. Reservation in Utah, for his M.S. degree.

I think Paul is doing an outstanding job and will come out with some real insights and valuable information on the role this trout can play in a management program. You and Ron Gumtow might check with Jim Mullen for his candid opinion on this project and on Sekulich's performance.

Several years ago, Paul was one of my undergraduate advisees. He was academically our outstanding graduate in the department in 1969. He enlisted in the Army after graduation, but I told him to see me after his discharge. He was an officer in the ARmy Intelligence and just before his descharge I arragged the Snake River cutthroat project for him. Yesterday he discussed Ph.D. work and I told him I had no assured funds to cover a Ph.D. project. I suggested he communicate with other Coop Units because he is one of the few students who I have no doubts concerning abilities for Ph.D. work.

I then received your memo and thought over the Apache trout situation. There are two aspects of potential research on the Reservation where Sekulich's experience could ideally be put to use. These concern the mechanisms of coexistence of Apache trout with brook and brown trouts in upper Ord Creek and the interactions between Apache trout, rainbows and hybrids in the logged-over disturbed area of the Bonito Creek watershed-to determine niche parameters and how and under what conditions niche separation breaks down. This type of research is essentially the basis of the Snake River cutthroat project (we call it interactive segregation).

Looking ahead, Paul's maturity and quiet, unassuming competance is of the type that wins admiration and respect of both younger students and older practical field men--he works exceptionally well with a variety of people. I would like Bureau people to get to know him with a view towards eventual Bureau employment--I would like to see more persons of his caliber employed by the Bureau.

I am confident that the depth and completeness of information obtained from a well planned study, conducted by a person of Paul's ability, would far

Memorandum Bob Azevedo October 25, 1973 page 2

exceed a simple, two dimensional, life history study in its relevance and immediate application to management of the species.

Last Tuesday, October 16, Jim Mullen and I took 80 greenback cutthroat trout from Como Creek and transplanted them into Hidden Valley Creek in Rocky Mountain Park. Everything went well and I believe they will become established. The next issue of Trout Unlimited magaxine (due out any day) has a feature story on greenback trout and our efforts to restore them. The author, Mr. John Gagnon, accompanied Jim and I last week and took photos for a follow-up article.

I have a new office and laboratory in the new Zoology-Anatomy bldg. on campus (I still receive mail at Coop Unit) and I have a post-doctoral fellow from Yale, Dr. James Shaklee, in my lab. Shaklee is one of the world;s authorities on LDH enzymes in fishes and in electrophoretic techniques for protein determinations. We have started a project of gene flow between r rainbow and cutthroat trout in the Poudre River. I would like to have any interested Bureau personnel to know about my collaboration with Dr. Shaklee and the opportunity to obtain information on biochemical techniques for a variety of purposes.

Region II RRSE Team Attention: Bob Azevedo

Bob Behnke

Standardization of R&E reports

Harold Steinhoff related the details of the recent meeting in Albuquerque.

The Enclosed annotated outline is for review and comments so we can agree on a standard format for the final typing. There is a problem of pagination and indexing. Consectutive pagination would cause a problem with any additions and addenda incorporated at a later date. How about a phylogenetic breakdown? There are two major divisions--Wildlife (Mammalia and Aves) and Herps and Fishes (Osteichthyes, Reptilia, Amphibia). From there we have orders, families, genera, species and subspecies. Some combination of Latin and Arabic numbers and Capital and small letters might be devised for indexing and the pages of each report be numbered 1 - n. Let us hear of your ideas on this.

Dr. George R. Weisel Department of Zoology University of Montana Missoula, Montana 59801

Dear Dr. Weisel:

Enclosed are three reprints requested in your letter of October 25. I have a relatively good representation of cutthroat trout samples from the Flathead-Clark Fork drainage of Montana for the westslope study. We are lacking material from the Kootenai and South Saskatchewan systems, but all indications from what is available, suggest the native trout of these drainages are virtually identical with Clark Fork cutthroat trout. If it is not too much trouble, I would appreciate a list of cutthroat trout samples in your collection.

Also enclosed is a copy of a letter to Mr. Reinitz, a graduate student at your school, with my views on his original proposal to study westslope cuthroat trout with biochemical techniques. I saw Mr. Reinitz this summer and, as I had predicted, he was not able to find any qualitative (species specific) difference between rainbow trout and cutthroat trout in any protein he studied. No valid taxonomic implications (evaluation of phylogenetic divergences) can be made from simple allelic frequency data-and this was one of the points I attempted to bring out in my 1970 paper.

I meant to note for you on my distribution list of some Montana fishes that the occurrence of Prosopuins coulteri in the South Saskatchewan drainage is based on the paper of Lindsey and Franzin, 1972 (Jour. Fish. Res. Bd. Canada, 27[12]:1772-1773), discussing the recent find of this species in Waterton Lakes, Alberta.

Sincerely,

Robert Behnke

RB:vv

Enclosures

## COMMENTS

For your purpose of assessment of information on fish collections, I should bring out the following points regarding my collection.

I am currently employed by the U.S. Bureau of Sport Fisheries, Division of Research. When I came to Colorado State University as Assistant Leader of the Colorado Cooperative Fishery Unit in 1966, I emphasized studies on rare and endangered western trouts (genus--Salmo) and a collection was started. Due to space limitations and lack of technical assistance, the collection has specialized in samples of rare trout and probably now has the greatest concentration of specimens of various subspecies of Salmo clarki (including four undescribed subspecies), Salmo gilae, S. apache and several distinctive forms of an undescribed group of trout I have referred to as the red-banded trout. I also have two (paratypes) of the three known specimens of a species I described from Turkey (Salmo platycephalus). A separate collection of representative orders and families is manitained for teaching my ichthyology course.

Last year, I vacated my position as Assistant Unit Leader with the Coop. Fish. Unit, but have remained at Colorado State University, employed by the Bureau of Sport Fish. although without an official job position.

I have moved into the Zoology-Anatomy Building and discussions are underway concerning transferring my collections from the Coop. Fish. Unit to Zoology and combining them with the herp collection with curatorial assistance.

The ownership of the fish collection is dubious. About half of the specimens were personally collected and about half were sent by federal and state agencies for identification and information on status. Both federal and university funds were involved in establishing the collection. Considering the value of mycoollection as reference material on several forms of rare trouts, I have planned to divide it among the U.S.N.M., the Univ. Michigan and the Calif. Acad. Sci., if I should leave C.S.U., to ensure against the loss of my specimens.

Several graduate degrees and publications have been based on the specimens in this collection.

October 30, 1973

Mr. George Hetzel 1305 East Park Dr. Evansville, Indiana 47714

Dear George:

Thanks for your letter informing me of your activities. Last week I talked with Raleigh Brooks in his new office in Alyesworth Hall about the reception the booklets produced by you and Jon Hooper received. He told me the demand has been great and other states want to duplicate them. They are considered the finest examples of their kind in content and technical excellence. Your MS work was the best example of what a plan-B M.S. degree can be with proper planning and enthusiasm.

I don't know if you are actively seeking professional employment in the natural resource field, but the news is still discouraging-very few vacancies. The department is actively attempting to discourage students from the wildlife biology major because of the employment situation.

If you are in Colorado in January, plan to stop by for a visit. I have a new office in the Zoology building, but it shouldn't be difficult to find me.

Sincerely,

Robert Behnke

Mr. Bruce H. Bauer Department of Biological Sciences Eastern Kentucky University Richmond, Kentucky 40475

Dear Mr. Bauer:

I received your application forms and placed them in your file.

I regret that I must send you discouraging news, but at last weeks! faculty meeting it was brought out that our department has too many graduate students for the faculty and facillities to adequately handle and severe restrictions on acceptence of new students for the winter and spring quarter will go into effect in an effort to reduce the load. (enclosed is the memo of the faculty meeting where the problem was discussed). I would like to see every student who has the ability and motivation for graduate work be given the opportunity for graduate study and I am sorry that I cannot give you more hopeful news. Enclosed is an annual report of Cooperative Fishery Units. The type of research conducted at each Unit is summarized and names and addresses are listed. You may consider some of the Unit Leaders and inquire about possibilities for graduate work. I must point out, however, that most situations for graduate funding are similar to my own, whereas funds are available on a fiscal year basis and projects are designed to be completed in Juna and new ones with new students initiated in July or September.

Based on my experience with other students, who wanted to enter graduate school but could not gain acceptence at the appropriate time, I would suggest you consider employment with an agency which would allow you the opportunity to go back to school after a year or two on the job. Several state fish and game departments cover mody or all of the expenses and if you are located near a University campus, arrangements are often made for calss attendence and thesis work while remaining a full-time employee. Several Colorado state fisheries biologists have picked up M.S. (and at least 2 earned their Ph.D.) degrees while employed by the Division of Wildlife.

Sincerely,

Robert Behnke

RB:vv

Enclosures

November 1, 1973

Mrs. Barra Gots Department of Zoology University of Guelph Guelph, Ontario Canada

Dear Mrs. Gots:

I came across a reference to a recent publication by Dr. Mac Crimmon and you on rainbow trout in the Great Lakes. I would greatly appreciate a copy of this paper if available.

Sincerely,

Robert Behnke

November 6, 1973

Mr. Fred Eiserman Wyoming Game and Fish Commission 188 DAhlia St. Casper, Wyoming 82601

Dear Fred:

Enclosed is a copy of a letter to Pat Coffin Re: Red-banded twout and Humboldt cutthroat trout for transplants into Wyoming. Also a reprint on goldeye which I found after our discussion on their occurrence in Wyoming.

The copy of the story on greenback trout gives you the straight scoop on the concept of quality vs quantity in fish management.

In regards to new or unrecorded species in Wyoming do you know anything about the golden char of Sunapee Lake, New Hampshire (Salvelinus alpinus aureolus), in Wyoming? A note in a 1939 issue of Wyoming Wildlife, 4(8) claimed this fish was reported from Crystal Lake in the Big Horn Mountains. Is it possible that is Was there and might still periist?

Sincerely,

Robert Behnke

RB:vv

Enclosures

November 6, 1973

John S. Crellin Duputy for Researce Management U.S. Dept. of Agriculture Forest Service Carson National Forest Box 558 Taos, New Mexico 87571

Dear Mr. Crellin:

The sample of cutthroat trout from the Rio Chequito was received. Comparisons with data based on three samples from this stream, collected in 1966-1969, indicate no difference between the 1973 sample and previous ones. My opinion is that the cutthroat trout in the Rio Chiquito, althogh probably not 100% pure, ideally approximates the diagnosis of the original cutthroat trout of the Rio Grande drainage, <u>Salmo clarki virginalis</u>, and can be considered as a virtually pure stock of this subspecies. If rainbow trout or hybrids gained access to the Rio Chiquito this year during the loss of the fish barrier, effects of hybridization will not be apparant for several years.

Your letter of October 24, mentioned stream barriers were lost in three streams on the Carson Forest this year. Evidently one of these streams is the Rio Chiquito. If you would send me the names of the other two streams and I can let you know what information I have on the cutthroat trout populations occurring in them, in relation to their relative purity.

Sincerely,

Robert Behnke

Mr. Pat Coffin Nevada Department P.O. Box 1087 Elko, Nevada 89801

Dear Pat:

Evidently, no suitable S.C.S. ponds turned up in Nevada which might be used to establish brood stock of the red-banded trout and the Munboldt cutthroat, However, some suitable ponds have been offered for use in Wyoming. Wyoming Game and Fish people have expressed interest in the project and communication was initiated between them and Tom Trelease, I believe, concerning an exchange of fishes.

I doubt that sufficient numbers of red-banded trout could be obtained this year, but what might be the possibilities for next year? Did reproduction take place in Wolf Creek this year? Have any further transplants been made?

I sincerely hope something can be accomplished toward establishing a brood stock of the Chino Creek trout. Once established, eyed eggs would be available for re-introductions into Nevada. If arrangements are made between Wyoming and Nevada for obtaining a stock of redbanded trout, I would also like Wyoming to transport some Humboldt cutthroat trout for an experimental brood stock. The Humboldt trout appears to have the ability to thrive in warm, turbid reservoirs with warm-water species. I would suggest some readily accessible streams such as Ganz, Frazier and Sherman Creeks might be used for a stock for transplantings.

I am anxious to see some results of experimental plants for actural field tests of the red-banded trout and Humboldt cutthroat, but we need a source of eggs to get started.

Any new discoveries of native trout this year?

Sincerely,

Robert Behnke

cc: Mr. Fred Eiserman RB:vv OPTIONAL PORN NO. 10 MAY 1982 EDITION GSA FPMR (41 CFR) 101-11.8 UNITED STATES GOVERNMENT

## Memorandum

TO : Dr. R.E. Putz

DATE: November 6, 1973

FROM : R.J. Behnke

SUBJECT: Recent activities

For a general description of activities I have been involved with, enclosed is a copy of my quarterly report to the Buelah Genetics Lab.

I would like to call your attention to the comments on my new laboratory and my association with Dr. James Shaklee. Dr. Shaklee is an outstanding authority on techniques of protein analysis in fishes and the availability of the most modern electrophoresis apparatus--the Bach and Lombe Spectrophore II--offers an opportunity for learning techniques applicable to a variety of fisheries research. Interested Bureau personnel should be aware of this opportunity for detailed protein analysis and can contact me for further information. A copy of a research proposal, designed to obtain some funds from the University, is enclosed. This proposal outlines a project initiated by Dr. Shaklee and I.

A successful transplant of the endangered greenback cutthroat trout into Rocky Mountain National Park was made on October 16. A copy of an article on greenback trout in the most recent issue of Trout Unlimited: magazine is enclosed. Mr. Gagnon, the author, accompanied us on the October 16th, transplant operation for a follow-up story. The article points out the cooperative efforts of the Bureau, the Park Service and the Forest Service in initiating a program to save the greenback trout.

I would appreciate some expression from the Bureau on plans for my future. All indications are that I will be transplanted to the Buelah Lab--a course of action I frankly consider a dead-end to my career and to the several research projects with which I am currently involved. After two years and two submissions, I hope some in-depth and critical thought has been given to my proposals that I can best serve the Bureau in a variety of functions with a University based operation. Has any communication been initiated with the various agencies I work with--the Park Service, the Forest Service, B.L.M., and state fish and game agencies on their opinions regarding my role for input information for their programs.

Considering the economics of the situation it should be emphasized that most of the funds supporting my research, including rare and endangered fish studies, do not come from the Bureau--and the opportunities to develop an expanded program based on outside grant support is now more favorable because of my new laboratory and dual association with both the Fisheries and Zoology departments.

Enclosures



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

School of Public Health Sea Grant Program University of North Carolina Chapel Hill, North Carolina 27514

Dear Sirs:

I would greatly appreciate a copy of the publication: "A Bibliography on Artificial Reefs and Other Man-Made Fish Attractors."

Thank you.

Sincerely,

Robert Behnke Colorado Cooperative Fishery Unit Colorado State University FortC60limns, Colorado 80521

Coastal Plans Center for Marine Development Services 1518 Harbour Drive Wilmington, North Carolina 28401

Dear Sir:

I would greatly appreciate a copy of your publication, 63-2: "Bibliography on Artificial Reefs."

Thank you.

Sincerely,

Robert Behnke Colorado Cooperative Fishery Unit Colorado State University Fort Collins, Colorado 80521

Michigan Department of Natural Resources Mason Building Lansing, Michigan 48926

Dear Sirs:

I would agreatly appreciate a copy of your recent publication: "Michigan Great Lakes trout and salmon fishery 1969-72."

Thank you.

Sincerely,

Robert Behnke Colorado Cooperative Fishery Unit Colorado State University Fort Collins, Colorado 80521

Mr. Allen R. Reedall 14640 Natalie Drive Whittier, California 90604

Dear Mr. Reedall:

Two weeks ago I received a copy of a letter to you from Dr. Leopold at Berkeley, noting that your letter to me was being forwarded.

Your letter has not been recieved as yet.

I remember from our former correspondence that you had an interest in trouts, particularly those trout native to the Kern River.

I left California for Colorado in 1966 but continued my studies on the Kern trout. With the assistance of a graduate student, Dr. Carl Schreck, we completed this study in 1969 and published the results in 1971. The enclosed reprint is based on research on the Kern trout and other trout of California.

Our conclusion is that there are two distinct groups (subspecies) of golden trout, native to the Kern drainage. Salmo aguabonita aguabonita is the golden trout of the South Fork of the Kern and of Golden Twout Creek. The trout native to the main Kern River and the Little Kern River are considered as virtually identical and both are classified as Salmo aguabonita gilberti.

I might point out that our conclusions and revisions of the taxonomy are not unanimously accepted but no one has produced any evidence to the contrary.

We also believe that a trout represented by a few relict populations around Mt. Shasta are closely related to S. a. gilberti, and this contention has since been supported by comparisons of the chromosomes of the trout in Sheephaven Creek.

Also enclosed is a copy of an article from the most recent issue of Trout Unlimited's magazine which tells about some current projects.

If you can recall the contents of you letter of October 19, let me hear from you and I'll try to respond to any questions.

Omegon Game Commission P.O. Box 3503 Portland, Oregon 97208

Dear Sir:

I would greatly appreciate a copy of Fisheries Research Report No.6: Ecology and management of coastal cutthroat trout in Oregon.

Thank you,

Robert Behnke Colorado Cooperative Fishery Unit Colorado State University Fort Collins, Colorado 80521

Mr. Bobert H. Haburchak Bureau of Land Management Ø.O. Box 119 Worland, Wyoming 82401

Dear Mr. Haburchak:

Enclosed is a preliminary report on westslope cutthroat trout which makes mention of the trout native to the Yellowstone drainage. A current graduate student thesis will cover this subject in greater depth.

My opinion is that the cutthroat trout native to the Yellowstone drainage is distinct from the cutthroat trout of the rest of the Missouri River system because it had its origin from the Snake River and not the Missouri. Downstream from Yellowstone Park pure populations of the native cutthroat trout are rare. During a survey of the drainage last year, some collections were obtained in Montana, but according to Mr. Louis Pecacheck, Fisheries Biologist with Wyoming Game and Fish at Cody, pure populations of cutthroat trout in the Yellowstone system of Wyoming are extremely rare outside of Yellowstone Park. My only Wyoming collection came from South Paintrock Creek, northeast of Worland. Any remanat populations which has not been hybridized with rainbow trout should certainly receive special consideration to protect it.

Would you kindly send me a list of streams where you suspect native cutthroat may yet persist.

Sincerely,

Robert Behnke

RB:vv

Dr. James Deacon Department of Biology University of Nevada, Las Vegas Las Wegas, Nevada

Dear Jim:

During the busy sessions at the symposium we never did have time to adequately exchange information.

You mentioned you would like to see the original Needham and Behnke manuscript on western trouts. I have it in a loose leaf notebook and If you want, I can loan it to you to look over and to copy if so desired. As I told you, I have much more data now and many sections will need drastic revisions and new sections added.

I plan to complete the description of the undescribed subspecies of cutthroat trout and get into the red-banded trout group before I consider publication of a monograph.

I would appreciate a copy of the bibliography on <u>Plagopterus</u> and any new info to add to my reports on <u>Plagopterus</u>, <u>Lepidomeda and Gila robusts seminuda</u>. Also the names of the students (and the titles of their intended theses) who are working on the Virgin River fishes.

Enclosed is a copy of my abstract for the symposium.

Sincerely,

Robert Behnke

RB:vv

Mr. Ernie Schwiebert 1221 Stuart Road Princeton, New Jersey 08546

Dear Mr. Schwiebert:

Ed Merrick told me of your interest in my reports and publications on salmonid fishes in relation to a book you plan to write.

Enclosed are copies of some of my work which represent a cross section of the kind of information I have available. After persuing the material you may wish to direct more specific questions.

My publications on the taxonomy of the family Salmonidae are directed to a rather small segment of the scientific community, but in recent years I have been involved in studies on rare and endangered form of North American trout and I believe this information should be made more generally known to the public. Some of these trout may have some real potential as sportfish and a more general awareness of them will help to save them from extinction.

Among an undescribed group of trout I call the red-banded trout, I found a relict population in northern Nevada, which was persisting in a badly degraded, intermittant stream. The significant aspect of their survival was that the water temperature of their habitat was 83°F on the day we found them (a temperature which should have been lethal to most trout. Despite the extreme temperature, these trout rose to flies and fought vigorously when hooked. An attempt is now planned to establish a brood stock of this warm-adapted desert trout.

Another trout with angling potential is an undescribed subspecies of cutthroat trout native to the Snake River, Wyoming. A manuscript, coauthored with Mr. John Trojnar, to be published in the Transaction of the American Fisheries Society, is among the enclosures. This manuscript discusses the performance of this trout in a Colorado lake. Further studies have indicated that this trout is not so vulnerable to being caught by bait fishermen when stocked with rainbow trout. This has led to experimental stockings Mr. Eknie Schwiebert November 27, 1973 page 2

in heavily fished "put-and-take" lakes to test my assumption that a quality fishery with artificial lures can be established in heavily fished waters by using a trout less susceptible to bait fishermen along with plants of catchable rainbow trout.

An interesting aspect of the Snake River cutthroat trout is its facility to change feeding habits in different environments in coexistence with different fishes.

Sincerely,

Robert Behnke

RB:vv

Mr. Bob Wieey Wyoming Game and Fish 351 Astle Ave. Green River, Wyoming 82935

Dear Bob:

Evidently the specimens from Beaver Dam Hollow Creek have not been examined yet. I do not find data sheets on them in the folder on Green River trout. I'll try to have them completed this winter.

Enclosed is a status report on <u>S. c. pleuriticus</u> and copy of a letter sent to Forest Service re. Muddy Creek specimens. As I mentioned, a copy of a thesis with datmaon <u>S. E. pleuriticus</u> was sent to Fred Eiserman.

Sincerely,

Robert Behkke

RB:vv

Encleeures

Mr. Jack Larmoyeux Bureau of Sport Fisheries and Wildlife 711 Central Ave. Billings, Montana 59102

Dear Jack:

Enclosed are some reports pertaining to rare fishes with distribution (or former distribution in Wyoming). Galen Boyer, Wyoming Game and Fish, Cheyenne, has developed a state list of rare vertebrate animals of Wyoming.

Besides the names of fishes and people we discussed on the phone, you might togtact Dr. Andrew Sheldon, Zoology Dept., Univ. Montana, Missoula, regarding some odd-ball things like molluscs, arthropods, etc. which might be considered.

Soncerely,

Robert Behnke

RB:vv

Mr. Harvey Willoughby Bureau of Sport Fisheries & Wildlife 10597 West 6th Avenue Denver, Colorado 80215

Dear Harvey;

Enclosed ia a copy of a paper on Yugoslavian salmonids I prepared for Dr. Vukovic.

Thanks again for the copy of the proposal for studying <u>Salmo</u> marmorateus <u>Hucho</u> hucho and Salmothymus obtusieostris.

I know that Missouri was quite interested in <u>Hucho</u> a few years ago for possible reservoir stocking. There is a FAO Synopsis on <u>Hucho</u> <u>hucho</u> but it is far from adequate. There is a relatively comprehensive paper on <u>Salmothymus</u> <u>obtusirostris</u> by Draga Jankovic but virtually no nothing of value on the ecology of Salmo marmoratus.

Sincerely,

Robert Behnke

RB:vv

December 5, 1973

Mrs. Carl Hubbs University of California Scripps Institute of Oceanography La Jolla, California 92037

Dear Mrs. Hubbs:

I have been involved in moving into a new office and trying to arrange my reprint collection to establish some semblance of order. I have a box of reprints from Carl, Clark and Bob Miller (arranged by family as a fish collection). In going through the stack I can't find the 1932 paper from American Forests on trout stream improvement (although I believe I have a recollection of this reprint with a forestry motif on its title page?). I must have put it under a subject matter category, But it isn't with my reprints on stream improvement either. If you can send another copy I would appreciate it.

I have been accumulating literature on stream improvement and alteration to provide information to various federal agencies regarding habitat for rare trouts. I note in a recent bibliography on artificial reefs (published by the Coastal Plains Center for Marine Development Services, Wilmington, N.C.) that a 1933 paper by Hubbs, Tarzwell and Eschmeyer, a 1938 paper by Hubbs and Eschmeyer (on lakes) and a 1932 paper by Hubbs, Greeley and Tarzwell are listed but not the 1932 paper in American Forests.

Enclosed is a copy of my abstract prepared for the desert fishes symposium. Also is a copy made from the page proofs of the forthcoming edition of the Encyclopedia Britannica on Salminiformes. The editor had sent some of Carl's contribution to previous editions as guidelines for preparation.

Sincerely,

Robert Behnke

RB:vv

December 5, 1973

Dr. V.V. Barsukov Zoological Institute Academy of Science Leningrad, V-164 U.S.S.R.

Dear Volodya:

I just edited the English translations of Voprosy Ikhtiologii, 13(2) with your article on Helicolenus. I did not send you a copy because I didn't want to upset you with mistakes you always find. Your writing style seems to confuse the translator, but I believe we have all the essentials of the translation correct-if you want a copy of the English version let me know and I'll send it. I don't believe I have written to you in several months and there are some things to acknowledge and thank you for. First, thank you for sending another copy of Voprosy Ikhtiologii, 12(5). I must tell you that the original copy finally did arrive (about the same time as 13(3), badly damaged-it must have had a long and round-about voyage.

I believe I have previously acknowledged receiving the "Dictionary of names of freshwater fishes of the USSR" and Lindgerg's "Fishes of the World"--I find these works most valuable and frequently use them, thanks again.

Also, I should mention the recipe folder on preparation of traditional Russian food. We had a large and flourishing garden this year and converted some of the vegetables into our favorite Russian dishes-golubsti, shchi and borsh. I might mention a variation of borsh you might try and that is to use sourkraut instead of fresh cabbage.

Enclosed is a clipping from a translation list stating that your 1972 PINRO publication was translated by the Fisheries Research Board of Canada. Also are copies of two abstracts on trout which might be of interest to Mrs. Dorofeeva. One of the abstracts was prepared for Dr. Vukovich to present at the Ichthyology Congress, Sarajevo, Yugoslavia. I note in the program of the Ichthyology Congress that V.M. Korovina was scheduled to present a paper on the intestine of Slamothymus and Dr. V.V. Barsukov December 5, 1973 page 2

Mrs. Dorofeeva a paper on the genus Salmo. Would you tell Korovina and Dorofeeva that I would appreciate copies of their abstracts if available? I also note that Klyukanov was listed for a paper on Osmeridae, Shaposhnikova on Salminidae and Svetovidov, Dorofeeva, Klyukanov and Shaposhnikova on salminid classification--if abstracts of these papers are available, I would like to receive copies.

The enclosed photos show Bobby and Cynthia with some of the carp I poisoned from our pond before stocking the pond with cutthroat trout (Salmo clarki). Several 2-3kg carp were removed. The other photo shows the ducks and geese trying to get into the garden and eat the corn.

Best wishes to everyone.

Sincerely,

Robert Behnke

RB:W

December 6, 1973

Mr. Glen Dunning Wyoming Game and Fish Department Pimedale, Wyoming 82941

Dear Glen:

Enclosed are copies of reports on the two subspecies of cutthroat trout, <u>Sakmo clarki pleuriticus</u> (Green River) and <u>S. c. utah</u> (Bear R.), native to the area of your collections. These reports will provide general information on the subspecies, but unfortunately, I can't give you an evaluation of the purity of the 14 samples I received from you earlier this year. In the past, the university has provided student assistants, paid out of federal funds, to help me with the specimen examination. This year the funds were cut and I am without the help I need to handle the specimen evaluation procedure.

A start has been made on your samples but complete data is available only on 3 specimens from Muddy Creek. I had written to the Forest Service and to Bob Wiley about the Muddy Creek specimens, pointing out that I could not arrive at a definite conclusion concerning the purity of the Muddy Creek population based on 3 specimens, but the scale counts suggested a hybrid influence. I note that 31 specimens are represented from the east and west forks of Muddy Creek. If the topography is such to allow free intermingling of the trout between Muddy Creek and its east and west forks, then I can consider the three samples as a single population for purity evaluation--I had told Bob Wiley that a larger sample would be neeessary, but it may not be if the east fork and west fork trout are identical to main Muddy Creek trout (is there any reason to suspect they wouldn't?).

I made collections in the Bonneville basin this summer and hope to come up with an accurrate characterization of S. c. utah, the native trout of the Bear River drainage. The enclosed report lists a sample from the Thomas Fork of Wyoming, which appear to be fairly close to S. c. utah, but I doubt that they are pure. I have found that pure populations of S. c. utah are extremely rare.

A copy of a thesis with data on the Green River cutthroat trout was sent to your Casper office.

I will let you know when I have the complete data from your samples.

Sincerely,

Robert Behkke

December 11, 1973

Mr. Robert P. Pistono Wyoming Game and Fish Department 260 Buena Vista Lander, Wyoming 82520

Dear Mr. Pistono:

Enclosed are two reports on Salmo letnica. From the 1969 plants in three Colorado lakes, only one lake, Parvin Lake, has a creel census and a regular sampling of the fish population. Parvin Lake is about 50 acres at about 8000 feet elevation. It is heavily stocked with rainbow and brown trout. Evidently, the survival of <u>S</u>. letnica was low, but 2-3 specimens turn up each year. The feeding habits of these few specimens were mainly zooplankton (benthos is the major diet of brown trout in Parvin). When the eggs were obtained in 1969, they were divided between two hatchersies. The survival and growth of the fry was somewhat analogous to cutthroat trout in that they did best in the hatchery with the better water quality (less nitrogen).

I had corresponded with Mr. Donald Woods, Minnesota Dept. Conservation, St. Paul, in 1971 concerning Minnesota's experience with <u>S. Letnica</u>. It was propagated for a few years @their broad stock never spawned) and stocked into several lakes but returns were low and successful reproduction probably didn't occur. The Minnesota lakes were not considered as good habitat for <u>S. letnica</u> and the project was abandoned.

The federal brood stock was tranferred from Manchester Iowa to a federal hatchery in Tennessee and interest was stimulated for introducing S. letnica in the eastern states. Mr. R. P. Pistono December 11, 1973 Page 2

The August, 1972, newsletter of the Sotter Division of the American Fisheries Society mentioned "the exotic salmonid sub-committee" which was to prepare a report on <u>S. letnica</u> with a view toward using this trout in southeastern reservoirs. I don't know what come of this and I heard the sub-committee became defunct, but some evidently were stocked in lakes in Kentucky and Maryland. In January 1972, I had a letter from Mr. Robert Davis, University of Maryland, Nat. Res. Inst., Box 3266 National Highway, LaVale, Md. 21504, who, evidently, was in charge of <u>S. letnica</u> intorductions in that state. Mr. Harvey Willoughby, now Assistant Regional Director for Region VI (Denver office) of the U.S. Bureau of Sport Fisheries and Wildlife, is the person who originally brought <u>f. letnica</u> eggs from Yugoslavia. You might contact him for any information he may have.

Fred Eiserman told me a plant of <u>S</u>. <u>letnica</u> was made in a lake near Casper. I would like to be informed on any results you obtain from <u>S</u>. <u>letnica</u> stocking in Wyoming and anything you find out regarding <u>S</u>. <u>letnica</u> introductions in other states.

Sincerely,

Robert Behnke

RB:sa

December 11, 1973

Mr. Hank McKirdy U. S. Department of Agriculture Forest Service Federal Building Missoula, Montana 59801

Dear Hank:

I've been thinking about how to get the \$1000 into the Colorado Cooperative Fishery Unit's budget in the simplest manner. I have a copy of a contract between the Forest Service and the Bureau of Sport Fisheries involving a transfer of funds to the Washington Coop Unit for a fish study, but I think a more direct device is a purchase order arrgngement.

Enclosed is a copy of a purchase order for \$400 from the Forest Service to the Unit for a Rio Grande trout study. The university simply assigns a fund number and handles the billings. Can the Missoula office put the \$1000.00 for the westslope cutthroat trout study in the form of a purchase order as was done by the Albuquerque Office?

Sincerely,

Robert Behnke

RB:sa

Mr. Bill Hosford Oregon Game Commission P.O. Box 8 Hines, Oregon 97738

Dear Bill:

I was happy to hear from you. During the past year I have borrowed several old museum collections of trout and have been able to start to piece together some of the original distribution patterns of different species and subspecies although some problems remain.

All of the specimens we collected in 1972 from the Trout Creek drainage (tributary to Alvord Desert) are predominantly introduced rainbow trout-with a trace of the original cutthroat trout. The University of Michigan loaned me specimens collected from Trout Creek and Little Trout Creek in 1934. Although hybridization was already underway, the specimens make it evident that a cutthroat trout quite distinct from those found today in Whitehorse and Willow Creeks was once native to the Trout Creek drainage and it represents an undescribed, although extinct, subspecies. Another 1934 collection from Virgin Creek, Nevada, also tributary to the Olvord Desert, represents the same form of trout. The original Alvord Trout was definitely a cutthroat trout and not the red-banded trout. On the west slope of the Steens Mountains, in streams tributary to Catlow Valley and Malheur Lake, the red-banded trout is the native trout. I would be very interested to learn of the localities you surveyed in the Steens and what you found.

Evidently the red-banded trout was once more midely distributed in the Columbia River basin. I examined three specimens collected in 1894 near Yakima, Washington which are typical red-banded trout. Another 1894 collection from Walla-Walla, Washington are typical, large-spotted interior cuthroat trout which suggests that this same type of cuthroat may be native to the John Day River (the possibility of native cuthroat trout in the John Day River basin is still a problem I have no new information on).

I made a collection of red-banded trout from an isolated tributary of the Owyhee River in northern Nevada. The unusual aspect of this collection was the fact that we caught the specimens on flies in water of 83°F. It reminded me of Swamp Creek, which I remember was awarm. I don't have a temperature reading for W Mr. Bill Hosford January 8, 1974 page 2

temperature reading for Swamp Creek and I wonder if you might have taken one sometime during a hot summer day? It appears that some populations of red-banded trout might possess some special adaptations for warm water. I am not attempting to establish a brood stock of the Nevada red-banded trout.

Enclosed ia an abstract usummarizing my findings on desert basin trouts.

Sincerely,

Robert Behnke

RB:vv

Mr. V. A. Fry Chappell, Nebraska 69129

Dear Mr. Fry:

Thank you for the information on the weight of the specimen and the date caught. I did not receive the specimen until about one year ago and was under the impression that it was caught in the fall of 1972. From examination of the scales, it appears that despite the burden your trout had to bear, it was heavier than normal rainbow trout in Lake McConaughy of similar age.

For publication I would like to include a photograph of the fish showing the unusual condition and a photo of the fresh specimen would be far superior to one made after preservation. If you would kindly loan me annegative of a photo of the specimen, I will have a print made and return it to you.

Sincerely,

Robert Behnke

Mr. Robert Mac Gregor Department of Zoology University of Guelph Guelph, Ontario, CANADA

Dear Mr. Mac Gregor:

The computer programming aspect of the article on western Salmo was handled by Dr. Legendre. You may direct inquires on obtaining the CHARANAL program to him. His address is:

> Dr. Pierre Legendre Universite du Quebec a Montreal Case postale 8888, Montreal 101, Quebec Centre de Recherche ecologique

I might point out some problems you will encounter in any taxonomic analysis of introduced rainbow trout populations and they concern the fact that several parental sources were used to establish this species in various parts of the world. The earliest sources were from wild stock (mainly anadromous steelhead) but subsequent mixing of hatchery stocks and domestication and continued introductions have obscured most populations to a point that it would be difficult to draw any valid conclusions regarding comparisions of present populations with parental stocks and genetic differentiation occurring in introduced stocks.

Sincerely,

Robert Behnke

Mr. Rod Van Melson Nebraska Game and Parks Commission Alliance, Nebraska 69301

Dear Rod:

I am writing up the results based on examination of an unusual rainbow trout from Lake McConaughy given to Monte Madsen last year.

Imbedded in the ventral region is a partially degenerate body of another trout--the result of Siamese twinning during embryonic development, with one twin developing normally and the other becoming a parasitic mass.

I would like to include some remarks on age, growth and comparisons with mormal McConaughy rainbows. I have a copy of your manuscript for age and growth comparisons. What is the status of the ms.--shall I cite it as unpublished or in press?

I have aged the trout as 3t but am not confident about interpreting river and lake growth. You found 92% migrate to the lake after one year. I suspect this specimen may have enterred the lake in its second summer. Enclosed are some scales for you to take a look at and make an interpretation. The tail of the trout is broken and I can only take standard length (413mm)preserved length). Allowing for formalin shrinkage and extrapolating to total length allows an estimate that the trout was about 480-490mm when caught May 6, 1972. The fish was in excellent condition being deeper and more robust than average--with a fresh weight of perhaps 1.7kg. There was no sign of gonadal development and I suspect the specimen was sterile--there is no obvious spawning check on scales.

Would it be accurate to state that this unusual specimen from Lake McConaughy exhibited a growth rate comparable to normal McConaughy rainbow trout of similar life history category? Perhpas due to lack of gonadal development, its weight and condition was above that of normal trout of similar length.

I assume that the specimen came from natural reproduction. In your ms. you said no hatchery trout were stocked in the watershed after 1967. Mr. Rod Van Velson January 8, 1974 page 2

Were any eggs from the McConaughy rainbows hatched in hatcheries and stocked back into the tributaries after 1967?

It is possible that the unusual substrate of Nine Mile Creek increases the indidence of abnormal embryonic development.

Sincerely,

Robert Behnke

RB:vv

Mr. Allen O. Fordyce NX Bar Ranch Big Horn, Wyoming 82833

Dear Mr. Fordyce:

Thank you for a copy of your letter to Don Dexter re: red-banded trout.

Enclosed is a copy of a letter I received from Pat Coffin of Nevada Fish and Game relating their willingness to give Wyoming about 100 red-banded trout next summer.

I had also suggested that another rare trout, the Humboddt cutthroat trout, found in a few streams around Elko be brought into Wyoming to develop a brood stock. The Humboldt cutthroat trout also appears to be adapted to warm water and harsh environmental conditions.

I was much interested to learn of your position with the Environmental Quality Department and particularly your comments on the use of reclaimed strip minded areas for recreational fisheries. I have been thinking along these same lines. The use of reclaimed strip mining areas for maintaining brood stocks of rare trout and the subsequent use of these trout in recreational fisheries provides a tremendous opportunity to develop some posibite benefits from potential environmental disaster areas, and the mining companies would reap favorable publicity.

I talked with a person in the Environmental Services Division of the Amax Corp. about my ideas. I would very much like the opportunity to put some of my knowledte to practical use for the development of recreational fisheries reclaimed land. Presently, I am inhibited from such activities as a federal employee, but I will likely resign from federal employment this year if I can arrange for sufficient income from private consulting work--such as advising and developing plans for reclamation.

Enclosed is a short paper I presented at a recent meeting on desert trouts. The red-banded trout we have been considering for your pond is the one from Chino Creek, Nevada, which was in real danger of extinction. As you can note, there are many varieties (subspecies) of both cutthroat trout and red-banded trout native to the desert regions and all of them are rare and at least one is now extinct.

Sincerely,

Robert Behnke

Enclosures RB:vv Mr. Barry Nehring January 8, 1974 page 2

to bait fishermen than the rainbow resulting in a "quality" fishery on top of a put-and-take operation.

I would appreciate hearing from you--what you're doing, and evaluation of your experience, etc. Gene Decker told me that you are quite pleased with your position.

Sincerely,

Robert Behnke

RB:vv

Mr. Barry Nehring Department of Environmental Conservation Division of Wildlife and Parks P.O. Box 1430 Tehran, Iran

Dear Barry:

Enclosed is a copy of my letter to Dr. Farvar, re: a possible study in Iran.

I am indeed highly interested and fascinated by the possibility for collecting and studying Iranian trout and other fishes. If I can work out alternative sources of income, I will resign my job with the Bureau of Sport Fisheries this year, allowing me to get involved with new projects such as foreign travel, which I have wanted to do for several years.

From Dr. Farvar's letter, I assume that he is not offering direct financial aid. I have sent out some inquires on possible sources of funding and would like to hear any ideas you might have on the matter.

Do you know of the two references I cite of Berg's papers on Iranian fishes? Translated copies would be a valuable reference source for your department's library. I have the original Russian papers and I would have copies sent to you. Do you know anything of Mr. Armantrout's Ph.D. study at Oregon State on the fishes of Iran?

Enclosed are a few reprints, including the description of a new species of trout from Turkey. Only the three specimens described in the paper of this trout have ever been found, but I suspect that this species or other undescribed salmonids might occur in the Tigres-Euphrates basin or in some of the mountain regions of the interior basins of Iran. This is one of the reasons I am enthused over the possibility of an Iranian study.

The manuscript on the North Michigan Lake study by John Trojnar and I will be published this year in the Trans. A.F.S.

Further plants of Snake River cuatthroat trout were made in Parvin, West and Dowdy lakes this fall, and Llyold Hazzard put some in Haypress Lake for a brood stock. One aspect I want to look into in West and Dowdy lakes is the possibility that the Snake River cutthroat is less vulnerable January 10, 1974

Dr. Bruce H. Anderson Director, International Programs and Studies Utah State University Logan, Utah 84321

Dear Dr. Anderson:

Enclosed is a copy of a letter from Dr. Farvar and my reply concerning my involvement in a study of Iranian fishes.

I am definitely interested in participating in such a study and have inquired about possible sources of funding. Dr. Leo Teller suggested I contact you for information on CUSUSWASH activities in Iran and the possibility of initiating the ichthyological survey discussed in the letters.

Also enclosed is a copy of my vitae. Let me know if further information is desired. My phone number at CSU is (303) 491-5320.

Sincerely,

Robert Behnke

RB:vv

January 10, 1974

Mr. Abbas Ordoobadi Embassy of Iran Washington, D.C.

Dear Mr. Ordoobadi:

I received a letter from Dr. Farvar of the Iranian Department of Environmental Conservation concerning my participation in a study of Iranian fishes. Enclosed are copies of Dr. Farvar's letter and my reply.

One of my associates, Dr. Leo Teller, suggested I contact you and Dr. Bruce Anderson of Utah State University for information on CUSUSWASH activities in Iran and possible sources of funding a project on the study of Iranian fishes.

I am confident that such a study will yield valuable results for basic knowledge and a base for scientific management of the fisheries resources of Iran.

Also enclosed is a copy of my vitae.

Sincerely,

Robert Behnke

RB:vv



UNITED STATES DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE BUREAU OF SPORT FISHERIES AND WILDLIFE COLORADO COOPERATIVE FISHERY UNIT COLORADO STATE UNIVERSITY FORT COLLINS, COLORADO 80521

January 10, 1974

Dr. M. Taghi Farvar Department of Environmental Conservation P.O. Box 1430 Tehran, IRAN

Dear Dr. Farvar:

In response to your letter of December 6 (no. 37866), I can reply that I am indeed interested in any studies designed to answer several questions concerning the trout of Iran and Iranian ichthyofouna in general. I have long been fascinated by desert basin fishes and would be grateful for an opportunity for involvement in similar research in Iran.

At present, I am employed by the Federal Bureau of Sport Fisheries and foreign assignments are difficult to arrange. I am giving serious consideration to resigning from federal employment this year so that I may have the freedom to initiate new research projects of my own proclivity.

There are some intriguing problems concerning the trout of Iran. Besides the subspecies of Salmo trutta, native to the Caspian Sea basin, a form of S. trutta has been known at least since 1896 from the Tehran area (Boulenger, Ann. Mag. Nat. Hist (6), 18). There has been some doubt expressed, however, if the trout near Tehran is truly native or introduced by man. No taxonomic description of the Tehran trout found in the Daryacheh-ye Namak basin has been published and it is not known to what subspecies of Salmo trutta it should be assigned (S. t. caspius the Caspian trout, S. t. macrostigma, the Mediterranean trout, S. t. oxianus, the Amu Darya trout, or if it represents an undescribed subspecies). To my knowledge, no published record exists of a salmonid fish in the Tigres drainage or any of the internal desert drainages of Iran, except the Darya cheh-ye Namak basin. However it was not until 1954 that the first published account of Salmo trutta in the Tigres basin as a whole appeared (Tortonese, Hidrobiologi, 2[1]). The discovery of a new species of trout in Turkey, which I named Salmo platycephalus in 1968, and my own studies on the desert basins of the western U.S.A. (a well studied fauna) leading to the discovery of several undescribed subspecies of trout suggests that a survey of the montane tributaries of the Tigres drainage and the internal basins of Iran will produce some major, new findings on the distribution of salmonids and perhaps some undescribed species.

Dr. M. Taghi Farvar January 10, 1974 page 2

In addition, such surveys would yield invaluable data on Iranian fishes in general. Published information on Iranian fishes is not abundant. The most comprehensive papers I have are by the Russian ichthyologist, L.S. Berg--The Zoogeography of the Freshwater Fishes of Asia Minor (1933) and The Freshwater Fishes of Iran and Neighboring Countries (1949) (both in Russian). Berg designated an Iranian Zoogeographical province (which includes parts of Turkestan, USSR, Pakistan and Afghanistan). On the basis of similarities of genera and species, Berg divided the internal, desert basins of the Iranian Province into four subdistricts -- Tehran, Turkemenian (northeast), Seistan (southeast) and Farsi (southcentral). Berg lists about 50 species of primary freshwater fishes for the Iranian Province--predominantly Cyprinidae and Cobitidae. Close affinities appear between the Iranian fishes and the fishes of the Amu Darya basin and the Central Asian Uplands. It is apparant, however, that information based on systematic collections from montane regions is not available for the zoogeographical evaluation of Iranian fishes.

The plans mentioned in your letter, to develop and maintain a systematic, representative collection of Iranian fishes at the National Museum of Natural History, would be a pre-requisite for establishing an information base for Iranian ichthyofauna and the publication of a book on the fishes of Iran.

I have a report stating that a graduate student, Mr. N.B. Armantrout, at Oregon State University is writing a Ph.D. thesis on the fishes of Iran. I will make inquiries about this thesis and will be interested to find out what Mr. Armantrout has added to the knowledge of Iranian fishes.

If I am in a position to be free for several months this year, I would definitely be interested in participating in a research project on the distribution and systematics of Iranian trout and related ichthyological problems. A more precise proposal detailing the scope of such research will be produced if the reality of such a study develops toward fruition. I would envision, however, that in addition to and related to a general zoogeographical and systematic survey, information on the following subjects would be established:

(1) The biology of the Caspian trout. How many distinct biological forms exist such as anadromous and resident and spring and winter migrating forms of the anadromous type. What measures might be taken to increase the abundance of this valuable resource? The Caspian trout is certainly the largest form of S. trutta (Berg cites weights to 51 kg).

(2) What economically valuable species might be considered for introductions into waters where they do not now exist?

(3) What native species have a potential for intensive fish culture?

Dr. M. Taghi Farvar January 10, 1974 page 3

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(4) What species are rare, in danger of extinction and in need of protection?

The significant consideration for my participation in ichthyological studies in Iran is one of funding. If your agency can provide vehicles and field assistance, I believe several months of intensive work can be accomplished for a moderate sum--perhaps a total of about \$12,000-\$15,000.

I have discussed the matter funding Iranian studies with other faculty members and it was suggested I send copies of this letter and of your letter to Dr. Bruce Anderson, Utah State University for information on "CUSUSWASH" activities in Iran and to contact Mr. Abbas Ordoobadi of the Iranian Embassy in Washington D.C.

I will appreciate hearing of your thoughts on the matter.

For your general information, I am enclosing a copy of my vitae and a few recent reprints relating to desert basin trouts and problems of salmonid systematics. If you note any other publications of interest on my publication list, I will be happy to send them.

Sincerely,

Robert Behnke

RB:vv

Enclosures

cc: Mr. Barry Nehring Dr. Bruce Anderson Mr. Abbas Ordoobadi January 10, 1974

Dr. Sam Jewell Environmental Services Group Amax 4704 Harlan Street Denver, Colorado 80212

Dear Sam:

In regards to our phone conversation about my interest in getting involved in part-time consulting, I am enclosing copies of all of the items sent to Dr. Glover.

I recently received a letter from Mr. Allen Fordyce, Chairman of the Land Quality Advisory Board for Wyoming. Mr. Fordyce expressed an enthusiastic interest for developing reclaimed areas in 'relation to the implementation of my ideas on establishing brood stocks representing a range of natural genetic diversity of western trouts (a genetic storehouse) and their use in recreational fisheries--I think this idea has a tremendous potential for excellent results and favorable publicity.

Sincerely,

Robert Behnke

RB:vv

January 10, 1974

Dr. Fred Glover 1727 Rangeview Drive Fort Collins, Colorado 80521

Dear Fred:

Enclosed is a copy of my vitae. As I mentioned on the phone, the areas where my expertise might be put to good use concerns aquatic surveys and inventories and environmental factors influencing the distribution, abundance and species composition of the fauna. I would be particularly interested in getting involved in reclamation projects in relation to utilizing a natural genetic diversity of trouts for recreational fisheries and learning more about the evolutionary adaptations of several undescribed subspecies I have been working on. Some rare forms of Great Basin trout, evolving under extremely harsh and fluctuating environments appear to have a tremendous potential for use in special situations, such as warm and turbid waters not normally considered suitable as trout habitat.

In the past I have been supplying my services free for environmental impact statements where the situation involved identification of specimens or information on rare trout. Enclosed are copies of two letters I wrote in reference to the Truckee River and Lahontan cutthroat trout as examples of the range of information I have available "off the top of my head."

The information I have furnished to several state and federal agencies during recent years has resulted in excellent cooperation and working relationships with the federal and state biologists of the Rocky Mountain region.

I haven't set a date for resigning from the Bureau. I have been aiming for June or July, but it could be much sooner.

Sincerely,

Robert Behnke

RB:vv

Enclosures

cc: Dr. Sam Jewell

January 17, 1974

Mr. Glen Cole, Research Biologist Yellowstone National Park Wyoming 82190

Dear Glen:

Enclosed is a copy of my annual report relating last years activities. Two graduate student theses will be completed this year on the native cutthroat trout of the upper Columbia and Missouri river basins, including the two forms (subspecies) of the upper Snake River.

You will note the final paragraph of my report suggests that I could expand my research with the Park Service to new areas and supply valuable information and data to several areas administered by the Park Service.

As we discussed on the phone, I will resign from the Bureau of Sport Fisheries this year but plan to retain my association with the University. I would like to maintain continued support from your region and develop additional support to expand my fisheries studies to National Parks of other regions. The Cooperative Research agreement between the National Park Service and CSU should make the administrative details a simple matter. As I related to you, there are several areas where I believe I could produce valuable results for Park Service management plans. These include such matters as Zion National Park-a critical area for the unique and vanishing Virgin River fishes; Great Smokey Mountains and native brook trout; the Olympic Peninsula fishes, particularly Crescent Lake; and several small holdings such as National Monuments whose waters might hold rare, native fishes.

The current controversy in Colorado, over the plans of Rocky Mountain National Park to restore native fishes, would suggest another role I might play--as a spokesman or "expert witness" on matters relating to native fish restoration in Park waters.

I would appreciate your suggestions on how to proceed on the matter of expanding my Park Service research and requesting additional funding via the CSU--Park Service Cooperative Research organization.

I want to express my sincere gratitude to you for your support during the past two years. It has been a major factor for allowing any research to continue.

Sincerely,

Robert Behnke

January 17, 1974

Dr. A. Starker Leopold Wildlife-Fisheries School of Forestry and Conservation University of California Berkeley, California 94720

Dear Dr. Leopold:

I would like to thank you for putting Dr. Vaux in touch with me concerning the Pyramid Lake fishery. I just happened to have what is probably the most complete source of information on the subject.

In the past, I couldn't accept such offers for private consulting as a federal employee. I will resign from federal service next month and take a position with the University here which will allow for several months a year for consulting projects. At present I am considering an offer for a fisheries survey in Iran.

I believe my in-depth knowledge and personal research on fishes is a salable project and I would gratefully appreciate any future contacts you might direct to me on matters where expertise on fishes and fisheries is needed. I have been serving as a consultant to the National Park Service for studies of native fishes and restonation of the native species in Park waters. I also am in the process of completing a book of information of about 200 pages on the rare and endangered fishes of the Southwest and the factors causing their decline and disappearance.

Enclosed is a copy of my vitae. Dick and Sylvia Gard enjoy it here but are finding some hardships associated with living 10 miles out of town up the Poudre River Canyon (but with frontage on one of the best sections of trout water on the river.) When they returned from California after Christmas they found their pipes frozen and had to dip water from the river. The weather has turned warm and pleasant now and the pipes are open--and they're a little happier.

Sincerely,

Robert Behnke

RB:vv

January 17, 1974

Dr. James Adams 1170 Keeler Ave Berkeley, California 94708

Dear Jim:

I see from your card that you are still in Berkeley. I had heard from someone (Dick Gard, I believe) who told me they thought you had moved.

I will resign my present job with the federal government this year and join the University staff here. I plan to supplement my income with consulting work. I have a few things started such as establishing a value for the original Pyramid Lake fishery for the Piute Indians and possibly a fisheries survey in Iran.

I want to pass the word around that a source of ichthyological expertime will be avaiable for such projects as environmental analysis in the western U.S.

I expect you still handle all work for P.G.E. but I would appreciate any contacts you might know of.

I have been working with the cutthroat trout native to the Snake River in Wyoming in relation to its management potential when stocked in other waters. An interesting (at least in my opinion) article will come out in the April or Muly issue of the Transactions on the subject. I have some of these trout im my backyard pond and find them a supurb sport fish. If you ever get out this way Jim let me know--I think I can put you in touch with some good fishing.

Sincerely,

Robert Behnke

January 22, 1974

Dr. James Deacon Department of Biological Sciences University of Nevada, Las Vegas Las Vegas, Nevada 89154

Dear Jim:

Mr. Cross requested a loan of the unpublished Needham and Behnke manuscript and you will find it enclosed along with two reports for Mr. Cross. As I wrote to Mr. Cross, this is my most complete copy of the manuscript and I do make occasional reference to it, but because I have so modified my views on western trouts, I will never publish it in its present form.

Many thanks for your reprints and a copy of the Virgin River progress report.

I am going to quit my present job with the Bureau of Sport Fisheries and join the University here this year. I plan to supplement my income with consulting work. If you know of any consulting opportunities which you can't accept for some reason, I would appreciate hearing about them.

Sincerely,

Robert Behnke

RB:vv

January 22, 1974

Mr. Jeffrey Cross Department of Biological Sciences Universäty pf Nevada, Las Vegas Las Vegas, Nevada 89154

Dear Mr. Cross:

I much appreciate receiving a copy of the progress report on Virgin River fishes.

I will send a copy of the original Needham and Behnke manuscript -- mainly written in 1963--to Dr. Deacon. Although I Mon't plan to publish the manuscript because I have revised and modified so many opinions on western trouts. I do frequently refer to it and this is my most complete copy. If you or Dr. Deacon find anything of interest, you can reproduce it, but I would like to have it returned within about three weeks. I will also enclose a report with reference to the trout in the headwaters of the Santa Clara River, which up dates the opinions in the manuscript. Collections this summer found a cutthroat trout in Water Canyon Creek, just to the south of Reservoir Canyon-near Pine Valley. Water Canyon and Reservoir Canyon cutthroat trout are identical and both are entirely similar to my recent collections of S. c. utah from the southern Bonneville basin. Ι now have no doubt that "native" cutthroat trout in the Virgin drainage came from the Bonneville basin, but if they came naturally via headwater stream transfers or introduced by the earliest settlers is not known.

You mentioned that you have collections of trout from Nigger Creek (Mt. Moriah) and Williams Creek (Mt. Wheeler). If the specimens are not obvious rainbor cutthroat hybrids, I would indeed want to borrow them. Among the enclosures sent to Dr. Deacon, is a report on the native cutthroat trout of this area (Snake Valley of Bonneville basin) which represents an undescribed subspecies. The only pure populations I know of are in Pine Creek (Mt. Wheeler), Hampton Creek (Mt. Moriah) and Goshute Creek (Steptoe Valley). The populations in Hampton and Goshute Creeks were introduced from Pine Creek. A virtually pure population persists in the headwaters of Hendrys Creek on Mt. Moriah but all others I have seen are hybrids.

I would like to hear of anything you learn of cutthroat trout in the Virgin River drainage. Actual specimens would be best, but any reliable reports should be noted so they can be checked in the future. I have heard reports of cutthroat in tributaries arounc Navajo Lake and a small tributary of the Santa Clara coming in from the south of Pine Valley was reputed to have cutthroats by the Forest Service Ranger at Pine Valley.

Sincerely,

January 25, 1978

Fisheries Research Board of Canada Pacific Biological Station Nenaimo, B.C. CANADA

Dear Sirs:

I would greatly appreciate a copy of Circular No. 93: "Are hatcheries and spawning channels alternatives to stream protection?"

Shack you,

Robert Behnke

January 29, 1974

Mr. George Holten Montana Department Fish and Game Helena, Montana 59601

Dear George:

We're finishing up the systematic studies of the westslope cutthroat trout and a graduate thesis should be completed by June on the subject. To round out the total information available on this trout I am compiling references and data relating to life history, ecology and management. Along these lines, I would appreciate copies of Montana D-J Reports: Project No. F-344R-6 Job No. II-a (Hungry Horse Reservoir) and F-34-R-6, III-a (Life history studies of westslope cutthroat). Also if you have any other reports pertaining to westslope cutts.

John Clark has written up his data on the sampling of the experimental lakes stocked with westslope and Yellowstone. The most useful info will come in the next 2-3 years from these lakes and I hope we can arrange for at least sporadic sampling in the future. I may come with John Clark to the Montana Academy of Sciences meeting in May and hope to discuss my ideas with you and others in an attempt to generate continued interest in your mative trout after we have their taxonomy worked out.

I heard from John Clark that Montana has developed a trout management policy regarding wild trout waters and stocking of hatchery trout. Do you have a memo or policy statement on the matter? I would like to see what you've come up with on this problem. Has Vincent's Madison River studies been written up yet?

I am going to resign from Bureau of Sport Fisheries soon and will remain with CSU. I plan to supplement my income with consulting work. I may go to Iran for awhile on a fisheries survey, but I would like to initiate some projects based on my ideas of utilization of native races of western trouts. Reclaimed strip mined land might be a potential research area. If you know of any plans being developed for reclamation in Montana, I would like to hear about them, particularly in reference to designing ponds and reservoirs which might serve as brood stock lakes and experimental test sites for evaluation.

Sincerely,

Robert Behnke

Dr. John Patrick Jordan Director, Experiment Station Administration Building

Dear Dr. Jordan:

Enclosed is my abstract for the Annual Research Conference relating to the subject of our discussion regarding the implementation of my ideas and the use of ponds on University land.

I talked with Mr. Early about the Maxwell Ranch and he is certain that suitable pond sites are available for the project. He agreed that this type of research seems ideally suited to the goals set for the Maxwell Ranch.

I am pursuing the matter of financial support for the project and after discussions with Gus Swanson, a proposal to the Fleishman Foundation is now being written with an emphasis on the use of several rare forms of Nevada trout.

Sincerely,

Robert Behnke

RB:vv

Mr. E.J. Early Alysworth Hall Rm 352

Dear Mr. Early:

Enclosed is a copy of my abstract for the Annual Research Conference of the Experiment Station.

It would be ponds on the Maxwell Ranch that I envision such a project to be initiated.

I am writing a proposal requesting angrant to get the project underway and will probably talk to you again regarding projected costs of pond construction.

Sincerely,

Robert Behnke

RB:vv

Mr. James Dangee Alaska Department of Fish and Game Box 499 Sitka, Alaska 99835

Dear Jim:

Many thanks for the copies of your bibliography which were received today. It looks good and I'm sure you take some pride in seeing the completed results of years of effort.

I'll send a copy to Ray Simon and have some other requests already. If you have received free reprints I could give away one or two more, but if you have to purchase them don't bother.

I heard from Fred Utter that you had taken a job with Alaska Fish and Game. It is true that except for University positions requiring a Ph.D., there is not much of a job market for salmonid systematic specialists, but I would still encourage you to take advantage of any opportunity for graduate school.

I am also presently faced with somewhat of a job problem. To continue doing the type of research, in which I am most interested, I am resigning from the Bureau of Sport Fisheries. The Bureau wants to transfer me to the Genetic Lab in Buelah, Wyoming (where Ray Simon is now director). I prefer to stay with a university. There are no positions open here at present and all that can be offered is part-time imployment. I plan to supplement my income by selling my services if a project is interesting to me.

I may go to Iran this year to advise on their fisheries problems, particularly salmonid fishes. I have several other projects in mind and I'll see what develops. Perhaps, a alrge grant would provide funding for graduate research on one of my favorite themes of intraspecific diversity and intraspecific hybridization. Keep in touch and let me know if you'd still be interested in graduate work in a year or two.

Any information you might have concerning opportunities for a "free lance" ichthyologist in Alaska, such as the Alaskan pipeline, would be appreciated.

Sincerely,

Robert Behnke

February 4, 1974

Mr. R. Barry Nehring Department of Environmental Conservation P.O. Box 1430 Tehran, Iran

Dear Barry:

Your letter wad encouraging on the matter of my involvement in Iranian fisheries studies. June of July would be a more reasonable time and this would give us a period to exchange information and develop a plan to maximize the efficient utilization of my time once I was there.

My present situation is this: I will leave the federal service--probably in a month. The problem forcing a decision was an order to move immediately to a genetics laboratory in Wyoming. I have no quarrel with the move itself, but cannot accept the circumstances and timing of the action. For almost two years. I have been officially separated from the Coop Fish Unit and have been attached to the Division of Research without any designated job position--and without any Bureau funds. I have obtained funds from various sources to support my work and for graduate student research. These funds, of course, commit me to complete the projects for which they are granted, and this can't be done if I move. My plans are to decline the transfer and this would provide severance pay to June. Although there are no University positions in fisheries or zoology at present, the University wants to retain me and I am willing to accept part-time employment and develop sources of income from private consulting, grants, etc. This situation would be ideal for foreign projects because I can be free for 6-8 months of the year, if I so desire.

I am currently teaching the ichthyology course which will be finished about mid March. I plan to have my 3 graduate students complete their theses by June and then I should be without obligations until next January and the 1975 ichthyology course (and that can be changed).

If you can outline the range of activities your agency is involved with and where my expertise could be best used, we can start to develop a tentative program. I expect the emphasis would be on salmonid fishes. An indication of the scope of your jurisdiction would be useful to me. For example, does your agency deal with the anadromous trout of the Caspian Sea, or would that be under another agency because it might be a commercial fish? Is fish culture important in Iran or might it be intthe future? Mr. R. Barry Nehring February 4, 1974 page 2

I would state that seeking an outside source of expertise on fisheries research, by dealing directly with an individual, is much more likely to yield desired results than the usual way the matter is handled. Typically a foreign government requests assistance trhough the American embassy which contacts the Bureau of Sport Fisheries. An honest, trustworthy, loyal, but incompetent person, perhaps mearing retirement, is sent. Such a person has probably not had an original idea in his whole career and it is not likely he would suddenly be inspired at this stage, so nothing of value is accomplished except to demonstrate that funds were expended needlessly.

I am attempting to initiate a project which will maintain brood stocks of certain genotypes representing various adoptive features of the rainbow and cutthroat trout species (preservation of a spectrum of intraspecific diversity). The availability of eggs of these diverse genotypes could then be used in experimental fisheries management based on the ideas developed from the North Michigan lake study.

The implementation of innovative ideas into a management program could be more readily accomplished in Iran than in the US. The situation is somewhat analagous to the problems of laying a new foundation and corner stone in a building 100 years old is doing the job during the initial stages of construction.

From your letter, it appears that you are associated with competent and enthusiastic people--they are the kind that would be a pleasure to work with.

I was just discussing our correspondence with Dr. Swanson. He said he would write a supporting letter to Dr. Harrington.

I'll await further word from you or Mr. Farvar on funding the project and in the meantime I'll avoid any commitments past June.

Sincerely,

Robert Behnke

February 6, 1974

Dr/ Nicolaus Peters 2 Hamburg Gernotstrasse 10 West Germany

Dear Nicolaus:

Have your plans for travel to Canada this year become more finalized? Perhaps we can see you and your wife this year, but I am currently giving some thought to foreign travel also.

I will soon terminate my employment with the federal government. I plan to remain at Colorado State University, at least part time, but will be free for other activities such as foreign assignments. I must supplement my income by private consulting work--or selling my services as a "free enterprise" ichthyologist. One of the projects presently in the early stages of negotiation concerns a fisheries survey for the government of I Iran. If sufficient funds become available, I would spend a few months in Iran this year. Also the Russians are working on a monograph of the Salmonidei and requested my collaboration. If I go to Iran I might try to raise funds to stop over in Leningrad for about a month on my return. Can you think of a good excuse to visit Hamburg also?

There are some affinities between Iranian fishes and those of eastern Turkey--particularly the Tigres-Euphrates drainage. I know the Hamburg Zoological Institute has been most active in Turkish fish studies and I would appreciate some references which you might know of on the fishes of this area. Also if you can suggest some particular problem of fish systematics or zoogeography for which some interesting data might be uncovered from a survey of Iranian fishes. If Villawock has returned from South America you might ask him what I should be looking for in Iran.

I'll keep you informed of my plans and you can let me know your sebhdule for 1974.

Sincerely,

Robert Behnke

February 6, 1974

Dr. V. V. Barsukov Academy of Sciences Zoological Institute Leningrad, V-164, USSR

Dear Volodya:

I received your New Year's greeting and letter of January 16. I will not be able to obtain a copy of the English translation of your <u>Helicolenus</u> article until the English edition of Voprosy Ikhtiologii (called Journal of Ichthyology) is published--probably in 2-3 months.

You mentioned your laboratory's involvement with the monograph on Salmonoidei and asked if I could provide advice on the North American salmonids. I would be most willing to cooperate with you group on this project and I will give some thought to the possibility of coming to Leningrad and working for perhaps a month.

I am going to resign from my present government job but plan to remain associated with Colorado State University. Such an arrangement will allow me much more freedom for foreign travel. I am currently thinking about going to Iran this year to collaborate on some fisheries research. Since Iran is just south of the USSR, a stopover in Leningrad might be arranged on my return. If you would extend an official invitation to me to come to the Academy to work on the Salmonoidei monograph, it might be halpful for obtaining funds to cover my expenses.

I recieved the GOSNIIORRKH publication? "Promyslovye Resursy Finskogo Saliva," with two articles on the Neva River smelt (Osmerus) by Z.S. Po Podarueva, on which the author wrote "to Bob Behnke." I was baffled who Z.S. Podarueva could be. She is your wife Zoya? I always found it difficult to remember that Soviet women often don't take their husbands' name and become Mrs.

The books sent by G. Kh. Shaposhnikova and you have not been received yet. Although they were sent about 3 months ago, I am hopeful that they will get here. Sometimes the Voprosy Ikhtiologii you send takes 3-4 months. I would like to see the stories about Ural folklore. For our wedding anniversary I gave Sally a two volume set of books on Russian history and Russian art with a phonograph album of Russian fold music. We can listen to the music when we eat a meal of borsh and pickled mushrooms. We still Dr. V. V. Barsukov February 6, 1974 page 2

have some of the dried leaves and spaces for pickled mushrooms you sent about two years ago. Recently we used your leaves to make pickled mushrooms and everyone who ate them agreed no mushroom is so delicious as a Russian pickled mushroom. Perhaps only the leaves that grow in Dibuny are so excellent for this purpose.

You asked about skiing in Fort Collins. We haven't been skiing but we go ice skating on our pond. During the last few weeks, howevef, the weather has become warm and the ice is melting--the ponds will soon be ready for fishing.

Best regards to all.

Sincerely,

Robert Behnke

February 6, 1974

Mr. John Trojnar Department of Natural Resources Fernow Hall Cornell University Ithaca, New York 14850

Dear John:

I was somewhat surprised to receive a request for a job recommendation for you because everything I had heard (second and third hand) was to the effect that you were quire happy and enthusiastically pursuing your research work.

I must admit, formal academic work can get to be a drag, but perhaps your problem is that you are over-concientious. That is, you are driven to excel in every course you take. I enjoyed my graduate student days at Berkeley to such an extent that I hung around for 7-8 years. The course work got boring, but I learned to get through most coruses in a half-hearted manner by developing skills in test taking. Give the matter some consideration because a person with your basic abilities should--and could easily get a Ph.D.

You asked out literature citations to intraspecific differences in optimum incubation temperatures. The only one I can recall offhand is: Patrick and Graf. 1961. The effect of temperature on the artificial culture of Aurora trout. Canad. Fish Culturist (30):49-55. They found the aurora trout required lower incubation temperatures than the brook trout. For its intraspecific status within the species <u>Salvelinus fontivalis</u> refer to my 1972 paper on salmonids of glaciated lakes. I was somewhat noncommittal on its precise taxonomy, but printed out that it belonged to the <u>fontinalis</u> phylogeny and not <u>8</u>. <u>alpinus</u>. I cited Qadri and also Sale, I believe, who classified the anrora char as a subspecies of fontinalis.

Your findings on optimum incubation temperatures might explain the more restricted distribution of the drawf genotype.

Enclosed are three copies of the tax exemption form.

I have not received the page proofs for the Transactions article, so I expect it has been put off to the July issue. When I get them I will

Mr. John Trojnar February 6, 1974 page 2

inquire about acknowledgements. Perhaps I'll take out any we may have had to the Bureau of Sport Fisheries. I am going to resign from the Bureau because they wanted to abruptly transfer me to Beulah, Wyoming in January. All of the projects I have going and the graduate student work is dependent on outside funds and I have obligations to complete this work which can't be done at Beulah. There are no vacant positions in fisheries or zoology at CSU, but the University wants to keep me so I am agreeable to parttime employment and will try to go out and drum-up other funds to support a salary. One of the projects I have in mind concerns fisheries research in Iran. I've been corresponding with Barry Nehring and if funds are and available, I'll go to Iran for a few months this year. If you take a job with a consulting firm I'll request that you let me know of any possibilities to sell my services as a "free-lance" ichthyologist.

Paul Sekulich is writing his thesis on the Snake River cutthroat in Utah. We stocked some in West Lake, Parvin Lake and Dowdy Lake this year, also some in my backyard pond.

John Clark sampled the Montana lakes this summer for Yellowstone and Wests slope cuttherest. The fish were still too small to get adequate samples and good data, but he wrote up a report. When I edit it and have copies made I'll send you one.

What is the status of the proposed exchange between Wyoming and New York regarding Snake River cutthroat and Canadian brook trout? Last November Fred Eiserman asked me if I had heard from you about this. I'll see Fred in about two weeks, so if you have any info on a possible exchange, let me know.

Another project I am trying to launch concerns brood stock ponds to hold an array of intraspecific genetic diversity for experimental work. Enclosed is an abstract prepared for the CSU Experiment Station Conference (note emphasis on agriculture)--an initial attempt to develop some broad based support for finding the project.

Best regards,

Sincerely,

Robert Behnke

RB:VV

February 6, 1974

Dr. Henry Vaux Department of Economics University of California-Riverside Riverside, California

Dear Dr. Vaux:

About a month ago I wrote a letter to Weissbrodt and Weissbrodt expressing my willingness to consult on the Pyramid Lake fisheries evaluation. A subsequent phone call confirmed an informal agreement on a fee.

I have pursued the matter of compiling information necessary to make some judgements pertaining to fishery--past, present and potential, but I have a few questions concerning the scope of lawsuit and economic ramifications.

The Bureau of Reclamation's Newlands project is the most conspicuous federal project affecting Pyramid Lake, but are you interested in other federal projects which also have a detrimental effect, such as Boca Dam and Prosser Creek Dam, which block perhaps 50% of the potential spawning grounds in the Truckee River drainage from any fish migrating from Pyramid Lake. Also flood control channelization of the lower Truckee River by the U.S. Corps of Engineers has created a degraded environment that is a bottleneck for a fish stock depending on migration from Pyramid Lake. There is also detrimental effects from construction of Interstate 80, and perhaps most significant is the establishment of several species of non-native fishes in the Truckee River (supplied to Nevada and California by the federal government in many cases), which drastically curtails the potential success of natural reproduction of trout from Pyramid Lake.

Are other recreational values being considered? For example, the drop in water level dried up Winnemucca Lake which was not only an important fishery but also a waterfowl refuge. Although the level of Pyramid Lake fluctuated under natural conditions (before water abstraction) a long term average surface area (including Lake Winnemucca) may have been about 180,000 acres and the total biomass of trout might have been around 2,000,000 ls.--of which a well managed fishery might remove 500,000 lbs. annually, and in a sport fishery for a unique, trophy trout, the per pound value could be quite high.

For several reasons, I don't believe the original fishery can be re-created.

I would like you to tell me the range of information you need to establish a case for a damage claim.

I will officially terminate my position with the U.S. Bureau of Sport Fisheries about March 1, and would be free to have my name used, sign contracts, etc. at that time.

Sincerely,

Robert Behnke

Dr. Carl Schreck Division of Forestry and Wildlife Biology V.P.I. Blocksburg, Virginia 24060

Dear Carl:

Enclosed is a copy of a page from R.R. Miller's publication in Occ. Pap. Mus. Zool., Univ. Mich. (667):;-19 (1973). He couldn't resist a bit of sarcasim re. trout in Owens Valley.

What probably started as a demonstration of the determination of the Bureau of Sport Fisheries to show their independence from C.S.U. has forced my decision to resign from the Bureau. I was informed that I would be transferred to Beulah, Wyoming in January, and the decision was adamant. My major objection is that for almost two years I had to obtain sources of funding outside the Bureau to fund graduate students and keep my projects going. These funds from the Park Service, Forest Service, etc. obligate me to complete certain projects which I couldn't do at Beulah. I have three graduate students due to finish in June, Dr. Richard Wallace of the University of Idaho has taken sabbatical leave to come here to collaborate on the westslope cutthroat trout study, and there are several other valid reasons why I could not, on good conscience, accept the transfer at this time. By declining the move, I will receive severance pay until June. The timing may not be the most opportune because there are no vacant positions in fisheries or zoology at C.S.U., but I don't think I'll regret my decision. I will have to develop supplementary sources of income, but I'll be free to take advantage of new opportunities formerly prohibited.

I've been corresponding with BArry Nehring in Iran and if funds are available, I'll go to Iran for a few months this year to collaborate on some fisheries work. C.S.U. wants to retain me and I am willing to accept part-time employment until a position opens. I'll be attempting to bring in some funds which can be used to pay my salary during the rest of the year.

If you hear of any situations where the services of a "free-lance" ichthyologist could be used, let me know.

Evidently there is something to the possibility of "radio" communication in fishes- Cen article by Moffler in Hydrobiologia, 40(1):131-143 (1972), dem-

Dr. CArl Schreck Febraary 12, 1974 page 2.

onstrates that fishes do generate non-electrical signals which can be picked up on antenna. No speculation was made on what is used to generate and receive these signals.

Hope everything is going well with you.

Sincerely,

Robert Behnke

RB:vv

Mr. Ron Gomtow Bureau Sport Fisheries & Wildlife P.O. Box 128 Pinetop, Arizona 85935

Dear Ron:

Bill passed your letter re. Christmas Tree Lake on to me.

I have never been to Christmas Tree Lake but Anderson had collected a few trout from Sun and Moon Creek prior to Lake construction which I examined, The samples were too small to come to a definite conclusion on their purity but they appeared to be good Apache trout. The streams were rotenoned, I believe, before lake construction and if all the fish were killed it wouldn't matter what the original population was except to demonstrate that natural reporduction was taking place in the streams now tribu**a**ary to the lake.

I had suggested to Andy that a new population could be started with wild Apache trout from Ord Cfeek, Firebox Creek, Deepn Creek, etc. to establish a base of heterozygosity and then manage the lake on natural reproduction. My fear was that given a long enough period of time, a hatchery will almost certainly mix the trout and hybrids would result.

I examined a sample of 8 fish from Christmas Tree Lake taken two years ago and they were all pure Apache trout--probably from the Ord Creek stock raised at Sterling Springs Hatchery.

If natural recruitment is occurring at Christmas Tree Lake, it would certainly bbe simpler to manage the fishery on that basis and eliminate the worry from hatchery contamination.

Sincerely,

Robert Behnke

Dr. Leo Marnell BAt's Nest Lodge Box 191 Van Buren, Missouri 63965

Dear Leo:

I take it that you are still with the National Park Service in Missouri. I know there is some unusual and interesting elements in the fish fauna of your region and I would like to know of any problems or research plans or needs in regards to waters of National Parks in your region.

I will resign from the Bureau of Sport Fisheries but plan to remain at C.S.U. I am in the process of developing support for fisheries research and have approached the Park Service on the idea of expanding my present research, mainly in Teton and Yellowstone parks to other parks in other parts of the country. So I'm trying to find out where fisheries research would be useful and what kind of studies are needed.

A few months ago I forwarded a letter to you from Cuba. Did you receive it? I was wondering if your position related strictly to aguatic biology or if it is more of a general biology-naturalist type of category.

The job situation is again not bright for our students this year. During the past year, probably half or more of the graduates took jobs with private companies.

Sincerely,

Robert Behnke

Mr. R.P. Van Gytenbeek Trout Unlimited 4260 E. Evans Ave. Denver, Colorado 80222

Dear Pete:

Enclosed is a copy of a letter to Dr. Grove. As you'll note, besides accepting membership on the Scientific Advisory Board, I am offering my services to T.U. in any way they can be utilized to advantage for the organization.

Once I resign from my federal position I will be uninhibited in regards to my activities. For example, some of the environmental impact statements being put out by the Forest Service, B.L.M., Bureau of Reclamation, Corps of Engineers, etc., pertaining to potential influence on fisheries are simplistic and often inane.

The reference to a trip to Iran concerns a plan to make a survey of trout waters, arranged by BArry Nehring, now employed by the Iraniam Dept. of Conservation. I will remain part-time with C.S.U., but will become more involved with private practice--sort of a free-lance ichthyologist. Another interesting project concerns helping the Piute Indians recover damages for the loss of theorriginal Pyramid Lake trout fishery.

Also enclosed is an abstract for the C.S.U. Experiment Station Research Conference. I am trying to stimulate support to initiate a project to demonstrate the value of wild trout in fisheries management programs and at the same time, perpetuate several relict populations of unusual trout.

I will write up a proposal for funding this project to a philanthropic foundation (not T.U.). When I have the proposal ready, I'll send a copy to you and if you agree that my goals are basically the same as the goals of T.U. on the matter, I may request a letter of T.U.'s support (in principle\_ of this project.

Sincerely,

Robert Behnke

RB:vv

Dr. Alvin Grove Trout Unlimited 737 South Sparks St. State College, Pennsylvania 16801

Dear Dr. Grove:

I gladly accept your offer to serve on T.U.'s National Board of Scientific Advisors.

I will soon resign my position with the U.S. Bureau of Sport Fisheries to have more freedom to pursue my salmonid research. I plan to remain at C.S.U. for my base of operations but will be completely free to get involved in projects and render decisions without interference from any government agency.

I had planned to volunteer my services to T.U. on such matters as review and evaluation of environmental impact statements or in an advisory capacity where my expertise can be put to good use. I will do this via a copy of this letter to Mr. Van Gytenbeck.

One of the projects I am contemplating for this year may lead to spending several months in Iran. If so, I will supply you with a forwarding address.

Sincerely,

Robert Behnke

RB:vv

cc: Mr. R. P. Gyntenbeck

Mr. Allen O. Fordyce NX Bar Ranch Big Horn, Wyoming 82833

Dear Mr. Fordyce:

Enclosed is an abstract of a paper for a C.S.U. Experiment Station Research meeting. I will attempt to raise funds to develop a series of ponds on University property (The Maxwell Ranch on the Colorado-Wyoming border). If these plans materialize, several unique forms of trout, such as the red-banded trout, would be maintained and a source o of eggs for propagation and introduction into new waters (such as reclaimed mined areaa) would be available.

In the meantime, I hope a stock of one of the trouts under consideration can be established in your pond this year.

I would like to be kept informed of any plans that might be developed for reclaiming strip mined areas in Wyoming.

Sincerely,

Robert Behnke

RB:vv

G. Kh. Shaposhnikova Zoological Institute Academy of Sciences Leningrad V-164 USSR

Dear GAlena Kh:

Your book finally arrived. I had written to Barsukov last week that I was still hopeful that it would come. It is a beautiful book and everyone enjoys it. Some of the stories are familiar to the children. We all send our thanks for your thoughtfullness.

I had mentioned to Barsukov that I may go to Iran this year for a study of their fishes. If I do go to Iran, I would try to arrange a visit to your institute. I would enjoy seeing everyone again. I don't know at this time if Sally and the children can accompany me.

Sincerely,

Robert Behnke

Mr. Phil Pister California Fish and Game 407 West Line Street Bishop, California 93514

Dear Phil:

I've been putting together data on comparative productivity of trout lakes. I know Crowley Lake is one of the more productive ones and I know you wrote an Administrative Rept. (60-D1) on Crowley Lake but it is missing from our library.

I you have an extra copy I would appreciate one. If not, can you recall any statistics relating to yield, standing crop, etc.? What is the surface area of the lake?

R.R. Miller sent me his reprint describing the Owens chub and sucker. He couldn't resist a bit of sarcasm on the lack of trout fossils in the Owens Valley. I would certainly be elated if some Pleistocene trout fossils turned up some day.

Sincerely,

Robert Behnke

Mr. Rudolph Weiss Scripta Publishing Corp. 1511 K Street, N.W. Washington, D.C. 20005

Dear Mr. Weiss:

I received a copy of the Hydrobiology Journal which reminded me that I should inform you of some new events.

I will soon resign from my federal position but will remain at Colorado State University at least part-time.

I will be free to handle more private employment work and would be able to edit the Hydrobiology Journal, if another editor has not yet been found.

One of the projects I may be involved with this year would lead to spending several months in Iran. If I do leave the country for an extended period I will inform you and supply a forwarding address. I would plan to continue the editing and with airmail, the additional delay of sending manuscripts should only be a few days.

Sincerely,

Robert Behnke

Mr. V.A. Fry Chappel Nebraska 69129

Dear Mr. Fry:

I am returning your negative. A print was made which I will submit with the manuscript. It will be for the editor of the journal to decide if they print it.

I wrote a report on your trout specimen but have been waiting for the results on scale analysis from Mr. Van Velson of Nebraska Fish and Game, to add the final details of the life history interpretation of the fish.

Many thanks.

Sincerely,

Robert Behnke

RB:vv

Mr. James Mullen Bureau of Sport Fisheries and Wildlife P.O. Box 457 Vernal, Utah 84078

Dear Jim:

Many thanks for the flattering letter you wrote about me. I appreciate your efforts on my behalf. I haven't been motified of the termination date, but undoubtably the event is unalterable bacause it appears Hester's image as a "take charge" leader is involved. Enclosed is a copy of the only direct communication I have every received from Hester--re-affirming his stand. Also enclosed is a copy of my letter of January 15 to Hester. Perhaps over the years some of the behind the scene activities leading to my termination will come out. At present, all I can say is it seems simply incredulous that more consideration was not given to creating a formal position in the Bureau to make optimum use of my expertise.

Actually the whole series of events leading to my resignation originated with Nat Reed after he visited CSU in September 1971. He visited with me at the Unit, seemed impressed with my work, and after conversations with Gus Swanwon, he went back to Washington and started an inquiry into setting up a special position for me to provide a budget and allow expansion of my work. Lee Miller put bogether a report on the matter in January 1972. The recommendations included a budget of \$55,000 per year and a promotion. A letter from Reed to Swanson in January 1972 stated that we would soon be hearing from the Bureau and we would all "be pleased," After that, there was some tumblings from Willis King, who arranged for some funds for the Snake River cutthroat study, But Willis passed the buck to the Division of Research where I was officially transfered in the summer of 1972. It was clear by this time that there was a hard core of antagonism toward me because of what was considered Reed's interference on my behalf. Hester visited here later in 1972 and it was oavious that he had an impression that I was a difficult person to work with a "prima donna"---an employee that must be brought into line.

Last fall, evidently Hester was able to convice Reed that I am a difficult and troublesome person and received the go-ahead for the transfer to Beulah in the best interests of the Bureau.

No matter the reasons and personalities involved, it is obvious to me that I can no honger continue as a Bureau employee within the present administration.

Mr. James Mullen February 19, 1974 page 2

I doubt if you'll ever receive a reply to your letter. I would like to know, however, why Nat Reed, in the fall of 1973, backed down from his stand of Jan. 1972--who got to him and why? He was the one who instigated the chain of events--but the events followed the typical Bureau course not the strategy he envisioned in=1972--yet he apparantly endorsed the transfer to Beulah "in the best interests of the Bureau." It just doesn't seem reasonable, but I have no more time to worry about it.

Sincerely,

Robert Behnke

RB:vv

Mr. James Dangel Alaska Department of Fish and Game P.O. Box 499 Sitka, Alaska 99835

Dear Jim:

Thanks for the copy of the paper describing a new species of <u>Salvelinus</u>. I talked with Jim Morrow about hhis fish in 1970 and I mentioned it on p. 646 of my salminids of glaciated lakes paper. There is nothing new in the publication from what he told me in 1970. I had suggested that because there was no clear-cut differences between the new char and <u>S</u>. <u>malma</u>. the best I thought he could do was name a new subspecies-based mainly on the supposed relict distribution of the fish (quite disjunct from any known malma or alpinus).

Morrow has had no experience in salminid taxonomy and his description is inadequate to make a judgement on the validity of the new species. He states the fin ray counts are higher than for <u>S</u>. malma in the literature, but he didn't realize that the literature counts typically include only principal rays, whereas he counted every rudiment, which would make his counts 2-3 higher.

Morrow told me he submitted a description of this species to Copeia in 1970 and it was rejected--I can see why.

My suggestion would be that Alaska Fish and Game should recognize that this publication reports on a new distribution record for <u>Salvelinus</u> in Alaska. Because of the relict nature of the distribution and apparantly limited areas where it occurs some special recognition should be given to it if the envéronment is threatened. The validity of the name anakturukensis and its affinities to <u>malma</u> or <u>alpinus</u> is an open question which is not at all well documented in the publication. I could use the cliche that it is "in need of further study."

I received five more copies of your hybrid paper. I can now send a few more out, such as to Dr. Charles Remington at Yale who wanted one. Many thanks.

Mr. James Dangel February 19, 1974 page 2

I have some of Armstrongs reprints on Dolly Varden, such as his bibliography and the Eva Lake study. If he has others available, I would appreciate them, You might point out to him that Savvaitova has a paper on the ecology and taxonomy of freshwater chars from Kamchatka in Voprosy Ikhtiologii 13(1)-the English translation is due out any day. The Kamchatkan chars are S. malma, despite what Savvaitora sames.

Sincerely,

Robert Behnke

Dr. Charles Remington Department of Biology Yale University New Haven, Connecticut 06520

Dear Dr. Remington:

Enclosed is a copy of a listing of salminine hybrids. If you remember I mentioned this work to you during your visit last year.

Also enclosed is a copy of a proposal composed by a former Yalesman, Mim Shaklee and myself to obtain some token funding to initiate a project on rainbow trout and cutthroat trout hybridization, combining both of our areas of expertise. Jim is here at C.S.U. this year and I hope we uncover some interesting data to encourage expansion of the project.

The situation in the Poudre River if you recall our discussion from last year, involved hybridization between the two species which has been going on for about 80 gears. The result is not a typical hybrid swarm, however, because the cutthroat trout phenotype is maintained at higher elevations and a very typical rainbow trout is found below about 7000 ft. elevation.

Jim and I would be grateful for your comments and suggestions on this project.

Sincerely,

Robert Behnke

RB:vv

February 25, 1974

Mr. James T. Rybock Woodward-Envicon, Inc. 7330 Westview Drive Houston, Texas 77055

Dear Mr. Rybock:

Your letter requesting information relating to aquatic resources of eastern Colorado was given to me for reply.

Most of our fisheries activities are not in that region and I know of nothing in the way of faunal surveys of inventories since Hiram Li's work. I do note any new distribution records or occurrence of fishes not found by Li.

The Colorado Division of Wildlife has fisheries biologists working and gathering data in the region, particularly in relation to impoundments.

The Thorne Ecological Foundation has been conducting a study on aquatic biology in relation to the effects of the St. Vrain in an area north of Denver.

If you could cite the precise type of information you desire, I may be able to suggest other leads.

Sincerely,

Robert Behnke

February 25, 1974

American Fisheries Society 1319, 18th Street, N.W. Washington, D.C. 20036

Enclosed \$2.00 check for NCD/AFS, Special Publication No.2: "Stream Channelization: a symposium."

Robert Behnke Colorado Cooperative Fishery Unit Colorado State University Fort Collins, Colorado 80521

RB:vv

Enclosures

February 28, 1974

Mr. George Holton Montant Department of Fish and Game Helena, Montana 59601

Dear George:

I received several reports regarding Hungry Horse Reservoir and Flathead Lake cutthroat trout. Many thanks. We'll incorporate some generalized life history and ecology data in the thesis on westslope cutthroats. Which reminds me that there is really a paucity of detailed information on their ecology in various environments. Has any thought been given to expanding the Hungry Horse investigations to obtain data on feeding habits and degree of niche separation and overlap with the Dolly Varden, whilefish and suckers? What you need to know for intelligent management and effective utilization of hatchery raised fish would be: is natural recruitment fully adequate to maintain the Hungry Horse Reservoir cutthroat trout fishery at maximum levels (if so, then adding hatchery raised trout would be like pouring water into a bucket already full)? If not, what size fish stocked at what time and in what place, would provide the best return per dollar invested? Do you have any data on the contribution to the catch from stocked trout vs wild trout in the Hungry Horse fishery?

I received an abstract from Gary Reinitz. His conclusions support ours that the westslope and eastslope cutthmoat are very similar and both are distinct from Yellowstone cutthroat. Reinitz has gone a step too far however, in the implication that the westslope cutthroats is more closely related to the rainbow trout than it is to the Yellowstone cutthroat trout. I suspect he based this on analysis of the esterase enzyme, which is subject to rapid evolutionary change and convergent evolution -- much like the phenomenon that lacustrine populations of a species tend to increase the number of gillrakers (given several thousand years of isolation). This type of character (rapid evolutionary change and convergence) can lead to highly erroneous conclusions on relationships and taxonomy. I just thought I should tellyyou this so you aren't led to make a statement or give a news relacae that "modern technology" demonstrates that westslope cutthroats are derived from S. gairdneri and not S. clarki. Enclosed is a copy of my letter to Reinitz. You note GAry is looking for a job and I suggest he contact you if he already hasn't. I also suggest that a group interested in Montana native trout might be assembled at the Montana Academy of Sciences meeting for a session.

I haven't seen the cutthroat from Little Belt Creek. I note that Hanzel listed rainbow from the creek and cutthroat from two tributaries. A

Mr. George Holton February 28, 1974 page 2

sample from a tributary of the Judith River, nearby, are obvious hybrids, no before an introduction is made into a barren stream it would be a good idea to send a sample down to check the purity.

Yes, I would like to review and edit Vincent's paper. It looks like his work is finally bearing fruit after all these years.

As I told you in my last letter I will be resigning from the Bureau. I have no firm commitments for the future. My desire to continue working with rare trouts, which just couldn't be done if I accepted a transfer, led to my decision. This action has coused some people to view the situation as simply incredible (with which I must agree)--that the Bureau of Sport Fisheries, who is charged with protection and research on rare and endangered fishes, is forcing the termination of their only employee actively doing research on rare fishes, because he wants to continue and expand this work.

I am always the optimist however, and the situation may not be as bleak as it appears. In fact, it is probable that I can continue and expand my work and do more for rare fishes as a non-Bureau employee. I base this on the 1973 Endangered and Threatened Species Act, P.L. 93-205, which provides strong incentives for states (or groups of contiguous states to implement their own program for the management and preservation of all species deemed threatened within their boundaries. If a state develops an acceptable program they may recieve federal funds to cover 2/3-3/4 of the costs of administering this program (research, managment, alnd aquisition, etc.) Colorado may be elligible for \$300,000 in federal funds under this law. If a state fails to act, the federal government assumes control of the program. States in the Rocky Mountain gegion are in the fortunate position that several subspecies of native trout are threatened (subspecies are treated equally as species under the law). This means that research and recovery programs for these trouts are elligible for federal funding and can also be worked into the regular fisheries managment plans of the state. For example, Montana and Idaho may join in a project on westslope cutthroat and Montana and Wyoming on eastslope cuttherat.

The most obvious way for a state to develop a viable plan for threatened fishes would be by contracting for research with a University and with my past experience and present involvement I beleive I am best qualified to handle these prijects. This would entail complete documentation of all potentially threatened fishes, game and non-game. The geographical area I am considering is large, the threatened fishes numerous and the problems many. Presently, Dr. Richard Wallace of the University of Idaho is on sabbatical leave and working here with me and the students on the systematics of the westslope cutthroat. We have standardized our methods and techniques of making counts and measurements of specimens so our data is repeatable and interchangeable. This will allow Dr. Wallace to supervise studies similar to my own at the University of Idaho and in the future it is likely we would work as a team to tackle large scale projects such as our present Mr. George Holton February 28, 1974 page 3

cooperative venture on the westslppe cutthroat, where the species crosses state boundaries. Once the systematic research is completed, pure stocks can be selected for re-introductions in cooperative programs with federal agencies such as the Forest Service, Park Service, and B.L.M. This would be a strong lever to have these agencies institute good habitat managment plans in areas selected to restore or protect a threatened species.

Another venture I am proposing is to develop a series of brood stock ponds on C.S.U. lands to hold pure stocks of several forms of threatened western trouts (See enclosed abstract of talk presented to C.S.U. ExperimentSSitation Research Conference). These ponds would be designed to produce 100,000 to 1,000,000 eggs per year for propagation to establish new populations and for ecological evaluation to obtain data on their potential role in fisheries management. I believe, if the states involved contribute to this project, we can take and ship eggs for a threatened fish program more economically than the states can do it inflividually--and provide hasic information on the ecological potential of these trout at the same time.

The states must submit threatened species plan to the Dept. of Interior within about a year (November 28, 1974 in Colorado). Are Montana Fish and Game Administrators and commissioners fully aware of the implications of the 1973 Endangered and Threatened Species Act? I will go to Denver on April 1 for a meeting where I hope to get the latest word on the implementation and ramifications of this act.

I am hoping that I can organize research on rare fishes to provide information to various states and help these states develop and run their programs based on financial support contracted through the university and funded under the 1973 Endangered and Threatened Species Act.

Sincerely,

Robert Behnke

RB:vv

Enclosures

February 28, 1974

Mr. Gary Reinitz Department of Zoology University of Montana Missoula, Montana 59801

Dear GAry:

Thank you for a copy of your abstract. Unless there is strong correlation of allelic frequencies of proteins besides esterase, I wouldn't stress the apparant affinities of westslope cutthroat and rainbow trout compared to Yellowstone trout. Esterase is not a good character for denoting phylogenetic affinities or for malcing taxonomic implications. It is subject to convergence, much like the number of gillrakers which tend to increase independently in lacustrine populations of a species.

The westslope cutthroat, Yellowstone cutthroat, Lahontan cutthroat, Snake River cutthroat, and apparantly all interior subspecies, have a karyotype of 2N=64 with 106 arms. The coastal cutthroat has 68 and 106. Ray Simon made most of these counts and has either told me personally or in correspondence of his counts. The westslope cutts he examined came from the Creston Hatchery, I believe, which were reputedly from the Flathead River. Thus, the karyotypes suggest (as does morphological and zoogeographical evidence) that all cutthroat trout (coastal and all interior forms) are more closely related to each other than any are to <u>S. gairdneri</u>. That is, <u>S. clarki</u> is monophyletic, which of course it should be to be treated as a single polytypic species. Certainly then, all interior cutthroats, in a phylogenetic sequence, are at least one (and perhaps more) major divergences removed from a common ancestor linking S. clarki and S. gairdneri.

We have found consistant differences in spotting pattern, scale counts, vertebrae number and pyloric caeca (also basibranchial teeth) between westslope and rainbow trout, and lesser differences with the large-spotted form of cutthroat. I recently wrote to George Holton that I may come up with some students to the Montana Academy of Sciences meeting. If enough interested people can get together we might plan at least an informal meeting on the native trout of Montana.

I can't offer much in the way of definite leads for a job. Most of our students in the past year have gone with private firms involved with environmental consulting work. I have heard that the federal register is open Briefly to accept applications for fisheries biologists. It would be a good idea to get your name on the federal register while it is open, Mr. GAry Reinitz February 28, 1974 page 2

even if no suitable jobs are presently available. You should also check the job announcements in the Sport Fisheries Institute Bulletin (the newsletter accompanying the Bull, contains the job announcements). Montana Fish and Game employees at least three Ph.D.s that I know of halave you inquired with George Holton? Good Luck.

Sincerely,

Robert Behnke

RB:vv

cc: G. Holton

March 4, 1974

Dr. V.P. Vladykov Department of Biology University of Ottawa Ottawa, Ontario, CANADA KIN 6N5

Dear Vadim:

I have been offered a job to advise the Iran Department of Environmental Conservation on fisheries matters. One of the emphasis would be trout fisheries, and, of course, my intense interest would be in the possibility of finding undescribed forms and determining the status of the <u>S. trutta</u> native to the interior drainages north of Tehran.

I was fascinated by your remarks in the report on Iranian inland fisheries about a trout found in tributaries to Lake Rezaieh (Urmia). You wrote: "probably <u>Salmo ischchan</u> or possibly <u>S. trutta</u>." Did you preserve any specimens? Could you give me the locality where you found trout? Berg, 1949. Freshwater fishes of Iran and neighboring countries. Trud. Zool. Inst. A.N., 8(9):#83-858 and 1940. Zoogeography of the freshwater fishes of Asia Minor (Perednei Zaii). Uchen. Zapis. L.G.U., No. 56. Lists <u>S</u>. <u>trutta "macrostigma (?)"</u> in Iran only from the Daryacheh-ye Namek basin, near Tehran (excluding <u>S. trutta</u> of Caspian Sea basin). He did not find records of trout from the Lake Rezaieh basin nor from the Tigres River drainage. <u>Salmo trutta</u> is known from the upper Euphrates drainage in Turkey and it would seem logical they should be indigenous to the Tigres also.

It appears your record is the first on trout in tributaries to L. Rezaieh, and isolation of this basin suggests this trout represents an undescribed, relict form. I would appreciate any other comments you might provide on Iranian fishes-areas in need of surveys, etc.

It appears that the Iranian Department of Conservation is a vigorous and progressive organization, but the commercial fisheries of the Caspian basin is still under political control.

Sincerely,

March 4, 1974

Mr. R.P. Van Gytenbeck Trout Unlimited 4200 E. Evans Ave. Denver, Colorado 80222

Dear VAn:

Dick Klein mentioned to me that Colorado Division of Wildlife people are discussing the problems of how to handle the skyrocketing costs of producing catchable trout. The general trend of opinion seems to be to place the burden on those who fish for catchables by selling an extra stamp which would be necessary to fish in areas where catchables are stocked. This is a step in the right direction because we'll learn how many fishermen are willing to support a catchable program and production can be geared to the number of catchable stamps sold.

Support from the commissioners, the legislature and the public will probably be necessary for such a change in the laws and if TU has an opportunity to ingluence thinking on the matter, you whould push for acceptance of this concept.

I should also mention another item of interest. There may be a potential bonanza in several states (such as Colorado, Wyoming, Idaho and Montana) for getting federal funds which could be used for wild trout management and research. The 1973 Endangered and Threatened Species Act (P.L. 93-205) provides and incentive for states to develop their own threatened species program for fish, wildlife and all potentially threatened species of life. In Colorado, the potential federal contribution to such a program may be \$300,000. Because many of the threatened fishes of the Rocky Mountain region are various forms of native trouts, a program can be devised as part of the regular fisheries management activities of the state to develop fisheries based on the native trout. The ramifications for influencing the activities and policies of agencies such as the Bureau of Reclamation, Corps of Engineers, BLM and Forest Service are great. Intelligent planning could designate vital areas for the recovery and restoration of a threatened trout species which would be a powerful lever to influence decisions of projects which would be detrimental to the restoration efforts and cooperative efforts with these agencies to protect and improve habitat would be enhanced.

I think we have a real tool here to stimulate large-scale programs of wild trout management. I am currently propagating my ideas among fisheries people in Colorado, Wyoming, Montana and Idaho. I plan to be in Denver for the National Wildlife Conference, April 1, perhaps I'll seeyyou there.

Sincerely,

Mr. Ron Gumtow Bureau of Sport Fisheries and Wildlife P.O. Box 128 Pinetop, Arizona 85935

Dear Ron:

Re. cutthroat trout reproduction in streams and trapping of spawning runs, I just received several D.J. reports from Montana concerning studies on spawning runs from Hungry Horse Reservoir. Colorado Fish and Game has some considerable work on cutthroat trout reproduction in Trappers Lake which resulted in at least three publications: Cutthroat trout reproduction in the inlets to Trappers Lake, Snyder and TAnner. 1960. Tech. Bull. 7; and further reports by Drummond and Kolburn in the late bo's. There were copies of these in the Unit library but I can't find any now. Dick Klein of Colo. Fish and Game made copies from one of these reports showing the traps used and these are enclosed. The studies at Trappers Lake demonstrated that a few small tributaries can provide all the natural reproduction and recruitment needed to maintain a cutthroat population in a 275 acre lake at maximum abundance (even when over 1,000,000 eggs are removed for propagation for other waters).

You might check the abstracts found in Cope's "Revised bibliography on the cutthroat trout." 1964, Bur. Sport Fish and Wildlife Res. Rept. 65.

I strongly endorse your opinion to maintain the Christmas Tree Lake stock with the fish already in the lake and avoid the possible contamination of hatchery trout.

I think you will find that if even a small amount of good spawning area is available in the tributary streams (sufficient to handle 10-50 pairs of spawners), natural recruitment will be entirely adequate to maintain the lake population without artificial propagation.

Do you know if Anderson ever carried out the original plans to introduce pure stocks of Apache trout from Ord Creek, Firevox Creek and Deep Creek, right after Christmas Tree Lake was constructed:

Sincerely,

Dr. Bruce H. Anderson Office of International Programs and Studies Utah State University Logan, Utah 84322

Dear Dr. Anderson:

In reference to my proposed study of Iranian fishes and fisheries ( my letter of January 10, and your reply of January 30), I would appreciate any update of information on the CUSUSWASH program in Iran. The Iranian Department of Conservation has offered me a position to set up and conduct a program of fisheries research. If arrangements can be worked out allowing me to spend six months in Iran and six months here, I will accept the position.

I suspect that I may be able to propose some very obvious programs for development of fisheries but may have problems for instituting these programs. For example, the Ministry of Rural Affairs has plans to use rainbow trout as a major source of protein for the rural populace by stocking large numbers in reservoirs. The problem is that they seem to completely lack an understanding of the very restrictive environmental tolerances of trout and their trophic level in an ecosystem which makes trout an inefficient energy converter. I am certain that for most regions of Iran, other fish species would be much more feasible as a source of human protein.

You mentioned that CUSUSWASH plans to have a team in Iran working with the Ministry of Cooperation and Rural Affairs. If you could keep me informed of their names and how to contact them I would plan to see that any pertinent information obtained from fisheries studies I might make for the Department of Environmental Conservation, is made available to them.

Sincerely,

Robert Behnke

RB:vv

Dr. Carl Schreck Department of Fisheries and Wildlife Sciences V.P.I. Blacksburg, Virginia 24061

Dear Carl:

Many thanks for all the material. I take it that you provide the reference bibliographies to your class. They will be useful for my files. Enclosed is a new bibliography for you on salmonine hybrids. If you have a list of all your publications for 73 (and 74 in press) I can give it to the Unit Secretary for their annual report--in case they want to pad the publication list--but it would be valid since it is based on your Ph.D. research.

I think you would have enjoyed this winter quarter at CSU. We have a post doctoral fellow, James Shaklee, from Yale who did his Ph.D. work on LDH in fishes. He has been running a fish physiology seminar for us and twice a week one topic is covered in-depth.

I have been offered a job in Iran, and if they will agree to a "split" appointment, 6 mo. in Iran and 6 mo. here, I will go over this year and return to teach ichthyology and get on with my other work next winter. I would appreciate any leads or help you might provide for outside jobs. I have suggested to James Cole at Yellowstone Park, that if the Park Service would increase their funding I could expand my fisheries studies. Perhaps next year we can look into the visiting scholar program at V.P.I. One large potential source of funds for ichthyological studies might be the 1973 Endangered and Threatened Species Law. If each state does not develop its own plan for all threatened species within its boundaries within a year, the federal government will take over the responsibility. There is a strong financial inducement for the states to develop their own program--which in Colorado might be \$300,000 a year in federal funds (see enclosures). Most states have little information and scarce interest in threatened fishes and this might be a logical area for someone like you for Virginia and contiguous states and me in the Rocky Mountain region to offer a package deal to them to develop a plan, conduct surveys and inventories and come up with recommendations so they will have acceptable plans and get federal funding.

I have received comments from various people who find it almost unbelievable that the Bureau, who is charged with all the work on threatened fishes, is now forcing the termination of their only employee who has been actively working on these fishes. Jim Mullen, the federal biologist in Vernal, Utah, Dr. Carl Schreck March 5, 1974 page 2

wrote a heated letter to the Director pointing out this inconsistency. I had a call last week from Kermit Snead, the fish culturist, who was working in the Washington office making out next year's budget. He wanted to know how much I could use to continue my work on rare fishes--as a non-Bureau employee--by contracting with the University. I told him \$50,000. Of course I don't have the money yet, but it seems so ironic that for years as an employee I couldn't get a cent or even a response, now they ask how much I can use to continue my work.

I still haven't heard when my termination date is and I'm certainly not going to press the question and cut off my pay, but I thought the date would be before March 1, and on that basis accepted a job to provide data to help the Piute Indian tribe sue the government for loss of the Pyramid Lake fishery. It may be a touchy situation for a government employee working for the plaintiff in a suit against the government.

I was most happy to read about the apparant success of the Lake Ohrid trout in Watugo Lake, Tennesee. I was certain that under the right conditions this trout can be a valuable fish. Its ecology seems quite distinct from the typical <u>Salmo trutta</u>. Wyoming has a brood stock now in a lake near Casper and I hope we can learn more about its life history and ecology in Wyoming. It might do well in the series of reservoirs on the North Platte River. I would like to be kept informed of any other bits of information you come across on <u>S. letirica</u>.

I have been reading the Ph.D. thesis of Dr. Maughan, the Asst. Leader at V.P.I., on sculpins of the Clearwater River, Idaho. He did a good job but I wonder why he did Ph.D. work in ichthyology at Washington State? I note several instances where it is obvious he did not have a source of expertise in fish systematics and zoogeography available for advice.

Have you developed any new ideas on techniques to produce asexual fish? This is the area where you are likely to establish a reputation in fisheries. Can you envision the "Schreck rainbow" of the "Schreck kokanee," surviving twice as long as reaching twice the size as their sexual cohorts?

We have the annual meeting of the Colorado-Wyoming AFS calpter in Fort Collins this week. Steve Flickinger is program chairman and he told me someone submitted a resolution protesting my resignation.

Best regards to your family.

Sincerely,

Mr. Barry Nehring Department of Environmental Conservation P.O. Box 1430 Tehran, Iran

Dear Barry:

Enclosed is a copy of my latest letter to Dr. Farvar. Just as I was finishing that letter, I received your delayed letter of January 18, with a copy of your letter or Dr. Carlson.

I think the idea of graduate education is a good one, and it endorses my suggestion that I direct Iranian graduate students on specific Iranian fisheries projects by spending half of the year in Iran and the other half here. I believe we could handle at least part of the grass carp project that way.

As you'll note, I would be willing to reduce my annual income for an opportunity to work in Iran (which will be difficult at present due to skyrocketing prices which have doubled and tripled the costs of many basic food items). However, I must maintain sufficient connections here to be sure of an adequate income when I completed employment with the Iranian government, and the only feasible way is to spend at least six months here in teaching and research and obtaining grant support. Much of my time here could be used on Iranian projects and directing Iranian related graduate programs, which would justify partial salary and provide an annual income at a level where I believe we could get by, but not get rich.

I see in your letter written January 18, that you also found the trout mentioned in Vladykov's report from the Lake Rezaiyeh basin. Based merely on the isolation of the basin, it is a good bet that this trout warrants at least subspecific recognition. Have you seen Vladykov's report on Iranian inland fisheries resources? Vladykov worked for FAO at the time and worked mainly with "Sherkat Shilat," the organization in charge of Caspian fisheries. At that time, Sherkat Shilat was under the Minister of Finance and lacked competent biologists because all positions were political appointees. From your comments in your letter of Feb 18, it appears that "Sherkat Shilat" is the Northern Fisheries Company and things haven't changed much in the last 20 years in regards to restructuring and moderinizing this organization.

I do think you should give high priority to saving at least some of the genotype of the Caspian trout by establishing a population in a new lake.

Mr. Barry Nehring March 5, 1974 page 2

There are many desirable attributes in the typical life history of the anadromous form of the Caspian subspecies of <u>S</u>. trutta such as delayed age of maturity (4-6 years or more) which could be put to good use in management programs. There is probably much suitable trout waters, in mountainous tributaries to the Persian Gulf that are (or were) barren of salmonids. I would like to see any large scale stocking programs for these waters emphasize the native trout of Iran (from the Lake Rezaiveh basin, Daryasheh--ye Namak basin or Caspian Sea drainage) before widespread stocking of rainbow trout takes place. I think I can convince you that manipulation of inter and intraspecific genetic diversity can greatly increase trout production in any given body of water. If my plans for "stockpiling" genetic diversity in a series of brood ponds, gets off the ground, I'll have a source of experimental stocks available to work into management evaluation situation.

As I wrote in the letter to Dr. Farvar, it is times like these that I almost wish I didn't have the financial obligations of property and family. Does an American citizen also pay U.S. income taxo on salary earned in Iran? If I came for six months, I would plan on only bringing my immediate needs-clothing, a few books etc., and not worry about household goods. Are furnished apartments available? I would hope most of July and August could be spent on field work to familiarize myself with the fishes, waters, zoogeography, etc. and develop some thoughts on the type of input information needed for long range planning of a scientifically based fisheries program.

Has your organization had any contacts with Russian fisheries organizations. I cummunicate regularly with fisheries people at the Academy of Sciences in Leningrad.

Perhaps arrangements could be worked out with the Russians to get a source of eggs of the Caspian Sea trout if they are not available in Iran. Also the Russians propagate the Lake Sevan trout, <u>Salmo ischchan</u>, a lacustrine adapted relative of <u>S. trutta</u>, and have had good results with introductions into other lakes, particularly saline lakes such as Issy-kul.

Steve Flickinger is planning a study of grass carp and will get a stock for his foothill ponds. I'll talk to him about your project and see what he has in the way of background literature.

I think that If you can pin point certain problems we where basic research is needed and find potentially good students, a mutually beneficial educational program can be established between your organization and C.S.U.

Have you any thought to the matter of getting a Ph.D. yourself while employed by the Iranian government.

Sincerely yours,

Robert Belinke

March 12, 1974

Mr. Dave Butz Rocky Mountain National Park Estes Park, Colorado 80517

Dear Dave:

As I briefly mentioned to you, I would like to expand my fisheries work for the Park Service.

I think you agree that my type of fisheries expertise can be put to good use by the Park Service and the new CSU Cooperative Research agreement with the Park Service would facillitate future arrangements which would be mutually beneficial.

By contracting through the CSU National Park Cooperative Research agency for consulting services and graduate student projects on specific research topics, I would be able to contribute more relevant input to Park Service management programs than I could as a full-time federal employee.

Enclosed are copies of my annual report to Yellowstone Park and a letter to Glen Cole.

Good luck with your new position in Washington. Let me know if I can be of any help in contributing information or suggestions for manamgement of the aquatic resources of National Parks.

Sincerely.

Robert Behnke

RB:vv

Enclosures

March 12, 1974

Mr. John Gagnon Box 401 Wellington, Colorado 80549

Dear John:

It is not surprising that you received negative responses from publishers regarding a book on trout. There has been a splurge of books relating to trout and trout fishing and, except for one on Kamloops trout, all are by established and reknowned names.

I might suggest plans for co-authoring a book on native trouts to the Rocky Mountain region which I believe the Colorado Universities Press would handle. I can provide information on the trouts, their taxonomy, life history, efforts to save them, etc., and you might fill in the text with background color. As I mentioned to you, the monitary rewards of such an effort would be slight and the only justification for the time and effort expended would be that of establishing your name and a labor of love.

I probably will not have much time to devote to such a project perhaps until next year. I am currently negotiating to go to Iran for several months this year to develop a fisheries research and management program. In the meantime you can plug away at publishing short articles emphasizing wild, native trout.

Sincerely,

Robert Behkke

RB:vv

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

March 13, 1974

Mr. Phil Laumeyer River Basin Studies P.O. Box 1487 Olympia, Washington 98507

Dear Mr. Laumeyer:

As I mentioned to you on the phone, the indigenous trout of the Coer d' Alene drainage share a common origin and affinities to the cutthroat trout of the Clark Fork ("westslope cutthroat") which is <u>Salmo</u> <u>clarki</u> <u>lewisi</u>. Another form of cutthroat trout, quite distinct in its spotting pattern is native to some other areas of the Columbia drainage.

I would hesitate to state that any of your four samples are from pure populations, but only the East Fork of Pine Creek are obvious hybrids--3 of 10 lack basibranchial teeth and the lateral series scale count ( $\dot{x}$  147) is about 20-25 lower than expected for westslope cutthroat. The characteristics of the other samples appear typical of westslope cutthroats but there are only four specimens from Big Creek and 1 of 11 from Teepee Creek and 2 of 13 from Spruce Creek lack basibranchial teeth. The enclosed sheet summarizes some of the data.

I would like to be informed of a summary of your findings on the fishes of the Coer d' Alene drainage, when you complete your thesis.

Sincerely,

Robert Behnke

RB:sa

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

March 13, 1974

Dr. Robert W. Pennak Department of Environmental, Population and Organissmic Biology University of Colorado Boulder, Colorado 80322

Dear Dr. Pennak:

The reference to a trout living at over 80° F., you noted in the article on the greenback cutthroat trout, can only be given as personal communication at present.

On July 26, 1972, I visited Chino Creek, an isolated headwater tributary of the Owyhee River, Elko Co., Nevada. The stream drains an badly overgrazed, arid region and consisted mostly of shallow intermittant pools on that date. Each pool contained several trout, mostly from 6-12 inches. I easily collected a sample of 15 specimens by fly fishing. The trout rose to the fly, fought vigorously, appeared to be in good condition and exhibited no signs of stress despite a water temperature of 83° F. ( 2 P.M.). I held the thermometerb at the bottom of the pools, where the trout congregated, and later that day compared this thermometere with two others over a range of temperatures from  $70^{\circ} - 90^{\circ}$  F.00all readings coincided.

The taxonomic characters of the trout from Chino Creek place it with a group of trout I have celled the red-banded trout. The enclosed reprent written by my former student, Carl Schreck and I, discusses the apparent relationships of the red-banded trout with <u>Salmo aguabonita</u>, the California golden trout. When that article was written we had no specimens of red-banded grout from the Columbia River basin, but just prior to the collection from Chino Creek, I found this same form of trout in headwater tributaries of the Owyhee drainage in Oregon. I recently examined two museum specimens collected in the Wood River, Idaho in 1994 and they are also red-banded trout, which suggests a much broader historical distribution. Dr. Robert W. Pennak March 13, 1974 Page 2

I wrote up a short note to submit for publication on a trout living in 83° water, but when I got into the literature on thermal tolerances the situation became quite complex. Virtually all data is based on lab experiments. The upper temperature tolerance for most trout (Salmo) tested is about 83° F., but diurnal fluctuations--as would be expected in nature can raise the upper lethal limits. However, when temperatures are raised toward the upper lethal limits, experimental trout exhibit obvious stress--cessation of feeding, hyperventilation, loss of equilibrium, etc. I am relatively certain that the Chino Creek trout have a genetic basis for functioning at higher temperatures than other trouts tested, but the evidence is circumstantial. I believe my observation is significant and I will go ahead and complete the paper and submit it for publication, although acknowledging the fact that there is no proof of this trout's higher than normal upper lethal temperature.

In the meantime I have initiated efforts to save this potentially valuable gene pool. Chino Creek was so badly degraded that I didn't believe the population could persist for more than a few more years-no young-of=the-year trout were observed in the stream and the total section holding trout in intermittent pools was only about 1000 feet. Nevada Fish and Game and BLM biologists initiated a transplant into the headwaters of a neighboring stream which was barren of fish. This should provide a temporary reprieve until a brood stock can be established. A private pond in Wyoming was offered and arrangements have been made to attempt to bring some Chino Creek trout into Wyoming this year.

I am now attempting to stimulate cooperation and raise funds to develop a series of ponds on the C.S.U. Maxwell Ranch which can serve as a genetic storehouse for rare and unique genotypes of trout such as the Chino Creek trout, and provide eggs for introductions. Another trout, an undescribed subspecies of cutthroat trout, native to the Humboldt Riber drainage of Nevada, appears to have high temperature tolerance. We found this trout thriving in two streams with water temperatures of 78° F.--although the literature reports an upper lethal temperature of 77° F. for cutthroat trout. This example emphasizes that the typological approach can be just as misleading, if not more so, for fisheries biology as it is for taxonomy.

Sincerely,

Robert Behnke

RB:sa

Dr. Clare Stalnaker Utah Cooperative Fishery Unit Utah State University Logan, Utah 84321

Dear Clare:

Enclosed is a data sheet with the values of some of the diagnostic characters we found for the three collections made last summer. Also is a sketch which depicts the grouping of these specimens when 16 characters were compared in about 1200 specimens of cutthroat trout from a wide geographical area. This particular technique is a principal component analysis interpreted from a computer print-out. Only three of the Bonneville specimens overlapped into other groups (two with the Mt. Wheeler cluster). The lack of basibranchial teeth in 4 of 16 Asay Creek trout is the most suspicious suggestion of hybridization in any of our three collections, but the Asay Creek specimens look good in all other characters.

Utah is in a fortuitous position to capitalize of the endangered species law because there are at least three subspecies of cutthroat trout which can be considered as endangered or threatened and federal funds for their restoration can be worked right into a management program emphasizing wild trout fisheries for native trout.

Keep me informed of the results of the enzyme analysis.

Sincerely,

Robert Behnke

RB:vv

Enclosures

Mr. Phil Pister California Department of Fish and Game 407 West Line St. Bishop, California

Dear Phil:

Many thanks for your Crowley Lake reports. I am curious to know of the outcome of the plans to establish natural reproduction of ranibow trout by stocking the spring spawning Mt. Whitney strain. It is interesting to note the fabulous results in Crowley Lake from the Hot Creek rainbow did so poorly in competition with rough fish and wild ranibow strains in the tests of Cordone and Nicola. Crowley must have a super abundance of forage. Were any of the various strains used by Cordone and Nicola ever tried in Crowley? I'll have a paper coming out this year in the Transactions revealing that survival estimates based on creel census can be very misleading w when comparing two strains of cutthroat trout stocked in the same lake.

I received a copy of Hubbs, Miller and Hubbs monograph and it is indeed a great piece of work.

I want to call your attention to the 1973 Endangered and Threatened Species Act (PL-93-205) and the potential for obtaining funds for rare fish projects. Each state has about one year to develop comprehensive plans for all threatened species of animals (subspecies count as species) not just birds or mammals. If the states fail to come up with an acceptable plan the federal government assumes the responsibility. There is a financial inducement for the states to handle their own rare species management. Federal contributions will equal 3/4 of the total funding if two or more states develop cooperative plans and in Colorado the federal contribution might be as much as \$300,000. I'll learn more about the ramifications of this act and how it is to be implemented, but it could be a real bonanza for members of the Desert Fishes Council.

Just as I was finishing this letter I had a call from Steve Nicola. Among other things he mentioned you found cutthroat trout in three Walker River tributaries. Next time you write, send me the localities.

Sincerely,

Associate Director-Research Bureau of Sport Fisheries and Wildlife U.S. Department of Interior 18th & C Streets, N.W. Washington D.C. 20240

Dear Dr. Hester:

I have no desire to appeal the decision to terminate my employment, nor do I see any need to review documents on the matter. The only point in question is the actual termination date. As a Bureau employee planning and budgeting on a July 1 to June 30 basis, I have financial obligations and moral commitments to complete projects initiated during this fiscal year on rare and endangered fishes for Region II of the Bureau of Sport Fisheries of Wildlife (information book), the Albuquerque region of the U.S. Forest Service (Rio Grande trout), Missoula, Montana region of U.S. Forest Service (Westslope cutthroat trout), National Park Service (Yellowstone and Teton trout) and also a Division of Research funded project on evaluation of Snake River cutthroat trout on the Uinta and Ouray Indian Reservation, Utah.

These projects were accepted and are being carried out as a Bureau employee and I believe it is a reasonable request that I be allowed to complete them as a Bureau employee, particularly in view of the fact that they are all either funded by the Bureau of by other federal agencies but relating to Bureau programs. Thus, I would appeal a termination date prior to June.

The American Society of Ichthyologists annual meeting will be June 17-21. To avoid a request for travel authorization to attend these meetings as a Bureau employee, I suggest that the termination date be set on or about June 17.

Sincerely yours,

Robert Behnke

RB:vv

Ør. V.V. Barsukov Zoological Institute Academy of Sciences Leningrad V-164, USSR

Dear Volodya:

Your delightful gift of folk stories arrived in good condition. The children are fascinated by the beautiful art work and enjoy listening to me trying to read the stories in Russian. Cynthia took the book to her school to show it to her calss. She is now studying the Russian alphabet so she can read the stories herself.

There may be a delay in receiving the first issue or two of the Journal of Fisheries Research Board of Canada. I sent your renewal in several months ago but was only recently informed that the subscription rates had increased and additional funds were sent to complete the renewal.

I just completed the editing of Voprosy Ikhtiologii, 1973 (4). I hesitate to tell you that the translator had problems with your note on the type specimen of <u>Sebastodes ruber</u> Pavlenko. I had to rewrite some parts of it and put it in my own words. I should also point out that the original text on page 723 mistakenly has 169 cm instead of 169 mm.

Let me know if I am in error, but here is my interpretation of the synonomy and homonomy of <u>S. ruber</u>: Ayres 1856 describes <u>Sebastes ruber</u>, but <u>S. ruber</u> of Ayres is actually a synonym of <u>Sebastes auriculatus</u> Girard 1854. Jordan and Gilbert 1882 list <u>Sebastodes ruber</u> (Ayres). Other authors mistakenly use <u>S. ruber</u> Ayres for an undescribed species and this species is described as <u>Sebastodes ruberrimus</u> by Cramer in 1895. Wales 1930 discovered that <u>Sebastodes ruber</u> Pavlenko 1910 is a secondary junior homonym of <u>S. ruber</u> (Ayres) and replaced the name with <u>S. pavlenkoi</u>, and <u>S. pavlenkoi</u> is a synonym of <u>S. owstoni</u> Jordan and Thompson 1914. If all two page notes in Voprosy Ikhtiologii were as complex as yours, I would soon resign by job as translation editor.

Sincerely,

Dr. Donald Chapman Regional Fishery Officer FAO Box 90 Kigoma, Republic of Tanzania AFRICA

Dear Don:

The fishery faculty at CSU has sent a proposal to ACTION for training of Peace Corps people for fisheries work in Cameroon. Could you provide us with any information on the important fishes of this area, particularly in relation to their potential in fish culture?

Perhaps for the same general reasons, I too am about to resign from the Bureau. Actually, I'll take a termination for refusal of a transfer order. The advantage of a termination rather than resignation is one of severance pay. My future plans are somewhat indefinite. I hope to remain at least part of the year at CSU and develop funds to continue and expand projects on rare fishes. I also will get involved with private consulting type work. I have an offer from Iran to conduct a fisheries survey and advice on fisheries research, management and education. If my terms are accepted, I'll probably go to Iran for several months this year.

The opportunity to study new faunas of new areas is still very exciting to me and I would appreciate any leads you might provide for positions with FAO where my talents may be put to good use.

Dick Wallace has been spending his sabbatical leave here with me, studying Idaho trouts and learning systematic techniques. Presently we're setting up an electrophoresis apparatus so Dick can become accomplished in the modern methods of genetic analysis. We're learning quite a bit about Idaho trouts that was never known before, including the discovery that a form of trout, I have called the "red-banded" trout, is native in the Wood River (based on specimens collected in 1894), the delineation of the taxonomy and zoogeography of divergent groups of cutthroat trout and the fact that the steelhead trout of the Clearwater represents a fine scaled type of steelhead quite distinct from <u>S. gairdneri</u> in other parts of the range. We now have to determine if this divergent steelhead is representative of all the stocks of the upper Snake drainage. The phenomenon of distinct gene pools of specifically adapted races of an cenadromous species has significant implications for management and propagation of the species, a fact that has yet to receive proper consideration.

Sincerely,

Mr. Allen R. Reedall 14640 Natalie Drive Whittier, California 90604

Dear Bob:

Thank you for the color slide of your beautiful painting of a Kern River trout. If you have access to a large library you would be interested to compare your picture with the color plates published by Evermann in 1906 (Citation in the reprint I previously sent) of Kern River trouts.

I don't believe I could learn anything new from additional Kern River specimens because from my survey there in 1968 it was obvious that although all degrees of variability exists, the original native trout of the main Kern River, which we call <u>Salmo aguabonita gilberti</u>, has hybridized with the introduced rainbow trout and does not maintain itself as a pure population, although occasional individuals may closely resemble the original trout, as does your specimen. Brightly colored trout must enter the Kern River from Coyote Creek where they are protected against mass hybridization by a series of falls.

Where did you catch the bright colored trout last year? I was wondering if you were fishing in the area of the upper Kern near Coyote Creek at the Kern River Ranger Station? A small mineral spring, called Soda Springs, is located just above the ranger station and this was the spot on the Kern River where specimens were collected in 1893 and on which the name <u>gilberti</u> is based.

I have corresponded with another avid trout fisherman, Mr. John Hewiston of Encinitas, California, who sent me a sketch he made of a trout from a small stream on Mt. Palomor. Although the population has been hybridized with hatchery rainbow trout, Mr. Hewiston related that occasional specimens have orange and yellow colors with bright tips on the fins, similiar to gilberti. It is not difficult to believe that the same evolutionary groups of trout to which gilberti belongs, was also native to the San Luis Rey River system. Through collections and museum specimens I have found that the natural distribution of a trout, related to <u>aguabonita</u> and <u>gilberti</u>, originally extended at least to northern Nevada and southern Idaho.

Sincerely,

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

March 27, 1974

Dr. James Morrow Department of Biology Univeristy of Alaska Fairbanks, Alaska 99701

Dear Jim:

I received a request from the National Geographic Society to review your grant proposal. I would certainly like to learn more about the relict char in the Brooks Range and I emphasized the potential significance of your proposal. I did, however, state a reservation concerning the reality of obtaining sufficiently good karyotypes to evaluate evolutionary affinities. To my knowledge, no one has yet produced sufficiently detailed salmonid karyotypes to interpret homologous chromosomes or parts of chromosomes to trace fusions, translocations, etc. which may have occurred from one evolutionary group to another. Also, with somatic tissue there is always the problem of chromosomal polymorphism which may be due to individual tissue variation and not representative of the ginome. About all you are likely to find is that the angayukaksurak has a modal diploid complement of 80 chromosomes with about 96 arms, similar to all S. malma and S. alpinus which have been studied to date. Thus, my emphasis in support of your proposal stressed the importance of basic research and development of techniques to evaluate karyotypes.

I received a photocopy of your publication describing <u>Saloelinus</u> anakturukensis from Jim Dangel. I noted that your student, I.V. Frohne has a paper with further data (Biol. Pap. Univ. Alaska, 13). I went to our library to read Frohne's article, but the series had been sent to the bindery and will not be available for some mo**hn**hs. I would appreciate a reprint of Frohne's work.

I'll pass on a few comments on your description. You are likely to encounter opposition to the recognition of <u>S</u>. anakturukensis as a full species. The meristic values you found for the Brooks R**s**nge char Dr. James Morrow March 27, 1974 Page 2

are quite typical of McPhail's northern form of <u>S. malma</u>, and for a <u>S. malma</u> sample I once obtained from Willow Creek, a tributary of the <u>Suisitna River</u>. Your higher fin ray counts may be an artifact of your technique of counting from X-ray negatives. Typically you can find an extra rudimentary ray on X-rays which is overlooked on the external examination of a specimen. Because of different counting methods, about the only way to make your counts comparable to others in the literature is to list three counts: 1. total (as you did), 2. principal ray count, and 3. branched ray counts. You may have a reality in the pelvic ray count (predominantly 10) because most <u>malma</u> and <u>alpinus</u> have predominantly 9. If you counted all pores in the lateral line your counts would be 3-5 higher than the standard count in salmonid taxonomy which terminates at the end of the vertebrae column (standard length).

You didn't mention the presence or absence of basibranchial teeth (hyoid teeth) but I assume they are present. The most convincing argument for the general acceptance of <u>anakturukensis</u> as a valid taxon and not merely as a series of disjunct populations of the northern form of <u>S. malma</u>, would be better evidence of actual or potential reproductive isolation of the Brooks Range char from all other <u>Salvelinus</u> in Alaska. Proof that they are spring spawners, as reputed, would help to establish the fact of their potential reproductive isolation.

Keep me informed of your work with this interesting fish. If they are pre-glacial relicts as you surmise, they should possess considerable genetic divergence from other malma of a magnitude greater than is apparent from meristic comparisons, and perhaps this can be detected by their karyotypes or by specific protein comparisons. I am not optimistic, however, that these new techniques will be really useful. No one yet has found any qualitative (species specific) differences in the chromosomes or the proteins between malma and alpinus.

Sincerely,

Robert Behnke

RB: sa

March 27, 1974

Mr. Fred Eiserman Wyoming Game & Fish Commission 188 Dahlia Street Casper, Wyoming 82601

Dear Fred:

Enclosed is a copy of a letter to George Holton which elaborates on some of my points of how federal funds available from the 1973 endangered species law might be advantageously used. First a comprehensive plan for all threatened fishes must be made. Wyoming is in a favorable position in that several subspecies of native trout could be designated and qualify for federal funds for restoration projects: 1) <u>S. c. lewisi</u> (upper Missouri R. drainage), 2) <u>S. c. utah</u> (Bonneville cutthroat), 3) <u>S. c. pleuriticus</u> (Colorado R. cutt), 4) <u>S. c. stomias</u> (now extinct in state, but one native to a small area south of Laramie in the South Platte basin) 5) fine-spotted Snake River cutt (undescribed), and 6) large-spotted Snake River and Yellowstone drainage cutthroat, which is definitely rare outside the National Park (correct subspecies name not yet determined).

I believe, with proper planning a rare trout restoration program can have a beneficial miltiplier effect by the designation of key areas controlled by federal agencies as restoration sites. For example, the Green River cutthroat on BLM lands southwest of Pinedale. The BLM biologists have proposed plans for habitat improvement but funds are never forthcoming from Washington. Suppose the area is designated as a prime site for Wyoming Game and Fish's S. c. pleuriticus restoration project with abundant publicity and fan fare. Would the BLM hierarchy prevent the implementation of the project because they refuse funds recommended by their own biologists and thus create a scandalous situation of a USDI agency foot dragging on such an important issue given such high priority by the USDI?

Native trout populaitons can be managed as wild trout fisheries (hatchery expenditures nil or minimal for lake stocking) and potentially large areas on BLM and USFS lands can be brought back to support thriving trout populations and fisheries where non exist today.

As you pointed out to me, the problems with Mr. Fordyee demonstrates that the use of private ponds to hold brood stock of rare trouts for propagation is a dubious alternative. Because most states don't have available brood stock lakes and holding a hatchery brood stock is expensive and will result in unavoidable demestication of the stock, I have approached the CSU administration about using the University's Maxwell Ranch, an 11,000 acre spread in Mr. Fred Eiserman 3/27/74 page 2

Colorado and Wyoming (south of Laramie) to construct a series of ponds to hold brood stocks. I seem to have received enthusiastic acceptence of the idea and now the problem is one of funding to get going. The SCS may be interested in helping and we might use National Guard equipment and labor to get started until a source of funds are available. If we can get sufficient support I believe private foundations might contribute also. If several states in the Rocky Mountain region were willing to contribute perhaps \$10,000 of their federal allotment for endangered species restoration for a central facillity for brood stock maintenence and propagation, I think we could launch a major program, not only to perpetuate rare genotypes of trout but also have a tremendous source of genetic diversity for use in fisheries management programs.

Sincerely,

Robert Behnke

RB:vv

Enclosures

cc: Jim Mullan

March 27, 1974

Mr. James Mullan Bureau of Sport Fisheries & Wildlife P.O. Box 457 Vernal, Utah 84078

Dear Jim:

Enclosed is a copy of the greenback article from the fall issue of Trout Magazine. Mr. Gagnon was the fellow who accompanied us on the transplant last October, taking pictures. He wrote a story on the October transplant of greenbacks into Hidden Valley and sold it to National Parks Magazine. Perhaps you can suggest to Dick Stroud he might publicize the fact that some endangered trout restoration projects are underway with which you and I are involved, without mentioning the fact that I will no longer be a Bureau employee.

Also are copies of various letters, etc. to keep you informed of recent happenings.

I received a copy of your essay to the Area Manager. I must say it is direct and to the point. I had some thoughts on drafting an eloquent statement to the Bureau in regards to my situation and the irony I feel when I read the grandiose verbiage in the latest job announcements (74-11, Apr. 8) regarding a new Bureau division (Biological Services) which wants to: "hire the best qualified people whereever they may be now located," so the Bureau can become the "biological arm of the federal government, etc., etc." But after thinking it over I thought it would be a waste of time and energy to attempt communicating my thoughts on the matter--about like punching a bag full of goose down.

Sincerely,

Robert Behnke

RB:vv

Enclosures

March 27, 1974

Mr. Robert Armstrong Alaska Department of Fish and Game 210 Ferry Way Juneau, Alaska 99801

Dear Bob:

Many thanks for the package of interesting reprints. I am enclosing a copy of a letter to Jim Morrow re. his description of Salvelinus anaktevukensis with comments on my review of his grant proposal to study this fish. There's not much I can say about the validity of Morrow's new species except to point out that on the basis of the data he presented. I personally would have refrained from proposing a new taxonomic name. I would have emphasized that this is the first published documentation of Salvelinus occurring in this area and suggest that they are likely glacial relicts but that their taxonomic characters are typical of the northern form of malma. The confusion over the taxonomic status of malma and alpinus will never be settled to everyone's satisfaction. This is because there is no practical way to categorize all the variability within the species with out simple binomial system of nomenclature. There is no doubt in my mind that the char we call S. alpinus and S. malma are evolutionary realities. That is, they represent a significant phylogenetic divergence in the genus. However, both species consist of numerous, distinct intraspecific forms and probably both species have historically hybridized occasionally with each other to produce the present confused situation where sharp diagnostic lines cannot be used to separate all malma from all alpinus.

As you also note, the two species completely overlap in life history types, resident fluvial, resident lacustrine, fluvial-anadromous, lacustrine-anadromous and lacustrine-fluvial. All this had led Savvaitove, the Russian ichthyologist, who has intensively studied Kamchatkan char to claims that <u>malma</u> is not a valid species but a synonym of <u>alpinus</u>.

You are essentially correct however, that from a management viewpoint the names <u>malma</u> and <u>alpinus</u> are meaningless in regards to characterizing two consistently different life history types. Enclosed are two reprints, in which I tried to elaborate on this point that salmonid taxonomic categories may be misleading for fisheries management because significant life history differences (for ex. anadromous vs resident) may be found between closely Mr. Robert Armstrong 3/27/74 page 2

related populations, perhaps both treated taxonomically as a single subspecies. A publication will appear in the Transactions AFS this year with further evidence on ecological differentiation within a species based on stocking two forms of <u>Salmo clarki</u> in a lake in Colorado.

Sincerely,

Robert Behnke

RB:vv

Enclosures

COLORADO COOPERATIVE FISHERY UNIT Colorado State Univerššty Fort Collins, Colozzdo 80521

March 27, 1974

Mr. James Dangel National Marine Fisheries Service Division of Enforcement and Surveillance P.O. Box 1668 Juneau, Alaska 99801

Dear Jim:

Enclosed is a copy of a letter to Dr. Morrow regarding his new species. I also sent a copy to Bob Armstrong.

Hope you like your new job.

Sincerely,

Robert Bahnke

RB:sa

March 28, 1974

Dr. S. A. Levin Department of Ecology & Systematics Cornell University Ithaca, NY 14850

Dear Dr. Levin:

I may be interested in the position of ichthyologist my self, but on a separate enclosed letter I am writing in support of the application of one of my associates, Dr. James Shaklee.

My present status and tentative future plans which will influence any attempt to seek a new position can be summarized as follows: I have been employed by the U.S. Bureau of Sport Fisheries for more than seven years. All of this time has been on the SCSU campus, first with the Cooperative Fishery Unit and later as a research biologist. I have taught classes, supervised graduate students, advised undergraduates and functioned in every way as a regular faculty member. Although my federal job is financially rewarding and loaded with security, I feel inhibited from involvement with the full range of research work most interesting to me. I have decided to eterminate my federal position by this June. I have been offered a position to develop a fisheries research and management program for the government of Iran. If my terms are accepted, I will go to Iran for several months this year and return to the US this fall or winter. Although no suitable vacancies are envisioned at Colorado State University this year, both the Fisheries and Wildlife Department and the Department of Zoology have expressed their desire to retain me in a temporary positon on my return. I have been active in echthyological studies on rare and endangered fishes and a new federal law providing funds to each state for such studies, put me in a favorable position to contract through the University to obtain funding for these studies and pay part of my salary (The April-May issue of National Wildlife magazine has a photo of me and a short note on my rare fish work on p. 58)

If a position becomes available at CSU and I am successful in obtaining funding for my research, I would, of course, prefer to remain at CSU where I maintain the most complete collection of rare trouts of the world.

Because I have only recently made the final decision on termination of my federal position, none of my plans are definite or finalized. Enclosed are: 1) my vitae, 2) an outline of my ichthyology course as presently taught, 3) An abstract from an Experiment Stateion conference which outlines one of the projects I propose for use of rare and endangered species funds, and Dr. S. A. Levin 3/28/74 page 2

4) a proposal used to obtain some faculty research funds to initiate a joint project by Dr. Shaklee and I (this proposal might also be included with Dr. Shaklee's application.)

Although at present, I must submit my name as only a potential applicant, I will gladly furnish any further information your committee desires and might suggest Dr. W. Harry Everhart and Dr. Dwight Webster with the College of Natural Resources at Cornell, Dr. Gustav Swanson, head of Fishery and Wildlife Biology Department at CSU, Dr. Carl Hubbs, Scripps Institute of Oceanography, La Jolla, California, and Dr. A. Starker Leopold, College of Forestry and Natural Resources, University of California, Berkeley, as possible references.

Sincerely,

Robert Behnke

RB:vv

Enclosures

April 2, 1974

Dr. Peter Moyle Wildlife and Fisheries Biology University of California Davis, California 95616

Dear Peter:

I believe you should include some discussion of the red-banded trout as one of the native fishes of California in your book and you can use any of the data I have sent to Steve Nicola on these trout. My interpretation of the data leaves little doubt in my mind that probably several distinct groups of red-banded trout are native to California. Virtually all present populations have been influenced by hybridization with introduced rainbow trout, but I also believe that more than one form of red-banded trout invaded California during different geological periods. These divergent forms hybridized with each other to some extent and also with <u>S. gairdneri</u>, invade ing the Sacramento basin, probably during the last glacial epoch. This resulted in a mosaic pattern of distinctive forms which would have made any attempt at taxonomic delineation difficult, but with the noise level now apparant from introduced rainbows and hybrids, the original situation is virtually impossible to diagnose accurately.

I will try to summarize some points for you to use in your book and the enclosed schematic sketch of the McCloud and Pit drainages shows sites from which I have examined specimens. There are two major falls on the McCloud, Anadromous steelhead occurred to the lower falls, Above this, Dolly Varden and red-banded trout were indigenous. Above the upper falls, only redbanded trout are native. Thus we can assume that the original red-banded trout arrived early and established itself in the headwaters of the McCloud before formation of the upper falls and the subsequent arrival of Dolly Varden. Sheephaven Creek is the only site which I consider to contain a pure population of red-banded trout and It is the population I believe to represent the closest approximation of the original form which invaded California waters. This assumption is further supported by the very close agreement in taxonomic characters between Sheephaven trout and the native trout of the Kern-Little Kern drainage which I recognize as S. aguabonita gilberti. Other samples from the McCloud drainage vary from the Sheephaven trout but it is difficult to estimate how much of these differences are due to hatchery rainbow introductions. There is little doubt, however, that the Pit River red-banded trout, by and large, are divergent from the McCloud populations and this divergence becomes greater proceeding upstream. The red-banded trout of the lava plains area of the Pit have some unique charDr. Peter Moyle 4/2/74 page 2

acters of their own (probably the Eagle Lake rainbow was originally derived from this type), near the headwaters of the Pit the red-banded trout are typical of the Goose Lake basin, with higher gillraker counts. The upper Klamath basin also had native red-banded trout, distinct from the Pit and McCloud forms. At least one population (slightly hybridized) of the Klamath red-banded trout still occurs in California--in Butte Creek. A problem of nomenclature arises from the fact that the name Salmo newberryi is available for Klamath basin red-banded trout and newberryi has priority over aguabonita.

Your study of the McCloud River might turn up some interesting populations which might be important for a better understanding of the systematics of red-banded trout. I urge that samples be preserved from any unique appearing populations you encounter. It will be interesting to learn of the status of the Dolly Varden in the McCloud. I have heard that no specimens have been found in the last 3-4 years.

Your section on the brook trout contains the statement that 15 year old fish were in Bunny Lake (1966). I talked with Norman Reimers (Convict Creek Lab) in 1972 and he was still following the population in Bunny Lake which at that time were 21 years old and most specimens were less than 25cm.

I might mention that I now have found relict red-banded trout populations from isolated streams of the Owyhee drainage (Columbia R. basin) in Oregon and Nevada and the steelhead trout of the upper Snake River drainage of Idaho have characteristics (high scale counts, occasional basibranchial teeth) which might be due from the amalgamation of the red-banded genotype into <u>S. gairdneri</u> by hybridization in post glacial times when the steelhead gained access to the range of the red-banded trout in the Snake River system.

I think you can appreciate the problems of working out a rational taxonomy of the red-banded trout, but for your purposes you only need to emphasize that they are a reality, are a part of the California fish fauna and are a threatened trout in need of special recognition and protection.

No set of typical values for characters can be quoted to diagnose all the California red-banded trout from rainbow trout and cutthroat trout. Mainly the coloration is somewhat similar to <u>S</u>. aguabonita gilberti, with a pronounced brick-red lateral band. Scale counts (lateral series) are typically higher than <u>S</u>. gairdneri (140-170 vs 120-140). Occasionally basibranchial teeth occur <u>f</u>in 50% of Sheephaven population). The chromosome complement is 2N=58 with 104 arms (identical with aguabonita).

Sincerely yours,

Robert Behnke

April 2, 1974

Dr. William B. Willers Department of Biology University of Wisconsin-Oshkosh Oshkosh, Wisconsin 54901

Dear Bill:

I enjoyed reading your manuscript. Several notations are penned in the margins. An editor may feel that you have gone into greater depth and detail on taxonomy and evolution than is necessary for the intended audience. However, there is no other available lext which does this for those who are interested. The question is: how many trout fisherman would be interested to have this information in a book? Formerly, David Starr Jordan frequently wrote on trout taxonomy and evolution in popular journals, but for the last 60-70 years the scientific literatire has been sequestered away from the laymen with only feeble and usually erroneous attempts to convey taxonomic information to a general audience. You might consider to stress this point in your introduction--one of the unique facets which makes your book divergent from the mainstream of books on trout.

I heard that Ernie Schweibert is writing a new book on trout and by a request through a mutual aquaintence, I sent him some reprints on trout classification. Schweibert had published a series of paintings with brief descriptive texts, on the salmon of the world, a few years ago. I don't know where he got his list of "species" but it may have been, in part, from Suckley's monograph of Salmo, which was written in 1858 and published in 1874. Schweibert's taxonomy was about 100 eyears out of date.

McClane had an article in Field and Stream last year about a relict landlocked salmon in Finland, but somehow he came up with a statement that this population was isolated for about 100,000,000 years, instead of the approximate 10,000 years since the glacial retreat. So there is a need to fill in the credability gap in the popular literature on salmonid taxonomy and evolution.

Enclosed are some reports and reprints. I can't remember if you received most, or all of these last year, but they relate to some of my comments.

In the phylogenetic diagram, I would suggest modifications to move the border between Pliocene and Miocene so the branching of <u>Oncorhynchus</u> from Parasalmo takes place in lower Pliocene and Parasalmo from Salmo in Dr. William B. Willers 4/2/74 page 2

upper Miocene (about at Pliocene-Miocene boundary). The unjoined lines representing <u>Salmo</u> and <u>Salvelinus</u> can be slanted to suggest a junction about mid-Miocene. The estimated times of phylogenetic separation is still highly speculative.

Although I haven't seen it yet, the new edition of the Encyclopedia Britannica has my article on Salmoniformes and possibly other articles on trout and salmon you might cite as references.

Sincerely,

Robert Behnke

RB:vv

April 4, 1974

Mr. John Beecher 3005 West Polk Street Phoenix, Arizona 85009

Dear Mr. Beecher:

My work with endangered trout is mostly a one man operation in cooperation with state and federal biologists. Unfortunately, there are no salaried positions associated with my ichthyological studies at present.

I would like to encourage a person with your interests and enthusiasm to gain employment in the natural resource profession. If you haven't already done so, you should try to get on the federal register to be eligible for federal civil service jobs when they are open, with such agencies as the Bureau of Sport Fisheries and Wildlife, U.S. Forest Service, B.L.M., etc. Also, write to all of the state fish and game agencies where you might be willing to work for applications.

As you know, jobs in the outdoors with natural resource agencies are very popular and the supply of eligible applicants far exceeds the number of vacancies. You will have to be persevering and perhaps lucky in your endeavors. I wish you well.

Sincerely yours,

Robert Behnke

RB:vv

April 4, 1974

Dr. K. A. Savvaitova Department of Ichthyology Moscow State University Moscow, USSR

Dear Dr. Savvaitova:

I extend my sincere gratitude to you and your collegues for your book on <u>Salmo mykiss</u>. I have been following recent articles on <u>S.mykiss</u> in Soviet journals and am delighted to have a whole series of papers brought together in one book.

I consider <u>S. mykiss</u> as virtually identical with <u>S. gairdneri</u>--probably the same species. However I note in one of your previous publications and in chapter IV of the book that some specimens of <u>mykiss</u> have basibranchial teeth. Previously I had not found basibranchial teeth in <u>S. gairdneri</u>, but recently have found these teeth in about 5% of specimens of steelhead trout in the upper Snake River drainage (Columbia River basin). I suspect that the basibranchial teeth in these steelhead trout are due to hybridization of the steelhead with another group of trout I have called the "red-banded" trout, which are somewhat intermediate between <u>S. gairdneri</u> and <u>S. clarki</u>, but have a distinct karyotype (2N=58 with 104 arms). The origin of basibranchial teeth in Kamchatkan <u>mykiss</u> remains to be adequately explained. What percentage of the specimens have these teeth? Are they more prevalent among certain populations?

Have any introductions of <u>S</u>. mykiss been made into new waters since the article by Smirnov (1971. Zool. Zhur.) which recommended that <u>S</u>. mykiss be propagated?

I am enclosing a copy of a recent paper by J.E. Morrow describing <u>Salvelinus</u> anaktuvukensis from Aladka--and a letter I wrote to Morrow on the matter.

Although you and I have differences of opinion of Salvelinus taxonomy, I think we both would agree that S. anaktuvukensis is not a valid species.

Also enclosed are copies of some reprints. I believe I have sent these to you before, but they may be distributed among your colleagues.

Sincerely yours,

Robert Behnke

April 4, 1974

Dr. J.C. Stevenson Journal of the Fisheries Research Board of Canada 116 Lisgar Street Ottawa, Ontario, Canada K1A OH3

Dear Dr. Stevenson:

Enclosed is the edited manuscript by Hansen with my comments.

It contains subject matter worthy of publication, but the volume of the text seems excessive to me in relation to its information content. The manuscript reads too much like a thesis. The process of trimming and condensing shouldn't be too difficult.

Henry Regier, who obtained funds for this project, was recently here and I asked him why the more significant aspects of the interaction of the three forms of char in Redrock Lake--feeding and niche segregation--wasn't invest-igated. He told me another student did study this aspect of the interactions but refused to release his data to Mr. Hansen to include in his manuscript. This is unfortunate because it would have resulted in a much more comprehensive and significant paper.

I happen to have a paper with similar subject matter--niche segregation in cutthroat trout--in press with the American Fisheries Society.

If you wish, my name may be included with the review sent to the author.

Sincerely yours,

Robert Behnke

RB:vv



UNITED STATES DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE BUREAU OF SPORT FISHERIES AND WILDLIFE COLORADO COOPERATIVE FISHERY UNIT COLORADO STATE UNIVERSITY FORT COLLINS, COLORADO .80521

April 10, 1974

Dr. N. Allen Binns Wyoming Game and Fish Department Box 342 Lander, Wyoming 82520

Dear Dr. Binns:

Enclosed are some reports dealing with Salmo clarki pleuriticus and S. c. utah and other miscellaneous items pertinent to cutthroat trout taxonomy.

A few months ago I wrote to Glen Dunning with a summary of information from examination of cutthroat trout of the Green River and Bonneville basins. I pointed out that most of the collections made since 1972 have not yet been analyzed because I have had no work-study students to assist on these projects this year and my three graduate students are all busy completing their own owrk, which pertains to Wyoming trout--of the Snake, Yellowstone and upper MIssouri rivers--but they are not concerned with Green River cutthroat.

Right now would be a very opportune time to get this work done if funds are available. Mr. James Roscoe has worked for me for three years, as an undergraduate assistant and as a graduate student on projects dealing with cutthroat trout taxonomy. He should complete his M.S. thesis next month but probably won't take a job until September. I believe he would be willing and eager to continue employment this summer examining the Wyoming specimens and evaluating the purity of the various samples. We could write an interpretive report, ranking the samples on their degree of relative purity, which could serve as a basis for any proposed management plan.

I recently wrote to Fred Eiserman about the management potential of restoration of rare, native trout, the possibility of federal funding and the powerful lever of instituting viable and large-scale habitat improvement on federal lands by federal agencies.

You raised a valid question on how accurately one can evaluate the purity or contamination of cutthroat trout subspecies. The documentation of the validity and repeatability of my techniques is too involved to cover in detail but the process is analyagous to any comparison and evaluation of similarities and differences--just as you might recognize your friends and relatives in a crowd because of their peculair attributes you recognize, we do the same with races of cutthroat trout because of familiarity with the fishes involved. The assumption is that subspecies are (or were originally) geographically isolated from each other and accumulated slight differences during their recent evolution in isolation. These genetic based differences Dr. N. Allen Binns April 10, 1974 page 2

are manifested in different range and mean values of several characters, such as spots, coloration, scales, vertebrae, pyloric caeca, etc. The problem is that it takes considerable experience to make accurate counts of characters and to gain the experience necessary to interpret the data and make more subtle comparisons on such characters as spotting pattern. This is why I mentioned it would be a very opportune time to go ahead with a project such as you outlined while I have an experienced person like Mr. Roscoe available to assist on the specimen examination.

I can cite one example where I demonstrated the efficacy of my techniques. In 1969 Galen Boyer gave me samples of cutthroat trout from two lakes in the Boulder Creek watershed in Bridger National Forest north of Pinedale. Only cutthroat trout were found in a series of 8 lakes above a barrier falls and it was assumed they must be the native cutthroat. <u>Salmo clarki</u> <u>pleuriticus</u>. No stocking records were known for this drainage. My examination of the specimens made me almost certain that the Boulder Creek drainage cutthroat trout were not <u>S. c. pleuriticus</u> but were introduced from Yellowstone Lake. Further inquires by Galen verified my conclusionsthe waters were originally barren and were stocked with Yellowstone cutts in 1937 by C.C.C. people.

Further details on methods is included in the report prepared for the USFS on Rio Grande trout by Richard Wallace and myself. An in-depth look at the taxonomy of <u>S. c. pleuriticus</u> and on character evaluation, including comparisons of identical genotypes raised in different environments to test non-genetic influence, is found in a M.S. thesis by Wernsman. I sent a copy to Fred Eiserman and I'm sure you can arrange a loan.

I should emphasize that there is no magical short-cut method to make valid taxonomic evaluations for relative purity. Most fisheries people immediately think of biochemical techniques such as immunology and protein electrophoresis. The problem is that no one has yet found a single protein that consistantly differs between rainbow trout and cutthroat trout, much less between cutthroat subspecies. What we do find id allelic frequency differences at a gene locus, but since any two populations not freely interbreeding with each other will likely have different gene frequencies, their is no way to say if the differences are natural or due to a hybrid influence. The only feasible basis for a judgement is the comparison of several characters. It is a time consuming task, but I foresee no major breakthrough with new techniques in the near future.

Let me know as soon as possible on the matter of funding a project this summer, while I have Mr. Roscoe available and uncommited.

Sincerely yours,

Robert Behnke

## April 10, 1974

Mr. Fred Eiserman Wyoming Game & Fish Department 108 Dahlia Street Casper, Wyoming 82601

Dear Fred:

Enclosed is a copy of a letter to Allen Binns re. Wyoming cutthroat specimen examination. As I had written to Glen Dunning, I just didn't have any available help this year to work on a stockpile of specimens, not directly pertaining to funded studies.

Let me know about possibilities for funding. The amount would not be great-perhaps \$1,000 should cover 2-3 months work if we can work out an arrangement to avoid University overhead charges.

Sincerely,

Robert Behnke

RB:vv

## April 10, 1974

Mr. Galen Boyer Wyoming Game & Fish Department P.O. Box 1589 Cheyenne, Wyoming 82001

Dear Galen:

Enclosed is a copy of my reply to Allen Binns re. examination of cutthroat trout specimens.

I believe I could arrange to employ Mr. Roscoe, a person experienced in trout taxonomic investigation, for two or three months for about \$1,000, to do the work proposed vby Dr. Binns.

Sincerely,

Robert Behnke

RB:vv

## April 11, 1974

Mr. John Dimas Soil Conservation Service P.O. Wox 1629 Grand Junction, Colorado 81501

Dear Mr. Dimas:

For your information on rare and endangered fishes of Colorado a series of reports are enclosed. The trout reports are updated revisions of the papers you requested, except for the greenback trout report which is currently being revised.

These reports are being revised again this year and will be re-issued. Extra copies will be available in 4-6 weeks and you may send a request for copies of the new editions if so desired.

Sincerely,

Robert Behnke

RB:vv

April 11, 1974

Dr. Robert White Idaho Cooperative Fishery Unit University of Idaho Moscow, Idaho 83843

Dear Bob:

Many thanks for a copy of your thesis. I had to sit right down and read it. Your data convinces me that <u>spilonotus</u> does consist of two spedies. I would urge that you go ahead and publish a formal description of P. <u>nannomaculatum</u>, no matter what the karyotype turns out to be. I can see no other explanation for the consistant differences in taxonomic characters and life history between the two forms except that they are genetically divergent and reproductively isolated. Because of their endemism in Bear Lake, you have no such problems concerning monophylatic vs polyphyletic "species" as with <u>Coregonus lavaretus</u> and <u>C. clapeaformis</u> sympatrie sibling species.

I would be happy to review any manuscripts you prepare for publication.

Sincerely yours,

Robert Behnke

## April 11, 1974

Mr. Phil Pister California Department of Fish and Game 407 West Line Street Bishop, California 93514

Dear Phil:

I received a copy of your letter to Wayne Seaman re. Trappers Lake cutthroat in California and Wayne sent me a copy of his reply and the photo of these fish.

Mr. Seaman probably sent you a copy of my 1973 report on <u>Salmo clarki pleur-</u> iticus which mentions that the present stock in Trappers Lake has no obvious hybrid influence. Trappers Lake is the only lake (of 100 surface acres or more) in Colorado that contains a self-reproducing population of essentially native cutthroat trout. My evaluation of the taxonomic characters of the Trappers Lake trout surprised me because millions of non-native cutthroat trout (and some rainbow trout) have been stocked in the lake--probably as far back as 1890 or earlier.

Snyder and Tanner. 1960. Colo. Dept. Game and Fish Tech. Bull. 7, described two types of cutthroat trout in Trappers Lake=-the native and the Yellowstone cutthroat. Stocking records showed 50,000 to more than 100,000 Yellowstone trout were stocked each year in Trappers Lake from 1943-1950. My interpretation is that the native stock has been in this stable environment for thousands of years and is so highly adapted that hybridization with nonnative trout is strongly selected against through differential survival. The status of <u>Salmo clarki pleuriticus</u>, the Trappers Lake stock and comparisons with Yellowstone cutthroat is treated in greater detail in a 1973 MS thesis by Gary Wernsman. I can loan you a copy if you want to look it over.

A point I should mention is that almost certainly the Trappers Lake cutthroat sent to California in 1931 had been exposed to possible hybridization from non-native trout. Trappers Lake was one of the first sources of trout eggs for propagation in Colorado. When the Leadville federal hatchery was opened in 1890, statements in the U.S. Fish Comm. Repts. in the 1890's revealed that cooperative arrangements between state and federal fish culturists utilized a variety of sources for cutthroat eggs, such as Trappers Lake and Stillwater Lake (S. c. pleuriticus) and Twin Lakes (S. c. stomias). These trout were all propagated together stocked back into the lakes and other waters as "native black spotted trout." Rainbow trout came to Colorado in 1881 and were typically mixed with cutthroat for stocking. I examined 7 Mr. Phil Pister April 11, 1974 page 2

specimens of trout collected from Twin Lakes by Jordan in 1889 and two of these specimens are rainbow x cutthroat hybrids. The native cutthroat in Twin Lakes were gone by the early 1900's and most other lakes followed the same pattern, which is why Trappers Lake is unique.

I am somewhat baffled by the common belief among the people who worked at Trappers Lake in the 1940's and 1950's that both native trout and Yellowstone trout were coexisting in the lake. I suspect that much of the basis of the belief related to different ages of the spawning fish particularly repeat spawners vs first spawners--a situation which led to the recognition of S. c. henshawi and S. c. tahoensis in Lake Tahoe. The fish in your photo have the typical spotting pattern of Trappers Lake fish, but lack the bright colors typical of spawning fish. Perhaps your specimens were caught late in the year or the lake lacks a forage organism necessary to supply the color pigments, but S. c. pleuriticus can develop colors almost as bright and guady as the most extreme examples of S. aguabonita.

I can suggest that you rough out a draft of a manuscript and send it to me for review and comment.

Sincerely,

Robert Behnke

RB:vv

cc: Wayne Seaman

April 16, 1974

Dr. James Morrow Department of Biological Sciences University of Alaska Fairbanks, Alaska 99701

Dear Jim:

I believe it was Ray Simon or his student Dick Wilmot who told me they found 80 chromosomes and 96 arms from Dolly Varden in Oregon. For published accounts you'll have to go to the Russian literature, which is eased by the fact that most counts are in a 1973 paper by Savvaitova available in the English translation of Voprosy Ikhtiologii, called Journal of Ichthyology in English. The citation is: Savvaitove, K.A. 1973. Ecology and systematics of freshwater char. of the genus Salvelinus from bodies of water in Kamchatka. Voprosy Ikhtiologii (Journal of Ichthyology, English translation,) 13(1). Savvaitova considers malma as a synonym of alpinus, but the characters of the char she studied in Kamchatka are typical of malma. Evidently the counts aren't very reliable but the following counts are listed: predatory char 2N 78-84; benthic char, 78-82; river char 76 + 2 (96 arms) (cited from Chernenko, 1969. Evolution and cytotaxonomy of the family Salmonidae. Voprosy Ikhtiologii, 9(6)); stone char, 78 + 2 (92-98 arms); brook char 69-80 (76) with 96 arms.

I have not seen the following citation but I'll pass it on. Chernenko, E.V. and R.M. Viktorovskuj. 1971. Chromosome sets of the masu salmon and the southern Dolly Varden char. Nauckn. soobshch. Inst. Biol. Morya, no. 2. Vladyvostok.

Other Russian papers on biochemical analysis of malma, alpinus and leucomaenis are: Zakharova, L.A., G.G. Novikov and K.A. Savvaitova. 1971. Establishment of relationships between chars of the genus <u>Salvelinus</u> by precipitation and immunoelectrophoresis. Zool. Zhur., 50(4). Vasilov, V.D. and K.A. Savvaitova. 1972. Immunological analysis of the Arctic char, <u>Salvelinus alpinus</u>. Nauchn. dokl. Vyssh. shk. Biol. Nauk. no. 6.

Osteological comparisons are in a paper by Shaposhnikova, G. Kh. 1970. Comparative morphological description of some species of the genus <u>Salvelinus</u>. Tr. Zool. Inst. Akad. Nauk. SSSR, 48.

The Russian work indicated no real differences in the protein they looked at between what might be malma and alpinus in Kamchatka. Also Nyman (Rept. Drottingholm Inst. 1972. "A new approach to the taxonomy of the <u>Salvelinus</u> alpinus species comples") mentioned he found no qualitative differences in the Dr. James Morrow April 16, 1974 page 2

esterase enzyme. Katsuhiko Yoshiyasu compared hemoglobin patterns of S. malma and S. leucomaenis in Japan and found real differences. His papers are: 1972. Starch-gel electrophoresis of hemoglobins of freshwater salmonid fishes in wouthwest Japan. I. genus <u>Salvelinus</u> (char). Bull. Jap. Soc. Sci. Fishl, 38(7), and - - - salmonid fishes in northeast Japan, ibid., 39(4). The latter paper also includes data on a lacustrine char, described as <u>Salvelinus miyobei</u>, from Hokkaido which I have suggested might represent a relict population of <u>S</u>. alpinus The suggestion in Yoshiyasu's publications that hemoglobin patterns are useful in Salvelinus taxonomy should be looked into for malma and alpinus.

I have some other Japanese publications including a book on <u>Salvelinus</u>, but they are in Japanese.

I was sorry to hear you didn't receive grant support for your studies, but I would like to encourage you to keep somen momentum going. <u>Salvelinus</u> systematics can be done a little at a time until you think you might be on the verge of a major breakthrough. Good Luck.

Sincerely yours,

Robert Behnke

RB:vv

April 16, 1974

Ziontz, Pirtle, Morisset & Ernstoff 3101 Seattle - First National Bank Building Seattle, Washington 98154

Attention: Rossell W. Busch

Dear Mr. Busch:

I received your letter re: the lawsuit to protect No Name Creek in relation to the fishery of Omak Lake.

I probably maintain the most detailed and comprehensive source of information on the biology and systematics of trout available anywhere. This statement is particularly true in regards to the Lahontan cutthroat trout. I have agreed to act as a consultant for the lawfirm of Weissbrodt and Weissbrodt, representing the Piute Indian tribe in their suit for damages in relation to the destruction of the Pyramid Lake trout fishery.

Presently I am a federal employee but my refusal to accept a transfer to a new position will terminate my federal employment. I have not yet been informed of the termination date, but in the meantime I have accepted various private consulting offers. I have agreed to provide the Piute tribe with the critical information for their lawsuit, but cannot sign a contract until I have officially terminated my federal position.

Undoubtly, a fishery for the large, rare and beautiful Lahontan cutthroat trout, intrinsically has a significantly greater value than an ordinary trout fishery. This is magnified by the fact that the Lahontan cutthroat trout is recognized as an endangered species by the U.S. Dept. of Interior (which also has some legal implications).

It should not be difficult to demonstrate that degradation of a potential spawning and nursery stream will adversely affect the population in the lake.

It might be important to know the source of the Lahontan cutthroat trout in Omak Lake. The common source used in propagation is a stock in Heenan Lake, California. The Heenan Lake stock has been slightly hybridized with rainbow trout and cannot be accurately considered as "endangered." One of the very few pure stocks of Lahontan trout is in Summit Lake, Nevada. At my urging, the federal hatcheries have propagated the Summit Lake fish, and if the Omak Lake population was derived from the Summit Lake stock, an extra measure of significance is attached to the Omak Lake fishery in relation to its importance of expanding the abundance of an endangered species. Mr. Busch April 16, 1974 page 2

Although there is the problem of my partisan involvement in lawsuits as a federal employee, I would be agreeable to informally provide the necessary information and statements as needed and formalize my participation after my termination date.

I am planning to go to Iran this summer as a fisheries consultant for the Iranian government and will likely be out of the country from July to December.

Enclosed is a copy of my vitae and some publications with reference to Lahontan cutthroat trout. During the last few years I have been active in projects designed to save endangered forms of trout and a short article on my work appeared in the latest issue of National Wildlife magazine.

Sincerely yours,

Robert Behnke

RB:vv

Dr. Clark Hubbs Department of Zoology University of Texas Austin, Texas 78712

Dear Clark:

The enclosed MS. is submitted as an ichthyological note for Copeia.

Sincerely,

Robert Behnke

RB:vv

April 18, 1974 •

Mr. Rod Van Velson Nebraska Game and Parks Commission Box 725 Alliance, Nebraska 69301

Dear Rod:

Enclosed is a copy of a MS. submitted to Copeia for publication.

Sincerely,

Robert Behnke

RB:vv

Mr. Monte Madsen Nebraska Game and Parks Commission Route Four North Platte, Nebraska 69101

Dear Monte:

Enclosed is a copy of a MS. submitted to Copeia. A copy is being sent to Mr. Fryl

q

Sincerely,

Robert Behnke

RB:vv

Mr. Steve Nicola Department of Fish and Game 1416 Ninth Street Sacramento, California 95814

Dear Steve:

Thanks for a copy of the minutes of the Threatened Trout Committee, which I assume were sent by you.

I noted the comments on Piute trout and the question of spots. I examined all of Snyder's original material and as I remember, there are no spots on the body but a very few might be found on the tail and dorsal fin. Dick Gard collected 14 specimens from Silver King Creek in 1956 and they are all without spots on the body. It was about that time, however, that occasional specimens started turning up with spots, probably from the 1949 plant of rainbow trout. The possibility that Vestal brought some hybrids to Cottonwood Creek in the original transplant depends on if he took some specimens from Corral Creek. If the spots are due to rainbow trout hybridization, other characters such as lower numbers of scales and gillrakers and reduced basibranchial teeth will be apparant. There is no difference in any character between S. c. seleniris and S. c. henshawi, except the spots, to detect hybridization between them.

If a manuscript is received from Ted Cavender on Dolly Varden taxonomy, let me know, I'd like to have a look at it.

Sincerely,

Robert Behnke

RB:vv

Mr. Vernon Fry Chappell, Nebraska 69129

Dear Mr. Fry:

Enclosed is a copy of a manuscript prepared for publication re: your trout.

Sincerely,

Robert Behnke

RB:vv

Dr. and Mrs. Carl L. Hubbs University of California Scripps Institution of Oceanography La Jolla, California 92037

Dear Dr. and Mrs. Hubbs:

Many, many thanks for a copy of the monograph. I am certain you have received abundant and deserved acclaim--it is a tremendous piece of work.

I can add a few comments on (Siphateles) bicolor obesa and (S.) pectinifer as species or subspecies. After John Hopkirk and I published our note expressing our opinion that they should be regarded as species, John continued gathering data. As I remember, he found that the Pyramid Lake populations were the most discrete in regard to gillraker counts, but when he recounted Bruce Kimsey's specimens from Eagle Lake, he got virtual complete separation of the two forms. I believe this separation was manifested only on the lower arch or posterior raker counts. Independence Lake, tributary to the Little Truckee River at about 7100 ft. el., has only obesa. In any event, pectinifer and obesa represent a major evolutionary divergence. That is, pectinifer isn't an ocotype of obesa, developing independently in each lake after the recession of Lake Lahontan.

I note you plan a separate publication to take in the Alvord basin. I'll summarize the data on the two forms of trout (Virgin Creek and Whitehorse-Willow creeks) and send copies to you and Bob Miller. Apparantly the trout native to Virgin Creek and Trout Creek is gone. I have alerted Nevada Fish and Game people, B.L.M. and S.C.S. biologists to be on the lookout for any remnant populations which might persist, but the outlook is not bright.

In attempting to correlate trout distribution and speciation in the upper Snake River and Bonneville basin I find conflicting views on the timing of the overflow of Lake Bonneville. Malde (1968. U.S.G.S. Prof. Pap. 596) is confident the overflow to the Snake River was about 30,000 years B.P. Broecker and Kaufman (L( $\notin$ %. Bull. Geol. Soc. Amer. 76:537-566) seems equally sure that the event took place only 12,000 years B.P. If you know of any further evidence on the matter I would like to hear of it--or any opinions of your own.

Also thanks for the reprint of Ricker's translations of Berg's 1934 paper on vernal and heinal races. I have the original Russian edition. I have two large

Dr. and Mrs. Carl L. Hubbs April 18, 1974 page 2

volumes of Berg's reprints which were published by the Academy as a memorial to Berg.

Sincerely yours,

Robert Behnke

RB:vv

cc: Dr. R.R. Miller

Mr. Barry Nehring Department of Environmental Conservation Box 1430 Tehran, Iran

Dear Barry:

Thanks for letting me know my letter arrived. I note that some letters such as yours of April 7, arrived in a little more than a week, while others take two or three weeks or more. You mentioned that you had not yet received a copy of my letter of March 5 to Farvar. A letter to you with a copy was sent at the same time.

I believe that any long lasting beneficial influence I might contribute to the Iranian Department of Conservation would be through the development of a sound program in graduate education. The close association with future leaders both in Iran and at CSU should impart a progressive philosophy that scientifically based ideas can be implemented in long range planning goals.

On January 31, I signed and returned my refusal to accept a transfer. This action should have set in motion the mechanisms leading to termination of my federal employment. I still haven't been informed of a termination date and I recently wrote to Washington suggesting it be in June. This procrastination is fine with me as it insures regular pay checks, but it is to my advantage to force a termination instead of a resignation because of the matter of severance pay. In the meantime, without my knowledge, some individuals have written to the Bureau protesting my leaving the Bureau of Sport Fisheries--in relation to its effects on rare and endangered fish projects underway--and the Bonneville chapter of the American Fish. Soc. sent a resolution on the matter. The last issue of National Wildlife magazine had a note on my work (see enclosure) with rare trouts, which adds to the Bureau's embarassment over their decision to terminate me for refusal to move. I hope they aren't having second thoughts on the matter bacause this would force me to resign and lose the severance pay due from a termination on their part.

My **tenarate** plans are to attend the annual meeting of ichthyologists in Ottawa, Canada from June 17-21. I have an invitation to give a lecture at the University of Hamburg, and I might arrange my travel to spend a few days there, which should time an arrival in Tehran about July 1. I would not come before I have a contract, but it is not imperative that I be there on July 1, and the date can be delayed until a contract is agreed on. Mr. Barry Nehring April 18, 1974 page 2

I recently attended a local Trout Unlimited meeting and some of the fellows were asking about you. Its been a late spring this year. Dick Klein and I hope to go up this week and sample the Snake River cutthroat trout planted in West Lake and Dowdy Lake last year. We were snowed out last week.

Sincerely,

Robert Behnke

RB:vv

April 23, 1974

Mr. Joe Ferguson 521 South 12th Street Bozeman, Montana 59715

Dear Mr. Ferguson:

The samples of golden trout from Lightning and Sylvan lakes are here among a backlog of specimens awaiting examination. This past year, virtually all the time on trout investigations have been devoted to completing graduate projects on several subspecies of cuthroat trout. Specimens not directly relating to these projects have been set aside until extra help is avialable to run them through the examination process.

Phenotypically, there is no indication of hybrid influence in the specimens from Lightning and Sylvan lakes. I will have an X-ray film taken of these specimens for vertebral counts--which is one of the better diagnostic characters of S. aguabonita. A slight hybrid influence of cutthroat trout is difficult to detect in a golden trout population and about 20-30 specimens are necessary to determine a hybrid influence when 90% or more of the gene pool is S. aguabonita and 10% or less is S. Clarki. Rainbow trout influence is more readily detected.

I plan to attend the Montana Academy of Sciences meeting in Bozeman next week. I will probably be at the university on Friday, May 2. If I have the vetebral counts completed, I'll bring the data with me. I can arrange to leave it at the Montant Coop. Fish. Unit on campus.

Sincerely,

Robert Behnke

RB:vv

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

April 25, 1974

Mr. Bob Saile The Denver Post Box 1709 Denver, Colorado 80202

Dear Bob:

Enclosed are some reports in reference to the cutthroat trout of Pyramid Lake. The point I am making is that the original population native to Pyramid Lake, was highly adapted to the conditions of the lake and reached a much larger size than the present trout propagated as Lahontan cutthroat trout. The recent record for Pyramid Lake cutthroat is about 19 1/2 lbs. The official record for the original stock is 41 lbs., but reliable evidence from the person who formerly purchased the catch from the Indians (Fred Crosby), puts the maximum size at about 62 lbs. Wome historical information on Pyramid Lake and its trout is contained in a paperback book: The Desert Lake, by Sessions Wheeler, 1967. Caxton Printer, Caldwell, Idaho.

The stock of Lahontan cutthroat trout currently propagated in Nevada and California comes from Heenan Lake, California. The origin of the Heenan Lake trout is from the Carson River, but rainbow trout have been hybridized into the population.

I noted in your recent column and in the special supplement on wildlife in the Tuesday Denver Post that Commissioner Cool favors an emphasis on continued stocking of massive numbers of catchable hatchery trout because it is favorable for the tourist trade and allows unskilled fishermen to catch trout.

The facts on the success ratio and the economics of hatchery vs. wild trout in the Poudre River Fishery are contrary to Mr. Cool's beliefs. The documentation on the matter was compiled in the Ph.D. thesis by Larry Marshall in 1973. The study was supported in part by the Mr. Bob Saile April 25, 1974 Page 2

the Colorado Division of Wildlife to provide basic information to commissioners and administrators so rational decisions could be made for long range fish management programs. Perhaps a condensed synthesis of the highlights of the thesis should be made for the commissioner's enlightenment.

The facts on the matter of the distribution of the catch among fishermen in areas heavily stocked with catchables are as follows: In 1971 fiver percent of the anglers harvested 37 percent of the catchables caught, 10 percent caught 59 percent and 68 percent caught nothing (based on 1,047 interviews of anglers completing their fishing day). In 1972, six percent of the anglers caught 38 percent of all catchables caught, nine percent caught 53 percent, 13 percent **aug**ght 69 percent and again 68 percent caught no fish (based on 558 interviews). The Poudre River study demonstrates that more than half of all the catchable hatchery trout caught are harvested by less than 10 percent of the anglers fishing for them (data from other states shows about the same ratios), thus a small proportion of license buyers are being heavily subsidized by all of us. The argument that catchables provide fish for the unskilled angler just doesn't hold up under the light of the research facts.

The most convincing argument for greater management emphasis on wild trout fisheries is the fact that the anglers interviewed placed a higher value on fishing for wild trout vs. hatchery trout and are willing to pay more for the opportunity to fish unstocked waters. The catch rate in the stocked and unstocked sections did not greatly differ but most trout are released in the unstocked ("quality") section and some trout must be caught several times in their lifetime.

It is not a matter of hatcheries vs. no hatcheries, but of the proportion of the total budget used to support a catchable program which benefits such a small percentage of the license buyers. If the costs of maintaining a catchable program could be shifted to those anglers who actually fish for catchables, to equitably distribute the costs to the users and not all fishermen, the demand for hatchery trout would be drastically curtailed. The economics of the matter should be well publicized so that all fishermen fully understand what they for the for

Sincerely yours,

Robert Behnke

RB:sa

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

April 26, 1974

Miss Zelldene Sword Route 1, Box 150 Dolores, Colorado 81323

Dear Miss Sword:

Most of the books and articles relating to endangered species are not likely available to you. Enclosed are reports about some rame fishes which might provide you with sufficient information to write your paper.

Sincerely,

Robert Behnke

RB:sa

April 30, 1974

Dr. Nicolaus Peters Institut fur Hydrobiologie und Fischereiwissenschaft 2 Hamburg 50, Olbersweg 24 GERMANY

Dear Nicolaus:

Many thanks for the information of Turkish and Iranian fishes. I had not known of the cavefish, <u>Iranocypris</u>, I must learn more about this species. I will send the name and address of Mrs. Schulz to my former student in Teheran and request he make an inquiry to her knowledge of Iranian fishes.

I have received a letter from the Iranian Director of Conservation agreeing with my terms ofor employment but I will not make definite plans until I have a contract, stating all the terms in, a legal manner.

If an agreeable contract is received I plan to go to Teheran about July 1. I will probably attend the annual meeting of ichthyologists in Ottawa, Canada, June 17-21. If I leave for Teheran after this meeting, I would schedule a stopover for a few days in Hamburg, probably during the last week of June.

I would be most happy to present a lecture on a topic you think of general interest. I have been involved with experimental projects investigating interactive segregation in salmonid fishes to get basic data on the question of niche separation between chosely related, sympatric populations. The first phase of this study, discussing the results of stocking two subspecies of cutthroat trout in the same lake, will soon be published in the Trans. Amer. Fish. Soc. Another interesting project concerns the interpretation of biochemical evidence in systematics (see enclosed abstract).

My main concern is that with world wide inflation, Deutchland will not be the same as I fondly remember it. Can you yet purchase a liter of beer for a mark?

Sincerely,

Robert Behnke

RB:vv

April 30, 1974

Mr. John Strohm, Editor National Wildlife 534 N. Broadway Milwaukee, Wisconsin 53202

Dear Mr. Strohm:

I would like to express my gratitude for the beautiful bound volume of the endangered species issue of National Wildlife magazine.

Although somewhat short on information on my favorite subject rare fishes; the issue was most impressive. I consider the April-May issue of National Wildlife to be the most significant contribution yet published serving to stimulate a general awareness and appreciation of threatened forms of 1 life.

My experience in developing programs to perpetuate threatened fishes has emphasized the fact that public concern is a most important element to encourage state and federal agencies to initiate meaningful programs.

You and your staff are to be congratulated on this most significant contribution.

Sincerely yours,

Robert Behnke

RB:vv

May 2, 1974

Mr. W.I. Follett Department of Ichthyology California Academy of Sciences Golden Gate Park San Francisco, California 94118

Dear Bill:

I am returning, under separate cover, the trout specimens I have on loan. These specimens were most helpful in determining the type of trout native to certain areas of the Columbia River basin.

I have a question on locality of one of the samples (5U 4769). The label states: "Shake Creek near Mt. Carleton" (J.O. Snyder tag). There is no date and no further information on this collection?

I have a further request for specimens, but this time for fresh frozen ones. I have been interested in the evaluation of biochemical information for phylogenetic studies and I think we may be one to something useful. An associate, Dr. James Shaklee, is an authority on LDH enzymes in fishes. He has found that most teleosts consistantly express a certain form of LDH in either the eye or the liver. The enclosed abstract submitted for the ASIH meetings in Ottawa tells the story of the Ophidiidae and Zoarcidae--if they might be Gadiformes or Perciformes. The problem is only a few species have been looked at and more are needed for comparison. The enclosed sheet was prepared by Dr. Shaklee and lists some of the species he would like to examine. If any of these species might be available by dying in the aquarium or picked up by some boat making collections, that you know of, could you have the specimens frozen and drop me a note right away? Can you suggest the name of any persons who might be collecting any of these species in the near future?

I know Warren Freihofer believes the Ophiidoidei and Zoarcoidei are Gadiformes and Bill Gosline is very adamant that they're Perciformes. Tell Warren that I haven't taken any position on the matter but plan to relate about a technique which can contribute new information on the subject.

Sincerely yours.

Robert Behnke

RB:vv

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

May 8, 1974

Mr. Bob Saile The Denver Post P.O. Box 1709 Denver, Colorado 80201

Dear Bob:

I would have no objections if you made copies of my last letter for Mr. Cool (and other commissioners) with a copy to Jack Grieb. It might be a beginning at gaining acceptance of a more rational and scientifically based fish management program.

I see no problem for the implementation of sound programs with Jack Grieb. Jack has the most impressive scientific credentials of any fish and game director in the country. Nor is there a lack of competence or ideas in the staff of biologists employed by the department. The fact is, however, that policies and programs are largely governed by the commission and often the commissioners, believing they are acting in the best interests of their constituents, assume a stand antagonistic to the position of the professional staff of the department.

In the matter of the role of catchable trout in the fisheries management program, I think it would help if the commissioners understood the facts already compiled by the fisheries people. After many years of turmoil, the commissioners in Montana finally accepted the data compiled over many years by fisheries biologists and prepared a new policy on the use of hatchery trout. Essentially, the Montana policy states that quality streams with adequate natural reproduction will be man**mg**ed for wild trout. Hatchery trout will be stocked mainly in ponds, lakes and reservoirs and in lower, more marginal sections of streams, particularly along roadsides, campgrounds and urban areas.

I think it would be enlightening if the Colorado commissioners had all the farts and understood the reasons which led the Montana Commissioners to come up with their new policy. Mr. Bob Saile May 8, 1974 Page 2

The question is not one of yes or no with hatchery trout. The pertinent questions to be faced are: what proportion of the budget should be taken up to produce catchables? How can costs be more equitably distributed among those who derive the benefits of catchables and/or how to spread the catch among a greater proportion of the license buyers? Implied in these questions is the degree of emphasis to be given to environmental protection and improvement in relation to fisheries based on wild, self-maintaining trout populations.

Sincerely yours,

Robert Behnke

RB: sa

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

May 8, 1974

Dr. Gunnar Naevdal Institute of Marine Research Directorate of Fisheries 5011 Bergen-Nordres Norway

Dear Dr. Naevdal:

The specimens you sent were received in good order. I want to express my sincere thanks and gratitude for your efforts and kindness. The maps with the localities are most helpful.

I will probably be out of the country for several months this year and the complete examination of these specimens will likely be delayed until my return.

These specimens should provide a basis for the first attempt at a comprehensive systematic work on Norwegian char denoting evolutionary relationships within the genus.

If any publications appear this year on Norwegian or Scandanavian char, I would appreciate having them called to my attention.

With best regards and much appreciation,

Sincerely yours,

Robert Behnke

RB:sa

May 14, 1974

Mr. James A. Young Bureau of Sport Fisheries and Wildlife 2215 Federal Building 125 South State Street Salt Lake City, Utah 84138

Dear Mr. Young:

I have been writing a series of reports on rare fishes of the Southwest for the Albuquerque office of the U.S.B.F.W. The enclosed list covers some of the species under consideration and those occurring in Colorado and Utah are noted for your convenience.

Enclosed are copies of some of the reports on rare fishes of Colorado and Utah. Dave Foster has the complete set in Denver. Reports are completed on all species except the least chub. Iotichlhys phlegethontis.

Many of these species, such as the bonytail chub, <u>Gila elegans</u>, are on the verge of extinction, but are not included in the 1973 edition of the "Redbook."

Sincerely,

Robert Behnke

RB:vv

Enclosures

May 14, 1974

Mr. George Holton Montana Department of Fish and GAme Helena, Montana 59601

Dear George:

It was unfortuante that we didn't have more time to get together last week in Bozeman.

I completed the final editing of Jim Roscoe's thesis and copies should be available soon. I plan to make summaries of the highlights which can be distributed to interested persons. The Forest Service provided some funds to complete the thesis but I don't believe they would object if I sent copies of the thesis with the summaries to you.

Sincerely,

Robert Behnke

RB:vv

May 14, 1974

Mr. Frederick W. Kircheis Maine Department of Inland Fisheries 34 Idaho Avenue Bangor, Maine 04401

Dear Mr. Kircheis:

Dr. R.R. Miller forwarded your letter re: Sunapee trout to me for reply.

I know of instances where Sunapee "golden trout" were stocked and reputedly established in Idaho and Wyoming, however, I doubt that they presently exist, at least as pure populations.

The "Biennial Rept. of the Fish and Game Warden of the State of Idaho" for 1925-26, lists Sunapee trout in: Alice, Vernon, Big Redfish and Sawtooth lakes, in the headwaters of the Salmon River drainage of the Sawtooth Mountains (abstracted from Linder, A.D. 1963. Idaho's Alein fishes. Tebriva, vol. 6:12-15). Sunapee trout in the Sawtooth Mtns. were also mentioned by Locke, U.S. Fish. Comm. Rept. for 1929+173-190.

I discussed the matter of Sunapee trout in Idaho with Dr. Richard Wallace of the University of Idaho who is preparing a check list of Idaho fishes. He doubts that they still persist but he is going to inquire with regional fisheries biologists.

The Sunapee trout has also been reported in the Bighorn Mtns. of Wyoming in a 1939 issue of Wyoming Wildlife magazine. I once checked with the local fisheries bioligist who told me he believed the lake in question is called Crystal Lake, which now contains brook trout.

Evidently the former U.S. Fish Commission once distributed Sunapee trout eggs to several states. Information on when and where these shipments were made might be found by examining the propagation and distribution section of the annual reports of the U.S. Fish Comm.

Probably the only possibility of any of these early introductions still persisting would be in situations where a suitable lake was barren and no subsequent introductions ever took place. With the advent of aerial stocking of mountain lakes, such a possibility would seem remote. Mr. Frederick W. Kircheis 5-14-74 page 2

In any event, for your purposes, you are not likely to learn anything about the Sunapee trout based on introductions in the west except to note that introductions were made with no evidence of success.

Sincerely,

Robert Behnke

RB:vv

cc: Dr. R.R. Miller

May 17, 1974

Dr. V.V. Barsukov Zoological Institute Academy of Sciences Leningrad, USSR

Dear Volodya:

Enclosed is a copy of a translation of your article from Voprosy Ikhtiologii, 13(6).

I have your letter of April 18 concerning the monograph on Salmonoidei and refreshing my memory on how husbands and wives may choose their family name.

It looks like my schedule will be full for the next year. I have been offered the position as fisheries adviser in Iran but haven't signed a contract yet. It is likely that I will go to Iran this summer, returning to the university next winter to teach the ichthyology course. I will make inquiries concerning possible opportunities to visit Leningrad in 1975.

I might point out that American women are demanding equal rights as enjoyed by Soviet women and some American women are retaining their family names after marriage instead of assuming their husband's name. Such a revolution might shake the structure of a capitalistic society.

There was nothing at all improper in Zoya's note to me on her publication. It was most thoughtful of her to send me the book. It was my fault that I did not recognize her name.

Sincerely,

Robert Behnke

RB:vv

Enclosures

May 17, 1974

Dr. R.R. Miller Museum of Zoology University of Michigan Ann Arbor, Michigan 48104

Dear Bob:

Enclosed is a copy of my reply regarding Sunapee trout introductions in the west.

I am completing a few more threatened species reports and would like to know if I may cite your current activities with the genus <u>Cyprinodon</u>. For example I have a manuscript by Tony Echelle and you on the redescription of <u>C</u>. bovinus. A note mentions this manuscript was prepared for publication in Southwestern Naturalist. Has it been published? I checked the library and numbers 3 and 4 of 1973 are at the bindery--did it appear in one of these issues? A letter of last year from Clark Hubbs mentioned you and Echelle planned to describe the <u>Cyprinodon</u> of the Devil's River and perhaps the Pecos pupfish. Doug Jester mentioned that he and you would publish on the Tularosa pupfish--any up-to-date information on any of these matters?

I'll return your museum specimens to you this week. The specimens have numbered tags and I'll provisionally designate a type specimen of <u>Salmo clarki</u> <u>alvordensis</u> from Virgin Creek. We're just completing two theses on cutthroat trout and I can mention a few of the significant findings.

S.c. Lewisi is the name for the cutthroat trout of the upper Missouri basin. The origin of this trout was from the upper Columbia basin (Clark Fork) a postglacial transfer. A virtually identical form of cutthroat also occurs in the upper Columbia basin (Clark Fork, Coeur d'Alene and Kootenai drainages) and in the South Saskatchewan drainage. A differentiated cutthroat, characterized by larger, rounder spots evidently is the ancestral form of interior cutthroat which gained access to the upper Snake River before Shoshone Falls was formed. The large-spotted cutthroat appears to have been almost completely replaced by S. gairdneri in the areas of the Columbia basin where the two species came in contact, except for isolated relicts such as those described. from Waha Lake, Idaho and Crab Creek, Washington. The Yellowstone and Bonneville cutthroat are derived from the large-spotted form and apparantly the cutthroat of the Yellowstone drainage and cutthroat of the upper Missouri never came in contact. One fact which is not readily explained is that a very typical S. c. lewisi type of cutthroat is native to the Salmon and Clearwater drainages of the Snake River where the large-spotted form is expected. This is the only large area where interior cutthroat trout have historically

Dr. R.R. Miller May 17, 1974 page 2

maintained sympatry with <u>S. gairdneri</u>, suggesting that the large spotted cutthroat was eliminated and a later trnasfer from the Coeur d'Alene system extablished <u>S. c. lewisi</u>. The trout, which led to so much confusion in the early investigations of Jordan, Evermann and Gilbert, in the area between Shoshone Falls and the Cascade Range, was probably the red-banded trout. This trout was often called the silver trout, <u>"S. gibbsi."</u> I examined three specimens collected in 1894 from the Wood River, Idaho. They are undoubtably red-banded trout. (Evermann described them as unusual cutthroat trout without a well defined cutthroat mark and a "rosy wash" on their sides.) It appears the red-banded trout hybridized with anadromous <u>S. gairdneri</u> in postglacial times and some of the present steelhead populations have a large influence of red-banded trout in them. Two samples from the headwaters of the North Fork of the Clearwater River, Idaho, have about 150-160 scales, 40-45 pyloric caeca and 2 of 35 specimens have basibranchial teeth. This may explain the high scale counts listed by Jordan and Evermann in 1896 for <u>S. gairdneri</u> from the Columbia River.

The undescribed fine-spotted cutthroat trout of the upper Snake River, which is completely circumscribed by the large-spotted form, may have resulted from S. c. lewisi via the Salmon River across the lava plains streams, such as the Lost River, or it is autochthonous, originating independently form the largespotted form in a glacial refuge, such as an ice-dam lake in the Hoback Canyon area. The two forms of cutthroat trout in the upper Snake River are essentially allopatric (although in a continuous environment). Both forms appear, with intermediate specimens, in the Gros Vente drainage. Past and present stocking programs have undoubtably added to the confusion.

Sincerely,

Robert Behnke

RB:vv

Enclosures

cc: Dr. CArl Hubbs

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

May 17, 1974

Mr. Henry McKirdy U.S. Forest Service Federal Building Missoula, Montana 59801

Dear Hank:

The University billing to the Forest Service was a bit premature, but three copies of the thesis on westslope cutthroat trout are on their way under separate cover.

I will write up a summary and synthesis of the highlights of the thesis which can be provided to your staff. Several copies of this summary will be sent to you soon. Also, another thesis, on cutthroat trout of the Snake River and Yellowstone drainages, is now nearing completion and will be sent to you when it is ready.

Sincerely,

Robert Behnke

RB:aa

May 21, 1974

Mr. Glen Cole National Park Service Yellowstone National Park Wyoming 83020

Dear Glen:

Under separate cover, four copies of a thesis on the cutthroat trout Salmo clarki lewisi are being sent to you. Pass one on to Jack Dean and tell him thanks for the data on Yellowstone fishing regulations and the impact on cutthroat trout populations. Another thesis, more specifically on the Yellowstone and Snake river cutthroat trout, is now being completed and copies will be sent as soon as it is ready. The contents of the two theses cover the native trout on both sides of the Continental Divide in Wyoming and Montana. The situation is complex in that two, divergent forms of ancestral cutthroat each, independently crossed the Continental Divide, but never got together. For example, in Yellowstone Park, the native cutthroat trout in the upper Missouri drainage (Cougar Creek, Grayling Creek, etc.) is quite distinct from the Yellowstone cutthroat trout, although they occur within miles of each other. The affinities of the upper Missouri trout are closer to the upper Columbia River cutthroat. An added measure of complexity is found in the Snake River where the fine-spotted cutthroat is found, whose range is completely surrounded by a large-spotted (Yellowstone-like) cutthroat trout.

I now plan to write summaries of the theses which will synthesize and highlight the significant findings and hopefully stimulate further management and restoration efforts.

We've made real progress on the systematics of the trout native to Yellowstone and Teton Parks with these two theses. We can now state with some authority that Yellowstone Park has two distinct (subspecies) of cutthroat trout--the upper Missouri cutthroat (S. c. lewisi) and the Yellowstone and large-spotted upper Snake River cutthroat (the correct subspecies name is yet to be decided). Also, the Yellowstone Lake cutthroat is further differentiated from stream populations of the drainage, but I wouldn't propose formal taxonomic recognition for this. In Teton Park there are two native subspecies, the large-spotted form, mentioned above, and the fine-spotted form, which represents an undescribed subspecies. The Snake River situation is unique in that two forms of trout, fully able to hybridize are maintaining their integrity in the continuous environment Just how they do this I can't say, but we have pin-pointed the area where they come together--the Gros Vente River drainage. Mr. Glen Cole May 21, 1974 page 2

I would like to continue these studies particularly into the mechanisms which allow the two forms of cutthroat trout to coexist in the Snake River without massive hybridization and with Jack Dean's help to further document the distribution of native trout populations in the Park.

I would like to thank you for the financial support which made these studies possible and to request that this support be continued for the coming year.

Sincerely,

Robert Behnke

RB:vv

May 21, 1974

Dr. Joseph Nelson Department of Zoology University of Alberta Edmonton, Alberta, CANADA

Dear Joe:

Under separate cover I am returning the collection of cutthroat trout from the South Saskatchewan drainage. Your specimens were valuable for a recently completed graduate thesis, as they were one of two samples we had from the South Saskatchewan. I have no doubt, however, that the cutthroat trout in the South Saskatchewan were derived from the upper Columbia basin (Clark Fork) about the same time a transfer was made into the upper Missouri basin (about 8,000 - 10,000 years ago).

All of these cutthroat trout (Clark Fork, South Saskatchewan and Upper Missouri are virtually identical and the correct name is <u>Salmo clarki lewisi</u>. The Yellowstone cutthroat, however, is quite a different fish, being derived from a differentiated ancestor via the upper Snake River.

Many thanks for your assistance.

Sincerely,

Robert Behnke

RB:vv

May 21, 1974

Mr. Fred Eiserman Wyoming Game and Fish Department Box 840 CAsper, Wyoming 82601

Dear Fred:

Enclosed is a copy of a thesis on the systematics of cutthroat trout of the upper Columbia and upper Missouri river basins (S. c. lewisi). This is the cutthroat native to the headwaters of the Madison and Gallatin rivers in the northwest tip of Wyoming. The Yellowstone and Snake River cutthroats are being covered in another thesis which should be ready soon.

I will write-up summaries of these theses which will highlight the significant findings in a condensed format and will send along some copies when they are completed.

Have you found Wernsman's thesis? If not, let me know and it won't be too much trouble to run off another copy.

Sincerely,

Robert Behnke

RB:vv

Enclosure



UNITED STATES DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE BUREAU OF SPORT FISHERIES AND WILDLIFE COLORADO COOPERATIVE FISHERY UNIT COLORADO STATE UNIVERSITY FORT COLLINS, COLORADO 80521

May 21, 1974

Mr. Steve Nicola California Department of Fish and Game 1416 Ninth Street Sacramento, California 95814

Dear Steve:

Thanks for informing me of your observ-tions on the spots of the Piute trout. Evidently, I didn't examine the specimens as thoroughly as you did. I did note occasional spots on the dorsal and caudal fins. I have gone through my notes on Piute trout and will provide you with further information which might be useful or, at least, interesting.

Enclosed is a copy of a letter from Dan Christenson re: lack of spots on Cottonwood Creek specimens, and a letter I wrote to Dick Beland after examining specimens he sent.

I have data on all of the Piute collections now in the California Academy of Sciences. Some were taken in different years and this provided an opportunity to check on the stability of certain characters. I found that all the meristic characters of seleneris are identical to henshawi: gillrakers 21-27 ( $\overline{X}$  ca.24), vertebrae 60-63 (61.8), scales 35-40 above lateral line, 150-180 (ca. 165) in lateral series, pyloric caeca 50-70. No significant differences appeared between samples made at different times. There was a significant difference in body depth between the 1956 sample and earlier ones. The 1956 fish were larger and more robust which eliminates one of Snyder's diagnostic characters of the "slim, terete body form."

The Academy should have a large sample of trout taken from below Llewellyn Falls in 1933. These are typical rainbow x Puite hybrids and you can see what a typical hybrid is like.

One of the questions you are interested in is: Are the fish in Cottonwood Creek pure seleneris? Go down and take a look and make some collections. Note barriers to upstream migration and take samples from between any potential barriers. Check the spotting pattern and then the meristic characters. Pure Piutes will show 21-27 (mainly 22-26) gillrakers with a mean of about 24 (+ .5). They will all have basibranchial teeth. The teeth, gillrakers and Mr. Steve Nicola May 21, 1974 page 2

spotting should allow an accurate diagnosis of the present status of Piute trout in Cottonwood Creek. As you'll note in my letter to Beland, it appeared that hybridization got started in Coral Valley and Coyote Creeks before it did in Silver King Creek. Were hybrids there when Vestal got the fish for the transplant to Cottonwood Creek? The only way to know with more certainty if the Cottonwood Creek trout are pure is to study them.

Sincerely,

Robert Behnke

RB:vv

Enclosures

## May 23, 1974

Dr. Robert E. Vincent Route 2, Box 9-A Philomath, Oregon 97370

Dear Bob:

Marlin Hornberger just completed his thesis on trout movement in Little Beaver Creek and kindly donated a copy for you.

I have accepted the offer to go to Iran and help set up a fishery and education program. I'll probably leave in July for six months.

If everything goes according to plan, the Bureau should terminate my employment in mid June. Withe severance pay and vacation time I should draw my full salary until about November.

I have no definite plans yet for after my return, but the Iranian project might last for two or three years.

Sincerely,

Robert Behnke

RB:vv

Enclosure

May 23, 1974

Dr. Henry Vaux Department of Economics University of California Riverside, California

Dear Dr. Vaux:

Re: The lawsuit of the Piute tribe

My tentative plans are to go to Iran on a consulting job about July 1. I will probably be out of the country until December. I will be at a meeting in Ottawa, Canada from June 17 to 21.

If you want to personally discuss my information and ideas on the past, present and potential fishery of Pyramid Lake, it must be before July 1. Otherwise I can write a summary covering the points you deem critical for a deposition on the case.

Sincerely,

Robert Behnke

RB:vv

COLORADO COOPERATIVE FISHERY UNIT Colorado State University Fort Collins, Colorado 80521

May 28, 1974

Mr. Fred Eiserman Wyoming Game and Fish Department Box 840 Casper, Wyoming 82601

Dear Fred:

I received your letter of May 21 regarding funding for a Wyoming cutthroat study to provide information on where pure populations of <u>S</u>. <u>c</u>. pleuriticus exist.

Yes, it would be possible to contract with me, but it might be simplest to employ Mr. Roscoe directly as a temporary employee of Wyoming Game and Fish for the months of July and August. If this is possible, it would be the best route to follow because I plan to be in Iran from July to December. Mr. Roscoe has just completed his thesis (a copy was sent to you last week) and he will not take a permanent position before at least September. I will keep him on the payroll during June finishing up some specimens for the U.S. Forest Service. He has worked closely with me for more than three years and has experience with examination of a wide variety of cutthroat trout, including S. c. pleuriticus ppecimens. He understands the key characters to emaluate for relative purity and can handle the job even if I am not here. I would arrange, however, for him to send me all the data foom his analysis and interpretations so the final report would be written by me.

This would get around any contract the universisty might claim overhead on. Is there a temporary category which pays about \$450 per month (two months = \$900)? If so, send an application down and I'll have Jim fill it out.

Look over his thesis on <u>S. c. lewisi</u> and I think you'll be impressed with Jim's treatment of that confused group of cutthroat trout. He started from scratch on that project and we already have a bood book on the systematics and diagnostic characters of <u>S. c. pleuriticus</u> to build on such as Wernsman's thesis (by the way, do you have your copy of Wernsman's thesis?). Mr. Fred Eiserman Wyoming Game and Fish Department May 28, 1974 Page 2

I can roughly estimate how many specimens Jim can handle if he works full time for two months. It takes about one hour to adequately examine one specimen and extract the pertinent information. This would equal about 300 specimens examined, allowing time for analysis and synthesis of data. There are about 100 specimens of Green River cutthroat on hand now from Glen Denning. At least 200 more can be handled, but I wouldn't put a limit on collections because if a sample consists of 25 specimens and it is obvious that they are hybrids after the examination of four or five fish, then the rest can be passed. Each sample should consist of at least 10, preferably 15 specimens.

If for some reason, this proposal isn't fulfilled, then go ahead and collect specimens and we can arrange a contract next December of January for me to do the work on <u>pleuriticus</u>, or any other cutthroat trout in Wyoming.

Sincerely,

Robert Behnke

RB:sa

Dr. R.R. Miller Museum of Zoology University of Michigan Ann Arbor, Michigan 48104

Dear Bob:

I had a request for an address from your father-in-law. He wrote that he was leaving for Ann Arbor, via Boulder, Colorado, so I will enclose a letter for you to present to him when he arrives.

Under separate cover the specimens are being returned. The enclosed data sheets summarize the meristic characters of the trout in Willow and Whitehorse creeks on one hand and Trout and Virgin creeks on the other. It includes UMM2 specimens f from 1934 and recent collections of my own plus some borrowed from Carl Bond. You will note that the Willow and Whitehorse samples are quite distinct from the Virgin Creek trout, particularly in number of gillrakers, scales and number and presence or absence of basibranchial teeth. If they are of common origin they have been separated for a long time. The populations in Willow and Whitehorse creeks appear to be unchanged (no introductions-except perhaps in Little Whitehorse Creek which has a road crossing it). In contrast, no trace of the original trout is now apparant in the present populations in the Trout Creek and Virgin Creek drainages, sampled in the vicinity of the 1934 collections -- I also sampled from the very headwaters of E. Fk. Trout Creek and a tributary to Pueblo Slough -only typical rainbow trout can be found. It looks like "alvordensis" is extinct before it could be named. I have alerted BLM biologists to look for cutthroat populations in the Virgin-Thousand Creek drainage. I covered the Trout Creek watershed in 1972 and I could find no isolated sections where the native trout might persist. The phenomenon of rapid elimination of native cutthroat trout by introduced rainbow trout is particularly evident in those groups with a pluvial lacustrine ancestry. It appears they have never "re-adopted" to stream life and are completely vulnerable to extinction by introduced trout in small stream habitat. In contrast, my recent studies on the native cutthroat trout of the upper Columbia River basin in Idaho and Montana revealed large areas where at least a predominantly cutthroat trout phenotype is the dominant trout, despite continued stocking of massive numbers of rainbow trout.

The pertinent questions now are: What are the origins and affinities of the Willow-Whitehorse Creek trout, the original Trout Creek-Virgin Creek trout and the present Summit Lake stock, in relation to each other and to S. c. henshawi, S. c. "humboldtensis" of the Humboldt drainage of the Lahontan, but I believe this is convergentce rather than direct descendency. The headwatersdrainage of Willow Creek virtually intertwine with Trout Creek and a headwater transfer may Dr. R.R. Miller page 2 June 4, 1974

have been the route of entry rather than a pluvial connection from Alvord Lake. There is also only a slight divide from the "Whitehorse" desert to the Owyhee drainage.

From previous communications, I assume that Summit Lake formed from a lava dam across a Lahontan tributary but may have overflowed or at least provided a potential connection to Virgin Creek. This might have isolated a Lahontan cutthroat in Summit Lake and transferred it later to Wirgin Creek. But why are no other Lahontan fishes in Summit Lake? On the other hand, the lava flows may have exterminated all fishes prior to the formation of Summit Lake and the trout gained entrance from Virgin Creek. Comparisons of characters don't reveal any obvious answers. The Summit Lake trout have more gillrakers than typical henshawi (25.2 vs. ca. 24). They have an average of about 36 scales above the 1.1. and 155 in the lateral series (henshawi is typically about 36-40 and 160-175). The evidence of affinities of Summit Lake trout to Virgin Creek trout is the pelvic rays (many with 8), the common occurrence of fused vertebrae in both stocks and reduced number of basibranchial teeth (3 of 27 small specimens of Summit L. stock lack teeth and average only about 4). In the Virgin Creek trout, 50% or more lack teeth and of those with teeth, most have only one or two. I would suspect that the 1934 sample was already hybridized, except they look like good cutthroat trout in all other respects (except, perhaps, the low scale counts).

I have never seen a large, fresh specimen of Summit Lake trout to critically examine the spots. Virgin Creek trout appear to be typical of the generalized interior cutthroat in their spotting. S. c. henshawi has a distinctive pattern with spots evenly distributed over the body, onto the head and often on the abdomen.

That is where the matter now stands and I would like to hear any opinions you and Dr. Hubbs might have when I see you in Ottawa.

I just received a call from a BLM biologist in Salt Lake City. BLM people have been conducting studies in the Deep Creek Mtns. (Trout Creek and Deep Crk. drainages) of western Utah, and I had urged they be on the lookout for cutthroat trout. The message was that cutthroat trout were found in one of the headwaters forks of Trout Creek, above a barrier. Only rainbows and hybrids were found below the barrier and in other spreams sampled. Twelve specimens were preserved and will be sent to me next week. I'll let you know about these trout when I see you, but my hopes are high. I will now try to stimulate more searching for cutthroat in the Virgin Creek drainage of Nevada--perhaps alvordensis can be rediscovered.

I received your letter of May 23, before I had this letter typed so I'll add on some replies. Thanks for bringing me up-to-date on Cyprinodon. There is no problem with types of alvardensis. The specimens have small, numbered tags under the right operculum. When I would select a type, I'll let you know the number of the specimen and it can be assigned a new UMMZ number as the holotype of the subspecies. Dr. R.R. Miller page 3 June 4, 1974

I have a student finishing up a thesis on comparison of fine-spotted and largespotted Snake River cutthroat. We've learned quite a bit but there are still some unknowns. Both fine-spotted and large-spotted cutthroat are in the Gros Vente drainage but don't appear to be truly sympatric. The large-spotted populations are in the smaller tributaries and there are intergrades which suggests hybridization does occur here.

It seems unusual that Jordan, Evermann and Gilbert never mentioned the distinctive fine-spotted form during their investigations on the Snake River. Most likely, they didn't sample where the fine-spotted form occurred. But what were the original limits of their distribution. Today it extends to Palisades Reservoir -all tributaries below here -- Henry's Fork, Raft River, Goose Creek have largespotted cutthroat. Perhaps you can locate some of the collections made in the 1890's at the USNM which might shed light on the form of trout native to the Snake River down to Shoshone Falls. Also we know little about the native trout from Shoshone Falls to the Cascade Range. If you can find any of the specimens collected by Evermann, Gilbert, Thoburn, Rutter and others in the 1890's from this area, they would be valuable. I found a few at the California Academy last summer. A largespotted cutthroat was native to a stream near Walla Walla, Washington and Wood River, Idaho specimens, labled S. mykiss are red-banded trout (The Wood River trout were called "S. gibbsi" in the Gilbert and Evermann publication). What is the native resident trout of the Payette Owyhee, Grande Ronde, John Day and Deschutes rivers? If you can find any specimens at the USNM from these areas, let me know. Also, Don Seigrist once told me the saw the type of S. gibbsi at the USNM (just a skin or a stuffed specimen, I believe). The name "gibbsi" was used for a trout which I believe to be the red-banded complex -- at least in part (Wood R., Payette Lakes), but I suspect the type is S. gairdneri (taken from the Dalles, Oregon). Seegrist said it seemed coarse-scaled like a rainbow.

When at the USNM, you should try to find a steel tank containing W.C. Kendall's personal collections. Harry Everhart told me it was at the University of Maine and he sent it to the USNM several years ago. Of particular interest would be the possibility that Kendall had specimens of "S. agassizi" from Christine Lake, New Hampshire and another lake (which he naver named in print) where he claimed it was found. I am curious to find out what is in Kendall's tank. I have heard it is stored in the basement and has not been cataloged. You might want to examine USNM 34710, 35355 and 39327 and convince yourself that agassizi was quite divergent from fontinalis.

Yes, Don Seegrist is correct, I'm terminating my employment with the Fish and Wildlife Service in June. There has been no great disagreement or unpleasant relationships involved, but the Bureau is taking a new course which is centralizing authority and tightening the reins. The existence of a loosely attached and ill-defined position such as I have doesn't fit the new reorganization and they wanted me to move my operations to Buelah, Wyoming. There isn't a worthwhile library within 400 miles of Buelah, among tother things. Dr. R.R. Miller page 4 June 4, 1974

My long range plans are not definite. I have accepted an offer from Targi Farvar in Iran to go there in July and help set up a fisheries program and start a graduate education project. I would return in December and then see what develops here at C.S.U.

If you chear of opportunities for a "free-lance" ichthyologist for one to six month periods of employment in 1975, let me know.

Sincerely yours,

Robert Behnke

RB:vv

Enclosures

Dr. Swanson, Dean Dils, Dr. Wooley

June 4, 1974

Bob Behnke

Plans from July 1, 1974 to June 30, 1975

I accepted the offer from the Iranian Department of Conservation to go to Iraniafor six months to advise and supervise a fishery research and graduate education program. I plan to leave about July 1 and return in late December.

Concerning the ichthyology course (FW 300) I tentatively plan to be available to teach this course during the winter quarter. Because of a tight financial situation, I understand that the College of Forestry and Natural Resources can not make a commitment at this time to pay for these services. One possibility would be to teach ichthyology during the winter quarter and postpone reimbursement until later in the year when funds are available. Under the present circumstances, however, a degree of uncertainty is apparant. If I am offered a temporary position at another university (for ex., a professor is on sabbatical leave), I would accept the opportunity for guaranteed salary.

In any event, the following points concerning the ichthyology course are important for orderly planning if the course is taught by me or someone else. The course should be listed for room 212 Zoology (where it was taught this year) instead of room 236 Forestry. This allows the accomodation of more se students (40 vs 30) and provides much superior facilities, particularly for the laboratory section.

About 40 carp specimens (10-12 inches), should be collected this summer and kept in a freezer (In the past we have used freezers in the Forestry Bldg., Coop Unit Quonset hut and rm. 207 Zoology). In the past the carp have been obtained by the T.A. for the course during one of several opportunities usually arising in the course of the normal summer's activities of the fishery faculty or grad students (for ex. Dr. Post's sampling of the Poudre R. for Kodak). I have written a laboratory manual (sufficient copies are available for the 1975 course) for the dissection and examination of carp. The manual also covers each lab section of the course listing the specimens to be examined and the relevant information to be learned by the students.

Because of the basic content of the ichthyology course as I teach it (evolutionary and organismic biology), I would recommend that it become a zoology course. If this could be accomplished, I would like to retain part-time affiliation with both zoology and fishery and wildlife until a permanent position would be available for me at C.S.U. or some other university at some future time. For the fiscal year July 1, 1974 to June 30, 1975, I have funds of about \$6,000 from the National Park Service and U.S. Forest Dr. Swanson, Dean Dils, Dr. Wooley page 2 May 4, 1974

Service to expend on my fisheries research for these organizations. Some of these funds might be used for partial salary while I am completing these projects next winter and spring. I am hopeful that further contracts with the National Park Service can be initiated through the proposed C.S.U. National Park Service Cooperative Research Unit, which can support my research and provide a few months salary. The outlook seems good for contracts with state and federal agencies for specific studies on rare fishes. I have been offered one with Wyoming Game and Fish but the information is needed by the end of this year and I have suggested they contract with a graduate student for the job. Such contracts, however, are often requested to be on a personal basis to avoid university overhead and I must accept loss of retirement and insurance benefits associated with university employment.

Because of my large collection of rare trouts, the reputation already established here for ichthyologyical research and my continuing research projects, I would prefer to maintain my association with C.S.U. even though it means generating my own source of income for six months or more each year for the next two or three years. My arrangements with Iran will defer part of my salary to 1975, and it is probably that a similar contract can be initiated for 1975-76. Part of my Iranian commitment concerns graduate education with the proposal that I select a research project and a prospective Iranian graduate student to bring to C.S.U. and serve as his major professor.

I am also considering another form of foreign employment in 1975 or 76. I received a request to participate in writing a monograph of salmonoid fishes as part of a major project of the Academy of Sciences of USSR. I will look into opportunities to funding this venture for about a three month period.

After my return later in the year, and when I have more definite future plans, I will faunch an effort for funding to construct brood stock ponds on university lands (University officials have given me their enthusiastic OK) to use the Maxwell Ranch). These ponds would maintain uniquely adapted genotypes of rare forms of trout to be used in restoration projects and experimental breeding programs (analagous to the Dept. Agriculture's seed storage lab to provide and maintain a source of genetic diversity). The funds will be solicited from state and federal agencies and private foundations. Money should be available for such a project from the 1973 rare and endangered species law which will provide federal money to states to develop projects to perpetuate threatened species.

Concerning routine matters, I will transfer my fish collection from the Coop Units Bldg. to rm. 302 Zoology until a more permanent repository is found. Mr. James Roscoe, who remently completed his MS work, plans to remain during July and August to complete examination of specimens for the Park Service and Wyoming Game and Fish Dept. I am happy and satisfied with the facilities provided to me by the Zoology Department and hope the present arrangements will be continued under a new department head. Dr. Swanson, Dean Dils, Dr. Wooley page 3 May 4, 1974

Electrophoresis equipment purchased under a current faculty research grant (project 811) is assigned to the Department of Fishery and Wildlife Biology. To maintain all electrophoresis equipment in a central locality and make it available for greater utilization, Dr. Dave Pettus will maintain this equipment while I am away.

My address in Iran will be: Department of Environmental Conservation P.O. Box 1430 Tehran, Iran

Mr. Bill Jackson Anoka-Ramsey Community College Coon Rapids, Minnesota 55433

Dear Mr. Jackson:

Enclosed is a copy of a thesis pertaining to cutthroat trout (including Yellowstone and upper Missouri River cutthroat).

I talked to Jack Dean and mentioned the possibility of the graduate student project that we discussed a few weeks ago.

Sincerely,

Robert Behnke

RB:vv

Enclosure

Dr. Simon A. Levin Division of Biological Science Langmiur Laboratory Cornell University Ithaca, New York 14850

Dear Dr. Levin:

I received a request for reprints and teaching and research pland in regards to the position of ichthyologist. I have given my written agreement to an offer of the government of Iran to serve as a fishery adviser starting about July 1. I will likely be out of the country for six months.

I believe the ichthyologist position is to be filled by this fall, which would disqualify me from further consideration. If not, you may notify me and I will gladly forward my reprints and teaching-research plans.

Sincerely,

Robert Behnke

RB:vv

Mr. Jean-Louis Gaudet European Inland Fisheries Advisory Commission FAO Via delle Terme di Caracalla - 00100 Rome, Italy

Dear Mr. Gaudet:

In reference to correspondence FI 11/3.171 (Mar. 27), I must send you disheartening news regarding the Atlantic salmon synopsis.

I will terminate my employment with the U.S. Bureau of Sport Fisheries and Wildlife this month and will go to Iran as an adviser on matters of fisheries research and education in July for about a six month period.

My acceptance of the editorship of this synopsis was based on my federal employment and the use of my time, secretarial services, etc. as part of my normal job functions. This is now no longer possible.

The difficulties in putting this synopsis together has convinced me that unless some government agency assumes the responsibility of completing the synopsis, its completion under the present voluntary basis will be virtually impossible. I would suggest budgeting some funds and contracting for the work, otherwise, the delays will drag on indefinitely.

If you wish to contact me between July and December, my address will be: Department of Environmental Conservation P.O. Box 1430 Tehran, Iran.

Sincerely,

Robert Behnke

RB:vv

June 5, 1974

Dear Dr. Hubbs:

Steve Berwick 's present address is: Department of Wildlife and Fishery Science, Texas A. and M., College Station, Texas 77843. Steve is a wildlife biologist but I am certain he would be surprised and highly pleased to receive a copy of the monograph. He had asked me to let him know when the formal description of Gila bicolor "schlubbsi" was published.

Dr. Richard Wallace of the Department of Zoology, University of Idaho, Moscow, has been spending a sabbatical leave with me working on collections of cutthroat and rainbow trout from Idaho. I loaned him the monograph and he wants to obtain a copy, but there is no information concerning the price, where to send the order, etc. If you have extra copies after all the persons acknowledged, have been supplied, Dr. Wallace would make good use of such a model for fish taxonomy of isolated basins. Or, let me know how copies can be ordered and the price.

There was not time for this letter to reach you in La Jolla before you left, or I would have requested you contact me when you were in the Boulder area to see your great-grandchild. As I remember, your grandson lives near Nederland, which is close to Como Creek, a tiny stream which has a population of <u>Salmo clarki stomias</u> that we've used for re-introductions. The Como Creek trout look just like the illustration of <u>stomias</u> in Jordan and Evermann. Anyway, I should see you all in Ottawa. Enclosed is an abstract of my planned presentation. You'll note it is new subject matter for me. Dr. Shaklee has been working with Dr. Wallace and I and the information is based on his work, but I will present my interpretation of it.

I expect the Cornell job will be a popular one. I replied to an inquiry that I might be interested, but I may have to disqualify myself. I have an offer to go to Iran as an adviser on fishery research and education. The opportunity to work with a whole new faunal complex is exciting to me, particularly when I know that a trout occurs in at least one isolated basin, which has never been mentioned in the literature. If I go to Iran, I will probably be there from July to December, and should have almost unlimited opportunity to collect fishes.

Sincerely,

Robert Behnke

RB:vv

Enclosure

June 6, 1974

Dr. Nicolaus Peters Institut fur Hydrobiologie und Fischereiwissenschaft 2 Hamburg 50, Olbersweg 24 Germany

Dear Nicolaus:

I have arranged my schedule to stop in Hamburg for several days on my way to Iran. The schedule calls for arrival in Hamburg at 3:40 pm, Tuesday, July 2, on Lufthansa flight #43 from London. I will depart Hamburg at 11:35 am on Sunday, July 7.

I could present a lecture on June 3, 4, Or 5, whichever date you choose (I will have material for 2 lectures if you wish). I received your letter of May 31, and I am saddened that I cannot be there on June 28 for the Elba River bierfest. I must tell you, however, that since I lost much weight, I can no longer consume large quantities of beer. Perhaps I could make one exception to this rule if we are able to visit your cousin, the brewmaster at the Jever Brewery.

Sally and the children will go to her mother's house for the summer. I will miss them very much while I am away, but I should be able to get more work accomplished. If I return in 1975 I may arrange to bring the family.

I hope you will be in Hamburg during the week of July 2, or I must spend much time at Planten u. Bleunen and riding the Grossen Hafenrundfahrt.

Looking forward to seeing everyone soon.

Sincerely,

Robert Behnke

RB:vv

June 6, 1974

Mr. Thomas J. Trelease Nevada Department of Fish and Game P.O. Box 10678 Reno, Nevada 89510

Dear Tom:

I received your letter and the trout specimens from Willow Creek just as I was preparing a letter to R.R. Miller and Carl Hubbs with information on the Alvord trout. I will enclose a copy of the letter and the data sheets for your information--this is the most complete source of data on these trout until I publish a manuscript describing new subspecies.

Briefly, my conclusions are that two, distinct forms (subspecies) or cutthroat trout were native to the area, commonly called the Alvord basin of Nevada and Oregon. The differentiation of the cutthroat trout and the absence of <u>Gila</u> <u>alvordensis</u> from Willow and Whitehorse creeks, argues against the former opinion of Hubbs and Miller that all of the Alvord tributaries (Trout Creek, Thousand and Virgin Creek on the west and Willow and Whitehorse on the east) were once tributaries to pluvial Lake Alvord during the last glacial epoch. Evidently Lake Alvord did not rise above the divide separating Willow and Whitehorse creeks from the rest of the basin.

Apparantly, the cutthroat trout once native to the Virgin-Thousand Creek drainage of Nevada and Trout Creek, Oregon is now estinct. Collections made in 1971 and 72 from localities where this trout was collected in 1934 yielded only typical rainbow trout. It would be a most important discovery if native cutthroat trout could be found in some isolated tributary of the Virgin Creek drainage southwest of Denio. Let me know if you ever hear of such a possibility.

You will note comments in the letter re. the origins and affinities of these trout in relation to Lahontan cutthroat, Humboldt cutthroat and the Summit Lake cutthroat. I know it is commonly believed that the present Summit Lake trout was derived from an earlier plant of Pyramid Lake trout, but I find their characters to be too divergent to accept this premise.

The reference to the Trout Creek, Utah specimens, collected by BLM biologists, refers to the parent stock from whence came the Pine Creek trout on Mt. Wheeler.

Nevada probably has (or had) more unique forms (subspecies) of cutthroat trout than any other state. Then, you also have the strange trout native to Chino Creek of the Owyhee drainage, which we found to be thriving in 83°F. waters. Undoubtedly, the Chino Creek trout belongs to a group I call the red-banded Mr. Thomas J. Trelease page 2 June 6, 1974

trout. I hope that the efforts to establish new populations of this fish are successful. I'm writing up a note on this trout for publication and will make Pat Coffin co-author.

My efforts, often frustrating, to develop programs to perpetuate and expand the range of rare forms of trout, has made it apparant to me that we must have a series of brood stocks maintained in ponds (under as natural conditions as possible) to provide a source of eggs for restoration programs, experimental programs to study the ecological potential of these trouts and for a possible source of genetic diversity to produce new adaptive types by inter-racial hybridization. Of particular interest would be to look into the possibility of developing a stock of Salmo clarki henshawi for Pyramid Lake, which might approach the maximum size of the original Pyramid Lake cutthroat. One approach would be to obtain stocks from Independence Lake, California, Summit Lake, Nevada and Macklin Creek, California ((a pure stock introduced from the Trucker River about 75 years ago) and try various crosses between those stocks to promote genetic heterozygosity and then stock them into Pyramid Lake and make selections from those surviving to spawn for such traits as rapid growth, older age at maturity, etc. in an attempt to re-create the life history characteristics of the original Pyramid cutthroat.

Attempts to obtain S.C.S. ponds in Nevada and Wyoming for this purpose haven't worked-out. Also, such ponds would be scattered and difficult to coordinate. I've approached Colorado State University officials on the subject of using University controlled property to construct ponds for maintenance and propagation of rare trouts and have been given an O.K.

I would like to hear your comments on my idea and if you approve, let me know. I'll have to establish sources of funding for such a project and it would be helpful if the concept is generally endorsed by the fishery agency of each state with rare forms of trout which might be used in the program. One possible source of funding would be the Fleishman Foundation, if I placed an emphasis on Nevada trouts such as the Lahontan cutthroat, Humboldt cutthroat, Mt. Wheeler cutthroat and Chino Creek trout. Some of these Nevada trout thrive in submarginal situations and evidently have some adaptive traits of potential use in fisheries programs.

Some of my notions on innovations for cutthroat trout management will appear in a forthcoming issue of the Trans. A.F.S. (July ?). The article is based on the interactions of two subspecies of cutthroat stocked in the same lake--how they segregated the food resources and its effects on the angler's catch. If you'd like to see the manuscript before publication, let me know and I'll have a copy made for you.

I must point out that I will be out of the country from July to December. I have accepted an offer from Iran as an adviser on fisheries research and educa tion. I have resigned from my position with the Bureau of Sports Pisheries

Mr. Thomas J. Trelease page 3 June 6, 1974

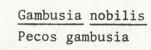
and my long range plans aren't definite, but I will return to C.S.U. in December and try to activate my plans for brood stock ponds for rare and unique genotypes of western trouts.

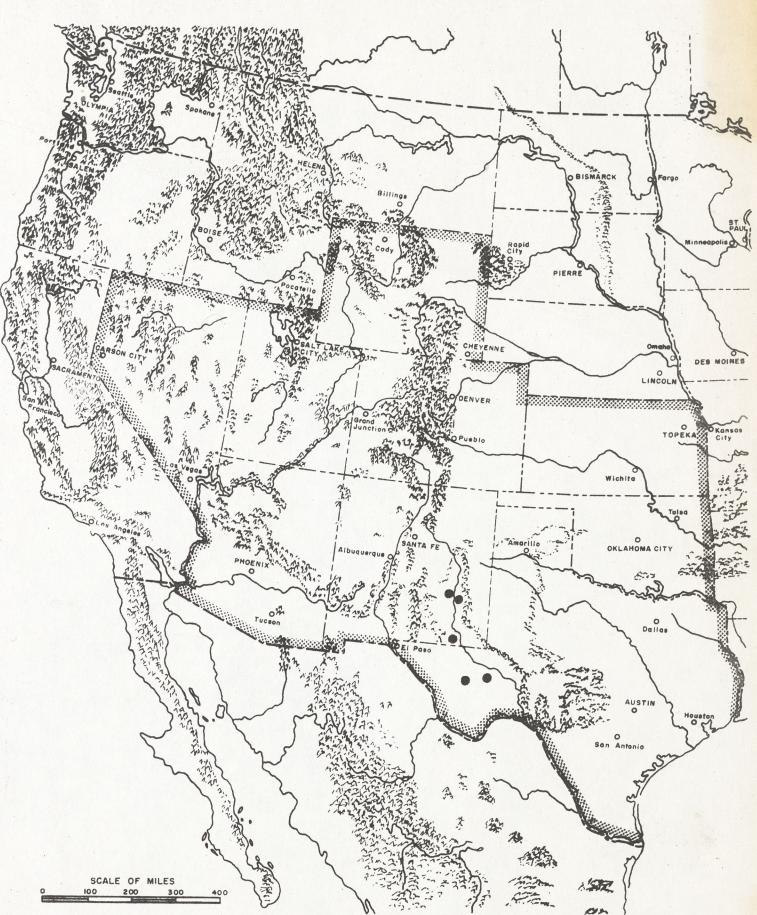
Sincerely,

Robert Behnke

RB:vv

Enclosures





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- 37. Texas Organization for Endangered Species. 1972. Rare, endangered and peripheral fishes, amphibians, and reptiles of Texas. 5 pp. Status of G. nobilis.
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- 39. United States Department of the Interior. 1973. Threatened wildlife of the United States. Bur. Sport Fish. Wildl. Resour. Publ. 114. 289 pp. Status and fact sheet on G. nobilis.
- 40. Warburton, B. 1958. Selection studies on artificial populations of Gambusia. Unpubl. M.A. thesis. Univ. Texas. 74 pp.
- White, W.N., H.S. Gale and S.S. Nye. 1938. Groundwater resources of the Balmorhea area in Western Texas. U.S. Geol. Surv., Water Supply Pap. 849-C:81-146. Habitat information in Balmorhea area.



UNITED STATES DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE BUREAU OF SPORT FISHERIES AND WILDLIFE Colorado Cooperative Fishery Unit Colorado State University Fort Collins, Colorado 80521

January 12, 1971

Dr. Nils-Arvid Nilsson Institute of Freshwater Research Drottingholm Sweden

Dear Nils:

I will address this letter to you but enclose a copy to pass on to Dr. Svärdson.

I have thoroughly examined the Salvelinus specimens from four Swedish lakes and my tentative conclusions will be of interest to you and Dr. Svärdson concerning the evolution of sympatric sibling species in Salvelinus. The enclosed data sheet and comments, summarize the information extracted from the specimens. Of major significance from the data evaluation is the fact that I can not detect two "species" involved; that is, there is no correlation between all samples of "titans" and all samples of "dwarfs" which would indicate that all the dwarfs and all the titans are derived from two ancestral species invading each lake from glacial refugia. In fact, all the charr samples from Lake Blasjon and Lake Ankarvattnet appear to share closer affinities with each other than to any of the samples from Lake Kultsjon and Lake Övre Björkvattnet. The samples from the latter two lakes do seem to represent well-diverged stocks, but again, there is virtually no evidence to support common origin for the two races between the two lakes. In the manuscript you sent to me on the Lake Ovre Bjorkvattnet charr you called the ordinary charr "foding" and the small littoral charr, "blattjan." You state that the "foding" have more gillrakers than the "blattjen" (19-27 [23] vs. 19-23 [21]). This leads me to believe that the sample I examined labeled "titans" (20/036-048) are actually the "blattjen." The difference in gillraker number between my counts and yours is due to the fact that I stained the gill arch with alizarin dye to detect every rudiment - an important consideration if specimens of different size are compared.

Dr. Nils-Arvid Nilsson January 12, 1971 Page 2

None of the Salvelinus samples from these four lakes are typical of the S. alpinus of the Alpine lakes of Europe where the typical gillraker number is 26-32 in both the "sibling species" called normalsaibling and wildfangsaibling. I suspect the Salvelinus in lakes tributary to the Gulf of Bothnia (where the whitefish of the Coregonus lavaretus complex occurs with about 45 gillrakers - a form not found in the Alpine lakes of Europe) have a different origin from the charr of the Alpine lakes and other Baltic Sea drainages. Salvelinus with 23-25 gillrakers are in lakes tributary to the White-Barent Sea region and those in Iceland-Greenland typically have 25-27 (this is true of both the sympatric "murta" and "bljeeka" of Lake Thingvallavatn.

I have data on a single specimen from Lake Vattern, Sweden. This charr has 29 gillrakers, typical of the Alpine Salvelinus.

The enclosed manuscript on salmonine fishes of glaciated regions is a pre-publication copy. It includes a section on sibling species of Salvelinus and you will find much relevant information relating to the situation in Scandinavia. May I request that you pass this manuscript on to Dr. Svärdson. I would like to receive his opinions on my theories of sibling species and nomenclature. The present Swedish charr samples reinforce what I state in my manuscript - that all sympatric charr populations in the Salvelinus alpinus complex can not be assigned as derivatives of 2 or 3 distinct species; but the sympatric populations from each geographical area or each lake are more closely related to each other than to any population outside the region. I noted in Dr. Svardson's paper in the Biology of Coregonid Fishes, where he admitted that reproductive isolation had been established between two Coregonus populations isolated for no more than 9,000 years. This is what I believe has occurred independently and repeatedly in Salvelinus and Coregonus - relatively brief isolation and subsequent sympatry, so that the "sibling species" are not relicts of pre-glacial species, but are local phenomena. In this case, all sympatric populations can not be traced to monophyletic divergences and common ancestors - so if you want to treat biological species as taxonomic species - how can nomenclature be applied to construct a natural system of classification, denoting true evolutionary affinities?

When you have completed the final version of your manuscripts "Characteristics of two discrete populations of Arctic char in a north Swedish lake" with tables and literature cited, I would like to receive a copy. I would like to request from Dr. Svärdson a reprint of his 1961 paper you cite referring to 17 Scandinavian lakes with two or three sympatric charr populations. Also if available from your Institute, I would like to receive the paper by Filipsson (1967) on otolith differences in charr.

I discussed some systematic problems in <u>Coregonus</u> and <u>Salvelinus</u> with Dr. Nyman at a meeting two years ago. I noted in your manuscript that Dr. Nils-Arvid Nilsson January 12, 1971 Page 3

Nyman has a manuscript on the serum protein genetics of the Lake Övre Bjorkvattnet charr. If Dr. Nyman has returned to Sweden I hope you can encourage him to continue his studies on <u>Salvelinus</u>. I agree that protein taxonomy is the most promising technique to obtain quantitative comparative data to test various hypotheses of origins and affinities between sibling species.

Here are some possible theories on the origins of sympatric charr populations in northern Sweden: (1). Classical sympatric speciation. The sympatric populations in each lake diverged in recent times in the lake itself. This would mean the evolutionary separation of the two populations was more recent than other divergences in the phylogeny leading to these populations - that is, they are more closely related to each other than to any Salvelinus population outside their home lake. (2). Micro-geographical isolation. A single common ancestral charr invaded the region (Gulf of Bothnia lakes) in post glacial times. Local isolation for a few thousand years in various lakes, river systems or from changes in sea level - then opportunities for co-existence of probably several isolated stocks and subsequent sympatry and ecological divergence in lakes with sufficient niche diversity. This alternative can be divided into two categories: (A) two (or three) basic stocks producing all the present sympatric populations. (b) several stocks, derived from many isolated segments of the region, for example the charr in each drainage basin or series of lakes could have incorporated isolating mechanisms allowing later sympatric occurrence with charr of neighboring basins. In this case, a mosaic pattern of relationships would be present. (3). Distinct species are involved. Pre glacial divergencies in the Salvelinus alpinus evolutionary line produced well-differentiated groups which independently invaded these lakes and established sympatric populations. The most likely stocks involved would be the Salvelinus now found in the Barent-White Sea region and the lacustrine Alpine charr. (My examination and comparisons of specimens does not support this rather logical solution to the problem). (4). Various degrees of introgression between distinct groups of the S. alpinus complex invading and mixing in the area after the last glacial retreat.

Personally, I favor alternative 2 with a probability that introgression between disjunct ancestral stocks may have played a role in influencing the present situation. I hope Dr. Nyman will launch a vigorous attack on the problem. Dr. Nils-Arvid Nilsson January 12, 1971 Page 4

I am now returning these specimens to the Natural History Museum. Unfortunately the specimens were in generally poor condition and I could learn little concerning differences in coloration, spotting and general morphology. I would very much like to receive further specimens of sympatric charr from these same lakes or other lakes for more intensive study and osteological comparisons. Enclosed are direction sheets for obtaining good preserved specimens. If you or members of your Institute have the opportunity to collect charr, I hope you will remember this request.

Sincerely yours,

Robert Behnke Assistant Unit Leader

RB:dch Enclosures

LOCALITY	VERTEBRAE	GILLRAKERS	PYLORIC CAECA	SCALES, LAT. SER. AND ABOVE LAT. LINE		FRELVIS IN RATS SIZE	BASIBRANCH TEETH
Lake Övre Björkvattuct 70/030-835	60 61 62 63 64 65 66 1 3 1 1 (64.3)	2 3 1 (24.8)	N RANGE X 6 (42.0) 34-50	$\frac{N}{6} = \frac{RANGE}{188 - 221} (200.0)$ $\frac{6}{37 - 40} (38.0)$	N RANGE X R. 10-10 (10.0) L. 9-11 (10.4)	N RANGE X Standard L, mm. 132-208 (151.5)	N 6 (9,2) 3-12
Lake Övre Björkvatinet 70/036-048 "titans"	3 8 1 (63.8)	235111 (22.9)		10 (194.2) 184 - 204 10 34 - 38 (35.7)	L9-11(10.0)		13 (19,3) 5-33
Lake Kultsjön 70/021-025 "drawf"	122 (62.2)	311 (23.6)	5 (41.6) 37-45	5 176-193 5 37-40 (38.4)	L 10-12 (11.0)	153-188 (175,2)	5 (11.4) 5-18
Lake Kultsjøn 70/016-020	(63.8)	(25,4)	5 (50.0') 44-57	5 (213.2) 206-223 5 35-42 (39.6)	L + 11-12 (11.2)	155-197	5 (10.6) 3-16
Lake Blasjon 70/006-010	23	(26.0) 29	5 (41,6) 3 <sup>-</sup> 3-45	5 (198,2) 190 - 206 5 37 - 42 <sup>(40,0)</sup>	10-12 (11.0)	160 - 175 (167.8)	5 (9.6) 5-18
Lake Blásjón 70/011-015 "titans"	(63.2)	(26.0)	4 (41,0) 37-43	5 185-209 5 36-41 (38,2)		137-178 (147,8)	5 (11.8) 5-20
Lake Ankarvathe 70/001-005	1 2 2	(26.2)	5 (41.6) 36-416	5 (195.4) 186-206 5 34-40 (36.4)	10-12 (11.2)	(128,2)	5- (5.6) 3-10
L. Ankarvattnet 70/026-029 "titans"	63	(26.0)	4 (38.3) 30-47	4 187-208 4 36-38 (37.0)	9-12 (10,3) 9-12 (10,8)	113-168 (142,3)	5 (9.5) 5-13

## Lake Övre Bjorkvattnet (70/030-035) dwarfs:

None of 6 specimens with cestode parasites in pyloric caeca. Only one of 6 specimens (the largest, a female of 208 mm. S.L.) with mature gonads. The differences in gillraker counts, basibranchial teeth development and parasite infestation leaves little doubt that the two populations of charr in Lake Ovre Bjorkvattnet are dintinct entities.

(70/036-048) "titans" (probably "blattjen," see letter). Eleveh of 13 specimens with parasites in pyloric caeca. None of specimens are sexually mature; 3 of 7 males with partially developed testes, 1 of 6 females with partially developed ovaries.

Lake Kultsjön (70/021-025 and 70/016-020) dwarfs and titans (?).

Differences in scale counts, pyloric caeca, vertebrae, and gillrakers indicate these two populations of charr in Lake Kultsjön are more diverged from each other than those of the other lakes. Parasites in the pyloric caeca were found in 1 of 5 specimens in both samples. All of the 5 "dwarf" charr have mature gonads, none of the "titans" (?) reveal sexual maturation, although there is little difference in size of the specimens between the two samples. The sexually mature "dwarf" charr are morphologically distinct with deeper bodies and larger fins. (Collected, Oct. **3**0, 1969).

Lake Blasjon (70/011-015 and 70/006-010) "titans" and "dwarfs" (?).

None of the characters investigated indicate that these two samples were from different, reproductively isolated populations. They appear more similar to each other than to any sample from other lakes. No parasites were found in any specimen. The sample listed as "titans" averaged smaller in size than the "dwarfs"(?). One of the titans (the smallest specimen, a female of 137 mm. S.L.) was sexually mature. No gonadal development observed in other 4. One "dwarf"(?) was found with well developed testes, 2 had moderate development, and 2 had no development (Collected, November, 1969).

Lake Ankarvattnet (70/001-005 and 70/026-029) "dwarfs"(?) and "titans".

Similar to samples from Lake Blasjon and also no indication from character analysis (except sexual maturity) that these small samples represent two distinct stocks. Two of 4 titans and 1 of 5 dwarfs with parasites in caeca. However, all of the "titan" specimens were sexually mature whereas none of the "dwarfs" had any gonadal development. Perhaps the labels were reversed with these samples. Typically in sibling species the dwarf race matures earlier and at a smaller size than the normal or large race.