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

January 8, 1973

Dr. Frank Schwartz
Institute of Marine Sciences
University of North Carolina
Morehead City, N.C. 28557

Dear Frank:

Enclosed are two other reports (in press).

I found a copy of the Coop. Unit Report, Vol. 6, with Leik's article on splake (essentially, a duplication of his thesis); I can't find the 1961 report, but it may be in the Colo. Fish and Game office in Ft. Collins. Let me know how important it is that you have these; I can probably arrange copies for you. The problem is that the old (pre 1964) Colo. Coop. Fishery Unit was not a direct predecessor of the present one - the old Unit was strictly a state operation.

I sent some information on salmonid hybrids recently to Jim Dangle for his massive annotated bibliography on salmonine hybrids. I urged him to go ahead and submit his work or he'll never bring it to completion. Ask Dangle to send you his revision - everything you'll need on salmonine hybrids should be in it.

I'm preparing a manuscript for publication on the ecological separation of 2 subspecies of cutthroat trout stocked in the same lake (using some principles of evolutionary biology in fisheries management). I believe you and your students will find the data and ideas interesting and I'll send a prepub. copy to you when it's ready.

Sincerely yours,

Robert Behnke

RB:dch
Enclosures

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

January 8, 1973

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

Dear Steve:

Thanks for the copy of the manuscript on coldwater reservoir studies. I have some questions concerning the strains of trout used in the experiments. The abbreviations were not defined in the report except for wild Kamloop = RT-KJ. I have interpreted the abbreviations as follows - let me know any corrections: KJ x CT-L = Wild Kamloop x Lahontan cutthroat (Heenan Lake strain). V x H = Virginiaand Hot Creek domesticated rainbows. KC x S = Coleman Kamloops x Shasta? O = Oregon (What hatchery developed this strain?). KC x SH = Coleman Kamloops x Shasta? The size at stocking was quite variable and undoubtably influenced survival but the consistant success of the KJ x CT-L probably has a genetic basis. The V x H cross also seems promising.

The discussion on recommended strains to be stocked in specific environments and the suggestion on proportional mixing of strains seems so logical and is backed up by plenty of data, that I am amazed that the hierarchy of California Fish and Game have not implemented these ideas into the hatchery production and fisheries management program on a large scale.

Enclosed is a pre-publication copy of a manuscript which gives you some documented evidence that intraspecific strains can be stocked and coexist in the same lake.

You requested copies of reports on taxonomic characters of western trouts. I believe you're referring to the list included in "Rare and Endangered Trouts of the Southwest." I have enclosed a copy and you can note the reports you want. An example of one of these reports - on Bonneville trout - is included.

Sincerely yours,

Robert Behnke

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

January 8, 1973

Mr. Don Dexter
Wyoming Game and Fish Commission
Cheyenne, Wyoming 82001

Dear Don:

I would appreciate a renewal of my collecting permit for 1973. Enclosed is my 1972 permit which may serve as a model. During 1972 collections of cutthroat trout were made in the Snake River drainage around Jackson (with Max Rollefson), in Yellowstone Park and in the Big Horn Drainage (with Lou Perhacek). A total of about 100 specimens were involved and a report on the systematic investigations of Wyoming cutthroat trout will be presented at the Colorado-Wyoming AFS chapter meeting.

Sincerely yours,

Robert Behnke

RB:dch
Enclosure

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

January 8, 1973

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

Gentlemen:

Collections made under the enclosed permit during 1972 consisted of approximately 120 specimens of native trout taken in the Harney-Mahleur basin (tributaries of Silvies R.), the Malheur River drainage and in the Alvord basin (Willow and Whitehorse creeks). All of the collections were made with the assistance of Mr. Bill Hosford, Game Commission biologist at Hines.

Sincerely yours,

Robert Behnke

RB:dch

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

January 8, 1973

Utah State Division of Wildlife Resources
1596 West North Temple
Salt Lake City, Utah 84116

Gentlemen:

The fish specimens collected under the enclosed permit consisted of a sample of cutthroat trout taken in One Mile Creek (Raft River Mountains), Box Elder Co.

Sincerely yours,

Robert Behnke

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

January 8, 1973

Mr. Daniel S. Plosila
New York State Dept. of Environmental Conservation
Fish Research Office
Ray Brook, New York 12977

Dear Mr. Plosila:

Enclosed is the reprint you requested and a pre-publication copy of a manuscript which provides some documented evidence of the utilization of intraspecific genetic diversity in fisheries management that is discussed in the reprint.

I noted in a 1971 newsletter of the Northeastern Div. AFS that you are project leader for coldwater fisheries investigations. The projects mentioned included survival and growth of 2 strains of lake trout in 9 lakes, comparisons of wild, domestic and hybrid brook trout under general fisheries regulations, and performance of 2 hybrid strains of brook trout.

Can you provide me with copies of reports, manuscripts, etc., with data and information on these projects? As you can note in the reprint and manuscript, I am much interested in documenting the use of intraspecific genetic diversity in fisheries management.

Sincerely yours,

Robert Behnke

RB:dch

Regional Director, U.S. Bureau of Sport Fisheries and Wildlife, P.O. Box 1306, Albuquerque, N.M. 1/8/73

Robert Behnke and Harold Steinhoff

Progress Report - Rare and Endangered Status Book

To December 31, the bulk of activity has been devoted to literature surveys and personal communication to accumulate the necessary background material for preparation of write ups of the rare and endangered vertebrate animals of Region 2. The objectives are to produce a compendium of information documenting the status of each of the species under consideration and to serve as a basis on which actinn programs can be initiated.

Wildlife

Thred undergraduate students are involved in the literature review covering the birds and mammals. Two of these students are supported on the project and have put in 168 hours to date. One student is supported under a work-study project at no cost to the Bureau. This student has spent 106 hours on the project.

The literature review is well underway for 11 of the 21 mammals and 10 of the 35 birds; the reference search is nearing completion on many of these. For four mammals and four birds, also being covered by the BLM under their contract with the Denver library, work is delayed pending the completion of the BLM project, to avoid unnecessary duplication of effort.

Questionnaires are being sent to state and federal conservation agencies, universities and museums of the region to identify people with special interests and expertise concerning the species involved.

Fishes

Literature surveys, personal communications and personal knowledge led to a critical review and evaluation of the fishes of region 2 and subsequently a major revision of the list of rare and endangered fishes. Guidelines have been established for criteria of status and inclusion. The most up-to-date information, including unpublished manuscripts have been obtained. Correspondence with leading ichthyologists of each state has uncovered much new information, including undescribed species of very restricted distribution (including one being presently maintained wholly in aquaria). One part-time graduate student is

being supported by the project and use is made of work-study help at no cost to the project. At present, files on 51 fish species have been developed plus 7 reptiles and amphibians.

Estimated Funds Needed for Completion of Write Ups Through June, 1973

Omitting publication costs, our best estimates are than $5,000 will be necessary to complete the write-ups. This is broken down into $4,000 for wages of students completing literature surveys and write-ups, figures at approximately 20 hours per species with 114 species considered. Work-study students (at no cost to the project) provide the necessary assistance to the students paid from project funds. For miscellaneous expenditures; typing, duplicating papers, inter-library loan, phone, postage, etc., we estimate the sum of $1,000 will be sufficient.

Estimated publication costs can be based on approximately 600 pages (5-7 pages per species x 114 species) and the number of volumes produced. Publication costs can be compared between University and Bureau publication and a decision can be made at a later date regarding the duplication and publication of the data sheets.

cc: Harold Steinhoff

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

January 10, 1973

Mr. James Dangle
College of Fisheries
University of Washington
Seattle, Washington 98195

Dear Jim:

I found a citation to Nevada's use of rainbow x Lahontan cutt hybrid. The enclosed page is from: Pisces, vol. 2, no. 3(1972). The title of the paper is: "The great Pyramid Lake water war" by V.K. Johnson on page 3 + 8. Pisces is a publication of the California-Nevada Chapter A.F.S.

Sincerely yours,

Robert Behnke

RB:dch
Enclosure

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

January 10, 1973

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

Dear Mr. Hewitsson:

I remember reading an article or note authored by you on New Zealand trout in an issue of the Trout Unlimited magazine, and I had inquired with Mr. VanGygenbeek concerning your interests.

I, too, have been attempting to pin point the source of the rainbow trout in New Zealand to document genetically based behavioral differences within a species. I have corresponded with Dr. Scott on the matter and enclosed are his comments (which you probably already have).

It seems generally agreed that the origin of New Zealand rainbow trout came from an 1883 shipment from California. Stokell's book "Fresh Water Fishes of New Zealand" states the origin as the 1883 shipment from which 4000 fry were hatched, and a larger shipment in 1884, arranged by the Auckland Acclimatization Society (source not mentioned). Dr. Hugh R. MacCrimmon, Dept. Zoology, Univ. Guelph, Guelph, Ontario, published a paper: "World distribution of rainbow trout (Salmo gairdneri)." 1971. Jour. Fisheries Research Board of Canada, 28(5):663-704. He listed an "about 1877" introduction by the Auckland Society that was unsuccessful (this was likely from McCloud R.) and two shipments in 1883 ... "apparently collected privately from steelheads at the Russian River." Who sent the fish and from where I do not know. If records of the Aukland Acclimatization Society exist, the information should be there. I have found a statement made by Livingston Stone on p. 201-202 of the Rept. U.S. Comm. Fish. for 1872-73 (first volume of this series) concerning the California Acclimatization Society and requests they had received from Australia and New Zealand for "large numbers of eggs of California Salmonidae." It is likely that the California Acclimatization Society or its members arranged the original shipments. I checked the Repts. of the U.S. Fish. Comm. for the 1880's and no rainbow trout were sent to New Zealand by the federal government, so it must have been a private arrangement. It is possible the state of California shipped the eggs; if so, this information should be in the Biennial Rept. Calif. Fish Comm.

It is possible that if the eggs were shipped by a private party such as the California Acclimatization Society, they could have come from the McCloud R. area because an individual named Campbell operated a private hatchery and sold eggs from a tributary stream above Baird before the federal operation was established. A shipment of eggs to Japan in 1877 originated from this source.

The most significant point, however, concerning the behavioral type of rainbow trout imported into New Zealand - anadromous or resident, is that even if they came from the McCloud River, they were most probably (or mostly) steelhead. The enclosed copy of a paper I authored with the late Professor Needham relates our opinions on the matter. Steelhead runs entered the McCloud River prior to Shasta Dam. The size of the fish and their time of appearance in the river, reported by Livingston Stone leaves little doubt that the bulk of the eggs produced on the McCloud were of steelhead origin - which explains the apparant confusion of fisheries people in Europe and South Africa wondering why their rainbow trout were migratory when they were supposedly derived from resident trout of the McCloud River. At the time, Needham and I wrote the paper, we believed the fine scaled resident trout of the McCloud drainage was a rainbow x cutthroat hybrid. Since then I have obtained considerably more material and I now believe they are a distinct group most commonly related to the golden trout, S. aguabonita. The enclosed paper by Schreck and Behnke discusses my more recent opinions on the "red-banded" trout (the name used by Livingston Stone).

I would agree with you that the origin of the 1883-84 introductions probably were not from the McCloud River, and most likely were, as the New Zealand records indicate, from the Russian River. If you can find who shipped these fish - the California Fish Comm. or the Calif. Acclimatization Soc. - let me know.

Also enclosed is a paper, largely based on my investigations of intraspecific genetic based variability.

Sincerely yours,

Robert Behnke

RB:dch
Enclosures

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

January 10, 1973

Dr. Walter R. Courtenay
Department of Biological Sciences
Florida Atlantic University
Boca Raton, Florida 33432

Dear Walter:

Thank you for a copy of your letter to Axelrod in reference to Salmo letnica. Enclosed are two reports I prepared on S. letnica introductions.

Aside from any possible dangers of disease or parasites, S. letnica does not pose any conceivable threat to any rare or endangered North American salmonid. S. letnica is strictly a lacustrine species and would be introduced in lakes and reservoirs (typically without any native salmonid fishes). The habitats of virtually alloof our rare forms of native trouts are small, isolated streams.

Also enclosed are other reports on rare trouts and a recent reprint.

Please keep me informed if you hear of any further information concerning introductions of Salmo letnica.

Sincerely yours,

Robert Behnke

RB:dch
Enclosures

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

January 10, 1973

Dr. T.G. Northcote
Institute of Fisheries
University of British Columbia
Vancouver 8, B.C., Canada

Dear Dr. Northcote:

Enclosed is a manuscript for your review. We were stimulated by your publications on interaction between cutthroat trout and Dolly Varden. The situation we discuss is based on the segregation of two introduced populations of cutthroat trout.

You have devoted considerable and in-depth thought to the matter of the interaction between ecologically similar fishes and we would appreciate your comments and criticisms of the manuscript before it is submitted for publication.

Sincerely yours,

Robert Behnke

RB:dch
Enclosure

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

January 10, 1973

Dr. Anne LaBastille
c/o Ecology Program
Smithsonian Institution
Washington, D.C. 20560

Dear Dr. LaBastille:

Dr. Harold Steinhoff and I are preparing information on rare and endangered vertebrates of the Southwest. Enclosed is a copy of my report on the trouts of the Southwest.

The American Fisheries Society has a rare and endangered fish committee with representatives in each state - the quality of information available depends on the individual. I could suggest that you contact Dr. Walter R. Courtenay, Department Biological Sci., Florida Atlantic Univ., Boca Raton, Florida 33432, who has been active in documenting the status of fishes of the Southeast.

Sincerely yours,

Robert Behnke

RB:dch
Enclosure

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

January 17, 1973

Dr. Herbert R. Axelrod
P.O. Box 27
Neptune, New Jersey 07753

Dear Dr. Axelrod:

I sent Dr. Courtenay some information on Salmo letnica and I am enclosing a report I prepared for the A.F.S. exotic fish committee (Jim Deacon, chairman) in 1970. Besides, the introductions mades in Minnesota, Colorado and Wyoming, S. letnica has been introduced into Kentucky and perhaps other states that I am not aware of. I am not competent to consider possible disease or parasite problems, but S. letnica would not pose any conceivable threat via predation or competition with any of the rare or endangered trouts of North America. This is because all of the rare trouts are restriced to small, isolated stream habitat and S. letnica is a lacustrine species imported for reservoir introduction.

In reference to your second question concerning trout in waters of 20-22°C - there is no doubt that rainbow trout (S. gairdneri) and brown trout (S. trutta) can survive without difficulty (if O_2 content adequate) in 20-22°C. Such a temperature is, however, above their optimum range for feeding and food assimilation. Also, trout will not reproduce unless a temperature of 12-13°C is attained. I have been accumulating data on temperature tolerances in salmonid fishes for a publication concerning an incident this past summer. During a collecting trip for a systematic study of desert basin trout I found a population of an undescribed form of trout I have referred to as the "red banded" trout in northern Nevada, apparantly thriving in water of 28°C. These trout were active and were readily caught on dry and wet flies. I have never encountered any trout that lived under such conditions.

I have corresponded with R. S. Cross, Natal Parks, Game and Fish Preservation Board, P.O. Box 662, Pietermaritzburg, South Africa. He may be able to provide you with some advice based on personal experience in African waters.

Sincerely,

Robert Behnke

RB:bw

R. Putz, Division of Fishery Research
Washington, D. C.

January 18, 1973

Bob Behnke

Bureau funded research project

You requested some information to support a request for continued funding of Research Project 14-16-0002-3440.

The most logical arguments for the justification for continuance are found in the enclosed manuscript, Mr. Trojnar and I wrote, based on the first phase of the research (study of the role of the Snake River cutthroat trout in one small lake). The mention in the discussion section (p. 11-12) of the Snake River cutthroat trout stocked by the Bureau on Indian Reservations, concerns the subject that I want to pursue in 1973 under this contract with graduate student, Paul Sekulich.

Because Mr. Sekulich is a M.S. and not a Ph.D. student, and the first year of his graduate work is being supported by Colorado Division of Wildlife, I will request only a one year (th June 30, 1974) extension of the contract.

I have not scaled down the goals established for the original 3 year Ph.D. research project, but I plan to "farm out" the evaluations on Montana west slope cutthroat trout initiated this year, for support by Montana Fish and Game. I would guide the study as a graduate advisor. I believe we can obtain sufficient data in 1973 to supplement the 1972 sampling program to document the performance of the Snake River cutthroat trout in several lakes managed by the Bureau. The significance of this study is based on the facts that the Snake River cutthroat trout is propagated by the Bureau, it is used in Bureau management programs and, except for the present project, there is absolutely no data concerning what these fish do after they are stocked (which relates to the justification of the unfavorable production costs comparisons of Snake River cutthroat trout and rainbow trout). As mentioned in the manuscript, the survival ratios are indeed striking. Gillnet samplings indicated 20-30 to 1 survival advantage of Snake River cutthroat over rainbow trout in some lakes over a 2 and 3 year period.

The Bureau will definitely receive good value on its investment to continue this study for one more year. The results will be available first as a thesis (June, 1974) and then as a publication.

Please inform me as soon as possible regarding the future of this contract. If the contract is not continued the project must be dropped. The Colorado Division of Wildlife has allowed a great degree of flexibility in the projects they have supported through the Unit program, but they want the research to be done in Colorado and their continued support of Mr. Sekulich would require a major change in plans.

The present contract for $9,100.00 per year was designed to cover some of my operating expenses such as field trips, student assistants etc. Because I expect most of these costs to be supported from non-Bureau funds this year, I would estimate that for a one year renewal of the contract, the request for funds can be reduced to $7,500.

Also enclosed is an abstract of a planned presentation by Mr. Trojnar and Mr. Sekulich on the Snake River cutthroat in lakes on Indian reservations.

Sincerely yours,

Robert Behnke

Enc.
RB:bw

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

January 22, 1973

Mr. George Holton
Montana Fish and Game
Helena, Montana 59601

Dear George:

Enclosed is a copy of a manuscript prepared by John Trojnar and I. You could be considered as the personification of the audience we are trying to reach so we would appreciate any comments you might have.

As you know from talking with John Clark, I am hoping that the Montana westslope cutthroat evaluation study can be picked up as a full time graduate student project perhaps through the Montana Cooperative Fish Unit and I would serve as a graduate committee member. John Clark was informed by Dr. Graham that the Unit had a full complement of students and it was doubtful that they could accept any more, particularly now the C. J. D. Brown has left the University. The University of Montana at Missoula with Dr. Andrew Sheldon, a competent fisheries person, might better handle shch a project. I was thinking about some practical applications of this type of research that would justify D.-J. funding. One such aspect would be to document thee respective roles of hatchery trout and trout from natural reproduction in Hungry Horse Reservoir. With this information, the hatchery operation could be designed to maintain cutthroat trout populations at maximum abundance in relation to the environmental limitations and not be a matter of guesswork (perhaps very expensive guesswork). Such a directly applicable project would be in addition to the evaluation of the 5 lakes inititated by John Trojnar this year. I believe a good Ph. D. student could handle it if the research is properly designed.

I have a report to write up for the Forest Service concerning westslope cutthroat trout in Idaho (for an impact statement on logging a certain area). I'll send you a copy to keep you up to date on my systematic studies.

Sincerely,

Robert Behnke

RB:bw

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

January 26, 1973

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

Dear Steve:

Enclosed are reprints you requested plus a recent one from Systematic Zoology. I haven't considered my plans for this summer, but its likely I'll be concentrating on the cutthroat trout of the upper Columbia and Missouri basins and trying to find out more about possible occurrence of red-banded trout in the Columbia River system - they undoubtedly occur in some parts of the Owyher drainage, tributary to the Snake River.

You didn't mention where your field work would be this summer, but if you're in the upper Sacramento or upper Klamath drainages, be on the lookout for populations of red-banded trout and preserve a series if you find them.

Sincerely,

Robert Behnke

RB:bw

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

January 26, 1973

Miss Barbara Shor
1016 14th Street
Boulder, Colorado 80302

Dear Miss Shor:

I can not provide you with any positive leads regarding summer employment, but suggest that you inquire with the Colorado Division of Wildlife. Several C.S.U. undergraduate students are employed in fisheries jobs each summer by this state agency.

I will keep your letter on file and contact you if I learn of summer jobs. The Co-op Fish Unit sometimes hires student assistants, but it would be May or June before we know what funds will be available.

Sincerely,

Robert Behnke

RB:bw

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

January 26, 1973

Mr. Fred Eisermann
Wyoming Game and Fish Commission
188 Dahlåa
Casper, Wyoming

Dear Fred:

We've sent out all the copies of the Trojnar and Behnke manuscript, but when we write the final version for publication, additional copies will be made and several will be sent to you.

Enclosed is an abstract of a seminar on the subject that I'll present at the University of Wyoming on Feb 22. If any of your biologists are in Laramie on that date, I'm sure they'd be welcome (I suspect, however, that its a holiday for state people).

You mentioned you have specimens of S. c. pleuriticus. Perhaps you can have them at the Colo.-Wyo. chapter meeting in Cheyenne for me to pick up.

Sincerely,

Robert Behnke

Enc.
RB:bw

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

January 26, 1973

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

Dear Mr. Hewitson:

If you have extra copies of manuscripts on the history of rainbow trout in New Zealand and on Anadromy in acclimatized rainbow trout, I would much appreciate receiving them.

It appears that the hatchery on the Russian River at Ukiah separated by the railroad is the likely source of New Zealand rainbow trout. Stokell once published the taxonomic characters of several samples of New Zealand rainbow trout, trying to correlate them with the very inadequate descriptions in the literature, to estimate their origin. His data, particularly the number of vertebrae, seemed characteristic of California steelhead (Russia River soughward). Stokell is not a professional biologist. He is self-taught, and was a prolific collector and writer, but essentially was a layman in fisheries biology.

I would like to examine a series of the bright colored trout you've found on Mt. Palomar. Undoubtedly the native strain has hybridized with hatchery rainbows, but they may prove interesting. About 10-15 specimens can be preserved in 10% formalin and after a few weeks of fixing, can be wrapped damp and posted. Perhaps Dr. or Mrs. Hubbs can send them to me. Please give them my regards when you see them. I always enjoy meeting the Hubbs' they have such an immense and broad knowledge of everything pertaining to fish.

The proliferation of names, dividing a larger taxonomic unit into several units can indeed by confusing and frustrating. There are situations, however, such as the golden trout-red-banded trout group, which have been generally grouped with Salmo gairdneri, but in reality represent independent evolution and enormous genetic diversity accumulated during, perhaps, one half million years or more of evolution since their seperation from S. gairdneri ancestor. To accurately reflect evolutionary reality in taxonomy, these trout must be separate from S. gairdneri. There is much to be done, however, before their taxonomy is worked out

Sincerely,

Robert Behnke

ENC.
RB:bw

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

January 29, 1973

Dr. Hiram Li
Department of Animal Physiology
University of California
Davis, California 95616

Dear Hi:

Enclosed is a reprint based on Dave Rogers Taximetrics. It looks relatively impressive in its quantitativeness, but as you realize, we loaded the dice to make the printout conform to my preconceived notion of what the clusters should be.

Many thanks for the unique wooden train we received from you. Bobby loves it and it is so well put together that it is still intact. I was looking it over and it is obvious that a great deal of ingenuity went into the construction. Did you make it yourself?

Sincerely yours,

Robert Behnke

RB:bw
Enc.

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

January 29, 1973

Dr. Donald Seegrist
Northeastern Forest Experiment Station
6816 Market Street
Upper Darby, Pennsylvania 19082

Dear Don:

Enclosed is the reprint of computer analysis of trout data. I received the reprints on Sagehen trout. I found the dedication to P. R. N. somewhat humorous and ironic in view of the former opinions expressed by Dick Gard. I suspect that Dick is wishing about now that he'd developed some of P. R.'s expertise in biopolitics to sell himself. It's hard to believe that Dick can't find some kind of job with a Ph.D. Does he stay home with the baby while Sylvia works?

Nothing new on my position. The Bureau's supposedly undergoing another great shake-up and reorganization, but I really haven't given the matter much thought. I've been too busy trying to keep all my projects going (trout taxonomy, rare and endangered species, graduate student research, etc.) and also teaching the ichthyology course.

I am going to give a seminar for the zoology department at the University of Wyoming next month. Oscar Paris is the Department head there.

Many thanks for Cynthia's gingerbread house. It was almost too pretty to eat. It did make a nice dual purpose gift - after they admired it and played with it, they ate it.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 30, 1973

Mr. Gordon Haugen
Lolo National Forest
2801 Russell
Missoula, Montana 59801

Dear Gordon:

Enclosed is a copy of a preliminary report on westslope cutthroat. Examination has begun on the specimens you sent, but it will be a few months yet before the analysis is completed.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 30, 1973

Dr. William Gould
Montana Coop. Fish. Unit
Montana State University
Bozeman, Montana 59715

Dear Bill:

George Holton mentioned that you have some collections of Montana cutthroat trout which he assumes to representative of the upper Missouri type. I'd like to arrange a loan of these specimens for examination.

Enclosed is a report on "westslope" cutthroat trout which discusses the significance of establishing the taxonomic characters of upper Missouri cutthroat (S. c. lewisi) before a decision can be made on the status of westslope cutthroat.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 30, 1973

Mr. Jack McIntosh
District Manager, B.L.M.
P. O. Box 1048
Dillon, Montana 59725

Dear Mr. McIntosh:

I previously had an inquiry from your office on westslope cutthroat trout. The enclosed report may be useful to answer certain questions on this trout that you are likely to encounter.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 30, 1973

Mr. Don Duff
Fisheries Biologist, B. L. M.
P. O. Box 11505
Salt Lake City, Utah 84111

Dear Don:

The enclosed report concerns the "westslope" cutthroat trout. These trout are removed from your area now (except, perhaps in the Raft River drainage) but they are part of the whole picture and I thought you might be interested. If you can suggest people who should have this report let me know.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 30, 1973

Mr. Robert J. Bell
Idaho Fish and Game Department
Box 138
Jerome, Idaho 83338

Dear Mr. Bell:

I would very much like the opportunity to examine the specimens of cutthroat trout you found spawning in November.

The enclosed report on "westslope" cutthroat trout discusses the significance of learning more about the cutthroat native to the Snake drainage above Shoshone Falls. I am particularly interested to see if your specimens are of the fine-spotted or large-spotted race.

When you have an opportunity to wrap and package the specimens, I would appreciate it if you would mail them to me. I'll send a report of my opinions concerning their systematic status.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 30, 1973

Mr. James L. Cooper
Kanksu National Forest
Box 490
Sandpoint, Idaho 83864

Dear Mr. Cooper:

Examination of your samples from South Granite and Brett Creeks has been completed. The problems of determining the taxonomic status and distinguishing characters of the westslope cutthroat trout is complex and of interest to many people. For this reason, I wrote a preliminary report to cover the subject and included the evaluations of of the Granite Creek and Brett Creek samples.

I am relatively confident that South Granite Creek above the falls, has a pure population of westslope cutthroat. I believe there is a very slight contamination of rainbow trout in the Brett Creek population.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 30, 1973

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

Dear George:

Enclosed is a preliminary report on westslope cutthroat trout.

Thanks for the information on the collection at Montana State. Ilil write Dr. Gould and try to arrange a loan. I am still at C. S. U. but I am attached to the Fish Genetics Lab at Buelah, Wyoming for administrative purposes. The Bureau is undergoing another re-organization and I don't know what the future holds. I may look into a University appointment if the Bureau tries to move me.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 30, 1973

Mr. Osborne Casey
Flathead National Forest
Kalispell, Montana 59901

Dear Osborne:

Enclosed is a preliminary report on westslope cutthroat trout.

Many thanks for your help and the excellent series of slides and notes you recently sent.

We have started examining the specimens received during the past year. Some samples look like pure westslope cutts and some are obvious hybrids. The color slides greatly assist my evaluation. The Whale Creek trout certainly don't resemble westslope cutts in their spotting. You mentioned there is a falls on Whale Creek. I wonder if trout were native above the falls?

In checking the list of Middle Fork Flathead tributaries against my inventory of westslope cutthroat samples I can't find a collection for Gateway Creek. I have 54 samples collected in 1972 mainly from the Flathead and Lolo National Forests, one samples is listed as "Unknown" Creek and it could be Gateway Creek. Did you send a collection from Gateway Creek?

Sincerely,

Robert Behnke

RB:bw
Enc.

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

January 31, 1973

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

Dear Mrs. Gots:

Enclosed is copy of FAO outline. The following citations to S. salar hybrids are selected from more obscure sources that may not be familiar to Dr. Mac Crimmon. I have omitted the better known references such as Alm (1955).

Abrakumov, V.A. 1960. Local disruption of the reproductive isolation between salmon and sea trout. Tr. VNIRO, 42:167-170 (Russian)

Alabaster, J.S. and F.J. Durbin. 1964. Blook groups in salmon, trout and their hybrids. Salmon Research Trust Ireland, Ann. Rept. 1964:38-39.

Arens, C. 1894. Uber den Lachabastard. Allg. Fish. Ztg., 19:346-347. S. salar x s. trutta hybrids reported infertile. Produced at Huningen, Alsace.

Cordier, Goni P. 1939. Hypothese sur un hybride du sallmon et de la truite (Salmo salar - Salmo (Trutta) fario). Riviera Scientifique (Nice)26(1-2):3-10. Report of natural hybrid.

Day, F. I have 11 references to Day's hybridization with Salmonidae. I believe they are covered in Day's 1887 book: British and Irish Salmonidae. Williams and Norgate, London: 312p.

Europeitseva, N.V. and G.V. Belyaeva. 1963. Experimental-ecological ahalysis of the fry of the hybrids of the Baltic salmon (Salmo salar) and the sea trout (Salmo trutta) grown in ponds. Akad. Nauk Latv. SSR, Inst. Biol., Rybn. Khoz. Vnutr. Vod. Latv, SSR, 7:297-308. (Russian).

Fehlman, W. 1926. Die Ursachen des Ruckganges der Lachsfischerei in Hochichein. Beitrage z. Jahresfericht der Kantonsschule Schaffhausen. 112p. (Alm, 1955 cited Fehlman's work).

Gaylord, H.R. and M.C. Marsh. 1912. Carcinoma of the thyriod in the salmonidfishes. Bull. U.S. Bur. Fish., 32:363-524 (S. frontinalis x S. salar).

Haen, P.J. and F.J. O'Rourke. 1968. Protein and haemoglobins of salmon-trout hybrids. Nature, 217(5123):65-67.

Haen, P.J. and F.J. O'Rourke. 1969. Comparative electrophoratic studies of soluble eyelens proteins of some Irish freshwater fishes. Proc. Roy. Irish Acad., Sect. B, 68(4):67-76 (Salar x trutta)

also: ibid. 68(7):101-110.

Jones, J.W. 1948. Salmon and trout hybrids. Proc. Zool. Soc. London, 117(4):708-715.

Riggins, D.J. 1965. Salmon and sea trout hybrids. Sal. Res. Trust Ireland, Ann. Rept. 1964:27-37 (Also in Atlantic Salmon Journal, Fall 1965:3-5.

Piggins, D. J. 1966. Further studies on thespecific characteristics of brown trout and salmon-sea trout hybrids. Sal. Res. Trust Ireland, Ann. Rept. 1966:29-32.

Piggins, D.J. 1970. Salmon x sea trout hybrids (1969-70). ibid. 1970, 15:41-58.

Winge O. and E. Ditlevsen. 1948. A study on artificial hybrids between salmon (Salmo salar) and brown trout (Salmo trutta). Compt. rend. Lab. Carlsberg, Ser. Physiol. 24(23):317-345.

Spaas, J.T. and M.J. Heuts. 1958. Contributions to the comparative physiology and genetics of European Salmonidae. II. Physiology and genetics of embryonic development. Hydrobiologia 12(1):1-26 (salar x trutta physiology and mortality).

I must apologize for the delay in replying to your letter of December 20. I had begun putting together a list of hybrids references some time ago but got involved in other urgent matters and misplaced the material.

Enclosed is a recent reprint from Systematic Zoology. I would appreciate a reprint of the recent paper in Jour. Fish. Biol. co-authored by Dr. Mac Crimmon.

Sincerely,

Robert Behnke

RB:bw
ENc.

Colorado Cooperative Fishery Unit
Colorado State University
Fort Collins, Colorado 80512

February 1, 1973

Dr. Frank Schwartz
Institute of Marine Sciences
University of North Carolina
Morehead City, North Carolina 28557

Dear Frank:

Enclosed are a few reprints from Systematic Zoology on computer clustering of taxonomic data.

If you have reprints of the paper: Fishes of Central Appalachian drainages, co authored with Jenkins and Lachner, I would appreciate one. I have been interesteed in the southern Appalachian brook trout, Salvelinus fontinalis. I would appect that there should be subspecific differences form the northern populations. Because of the indescriminate stocking and introductions of northern brook trout over the years. I suspect the original stocks are about gone in their pure form. Do you know of any likely source of isolated populations that might be pure?

Sincerely,

Robert Behnke

RB:bw
Enc.

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

February 1, 1973

Mr. Dean Doell
Humboldt National Forest
976 Mountain City Highway
Elko, Nevada 89801

Dear Dean:

Many thanks for copies of the stocking records. I take it that this stocking was done by the Forest Service and not Nevada Fish and Game. Between the two, I don't think they missed many streams with native fish.

We have the Nevada samples almost completed. The effects of introductions of rainbow trout is quite apparent in the populations in the streams of the Mt. Wheeler area, where almost all trace of native cutthroat is gone except for Muncy Creek and headwaters of Hendrys Creek (The very headwaters where Frank Dodge made a collection last June has a pure population and should be protected at all costs). In the Humboldt drainage, however, despite a similar stocking history, there is no obvious hybrid influence in our samples. When the data is analyzed, I'll get a report to you and Pat Coffin.

Has anything more been done concerning possible transplants of Humboldt cutthroat?

Sincerely,

Robert Behnke

RB:bw
Enc.

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

February 5, 1973

Mr. Henry McKirdy
U.S. Forest Service
Division of Range and Wildlife Management
Federal Building
Missoula, Montana 59801

Dear Hank:

Enclosed is a write-up on westslope cutthroat trout. It points out the taxonomic problems and about where we stand at present.

My own research is spread along so many diverse lines that I do not believe I will have the time to complete a well-documented, authoratative report on the westslope cutthroat, which would determine its systematic status and provide all the answers necessary for its protection and management. This type of information analysis and synthesis is more ideally suited for a graduate student thesis project. At this time of year I plan for the forthcoming year's graduate projects and accept new students. My present source of funds for student support - Bureau of Sport Fisheries and National Park Service, must be spread over rare trouts in general. I would like to begin a single group in-depth project such as the westslope cutthroat trout for M.S. thesis research, but must develop a source of funds to finance a student.

Could you let me know what the Forest Service plans are for financing rare and endangered work this year in your region? I plan to talk with Dale Jones next week and see if the southwestern region is interested in similar projects on Gila, Apache or Rio Grande trouts.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

February 5, 1973

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

Dear Carl:

Many thanks for the translation of the salmon and trout paper. I had never seen the original, but recently I made a bibliographic reference to it for the F.A.O. synopsis on Salmo salar, I am compiling so I was most happy to have a copy.

Enclosed is an abstract of a seminar I plan to present at the University of Wyoming later this month. If I must make a trip to Washington, I'll let you know and perhaps we can arrange a visit.

I came across a references to a volume on the distributional history of the biota of southern Appalachia (V.P.I. monograph 3). There is a section on fishes by Jenkins, Lachner and Schwartz. I wrote to Frank Schwartz for a reprint. Have you seen this work?

Vedor Wespestad tells me that he will join the C.S.U. alumni association at V.P.I. this year.

Best regards:

Robert Behnke

RB:bw
Enc.

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

February 5, 1973

Dr. G. S. Whitt
Department of Zoology
University of Illinois
Urbana, Illinois 61801

Dear Dr. Whitt:

Many thanks for the collection of reprints. I find them most stimulating, as I did the two seminars you presented. I am interested in biochemical application to fish taxonomy with a view of testing some assumptions on evolutionary affinities in some salmonid fishes. I hope to begin a graduate student project and if I do, I will prepare an outline of the goals and objectives which I would send to you for review and suggestions. What we need is a series of proteins representing a gradation of rate of evolutionary change that might be helpful in assessing monophyletic divergences taking place from the time of the last glaciation extending back to the Pliocene. In some publications, I give lip service to what biochemical techniques might do to provide critical information on questions that can not be answered with any authority based on orthodox methods.

Enclosed are a few recent reprints.

Sincerely,

Robert Behnke

RB:bw
Enclosures

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

February 7, 1973

Dr. John Ramsey
Alabama Cooperative Fishery Unit
Auburn,,University
Auburn, Alabama 36830

Dear John:

Enclosed is the reprint from Systematic Zoology (they just arrived). Also a copy of a rare and endangered fish report I prepared on various fishes for state and federal agencies. This particular trout is officially listed although of unknown taxonomic status. The Forest Service, B.L.M. etc. must consider its preservation before habitat alteration - but no one can distinguish it when they find it. The trouts are interesting that way; you can make the rules to the game as you go along.

The other enclosure is an abstract of a seminar for the Zoology Department of the University of Wyoming. The subject matter is the basis for a ppper that will soon be submitted for publication.

Many thanks for the copy of Rare and Endangered Vertebrates of Alabama. It's a well done piece of work and most helpful for my own efforts along these lines.

Sincerely,

Robert Behnke

RB:bw
Enclosures

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

February 8, 1973

Mr. Harvey Willoughby
United States Department of the Interior
Bureau of Sport Fisheries and Wildlife
10597 West Sixth Avenue
Denver, Colorado 80215

Dear Harvey:

I received the copy of your letter concerning the visit of Dr. Vukovic. I note that his schedule only allows a few days in Colorado (Apr. 6-10). Let me know when he would come to Fort Collins and how much time he could spend with me and I'll arrange an itinerary. There are several sites around Fort Collins that could be visited in a day, such as an experimental research hatchery, a production hatchery, warm water fish culture and the research laboratory of Colorado Division of Wildlife. If we could have 2-3 days, a visit to Rocky Mountain Park and/or to some of my trout research sites in the mountains west of Fort Collins could be arranged.

Let me know your plans. I'll be looking forward to visiting with Dr. Vukovic and discussing Yugoslavian and American fishes.

Sincerely,

Robert Behnke

RB:bw
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

February 8, 1973

Dr. Alan M. Campbell
Section on USSR and Eastern Europe
National Academy of Sciences
2101 Constitution Avenue
Washington, D. C. 20418

Dear Dr. Campbell:

I would be pleased to host Dr. Vukovic during this part of his stay in Colorado. I will contact Mr. Willoughby and we will work out the schedule.

Sincerely,

Robert Behnke

RB:bw
cc: Mr. Harvey Willoughby

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

February 9, 1973

Business Center for Academic Societies Japan
4-16, Yayoi 2-Chome, Bunkyo-ku
113 Tokyo, Japan

Enclosed is remittance for my 1973 membership to the Japanese Sooiety of of Ichthyology.

Robert Behnke

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

February 14, 1973

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

Dear Bill:

The specimens arrived in excellent condition. They are an important group because the Smith River, joining the Missouri near Great Falls should be expected to have S. c. lewisi, very similar or identical to the cutthroat trout of the type locality of this subspecies. It's too early to say anything definite yet but indications are that the native trouts of the upper Missouri (S. c. lewisi) and the upper Columbia in Montana (westslope cutthroat are very similar to each other. Both appear to be divergent from Yellowstone drainage cutthroat which probably have their closest affinities to the large-spotted cutthroat native to the headwaters of the Snake River, Wyoming.

I'll return the specimens after they have been examined, X-rayed and pertinent data recorded. Do you have reason to believe that these samples represent pure population?

Enclosed is an abstract of a seminar based on the results of stocking two subspecies of cutthroat together in a small lake. Their ecological segregation was quite striking. A manuscript has been prepared for publication on the subject.

Sincerely,

Robert Behnke

RB:bw
Enclosure

Colorado Cooperative Fishery Unit
Colorado State Universities
Fort Collins, Colorado 80521

February 14, 1973

Dr. Ronald A. Ryder
Department of Biology
Memorial University
St. John's, Newfoundland, Canada

Dear Ron:

I heard part of a recent tape you sent down and I was reminded that you are in an area that I would like to get specimens of char (Salvelinus).

Enclosed is a reprint recounting some problems (see p. 646-647). I would like to know if Newfoundland char are more similar to the char with high numbers of gillrakers or to the low number groups, or if they are intermediate.

If you have an opportunity to discuss the matter with faculty or students working with fish, perhaps they could collect some specimens for me. Ideally, I would like representatives of both anadromous and landlocked populations.

It sounds like you're enjoying your stay.

Sincerely,

Robert Behnke

RB:bw
Enclosures

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

February 15, 1973

Dr. Stephen H. Taub
Division of Fisheries Services
Bureau of Sport Fisheries and Wildlife
Washington, D. C. 20240

Dear Steve:

I am returning the Ball Pond creek census reports, many thanks for their loan.

I was frustrated to observe the tremendous effort to detail all sorts of data on the fishermen but not much on the fish. The reports seem more sociological thean biological. There is no way I could interpret clear-cut differences between the "domestic" and "western" (Donaldson ?) rainbow trout with the data presented. Also, the different times of stocking and size differences precludes any analysis of genetic based influence on the catch.

I'll submit a manuscript for publication soon which I hope will stimulate more sophisticated thought concerning intraspecific genetic variability and its application to fisheries management. Enclosed is an abstract of a seminar to be presented on the subject.

Sincerely,

Robert Behnke

RB:bw
Enclosure

Bob Azevedo

Feb. 15, 1973

Bob Behnke

Specimen of R. & E. write-up on greenback trout for examination

Enclosed is the section on greenback cutthroat trout I prepared. It is somewhat more detailed and lengthier than most of the other species will be. This is due to the fact that there is virtually no published information to cite and therefore I elaborated from my personal files. I will aim to have the write-ups slanted to provide sufficient information so the team can select those species where a recovery program is feasible. I received the policy statement. I'll have Dr. Steinhof go over it and we'll send any comments next week. Also enclosed is a reprint on "westslope" cutthroat trout. It probably enters the region in Wyoming and the region should be aware of the information included in the reprot.

Robert Behnke

Cooperative Fishery Unit
Colorado State University
Fort Collins, Colorado 80521

February 15, 1973

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

Dear Dick:

Thanks for the slide of the Kootenai drainage cutthroat trout. Could you send me a list of collections you've made, or have available to you for study? I received 52 samples of cutthroat trout from the upper Columbia River basin this summer (500 + specimens.) Most of the samples, however, are from the Flathead drainage of Montana. The enclosed report I just completed on "westslope" cutthroat will bring you up to date on this facet of my systematic studies. You might consider the specimens you have and the role you could play in answering the questions or problems posed in this report as part of your sabbatical research.

Sincerely,

Robert Behnke

RB:bw
Enclosures

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

February 21, 1973

Mr. Robert J. Bell
Regional Fishery Mgt. Biologist
P. O. Box 188
Jerome, Idaho 83338

Dear Mr. Bell:

Enclosed is an addressed label for shipment of the cutthroat trout specimens. This label will permit postage-free mailing.

Formalin preserved specimens are best for taxonomic examination. If a histological study is necessary to determine maturation sequences, then fresh frozen specimens may be needed, and I thank you for the information regarding their shipment.

Also enclosed is a report on "westslope" cutthroat trout, pointing out the gap in knowledge regarding the cutthroat trout of your area. I hope to arrange a field trip in your region this year and will contact you when I am able to better formalize my schedule.

Again, I express my appreciation of your assistance.

Sincerely,

Robert Behnke

RB:bw
Enc.

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

February 26, 1973

Dr. Paul D. Hurd, Jr.
Dept. Entomology
National Museum of Natural History
Washington, D.C. 20560

Dear Dr. Hurd:

Enclosed is an abstract for a paper for presentation at the annual meeting in Boulder, Colorado, next August.

Please send a copy of ICSEB Bruchure 2.

Sincerely yours,

Robert Behnke

RB:dch

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

February 28, 1973

Mr. Gary Thorgaard
2535 Taylor
Corvallis, Oregon 97330

Dear Mr. Thorgaard:

I have been exploring possibilities of financial support for you to conduct a graduate research project in some aspect of salmonid systematics. There may be a teaching assistantship available which primarily consists of assisting in the laboratory of my ichthyology course and curating our teaching collection of fishes. It would be highly desirable if I could find summer employment for you which would allow you to conduct field work and gather data on your research. For example, study of the "westslope" cutthroat trout might be financed by the U.S. Forest Service and provide financial assistance during the summer months. The problems of the westslope cutthroat trout are summarized in the enclosed report.

You may let me know your thoughts on the matter. I should be able to provide you with more details on financial assistance and arrangements in the near future.

Sincerely yours,

Robert Behnke

RB:dch
Enclosure

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

February 27, 1973

Dr. Ray Simon
Oregon Cooperative Fishery Unit
Oregon State University
Corvallis, Oregon 97330

Dear Ray:

Enclosed is a copy of an article chum salmon karyotypes from Journal of Ichthyology (translation of Voprosy Ihktiologii) 11(6). Also a copy of a draft of a ms. on using native races of cutthroat trout in a fisheries management program and my ideas on preserving genetic diversity.

I made up an outline of a program submission last year to assist the Bureau in coming to a decision on my future. Enclosed is a copy. I don't have the enclosures mentioned in the outline except for the letter to Terry Merkle re. performance of Snake River cutthroat in a lake in New Mexico. We now have data on Snake River cutthroat in four additional lakes in Utah and the trend is similar - I'm trying to keep this project going and asked Putz to request a one year extension of a graduate student research contract. These are some of the matters we can discuss next month when you get to Buelah.

Sincerely,

Robert Behnke

RB:bw
Enclosures

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

March 6, 1973

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

Dear Fred:

Enclosed are 5 copies of the manuscript as it was submitted to the Transactions of A.F.S.

You are likely to hear more about experimenting with different races of trout. Ray Simon has been appointed director at the Buelah Genetics Lab and I will probably get together with him later in the month to discuss programs the lab can initiate. I would like to see more effort on evaluation of some of the fishes Wyoming is raising such as Snake River cutthroat, Eagle Lake rainbow, Ohrid trout, Bighorn cutthroat, etc. This will necessitate federal-state cooperation and I think I can count on you to endorse and support such work, particularly if it provides directly relevant data for your management program.

I requested Ron Kent get some stomach samples throughout the season from rainbow trout, "Yellowstone" cutthroat and Snake River cutthroat in Buffalo Bill Reservoir, so we can determine their ecological niche and how they specialize. Ron said he'd try and an occasional reminder from you may provide the needed stimulus to get the job done. The material can be sent to me and we'll take care of the analysis.

Sincerely yours,

Robert Behnke

RB:dch
Enclosures

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

March 6, 1973

Mr. James Dangle
College of Fisheries
University of Washington
Seattle, Washington 98195

Dear Jim:

Many thanks for a copy of the revised bibliography and the copy of Acta Zool. Sinica. I couldn't find the location of the Yathong River in Tibet (the site where S. trutta was collected), but I note that a large area of Tibet is drained by the Ganges and particularly the Indus River, where the British introduced S. trutta many years ago. Undoubtably the record is from an upstream spreading in the distribution of the introduced trout. The upper Yangtze River forms the eastern border of Tibet, and this is the area where Hucho bleekeri occurs. I was hoping the article would mention something about Hucho.

I have therreprints of the Russian articles you mentioned by Savvaitova and also by Shaposhnikova (plus several more) concerning S. malma and S. alpinus.

My opinions on the validity of S. malma are found in my paper in the Jour. Fish. Res. Bd. Canada 29(6) and in correspondence with Savvaitova (a copy was sent to you last year). I have read all (or almost all) of the Russian papers regarding the systematics of alpinus and malma but I haven't put the translations into writing.

I note in your manuscript that Salmo aguabonita is usually erroneously spelled as S. aquabonita. On p. 31, Coregonus clupeiformis (freshwater herring) shouldbbe: C. clupeaformis (lake whitefish). The answer to your question noted in "Fishes of Glacial Park" regarding S. gairdneri crescentis and S. gairdneri beardsleei is that both rainbow trout and cutthroat trout were native to Crescent L., Washington. The type specimen of "crescentis" is a cutthroat trout (S. clarki), the type of "beardsleei" is a rainbow (S. gairdneri).

Another citation for your addenda file: Uyeno, T. 1972. Chromosomes of offspring resulting from crossing Coho salmon and brookttrout. Jap. Hour. Ichthyol., 19(3):166-171. I also found a note I once made to a reference of rainbow x golden trout hybrids maintained in a California hatchery described in the 19th (?) Bienn. Rept. Calif. Fish. Comm. (ca. 1900?).

You'll find reference to rainbow x cutthroat hybrids in the enclosed manuscript which has been submitted to the Transactions A.F.S.

Sincerely yours,

Robert Behnke

RB:dch
Enclosure

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

March 5, 1973

Ms. Johanna M. Reinhart
1040 Washington Building
15th Street and New York Ave., N.W.
Washington, D.C. 20005

Dear Ms. Reinhart:

Enclosed are two copies of a manuscript submitted for publication in the Transactions. The original photographs (Figure 1) and figures will be forwarded if the manuscript is accepted. Page charges will be paid.

The emphasis of the paper centers on the idea of utilizing intra-specific variability in fisheries management.

The experimental site is a public recreation area and our sampling program necessarily had to compromise between exhaustive removal of trout and the public relations. The experimental data, however, definitely supports our contention of ecological segregation between the two populations and the statistical data is valid. We have been assured of this fact by Dr. Mielke, recognized authority on non-parametric statistics at Colorado State University.

I raise this point because I anticipate that some reviewers may question the adequacy of our sample sizes and we would prefer to avoid a hand-up on this matter. Considering the size of the lake and the populations involved, our data is adequate to substantiate the assertions made. Above all, however, the major thrustoof the paper concerns new ideas on the application of concepts developed from evolutionary biology and genetic diversity and is not dependent on statistics to make our assumptions meaningful. The fact is, however, that the statistical data validates our assumptions. We hope that bickering over this point can be avoided.

Sincerely yours,

Robert Behnke

RB:dch

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

March 7, 1973

Mr. Gary H. Thorgaard
2535 N.W. Taylor
Corvallis, Oregon 97330

Dear Mr. Thorgaard:

My present status has some degree of uncertainty. I am associated with the fish genetics lab of the Bureau of Sport Fisheries but am stationed at C.S.U. with the Department of Fisheries and Wildlife Biology. Dr. Ray Simon, Leader of the Oregon Cooperative Fishery Unit, will assume the directorship of the fish genetics lab and I plan to meet with him later in the month to discuss my role in the lab's program. I will stress the benefits of utilizing graduate students to conduct certain research projects in fish genetics.

Dr. Simon plans to leave for Buelah, Wyoming, is about one week and I would urge that you talk to him of your interests and perhaps gain some ideas on the types of research that the lab may be involved with. Will there be an area that you could participate your graduate research in under my direction at C.S.U.?

You, Dr. Simon and I have many common interests and goals. I am hopeful that mutually beneficial arrangements can be worked out that would allow you to be a graduate student at C.S.U. with both Dr. Simon and myself on your graduate committee.

Sincerely yours,

Robert Behnke

RB:dch

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

March 8, 1973

Mr. Frank Dodge
Nevada Dept. Fish and Game
P.O. Box 1109
Ely, Nevada 89301

Dear Frank:

We're still re-working data and double and triple checking specimens to get an acceptable level of accuracy in some difficult characters such as scale counts. There is also the problem is unexpected character values found in small populations such as Pine Creek, Hampton Creek, Goshute Creek due to "founder's principle" and genetic drift. However, comparisons of several samples from Pine, Hampton and Goshute creeks, now permit a valid evaluation of the diagnostic characters of the trout once native to Snake Valley on the Bonneville side of the divide, and a more definitive statement on the sample you obtained last June from the upstream limits of trout distribution in Hendrys Creek.

Coloration, spotting and morphology: In these characters the Hendrys Creek fish appear identical to the Pine Creek trout and its derivitives in Hampton and Goshute creeks.

Vertebrae number: Pine Creek, 60-64 (62.3); Goshute Creek, 61-64 (62.3); Hampton Creek 59-63 (61.5). All these populations are from a common genotype and the lower values in Hampton Creek may be due to direct environmental effect and/or "founder's principle" whereby the introduced fish from Pine Creek that survived to establish breeding populations were not representative of modal values of parental population but were skewed toward one extreme or the other in the natural range of variability (also this effect is apparent in gillraker numbers). I would surmise that the populations once native to Snake Valley probably had vertebral counts of 60-64 with mean values of 62-62.5. Your sample of trout from the head of Hendrys Creek are 61-64 (62.4) (N=17).

Gillraker numbers: Pine Creek, 19-25 (22.0); Hampton, 20-23 (20.9); Goshute, 17-22 (20.0). Gillraker numbers are generally stable and little affected by environmental influences. The surprising difference between the 3 localities from a common genotype is likely due to the "founder's principle". It may be that the Pine Creek population have higher counts than the parental stock from which they were established. I would assume that modal values of 20-22 were found in the original populations of Snake Valley cutthroat. Your Hendrys Creek sample is 18-23 (20.9) (N=20).

Pyloric caeca: Individual variability ranges from 25-47; the mean values are: Pine Creek (33.6); Hampton Creek (32.1); Goshute Creek (36.4); Hendrys Creek (36.1).

Scale counts mean values: Pine Creek (147); Hampton (144); Goshute (144); Hendrys (142). These counts are lower than in any other subspecies of cutthroat trout except for the Humboldt cutthroat.

Basibranchial teeth counts have great individual variability (5-90) but mean values are higher than for any other subspecies of cutthroat trout. Pine Creek (27.3); Hampton (27.3); Goshute (28.6); Hendrys (23.5). A single specimen (of 20) from your June, 1972, sample from Hendrys Creek completely lacked basibranchial teeth - and this is the only evidence of possible rainbow trout influence in this sample. This sharply contrasts with the 7 specimens you collected "above the falls" in the headwaters of Hendrys Creek in 1970. Four of those 7 specimens lacked basibranchial teeth. Other characters differ between your 1970 and 1972 samples and I am certain that the 2 samples (1970, N=7 and 1972, N=20) could not have been from a continuous interbreeding, homogeneous population. There must be some degree of reproductive segregation between the populations represented by your 1970 and 1972 samples, although both occur in the headwater section above a falls. I would urge that every effort be made to protect the population you sampled last June and prevent any mixing with the more hybridized population occurring downstream (but above the falls). I endorse your suggestion made in a letter to Jack Wilcox that the fishes in Hendrys Creek be eradicated below a point where you made the collections last June. This would allow the entire stream to be inhabited by essentially pure Snake Valley cutthroat of the original type. Also transplants to barren streams (or those made barren by eradication) should be attempted this year. The population in the very headwaters of Hendrys Creek is the best example of the original cutthroat trout native to the Snake Valley area. All other streams with cutthroat trout phenotypes in the Trout Creek-Deep Creek drainages are definitely hybrids (Muncy, Mill, Johnson).

The 1972 sample from Mill Creek is interesting. The vertebrae count (60-64 [62.1]) is lower than that found in the 6 specimens you collected from there in 1970 (63.5). They are predominantly cutthroat of the native type but the gillrakers are 17-22 (19.3), scales 139-175 (154), basibranchial teeth 2-27 (13.2) and caeca 34-58 (42.2). The Muncy Creek sample is also predominantly cutthroat (but with more evidence of rainbow hybridization than Mill Creek). They have fewer vertebrae (60.9), gillrakers (19.1) and scales (134) than the other samples and 2 of 15 lack basibranchial teeth (mean total count of sample is 8.7).

When the data is ready to proceed with a formal description of a new subspecies, I'll probably use the Hendrys Creek sample for a type specimen and the headwaters of Hendrys Creek will be the type locality for the subspecies. So, these are a most important population.

Sincerely yours,

Robert Behnke

RB:dch
cc: Mr. Dean Doell

James Mullen, Fishery Management Biologist, 3/9/73
Vernal, Utah

Robert Behnke, Colorado Cooperative Fishery Unit,
Colorado State University, Ft. Collins, Colo. 80521

Snake River cutthroats

Dear Jim:

If you plan tobbe up this way in the near future, let me know, I'd like to get together with you and discuss a tentative plan for sampling the U & O lakes stocked with Snake River cutthroats so that we can supplement last year's data and obtain sufficient data for a MS thesis.

I have a graduate student, Mr. Paul Sekulich, working on the project and he has analyzed last year's data and the food habits of the specimens.

Enclosed are some summaries of the findings. You'll note that there are interspecific food habit differences in the lakes and also food habit differences between size groups of the same species. There is strong evidence (as you know) that the Snake River cutthroat survival ratio becomes increasingly greater than the rainbow after one year in a lake. The low angler vulnerability of brook trout in Bottle Hollow is almost certainly an example of interactive segregation, as we found in North Michigan Lake (see enclosed manuscript). The greater angling vulnerability of the rainbow trout is likely due to their hatchery origin and the methods of the fishermen. We found the Snake River cutthroat trout more vulnerable than wild rainbows in North Michigan Lake under artificial lure only regulations. I suspect the same is true at Towave. There appears to be a substantial contribution of wild hybrids in both Weaver and Towave.

Some data from Stone Lake, New Mexico, is included for Terry Merkel's benefit.

We would like further information on the following subjects:

<u>Weaver Reservoir</u>

(1) Summer water temperature (July & August)
(2) Exact years and numbers of fish stocked, including 1972. (The annual report mentions a 1963 rainbow stocking but does not state what years Snake River cutthroats were stocked).
(3) Are 2,000 cutthroats stocked every year and are they always approximately 7" when stocked?

Towave Reservoir

(1) Has any evidence appeared of a resident rainbow population in Hill Creek just above Towave?
(2) Did cutthroat stocking begin in 1966 or 1967? What did stocking consist of in 1972?

Bottle Hollow Reservoir

(1) Need 1972 stocking data.
(2) Is spawning possible in inlet of Bottle Hollow? Does it occur at all?

Midview Reservoir

(1) Have any cutthroats appeared after collection of 5 October 1972 (which showed no cutthroats)?
(2) Elevation?
(3) Summer temperatures
(4) In 1972, stocking data (and did total 1971 stocking consist of 50,752 rainbows or were more stocked?).
(5) Spawning possibilities.

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

March 9, 1973

Mr. John Hewitson
1033 San Abella Drive
Encinitas, California 92094

Dear Mr. Hewitson:

Thank you for a copy of your M.S. thesis and a report on New Zealand rainbow trout. If you haven't already read it, a paper by W.E. Ricker, "Hereditary and environmental factors affecting certain salmonid populations", in: The stock concept in Pacific Salmon. 1972. H.R. MacMillan Lectures in Fisheries, Univ. Brit. Col., gives an interesting summary of genetic and environmental factors influencing many traits such as anadromy.

Thanks also for the beautiful and detailed illustration of the Mt. Palomar trout. There is little doubt that trout were indigenous to the streams of the region, but continuous introductions of hatchery rainbows have probably obscured the native genotypes. However, your observation on the orange belly and dorsal fin tip is most interesting. These are among the diagnostic characters of my "red-banded" group. My interpretation is that the golden trout-red-banded group occurred in California prior to S. gairdneri. There were no reproductive barriers and after the invasion of S. gairdneri, hybridization and displacement took place except in a few isolated areas such as the head of the Kern River drainage and the upper McCloud River drainage above the falls. The original trout of the Mt. Palomar region (before stocking) was likely a transitional form (due to hybridization) intermediate between the red-banded trout and rainbow trout -- hence the orange colors. I would expect this trout is native to Baja. Stocking of hatchery rainbows has probably so diluted the original genotype that only an occasional specimen with orange colors is seen today.

I once examined a sample of 7 trout from upper Siberia Creek, San Bernardino Co., reputed to be of an unusual type. They were heavily spotted, but except for slightly lower numbers of vertebrae and pyloric caeca, their characters were typical of S. gairdneri.

Dr. Hubbs certainly has an amazing memory! I have always been impressed by his precise recolletions from a field trip of 40 or 50 years ago or an offhand citation to an obscure publication. The salmonid fishes are great to stimulate disagreement among ichthyologists because species boundaries are not sharply delimited as in most other groups and the usual criteria for species and subspecies often just aren't very practical in salmonid taxonomy. The lack of agreement between Dr. Hubbs (and also his son-in-law, R.R. Miller) and myself over the assignment of gilberti to gairdneri or aguabonita is a good example. It mainly centers on my contention that gilberti and whitei are similar and whitei then becomes a synonym of gilberti, which in turn places gilberti under aguabonita. Almost certainly, rainbow trout invaded the Kern River and hybridized with the original native trout (golden trout) except iniisolated areas such as the head of the South Fork of the Kern and Golden Trout Creek (S. aguabonita aguabonita). Was this hybridization sufficient to make the native Kern trout (gilberti) more similar to gairdneri than to aguabonita? If so, was the population in the Little Kern River (whitei) effectively isolated from the main Kern to retain its affinities to aguabonita?

My examination of the original specimens collected from the Kern (gilberti) and from the Little Kern (whitei) showed they were virtually identical and their characters are more similar to aguabonita than to gairdneri (by current definition, aguabonita and gairdneri should be of the same species because they hybridize - but then aguabonita also hybridizes with S. clarki and you can't make it a subspecies in two different species). The real obstacle to a really definitive study is the fact that man has so messed up the native fauna by introductions that we'll never know for sure what was the original situation.

Sincerely yours,

Robert Behnke

RB:dch

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

March 9, 1973

Mr. Robert Bell
Idaho Fish and Game
P.O. Box 133
Jerome, Idaho 83338

Dear Mr. Bell:

The two specimens of trout were received and examined. Their taxonomic characters reveal that they are rainbow x cutthroat hybrids. The female appears to be predominantly cutthroat and the male predominantly rainbow. This fact would seem to eliminate the possibility of a distinct fall spawning race of native trout. Still your observations of spawning activities on November 18 is noteworthy. This is probably the earliest observed spawning in nature of any cutthroat or rainbow trout (or hybrid) and raises several fascinating questions on the relative influences of photoperiod and temperatures on the time of spawning. I plan to look into this matter in more detail and will probably write a short note for publication. If it is agreeable with you I would list you as co-author.

Was Vinyard Creek the collection site where you saw spawning activities in November? Can you give me the precise location? Did you find any eggs in redds in November? You mentioned that you know trout spawn in Vinyard Creek in the spring. Do you have any dates when spring spawning was observed? I believe you told me that the source of the creek is a constant temperature spring. Would you have any data on temperatures?

Thank you for your cooperation. These specimens, although hybrids, are certainly most valuable. I still am not able to determine, however, if the cutthroat ancestry of the specimens is of the fine-spotted or large-spotted variety of Snake River cutthroat trout. I will be anxious to examine specimens from pure native cutthroat trout populations of your area.

Sincerely yours,

Robert Behnke

Richard J. Baldes, Fishery Management Biologist,
185 S. Fifth St., Lander, Wyoming 82520

3/12/73

Robert Behnke, Colo. Coop. Fishery Unit, Colo.
State Univ., Ft. Collins, Colo. 80521

AFS Presentation

Enclosed are reports on westslope cutthroat trout and Colorado River cutthroat trout which essentially cover what I discussed in Cheyenne. Also is some information I put together on golden trout on the Wind River Reservation.

I regret I had to miss your talk but I had a class to teach on Friday. Bill McConnell told me you made an excellent presentation.

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

March 12, 1973

Dr. Clare Stalmaker
Utah Cooperative Fishery Unit
Utah State University
Logan, Utah 84321

Dear Clare:

I noted in the latest monthly regional report that you and Paul Holden submitted a ms. on fish distribution in the Delores and Yampa Rivers.

Could you kindly send me a copy of your ms.? I've been putting together information on rare fishes and would be particularly interested in your findings on Ptychocheilus, Xyrauchen and Gila.

Enclosed are reprints for you and Paul on a taximetric analysis of trout data.

Sincerely,

Robert Behnke

RB:bw

Fiscal Officer, Bureau of Sport Fisheries and Wildlife, Albuquerque, New Mexico

3/12/73

Robert Behnke, Colorado Cooperative Fishery Unit,
Colorado State University, Ft. Collins, Colo. 80521

Outstanding Travel Advance -- See attached memo

Our records indicate that as far back as Fiscal 1971, Robert Behnke had no outstanding travel advance. Could you please check your records and indicate when this advance remained last on record in your files and from what Travel Voucher it remained outstanding?

Thank you.

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

March 12, 1973

Dr. Frank Schwartz
University of North Carolina
Institute of Marine Sciences
Morehead City, North Carolina 28557

Dear Frank:

I found two Coop. Unit reports with articles by Leik and by Burkhart on splake. I Haven't seen the theses on which the articles are based, and I believe the only way you could gettthem would be through an inter-library loan.

Thanks for the interesting reprints. I note that you have some knowledge of fish anomalies and perhaps you can assist me. I received a specimen of a large (ca. 3-1/2 lb.) rainbow trout caught by a fisherman in Lake McConaughy, Nebraska. This trout has the body of a smaller fish grown into the ventral surface. The "parasitic" body is about 6 in. and a head a fins (in deformed condition) can be made out clearly. Although the tissues are continuous and fused between host and parasite, the coloration is different. I suspect they started out as Siamese twins (a relatively common occurrence in trout hatcheries) and one individual became dominant while the other developed as an appendagge

The CSU library lacks the Gulf Coast reports of Dawson's bibliographies of fish anomalies and I must arrange an inter-library loan to check on any previous reports of such a situation. Have you ever heard of anything like it?

I believe I sent some reprints of an article in Systematic Zoology. Allen Press delayed in sending a print-out for this reprint and a few are enclosed.

Sincerely yours,

Robert Behnke

RB:dch

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

March 12, 1973

Mr. James Dangle
College of Fisheries
University of Washington
Seattle, Washington

Dear Jim:

I found the exact citation to golden x rainbow hybrids. It is: Nineteenth Biennial Rept. of the State Board of Fish Commissioners of the State of California (1906-1907) 112 p. On p. 21 is the statement that 200 golden x rainbow hybrids are on hand of 3"-6" in length. Also on p. 51 is the comment that male rainbows were crossed with female goldens, They were a year and a half old at that time and more resembled the golden trout.

If you have turned up any new information on the rainbow x cutthroat hybrid used in Pyramid Lake, I'd like to hear about it.

For your general interests I can mention an unpublished study from California Fish and Game (The manuscript is entitled: "Coldwater reservoir studies: summary of experimental hybrid study). A hybrid between Kamloops rainbow and Lahontan cutthroat consistantly exhibited superior survival in lakes with competing species over various stocks of rainbows and inter-racial crosses of rainbows.

I received a copy of the manuscript from Steve Nicola of California Fish and Game last year.

Sincerely yours,

Robert Behnke

RB:dch

March 15, 1973

Dr. Carl Hubbs
Scripps Institution of Oceanography
LaJolla, California 92037

Dear Dr. Hubbs:

Thank you for your observations and notes on the trout from a tributary of the San Luis Rey River. I have not received the specimens from Mr. Hewitson but he did send a colored illustration indicating the orange tipped dorsal and orange ventral region - diagnostic characters of the golden - red-banded trout group. My opinions on the native trout of this region were expressed in a letter to Mr. Hewitson (copy enclosed).

My interpretation would be that a golden - red-banded trout was the first invader of the streams of southern California (Santa Ana, San Luis Rey, probably Baja). Later invasion of S. gairdneri hybridized with them to varying degress but introductions of hatchery rainbows have probably obscured the original situation.

I was asked for some advice and information regarding the life history of the original Pyramid Lake cutthroat trout. The Piute Indians have won a major court test and it appears that the Truckee River will again flow into Pyramid Lake. The questions concern how flows and temperatures will influence potential natural reproduction of the trout now being stocked into Pyramid Lake. The major fact I've pointed out is that the Lahontan cutthroat trout now being propagated (Heenan L.) is genetically far removed from the original Pyramid Lake stock and exploitation of life history data couldn't be made with much authority. It is unusual that the life history of such an important commercial fish as the Pyramid Lake cutthroat was not better known before its extinction. Snyder's account is the most complete, but there is a complete lack of detailed information on what part of the river contained the most important spawning grounds, the actual time of spawning and the timing and age of the down-stream migration of young to Pyramid Lake.

Summit Lake cutthroat trout are propagated also and I would like to know if you made any notes on these trout when you visited Summit Lake in 1934, such as their spawning run and size groups found in the tributary stream?

Sincerely yours,

Robert Behnke

RB:dch

John Varley and Jack Dean, Fishery Management Investigations, P.O. Box 184, Mammoth, Wyo. 82190

3/15/73

Bob Behnke, Colorado Cooperative Fishery Unit, Colorado State University, Ft. Collins, Colo. 80521

Grayling and Trout

I had to teach my ichthyology class on Friday, March 2, and could not attend the meetings in Cheyenne.

I endorse your action program to restore grayling to Grayling Creek. It may have some success if all other fishes are eradicated. It will remain to be seen if the grayling and cutthroat can coexist in such a small environment - the niche diversity present will provide the ultimate decision. If established, a fish-for-fun type fishery might be contemplated whereby all grayling caught must be returned. The grayling is exceedingly vulnerable to angling.

I wouldn't place undue emphasis on lacustrine vs. fluvial adapted grayling for considering a "pre-adapted" form for introduction into Grayling Creek. The grayling native to the upper Missouri basin (to Great Falls) was probably a homogeneous stock and not segregated into lacustrine and fluvial populations analagous to the isolation between the Yellowstone Lake and stream populations of cutthroat trout in the Yellowstone River drainage - in which case the genetic background of the stock could play a major role in its success in a new environment.

I don't know anything about the original grayling of Red Rock Lakes, Montana, however, and perhaps this stock had developed some lacustrine specialized ecological and behavioral traits - but I doubt that I could detect it in their taxonomic characters (as I can between Yellowstone Lake cutthroat trout and resident stream populations). Your line of reasoning is valid, however, and should be considered. I would suggest that the more heterozygonity introduced into Grayling Creek, the better the chances are of success of the newly established population. This would allow a broader base for natural selection to work on to more quickly adapt the new population to the conditions in Grayling Creek. Introductions of Grebe Lake grayling might be made along with those of a stream population and their relative survival evaluated. Once natural reproduction takes place, "unadaptive" genes would be quickly sorted out of the population.

M E M O

Yes, I would certainly like to obtain a cutthroat trout sample from Teepee Creek. We made a good start on a systematic survey of the native trout on both sides of the Continental Divide last summer. I hope to be back this summer to continue the work - which depends on the Park Service renewing their contribution to the program (put in a good word with Glen Cole if you have a chance).

Enclosed is a report on westslope cutthroat trout with mention of relationships of the Yellowstone trout. The evidence is fairly convincing now that the upper Missouri cutthroat trout (lewisi) are very similar to the upper Columbia (but not upper Snake) cutthroat trout - and it is the Yellowstone drainage trout that are different from both. The Yellowstone trout are similar to the large-spotted cutthroat native to the upper Snake. Samples collected last summer in the upper Snake and Sedge Creek (above Turbid Lake) are virtually identical. The Yellowstone Lake cutthroat is recognizeably different due to lacustrine selection for several thousand years. A graduate student and I recently submitted a manuscript to the Transactions A.F.S. on cutthroat trout coexistence and genetic diversity which discusses the genotype of Yellowstone Lake cutthroat trout in relation to selection pressures and success in new environments. The enclosed copy may re-inforce your thinking on the grayling matter.

March 19, 1973

Dr. Carl Schreck
Div. Forestry and Wildlife Sciences
Virginia Polytechnic Inst. & State Univ.
Blacksburg, Virginia 24061

Dear Carl:

Many thanks for our course outline. It gave me some ideas to incorporate into our course, particularly some handout material.

The big news here is that Dick Gard was hired for the fishery position at CSU - a real dark horse candidate. After Chapman and Youngs turned the job down and other people had accepted other offers - it about came down to the option of hiring Gard or losing the position. Dick came out for an interview last month and seemed quite cordial with me. I expect that he'll be here this week because he is already scheduled to teach the sophomore fishery course starting Wednesday, March 21. I haven't told Seegrist about Gard coming here. I thought he'd hear about it through their respective wives -- I expect an FTS call anytime now.

I have an unusual fish specimen on which I plan to write a note. It is a large rainbow trout caught in Lake McConaughy, Nebraska. Fused into the ventral region is a partially developed "parasitic" fish. Probably they started off as Siamese twins and one body became a parasitic appendange on the other. Dr. Kainer and an assistant are doing some histological investigations on the specimen. I don't think anything like this has ever been reported in the literature. There is a bibliography (and two supplements) on fish anomalies published by the Gulf Coast Research Lab, but the CSU library doesn't have them and I'll have to arrange a loan.

I have two other specimens worthy of a note. They concern natural spawning in November. I heard about cutthroat trout in the Snake River spawning in the fall. An Idaho biologist took 2 large fish off of spawning grounds on November 19. They turned out to be rainbow x cutthroat hybrids, which weakens the assumption that they may represent a distinct fall spawning race of cutthroat trout. I suspect that the situation is caused by large volume, constant temperature springs that flow into the Snake River (the specimens came from such a site). The trout go into the fall-winter period with essentially mature gonads, ready for spring spawning, but migration into the warmer spring water in November probably triggers the spawning act. There are some intriguing questions on the relative influence on photoperiod and temperature. These are some of the matters where I keenly miss your knowledge of fish physiology and reproduction.

Then there is the example of collecting "red-banded" trout in an isolated tributary of the Owyhee River in northern Nevada last summer. I took the fish on flies in 83° F water. They were active and vigorous, showing no signs of stress. Do you have any good references to "heat" physiology of trout?

If you haven't already seen it, enclosed is the article on Earl Herald's death.

I doubt if I'll make the ichths and herps meeting in Costa Rica this year. We have sufficient funds in the budget, but out-of-country travel is another matter. We had the Colorado-Wyoming AFS meeting two weeks ago in Cheyenne. It was a good meeting - with more real information content than at national meetings.

There was a great blizzard in Wyoming last Monday-Tuesday, and in much of Colorado. It was all around Fort Collins, but we didn't get the snow; although all of the roads just out of town were closed.

Sincerely yours,

Robert Behnke'

March 19, 1973

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

Dear Volodya:

Enclosed is a copy of the English translation of your paper after I edited it. There was a problem in the translation of your footnote on the first page to convey exactly what you mean. I changed the wording around but I hope I have your intentions correct - that you now combine Sebastodes and Sebastes in a single genus with subgeneric taxa.

Enclosed are some recent reprints of a paper experimenting with computer taxonomy. Also some older reprints for V.M. Korovina. Yes, I received her reprints last year and thought I had reciprocated and thanked her, but then I read in your New Year's letter that she hadntt heard from me. Relay my apologies to her. I edited a paper Korovina co-authored on hybrids of peled and chir in Voprosy Ikhtiologii, 12(3).

I renewed your subscriptions to Copeia and Jour. Fish. Res. Bd. Canada for 1973.

Issuesnumber 5 of volume 12 of Voprosy Ikhtiologii was not received. I suspect it was lost in the mails. They must experience rough handling because the wrappers are usually torn and shredded when I receive them. Evidently the address on no. 5 was torn off in transit. If you are able to find another copy of 12(5), I would appreciate it - I have a complete set except for that issue.

I didn't know that you are now the Director of the Ichthyology Department of the Academy, until I read your New Years letter. Congratulations! I know you must be burdened with many new tasks. I hope you still have some time to pursue your own research interests.

Thank you for the color slide of your grandson and the old one of me cleaning mushrooms with the Barsukovs - it brought back many pleasant memories.

Unfortunately Miss Lupak's group had to depart from Leningrad on their tour before she could return to the Academy and pick up the mushroom spices and gifts from you. The next time I hear of someone who will visit Leningrad I'll ask them to go to the Academy and get my spices.

Give my best regards to Shaposhnikova, Klyukanov, Dorofeeva, Korovina and "Mrs. Mary".

Sincerely yours,

Robert Behnke

RB:dch
Enclosures

March 21, 1973

Mr. Larry C. Peterson
Bureau of Sport Fisheries & Wildlife
P.O. Box 567
Kalispell, Montana 59901

Dear Mr. Peterson:

I would indeed be most interested in any cutthroat trout collections from the upper Missouri, upper Columbia and South Saskatchewan drainages of Montana. Over 500 specimens from 55 localities were sent to me last year as part of a study on the systematics of the native trout of this area and to determine the taxonomic status of the "westslope" cutthroat trout. Most of the collections were made by Forest Service personnel and by Montana Fish and Game, but I have attempted to encourage other agencies because the area is so large and there is much water to cover. Any assistance you may render will be appreciated. I am lacking specimens from the South Saskatchewan drainage (your Kennedy Creek and Divide Creek) and any samples from this basin would be most valuable.

Enclosed is a report on westslope cutthroat trout and an outline of the study presently supported by the National Park Service.

Sincerely yours,

Robert Behnke

RB:dch

March 21, 1973

British Columbia Fish & Wildlife Branch
Parliament Building
Victoria, British Columbia
Canada

Gentlemen:

I would greatly appreciate receiving the reprints marked in red on the enclosed publications list of the Fisheries Management Division.
Thank you.

Sincerely yours,

Robert Behnke

RB:dch

March 21, 1973

Mr. Keith Bilby
2 South Gay Drive
Longmont, Colorado 80501

Dear Keith:

I am finally returning the slides you sent last November. I had some duplicated and because thedduplication takes about two weeks, I had to wait until I finished a series of presentations during the past few months, in which the slides were used.

Enclosed is a manuscript submitted for publication in the Transactions of the American Fisheries Society. It concerns the North Michigan Lake study and you'll note that one of your pictures of the Snake River cutthroat trout is part of figure 1.

Also enclosed is a report on the cutthroat trout native to the upper Columbia and upper Missouri basins, pointing out that the Yellowstone cutthroat is probably a distinct race derived from the upper Snake River and not the Missouri River.

I would like to encourage your photography of trout - your slide of the Como Creek specimen is my best example of the greenback trout.

Sincerely yours,

Robert Behnke

RB:dch

March 29, 1973

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

Dear Chuck:

Enclosed are a number of reports and reprints for your general information and for Mr. McClane. It would be a great selling point for the preservation of rare and endangered fishes if Mr. McClane could stimulate public interest and awareness in the subject. Some of the enclosures present the practical values involved in preserving the remaining genetic diversity in a species like the cutthroat trout.

You'll also note the lack of information on Pecos and Canadian River basin cutthroat in the Rio Grande reports. I do have a good file of information on Rio Grande, S. c. virginalis now, but still no specimens from the Pecos or Canadian basins.

I will appreciate any funds you can direct my way to finance the specimen examinations. I believe I can provide definitive evaluation of the purity of the populations if the sample size consists of about 15-20 specimens. I would like to be informed on any information on rare and endangered species activities such as the transplants of Plagopterus and Gila trout. Has the Forest Service ever done any more with the habitat improvement projects Hank McKirdy started with the Little Colorado spinedace, Lepidomeda vittata? Have these areas been checked to see if spinedace are there at present?

Sincerely yours,

Robert Behnke

RB:dch

April 6, 1973

Mr. Robert Evans
U.S. Bureau of Reclamation
P.O. Box 515
Pueblo, Colorado 81002

Attention: P-420

Dear Mr. Evans:

Mr. Wilbur Banner requested a report on a collection of cutthroat trout from Cunningham Creek for input into an impact statement.

I have little doubt that the Cunningham Creek population of cutthroat trout is a most significant fish. It is one of two known populations in Colorado that I believe to be essentially pure Salmo clarki pleuriticus, the indigenous trout of the upper Colorado River basin. I am including a page and a table from a rough draft of a M.S. thesis by Mr. Gary Wernsman on the native trouts of Colorado, which pertain to Cunningham Creek. All of the character evaluations indicate that there is no hybrid influence in the Cunningham Creek specimens and the extreme scale counts of 182-202 (193.7) can not be explained from mixtures of other cutthroat trout subspecies that may have been introduced. The coloration, spotting, morphology and anatomy ideally approximate our diagnosis of S. c. pleuriticus.

The "Red Book" of rare and endangered species of the U.S. Dept. of Interior has listed S. c. pleuriticus as "status undetermined" in previous editions. I am currently compiling information on rare and endangered fishes for the Albuquerque office of Region II of the U.S. Bureau of Sport Fisheries and Wildlife and I will suggest a status of "rare" for the Colorado River cutthroat trout. I have sufficient information now to know that this trout has disappeared from virtually its entire range and pure populations are a rarity.

Also enclosed are other reports I have prepared with reference to this trout.

Sincerely yours,

Robert Behnke

RB:dch
cc: LarryFinnell; Gary Wernsman

April 9, 1973

Mr. Gary H. Thorgaard
2535 Taylor
Corvallis, Oregon 97330

Dear Mr. Thorgaard:

The Department of Fishery and Wildlife Biology has agreed to allow me to grant the teaching assistantship to a student of my choice. Are you willing to accept an offer? Dr. Simon told me that you were considering graduate school at the University of British Columbia - the choice, of course, is entirely your own and I wish you well whatever your decision.

I talked with Dr. Simon about summer employment and working you into the program at the Fish Genetics Lab where he is now director. At this early stage of their planning and uncertainty of funds, nothing definite was accomplished except for the fact that everyone agreed it was a good idea.

I am still awaiting some definite word on possible funds that could be used to support some aspect of research in salmonid systematics for a student during the summer months.

Sincerely yours,

Robert Behnke

RB:dch

Steven Taub, Division of Fishery Services, 4/11/73
B.S.F.W., Washington, D.C.

Robert Behnke, Colo. Coop. Fishery Unit,
Colo. State Univ., Ft. Collins, Colo. 80521

Picture of Rare and Endangered Trout

The only black and white prints of trout available are of a typical interior cutthroat trout and the Snake River cutthroat which were made for a paper submitted to the Trans. A.F.S. All other pictures of trout are color slides.

I plan to have a series of drawings made of rare trout but they won't be ready in time for your needs.

April 12, 1973

Miss Gail Felman
822 S. Meadow St.
Ithaca, New York 14850

Dear Miss Felman:

Dr. McConnell requested I answer your inquiry on graduate research in ecology with emphasis on endangered species because of my own involvement with endangered fishes.

Graduate research in the general area of ecology could be undertaken in any of several departments. Your specific interests in animal behavior would limit the logical choice to the Zoology Department or the Department of Fishery and Wildlife Biology at Colorado State University. The only specialist in animal behavior at C.S.U. is Dr. Phillip Lehner, Department of Zoology. There are behavioral studies conducted in fishery and wildlife; for example, a current research project on coyote behavior by Dr. Alex Cringan, Dept. Fishery and Wildlife Biology.

You may wish to write to Dr. Lehner and Dr. Cringan outlining your specific interests and goals and inquire on possible graduate student research projects for which you might qualify.

Sincerely yours,

Robert Behnke

RB:dch

April 12, 1973

Dr. R.M. McDowall
Fisheries Research Division
Marine Department
P.O. Box 19062
Wellington, New Zealand

Dear Dr. McDowall:

I am enclosing a series of my available reprints and some unpublished reports.

I am quite familiar with your publications on galaxoid fishes because of the many systematic problems they have in common with the salmonids. I also used your publications to write a section on the order Salmoniformes for the new edition (unpublished as yet) of the Encyclopedia Britannica.

The most recent paper of yours I read on systematic problems of Galaxis, particularly in reference to several lacustrine populations, evidently of independent origin (that is, all lacustrine populations did not evolve from a single "pre-adapted" lacustrine ancestor), is particularly relevant to similar situations in Salmo, Salvelinus and Coregonus. In my paper on the systematics of salmonid fishes of recently glaciated lakes I discussed the taxonomic problems involved in such situations (often compounded in salmonids because of sympatric occurrence of recently diverged populations). My suggestion is that similar ecological forms of a species can be grouped as "polytopic subspecies".

Undoubtably, an exchange of information, literature and ideas will be mutually beneficial.

Sincerely yours,

Robert Behnke

RB:dch

April 12, 1973

Mr. Dean Marriage
Soil Conservation Service
209 Federal Building
701 N.W. Glisan
Portland, Oregon

Dear Dean:

I talked with George Dern and Ivan Lines concerning S.C.S. ponds for some of my trout projects. Enclosed is a copy of a letter to Mr. Dern. Both men expressed their enthusiastic intention to see what could be done.

Sincerely yours,

Robert Behnke

RB:dch

Dr. Ray Simon, Fish Genetics Lab., Beulah, Wyo. 4/12/73

Robert Behnke, Colo. Coop. Fishery Unit, Colo.
State Univ., Ft. Collins, Colorado 80521

S.C.S. Ponds

I was discussing the idea of utilizing private Soil Conservation Service ponds for holding brood stock of rare forms of trout with Dean Marriage. I also thought that some of these ponds might serve for field evaluation of various strains under natural conditions. Enclosed is a copy of a letter to George Dern on the matter. I'll keep you informed if Dern finds some ponds we might consider. Also is a copy of a letter to Fred Esierman. Fred and Galen Boyer are likely to be the people we would deal with in Wyoming for any state-federal cooperative projects. Fred had inquired about the programs of the genetic lab and about state-federal relationships. Many state people are leary of federal encroachment so I assured Fred of our good intentions.

I heard from Putz that Fisheries Services would supply the funds for the 1973-74 fiscalyyyear for the Snake River cutthroat trout evaluation on Indian Reservations. Still to be resolved is funding for work on rare and endangered species (taxonomic services currently provided to state and federal agencies - Forest Service, Park Service, Bur. Reclamation, B.L.M., etc.). Most of these fishes have no direct relevance to any of the Fish Genetics Lab's goals.

This year I have operated on funds from the Bureau's Albuquerque office and from the Park Service, but these are for specific projects. Some contribution on an annual basis should come from the office of endangered species to support this work - a matter you can bring up with Putz or Hester.

In my discussions with the Yugoslavian ichthyologist. Dr. Vukovich, I found out that Harvey Willoughby has interested ihe Bureau on the subject of importing some more Yugoslavian salmonids, Hucho hucho, Salmo marmoratus and Salmothymus obtusirostris. I don't know if these proposed introductions will relate in any way to the Genetics Lab, but you may hear more about the subject.

April 12, 1973

Mr. Galen Boyer
Wyoming Game and Fish Commission
Box 1589
Cheyenne, Wyoming 82001

Dear Galen:

To keep you informed on some potential research projects in Wyoming, copies of letters to George Dern and Fred Eiserman are enclosed.

As I mentioned over the phone and repeated in the letter to Fred, I believe the staff at the Fish Genetics Lab sincerely wish to encourage mutually beneficial state-federal relations in fisheries research. I expect a meeting is being planned to get various people together and discuss programs and areas of cooperation.

Sincerely yours,

Robert Behnke

RB:dch

April 12, 1973

Mr. Ivan Lines
U.S. Soil Conservation Service
Room 4012, Federal Building
125 S. State Street
Salt Lake City, Utah 84111

Dear Mr. Lines:

Enclosed is a copy of a letter to George Dern concerning our conversation of last week on possibilities of utilizing S.C.S. ponds in rare and endangered trout propagation and/or an experimental strain evaluation program.

The trout in Nevada that I am involved with are the Mt. Wheeler cutthroat trout (Ely area), the Humboldt cutthroat tfout (Elko area) and the red-banded trout (Chino Creek, Owyhee drainage north of Winnemucca).

Sincerely yours,

Robert Behnke

RB:dch

April 12, 1973

Mr. George Dern
U.S. Soil Conservation Service
Box 2440
Casper, Wyoming 82601

Dear Mr. Dern:

This letter is a statement of the ideas we discussed on the phone regarding S.C.S. ponds for experimental and conservation purposes.

There are two major areas in which private S.C.S. ponds could play an important role. One would be as brood stock ponds for propagation of rare forms of trout (preservation of genetic diversity) or distinct races of trout to be used in experimental programs. There are several forms of trout that I believe could be increased in abundance and which have some real potential for fisheries management, if their propagation could be undertaken. One trout (the "red-banded" trout native to the Owyhee River drainage of Nevada) is known to exist in small numbers in only a single intermittant stream. The habitat is badly degraded from overgrazing, and I fear this trout (which will be the type of a new subspecies) will be extinct before a published description is made. A unique attribute I could mention for this trout is that we caught it by fly fishing in water of 83° F - there may be some valuable genetic raw material here for developing a farm pond trout for warmer waters. There are also 3 undescribed subspecies of desert basin cutthroat trout that have survived under harsh conditions.

The other suggestion I discussed with you concerning uses of S.C.S. ponds was for experimental purposes for performance evaluation of various races of trout. I am now associated with the Fish Genetics Lab at Beulah, Wyoming, and one of our objectives is "strain evaluation". The only meaningful evaluation in regards to growth, survival and yield to fishermen, must be made under natural conditions. Controlled conditions could be much more readily exerted over private ponds. As we discussed, however, we would need the enthusiastic interest and cooperation of the owner to implement an experimental program. Keep me informed of the feed-back you receive from S.C.S. offices and field personnel.

I also talked with Ivan Lines at your Salt Lake City office and a copy of this letter will be forwarded to him.

Sincerely yours,

Robert Behnke

cc: Eiserman; Simon; Marriage; Lines; Boyer

April 12, 1973

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

Dear Fred:

Enclosed is a copy of a letter to S.C.S. biologist George Dern, concerning S.C.S. ponds for holding brood stock and for strain evaluation experiments. I was at the Beulah lab last week discussing the new direction of the research with Dr. Simon and the staff. One objective is "strain evaluation". The documentation of adequate information on various strains (and the selection of strains to be evaluated), comparable to what my students and I have done with the Snake River cutthroat trout, will require a large measure of federal-state cooperation. One problem will be selection of waters where evaluations can be made under natural conditions, and perhaps the S.C.S. can be helpful.

I can assure you that the consensus of opinion at the Beulah lab heartily supports a new era of federal-state cooperation on common research goals. I believe that when you and Wyoming personnel have the opportunity to meet with Dr. Simon and his staff you will find a new emphasis on mutual cooperation that is sincere and not mere rhetoric. Precisely how the field evaluations can be carried out is not yet decided. The lab is set up along the lines of hatchery evaluation - physiological indexes, blood parameters, growth, feed conversion under hatchery conditions, etc. The most effective and economical method for field evaluations, patterned after our research on North Michigan Lake and currently under way on Indian Reservation lakes, would be with graduate students. The immediate problem is that the Genetics Lab is not budgeted for financing such studies. The field evaluations are directly relevant to other divisions of the Bureau - Fisheries Services and Fish Hatcheries and it would seem logical that they should support relevant graduate student projects. Fisheries Services has agreed to supply funds for the coming year to complete our evaluation of Snake River cutthroat trout on Indian Reservation lakes. I have also tried to stimulate support from state agencies

for specific studies on a trout they are significantly involved with, such as Montana Fish and Game and the Montana westslope cutthroat. For strain evaluation, Wyoming has the greatest potential of any state. Besides the Snake River cutthroat, you have Eagle Lake rainbow, DeSmet rainbow, Lake McConaughy rainbow, Lake Ohrid trout, and, hopefully, soon the Canadian brook trout - all in your propagation program.

I am very interested in finding out more about the Snake River cutthroat plants in Pathfinder Reservoir. What are the dates, numbers and size stocked? Anything yet on growth, survival and contribution to the creel?

Your comments on the high mortality of age 3+ Pikes Peak cutthroat trout discussed in the Trojnar, Behnke manuscript, caused by sexual maturity is probably not the answer. Virtually no age 3+ cutthroat in North Michigan Lake exhibited any indication of gonadal development. The mortality must be real, however, because we found age 4 Pikes Peak cutthroat to be extremely rare both in 1971 and 1972, whereas age 4 Snake River cutthroat were relatively abundant in 1972 (the only year class stocked). I'm still awaiting the A.F.S. reviewer's comments on the manuscript.

Concerning the choice of brook trout strains available from New York, I would suggest you go for one of the pure Canadian strains (Assinica or Temiscamie). The hybrid between Canadian and domestic brook trout has demonstrated some real success, but they were all F_1 hybrids. Data is not available on F_2 hybrids. With a pure Canadian strain you can make your own inter-racial hybrids each year (as long as you maintain a pure Canadian stock), but if you get a hybrid stock to begin with, the options for experimentation with new genetic combinations will be more limited.

The Canadian strains I observed in the Adirondacks are indeed quite distinct from the typical Salvelinus fontinalis as we know them, in life history traits such as age of maturity, maximum life span and growth rate. The Canadian brook trout grows well up to 16-18 inches on invertebrate fauna, which should suffice to maintain a brood stock without forage fish.

Sincerely yours,

Robert Behnke

RB:dch
cc? Simon; Boyer

April 13, 1973

Ms. Norma Ames
Wildlife Management Officer
New Mexico Dept. of Game and Fish
State Capitol
Santa Fe, New Mexico 87501

Dear Ms. Ames:

Thank you for a copy of a list of endangered fishes of New Mexico, sent to me for comment.

Why is the Apache trout, Salmo apache, listed for New Mexico? In the description of S. apache, a population was discussed which once occurred in a tributary of the Blue River, Arizona. Thus, this trout may have once inhabited New Mexican waters, but I know of no authentic record. It is likely that some of the rare "big river" Colorado River species such as the bonytail chub, Gila elegans, and humpback sucker, Xyrauchen texanus, once occurred in New Mexico in the San Juan and Gila rivers. A rare chub endemic to the Gila River, Gila intermedia, also may have ranged into New Mexico, but is now likely extinct there.

The proserpine shiner, Notropis proserpinus, a Rio Grande species, may now be extinct in New Mexico.

I would suggest the isolated, disjunct population of rock bass, Amblo-plites rupestris, in Blue Springs (Rio Grande basin) be given some special recognition. This population has a similar status and zoogeographical significance as the brook stickleback, Culea inconstans, which is on the list.

I am currently compiling information on many of the rare and endangered fishes of the Southwest for the U.S.B.S.F.W. (Albuquerque office). When completed, these reports should provide a useful source of data on the rare fishes of New Mexico.

Sincerely yours,

Robert Behnke

April 17, 1973

Dr. Donald Seegrist
Northeastern Forest Experiment Station
6816 Market St.
Upper Darby, Pennsylvania 19082

Dear Don:

I thought you might be interested in the enclosed copy of a letter regarding trout in a stream on Mt. Palomar in southern California. Mr. Hewitson recognized they looked different from typical rainbow trout and sketched a colored illustration for me showing an orgnge belly and orgage tipped fins which he found in about 10% of the population. As you'll note from my evaluation, continued introductions of hatchery rainbow has probably obscured the original genotype and any affinities to the red-banded trout, except for the occasional brightly colored individual.

Sally said you phoned last week while I was at the Genetics Lab in Buelah, Wyoming. How did you lose your FTS phone - part of the Forest Service economy drive? The hiring of Dick Gard to fill the faculty vacancy left by Everhart occurred quite suddenly. He wasn't even under consideration to begin with, but as one after another person turned down the job or had taken new jobs - it became a matter of hiring someone in a hurry or losing the position. Strong recommendations from Starker Leopold helped but actually there wasn't much choice left. I think Dick and Sylvia will enjoy living in Fort Collins and I'm sure he's happy to have a steady job. He started right in by teaching an introductory course in fish management this spring quarter.

Sincerely yours,

Robert Behnke

RB:dch

April 17, 1973

Dr. R.R. Miller
Museum of Zoology
University of Michigan
Ann Arbor, Michigan 48104

Dear Bob:

To keep you informed on the trout from Mt. Paddmar, copies of letters to Mr. Hewitson and Carl Hubbs are enclosed. You'll note in Dr. Hubbs letter that I would like to borrow the UMMZ Alvord trout specimens collected in 1934 from the Virgin River and Trout Creek basins (we discussed this last year but you were lacking adequate student assistants).

I would also like the return of my copy of the translation of Oshima's paper on O. masou. I received 3 specimens of "O. iwame" - one from the type locality on Kyushu and two from a stream on Honshu. The Honshu locality was not mentioned in the original description, but the specimens do agree in the diagnostic characters of complete absence of spots and parr marks. I wanted to check on the possibility that O. iwame might be relicts of O. formosanus, but I doubt that they are. My 3 specimens lack basibranchial teeth and otherwise their meristic characters appear within the range of O. masou. I can't prove that "O. iwame" is not due to polymorphic O. masou until I get more detailed data on reproductive isolation on the two forms in the same stream. I can tell you, however, that color photographs of live iwame more resemble a creek chub (Semotilus) with an adipose fin, than they do any Salmonid.

I am planning on a short note on the O. iwame specimens pointing out that they are not likely closely related to O. formosanus. I would avoid the details of the description and confusion of O. formosanus that you and Watanabe are handling, but I should make mention of your information. What is the status of your paper? Can I mention that you and Watanabe will prepare a manuscript for publication, pointing out that O. formosanus is a valid species and clearing up the confusion caused by Oshima?

I have some literature that you may want to use on Formosan salmonids. Dr. Watanabe probably has these references, but if you don't have them in Ann Arbor and want copies let me know. They are:

1. Oshima. 1919. On the new species of trouts in Taiwan. Taiwan Nojiho (Formosal Agricultural Magazine), 13(6):350-352 (Japanese). The original description of "Salmo saramao Jordan and Oshima" Fig. b of S. saramao is the same one used by Jordan and Oshima for S. formosanus.

2. Tadao Kano. 1940. Zoogeographical studies of the Tsugitaka Mountains of Formosa. Published by the Sibusawa. Inst for Ethmographical Res. (in English). Section 10, pg. 86-90 is: "On the occurrence of Oncorhynchus masou in the mountains." Includes notes on distribution and ecology - water temperatures, stream gradients, etc.

3. Teng, H.T. 1959. Morphology and ecology of the landlocked salmonid fish in the highlands of Taiwan (Chinese). Taiwan Fishery Experiment Station Bull. 5:77-82.

4. Oshima. 1936. Ecological studies on the landlocked salmon found in the interior of Formosa. Syokubutu Oyobi Dobutu, 4:337-349 (Japanese). Revised S. formosanus as synonym of O. masou (I think).

Also enclosed are reports on rare trout. I'm writing up information on several species of rare fishes for region II U.S.B.S.F.W. and I'll send copies to you for comment as they become available.

Sincerely yours,

Robert Behnke

RB:dch

April 17, 1973

Dr. Carl Hubbs
Scripps Institute of Oceanogr.
LaJolla, California

Dear Dr. Hubbs:

Although you're likely to be away until summer, I'll send along my evaluation of the Mt. Palomar trout caught by Mr. Hewitson. As you'll note, it is a coarse scaled trout, apparently similar to typical S. gairdneri except for low caecal counts. Many thanks for the interesting bits of historical information you turned up, and the copy of your 1965 letter to Bob Miller with your incisive and valid criticisms of the Needham and Behnke manuscript in regards to Lahontan basin cutthroat trout. I had realized that there were large gaps in our knowledge and wanted to delay the manuscript but Needham was obsessed about getting it published. I can tell you now, however, that the two forms of cutthroat trout, S. c. henshawi and those native to Humboldt drainage, are a reality. I made several additional collections last summer and have "humboldtensis" pretty well characterized. It is consistantly a coarse scaled cutthroat trout (mean values range from about 130-155; henshawi is ca. 170). The mean values of gillrakers are consistantly right around 21 (henshawi 23-25). Evidently humboldtensis was restricted to the Humboldt drainage and not truly similar to the "bicolor-pectinifer" situation of the Lahontan chub. Isolated stream populations of henshawi in the Truckee, Carson and Walker drainages are virtually identical to the original henshawi of Tahoe and Pyramid lakes in meristic characters. The Summit Lake henshawi is distinctive from other henshawi in several characters, suggesting a long period of isolation and arguing against introduction by man. The Virgin River samples (at VMMZ) are a mystery. I discount my original assumption that they were introduced henshawi. Probably natural headwater transfers occurred foom the Lahontan basin (Summit L.?). I'll send a copy of this letter to Bob Miller and remind him of my request for a loan of the Virgin R. (and Trout Creek) Alvord samples so I can count pyloric caeca. S. c. henshawi (and humboldtensis) have the highest

caecal counts in S. clarki (50-60). The Willow and Whitehorse creek samples appear virtually identical to humboldtensis, but they do have significantly lower caecal counts and typically higher scale counts.

I was hoping to find native trout in the headwaters of the Quinn River drainage of the Lahontan basin last summer for comparisons with Alvord trout. Only typical rainbow trout were found. I didn't cover any territory in the upper Virgin drainage but was told that persistence of native trout is very doubtful because of reservoirs and extensive rainbow introductions. If you know of any possible isolated sites let me know and I'll try to have them checked.

Sincerely yours,

Robert Behnke

RB:dch
cc: Dr. Miller

April 17, 1973

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

Dear Mr. Hewitson:

I have examined the 9 specimens of trout from Pauma Creek, tributary to the San Luis Rey R. I am unable to recognize any diagnostic character that would strongly suggest influence from a red-banded trout ancestor. None have basibranchial teeth. The number of pyloric caeca, however, is definitely lower than counts I've found in S. gairdneri and is similar to caecal counts of the red-banded trout native to the desert basins of southern Oregon. The number of pyloric caeca is, essentially, under genetic control, but is highly variable between individuals of a population, and can be significantly different between local isolated populations of a subspecies. That is, slight genetic differentiation can be manifested in a large change in caecal numbers and thus this character must be cautiously evaluated for taxonomic conclusions. I do believe, however, that if you obtained a sample of the hatchery rainbows stocked into Doane's Pond at the head of Pauma Creek, I could demonstrate that the caecal numbers and perhaps the number of gillrakers and vertebrae are significantly different, demonstrating that the wild stock in Pauma Creek is not derived from the hatchery plants (although there must have been some influence from the intensive stocking over the years). For Drs. Hubbs and Miller's benefit I can point out that I now have data on how much environmental influence (non-genetic) can be expected in various characters under natural conditions. I have compared several samples of known genotypes introduced into different waters and now maintaining themselves by natural reproduction. Over-all, most characters change little under natural conditions. Scale counts are the most readily modified character and pyloric caecal numbers are the most stable.

Your observations on the orange colors of the ventral region and lower fins on some specimens is, perhaps, the most convincing evidence that these trout are not typical S. gairdneri and that some measure of the original genotype is still present.

It is not likely if we'll ever know much more about the original trout of the San Luis Rey drainage. It is conceivable (as suggested by the orange colors and distinctively marked fins on some Pauma Creek specimens) that two forms once inhabited the drainage - as was the case in the McCloud River. The more primitive red-banded trout may have been established in isolated tributaries with anadromous S. gairdneri dominating the main parts of the drainage.

Dr. Hubbs sent a note stating that Mr. G. Newton Bailey remembered his father relating of trout stocking in Pauma Creek. The question then is, was Pauma Creek barren of trout before this stocking (is there an impassable falls downstream from the present population?)? Were the trout stocked by Mr. Bailey's father from local populations in the San Luis Rey drainage? These are typical of the frustrating questions that make for great confusion in attempting to work out the taxonomy of native trout of any geographical area. The enclosed table does indicate that the more southerly S. gairdneri has lower numbers of vertebrae, gillrakers and perhaps pyloric caeca than typical S. gairdneri (Columbia River, northward). The suggestion is that the genotype was influenced by some other form of trout - probably the red-banded trout. Needham and Gard did find a basibranchial tooth in a specimen from the Santo Domingo R. in Baja California.

Your query on the effects of introductions of hatchery rainbows on a wild population can only be answered in generalities. I have seen such abundant evidence of rainbow x cutthroat hybrids in streams where only cutthroat were native, that there is no doubt in my mind that introductions of rainbow trout has been the leading cause of the virtual extinction of pure populations of many subspecies of interior cutthroat trout. On the other hand, there are waters that have been massively stocked with rainbow trout for years with little evidence of influence on the native genotype - for example the cutthroat trout of the upper Snake River, Wyoming, and red-banded trout in some streams in southern Oregon (where I compared samples collected in 1897 and 1904 with collections I made in 1968).

The key to the matter is how well adapted the local genotype is to its environment. A well-adapted form will have strong selective pressures against change. A change in the environment - warmer temperatures, increased siltation, habitat disturbance, etc., will typically stimulate hybridization because a changing environment selects for a changing genotype. A student has been accumulating some interesting data on the trout fishery in the Poudre River, west of Fort Collins. More than 100,000 catchable rainbow trout are stocked annually on top of a wild population of rainbow and brown trouts. The wild rainbow is

actually a rainbow x cutthroat hybrid which phenotypically expresses a transitional series from a typical cutthroat trout at higher elevations (10,000 ft) to a typical rainbow trout at lower elevations (7000 ft). The fishing pressure is heavy and about 70% of the catchable trout are caught within two weeks. Less than one percent are left in the stream by October, whereas the wild rainbow and brown trout populations actually increased in biomass during the height of the fishing season. By the next spawning season, virtually no hatchery rainbow trout are left in the river and I suspect that they have no significant influence on the wild genotype.

The inimical effects of hatchery trout on the wild trout in the Madison River, Montana, is probably due to the fact that angling pressure is low (only 15% of the hatchery trout are caught) and unnatural densities build up to cause social stresses on the wild population.

Sincerely yours,

Robert Behnke

RB:dch
cc: Dr. Hubbs; Dr. Miller; Dr. Seegrist

TROUT SAMPLES, SOUTHERN CALIFORNIA - BAJA

Location	N	Vertebrae	Scales, above lat. line and lat. series	Gillrakers	Pyloric caeca
Pauma Creek, San Luis Rey R. drainage	9	62-63 (62.3)	24-30 (27.3) 122-140 (130.8)	17-19 (18.3)	34-54 (42.0)
Upper Siberia Creek, Bear R. drainage (1961)	7	60-63 (61.7)	26-32 (27.9) 123-137 (129.9)	16-19 (17.3)	37.55 (44.9)
Santa Ana R.[1]	21	61-64 (62.4)	26-33 (29.9) 126-149 (137.0)	18-21 (19.0)	----------
Santo Domingo R.[2] Baja California	25	61-63 (61.8)	22-29 (25) 120-141 (131)	16-20 (18.0)	----------
"Typical" S. gairdneri		62-65 (63±1)	24-32 120-140	18-21	40-70 (50-60)

[1] Data from: Gard and Seegrist. 1965. Persistence of the native rainbow trout type following introduction of hatchery trout. Copeia (2):182-185.

[2] Data from: Needham and Gard. 1959. Rainbow trout in Mexico and California. Univ. Calif. Publ. Zool., 67(1):124p.

May 2, 1973

Dr. James E. Morrow
Department of Biological Sciences
University of Alaska
College, Alaska

Dear Jim:

Enclosed is edited manuscript on Newfoundland brook trout and my comments.

As I state in the comments, it is really two separate papers but neither of them are complete entities. I don't believe much thought went into its preparation - for example, they state there is no known precedent on how to count gillrakers, evidently not bothering to consult the standard reference of Hubbs and Lagler.

My recommendation is that it needs a re-write before consideration for publication. If they only did otolith ageing for validation of the statistical technique, a very worthwhile paper could have resulted.

Sincerely yours,

Robert Behnke

RB:dch

M E M O

TO: Motor Pool

FROM: Robert Behnke, Colorado Coop. Fishery Unit

SUBJECT: Vehicle Use

Mr. Paul Sekulich will be using a university motor pool vehicle on an intermittant basis throughout the summer. Because we will have to wire the vehicle for boat trailer lights, etc., we would like to be assured that each time Mr. Sekulich has need of a vehicle - that we would be able to use the same one each time.

For that reason, please reserve one 1/2 ton pickup for his use for the following periods:

May 7-21
June 22-July 2
August 3 - August 13
August 31 - September 10
October 12 - October 22

Thank you for your help and cooperation.

May 3, 1973

Professor Tihomir Vukovic
University of Sarajevo
Faculty of Natural Sciences
Department of Biology
Sarajevo, Marsala Tita 114, Yugoslavia

Dear Dr. Vukovic:

Enclosed are your books, reprints and two copies of my paper for the First European Ichthyological Congress. As you will note, I have designated you to present the paper at the Congress.

I hope your excursion in the U.S.A. was a profitable experience. I thoroughly enjoyed your visit and look forward to a future meeting.

Sincerely yours,

Robert Behnke

RB:dch
Enclosure

May 3, 1973

Dr. Richard Wallace
Dept. of Biological Science
University of Idaho
Moscow, Idaho 83843

Dear Dick:

Your samples of cutthroat trout (Salmon, Clearwater, Kootenai drainages) should be most valuable. I received many samples during the past year but the overwhelming majority of them are from the Flathead drainage. I have found some consistencies between the samples - spotting pattern, gillraker, vertebrae and caecal counts, which provides a relatively valid diagnosis of the "Montana westslope" cutthroat trout. I can also tell you that they are quite similar in all characters to the upper Missouri drainage cutthroat, Salmo clarki lewisi (the slight differences would not justify taxonomic separation).

The information from your specimens should reveal if the diagnostic characters of the westslope cutthroat of the Flathead also apply to other native cutthroats of the upper Columbia River system.

There's no great rush on this study. Because of the immense geographical area and number of major drainages involved, I haven't set any deadlines and will probably finish up other studies before getting seriously involved in the systematics of Columbia River basin cutthroat trout.

The collaboration of someone knowledgeable in the techniques of biochemical taxonomy would be desirable. Such research would have to be at a more sophisticated level than has been typical in ichthyology, if we are to expect useful information. Several proteins should be studied to determine the degree of polymorphism. Hopefully a species specific protein between rainbow trout and cutthroat trout can be found. I have reservations about allelic frequencies to interpret evolutionary divergences (except to tell you that two samples are not from a freely interbreeding population, which would be already known). Some situations may develop, however, that could indicate clear-cut differences between westslope and eastslope or between both of them and Yellowstone drainage trout. I have other interesting groups of cutthroat trout that could be compared, such as the fine spotted and large spotted populations of the upper Snake River - both distinct from the typical westslope cutthroat.

Funding is always the major problem. N.S.F. would seem the most logical. If you could get some promising results from protein analysis this summer and write a short article for publication it should help. I have defined some of the systematic problems in western North American Salmo, and if you could demonstrate a promising technique that could be applied to solving these problems, it should at least make an attractive grant proposal.

You can check an article by Powers and Edmundson. 1972. Multiple hemoglobins of catostomid fish. I. Isolation and characterization of the iso-hemoglobins from Catostomus clarki. Jour. Biol. Chem., 247(20):6686-6693 (+II. 6694-6707). Ecological or functional specializations of hemoglobins and enzymes between closely related species should be a promising area for studying differentiation. My observations on "optimum" cutthroat habitat as compared with typical rainbow habitat is relatively clear-cut. That is, higher elevation, colder water. The physiological differences causing the habitat preference should be reflected in enzymes and hemoglobins.

Enclosed-is a copy of a paper I was invited to submit to the European Ichthyological Congress.

Sincerely yours,

Robert Behnke

RB:dch
Enclosure

May 7, 1973

Dr. R.R. Miller
Museum of Zoology
University of Michigan
Ann Arbor, Michigan 48104

Dear Bob:

The specimens were received in good order. When they are returned I'll send a copy of the data extracted from them. Many thanks.

Sincerely yours,

Robert Behnke

RB:dch

May 7, 1973

Mr. Steve Nicola
Dept. Fish and Game
1416 Ninth Street
Sacramento, Calif. 95814

Dear Steve:

Thanks for keeping me informed on your plans for California's rare trouts. Your group is to be congratulated for generating the beginnings of a program. I wish you well, particularly your in-house taxonomic efforts. The problems are somewhat complex but the techniques are not difficult. Without a clear understanding of the objectives, however, one can get bogged down in much abortive wheel-spinning. This is particularly true in protein analysis. I've elaborated on problems of misinterpretation of biochemical information in a letter to a graduate student and in a paper for the European Ichthyological Congress and copies are enclosed. The key to the matter is to have sufficient understanding of the fishes you're dealing with to pose specific questions and then consider the most effective way to answer them, with an understanding of the limitations of the methods for extracting the desired information.

For example, I note Salmo gairdneri gilberti and S. aguabonita whitei are considered as two separate species in the report. I have claimed they are the same. If the committee's position is to have some validity, evidence must be brought out indicating that I was wrong and that there were two distinct species - one in the Little Kern and one in the main Kern.

The Little Kern golden still persists in virtually pure populations in the head of Soda Creek which can provide specimens for research. The Kern "rainbow", however, almost certainly is extinct as a pure population - the only material on which to study this taxon are the few preserved specimens collected in 1893 and Evermann's 1904 collections (and some of these are probably hybrids). This fact eliminates karyotype or biochemical analysis and my comparisons of the original specimens of whitei and gilberti (the 1893 specimens) demonstrated no differences. Just what

ideas might your group have in mind to defend the validity of whitei and gilberti as two separate species? The statement that karyotyping of the Soda Springs trout was unsuccessful isn't quite true. Ted Uyeno made the karyotypes OkK., and most showed 2N=58 with 104 arms (as S. aguabonita and the red-banded trout of Sheephaven Creek) but a relatively high percentage (20-25%, I believe) had different counts which may be attributed to the effects of slight rainbow trout hybridization. There is one place that was never collected which might have a pure population of Little Kern golden and should be checked. It is the extreme headwaters of the Little Kern above Broder's Cabin. There are falls right at Broder's Cabin and perhaps a half mile of trout water above it.

What is the basis for the claim that pure Lahontan cutthroat trout might exist in Cascade Lake? I observed cutthroats spawning in the inlet of Cascade Lake about 1960 but was told that they originated from plants of Heenan Lake stock (or when that stock was in Blue Lakes).

I was happy to read that successful transplants were made from Macklin Creek and that the Piute trout has some new populations going.

If you do get into the taxonomy business, it is important that representative collections of the fishes you're working with be maintained I would suggest the fish collection at the California Academy as a permanent repository.

Sincerely yours,

Robert Behnke

RB:dch
Enclosures

ADDENDA TO LETTER

After our phone conversation, I put together data from red-banded trout samples and a rough map with localities. To say the least the data is confusing. There is nowhere else in the distribution of western North American Salmo where such extreme variability is found as in the Pit and McCloud drainages. Undoubtably, much is due to introductions and subsequent hybridization, but the magnitude of the variability can't be explained away so readily. You can see what I've been hesitant about describing the Sheephaven trout which, I believe, represents the only pure population of all the samples. About all they have in common are the distinctly tipped dorsal, anal and pelvic fins, some yellowish body colors (often tints of orange ventrally) and the brick-red lateral band. My interpretation is that there were probably several invasions by distinct groups of the red-banded trout from the north, later S. gairdneri invaded and hybridized in some areas and finally man messed around with introductions.

The upper McCloud trout were probably identical to sheephaven fish 0 low numbers of vertebrae, gillrakers and caeca and numbrous scales. (These were isolated from S. gairdneri invasion and evidently Sheephaven Creek from stocking). In Goose Lake - Upper Pit drainage, the native trout (probably gone as pure populations) have high vertebral counts, moderate scale and caecal counts and higher gillraker numbers, probably from a past lacustrine influence. Further down the Pit there is a group with high pyloric caecal counts, which evidently represents another ancestral stock of red-banded trout and probably close to the progenitor of the Eagle L. "rainbow".

I'm sure it would have been confusing even if I had adequate samples from 100 years ago, but at present the situation is almost hopeless to come up with an authoritative taxonomy for these trout.

Also enclosed is information on possibilities of red-banded trout in southern California and Cavender's comments on the interior Dolly Varden (which is in the McCloud below the upper falls).

R. Azevedo, Rare and Endangered Species Team, Div. Fishery Services, Albuquerque

5/17/73

Robert Behnke, Colorado Cooperative Fishery Unit, Colorado State Univ., Ft. Collins, Colo. 80521

Rare and Endangered Reports

Enclosed are 3 copies each of reports on the "large river" species of the Colorado River, Xyrauchen, Ptychocheilus, Gila elegans and G. cypha.

I've tried to compact every bit of pertinent information into these reports including several personal communications. I consider this as the "last word" at present, but circulation of these reports may stimulate further comments that can be appended.

More trout reports should be available in about a week to be followed by other Colorado basin fishes and fishes of Texas and New Mexico. I've given priority to those fishes within the present limits of region II - but will have something on all of the original list plus some new ones.

May 17, 1973

Dr. Mike Pontrelli
2294 Oppio Street
Sparks, Nevada 89431

Dear Mike:

I have made some comments on the Truckee River and its potentials and problems for natural recruitment of Pyramid Lake trout. These remarks are made not as a consultant, but because of my interest in trout in general and Lahontan cutthroat trout in particular. There are some questions raised on which I would like information.

The first obvious fact I gathered from examining the literature you gave me is that the lower Truckee River in its present state is sub marginal trout habitat and will not make any significant contribution to the Pyramid Lake fishery until considerable improvement takes place in flows, reduced temperatures and adequate trout habitat for spawning and nursury areas. The prime causative factors here are the flow restrictions (which supposedly will be rectified) and the habitat degredation from channelization and stream bank vegetation removal (and there is some hope that this situation can be improved). The fact that the water temperatures continue to rise downstream from the power plant during the summer is indicative that this area will continue to be inimical to trout until a substantial increased flow of colder water is available - even if the power plant ceases discharge. The effects of the power plant discharge adding a head burden to an already deteriorated environment might be likened to the straw that breaks the camel's back - but in this case the back seems already broken. I should, however, emphasize thatpohential dangers of sub-lethal effects of heat on fish. I believe it was an article by Brett (1956. Quart. Rev. Biol., 31:75-87) which described a situation in the Columbia River in 1941 when temperatures rose to 23.6°C and the young-of-the-year sockeye salmon were wiped out, not from the lethal effects of heat, but from an outbreak of myxobacteria, Chondrococcus columnaris, which readhed epidemic proportions with warmer temperatures.

What I would like to know is what are the long range plans for the Truckee River as an area for natural reproduction of Pyramid Lake trout? Assuming that sufficient flows are maintained, the habitat improves, athermal discharges cease and trout are able to migrate upstream from the lake for spawning - how can Lahontan cutthroat trout be prevented from hybridizing with rainbow trout (particularly when large numbers of hybrids are currently being stocked into Pyramid Lake)? What level of survival (recruitment) can be hoped for from nursery areas already supporting large populations of resident rainbow and brown trouts? Just what are the plans to promote natural reproduction and significant recruitment back to the lake? The problem has been greatly compounded from the original conditions when the Pyramid Lake cutthroat had the river essentially to themselves. spawning channels or tributary streams managed specifically for Pyramid Lake cutthroat trout reproduction may have some possibilities.

There are some significant gaps in our knowledge of the life history of the original Pyramid Lake cutthroat, and even if all was known it wouldn't be directly applicable to the present situation, using a cutthroat trout (or hybrid) of very different genetic background and with different evolutionary imprinting.

I will review a few points, however, which may have some relevance.

Under pristine conditions - where were the major spawning grounds? When did the trout spawn? How long did the young remain in the Truckee River before migrating to Pyramid Lake?

The first mystery concerns the two runs from Pyramid Lake - a winter run of large "redfish" and a spring run of smaller trout - "tommies". I doubt that there were two distinct genetic races, but probably the larger trout (redfish) were repeat spawners that had skipped a year. The peak of spawning was probably April-May and the adults returned to the lake soon after spawning. The fact that the population was apparently able to maintain itself after Derby Dam blocked the river in 1906 and reduced the potential spawning and nursery area in the Truckee River from 100 miles to 30 miles, indicates the first 30 miles must have provided good conditions for recruitment until flows reached critical levels.

The remarks found in the Bien. Rept. Calif. Fish. Comm. of 1870-71 suggest a large run of Pyramid Lake trout migrated all the way up to below Lake Tahoe. The belief expressed was that the Tahoe trout made an annual migration to Pyramid Lake - which is most likely explained by the return migration of spent fish of the Pyramid Lake population. Concern was expressed in this early report that dams were hindering the movement of trout up the Truckee River from Nevada into California.

I suspect that the young trout probably migrated to Pyramid Lake during their first year of life. I base this on the large size of the adult fish which suggests most of their life was spent in the lake. This point could possibly be checked by examining scales from specimens collected by J.O. Snyder, now in the California Academy of Sciences fish collection.

I suspect, however, that when all the improvements have been made and spawning runs utilize the Truckee River, the presence of a large, resident trout population, particularly brown trout, will severely suppress recruitment back to the lake. Also, there is the fact that must be faced concerning the cutthroat trout and its reproduction in the Truckee River. The most publicized aspect of Indians fight for water in the Truckee River has been the restoration of the Lahontan cutthroat trout under natural conditions. Almost certainly, the cutthroats will hybridize with the abundant resident rainbow trout if given the opportunity.

If you have any information on future management plans for the Truckee River I would like to see them.

Sincerely yours,

Robert Behnke

RB:dch

May 17, 1973

Dr. Ray Simon, Director
Fish Genetics Laboratory
Beulah, Wyoming 82712

Dear Ray:

Your letter of April 27, pointing out the very practical problems of accommodating my research into the Genetics Lab's program is essentially corredt.

The original primary objective and highest priority for separating me from the Coop. Units program and the subsequent transfer to the Division of Research was to allow more time to devote to the ichthyological services on rare and endangered species I provide to several public agencies (U.S.B.S.F.W., National Forest Service, National Park Service, B.L.M., Bur. Reclamation and state fish and game departments).

As we discussed, one particular facet of this research, the ecological evaluation of trout strains, has a direct connection to the objectives of the Genetics Lab. But this project is conducted with graduate (and undergraduate) students as part of the graduate program at C.S.U. and the results are put together in student theses. Thus, if I had to separate from the university, even this facet of my research would be greatly curtailed and most of my rare and endangered species work, without the help of student assistants and the University library (and financial assistance from the Park Service) would be severely limited. Presently I am involved in writing a series of comprehensive reports for the Albuquerque office (Region II) of the U.S.B.S.F.W. on rare and endangered fishes (sample copies enclosed). This work is based on a contract initiated last year when I was with the Coop. Fishery Unit. You can note from the reference sources used to compile these reports that access to a large library is a pre-requisite for this type of project.

As you point out, the supervisory responsibilities for my program leaves you in an awkward position. Your suggestion of transferring this responsibility to Denver may be logical if it could be worked out, but one of the reasons for the transfer from Fisheries Services to Fisheries Research was to make my services more available to all rggions and not confined to certain geographical boundaries.

In any event, I have pursued the matter we discussed last month - that of utilizing ponds or lakes for strain evaluation. Previously, I sent a copy of correspondence with George Dern, S.C.S. biologist, Casper, Wyoming. Mr. Dern contacted Mr. Donald Johnson, Sheridan, Wyo., inquiring about S.C.S. ponds in northeastern Wyoming. I have not yet received definite word but Mr. Dern told me the most likely area would be south of the Buffalo-Gillette region - within reasonable distance of Buelah. Ultimately, for direct relevance to the Bureau we need to know the potential role of the various strains in a fisheries management program, and for this we must obtain performance data under natural conditions. I would plan to conduct the research in a similar fashion as the Snake River cutthroat trout evaluations are currently being carried out - growth, survival, food habits, interaction with other species, etc. That is, to define the niche parameters. The Genetics Lab could be involved with physiological indexes forming the basis of the ecological responses. I believe it is obvious that no matter how I am assigned for administrative purposes, I can make important contributions to the strain evaluation goals of the Genetics Lab.

As mentioned above, no specific waters have been offered for our studies, but let us assume we will have some available this summer. What strains do you want tested in field evaluations? My original contact with S.C.S. last year was with a view of utilizing private ponds for holding brood stocks of rare forms of trout. I have several in mind - mainly from Nevada, but I have requested the Salt Lake City office of S.C.S. to find waters for this purpose and we could use Wyoming ponds for any trout strains the Lab wants data on. Relatively simple experiments can yield valuable data. For example, the S.C.S. was enthusiastic about using Donaldson's rainbow for farm pond stocking. I had suggested to Dean Marriage (S.C.S., Portland) that this may not be a wise choice and last year the S.C.S. set up a test in two small farm ponds in Utah, in cooperation with Clare Stalnaker of the Utah Coop. Unit. In June, 1972, 200 Donaldson rainbow and 300 Jones Hole National Fish Hatchery stock of rainbow of 3-4 inches were stocked in each pond. Sampling in October showed the average length and weight of the two strains clearly favored the Jones Hole rainbow: 212 mm (169-246 mm) and 99.2 gm (51.0-154.0 gm) for Donaldson strain vs. 234 mm (194-269 mm) and 142.6 gm (75-213 gm) for Jones Hole trout in pond 1. In pond 2, Donaldson's

rainbow were 170 mm (114-216 mm) and 57.9 gm (14.0-104.5 gm) and Jones Hole rainbow, 207 mm (149-264 mm) and 94.0 gm (57.0-196.5 gm). The next sampling is scheduled for May 31 and the stress of overwintering should be apparent in differential survivals. Would the Division of Fish Hatcheries be interested in similar comparative data on different hatchery strains of rainbows and perhaps the effects that inter-racial hybridization might have on performance?

It appears obvious to me from data I've accumulated that the influence of intraspecific genetic diversity can conservatively increase the potential biomass available to a fishery by 50% based on fish stocked as yearlings or younger. With the numbers of trout stocked by the Bureau and by state agencies, the significance of documenting this type of information is self-evident and I think it is this area of strain evaluation that the Genetics Lab can make a most directly relevant contribution.

Also enclosed are Bureau publication authorization sheets for a paper submitted to the First European Ichthyological Congress. I believe the routine has been this material routed to you first. I was invited to submit a paper although I don't plan to attend.

My student and I will be sampling the Utah Indian Reservation lakes for the Snake River cutthroat evaluation study during the week of May 14. I anticipate some interesting results.

The fisheries faculty and grad students would like to invite you for a seminar next fall. I suggested you may be at C.S.U. occasionally for radiation exposure of fish and a seminar could be arranged during such a visit.

Sincerely yours,

Robert Behnke

RJB:dch
cc: Putz

May 23, 1973

Mr. Fred Eiserman
Wyoming Game and Fish Commission
188 Dahlia Street
Casper, Wyoming

Dear Fred:

I forwarded your letter re. Snake River cutthroat trout eggs to John Trojnar. If you want to contact John his address is: Department of Conservation, Fernow Hall, Cornell University, Ithaca, New York 14850.

I can't tell you what the plans are at Buelah. I haven't been in communication since my visit last month. It is obvious that most of my activities have little relationship to their program and the one project on field evaluation of Snake River cutthroats, which is relevant to their goals, is conducted with student assistance and would have to be curtailed if I moved to the lab. Enclosed is a copy of a letter to Ray Simon which relates these problems and mentions the possibility of utilizing S.C.S. ponds for field evaluation studies. If we do get some ponds, would you have any suggestions regarding what fish to stock? Perhaps one would be suitable to hold a brood stock of the Canadian brook trout.

We were in Utah sampling lakes stocked with Snake River cutthroats last week. They do well in those semi-desert impoundments. One plant held up for three years with an abundant rough fish population (Utah chub, carp, flannelmouth sucker and green sunfish), whereas rainbows last only a few months.

Sincerely,

Robert Behnke

RB:sa
encl.

May 23, 1973

Dr. Mike Pontrelli
2294 Oppio Street
Sparks, Nevada 89431

Dear Mike:

Most of the basis for temperature relationships on trouts that is generally cited in the literature is from the studies of Brett and Fry at the University of Toronto. A review of this work can probably be found in Brett, J.R. 1956. Some principles in the thermal requirements of fishes. Quart. Rev. Biol., 31:75-87. There are two commonly used indexes of temperature tolerance. The Upper Lethal Temperature defines the limits of long term and gradually acclimated exposure to heat stress (this is the 77 degree F. value given for cutthroat trout). The other index is the Critical Temperature Maximum, which measures ability to withstand short term exposure (this is likely the factor involved in the mortality of trout in ponds which are suddenly forced up above the thermocline as we discussed on the phone).

The data, however, is not as clearcut as might be imagined. First there is the fact of intraspecific genetic diversity and this would be quite significant in a polytypic species such as Salmo clarki. That is, I wouldn't expect all races and subspecies of cutthroat trout to have an upper lethal temperature of 77 degrees F. as found by Fry for the cutthroat trout he experimented with. Two streams north of Elko (Frazier Creek and Sherman Creek) have populations of the native cutthroat trout (S.c. humboldtensis) which survive summer temperatures of 78 degrees F. (Pat Coffin, Nev. Fish. Biol., Elko. Personal Communication). This may be related to the fact that trout acclimated to fluctuating rather than constant temperatures are better able to withstand high temperatures (Heath, W.G. 1963. Thermoperiodism in sea-run cutthroat trout (Salmo clarki clarki. Science, 142:486-488)--a factor not considered in earlier experiments.

My own thoughts on the matter in relation to the influence of temperature on trout are that other criteria are necessary. I have been thinking about a concept I call "functional temperature limits." This would be the temperature where normal activity, feeding and digestion could occur without loss of weight--that is a temperature that the specific fish under consideration could indefinitely survive.

This concept has ecological implications in that within the functional temperature limits the particular fish might coexist with other species and not be displaced by more thermophillic species--which is essentially the problem in the lower Truckee River at present.

Temperature becomes a more critical factor for reproduction. Trout (genus Salmo) will not spawn at temperatures above 55 degrees F., and viability of the eggs are reduced at warmer temperatures (optimum temperatures for rainbow trout embroyonic development is about 5-12 degrees C. [40-54° F.] and probably the same is true for cutthroat trout). The only reference I can recall on cutthroat refers to the coastal subspecies (Merriman, D. 1935. The effect of temperature on the development of the eggs and larvae of the cutthroat trout, Salmo clarki clarki. Jour. Experimental Biol., 12(4):297-305). Bob Lea's M.S. thesis on Independence Lake cutthroat (S.c. henshawi) reported spawning at temperatures of 41-53° F. but these would be the higher range of a diurnal cycle (Ecology of the Lahontan cutthroat trout, Salmo clarki henshawi, in Independence Lake, California. M.A. thesis, Dept. Zool., University of California, Berkeley, 1968).

Cutthroat and rainbow trout spawn under the influence of increasing photoperiod and increasing temperatures. The temperature effect dominates the photoperiod however because I have notes on both cutthroat and rainbow trout spawning in November when they moved from a colder river into a warmer stream. So the spawning time can be highly variable depending mainly on the water temperatures of the spawning streams. During ontogeny, very young trout have slightly lower upper lethal temperature maxima than adult fish. (Spaas, J.T. 1960. Contribution to the comparative physiology and genetics of the European Salmonidae: II Temperature resistance at different ages. Hydrobiologia, 15[1-2]:78-88).

For more comprehensive bibliographic coverage I have: Bibliography on the effects of temperature in the aquatic environment. Contrib. No. 326, Univ. Md. Nat. Resources Inst. (1967) and A preliminary bibliography on extent and cause of early mortality in freshwater fish. FAO Circular No. 307 (1969).

Most studies on the effects of temperature on development concern influence on meristic characters such as number of vertebrae based on eggs hatched at various temperatures. A good review of these studies is found in: Garside, E.T. 1966. Developmental rate and vertebral number in salmonids. Jour. Fish. Res. Bd. Canada, 23(10):1537-1551. I would again emphasize that laboratory experiments are performed under constant temperatures and under natural stream conditions the diurnal fluctuations in temperature could exceed, for brief periods, the reported upper limits for egg development

without harm to the embryos (but salmon (Oncorhynchus) have hatched at constant temperature of at least 15.6°C).

When substantial increased flows are again available in the Truckee River, I don't believe temperatures will be a limiting factor for trout reproduction. Ironically, the improved conditions will most likely result in a substantial increase in the resident brown and rainbow trout populations in the river and consequently more intense competition for spawning grounds and nursury areas between the resident trout and the fish from the lake.

A situation which has some direct relevance to the Truckee River and Pyramid Lake in relation to maintaining the trout population in the lake based on upstream spawning is Lake McConaughy and the North Platte River, Nebraska. A self-reproducing rainbow trout population in Lake McConaughy maintains itself by spawning in tributaries about 100 miles above the lake. The young spend about one year in the tributaries before migration to the lake. However, there is virtually no competition from resident trout in the drainage. There hasn't been a publication on the Lake McConaughy trout yet but I have a copy of a manuscript: Self-sustaining rainbow trout population in Lake McConaughy, Nebraska, by Rod Van Velson, Nebraska Game and Parks Commission, Alliance, Nebraska 69301, which has been submitted to the Transactions of the American Fisheries Society.

I hope this information is of some use and perhaps contribute to more incisive thought on future of the Pyramid Lake fishery.

Sincerely,

Robert Behnke

RB:sa

May 23, 1973

Dr. Alvin R. Grove
Trout Magazine
737 South Sparks Street
State College, Pennsylvania 16801

Dear Dr. Grove:

In regards to the proposed article by Mr. Gagnon, I don't believe there will be any conflict or overlap between our manuscripts. It was my understanding from conversations with Mr. Gagnon that he planned to do an article on the greenback cutthroat trout, based on my data. A copy of an endangered species report on the greenback cutthroat trout is enclosed. This report is being used by Mr. Gagnon as an outline for his story.

The article that I have in mind is on the Snake River cutthroat trout and its potential role in fisheries management. I have been waiting to hear from the Trans. A.F.S. on the fate of a manuscript submitted for publication on this trout. I would like to provide a citation for the Trout Magazine article which would allow the more serious reader and students to examine the data in detail. For your interest, a copy of this manuscript is enclosed.

I also want to obtain more data from the Indian Reservation lakes, alluded to in the manuscript, to provide the most up-to-date information on this cutthroat trout living in very atypical cutthroat habitat. The first field trip and sampling was made in Utah last week and another will be made in June. We are turning up some interesting findings. The Snake River cutthroat survival is strikingly superior to the hatchery rainbow over a two and three year period and it seems virtually unexploited by the bait fishermen--apparently caught mainly on flies and lures. This suggests the possibility of providing a fishery for both the meat fishermen (with hatchery rainbows) and the artificial lure angler (with Snake River cutthroat) in the same lake. One point is becoming increasingly clear and that is when different species are stocked in the same lake, they do interactively segregate and behave differently (and are exploited differentially) than if they were the only species present in the lake.

I would appreciate any comments you may have on the manuscript which could assist me in emphasizing the points most important and relevant to the Trout Magazine audience.

Sincerely,

Robert Behnke

RB:sa
cc: Mr. John Gagnon

May 24, 1973

MEMORANDUM

TO: Wayne Seaman

FROM: Bob Behnkee

SUBJECT: Rare fishes of Colorado

REMARKS:

Enclosed are copies of reports on rare fishes which are pertinent to Colorado. I believe the Division has someone involved with rare and endangered species and you can forward these reports to him.

Thanks for the info you supplied on squawfish and bonytail.

May 24, 1973

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

Dear Jim:

Enclosed are copies of reports on some rare fishes of the Colorado River Basin. I received the copies of the thesis on Lepidomeda mollispinnis and the bait fish report. Many thanks for your assistance. Certainly, L. mollispinnis should be considered on an official list of rare fishes; it appears to be under more imminent threat than Plagopterus, yet has received little recognition except by you.

Has L. mollispinnis been successfully reared in ponds yet?

I take it that W.E. Rinne is related to J.N. Rinne, who wrote a thesis on Gila chubs at Arizona State. Both of these are excellent and are of real assistance for my efforts.

Sincerely,

Robert Behnke

RB:sa

May 24, 1973

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

Dear Steve:

Enclosed are copies of reports on rare trout which might be used by your rare trout committee in developing something similar for California trout.

Sincerely,

Robert Behnke

RB:sa

May 28, 1973

Mr. Gail Kobetich
U.S. Bureau of Sport Fisheries
and Wildlife
P.O. Box 830
Parker, Arizona 85344

Dear Gail:

Enclosed are copies of my reports on some of the rare fishes of the Colorado River basin. Thanks for your assistance in providing the latest information. Other species will be completed soon such as Plagopterus, Lepidomeda mollispinis, L. vittata, Meda fugida, Tiaroga cobitis, Gila intermedia, etc.

Sincerely,

Robert Behnke

RB:sa

Frank Richardson, Region 6
Bureau of Sport Fisheries and Wildlife

May 28, 1973

Bob Behnke, Colorado Cooperative Fishery Unit
Colorado State University, Fort Collins, Colo.

Region 6 endangered fishes

As I mentioned to you during your recent visit, I have some additional fishes the region should be aware of. The May 17 Notice: "Regional Endangered Species" did not include the Rio Grande cutthroat trout of Colorado which is listed in the latest Red Book. The fish section of the 1973 edition of Threatened Wildlife ofthe United States is little improved over previous editions and is far from an acceptable level of information content. Several of the reports I have been writing for Region II are applicable to Region VI. Enclosed are the pertinent species completed to date. The squawfish, humpback chub, greenback cutthroat and Rio Grande trout are on the USDI 1973 list. The Colorado River cutthroat and yellowfin cutthroat are listed as undetermined but my reports provide more up-to-date information. The Utah cutthroat is undetermined but I will suggest a rare category for it when I write the report. The bonytail chub is not included in the 1973 list but it should be--it is rapidly vanishing. Other species, such as the Virgin River spinedace, Lepidomeda mollispinnis, (Utah) will undoubtedly be included in future lists (it is more vulnerable to extinction than the Virgin River woundfin, Plagopterus argentissimus, which is listed), and I will forward copies of reports on species which the region should be aware of when they are completed.

RB:sa

Region II, Rare and Endangered Species Team
Bob Azevedo, Team=Leader

May 28, 1973

Bob Behnke, Colorado Cooperative Fishery Unit
Colorado State University, Fort Collins, Colo. 80521

Reports

Enclosed are copies of reports on three subspecies of cutthroat trout. I'll give you a call soon for the latest information on the Apache trout in relation to logging of the Bonito Creek watershed.

RB:sa

May 28, 1973

Mr. Paul Cuplin
Bureau of Land Management
Forestry and Wildlife
Denver Federal Center
West 6th Ave. and Kipling
Lakewood, Colorado

Dear Paul:

Enclosed are reports on some Colorado River basin rare fishes which have some relevance to BLM activities. You will see I mentioned your involvement with the squawfish--what are your plans for getting spawn?

Sincerely,

Robert Behnke

RB:sa

Drs. Pettus and Flickinger (Committee members) May 28, 1973

Bob Behnke

Gary Wernsman's thesis

The enclosed draft of Gary's thesis on Colorado native trout essentially covers all the information that will be presented. Some minor corrections and rearrangements and modifications of tables will be made and a short discussion on some projects to re-introduce some of these trout will be added.

Because Gary will be away until July with the National Guard, I thought we could go over this draft and have all comments ready to incorporate into final typing which should allow the completed version and oral exam (probably late July if we can all get together for about two hours) taken care of for an August 3 graduate school deadline for the next date of granting a degree.

Also enclosed are copies of reports I've written on these trouts, largely based on the data in the thesis.

RB:sa

May 28, 1973

Mr. Dave Stevens
Research Biologist
Rocky Mountain National Park
Box 1514
Estes Park, Colorado

Dear Dave:

I have been writing reports on rare fishes and enclosed are two reports relevant to Rocky Mountain Park--the greenback trout and the Colorado River cutthroat. You'll be particularly interested in the population of cutthroat discussed from the very source of the Colorado River in R.M.P. As mentioned in the report, this area should be examined more thoroughly. The collection in 1970 was made by my students and I have not seen the site above Lulu City. I would like to arrange a detailed trip and sample the area between the cutthroat population and Lulu City. The specimens taken in 1970 ideally approximate Salmo clarki pleuriticus and if more detailed sampling verifies this then you have a population of Colorado River cutthroats right in the Park that can be used for re-introductions.

Sincerely,

Robert Behnke

RB:sa

May 31, 1973

Forest Supervisor
Santa Fe National Forest
P.O. Box 1689
Santa Fe, New Mexico 87501

Attn: John Drake

Dear Mr. Drake:

I have discussed a project on identification of Rio Grande cutthroat trout with Mr. Chuck Kennedy of your regional office. This project would cover the examination and evaluation of preserved trout samples collected on Forest Service lands in the Rio Grande drainage this summer. Comparison of specimens with our established diagnosis of the Rio Grande cutthroat trout will allow an accurate evaluation of the relative purity of the populations the samples are derived from. The estimated costs to employ a student assistant (a graduate student will be used if possible) to assist in the examination of approximately 200 specimens and for the analysis of data and completion of a report, is $400.00. I anticipate the University will furnish a work-study student (at no cost) allowing more specimens to be handled. Thus, the figure of 200 specimens should not be considered as a maximum, and all collections made for identification from the Rio Grande basin are urged to be sent to me.

I estimate completion of the project by January, 1974.

Enclosed is a just completed report on the Rio Grande cutthroat trout and a direction sheet for preserving specimens which may be forwarded to the person involved with the collections.

Sincerely,

Robert Behnke

RB:sa

June 6, 1973

Mr. Chuck Kennedy
United States Forest Service
517 Gold Avenue, southwest
Albuquerque, New Mexico 87101

Dear Chuck:

Enclosed are reports of some rare fishes relevant to your area. Reports on the Gila trout and Apache trout will be ready soon and several other rare fishes of Arizona and New Mexico will be covered.

Any comments and suggestions that can help make these reports more useful for your purposes will be appreciated.

The latest U.S.D.I. "red book:" Threatened wildlife of the United States (1973), has not improved the fish section, which is still inadequate in regards to the species covered and in information content. My reports are aimed at supplying more complete information on the fishes of region II of the USBSFW.

Sincerely,

Robert Behnke

RB:vv

June 6, 1973

Mr. Bob Saile
The Denver Post
650 Fifteenth Street
Denver, Colorado

Dear Bob:

I read your column of last week regarding a book: "Through the fish's eye." Your comments on the book's failure to discuss the effects of weather and barometric pressure changes on fish behavior reminded me of our previous discussions on the matter. As I told you, I knew of no published reference to experimental studies on the influence of atmospheric pressure on fish feeding and behavior. I could only point out that fish have the equipment to detect minute pressure changes but the actual change effected by a drastic drop in barometric pressure is equal to the change a fish undergoes by moving only a few inches upward in the water. Enclosed is a copy of an English translation from a Russian journal which I edit. To my knowledge, this is the first publication dealing with the effects of atmospheric pressure changes on fish behavior based on experimental evidence. The fish studied, the loach, is known from aquarium observations to be influenced by barometric changes--being dormant during low pressure and more active with increasing pressures. The common name for the loach in the aquarium trade is "weather fish." A loach is not a trout but I thought you might be interested in obtaining some supporting data that activity decreases during a drop in barometric pressure at least in the loach.

I haven't seen the book you wrote about yet but I spotted one error from it reported in your review. Fish can't hear through their lateral line as commonly believed. The lateral line detects minute pressure changes (vibrations from moving objects, etc.) but sound waves are much too feeble to stimulate the sensory hairs of the lateral line system. The fact that fish can't hear through the lateral line was first demonstrated by the experiments of Dijkgraaf of the University of Utrech, Netherlands and his results were published in 1963.

Have you been keeping records of your quantitative fishing success in relation to barometer readings?

Also enclosed are reports on the four subspecies of cutthroat trout which comprised the original trout fauna of Colorado. Sometime when you need material for writing a column ahead, you might look these over. The greenback trout, and hopefully the Colorado River cutthroat trout, will be restored to some waters in Rocky Mountain Park. The yellowfin trout is a mystery; if you ever hear any stories about it let me know.

Sincerely,

Robert Behnke

RB:vv

June 6, 1973

Mr. Glen Cole
National Park Service
Yellowstone National Park
Wyoming 83020

Dear Glen:

The Park Service contribution to my program was renewed and I am thankful because these finds have been the major source for hiring student assistants and for field work. Because of the Park's Service's financial assistance I was able to get much accomplished during the past year.

Enclosed are some reports on rare fishes that are relevant to the Park Service. Several more will be available soon. A thesis was completed on greenback cutthroat trout and Colorado River cutthroat trout. Hopefully these trout can be re-introduced into Rocky Mountain Park this year.

For this year, I plan to support a M.S. thesis on Snake River cutthroat trout. If the Park Service has need of urgent information on any fish, let me know and perhaps we can arrange a study.

During my field work in the Yellowstone and Teton Park area last year, I was able to more accurately determine the distribution of the two forms of cutthroat trout in the Snake River (the large spotted form occurs in all waters above Jackson Lake and in downstream tributaries to Spread Creek. The fine-spotted form is in the main Snake River and tributaries from the Gros Ventre, southward, but in tributaries below Palisades Reservoir, the large spotted form is the native trout.

In Yellowstone Park, the population in Sedge Creek, above Turbid Lake, is sharply differentiated from the Yellowstone Lake cutthroat trout, evidently the Sedge Creek trout is close to the original ancestor which enterred the Yellowstone basin from the Snake River, whereas the lake population has undergone lacustrine selection

and is changed in several characters. We found the Sedge Creek trout to be extremely sparse despite the fact that Sedge Creek appeared to be an ideal trout stream. (Bulkley claimed the Sedge Creek trout were abundant: 1963. Fish and Wildlife Ser. Spec. Sci. Rept.-Fish n. 460). I doubt that their decline could be attributed to fishing pressure. Perhaps severe winter conditions are a factor. If re-establishment of native fishes is proposed in Yellowstone Park, a transplant of the unique genotype in Sedge Creek might be considered. A stream that could be rehabilitated for native trout is Elk Creek, tributary to the Yellowstone River below the falls. We found rainbow and cutthroat hybrids in the lower section and eastern brook trout in the upper area. The trout in the Yellowstone River below the falls are interesting and the situation is highly unusual. Although rainbow trout are present, the native cutthroat is the dominant fish. Both species maintain their integrity and the typical hybrid swarm, which usually develops when rainbow and cutthroat trouts exist together has not occurred here. Evidently there are strong selection pressures against hybrids.

We also found a population of native upper Missouri drainage cutthroat trout in Cougar Creek, an isolated tributary of the Madison River in the Park. Other collections from tributaries of Yellowstone and upper Missouri in Montana and from the Columbia River drainage of Montana and Idaho provided the material to begin to understand patterns of differentiation. It appears evident now that the westslope and eastslope cutthroat trout (upper Columbia and upper Missouri) are more closely related to each other than either of them are to the Yellowstone drainage cutthroat trout (which are derived from the large-spotted Snake River form). A publication of the role of the Snake River cutthroat trout in fisheries management should appear this year in the Trans. Am. Fish Soc. If any of the enclosed reports should be sent to certain people, send me their names and addresses. Copies of the greenback and Colorado River trout reports were sent to Rocky Mountain Park. As future reports, which relate to National Parks, such as the Virgin River fishes and Zion Park, Utah, are completed, I'll forward copies. Unfortunately the U.S.D.I. 1973 book on rare and endangered fauna: "Threatened wildlife of the United States" is still lacking a valid and creditable fish section. Information content is lacking, erroneous information is given and many glaring omissions occur.

Sincerely,

Robert Behnke

RB:vv

Don King, U.S. Bureau of Sport Fisheries and Wildlife, Reno, Nevada

6/7/73

Bob Behnke, Colorado Cooperative Fishery Unit

Truckee River

Enclosed are copies of two letters I sent to Mike Pontrelli regarding trout, temperatures and the Truckee River.

I hope that Mike hasn't used my remarks to make it appear that I am an apologist for the power plant. As you will note, I really was not considering the power plant as an important factor in the long range view of its effects on the Pyramid Lake trout and their spawning in the Truckee River because I was told the power plant would completely cease all discharge by next year. As you told me, however, this matter is not yet settled.

The point I am making in one of the letters regarding my ideas on "functional temperatures" is that marginal or subthreshold lethal temperatures are not good enough to maintain a trout fishery where non-salmonids are available to exploit a mutual resource.

Robert Behnke

RB:sa

June 13, 1973

Mr. Bill Jackson
N.O.L.S.
Box AA
Lander, Wyoming 82520

Dear Bill:

Enclosed are some reports, reprints, etc. with some background information on some trout you may encounter, which could be valuable for my studies. In particular, I would like samples from pure populations of native trout from the upper Snake and Yellowstone drainages (not Yellowstone Lake). Specimens from the Buffalo drainage would be most valuable. I would also be interested in any general ecological observations such a presence of brook trout, brown trout, rainbow trout and hybrids in any streams you may visit. I am attempting to better define optimum cutthroat trout habitat--that is, under what conditions can they hold their own and dominate introduced trouts and what environmental factors promote their displacement by introduced species.

If your group will keep accurate entries in a small note pad on such matters, they could be of real assistance.

Sincerely,

Robert Behnke

RB:sa

June 14, 1973

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

Dear Clare:

Enclosed are reports on Colorado River fishes which include much information I obtained from you and Paul Holden. If you and Paul will read them, I would appreciate any comments and addenda. Also are reports on the native cutthroat trouts of Utah.

I recently received five large specimens of humpback suckers collected in April above Grand Junction on the Colorado River. They are reported to be locally abundant in April, then disappear, but small specimens are never found.

Do you know anything about the Utah Lake sucker, Chasmistes liorus? Its status is quite uncertain due to lack of detailed information. Dave White at Brigham Young University told me one of his students obtained a live specimen from a commercial fisherman last December and they kept it alive for four months and now have it frozen. He claims it looks so distinct that it couldn't be confused with Catostomus. I would think that if such a distinct sucker had a spawning run up the Provo River, it would be common knowledge--perhaps they spawn elsewhere.

Did you make the surveys of the S.C.S. ponds on May 31, and get data on the Jones Hole and Donaldson rainbow trout? Jim Mullen told me he suspected winter kills would be common in farm ponds this year. If you were able to get the data, I would be most interested in examining the effects of over winter stress on differential survival.

Sincerely,

Robert Behnke

RB:sa

June 14, 1973

Dr. Alvin R. Grove
Trout Magazine
737 South Sparks Street
State College, Pennsylvania 16801

Dear Dr. Grove:

In my recent correspondence regarding articles on cutthroat trout I forgot to include an inquiry for further details on an article published in the winter, 1973 edition of Trout. The article is: The sacred trout of the Otomi Indians, by Emil Zubryn. My question concerns the "trout" discussed in the article. The Mezquital Valley is far outside the known, native distribution of trout or any species of Salmonidae. The photographs with the article are too obscure to identify the fish involved. Could you find out what the species of fish the author called "trout" in this article, or if a clear photograph of the fish is available I would like to examine it.

A student has just completed his Ph.D. dissertation on a local river with a fishery based both on wild trout and catchable trout. The data on populations, catch, etc. is most interesting, but the economic evaluations of the stocked and unstocked sections of the river in regards to costs and benefits is indeed most striking. For the first time some quantitative data is available demonstrating the value of a fishery based on wild, self-sustaining trout populations contrasted with an expensive put and take fishery on the same river. This information is so directly relevant to the message Trout Unlimited is trying the promote, that I will ask permission to abstract and synthesize the highlights for a jointly authored article for Trout magazine. Thsse research findings should be made known to a wide audience.

Sincerely,

Robert Behnke

RB:sa

June 15, 1973

Mr. George Dern
Soil Conservation Service
P.O. Box 2440
Casper, Wyoming 82601

Dear George:

Many thanks for your efforts in producing the list of potential ponds for fisheries research.

Enclosed are copies of letters to Ray Simon and Fred Eiserman on the matter. I hope something will come from your efforts. Personally, I have no authority to direct how these ponds might be used. I can only act as an adviser to the Game and Fish Department and the Genetics Lab to get something started that would be relevant to my trout research.

Also enclosed is a report on a rare trout in Nevada with mention of possible S.C.S. involvement for its propagation. Again, you'll note that the ultimate decision is up to Nevada Fish and Game and all I can do is urge that they take action.

Sincerely,

Robert Behnke

RB:sa

June 15, 1973

Dr. Ray Simon
U.S. Bureau of Sport Fisheries
and Wildlife
Genetics Laboratory
Buelah, Wyoming 82712

Dear Ray:

Mr. George Dern of the Soil Conservation Service, Casper, Wyoming, has sent a list of ponds that might be available for use in fisheries research. Enclosed are copies of the data sheets. Note that there are possibilities in the Sundance area. I also have a list and map of ponds in Converse Co., submitted by the Forest Service.

What I need to know now is if the Genetics Lab plans to get into field work this year and if you could use any of the ponds for experimental stockings? Perhaps you might contact the S.C.S. office in Sundance and arrange to examine some waters for suitability. I'll also pass this information on to Fred Eiserman for his consideration. Wyoming should receive a Canadian strain of brook trout this year and some of these ponds might be suitable to hold brood stock for propagation.

Have you selected the races of trout that will be evaluated by the Genetics Lab?

My best regards to the staff.

Sincerely,

Robert Behnke

RB:sa
cc: Fred Eiserman
George Dern

June 15, 1973

Mr. Fred Eiserman
Wyoming Game and Fish Commission
188 Dahlia Street
Casper, Wyoming

Dear Fred:

Enclosed are copies of some data sheets sent by George Dern regarding possible ponds for fisheries research, brood stocks etc. Also a copy of my letter to Ray Simon on the matter. Have you heard from Ray on the subject of a state-federal cooperative project on evaluation of trout races?

My thoughts are that some of these ponds might be suitable to hold some brood stocks of such fish as the Eagle Lake rainbow, Lake Ohrid trout, Snake River cutthroat, Canadian brook trout, perhaps a native Missouri basin cutthroat strain such as Paint Rock Creek, etc.

Enclosed are some reports on rare trout and other fish pertinent to Wyoming. The Snake Valley cutthroat trout is not a Wyoming fish, but there is mention of the possible use of S.C.S. ponds to hold brood stock.

I'm planning some farm pond plants of Snake River cutthroat in Colorado and Utah, and other plants in lower elevation, more eutrophic environments. Out samples from Utah two weeks ago pointed out that the Snake River cutthroat was able to persist with relatively good survival for at least three years in an enriched irrigation reservoir with a tremendous population of rough fish--carp, flannelmouth sucker, Utah chub, green sunfish, etc. No trace of a brown trout plant was found and rainbows do very poorly despite an abundance of Cladocera. In another lake we found the Snake River cutthroat was doing well with greater long term survival than either rainbow or brook trout, but the creel census data revealed that when the water warmed in late April, the cutthroat almost vanishes from the catch. This, I beleive, is mainly due to the fact that the fishermen are conditioned to fish for catchable rainbows. The abundant brook trout population was virtually untouched by the fishermen. I think we're getting some good data on the concept of interactive segregation developed in John Trojnar's thesis.

John sent me a copy of his letter to you on the proposed trout exchange. Eggs from both the Assincia and Temiscamie strains would provide more options for inter-racial hybrids. Although you'll probably keep a brood stock in a hatchery, it would definitely be advantageous if pure stocks could be maintained in ponds or reservoirs under natural conditions.

Sincerely,

Robert Behnke

RB:sa

June 19, 1973

Mr. Clifford J. Martinka
Research Biologist
Glacier National Park
West Glacier, Montana 59936

Dear Mr. Martinka:

Thank you for your letter informing me of your plans for trout collections this year. Most of the specimens I received last year were from the Flathead drainage. Samples from South Saskatchewan drainage and upper Missouri drainage in vicinity of Glacier Park are lacking in my collections and would be a most important addition for a comprehensive study of the systematics of the native trout of this region.

Reading early accounts of trout stocking in Glacier Park in the U.S. Fish Commissioner's Repts., makes it evident that trout were widely introduced in many remote waters. Evidently, much of the potential trout waters in the Park were originally barren of fish due to barriers.

Probably, the cutthroat trout introduced into Glacier Park came from Yellowstone Lake and I am confident I can distinguish the descendents of Yellowstone Lake trout from the true native trout of the area.

Encloded is a preliminary report on the westslope cutthroat trout. If specimens are forthcoming this year from the South Saskatchewan and upper Missouri drainages. I believe we will have sufficient material for a graduate student thesis.

Sincerely,

Robert Behnke

RB:vv

June 19, 1973

Mr. Terrence Merkel
Fishery Management Biologist
Bureau of Sport Fisheries and Wildlife
P.O. Box 1403
Gallup, New Mexico 87301

Dear Terry:

I was sorry to hear that Stone and Dulce lakes winter--killed. I was hoping to obtain some further data on the Snake River cutthroat survival. Fortunately, there are three lakes on the Uinta--Ouray Reservation which still have this strain and we are concentrating our sampling on these lakes to complete the project this year. Two students and I sampled these lakes with Jim Mullen last month and monthly samples will continue through the summer. The study will result in a thesis and I'll keep you informed on pertinent information regarding the role of the Snake River cutthroat in a management program.

A publication on Snake River cutthroat should come out in the Trans. Am. Fish. Soc. this year or early next year.

Keep me informed of any future plants you make.

Sincerely,

Robert Behnke

RB:vv

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : Region II Rare and Endangered Species Team
Attn: Bob Azevedo

DATE: June 20, 1973

FROM : Bob Behnke

SUBJECT: Species reports

Enclosed are copies of the most recently completed species reports. Because of the new funding, I'll go ahead and include several species that were not originally considered, but definitely should be--such as the enclosed "Goodenough" gambusia and the Snake Valley cutthroat trout.

Anyone taking the time to read all of the reports would have the benefits of a course in basic ichthyology.

5010-108

June 20, 1973

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

Dear Don:

Just to keep you informed on my activities with S.C.S. ponds in Wyoming for fisheries management, enclosed is a copy of a letter to Fred Eiserman on the matter. I haven't heard from the Genetics Lab on their plans, but I had hoped some sort of federal-state cooperative venture would be started this year on evaluation of various trout strains.

Also enclosed are some reports on rare fishes that pertain to Wyoming. I believe Galen Boyer was handling your rare and endangered species so you might pass these on to Galen.

Sincerely,

Robert Behnke

RB:sa

June 20, 1973

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

Dear John:

Thanks for keeping me informed on the N.Y.--Wyoming trout exchange and your sucker work. I suggested to Fred Eiserman that if they could get eggs from both the Assinica and Temiscamie strains, there would be more options for inter-racial hybridization.

I would like to receive any data, reports, etc. you have now or in the future on the dwarf sucker. I would also like some preserved samples of both the dwarf and normal forms--from both sympatric and from allopatric populations if possible.

I plan to have John Clark sample the Montana lakes this summer and try to get some information on Westslope cutthroat trout. Do you have any of the data from last year's samples? If so, could you send a copy of the facts and figures?

Ted Murphy has been quite successful in raising our Snake River cutthroat fry. A stocking will probably be made in West Lake (Near Dowdy) which has brown trout, rainbow trout and suckers.

Paul Sekulich and I sampled the Utah lakes a few weeks ago. High runoff and snow prevented access to Weaver Reservoir. The cutthroats were thriving in Towove and doing o.k. in Bottle Hollow, but neither the cutthroat or brook trout were being caught by anglers in any numbers. The April 30-May 14 creel census was 539 rainbow trout, 13 cutthroat and nine brook trout--yet our horizontal gillnet was crammed with brook trout. The cutthroat, however, are the larger and older fish. In Midview Reservoir, we found no cutthroat and they are probably about gone after three years. We found no brown trout from last year's plant and only recently planted rainbows in poor conditions were netted. The rough fish population is tremendous. When the nets were hauled it looked like the simplest thing to do would be to bury them--but the carp, suckers and chubs were finally removed after three hours.

Enclosed is a letter I received from the editor of A.F.S. It sounds favorable.

Tom Jackson tells me he may be living with you. Tom and Murphy slaughtered some sheep Saturday and I am waiting for Tom to show up so we can go over to the Soils Lab and cut the meat up--I was planning on lamb chops for dinner.

Sincerely,

Robert Behnke

RB:sa

June 21, 1973

Mr. Pat Coffin
Nevada Dept. Fish and Game
Box 1087
Elko, Nevada 89801

Dear Pat:

Enclosed is a copy of a report on rare fishes prepared for the U.S.B.S.F.W. You will note your name in relation to possible use of S.C.S. ponds for brood stock propagation.

I plan to update and add new information to these reports throughout the year and I would appreciate being informed on any plans or activities concerning the Humboldt trout and the Chino Creek trout.

Sincerely,

Robert Behnke

RB.vv

Enclosures

June 21, 1973

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

Dear Mr. Coad:

I am sorry that I can't be of much assistance in supplying specimens of the cyprinid genera you requested. All of the species on your list with the exception of Agosia chrysogaster are of highly restricted distribution and quite rare.

The following persons should have at least some of the species in their collections: Dr. W.L. Minckley, Dept. Zoology, Arizona St. Univ., Tempe, Arizona; Dr. James Deacon, Dept. Biology, Nevada Southern Univ., Las Vegas, Nevada; Dr. David White, Dept. Biology, Brigham Young Univ., Provo, Utah.

If you are unsuccessful let me know, I may have a few specimens of Lepidomeda vittata and L. Alvivallis in my collections (which are almost exclusively salmonid fishes).

I do have specimens of a new genus and two new species recently described by Hubbs and Miller (1972 Trans. San Diego Soc. Nat. Hist., 17(8): 101-106), Relictus solitarius and Gila alvordensis.

Apparently the affinities of Relictus, Agosia and Tiaroga are with Rhinichthys, whereas the spinedace tribe are derived from a Gila-like ancestor.

Is Dr. Qadri supervising your study? If so, give him my regards.

Sincerely,

Robert Behnke

RB:vv

June 21, 1973

U.S. Department of Commerce
National Marine Fisheries Service, NOAA, FX41
International Activities Staff (Translations)
Washington, D.C. 20235

Dear Sir:

Enclosed are sheets regarding NOAA translation lists. Also ä request a loan of #221 listed in No. A-67, 1973: The whitefishes of Siberia by B.K. Moskalenko.

Thank You,

Robert Behnke

RB:vv

Enclosures

June 21, 1973

Mr. Dean Doell
Humboldt National Forest
976 Mountain City Highway
Elko, Nevada 89801

Dear Dean:

Enclosed is a copy of a report prepared for the U.S.B.F.W. On rare fishes. New information will be added during the year and I would appreciate being informed on any plans or actions taken by the Forest Service on the Mt. Wheeler trout and the Humboldt trout.

Sincerely,

Robert Behnke

RB.vv

Enclosures

June 21, 1973

Mr. Frank Dodge
Nevada Dept. Fish and Game
P.O. Box 1109
Ely, Nevada 89301

Dear Frank:

I have written a series of reports on rare fishes and enclosed is a copy of the report on the Mt. Wheeler or Snake Valley cutthroat trout.

I plan to up-date and add current information to these reports throughout the year and I would like your comments, particularly in regards to the proposed treatment of Hendrys Creek mentioned in the report.

Sincerely,

Robert Behnke

RB:vv

Enclosures

June 25, 1973

Mr. John Hewitson
1033 San Abella Drive
Encimitas, California 92024

Dear Mr. Hewitson:

Thank you for the color slides of the Mt. Palomar trout. The pertinent question concerning the orange coloration is: can these colors be expressed by pure S. gairdneri? I doubt it. The orange coloration of native trout seems to appear only in areas where S. gairdneri came in contact with the red-banded trout after the last glaciation.

California Fish and Game now has a committee on threatened trout. They are considering the red-banded trout in this category and you may wish to call the Pauma Creek population to their attention. Mr. Steve Nicola, Dept. Fish and Game, 1416 Ninth St., Sacramento, CA 95814, is chairman of the committee. I will send Steve a copy of this letter to inform him and let him know that you have data and information from myself and Carl Hubbs on trout in southern California.

One of our students just completed his Ph.D. thesis on an economic evaluation of a wild trout fishery vs a catchable fishery on the same river. The information he uncovered is indeed interesting in that it establishes some quantitative economic values for both fisheries--and the wild trout fishery comes out ahead. I plan to summarize the data for an article in Trout Magazine and I'll send a copy of the manuscript to you when it is ready.

Sincerely,

Robert Behnke

RB:vv

cc:Mr Steve Nicola

June 25, 1973

Mr. Steve Micola
Dept. Fish and Game
1416 Ninth Street
Sacramento, California 95814

Dear Steve:

Enclosed is a copy of a letter to Mr. Hewitson to call your attention to some information on the native trout in southern California.

The trout in Panama Creek near Mr. Palomar (trib. San Luis Rey R.) exhibit some colorations similar to the red-banded trout. Undoubtably this population has been hybridized with hatchery rainbows which are regularly stocked in Doane's Pond on the headwaters of the creek, however, I examined 10 specimens and they have characteristics atypical of hatchery rainbows.

Several year ago I examined specimens from Siberia Creek, tributary to the Bear River, which also agree with the Pauma Creek trout in several characters. My contention is that the native trout of the coastal drainages of southern California--Baja probably was based on a hybrid between S. gairdneri and the original trout of the area, which was likely of the red-banded group.

I doubt if there is a single extant pure population of the native trout of the Santa Ana, Bear or San Luis Rey rivers, but your committee should recognize that if such a population could be found it would be a highly significant group.

You might circulate a query on possible pure populations of native trout in southern California among the committee and let me know if any leads turn up.

Sincerely,

Robert Behnke

RB:vv

Enclosures

June 25, 1973

Ms. Patti Some
American Fisheries Society
1319-18th St. N.W.
Washington, D.C. 20036

Dear Ms. Some:

I had not intended to officially change my permanent address for A.F.S. mailings, but to avoid this problem again, my address for all future A.F.S. mailings should be:

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

Sincerely,

Robert Behnke

RB:vv

June 26, 1973

Mr. Gilbert Davidowitz
309 West 109 Street #4B
New York, NY 10025

Dear Mr. Davidowitz:

Enclosed are three papers that refer to Atlantic salmon or Mediterranean Salmonids.

None of my articles are entitled "World-wide distribution of salmon," but Dr. Hugh MacCrimmon of Guelph University, Guelph, Ontario, Canada is working on such a paper at present.

The southernmost distribution of Salmo salar is northern Portugal. This species does not occur, nor is there any evidence that it ever occurred in in the Mediterranean area. As you may note in my papers, the references to S. salar in the Mediterranean are based on C.T. Regan's belief that a Yugoslavian trout, Salmothymus obtusirostris, is actually a relict Atlantic salmon, but this is not true.

Almost certainly, salmon occurred further to the south during the last glacial epoch, because suitable habitat was available at that time. How far south they extended can only be guessed. There are no relict populations, as there are with S. trutla in the Atlas Mountains of North Africa, nor is there known fossil evidence.

Sincerely,

Robert Behnke

RB:vv

Enclosures: