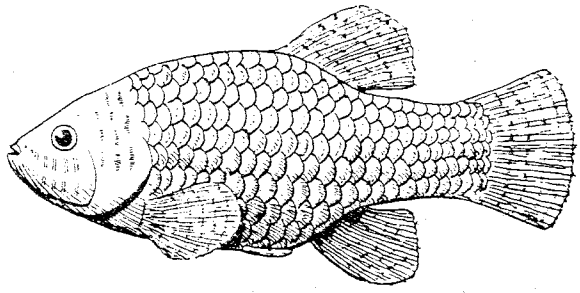
Desert Fishes Council



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The mission of the Desert Fishes Council is to preserve the biological integrity of North America's desert aquatic ecosystems and their associated life forms, to hold symposia to report related research and management endeavors, and to effect rapid dissemination of information concerning activities of the Council and its members.

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ISSN 1068-0381 **The entire DFC Proceedings is printed on 60% post-consumer recycled paper.**

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* marks the person who presented the paper

PISTER, E. P.; WILLIAMS, J. E. (Desert Fishes Council)

Introduction and Announcements

KEYWORDS: Desert Fishes Council; 24th Annual Symposium

ABSTRACT

Next year the Desert Fishes Council will celebrate its 25th Anniversary. As we view our progress, we may look with pride upon our growth and success. We have increased our numbers by more than 500, and we are truly international in membership and perspective. As we enter into the next 25 years, we may be sure that it will become increasingly difficult to protect the aquatic biological resources that brought us together in 1969. However, we may take comfort in the fact that we are now much better equipped to handle the problems that confront us than we were when we first met. The next 25 years will be fraught with both problems and promise. This will be a productive subject to occupy our thoughts as we approach next year's meeting.

RESUMEN

(Due to an oversight by the editor, this was translated by the editor, not the Translation Committee) En un año el Desert Fishes Council celebrará su vigésimoquinto aniversario. Podemos sentir orgullosos sobre el crecimiento del grupo y los exitos. Ahora contamos con mas de 500 miembros y somos verdaderamente un grupo internacional en membresia y perspectiva. En los 25 años futuros que vamos entrando, podemos estar seguros que va a ser siempre mas difícil proteger los recursos que nos animaron a reunirnos en 1969. Sin embargo, podemos estar cómodos en el hecho que estamos ahora mucho mejor equipados para manejar los problemas que nos enfrentan que eramos cuando primero reunimos. Los próximos 25 años estarán llenos de ambos problemas y promesas. Es un tópico fértil para contemplar mientras acercamos a nuestra próxima reunión.

BAUMGARTNER, J. V. (The Nature Conservancy, Western Regional Office, Boulder, CO)

Successful protection and management of desert fishes: The Nature Conservancy's perspective and prospectus / Protección exitosa y manejo de peces de desierto: Perspectivas y expectativas de The Nature Conservancy

KEYWORDS: desert fishes; protection; acquisition; water rights; preserves; management; public land

ABSTRACT

The Nature Conservancy (TNC) has been active in the protection of native desert fishes and their habitat since at least 1969. Protection strategies include: acquisition of fee title, either for addition to the TNC preserve network or for transfer to a public land management agency; acquisition of water rights for instream flow; conservation easements on land and water rights; management agreements with private and public partners; and financial support and staff participation in research and monitoring. To date, TNC has been involved in the protection and/or management of over 30 species and subspecies of desert fishes, including 19 that are federally listed as threatened or endangered. TNC owns and manages at least 10 preserves which protect desert fishes, including some of the best examples of intact native fish communities, and has been a leader in the protection of instream flow rights for desert fishes. Acquisition of water rights and cooperative projects with public land management agencies, rather than additions to the existing TNC preserve network, are likely to be the focus of future activity.

RESUMEN

The Nature Conservancy (TNC) ha sido activa en la protección de peces nativos del desierto y de su hábitat al menos desde 1969. Las estrategias de protección incluyen: Adquisición de títulos de derecho, siempre para adicionarlos a red de reservas de TNC o para transferirlos a agencias de manejo de tierras públicas; adquisición de derechos de aguas para flujo de arroyos; facilidades de conservación en derechos de tierra y agua; acuerdos de manejo con socios públicos y privados; y apoyo financiero grupos de participación en investigaciones y monitoreo. Como información, TNC ha estado involucrada en la protección y/o manejo de más de 30 especies y subespecies de peces del desierto incluyendo a 19 que están enlistadas federalmente como especies amenazadas o en peligro de extinción. TNC tiene y dirige al menos 10 reservas que protegen peces del desierto, incluyendo algunos de los mejores ejemplos de comunidades intactas de peces nativos, y ha sido un líder en la protección de derechos de flujos de arroyo para peces del desierto. La adquisición de derechos de agua y proyectos cooperativos con agencias de manejo de tierras públicas, más que adiciones a la red de reservas de TNC existente, parece ser el foco de actividades futuras.

STEFFERUD, J. A.*; WILLIAMS, C. D. (JAS-USDA Forest Service, Tonto National Forest, Phoenix, AZ; CDW-USDA Forest Service, Wildlife and Fisheries Staff, Washington, D. C.)

Agency Presentation--USDA Forest Service / Presentación de agencia--Servicio Forestal Departamento de Agricultura de los Estados Unidos

KEYWORDS: New Mexico; Arizona; Utah; Wyoming; Salmonidae; Poeciliidae; Cyprinidae; Catostomidae; Forest Service; Bureau of Land Management

ABSTRACT

Eighty-eight species of fish that have been listed or are candidates for listing pursuant to the Endangered Species Act of 1973 and 26 federally listed invertebrates occur on National Forest System (NFS) lands in the United States. An additional 340 aquatic species have been designated as "sensitive" by the Forest Service. Of the federally listed fish species, about 41 occur in the area of interest to the Desert Fishes Council (DFC). With the recent signing of a Memorandum of Understanding among the Forest Service, the Bureau of Land Management (BLM), and the DFC, management of native western fishes could receive significant new emphasis within both agencies. The DFC should continue to encourage the agencies to emphasize the terms of the MOU.

Polling of selected regions of the Forest Service indicated that management of nearly 25% of the 41 species of interest to the DFC is supported by specific programs, either species- or habitat-focused, that were coordinating long-term, recovery-oriented activities. A few species of trout, including Gila, Rio Grande cutthroat, and Colorado cutthroat *Oncorhynchus gilae*, *Oncorhynchus clarki virginalis*, *Oncorhynchus clarki pleuriticus*, respectively, received most of the effort. Activities included monitoring and surveys of populations, construction of barriers and other fish habitat improvement devices, replacement of nonnative trouts with native species, and in one case, construction of a reservoir. Nongame species, including Gila topminnow, Little Colorado spinedace, Chihuahua chub, and Sonora chub *Poeciliopsis occidentalis occidentalis*, *Lepidomeda vittata*, *Gila nigrescens* and *Gila ditaenia*, respectively, also had activities reported. Included were investigations on the status, life histories, and genetic makeup of the four nongame species referenced, as well as habitat restoration efforts for other nongame species.

In September 1991, the Forest Service initiated a new program, "Bring Back The Natives," with the BLM and the National Fish and Wildlife Foundation (NFWF), to improve management and restore the health of river systems and their native fish communities. Nineteen projects targeting 14 native fish species received funding during the first year. Of those, nine projects targeting six native fishes were on NFS lands of interest to the DFC. Phase two of "Bring Back The Natives" has received approval from the NFWF and includes 34 projects in 13 states. These projects target 20 salmonids, 12 cyprinids, 8 catostomids, 2 cottids, 1 petromyzontid, and 4 amphibians. As with all "Bring Back The Natives" projects numerous non-target native aquatic and terrestrial species also will benefit.

RESUMEN

Ochenta y ocho especies de peces que han sido enlistadas o son candidatas para ser enlistadas según el Decreto de Especies en Peligro de Extinción de 1973 y 26 invertebrados enlistados federalmente ocurren en terrenos del Sistema de Bosques Nacionales (NFS) en los Estados Unidos. 340 especies acuáticas adicionales han sido designadas como "sensitivas" por el Servicio Forestal. De las especies de peces enlistadas a nivel federal, cerca de 41 ocurren en el área de interés del Consejo de los Peces del Desierto (DFC). Con la reciente firma de un Memorándum de Entendimiento entre el Servicio Forestal, la Agencia para el Manejo del Suelo (BLM), y el DFC. El manejo de los peces nativos del Oeste podría recibir un nuevo énfasis significativo dentro de las dos agencias. El DFC deberá continuar fortaleciendo a las agencias para enfatizar los términos del Memorándum.

Un grupo seleccionado de regiones del Servicio Forestal indica que el manejo de casi 25% de las 41 especies de interés al DFC es apoyado por programas específicos, enfocados tanto a la especie como al hábitat, y que fueron coordinadas por actividades largo plazo orientados a la recuperación. Unas pocas de especies de truchas, incluyendo las truchas del Gila, Río Grande y del Colorado *Oncorhynchus gilae*, *Oncorhynchus clarki virginalis*, *Oncorhynchus clarki stomias*, respectivamente, recibieron la mayor parte del esfuerzo. Las actividades incluyeron el monitoreo y estudio de poblaciones, construcción de barreras y otras mejoras para los hábitats de peces, reemplazamiento de especies no-nativas de truchas con truchas nativas, y en caso, ,la construcción de un reservorio. Especies no-cinegéticas, incluyendo al Charalito del Gila, el charalito del Pequeño Colorado, el Charalito de Chihuahua, y el Charalito Sonorense, *Poeciliopsis occidentalis occidentalis*, *Lepidomeda vittata*, *Gila nigrescens* y *Gila ditaenia*, respectivamente, también tuvieron actividades reportadas. Incluidas están las investigaciones sobre su situación actual, ciclos de vida, y estructura genética de las cuatro especies no-cinegéticas referidas, así como esfuerzos de restauración de hábitat para otras especies no-cinegéticas.

En Septiembre de 1991, el Servicio Forestal inició un nuevo programa, "Regresar a los Nativos," junto con el BLM y la Fundación Nacional para la Pesca y Vida Silvestre (NFWF), para mejorar el manejo y restauración de la salud de cuencas y sus comunidades de peces nativos. Dieciocho proyectos sobre 14 especies nativas recibieron apoyo durante el primer año. De estos, nueve proyectos sobre seis peces nativos de interés para el DFC fueron dentro de terrenos del Sistema Nacional de Bosques. La fase dos del programa "Regresar a los Nativos" ha recibido aprobación del NFWF e incluye 34 proyectos en 13 estados. Estos proyectos son relacionados con 20 salmónidos, 12 ciprínidos, 8 catostómidos,

2 cótidos, 1 petromizóntido, y 4 anfibios. Así como todos los proyectos de "Regresando a los Nativos", otras especies nativas acuáticas y terrestres también se beneficiarán.

SIMMS, J. R.*; WILLIAMS, J. E. (JS - Bureau of Land Management, Tucson, Arizona; JW - Bureau of Land Management, Washington, D.C.)

Bureau of Land Management agency report for 1992 / Reporte de agencia para 1992 de la Oficina de Manejo de Tierras

KEYWORDS: public lands; desert pupfish; cutthroat trout; desert dace; tui chub; Arizona; California; Idaho; Nevada; New Mexico

ABSTRACT

With the release of our Special Status Fishes Habitat Management Strategy Plan in May 1991 and strong cooperation from our Forest Service and National Fish and Wildlife Foundation partners in the Bring Back The Natives initiative, the Bureau of Land Management has been active in efforts to protect fishes in arid regions. Major highlights of efforts during 1992 include the acquisition of 5,027 acres of critical habitat for the desert dace in Soldier Meadows, Nevada, plus a conservation easement on another 5,000 acres of adjacent land. The BLM, with the help of The Nature Conservancy, also acquired 1,260 acres plus water rights along New Mexico's Black River. In Arizona, the last remaining section of Ciénega Creek was acquired. A major effort was initiated to reintroduce Colorado cutthroat trout back into native habitat in the Green and Little Snake River drainages of Wyoming. Habitat improvement work has been conducted to secure the endangered Mohave tui chub at Lake Tuende and West Pond near Baker, California. Also in California, BLM acquired 1,200 acres including artesian pools in the Dos Palmas area that can provide expanded habitat for the desert pupfish. Staff have been busy with numerous other native fish reintroduction efforts, including work to reintroduce Rio Grande cutthroat trout onto public lands in New Mexico, and redband trout in southern Idaho.

RESUMEN

Con la publicación de nuestro Plan Estratégico sobre Manejo de Hábitat de Peces con Estatus Especial, y con la sólida cooperación de nuestros co-asociados (National Fish and Wildlife Foundation y Forest Service) en la iniciativa "Regresando a los Nativos"; la Oficina de Manejo de Tierras (Bureau of Land Management, BLM) ha estado activa en esfuerzos para proteger los peces en las regiones áridas. Los esfuerzos más sobresalientes durante 1992 incluyen la adquisición 5,027 acres de hábitat crítico del "desert dace" (*Eremichthys acros*) en Soldier Meadows, Nevada, además de los derechos de conservación sobre otras 5,000 acres de áreas adyacentes. La BLM con la ayuda de The Nature Conservancy, adquirió también 1,260 acres, más los derechos de agua a lo largo de Black River en New Mexico. En Arizona,la última sección remanente de Ciénega Creek fue adquirida. Un esfuerzo significativo fue iniciado para reintroducir a la trucha garganta cortada del Colorado dentro de sus hábitats nativos en las cuencas de Green y Little Snake en Wyoming. Trabajos de mejoramiento de hábitat han sido efectuados para proteger a la especie en peligro de desaparición Mohave tui chub (*Gila bicolor mohavensis*) en Lake Tuende y West Pond, cerca de Baker, California. También en California, la BLM adquirió 1,200 acres incluyendo pozos artesianos en el área de Dos Palmas, que pueden proveer la expansión de hábitat para el cachorrito del desierto (*Cyprinodon macularius*). Los miembros que participan en este proyecto, han estado también muy ocupados con muchos otros planes y esfuerzos para la reintroducción de otras especies de peces nativos, incluyendo la reintroducción de la trucha garganta cortada del Río Grande en las áreas de jurisdicción pública de New Mexico, y la trucha arcoiris (población interior o "Redband") en el sur de Idaho.

GARRETT, GARY P. (HOH Research Station, Texas Parks and Wildlife Department, Ingram, TX)

Texas Parks and Wildlife Department Agency Report / Reporte de agencia del Departamento de Parques y Vida Silvestre de Texas

KEYWORDS: Rio Grande; Balmorhea; Chihuahuan Desert; cienaga; endangered fishes

ABSTRACT

The Texas Parks and Wildlife Department is currently involved in three projects relevant to Desert Fishes Council interests, the Rio Grande Survey, Balmorhea Cienaga Project and the Chihuahuan Desert Fishes Status Survey. The Rio Grande Survey seeks to develop a comprehensive fish community data base for the relatively un-impacted ecoregions of the river in Texas. The data will be used as a baseline for managing the resource and providing for protection and mitigation after implementation of the North American Free Trade Agreement. The Balmorhea Cienaga Project will involve constructing a functional desert cienaga that will not only serve as an additional refuge for two endangered fishes, but will also create an example of a vanishing ecosystem in an educational setting that is available to the general public. The Chihuahuan Desert Fishes Status Survey is a cooperative, Section 6 project that will provide for status determination of several Federal Category 2 fishes that occur in the Chihuahuan Desert region of Texas, New Mexico and the Republic of Mexico.

RESUMEN

El Departamento de Parques y Vida Silvestre de Texas está actualmente involucrado en tres proyectos relevantes para los intereses del Consejo de los Peces del Desierto, el Reconocimiento del Río Grande, Proyecto Ciénaga Balmorhea y el Reconocimiento de la Situación Actual de los Peces del Desierto Chihuahuense. Los reconocimientos del Río Grande buscan desarrollar una comprensiva base de datos de comunidades de peces para las ecoregiones relativamente no impactadas del río en Texas. Los datos serán usados como base para el manejo del recurso proveer la protección y mitigación después de la implementación del Tratado de Libre Comercio en Norteamérica. El Proyecto Ciénaga Balmorhea involucra la construcción de una ciénaga desértica funcional que no sólo sirve como un refugio adicional para dos peces en peligro, pero también creará un ejemplo de un ecosistema en extinción en una escena educacional que está disponible para el público en general. El Reconocimiento de la Situación Actual de los Peces del Desierto Chihuahuense es un proyecto cooperativo de la Sección 6 que proveerá la determinación de la situación actual de varias especies de peces con Categoría Federal 2 que ocurren en la del Desierto Chihuahuense de Texas, Nuevo México y la República de México.

DIVINE, G. (U.S. Fish and Wildlife Service, Office of Endangered Species, Albuquerque, NM)

Agency Report - U.S. Fish and Wildlife Service, Region 2, Albuquerque, New Mexico

KEYWORDS:

ABSTRACT

Efforts to conserve the native fish fauna of the arid southwestern United States and northern Mexico must continue if these species are to survive through time. During the reporting period one species was proposed for listing with designation of critical habitat proposed also. Designation of critical habitat is being proposed for two species listed previously. Recovery plans were approved for two species. The number of Freedom of Information Act Requests and scope of information requested has increase substantially as has the number of Section 7 consultation actions. These activities led to a very busy year.

A very busy year since we last met. Activities are grouped under three categories. They follow:

1. Prelisting/listing

A package proposing to list the Rio Grande minnow (*Hybognathus amarus*) as endangered with critical habitat has been completed. Publication of the proposed rule will occur during fiscal year 1993.

Proposed critical habitat for the spikedace (*Meda fulgida*) and loach minnow (*Tiaroga cobitis*). Due to concerns over the amount of time that has elapsed since the 1986 original proposal to designate critical habitat for these two species, the Service has decided to repropose the designation of critical habitat. A new economic analysis has been prepared. Publication of the proposal is scheduled to appear in the Federal Register during fiscal year 1993.

Proposed upgrading status of spikedace and loach minnow from threatened to endangered. Threats to these two species have increased dramatically thus the need for greater protection.

A proposed rule to list the Pecos pupfish (*Cyprinodon pecosensis*) as an endangered species with critical habitat has been prepared. This action is scheduled to be completed during Fiscal Year 1993.

2. Recovery

a) Plans

Recovery plans have been completed for the Pecos bluntnose shiner (*Notropis simus pecosensis*) and Sonora chub (*Gila ditaenia*). Both plans were approved September 30, 1992.

The recovery plan for the Gila trout (*Oncorhynchus gilae*) has been revised. Approval of the revised plan is anticipated during fiscal 1993.

Draft recovery plans have been completed for the beautiful shiner (*Cyprinella formosa*), desert pupfish (*Cyprinodon macularius*), Yaqui catfish (*Ictalurus pricei*), Yaqui chub (*Gila purpurea*) and Yaqui topminnow (*Poeciliopsis occidentalis sonoriensis*). Approved plans are anticipated for all five species by September 30, 1993.

On January 23, 1992, Region 2 issued a Guidance and Procedures Memorandum designed to ensure approved recovery plan are prepared for all 107 federally listed species for which Region 2 has lead. All plans are to be completed prior to September 30, 1994.

b) Actions.

Construction of a refugium at Phantom Lake Spring, Texas, is underway. The Bureau of Reclamation and Texas Parks and Wildlife Department are primarily responsible for the construction of this facility. Both the Comanche Springs pupfish (*Cyprinodon elegans*) and Pecos gambusia (*Gambusia nobilis*) will be provided additional habitat.

A 5-year study is underway on the Pecos River. The purpose of this study is to gather information on a variety of flow releases from mainstem reservoirs and how different flows impact the Pecos bluntnose shiner and its habitat.

A 7-year research study is being finalized for the San Juan River. Sampling efforts during 1992 took 4 (one a recapture) adult Colorado squawfish (*Ptychocheilus lucius*). Young-of-the-year squawfish were not captured in New Mexico during 1992. Telemetry studies on tagged adult squawfish continue in the San Juan.

Some 450 3- to 7-inch Chihuahua chubs (*Gila nigrescens*) were reared at Dexter National Fish Hatchery and Technology Center (NFH&TC) for stocking into McKnight Creek. These fish were stocked during October 1992.

During October 1992, approximately 1,650 South Diamond "strain" Gila trout fingerlings (3") were provided by the Mescalero National Fish Hatchery for reintroduction to historic habitats in the upper Gila River. South Diamond and Mogollon Creek were the receiving streams

RESUMEN

RECEIVED TOO LATE TO BE TRANSLATED

HAMILL, JOHN F.* (U.S. Fish and Wildlife Service, Regional Office, Denver, CO)

Endangered Colorado River Fishes (Upper Basin) / Peces en Peligro del Río Colorado (Cuenca Alta)

KEYWORDS: *Ptychocheilus lucius*; *Xyrauchen texanus*; *Gila cypha*; *Gila elegans*; *Gila robusta*; *Catostomus latipinnis*; Colorado River fishes; Recovery Implementation Program for Endangered Fish Species; status

ABSTRACT

Recent data suggest that Colorado squawfish may be increasing in the Green and Yampa Rivers, but the small population in the Colorado River may be declining. Status of the small humpback chub populations in the Green and Yampa Rivers is unknown (perhaps stable), but the Colorado River population appears healthy. Razorback sucker status remains critical with few adults and no recruitment. Bonytail chub are very rare, with none seen in the Upper Basin in the past several years. The Recovery Program for Endangered Fish Species in the Upper Colorado River Basin remains active, all parties are actively participating, and a $3.0M work plan developed for FY 93. The Program has made some progress in protecting instream flows, and all major Federal dams in the Upper Basin are being operated to improve conditions for the endangered fishes. The Program also is pursuing restoring fish passage to the Gunnison River and upper mainstem Colorado River near Grand Junction, Colorado. The Program is working to restore access to historically flooded bottomlands, as well. Genetic surveys and taxonomic studies are underway, and refuge and broodstock populations are being developed at recently expanded research hatchery facilities. Numerous other research and monitoring activities continue to collect critical information on the life history and habitat needs of the fishes. The Service is pursuing designation of critical habitat for all four of the endangered fishes and anticipates publishing a draft rule in September 1993. The Colorado River Fishes Recovery Team is working on the razorback sucker recovery plan; a public review draft is expected within about a year. Finally, the flannelmouth sucker and roundtail chub are now candidate species for listing under the Endangered Species Act.

RESUMEN

Datos recientes sugieren que el charal del Colorado está incrementándose en los Ríos Verde y Yampa, pero la pequeña población del Río Colorado está en decline. La situación actual de la pequeña población del matalote jorobado en los Ríos Verde y Yampa es desconocida (quizás estable), pero la población del Río Colorado parece saludable. La situación actual del matalote jorobado permanece crítica con pocos adultos y no reclutamiento. El charal cola dura es muy raro, sin ser visto en los últimos años. El programa de Recuperación de Especies de Peces en Peligro en la Cuenca Alta del Río Colorado permanece activo, todas las partes están participando activamente, y un plan de $ 3.0 M se desarrolla para el AF 1993. El programa ha tenido progresos en la protección de flujos de arroyos, y todas las presas Federales importantes están siendo operadas para el mejoramiento de las condiciones de loa peces en peligro. El programa también persigue el paso de los peces al Río Gunnison y el cauce principal alto del Río Colorado Cerca de la Unión Grande, en Colorado. El programa está trabajando para restablecer el acceso a las tierras del fondo históricamente inundadas. Están en camino reconocimientos genéticos y estudios taxonómicos, y repoblamiento y refugio de poblaciones se están desarrollando en las recientemente extendidas instalaciones de granjas. Otras variadas investigaciones y actividades de monitoreo continúan para colectar información crítica sobre la historia de vida y necesidades de hábitats de las peces. El Servicio persigue la designación de hábitats críticos para todas los cuatro peces en peligro y publicaciones anticipadas de reglas en borrador en Septiembre de 1993. El Equipo de Recuperación de los Peces del Río Colorado está trabajando en el plan de recuperación del matalote jorobado; un borrador para revisión pública se espera dentro de un año. Finalmente el matalote y el charal cola redonda son ahora especies candidatas para enlistarse bajo el Acta de Especies en Peligro.

KANIM, N. R.; WHITE, R.; WITHERS, D. (U.S. Fish and Wildlife Service, Region 1, NRK-Sacramento Field Office, Sacramento, CA; RW-Portland Field Office, Portland, OR; DW-Reno Field Office, Reno, NV)

U.S. Fish and Wildlife Service, Region 1, report on conservation actions undertaken in 1992, for federally listed and candidate arid-region fishes in California, Oregon, and Nevada

KEYWORDS: Nevada; California; Oregon; U.S. Fish and Wildlife Service; Region 1; Recovery plans; consultations; endangered fishes

ABSTRACT

The Reno Field Office has prepared a draft proposal to reclassify the Pahrump poolfish (*Empetrichthys latos*) from endangered to threatened status and has completed draft recovery plans for the Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), White River spinedace (*Lepidomeda albivallis*), Big Spring spinedace (*Lepidomeda mollispinis*), and Railroad Valley springfish (*Crenichthys nevadae*). The Cui-ui (*Chasmistes cujus*) recovery plan has been approved and is available for distribution. A draft conservation agreement to protect the Amargosa toad (*Bufo nelsoni*) and Oasis Valley speckled dace (*Rhinichthys osculus* ssp.) near Beatty, Nevada has been prepared for signature by the U.S. Fish and Wildlife Service (Service), U.S. Bureau of Land Management (BLM), and Nevada Department of Wildlife. A draft wetlands restoration plan for the Ash Meadows National Wildlife Refuge was completed in October. Hearings for the Las Vegas Valley Water District's water rights applications in eastern and southern Nevada have been delayed until July 1993.

The Service has issued to the U.S. Bureau of Reclamation, a jeopardy biological opinion on the effects on the federally endangered Lost River (*Deltistes luxatus*) and shortnose suckers (*Chasmistes brevirostris*) of the long-term operation of the Klamath Project in Klamath County, Oregon, and Siskiyou and Modoc County, California. The Sacramento Field Office (SFO) will complete a recovery plan and propose critical habitat for these two species in early 1993. A new Klamath Basin Fish and Wildlife Service Office will be opened in Klamath Falls, Oregon, as early as February 1993. The purpose of the office, which will be staffed and funded by the Service and Reclamation, will be to launch an effort to restore wetlands in the Klamath Basin for the protection of endangered species, migratory birds, and downstream anadromous fishes. Discussions of a proposed emergency listing action for four fishes endemic to the Goose Lake Basin in Lake County, Oregon, and Modoc County, California, prompted local residents to form a committee to develop a plan to recover the Goose Lake redband trout (*Oncorhynchus mykiss* ssp.), Goose Lake sucker (*Catostomus occidentalis lacusanserinus*), Goose Lake lamprey (*Lampetra tridentata ssp.*), and Goose Lake tui chub (*Gila bicolor thalassina*). Goose Lake desiccated completely in late September or early October this year. The Service and BLM are exploring options for transplanting the Cowhead Lake tui chub (*Gila bicolor vaccaceps*), a Federal category-1 candidate species, which is in danger of extinction as a result of the continuing drought and current land management practices. For the past three years, Modoc National Forest Service biologists have salvaged Modoc suckers from drying pools and moved them upstream as the lower portions of several creeks continue to desiccate. The California Department of Fish and Game chemically treated the mainstem of Silver King Creek in Alpine County for the second year to remove any remaining introgressed Paiute cutthroat trout (*Oncorhynchus clarki seleniris*). SFO will revise the Paiute cutthroat trout recovery plan this year.

The Portland Field Office issued several consultations to the Vale and Burns Districts of the BLM on the effects of grazing on the Lahontan cutthroat trout this year. The Service, Nature Conservancy, and BLM continue to cooperate in funding life history, population dynamics, and habitat requirements research on the federally listed endangered Borax Lake chub (*Gila boraxobius*). The current population estimate is between 25,000 and 26,000 individuals. Ongoing Warner sucker (*Catostomus warnerensis*) research is focused on early life history and behavior, micro-habitat needs, and the effects of drought. Conservation efforts for the Summer Basin tui chub (*Gila bicolor* ssp). and Hutton tui chub (*Gila bicolor* ssp.) have been hampered by uncooperative landowners. There is some speculation that the Summer Basin tui chub now may be extinct.

RESUMEN

RECEIVED TOO LATE TO BE TRANSLATED

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Marys River "Bring Back the Natives" Project / Proyecto del Río Marys "Regresar a los Nativos"

KEYWORDS: *Oncorhynchus clarki henshawi*; Nevada; riparian; Marys River

ABSTRACT

The Marys River "Bring Back the Natives" Project is a cooperative effort, involving the Elko District Bureau of Land Management and the Humboldt National Forest, to restore the riparian/aquatic ecosystem of the Marys River drainage. This drainage, located in northeastern Nevada, is a 520 square-mile watershed which drains into the Humboldt River. Historically, the Marys River supported a thriving population of native Lahontan cutthroat trout (*Oncorhynchus*

clarki henshawi). However, due in large part to improper livestock management practices, trout habitat throughout the river system has deteriorated, leaving only a small percentage of the system with suitable habitat. Consequently, only remnant populations of cutthroat trout persist. Fortunately, all of the streams in the Marys River system exhibit high potential for recovery. The management objective of the Marys River Project is to restore Lahontan cutthroat trout habitat to allow for increased trout numbers and distribution. This will be accomplished through implementation of a long-term plan for management and monitoring of the Marys River subbasin.

RESUMEN

El proyecto del Río Marys "Regresar a los nativos" es un esfuerzo de cooperación, que involucra a la Oficina de Manejo de Tierra del Distrito de Elko y la Forestal Nacional Humboldt, para restaurar el ecosistema riberino/acuático de la cuenca del Río Marys. Esta cuenca, localizada en el noreste de Nevada, es una extensión de agua de 520 millas cuadradas la cual descarga en el Río Humboldt. Históricamente el Río Marys soportó a una próspera población de trucha asesina de Lahontan (*Oncorhynchus clarki henshawi*). Sin embargo debido en gran parte a las inadecuadas prácticas de manejo del stock, el hábitat de la trucha a lo largo del sistema del río se ha deteriorado, dejando sólo un pequeño porcentaje del sistema con hábitat adecuado. Consecuentemente, sólo persisten poblaciones remanentes de trucha asesina. Afortunadamente,todos los arroyos del sistema del Río Marys presentan alto potencial para su recuperación. El objetivo de manejo del Proyecto del Río Marys es restaurar el hábitat de la trucha asesina de Lahontan para permitir el incremento de las truchas en número y distribución. Esto se complementará a través de la implementación de un plan a largo plazo para el manejo y evaluación sistemática de la subcuenca del Marys.

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Arizona Game and Fish Department, 1991-1992 Activities / Departamento de Caza y Pesca, Arizona, Actividades 1991-1992

KEYWORDS: Arizona Game and Fish; Arizona Heritage Program; Glen Canyon; Arizona

ABSTRACT

This year marked the first anniversary of the Heritage Fund, a 10 million dollar allocation from state lottery proceeds for conservation of sensitive species and habitats in Arizona. Heritage dollars are being used for land acquisition, status inventories, wildlife education, public access, and funding of a grant program that allows for cost-shares with other governmental agencies. The major expenditure of Heritage funds for native fishes was in support of a statewide monitoring program.

Section 6 funding from the Fish and Wildlife Service provided for research and monitoring of Little Colorado spinedace (*Lepidomeda vittata*), Gila topminnow (*Poeciliopsis o. occidentalis*), desert pupfish (*Cyprinodon macularius*), Colorado squawfish (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), spikedace (*Meda fulgida*), and loach minnow (*Tiaroga cobitis*). Completion reports or special reports were written for all of these activities.

A cooperative agreement with the Bureau of Reclamation provided funding for the Department's involvement in the Glen Canyon Dam Environmental Impact Statement and Section 7 Consultation. The Department is one of four groups conducting research on native fishes of the Colorado River in Grand Canyon. The research is being conducted to satisfy Conservation Measures agreed to under the Section 7 Consultation. Information gathered from these efforts is being incorporated into the EIS, including a biological opinion that will be written on the preferred alternative.

Cost-share agreements with the Forest Service provided funding for two activities. The first was a survey of Little Colorado spinedace distribution, abundance, and habitat use in stream reaches designated as critical habitat in the Coconino and Apache- Sitgreaves forests. The second was a status survey of fishes in Tonto Creek on the Tonto National Forest.

RESUMEN

Este año marca el primer aniversario del Fondo de Patrimonio, una colocación de 10 millones de dólares de las ganancias de la lotería estatal para conservación de especies sensibles y hábitats en Arizona. Los dólares de Patrimonio son usados para adquisición de tierras, inventarios de situación actual, educación de vida silvestre, acceso público y financiamiento para un programa de donación que mantenga costos compartidos con otras agencias gubernamentales. El mayor desembolso de los fondos de patrimonio para peces nativos fue en apoyo a un programa de monitoreo estatal.

El financiamiento de la sección seis del Servicio de Pesca y Vida Silvestre proveyó para investigación y monitoreo del charal de espina (*Lepidomeda vittata*), el charalito de Sonora (*Poeciliopsis occidentalis occidentalis*), el cachorrito del desierto (*Cyprinodon macularius*), charal del Colorado (*Ptychocheilus lucius*), matalote jorobado (*Xyrauchen texanus*), charal jorobado (*Gila cypha*), charal spike (*Meda fulgida*), y el charal adornado (*Tiaroga cobitis*). Los reportes finales o reportes especiales fueron escritos para todas estas actividades.

Un acuerdo cooperativo con la oficina de Reclamación proporcionó el financiamiento para el involucramiento del Departamento en la declaración de impacto ambiental de la presa Cañón Glen y consultas de la sección siete. El departamento es uno de los cuatro grupos que conducen investigación sobre peces nativos del río Colorado en el Gran Cañón. La investigación está siendo conducida para satisfacer las medidas de conservación acordadas bajo la consulta

de la sección siete. La información recopilada de estos esfuerzos esta siendo incorporada en el EIS, incluyendo una opinión biológica que será escrita sobre la alternativa preferida. El acuerdo costo-compartido con el Servicio Forestal proporcionó financiamiento para dos actividades. La primera fue un muestreo de distribución, abundancia, y uso de hábitat del charal de espina en extensiones de arroyos designados como hábitats críticos en los bosques de Coconino y Apache-Sitgreaves. La segunda fue una evaluación actual de los peces en el arroyo Tonto del Bosque Nacional Tonto.

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Status and evaluation of Nevada fishes / Situación actual y evaluación de los peces de Nevada

KEYWORDS: Nevada; Devil's Hole; poolfish; springfish; spinedace; Ash Meadows; Virgin River; razorback sucker; tui chub

ABSTRACT

The Nevada Department of Wildlife's Endemic Fish Program has responsibility for the monitoring, status evaluation, and program coordination for 75 species and sub-species of endemic, non-game fish within the geographic boundaries of the state of Nevada. Currently the program is staffed with one full-time biologist stationed in Las Vegas. The primary concentration of effort at this time has been on the implementation and coordination of Section 6 funded projects for federally listed species, with inventory and evaluation of state-listed sensitive species being conducted on a time-available basis. Nevada currently has 17 species or subspecies of federally Endangered fish, an additional 5 which are Threatened, and 33 which are candidates for listing.

Major activities during 1991/1992 included the following, species: *Cyprinodon diabolis*, *Empetrichthys latos latos*, *Crenichthys baileyi grandis*, *Crenichthys baileyi baileyi*, *Gila robusta jordani*, *Lepidomeda albivallis*, *Plagopterus argentissimus*, *Gila robusta seminuda*, *Xyrauchen texanus*, *Crenichthys nevadae*, *Relictus solitarius*, *Gila bicolor* ssp., *Rhinichthys osculus* ssp., *Crenichthys baileyi thermophilus*.

1. Devil's Hole pupfish, *Cyprinodon diabolis* - Population counts were conducted at Devil's Hole in April and October. The combined spring dive/surface counts in October 1991, averaged 472 fish. This is comparable to previous fall counts of 525 (1988) and 441 (1986). Population counts conducted in April, 1992 generated a combined dive/surface count average of 272. This compares favorably with previous spring counts of 239 (1988), 151 (1987), and 152 (1985). Since 1988, numbers of devils Hole pupfish have stabilized at an annual peak of around 500 fish.

On June 28, 1992, Devils Hole was rocked by a serious earthquake that resulted in a 6-8 inch drop in water level. Counts have been made by University of Nevada, Las Vegas personnel monthly since August. Initial counts showed the population numbers still remaining stable.

Surface and dive counts were also conducted in spring and fall at the Amargosa pupfish refugium in Ash Meadows. In 1991, high counts were 80 fish in October, due to a pump failure, but returned to 104 in April 1992. This last figure is within the range of past years of stable counts.

Currently, the Hoover Dam pupfish refugium contains less than 5 fish. Ten fish were placed in the refugium in December of 1991, and to this date no reproduction has taken place.

2. Pahrump killifish, *Empetrichthys latos latos* - Census work was conducted on the three populations of Pahrump killifish at Corn Creek, Spring Mountain Ranch State Park, and Shoshone Ponds Refugium. All populations are stable or increasing. The combined population estimate of killifish at the three sites is approximately 24,000 fish. Population estimates are 9,084 and 13,546 at Corn Creek and Spring Mountain Ranch. At Shoshone ponds 1600 fish were trapped over a 3 hour period. At the Corn Creek refugium, dense growth of Typhus sp. in the three ponds had completely eliminated open water areas. Fish and Wildlife personnel continue to treat the cattails with spray applications of Rodeo herbicide, which are proving to be very successful.

3. Hiko White River springfish, *Crenichthys baileyi grandis* - Populations were monitored at Hiko, Crystal, and Blue Link Springs. The Hiko and Blue Link populations are stable or expanding. Mark and recapture estimates showed 6,000 fish in Blue Link Spring and 7,450 in Hiko Spring. The springfish at Crystal Spring remain at a severely depressed level due primarily to the numbers of exotic fish present in the spring source pools and outflows. The current population is estimated at 20-30 fish. Methodology needs to be developed to control numbers of exotics at this site to effect a recovery of the springfish population.

4. White River springfish, *Crenichthys baileyi baileyi* - Census work at Ash Spring indicates that the White River springfish population had a marked improvement in 1991/92 but continues to be depressed due to the presence of exotic species and disturbance by public use. Restricted use over a large portion of the pool has returned it to a natural state because annual drainings have not occurred. This has allowed the springfish to better compete with exotic cichlids and mollies. The larger portion of this spring is currently for sale, and efforts are being made to acquire this property. The spring source and head pool are on public land and recent improvements by the BLM have been effective in eliminating livestock use from the area. Numbers of springfish were estimated to be 7,452 at Ash Spring.

The outflow from Ash Spring, listed as critical habitat for both the springfish and the Pahranagat roundtail chub *Gila robusta jordani*, is located on private lands. Estimates of Pahranagat roundtail were made by establishing dive

transects within this reach. In 1991, adults totaled 156, while juveniles totaled 460. This is comparable with a U.S. Fish and Wildlife study several years previous.

5. White River spinedace, *Lepidomeda albivallis*.

A contract has been issued to the U.S.F.W.S., Seattle Research Unit, for obtaining inventory work and habitat requirement information. To date, the National Fisheries Research Center has completed a thorough ichthyological survey of the White River Valley with emphasis on documenting spinedace distribution. Results have so far been disheartening, less than 100 fish have been found in a single spring on State lands at the Kirch Wildlife Management Area. All other spinedace populations in this Valley have been lost. This spring is protected from exotics, namely largemouth bass, but work must be done to increase the spinedace distribution. A contract with Seattle Research Unit will continue through 1992 for recovery efforts.

6. Ash Meadows System populations

A coordinated study of the Ash Meadows System populations was implemented under contract with the U.S.F.W.S., National Fisheries Research Center. NDOW personnel assisted FWS personnel with seasonal studies, but only preliminary data has been received from the contracted agency.

7. Virgin River Fishes

Recovery efforts by the Nevada Department of Wildlife for the Virgin River fishes have increased over the last several years. In 1988/89 some Nevada sites were not surveyed or only abbreviated census work was done. This year survey work was increased and Woundfin, *Plagopterus argentissimus*, were found in both the Mesquite and Riverside areas of the Virgin River. Virgin River roundtail chubs, *Gila robusta seminuda*, were also found in the Mesquite area. Work will continue to monitor the presence and status of these fish at Nevada locations.

8. Razorback sucker, *Xyrauchen texanus*.

The Razorback sucker was listed as Endangered in November 1991 by the FWS. Survey work over the last year has included both Mohave and Lake Mead. Lake Mohave efforts have been as a support role on the Round-up program. Lake Mead efforts totaled six days in the Boulder Basin and Overton arm areas. Thirty-six Razorback suckers were captured, tagged and released.

9. Big Springs spinedace, *Lepidomeda mollispinis pratensis*.

This work was contracted in 1989 to the University of Nevada, Las Vegas. To this date the final report has not been submitted to Dr. Jim Deacon for comments and approval. The Shoshone ponds population of Big Springs spinedace appears to have been lost, no fish were taken in the last two years of survey. Another species of fish now inhabits this pond; possibly Meadow Valley Wash speckled dace.

10. Railroad Valley springfish, *Crenichthys nevadae*.

All populations of Railroad Valley springfish were censused or evaluated during 1992. Populations in Railroad Valley, at Lockes Ranch and Chimney Spring, are stable or expanding. A total estimate was not made in any of the spring systems but numbers of fish trapped per hour were excellent in all springs. North Spring which had a very small adult population in 1991 showed good recruitment, with a 95% young-of-the-year population. Sixty-six fish were trapped in 6.6 trap/hours of effort.

The populations in the Duckwater Valley were not censused, but snorkel surveys at Big Warm Springs did indicate that catfish have moved into all headwater areas. Snorkel surveys at little Warm Springs to the south, although severely altered, showed a good population of springfish in one of the smaller spring outflows. The isolated introduced populations at Sodaville and at Hot Creek Canyon remain at stable levels although they have shown slight impacts from recent habitat alterations and development.

11. Relict dace, *Relictus solitarius*

Time was spent obtaining distribution information on this species. Ruby, Butte, and Steptoe, and Spring Valleys were visited. Butte Valley has Relictus populations in all areas where they existed 10 years ago. Steptoe Valley has populations at Georgetown Spring and at the McGill pool, but the Grass springs area no longer holds Dace. Ruby Valley populations appear to be very depressed, a single spring was found to have pure Dace. Introduced speckled dace appear to be increasing their range in southern Ruby Valley and possibly hybridizing with Relictus. Franklin Lake was dry again this year.

12. Fish Lake Valley tui chub, *Gila bicolor* ssp.

Only the McNet ranch population of chubs is healthy, but goldfish have been introduced into this system. Fish Lake was nearly dry, although a single juvenile was dip-netted from shallow areas before total drying. No fish were found in the Pothole springs area. Plans are also being made by the town of Dyer to build a large Park with fishing ponds. This construction has already begun and unfortunately is only a quarter mile from the McNet ranch. Fish Lake Power Company has plans for geothermal wells just north of this area. More distribution work is required in this Valley.

13. Oasis Valley speckled dace, *Rhinichthys osculus* spp.

Drought conditions have restricted the population of this fish to five small areas within the Amargosa Valley. The strongest populations are within the Beatty city limits, and a spring system located at La Fleur in the northern portion of the Valley. Both areas are approximately 100 meters in length, and are somewhat degraded.

14. Big Smoky Valley/Monitor Valley speckled dace and Big Smoky Valley tui chub, Rhinichthys osculus ssp., Gila bicolor spp.

In 1992, populations appear stable in all areas that were previously surveyed in 1978. With land owner permission, additional recovery efforts should attempt to expand populations in Big Smoky Valley into historic habitats.

15. Pahranagat Valley speckled dace, Rhinichthys osculus spp.

An possible undescribed form of speckled dace was found in lower Pahranagat Valley in 1987. These fish were moved from L spring and North Cottonwood spring and placed in Maynard spring, a spring free of exotics. After the transfer in 1991, reproduction occurred, but in 1992 no small young-of-the-year were observed. When fish numbers are sufficient for a collection, systematics work will be done on these fish.

16. Moorman White River springfish, *Crenichthys baileyi thermophilus*.

This warm spring system has been invaded by largemouth bass from the Reservoir below, and fish numbers are extremely low. These bass will be removed and fish barriers improved so that this population can be protected.

17. Miscellaneous fish species

Some random time was spent on the following species or localities: Hot Creek Valley tui chub, Independence Valley speckled dace, Railroad Valley tui chub, Wall Canyon sucker, Meadow Valley Wash, Muddy (Moapa) River, Little Fish Lake Valley, and the White River Valley.

RESUMEN

El programa de peces endémicos del Departamento de Vida Silvestre de Nevada tiene la responsabilidad de monitorear, evaluar la situación actual y coordinar el programa de 75 especies y subespecies de peces endémicos y de pesca no deportiva dentro de los límites geográficos del estado de Nevada. Actualmente el programa tiene como personal de tiempo completo un biólogo establecido en Las Vegas. La concentración primaria de esfuerzos en este momento ha sido la implementación y coordinación los proyectos con fondos de la Sección 6 para especies federalmente enlistadas, con el inventario y la evaluación del estado de las especies enlistadas como sensibles realizado en una base de tiempo disponible. Nevada actualmente tiene 17 especies o subespecies de peces en Peligro de Extinción enlistados federalmente, 5 adicionales que se encuentran Amenazados, y 33 que son candidatos para ser enlistados.

Las principales actividades durante 1991/1992 incluyeron las siguientes especies: *Cyprinodon diabolis*, *Empetrichthys latos latos*, *Crenichthys baileyi grandis*, *Crenichthys baileyi baileyi*, *Gila robusta jordani*, *Lepidomeda albivallis*, *Plagopterus argentissimus*, *Gila robusta seminuda*, *Xyrauchen texanus*, *Crenichthys nevadae*, *Relictus solitarius*, *Gila bicolor ssp.*, *Rhinichthys osculus ssp.*, *Crenichthys baileyi thermophilus*.

1. Cachorrito del Hoyo del Diablo, *Cyprinodon diabolis* - los conteos de la población se conducieron en el Hoyo del Diablo en Abril y Octubre. Los conteos combinados buceando en superficie en Octubre de 1991, promediaron 472 peces. Esto se compara con los conteos previos de otoño de 525 (1988) y 441 (1986). Los conteos de la población realizados en Abril de 1992 generados por observaciones de buceo y de superficie promediaron 272. Esto es comparable de manera favorable con los conteos previos de primavera de 239 (1988), 151 (1987), y 152 (1985). Desde 1988, los números del cachorrito del Hoyo del Diablo se han estabilizado en un pico anual de alrededor de 500 peces.

El 28 de Junio de 1992, el Hoyo del Diablo fue obstruído con rocas debido a un serio temblor que provocó una caída del nivel del agua de 6-8 pulgadas. Los conteos se han realizado mensualmente desde Agosto por personal de la Universidad de Nevada en Las Vegas. Los conteos iniciales mostraron que el número de la población permanece estable.

Los conteos de superficie y por buceo fueron realizados también durante primavera y otoño en el refugio del cachorrito de Amargosa en Ash Meadows. En 1991, los conteos altos fueron de 80 peces en Octubre, debido a una falla de bombeo, pero retornaron a 104 en Abril de 1992. Esta última figura está dentro del intervalo de conteos en los años pasados.

Actualmente, el refugio del cachorrito de la Presa Hoover cuenta con menos de 5 peces. Diez peces se introdujeron en el refugio en Diciembre de 1991, y a la fecha no ha habido reproducción.

2. Pahrump killifish, *Empetrichthys latos latos*- Se realizaron censos sobre tres poblaciones de Pahrump killifish en las localidades de Corn Creek, Parque estatal Rancho Spring Mountain, y Refugio Posas Shoshone. Todas las poblaciones se encuentran estables o se están incrementando. El estimado de la población combinando las poblaciones de los tres sitios es aproximadamente 24,000 peces. La población estimada para Corn Creek es 9,084 y 13,546 en el Rancho Spring Mountain. En las posas Shoshone se atraparon 1600 peces en un período de 3 horas. En el Refugio Corn Creek, un denso crecimiento de *Typha* sp. en las tres posas había eliminado completamente áreas abiertas de agua. El personal de Pesca y Vida Silvestre continua tratando las colas de gato con aplicaciones de herbecida Rodeo en spray, el cual se ha probado tiene mucho éxito.

3. Pez de manantial del Río Hiko Blanco, *Crenichthys baileyi grandis* - Se monitorearon poblaciones en los manantiales Hiko, Crystal y Enlace Azul. Las poblaciones de Hiko y Enlace Azul están estables o se están expandieno. El estimado de la población por el método de captura-recaptura fue de 6,000 peces en el Manantial Enlace Azul y 7,450 en el Manantial Hiko. El pez de manantial del Manantial Crystal permanece en niveles severamente bajos debido principalmente al número de peces exóticos presentes en el manantial fuente y en los desagües. La población actual se estima entre 20 y 30 peces. Se necesita desarrollar una metodología para el control de exóticos en este sitio para hacer efectiva la recuperación de las poblaciones de peces de manantiales.

4. Pez de manantial del Río Blanco, *Crenichthys baileyi baileyi* - El censo en el Manantial Ash indica que la población del pez de manantial del Río Blanco ha tenido un marcado incremento en el período 1991/92 pero continua un decremento debido a la presencia de especies exóticas y el disturbio por el uso público. El uso restringido de una gran porción de la posa ha permitido su recuperación a su estado natural ya que los drenados anuales no se han llevado a cabo. Esto le ha permitido al pez de manantial competir con los cíclidos exóticos y mollies. La porción más grande de este manantial actualmente está en venta, y se han hecho esfuerzos por adquirir esta propiedad. El manantial fuente y la posa principal son terrenos públicos y mejoras recientes por parte del BLM han sido efectivas al eliminar el uso del área por el ganado. El número de los peces de manantial se estimo en 7,452 en el Manantial Ash.

El desagüe del Manantial Ash, enlistado como hábitat crítico tanto para el pez de manantial como para el charal cola redonda de Pahranagat *Gila robusta jordani*, se localiza en propiedades privadas. Las estimaciones de el charal cola redonda de Pahranagat se realizaron mediante el establecimiento de transectos subacuáticos hasta donde alcanzaron. En 1991 los adultos hicieron un total de 156, mientras que los juveniles fueron en total 460. Esto puede ser comparado con estudios previos durante varios años por el Departamento de Pesca y Vida Silvestre de Estados Unidos.

5. Charalito de espina del Río Blanco, *Lepidomeda albivallis* - Se contrató la Unidad de Investigación en Seattle del Departamento de Caza y Pesca de E.U., para obtener información sobre el inventario y requerimientos de hábitat. A la fecha el Centro Nacional de Investigación Pesquera ha realizado un minucioso estudio ictiológico integral del Valle del Río Blanco con énfasis en la distribución documentada. Los resultados hasta ahora han sido desalentadores, menos de 100 peces han sido encontrados en un sólo manantial en las tierras del Estado en el Area de Manejo de Vida Silvestre de Kirch. Todas las otras poblaciones del charalito en este Valle se han perdido. Este manantial está protegido de los exóticos, principalmente de la lobina, pero debe de trabajarse para incrementar la distribución del charalito. Se continuará con el contrato con la Unidad de Investigación de Seattle durante 1992 para llevar a cabo esfuerzos de recuperación.

6. Poblaciones del Sistema Ash Meadows - Se implemento un estudio coordinado de las poblaciones del Sistema Ash Meadows bajo un contrato con el Servicio de Caza y Pesca de Estados Unidos, el Centro Nacional de Investigación Pesquera. El personal del Departamento de Vida Silvestre de Nevada asistió al personal del Servicio de Caza y Pesca con estudios estacionales, pero sólo se han recibido datos preliminares por parte de la agencia contratada.

7. Peces del Río Virgin - Ultimamente durante varios años se han incrementado los esfuerzos de recuperación de los peces del Río Virgin por parte del Departamento de Vida Silvestre de Nevada. En 1988/89 no se habían estudiado algunos sitios en Nevada o sólo se habían censado de manera superficial. Este año el trabajo de prospección se ha incrementado y el charalito *Plagopterus argentissimus* se encontró en las áreas de Mesquite como en Riverside del Río Virgin. Los charalitos aleta redonda del Río Virgin, *Gila robusta seminuda*, también fueron encontrados en el área de Mesquite. El trabajo continuara para monitorear la presencia y estado actual de estos peces en localidades de Nevada.

8. Matalote jorobado, *Xyrauchen texanus* - El matalote jorobado fue enlistado como en Peligro de Extinción en Noviembre de 1991 por el Servicio de Pesca y Vida Silvestre. El trabajo de prospección durante el último año ha incluido los Lagos Mohave y Mead. Los esfuerzos en el Lago Mohave han tenido un papel de apoyo para el programa global. Los esfuerzos en el Lago Mead han totalizado seis días en el área de la Cuenca Boulder y del Brazo Overton. Treinta y seis matalotes jorobados fueron capturados, marcados y liberados.

9. Charal de espina de los Manantiales Grandes, *Lepidomeda mollispinis pratensis* - En 1989 se contrató a la Universidad se Nevada, en Las Vegas. A la fecha, el reporte final no ha sido sometido al Dr. Jim Deacon para sus comentarios y aprobación. La población del charal de espina de las posas Shoshone de los Manantiales Grandes parece haberse perdido. No se capturó ningún pez en los pasados dos años de muestreos. Ahora otra especie de pez habita esta posa, posiblemente el charalito moteado Wash del Valle Meadow.

10. El pez de manantial del Valle del Ferrocarril, *Crenichthys nevadae* - Todas las poblaciones del pez de Manantial del Valle del Ferrocarril fueron censadas o evaluadas durante 1992. Las poblaciones en el Valle del Ferrocarril en el Rancho Lockes y en el Manantial Chimney, son estables o se están expandiendo. No se realizó ningún estimado total en ninguno de los sistemas de manantial pero los números de peces capturados por hora fueron excelentes en todos los manantiales. El manantial del Norte que tenía una población de adultos muy pequeña en 1991 presentó un buen reclutamiento, con un 95 % de población de juveniles del primer año. Sesenta y seis peces se atraparon en un esfuerzo de 6.6 trampas/hora.

Las poblaciones en el Valle Duckwater no se censaron, pero muestreos con snorquel en los Manantiales Big Warm indican que el bagre se ha movido dentro de todas las áreas de cabeceras. Los estudios con snorquel en el manantial Warm pequeño hacia el sur, --- severamente alterados, mostrando una población en buenas condiciones del pez de manantial en uno de los manantiales afluentes más pequeños. Las poblaciones aisladas introducidas en Sodaville y en el Cañón Hot Creek, permanecen en niveles estables sin embargo han sufrido leves impactos debido a recientes alteraciones de hábitat y desarrollo.

11. Charal relicto, *Relictus solitarius* - Se ha invertido tiempo en obtener información sobre la distribución de esta especie. Se visitaron los Valles de Ruby, Butte, Steptoe y Spring. El Valle de Butte tiene poblaciones de Relictos en todas las áreas donde existieron desde hace 10 baños. El Valle Steptoe tiene poblaciones en el Manantial de Georgetown y en la posa McGill, Pero el área de Manantiales Grass ya no mantiene charales. Las poblaciones del Valle Ruby parecen estar muy reducidas, sólo se encontró un manantial que tenía charales puros. El Charal moteado introducido parece haber

incrementado su rango la sur del Valle Ruby y posiblemente se hibridiza con Relictos, el Lago Franklin otra vez estuvo seco este año.

12. Charal Tui del Valle del Lago Fish, *Gila bicolor* ssp. - Sólo la población del Rancho McNet se encuentra saludable, pero la carpa dorada ha sido introducida a este sistema. El Lago Fish estaba casi seco, sin embargo un solo juvenil se atrapó con red de cuchara en un área somera antes de que se secara totalmente. No se encontró pez alguno en el área de los manantiales Pothole. Se han hecho también planes por el poblado de Dyer para construir un gran Parque con posas de pesca. Esta construcción ya se inició y desafortunadamente es sólo un cuarto de milla del Rancho McNet. La Compañía Lake Fish Power tiene planes para posos geotermales justo al norte de esta área. Se requiere más trabajo sobre la distribución en este Valle.

13. Charal de espina del Valle Oasis, *Rhinichthys osculus* spp. - Las condiciones de sequía han restringido a la población de este pez a cinco pequeñas áreas dentro del Valle Amargosa. La poblaciones más fuertes están dentro de los límites de la ciudad de Beatty, y de un sistema de manantiales localizado en La Fleur en la porción norte del Valle. Ambas áreas tienen aproximadamente 100 m de largo, y están algo degradadas.

14. Charal moteado del Valle Big Smoky/Valle Monitor y Charal tui del Valle Big Smoky, *Rhinichthys osculus* ssp., *Gila bicolor* spp. - En 1992, las poblaciones parecen estar estables en todas las áreas que fueron estudiadas previamente en 1978. Con el permiso de los dueños de las tierras, los esfuerzos adicionales de recuperación deben intentar expandir las poblaciones en el Valle Smoky a los hábitat históricos.

15. Charal de espina del Valle Pahranagat, *Rhinichthys osculus* spp. - Se encontró una posible forma no descrita del charal moteado en la parte baja del Valle Pahranagat en 1987. Estos peces fueron movidos del manantial L y manantial North Cottonwood y fueron colocados en el manantial Maynard, un manantial libre de exóticos. Después de la transferencia en 1991, se llevó a cabo la reproducción, pero en 1992 no se observaron juveniles del año. Cuando haya un número suficiente de ejemplares para colección, debe de llevarse a cabo el trabajo de sistemática para estos peces.

16. Pez de manantial del Río Moorman White, *Crenichthys baileyi thermophilus* - Este sistema de manantiales termales han sido invadidos por la lobina del reservorio de abajo, y el número de peces es extremadamente bajo. Estas lobinas deben ser sacadas, se deben implementar barreras de tal manera que estas poblaciones se protejan.

17. Miscelánea de especies de peces. Algo de tiempo al azar se dedicó a las siguientes especies o localidades: charal tui del Valle Hot Creek, charal de espina del Valle Independencia, charal tui del valle Ferrocarril, matalote del Cañón Wall, Arroyo del Valle Meadow, Río Muddy (Moapa), Valle del Lago del Pez Pequeño, y Valle del Río Blanco.

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Agency report: Bureau of Reclamation, Lower Colorado Region / Reporte de agencia: Oficina de Reclamación, Región del Bajo Colorado

KEYWORDS: razorback sucker; Lake Mohave; Lake Mead; canal system; bonytail chub; Virgin River; Gila River; Devil's Hole pupfish; Lake Havasu

ABSTRACT

This report covers both the Lower Colorado Region and the Denver Engineering and Research Center activities. Activities of the Upper Colorado Region, including Glen Canyon Environmental Studies, are covered in a separate agency report.

Lower Colorado Region activities focused on razorback sucker (*Xyrauchen texanus*) this year, mainly with rearing fish in isolated backwaters of Lake Mohave. On Lake Mohave adult fish were placed in Yuma Cove where they successfully spawned and produced larvae. The young were monitored from February through October, showing excellent growth. A barrier net was installed at Davis Cove near Davis Dam, predator fishes were partially removed and 10,000 fingerlings (average TL 68 mm) were transferred to the backwater from Dexter National Fish Hatchery in mid-June. These fish also were monitored through October and again excellent growth was noted. Considerable information was gleaned through observation of these fishes and their occupied habitats. More detailed information is presented elsewhere in the program by Gordon Mueller. Related to this, some 6000 bonytail chub (*Gila elegans*) were transferred from Dexter National Fish Hatchery on October 5, 1992, to the backwater at Davis Cove. These fish will be monitored through the next year along with the razorback suckers.

A helicopter survey on Lake Mead during March identified numerous aggregations of fishes, some thought to be adult razorback suckers. Follow-up netting and electro- shocking by Nevada Division of Wildlife and Reclamation biologists yielded 30 adult razorback suckers from Lake Mead. Gametes were collected for MtDNA analyses and forwarded to Arizona State University. Fish were processed, PIT tagged, and released. This is the largest collection of these fish from Lake Mead in over 20 years.

On the lower portions of the Colorado River, Reclamation participated in collections of razorback suckers from the Colorado River Indian Tribes (CRIT) canal system near Parker, AZ. Reclamation is working with the CRIT biologists to develop native fish- rearing areas on tribal lands along the river, and we expect to begin construction this summer on the first one at No-Name Lake at the southern end of the Reservation.

Reclamation is an active participant in similar activities on Lake Havasu where at least ten coves have been selected to be used for native fish rearing areas under the interagency fishery improvement project known as "HAVFISH." Native fish are now an integral component of that program, and Reclamation is committed to funding portions of the project.

Probably the most significant action this past year with regards to razorback suckers, bonytail chubs and other mainstem Colorado River fishes is that the Regional Offices of both Reclamation and Fish and Wildlife Service have agreed to join together and initiate a Lower Basin recovery program. This initially will be the development of an umbrella plan or program to focus resource actions towards a common goal.

Reclamation was able to secure $100,000 of emergency drought relief funds to aid in recovery of Virgin River fishes. These dollars went to seven different activities related to recovery of the woundfin minnow (*Plagopterus argentissimus*): A project to refine culturing needs was initiated at Georgia Southern University under Steve Vives, the live stream at UNLV where Jim Deacon successfully spawned woundfin minnows was refurbished under the guidance of Fran Taylor, Director of Animal Laboratory Services at the University. A new stream gage was installed on the Virgin River below Quail Creek Reservoir. A self- contained "fish-farm" was purchased and installed along the river near Hurricane, UT to be used as a salvage station for native fishes. Rearing ponds at Dexter National Fish Hatchery were lined to control weed growth (the ponds are earmarked for Virgin River fishes). Videography techniques were used on imagery of the Virgin River to identify all possible water sources and assist in planning for further red shiner removal below St. George. Finally, Utah Division of Wildlife received funding support to develop a thorough treatment plan for future stream reclamation activities. In association with planning investigations on the lower Virgin River, Reclamation is conducting and participating in fish habitat analyses between Lake Mead and Mesquite, NV.

Other activities of the Lower Colorado Region include: annual surveys of the Gila River below Coolidge Dam and the lower San Pedro River to the confluence with the Gila; actions involving the continued use of the Hoover Dam Refugium for Devil's Hole pupfish (*Cyprinodon diabolis*); related activities of the Eastern Mohave Desert Fishes Recovery Team; and a resurvey of the Santa Clara Slough which had desert pupfish (*Cyprinodon macularius*) when last surveyed.

Activities of the Denver Engineering and Research Center other than those covered by the Upper Colorado Region [i.e., Rio Grande silvery minnow (*Hybognathus amarus*) and bluntnose shiner (*Notropis simus*) activities] were limited to the various populations of lake suckers in the Klamath Lake area [largescale suckers (*Catostomus macrocheilus*), shortnose suckers (*Chasmistes brevirostris*), Lost River (*Catostomus luxatus*) and Klamath Lake (*Catostomus rimiculus*) and (*Catostomus snyderi*) suckers. These fishes are presenting the same enigma of other longlived western fishes: no recruitment for 15+ years. Reclamation is investigating water quality effects on sucker larvae with the Fish and Wildlife Service office in Dixon, CA. Reclamation is funding a multi-year investigation by Oregon State University (COOP) on habitat use and population dynamics. The Klamath Project Office recently hired Mark Buettner, a biologist experienced with these fishes, to lead our efforts.

This year has been great, and we expect next year to be even better with regards to recovery of native Colorado River fishes.

RESUMEN

Este reporte abarca las actividades de la Región del Bajo Colorado las del Centro de Investigación e Ingeniería de Denver. Las actividades de la Región del Alto Colorado, incluyendo los estudios ambientales del Cañón Glen, son cubiertos por separado en reporte de agencia.

Las actividades de la Región del Bajo Colorado enfocadas sobre el matalote jorobado (*Xyrauchen texanus*) este año, principalmente con la crianza de peces en aguas tranquilas del Lago Mohave. En el Lago Mohave fueron colocados peces adultos en la Cueva de Yuma donde mostraron un excelente desove y produjeron larvas. Los juveniles fueron monitoreados de Febrero a Octubre, mostrando un excelente crecimiento. Una red de cerco fue instalada en la Cueva Davis, cerca de la Presa Davis, los peces depredadores fueron parcialmente removidos y se transfirieron 10,000 alevines (Talla promedio 68 mm) desde la Granja Reproductora Nacional Dexter a las aguas tranquilas a mediados de Junio. Estos peces fueron monitoreados hasta Octubre y otra vez un excelente crecimiento fue observado. Considerable información fue obtenida a través de las observaciones de estos peces y sus hábitats. Información más detallada es presentada en el programa por Gordon Mueller. Relacionado a esto, 6000 charalitos aleta dura (*Gila elegans*) fueron transferidos de la Granja Reproductora Nacional Dexter en Octubre 5 de 1992 a aguas tranquilas en la Cueva Davis. Estos peces serán monitoreados hasta el próximo año junto con los matalotes jorobados.

Un reconocimiento en helicóptero sobre el Lago Mead durante Marzo identificó numerosas agregaciones de peces, algunos probablemente eran matalotes jorobados adultos. Mediante redes y descargas de electropesca los biólogos de la División de Vida Silvestre y Reclamación de Nevada capturaron 30 matalotes jorobados adultos del Lago Mead. Se colectaron gametos para análisis de ADN mitocondrial y se enviaron a la universidad del Estado de Arizona. Los peces fueron procesados marcados (P.I.T.) a liberados. Esta es la más grande colecta de este pez en el Lago Mead en alrededor de 20 años.

En las pociones bajas del Río Colorado, Reclamación participó en colectas de matalotes jorobados del sistema de canales Tribus Indias del Río Colorado (TIRC) cerca de Parker, Arizona. Reclamación está trabajando con los biólogos

de TIRC en el desarrollo de áreas de crianza de paces nativos en tierras indias a lo largo del Río, y esperamos iniciar su construcción este verano en el primero en Lago No-Name en el sur de la Reservación.

Reclamación es un activo participante en actividades similares sobre Lago Havasu donde al menos diez cuevas han sido seleccionadas para usarse como áreas de crianza de peces nativos bajo el proyecto interinstitucional de mejoramiento pesquero conocido como "HAVFISH". Los peces nativos son ahora una componente integral del programa, y Reclamación se ha comprometido a financiar partes del proyecto.

Probablemente la acción más significativa del año pasado relacionado con matalotes jorobados, Charalitos cola dura y otros peces del cauce principal del Río Colorado es que las Oficinas Regionales de Reclamación y el Servicio de Pesca y Vida Silvestre han acordado unirse e iniciar un programa de recuperación de la Cuenca Baja. Inicialmente este será el desarrollo de un plan sombrilla o programa para enfocar recursos y acciones hacia un objetivo común.

Reclamación aseguró $100,000 dólares de emergencia para utilizarse en al recuperación de los peces del Río Virgin. Estos dólares servirán para siete diferentes actividades relacionadas con al recuperación del charalito (*Plagopterus argentissimus*). Se ha iniciado un proyecto para refinar las necesidades de cultivo en la Universidad de Georgia del Sur bajo Steve Vives, el arroyo vivo donde Jim Deacon desovó satisfactoriamente charalitos fue restaurado bajo al dirección de Fran Taylor, Director del Servicio de Laboratorio Animal en al Universidad. Fue instaado un nuevo medidor de arroyo en el Río Virgin debajo de la Presa Arroyo Codorniz. Se compró e instaló un auto-contenedor "pez-granja" a lo largo del Río cerca de Hurricane, Utah, para ser usado como una estación de salvamento para peces nativos. Los estanques de crianza de la Granja Reproductora Nacional de Peces Dexter fueron alineadas para control de crecimiento de malezas (los estanques están marcados para peces del Río Virgin). Se usaron técnicas videográficas en la composición de imágenes del Río Virgin para identificar todas las fuentes de agua posibles y asistir en futuras eradicaciones de la sardinita roja debajo de St. George. Finalmente la División de Vida Silvestre de Utah recibió apoyo financiero para desarrollar un plan de tratamiento completo de actividades futuras en el arroyo de Reclamación. En asociación con investigaciones en el bajo Río Virgin, Reclamación está conduciendo y participando en el análisis de hábitats de peces entre el Lago Mead y Mezquite, Nevada.

Otras actividades de la Región del Bajo Colorado incluyen: Reconocimientos anuales del Río Gila bajo la Presa Coolidge y el Bajo Río San Pedro a la confluencia con el Gila; acciones involucrando el uso continuo del refugio de la Presa Hoover para el cachorrito del Hoyo del Diablo (*Cyprinodon diabolis*); actividades relacionadas con el Equipo de Recuperación de Peces del Desierto Mohave Este; y un reconocimiento de la Ciénaga de Santa Clara que tuvo cachorritos del desierto (*Cyprinodon macularius*) en su último reconocimiento.

Las actividades del Centro de Investigación e ingeniería de Denver, diferentes de las cubiertas por la Región del Alto Colorado [por ejem. actividades sobre el charalito plateado Río Grande (*Hybognathus amarus*) y sardinita nariz chata (*Notropis simus*)] estuvieron limitada a varias poblaciones de matalotes lacustres en el,área del Lago Klamath [matalotes de escamas grandes (*Catostomus macrocheilus*), matalotes nariz corta (*Chasmistes brevirostris*), matalotes Río Perdido (*Catostomus luxatus*), y Lago Klamath (*Catostomus rimiculus*) y (*Catostomus snyderi*). Estos peces presentan el mismo enigma de los matalotes longevos del oeste: no reclutamiento para años 15 +. Reclamación está investigando con la Oficina en Dixon, California del Servicio de Pesca y Vida Silvestre los efectos de la calidad del agua en larvas de matalotes.Reclamación está financiando una investigación multianual para la Universidad Estatal de Oregon (COOP) sobre uso de hábitat y dinámica poblacional. La Oficina del Proyecto Klamath contrató recientemente a Mark Buetter, un biólogo experimentado con estos peces, para dirigir nuestros esfuerzos.

Este año ha sido grande y esperamos un próximo año aun mejor con lo relacionado a la recuperación de los peces nativos del Río Colorado.

YOUNG, D. A. (U.S Bureau of Reclamation, Upper Colorado Regional Office, Salt Lake City, UT)

Agency report on endangered species activities of the Upper Colorado Regional Office, U.S. Bureau of Reclamation

KEYWORDS: endangered fishes; upper Colorado River basin

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

LENTSCH, L. D.* (LDL - Utah Division of Wildlife Resources)

Utah's 1992 Agency Report: Progress in the Native Fish Program / Reporte de agencia de Utah 1992: Progresos en el Programa de Peces Nativos

KEYWORDS: Utah; Colorado River fish; Virgin River fish; June sucker

ABSTRACT

During 1992 significant efforts were made to enhance the native fish program of the Utah Division of Wildlife Resources (UDWR). Many of these efforts were accomplished because of the internal organization of the UDWR which allows for and mandates specific emphasis on native species. Three management sections exist within UDWR: Game,

Sportfish, and Native Wildlife. During 1992, the name of the section that emphasizes native species management within UDWR was changed from the Nongame Section to the Native Wildlife Section. The UDWR currently has five biologists working full time and an additional six biologists working part-time (some as much as 50%) on native fish issues and problems. Four major areas of emphasis are included in the native fish program during 1992: 1) General native species, 2) Colorado River fish, 3) Virgin River fish, and 4) June sucker.

Efforts within the general native species component centered on acquisition, accumulation, and synthesis of distribution/abundance information. Emphasis was placed on least chub and Virgin spinedace. Through cooperative agreements least chub population and habitat trend monitoring was initiated. Specific effort was placed on a livestock exclusion experiment. Additional surveys to document Virgin spinedace distribution were conducted in cooperation with Washington County Water Conservation District. Other activities included synthesis of statewide fish survey and museum collection information and establishment of a statewide database for native fish information.

Activities within all three components of the program involving federally listed species increased this year. Colorado River fish activities included conducting studies and participating in Recovery Program (Upper basin and San Juan) efforts. Specific studies included: Nursery habitat evaluation in the Green River, *Gila* monitoring and evaluation in Deso/Gray, Westwater, and Cataract Canyons, Nonnative fish control evaluation, Early life stage investigations in the San Juan River, Squawfish scale analysis, and Evaluation of northern pike impacts in the Green River. Activities associated with Virgin River fish included participation in the recovery team and a study to evaluate the potential to eliminate red shiner in the Upper Virgin River. June sucker recovery activities focused on development of propagation facilities, establishment of refuge populations, and writing a recovery plan.

RESUMEN

Durante 1992 se han realizado esfuerzos significativos para mejorar el programa de peces nativos de la División de Recursos de Vida Silvestre de Utah (DRVSU). Muchos de estos esfuerzos se han cubierto debido a la organización interna del DRVSU permite y encarga énfasis específico en los peces nativos. Existen tres secciones de manejo: Cinegéticos, Peces Deportivos y Vida Silvestre Nativa. Durante 1992, el,nombre de la sección que enfatiza el manejo de las especies nativas dentro del DRVSU fue cambiado de Sección de No-Cinegéticos a Sección de Vida Silvestre Nativa. El DRVSU actualmente tiene cinco biólogos trabajando de tiempo completo y adicionalmente seis biólogos trabajando tiempo parcial (algo como 50 %) en los aspectos de peces nativos y sus problemas. Cuatro áreas principales de énfasis se incluyen en el programa de peces nativos durante 1992: 1) Especies nativas generales, 2) peces del Río Colorado, 3) peces del Río Virgin y 4) matalote Junio.

Los esfuerzos dentro del componente general de especies nativas se centraron en la adquisición, acumulación y síntesis de información de distribución y abundancia. El énfasis fue puesto en el charalito pequeño y el charal de espina de Virgin. A través de acuerdos cooperativos fue iniciado el monitoreo de la población y el hábitat del charalito pequeño. Esfuerzos específicos fueron puestos en un experimento de exclusión de linaje vivo. Se condujeron reconocimientos adicionales para documentar la distribución del charal de espina de Virgin en cooperación con el Distrito de Conservación de Agua del Condado de Washington. Otras actividades incluyen síntesis de reconocimientos estatales de peces e información de colecciones de museos y establecimiento de base de datos estatales para información de peces nativos.

Las actividades dentro de los tres componentes del programa incluyen especies listadas federalmente incrementadas este año. Las actividades sobre los peces del Río Colorado incluyen la conducción de estudios y la participación esfuerzos en Programas de Recuperación (Cuenca Alta y San Juan). Los estudios específicos incluyen: Evaluación del hábitat de crianza en el Río Verde, Monitoreo y evaluación de *Gila* en el Deso/Gray, Westwater y Cañón Catarata, Evaluación del control de los peces nonativos Investigaciones de estadios de vida tempranas en el Río San Juan, Análisis de escamas del Charal del Colorado y Evaluación de los impactos del lucio del norte en el Río Verde. Las actividades asociadas con los peces del Río Verde incluyen la participación en el equipo de recuperación y un estudio para evaluar el potencial de eliminación de la sardinita roja en el Alto Río Virgin. Las actividades de recuperación del matalote June se enfocaron en el desarrollo de propagación de infraestructura, establecimiento de poblaciones de refugio y la escritura de un plan de recuperación.

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1992 agency report for the California Department of Fish and Game

KEYWORDS: California; Nevada; *Oncorhynchus clarki henshawi*; *Gila bicolor snyderi*; *Rhinichthys osculus*; *Cyprinodon macularius*; *Cyprinodon*; drought; habitat; genetics

ABSTRACT

Wolf Creek, Mono County, was chemically treated for the second year to eradicate non-native species in preparation for the 1993 introduction of Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) (CTL). The continuing drought forced biologists to move CTL from the nearly dry By Day Creek, Mono County, and release them into Mill Creek, which was also recently chemically treated.

With money provided from drought relief funds, additional habitat was developed for the Owens tui chub (*Gila bicolor snyderi*) at the Hot Creek headsprings. These springs are critically low due to drought, upslope water

development and geothermal development in the area. The habitat development will result in nearly a doubling of existing habitat at the site.

Preliminary results of our University of Nevada, Reno contract investigating the taxonomic relationships of speckled dace (*Rhinichthys osculus*) populations indicate that fish from the Owens River drainage are more closely related to fish from the Lahontan drainage than the Colorado River drainage. The Amargosa River population is the most genetically distinct.

The Department, based on the numerous *Cyprinodon macularius* found during a 1991 pupfish survey around the Salton Sea, effected a regulation change that eliminates or modifies bait fishing gear that could result in "take" of pupfish. The Department also provided some funding and collected fish for an Arizona State University electrophoretic study of *Cyprinodon macularius*.

Additional ponds were developed at Shoshone Springs for Shoshone pupfish (*Cyprinodon nevadensis shoshone*). The habitat for this fish consists only of two artificial ponds which could be lost in a severe thunderstorm or other event.

Molecular genetic studies of California (and some Nevada) pupfish populations will begin in November 1992. The study's primary focus is to examine the genetic relationships within *Cyprinodon nevadensis* complex and determine (at the subspecies level) from those in the Amargosa River. The study will also include samples from the following populations: *Cyprinodon diabolis*, *Cyprinodon radiosus*, *Cyprinodon salinus* ssp. and *Cyprinodon macularius*.

RESUMEN

RECEIVED TOO LATE TO BE TRANSLATED

VRIJENHOEK, R. C.*; LEBERG, P. L. (RCV - Center for Theoretical & Applied Genetics, Rutgers Univ., New Brunswick, NJ 08903-0231; PLL - Dept. Biology, Univ. of Southwestern Louisiana, Lafayette, LA 70504.)

Parasites and the Red Queen: the management of biological warfare in endangered populations / Parásitos y la Reina Roja: el manejo de la guerra biológica de las poblaciones en peligro

KEYWORDS: parasites; genetic diversity; Red Queen; *Poeciliopsis*

ABSTRACT

Introduction of exotic species poses an additional threat against native fishes that can be waged by fellow travelers -- parasitic helminths, bacteria, and viruses. The ability of native populations to withstand these additional threats would be affected by their demographic stability and their level of genetic diversity. Competent immune surveillance and variation in susceptibility affect the rate at which parasites spread through a host population. According to Red Queen hypothesis, a host population of a long-lived species must evolve as fast as it can just to keep up in an evolutionary race with short-lived parasites. Because evolutionary rate is tied to genetic variability in the host population, variability must be maintained to allow native populations to stay in place with their native parasites and to face the treat of exotic parasites. Field and laboratory studies with fishes in the genus *Poeciliopsis* were designed to examine critical assumptions on which the Red Queen hypothesis is based. Field studies revealed that genetic diversity in the host is associated with a lower parasite load. Laboratory experiments with these fish revealed genetic variation in susceptibility to a helminth parasite. The management implications for small endangered populations are discussed.

RESUMEN

La introducción de especies exóticas plantea de nuevo una amenaza adicional para peces nativos que pueden ser afectados por compañeros viajeros--helmintos parásitos, bacterias y virus. La habilidad de las poblaciones nativas para resistir esta amenaza adicional podría estar afectada por su estabilidad demográfica y su nivel de diversidad genética. La vigilancia inmune competente y la variación en la susceptibilidad afectan la tasa en la cual los parásitos se propagan a través de una población hospedera. De acuerdo a la hipótesis de la Reina Roja, una población hospedera de una especie de vida larga podría desarrollarse tan rápido como pueda mantener una tasa evolutiva con parásitos de vida corta. Porque la tasa evolutiva está ligada a variabilidad genética en la población hospedera, la variabilidad podría ser mantenida y permitir que poblaciones nativas permanezcan en el lugar con sus parásitos nativos y afrontar la amenaza de parásitos exóticos. Estudios de campo y laboratorio indican que la diversidad genética en el hospedero está asociada con una baja carga parásita. Experimentos de laboratorio con estos peces revelan variación genética en susceptibilidad a un helminto parásito. Se discuten las implicaciones de manejo para poblaciones pequeñas en peligro.

WILLIAMS, J. E.*; WILLIAMS, C. D. (JW - Bureau of Land Management, Washington, D.C.; CW - USDA Forest Service, Washington, D.C.)

A cooperative strategy to "Bring Back The Natives" to our public lands / Una estrategia cooperativa para "Regresar a los Nativos" a nuestros terrenos públicos

KEYWORDS: biodiversity; watershed; restoration; public lands; native species

ABSTRACT

The 191 million acres of National Forest System lands together with the more than 270 million acres of Bureau of Land Management public lands comprise nearly 70% of all federal lands in the United States. These multiple-use lands provide vast opportunities for restoration of aquatic biodiversity. In 1991, the National Fish and Wildlife Foundation joined both of these agencies in a cooperative effort to restore the biotic integrity of entire streams where the USDA Forest Service and BLM manage large portions of the watersheds. Twenty-one streams in 10 states were targeted under this strategy in 1992. During 1993, the program has expanded to 34 projects in 13 states. Projects are based on the premises of changes in land management prescriptions, watershed level restoration, and the involvement of as many landowners as possible.

RESUMEN

Los 191 millones de acres de terreno, del sistema de Bosques Nacionales junto con los mas de 270 millones de acres de terrenos públicos de la Agencia de Manejo del suelo comprenden cerca de los del 70% de todo el terreno federal en los Estados Unidos. Estos terrenos de uso múltiple proveen de oportunidades para la restauración de la biodiversidad acuática. En 1991,la Fundación Nacional para la vida silvestre y la pesca se unió con estas agencias en un esfuerzo cooperativo para restaurar la integridad biótica de ríos completos donde el servicio forestal y de la Agencia de Manejo de Suelo manejan grandes porciones de las cuencas hidrográficas. Veintiún ríos en 10 estados fueron seleccionados bajo esta estrategia en 1992. Durante 1993, el programa se ha expandido a 34 proyectos en 13 estados. Los proyectos están basados en las premisas de cambios en las prescripciones del manejo del suelo, nivel de restauración de cuencas y el mayor involucramiento de propietarios de tierra como fue posible.

MAYDEN, R. L.*; WOOD, R. M. (Department of Biological Sciences, University of Alabama)

Allozyme evolution in the *Cyprinella formosa* species group (Teleostei: Cyprinidae): A case study of speciation and historical biogeography in the desert southwest / Evolución aloenzimática en el grupo de especies *Cyprinella formosa* (Teleostei: Cyprinidae): Un caso de estudio de especiación y biogeografía histórica en el desierto del Suroeste

KEYWORDS: allozymes; systematics; speciation; Cyprinidae; *Cyprinella*; biogeography

ABSTRACT

The *Cyprinella formosa* species group is a monophyletic group inclusive of two species: *Cyprinella formosa* and *Cyprinella bocagrande*. The beautiful shiner, *Cyprinella formosa*, occurs in the interior drainages of the Guzmán Basin and disjunct northern and southern headwaters of the Río Yaqui. The largemouth shiner, *Cyprinella bocagrande*, is endemic to Ojo Solo in the Bolsón de los Muertos, part of the Guzmán Basin.

During Kansan period rivers of the Guzmán Basin (and Ojo Solo) formed tributaries to the extensive pluvial Lake Palomas. This once continuous aquatic system presumably provided suitable habitat for a widespread ancestral species to the *C. formosa* species group. Subsequent isolation of portions of Lake Palomas resulted in a series of endorheic drainages and isolated gene pools for members of the *C. formosa* species group.

In this study we investigate genetic variability (43 loci) in *C. formosa* from five drainages and *C. bocagrande* from Ojo Solo. Using *Cyprinella lepida* and *Cyprinella lutrensis* as outgroups, phylogenetic hypotheses (distance Wagner, PAUP, FREQPARS) are used to evaluate likely modes of speciation and rates of divergence operating within this species group.

RESUMEN

El grupo de especies *Cyprinella formosa* es un grupo monofilético integrado por dos especies: *Cyprinella formosa* y *Cyprinella bocagrande*. La sardinita yaqui, *Cyprinella formosa*, ocurre en los cauces internos de la cuenca del Río Guzmán y cabeceras disyuntas del norte y sur de el Río Yaqui. La sardinita bocagrande, *C. bocagrande*, es endémica a la localidad Ojo Solo en el Bolsón de Muertos, el cual es parte de la cuenca del Río Guzmán.

Durante el período Kansaniano, los ríos de la cuenca del Río Guzmán (y Ojo Solo) formaron tributarios al extenso lago pluvial Palomas. Este entonces sistema acuático continuo, presumiblemente proveyó de hábitat adecuado para una especie ancestral bien distribuida del grupo *C. formosa*. El aislamiento subsecuente de las porciones del Lago Palomas resultó en una serie de cauces endorréicos y grupos de genes aislados para miembros del grupo de especies *C. formosa*.

En este estudio investigamos la variabilidad (43 loci) en *C. formosa* de 5 cuencas y *C. bocagrande* en Ojo Solo. Usando *Cyprinella lepida* y *Cyprinella lutrensis* como grupos externos de comparación, hipótesis filogenéticas (distancia de Wagner, PAUP, FREQPARS) fueron usadas para evaluar modas similares de especiación y tasas de divergencia que operan dentro de este grupo de especies.

LANG, B. K.*; PLATANIA, S. P. (UNM Ichthyofaunal Studies Program, Department of Biology, University of New Mexico, Albuquerque, NM)

Current distribution and status of the Rio Grande silvery minnow, *Hybognathus amarus* / Distribución actual y situación del charalito plateado del Río Grande, *Hybognathus amarus*

KEYWORDS: *Hybognathus amarus*; Rio Grande; New Mexico

ABSTRACT

The Rio Grande silvery minnow, *Hybognathus amarus*, has experienced a 95% reduction in its historic range and currently is known only from the Middle Rio Grande in New Mexico. Demands by water users, fluctuations in regional precipitation patterns, and the decline in native fish populations stimulated the need for systematic survey to determine the conservation status of the middle Rio Grande ichthyofauna with specific focus on *H. amarus*. The first phase of a five-year cooperative study was initiated in 1992 and designed to document the present distribution and status of *H. amarus*. The study area consisted of three distinct zones, demarcated by drainage diversion structures, along a 186 km reach of the middle Rio Grande from Cochiti Reservoir downstream to Elephant Butte Reservoir. *Hybognathus amarus* was taken in 46 of 81 (57%) mainstem Rio Grande collections and one irrigation canal return site. Over 82% (38 of 46) of these occurrences were in the southern two regions (downstream of Isleta Diversion Dam) of the study area. While eight sites upstream of Isleta Diversion Dam yielded *H. amarus*, none were taken in the 25 km reach between Angostura Diversion Dam and Cochiti Reservoir.

RESUMEN

El charalito plateado del Río Grande, *Hybognathus amarus*, ha experimentado una reducción del 95% de su área histórica de distribución y actualmente se conoce solo de la región central del Río Grande en Nuevo México. La demanda de agua por usuarios, las fluctuaciones en los patrones regionales de precipitación, el decline de las poblaciones nativas estimularon la necesidad de estudios sistemáticos para determinar el estado de conservación de la ictiofauna de la región central del Río Grande enfocado específicamente sobre *H. amarus*. La primera fase de un estudio cooperativo de cinco años fue iniciado en 1992 y fue diseñado para documentar la distribución actual y situación de *H. amarus*. Este estudio consistió de tres zonas distintas, demarcadas por la estructura de diversión de la cuenca, a lo largo de un segmento de 186 km de la región central del R. Grande desde la presa Cochiti río abajo hasta la Presa Elephant Butte. *Hybognathus amarus* fue capturado en 46 de 81 (57%) colectas en el cauce principal del R. Grande y en un sitio dentro de un canal de irrigación. Mas del 82% (38 de 46) estas ocurrencia fueron en las dos regiones sur (río abajo de la Presa de derivación Isleta) del área de estudio. Mientras que en ocho sitios río arriba de la Presa de Derivación Isleta se encontró *H. amarus*, ninguno fue capturado en el segmento de 25 km entre las Presas de Derivación Angostura y Cochiti.

NAKAGAWA, P. A.; SOLTZ, D. L.*; SANDERS, B. M. (PAN and BSM - Molecular Ecology Institute and Department of Biology, CSULB, Long Beach, CA; DLS - Department of Biology, CSULB, Long Beach, CA)

The Role of Stress Proteins in the Physiological Adaptation of the Amargosa Pupfish, *Cyprinodon nevadensis* / El papel de las proteínas "stress" en la adaptación fisiológica del cachorrito Amargosa *Cyprinodon nevadensis*

KEYWORDS: chaperonin; *Cyprinodon*; hsp70; heat-shock proteins; stress-70; stress proteins; thermotolerance

ABSTRACT

The cellular stress response or heat-shock response, is involved in protecting organisms from damage as a result of exposure to a wide variety of environmental stressors. The response entails the rapid synthesis of a suite of proteins referred to as stress proteins. These proteins are ubiquitous and highly conserved. Their synthesis is closely correlated with acquired tolerance in which a conditioning heat shock confers the ability to survive a subsequent, more severe heat shock that otherwise would be lethal to the organism. Two of these proteins, stress-70 and chaperonin, are molecular chaperones which under normal conditions help maintain protein homeostasis. They also repair and protect other cellular proteins from temperature induced damage.

Surprisingly, little is known about the role of stress proteins in organismic adaptation under natural environmental conditions. If stress proteins are involved in this adaptation then we reasoned that an extensive stress protein response would occur in species which have successfully colonized more unpredictable and extreme environments. Further, studying differences in the stress response, perhaps differences in induction of stress protein synthesis or the appearance of unique proteins, between subspecies with differential tolerances to environmental factors might allow the identification of successful adaptive strategies.

To this end we have conducted an intraspecific study of the stress response in two subspecies of Amargosa pupfish *Cyprinodon nevadensis* which occupy different habitats. One subspecies, *Cyprinodon nevadensis amargosae*, lives in a

river in which seasonal temperatures fluctuate from near 0°C during the winter months to greater than 40°C during the summer. The other subspecies, *Cyprinodon nevadensis nevadensis*, inhabits a relatively constant thermal spring with an average temperature at 27.5°C.

Preliminary studies which were conducted to compare thermotolerance between the two subspecies indicated that exposure to a sublethal conditioning heat-shock increased the upper lethal temperature for both subspecies. However, *C. n. amargosae* expressed a slightly greater thermotolerance. Characterization of the stress response indicated differences in the response between subspecies, including differences in: (1) the number of isoforms of stress-70, (2) the level of accumulation of stress-70 in gill tissue, and (3) the temperature range over which stress proteins were induced. These data suggest that stress proteins may be involved in conferring temperature tolerance to this fish species. And that differences between the two subspecies might allow the identification of specific features of the stress response which have important roles in physiological adaptation to environmental extremes.

RESUMEN

La respuesta celular al estress o respuesta al choque térmico, está involucrada en la protección de organismos del daño como resultado de la exposición a una amplia variedad de factores estresantes del medio. La respuesta conlleva la síntesis rápida de un grupo de proteínas referida como proteínas del estress. Estas proteínas son escasas y muy conservadas. Su síntesis está muy correlacionada con la tolerancia adquirida en la cual un choque térmico condicionado confiere la habilidad de sobrevivir a un choque mas severo; que de no ser así podría ser letal para el organismo. Dos de estas proteínas, stress-70 y chaperonina, son chaperones moleculares los cuales bajo condiciones normales ayudan a mantener la homeostasis de proteínas. Ellos también reparan y protegen a otra proteína de daños inducidos por la temperatura.

Sorprendentemente, se conoce poco acerca del papel de estas proteínas del estress en la adaptación organísmica bajo condiciones ambientales naturales. Si las proteínas del estress están involucradas en esta adaptación, razonamos entonces que una respuesta extensiva de las proteínas del estress podría ocurrir en especies que han colonizado exitosamente ambientes mas impredecibles y extremos. Mas aún, al estudiar las diferencias en respuesta al estress, quizás la diferencia en la inducción a la síntesis de proteínas del estress o la aparición de proteínas únicas, entre subespecies con tolerancias diferenciales a factores ambientales que permita la identificación de estrategias adaptivas exitosas.

Para este fin conducimos un estudio interespecífico de la respuesta al estress en 2 subespecies de Cachorrito Amargosa *Cyprinodon nevadensis* el cual ocupa hábitats diferentes. Una subespecies *Cyprinodon nevadensis amargosae*, habita en un río cuyas temperaturas temporales fluctúan desde cerca de 0°c durante los meses de invierno hasta mas arriba de los 40°c durante el verano. La otra subespecie, *Cyprinodon nevadensis nevadensis* habita un manantial relativamente constante con una temperatura promedio de 27.5°C.

Estudios preliminares cuales fueron conducidos para comparar la termotolerancia entre las dos subespecies indicaron que la exposición a condición de shock de calor subletal incrementa la temperatura letal mayor para ambas subespecies. Sin embargo, *C. n. amargosae* mostró una termotolerancia un poco mayor. La caracterización de la respuesta de estres indicó diferencias en la respuesta entre subespecies, incluyendo diferencias en :(1) el número de isoformas de estres-70, (2) el nivel de acumulación de estres-70 en el tejido de la branquia, y (3) el rango de temperatura sobre la cual las proteínas fueron inducidas. Estos datos sugieren que las proteínas estén involucradas en conferir tolerancia a la temperatura a estas especies de peces. Y que las diferencias entre las dos subespecies podría permitir la identificación de características específicas de la respuesta al estres cual tiene un papel importante en la adaptación fisiológica a ambientes extremosos.

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PL. 101-646 (Aquatic Nuisance Prevention and Control Act of 1990): A Progress Report / Pl.101-464 (Decreto para el Control y Prevención del Disturbio Acuático de 1990): Un Reporte de Avances

KEYWORDS: legislation; non-indigenous species; agencies and special interests; United States

ABSTRACT

The Aquatic Nuisance Prevention and Control Act of 1990, signed on 29 November 1990, required input to Congress from a variety of federal agencies toward future national legislation on introductions of non-indigenous species. As expected, there have been snags in the process of gathering information and objections to the procedure from some entities. This presentation is intended to be an interim report on where various agencies are concerning progress toward reports due to Congress, and what can be expected in early-to-mid 1993 on this subject.

RESUMEN

El Decreto para el Control y Prevención del Disturbio Acuático de 1990, firmado el 29 de Noviembre de 1990., requirió de empuje al congreso de una variedad de agencias federales hacia una futura legislación nacional sobre la introducción de especies no-indígenas. Como se esperaba, han existido dificultades en el proceso de recopilación de información y objeciones hacia el procedimiento por parte de algunas agencias. Esta presentación intenta ser un reporte

interno sobre cuales agencias están interesadas sobre el progreso de los reportes enviados al congreso, y que se puede esperar para el inicio o mediados de 1993 sobre este tema.

SHEN, Y.*; EVANS, R. P.; WILLIAMS, R. N.; SHIOZAWA, D. K. (YS, RPE, DKS - Department of Zoology, Brigham Young University, Provo, UT RNW - Department of Biology, Boise State University, Boise, ID)

Restriction Fragments Length Polymorphism (RFLP) of cutthroat trout *Oncorhynchus clarki* mitochondrial DNA fragments amplified by Polymerase Chain Reaction (PCR) / Polimorfismo en la longitud de fragmentos de restricción (RFLP) de la trucha garganta cortada *Oncorhynchus clarki* a partir de fragmentos de ADN mitocondrial amplificados por reacción en cadena de la polimerasa (PCR)

KEYWORDS: Polymerase Chain Reaction; RFLP; *Oncorhynchus clarki*

ABSTRACT

Certain regions of the mitochondrial genome have been a valuable source of information concerning genetic diversity in fish. In this study, the mitochondrial DNA (mtDNA) ORF1, ORF2, ORF5/6 and Cytochrome B gene regions of different cutthroat trout subspecies were amplified by polymerase chain reaction (PCR). PCR amplified mtDNA fragments were cleaved with 10 restriction endonucleases (AluI, CfoI, HaeIII, HhaI, HinfI, HpaII, MboI, MspI, RsaI, and Sau3AI). Resultant restriction fragments were separated by agarose gel electrophoresis and detected by ethidium bromide staining. Forty unique restriction fragment length polymorphisms were detected which allow unique separation of all cutthroat trout subspecies and some populations. These data were used to infer phylogenetic relationships of the cutthroat trout subspecies. The combined use of PCR and RFLP techniques provides a rapid and nonlethal technique for the identification of native cutthroat trout subspecies.

RESUMEN

Ciertas regiones del genoma mitocondrial han sido una fuente valiosa de información en el estudio de la diversidad genética en peces. En este estudio, se amplifican por medio de la reacción en cadena de la polimerasa (PCR), las regiones génicas ORF1, ORF2, ORF5/6, y citocromo B del ADN mitocondrial (ADN mt) de diferentes subespecies de trucha garganta cortada. Los fragmentos de ADN mt amplificados por PCR fueron cortados con 10 endonucleasas de restricción (AluI, CfoI, HaeIII, HhaI, HinfI, HpaII, MboI, MspI, RsaI, y Sau3AI). Los fragmentos de restricción resultantes fueron separados por electroforésis en gel de agarosa y detectados por medio de la tinción con bromuro de etidio. Cuarenta polimorfismos de longitud de los fragmentos de restricción fueron detectados, los cuales permitieron la separación de todas las subespecies de trucha garganta cortada, como también de algunas poblaciones. Estos datos fueron utilizados para inferir las relaciones filogenéticas de las subespecies de trucha garganta cortada. El uso combinado de las técnicas de PCR y RFLP, proveen un procedimiento rápido y no letal para la identificación de subespecies nativas de trucha garganta cortada.

GORMAN, OWEN T.*; LEON, STUART C.; MAUGHAN, O. EUGENE (OTG - U.S. Fish and Wildlife Service, P.O. Box 338, Flagstaff, AZ 86002-0338; SCL - U.S. Fish and Wildlife Service, P.O. Box 39, Pinetop, AZ 85935; OEM - Arizona Cooperative Fish and Wildlife Research Unit, University of Arizona, Tucson, AZ 85721)

Habitat use by humpback chub, *Gila cypha*, in the Little Colorado River and other tributaries of the Colorado River / Uso de hábitat del charalito jorobado, *Gila cypha*, en el Pequeño Río Colorado y otros tributarios del Río Colorado

KEYWORDS: Cyprinidae; *Gila cypha*; ecology; streams; habitat; endangered species; Grand Canyon; Arizona

ABSTRACT

The objective of USFWS research is to determine habitat use by the endangered humpback chub and other native fishes in the Little Colorado River (LCR) and other tributaries of the Colorado River in the Grand Canyon, evaluate the potential for establishing a second spawning aggregation of humpback chub, and from the perspective of habitat requirements, evaluate the impact of Glen Canyon dam on native fishes. Research commenced in the LCR in July 1991 and in January 1992 for other tributaries. Stream habitat in the lower 21 km of the LCR and the lower 8 km of other tributaries has been mapped and sampled. Habitat use patterns were evaluated from seining, electrofishing, and hoopnetting. In the LCR, humpback chub were the predominant species and maintained a resident population. Preliminary analyses indicate that adult chubs are highly habitat specific and that juvenile chub show a very different pattern of habitat use.

RESUMEN

El objetivo de la investigación del USFWS es determinar el uso del hábitat del charalito jorobado en peligro de extinción y otros peces nativos del Pequeño Río Colorado (PRC) y otros tributarios del Río Colorado en el Gran Cañón, evaluar el potencial para el establecimiento de una segunda agregación de desove del charalito jorobado, y de la perspectiva de requerimiento de hábitat, evaluar el impacto de la presa del Cañón Glen en los peces nativos. Las

investigaciones comenzaron en el PRC en Julio de 1991 y para otros tributarios, en Enero de 1992. El hábitat de arroyos en los 21 Km más bajos del PRC y en los 8 Km más bajos de otros tributarios han sido mapeados y muestreados. Los patrones de uso del hábitat fueron evaluados con chinchorro, electropesca y red de cuchara. En el PRC, el charalito jorobado fue la especie predominante y mantuvo una población residente. El análisis preliminar indica que los adultos del charalito son de hábitat muy específicos y los juveniles del charalito muestran un patrón muy diferente de uso de hábitat.

CHILDS, M. R.*; ECHELLE, A. A.; DOWLING, T. E. (MRC and AAE - Department of Zoology, Oklahoma State University, Stillwater, OK; TED - Arizona State University, Tempe, AZ)

Dynamics of introgressive hybridization between the Pecos pupfish *Cyprinodon pecosensis* and sheepshead minnow *Cyprinodon variegatus* in the Pecos River, Texas / Dinámica de la hibridización introgresiva entre el cachorrito Pecos *Cyprinodon pecosensis* y el cachorrito cabeza de borrego *Cyprinodon variegatus* en el Río Pecos, Texas

KEYWORDS: genetic introgression; mitochondrial DNA; allozymes; Texas; pupfish; Cyprinodontidae; *Cyprinodon pecosensis*; *Cyprinodon variegatus*

ABSTRACT

Introduction of the sheepshead minnow *Cyprinodon variegatus* into the Pecos River in the early 1980's has resulted in extremely rapid and extensive genetic introgression of the Texas populations of the endemic pupfish *C. pecosensis*. Allozyme and mitochondrial DNA (mtDNA) data were used to assess the dynamics of this rapidly evolving system. Allozyme and mtDNA frequencies do not differ significantly at any of our sample locations, and we interpret this as evidence for genetic replacement or genetic augmentation rather than genetic displacement as the best explanation for the present genetic structure of the populations.

RESUMEN

La introducción del cachorrito cabeza de borrego en el Río Pecos en los inicios de los 80's ha resultado una introgresión genética extremadamente rápida y extensiva de la población del cachorrito endémico *Cyprinodon pecosensis*. La información de aloenzimas y el ADN mitocondrial (ADN mt) fue utilizada para la evaluación de la dinámica de un sistema de rápido desarrollo. Las frecuencia de aloenzimas y ADN mt no difieren significativamente en ninguna de las localidades muestreadas, y nosotros interpretamos esto como evidencia de reemplazo genético o aumento genético en lugar de dislocación genética, como la mejor explicación de la estructura genética actual de las poblaciones.

EDWARDS, ROBERT J.*; GARRETT, GARY P.; HUBBS, CLARK (RJE - Department of Biology, University of Texas-Pan American, Edinburg, TX; GPG - HOH Research Station, Texas Parks and Wildlife Department, Ingram, TX; CH - Department of Zoology, University of Texas at Austin, TX)

A Biogeographic Analysis of the Endangered Fishes of Texas / Analisis biogeográfico de los peces en peligro de extinción del estado de Texas

KEYWORDS: endangered fishes; Texas; habitats; biogeography; peces en peligro de extinción; biogeografía

ABSTRACT

Nearly 20% of the primary freshwater fishes of Texas appear in need of protection. Approximately two-thirds of the threatened fishes are dependent upon aquifers and their outflows state-wide, environments that are declining substantially. An additional quarter have been adversely impacted from hydrologic changes as a result of reservoir construction. Nearly 45% of the threatened species occupy spring systems in the Chihuahuan Desert region of west Texas and almost 25% are found in the eastern portion of the state. Five taxa appear to be extinct and only the panhandle region of northern Texas appears to be without threatened fishes.

RESUMEN

Cerca del 20% de las especies primarias de peces de agua dulce de Texas necesitan de protección. Aproximadamente dos tercios de los peces en peligro dependen de los mantos acuíferos y sus derivaciones en todo el Estado, ambientes que están declinando substancialmente. Una cuarta parte adicional ha sido adversamente afectada por los cambios hidrológicos resultantes de la construcción de presas. Cerca del 45% de las especies en peligro ocupan arroyos del Desierto Chihuahuense del oeste de Texas y casi 25% se encuentran en la parte este del Estado. Cinco grupos taxonómicos parecen estar extinguidos y únicamente la región del noroeste de Texas parece no tener peces en peligro de extinción.

ECHELLE, A. A.*; ECHELLE, A. F. (Department of Zoology, Oklahoma State University, Stillwater, OK)

An allozyme perspective on mitochondrial DNA variation and evolution of the Death Valley pupfishes / Una perspectiva aloenzímica de la variación de ADN mitocondrial y evolución de los cachorritos del Valle de la Muerte

KEYWORDS: phylogenetics; allozymes; protein electrophoresis; mitochondrial DNA; Death Valley; Cyprinodontidae; *Cyprinodon*

ABSTRACT

We used allozymes encoded by 32 gene loci in 12 species of *Cyprinodon* (Cyprinodontidae) to examine the evolution of the *Cyprinodon nevadensis* complex, a group of four species (7 extant subspp.) in the Death Valley System of California and Nevada. The most parsimonious phylogenetic trees supported monophyly of the *C. nevadensis* complex (*Cyprinodon diabolis*, *Cyprinodon nevadensis*, and *Cyprinodon salinus* from Ash Meadows-Death Valley, and *Cyprinodon radiosus* from Owens Valley). However, a hypothesis involving a diphyletic origin of the complex was nearly as parsimonious. The geographic distribution of alleles, together with results from an earlier study of mtDNA variation, suggest that introgressive hybridization has occurred between two divergent pupfishes that gained access to the Death Valley System. We suggest that secondary contact and introgressive hybridization among western pupfishes may have been more common in wetter times of the past than is generally appreciated. Such an event would explain conflicting phylogenetic statements from allozymes and mtDNA, as well as a variety of additional observations on variation in the western pupfishes.

RESUMEN

Usamos aloenzimas configuradas para 32 genes localizadas en 12 especies de *Cyprinodon* (Cyprinodontidae) para examinar la evolución del complejo *Cyprinodon nevadensis*, un grupo de cuatro especies (7 subespecies existentes) en el Sistema del Valle de la Muerte de California y Nevada. Los árboles filogenéticos más parsimoniosos apoyaron la monofilia del complejo *Cyprinodon nevadensis* (*Cyprinodon diabolis*, *Cyprinodon nevadensis*, y *Cyprinodon salinus* de Ash Meadows-Valle de la Muerte y *Cyprinodon radiosus* del Valle Owens). Sin embargo, una hipótesis que involucra un origen difilético del complejo fue casi como parsimoniosa. La distribución geográfica de los alelos, junto con el resultado de un estudio anterior de una variación de ADN mt, sugiere que ha ocurrido una hibridización introgresiva entre dos cachorritos divergentes que entraron al Sistema del Valle de la Muerte. Sugerimos que el contacto secundario. Sugerimos que el contacto secundario de hibridización introgresiva entre cachorritos del oeste pudo haber sido más común en tiempos más húmedos en el pasado que lo generalmente apreciado. Tal evento explicaría declaraciones filogenéticas conflictivas de aloenzimas y ADN mt, así como una variedad de observaciones adicionales sobre variación de los cachorritos del oeste.

MABEY, L. W.*; SHIOZAWA, D. K. (LWM and DKS - Department of Zoology, Brigham Young University, Provo, UT)

The planktonic and benthic microcrustacean communities in the Green River ecosystem near Ouray, Utah / Comunidades de microcustráceos bentónicos y planctónicos en el ecosistema de Green River, cerca de Ouray, Utah

KEYWORDS: Green River; zooplankton; microcrustaceans; benthos

ABSTRACT

The fry of the Colorado squawfish are known to utilize backwater habitats on the Green River and much of their diet consists of microcrustaceans. Given the historic association of the Green River with floodplain habitats and other quiet waters, the native fishes may have relied heavily on food production in these areas. Our objective in this study was to assess the density and habitat associations of microcrustaceans in both the plankton and benthos of river, backwater, and floodplain habitats. We selected representative sites for each of these habitat types and collected 50 benthic cores and five vertical plankton tows per site.

To date 25 species of microcrustaceans have been collected and identified. Seven species were collected in the river site plankton, while only 3 species occurred in the river benthos. In the backwater site 11 species were collected in the plankton while 2 species occurred in the benthos. In the wetland floodplain habitat the number of species changed over time, but in general the highest number of species occurred here, up to 18 in the plankton and 12 in the benthos. Most species in these three habitats are both planktonic and benthic in habit. Some are more likely to be found in the benthos or plankton than others, but it is apparent that many of the microcrustaceans are able to exist in either life style. Only a few species appeared to be obligate members of the plankton or benthos. Densities are high. In one floodplain wetland, for example, we estimated 205,922 microcrustaceans per cubic meter in the plankton and 261,228 per square meter of benthos.

RESUMEN

Las larvas de Charal del Colorado (*Ptychocheilus lucius*) son conocidas a utilizar los hábitats lénticos o de remansos en el sistema de Green River, ya que gran parte de su dieta se compone de microcrustáceos. Dada la asociación histórica del Green River con los hábitats de planicie de inundación y de otros de aguas lénticas, los peces nativos pudieron haber

dependido de la producción de alimento en esas áreas. El objetivo de nuestro estudio, fue estimar la densidad y asociación de hábitat de microcrustáceos planctónicos y bentónicos en los biotopos de río, remanso, y planicie de inundación.

Se seleccionaron sitios representativos para cada uno de los tipos de hábitats; en cada sitio se efectuaron 50 muestreos de bentos y cinco arrastres verticales de plancton.

Hasta la fecha, 25 especies de microcrustáceos han sido colectados e identificados. Siete especies fueron colectadas en el hábitat de plancton del río, y solamente tres especies ocurrieron en el bentos del río. En el sitio de remanso se colectaron 11 especies en el plancton y solamente dos en el bentos. En el hábitat de planicie de inundación el número de especies fue cambiante en el tiempo, sin embargo en términos generales, fue el que registró el mayor número de especies (18 en el plancton y 12 en el bentos). La mayoría de las especies en esos tres hábitats exhiben ya sea hábitos planctónicos como bentónicos. Algunas especies son más probables a ser encontradas en el plancton ó en el bentos, en comparación con otras taxa; pero es notable que muchos de los microcrustáceos son capases de existir en cualquier estilo de vida. Solamente unas pocas especies aparentan ser miembros obligados del plancton ó del bentos. Las densidades son altas. Por ejemplo, en las planicies de inundación fueron estimadas densidades en el plancton de 205,922 microcrustáceos por metro cúbico y densidades en el bentos de 261,228 microcrustáceos por metro cuadrado.

MOEHLE, C. (Arizona State Council Chairman, Trout Unlimited)

Convener and moderator: Management toward recovery of Apache trout *Oncorhynchus apache*. A Workshop presented by Trout Unlimited and the Desert Fishes Council.

KEYWORDS: Apache trout; management; recovery

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

RINNE, J. N. (U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station)

Historical review of concern and management for *Oncorhynchus apache*.

KEYWORDS: Apache trout; management

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

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* **DIVINE, G.** (U.S. Fish and Wildlife Service, Office of Endangered Species, Albuquerque, NM)

Management goals toward recovery and delisting.

KEYWORDS: Apache trout; management; recovery; delisting

ABSTRACT

In 1966 the U.S. Congress passed the Endangered Species Preservation Act providing protection against extinction for the Apache trout and numerous other animal species. Subsequent Acts have further strengthened the Nation's resolve to prevent extinction of species. The initial recovery plan for Apache trout was completed in 1978 and revised in 1983 setting forth objectives deemed necessary to recovery this fish. Progress toward recovery has been made; however some obstacles remain. Recovery is possible and will be achieved.

RESUMEN

RECEIVED TOO LATE TO BE TRANSLATED

CONTRIBUTED PAPER

Congress passed the Endangered Species Preservation Act in 1966. This law allowed listing of native animal species as endangered and provided limited means for the protection of species so listed. On March 11, 1967, the Arizona trout (*Salmo apache*) (= Apache trout, *Oncorhynchus apache*) was listed as one of numerous species "threatened with extinction. The Endangered Species Conservation Act of 1969 was passed to provide additional protection to species in danger of "worldwide extinction". As a result of this Act, the Apache trout was listed as "endangered." This designation remained until July 16, 1975 when the classification was changed to "threatened". This action was taken because the species was not "endangered" as defined by the Endangered Species Act of 1973, but rather, properly classified as "threatened." The reasons for the change in designation was that good populations of pure stocks of Apache trout existed in several headwater streams of the east fork of the White River and headwaters of Bonito Creek. Additionally, it was believed that fish culture work being done on this species and stream renovation projects would result in the reintroduction of Apache trout to streams within its historic range and therefore the species was not in danger of extinction throughout all or a significant portion of its historic range.

The initial recovery plan was prepared by the Apache trout recovery team and eventually approved by U.S. Fish and Wildlife Service Director Lynn Greenwalt on August 20, 1979. This plan was revised by the recovery team

and then approved by Regional Director Michael Spear (Region 2) on September 22, 1983. A second revision is in process and scheduled for completion prior to September 30, 1993.

The goal for recovering the Apache Trout still remains to increase populations both in size and number to levels were the species survival in the wild will be assured. At such time delisting can be proposed.

Although the language was changed some what in the 1983 revision, the five objectives remain the same. They follow:

1) Establish and/or maintain 30 self-sustaining discrete populations of pure Apache trout throughout its historic range.

2) Survey and manage Apache trout populations presently existing in waters outside the historic range.

3) Provide habitat protection through implementation of land management practices, programs and acquisitions.

4) Provide adequate enforcement of all Federal, State and Tribal laws and regulations to insure protection of Apache trout.

5) Develop public support of the Apache trout program through an information and education campaign.

Recovery continues to be a team effort with input from all affected agencies and the public. As specified in the Endangered Species Act (ESA) of 1973 (as amended), Congress intended that all Federal agencies cooperate with State and local agencies to resolve water resource issues in concert with the conservation of endangered species. Section 7 of the ESA requires that consultation occur when there is an expenditure of Federal funds on action where a federally listed species occurs. Cooperation has generally been good.

Although removal of Apache trout from the Endangered Species List remains a goal to be attained, progress has been made toward the completion of all five objectives.

Dr. John Rinne of the U.S. Forest Service was one of the pioneers in cataloguing the various populations of Apache trout and identifying their genetic purity. More recently, biochemical genetic analyses by Genean Laboratories and others indicate there are nine remaining endemic populations that can be identified electrophoretically. These analyses continue and the genetic composition of the species will undoubtedly be further refined as new techniques are developed. Present information gives much insight into how the remaining populations should be managed to preserve the genetic materials that remain.

Efforts to replicate and separate stocks from pure populations from stocks of unknown origin continue with contruction of stream barriers and introduction of pure stocks into renovated receiving waters upstream of barriers.

A captive broodstock population has been developed. In 1983 and again in 1984, eggs and milt were taken from wild Apache trout caught from the east fork of the White River, Arizona, and taken to Williams Creek National Fish Hatchery for culture. This effort has been very successful. In 1991 some 350,000 Apache trout were produced. The stocking of all rainbow trout into waters of the Fort Apache Indian Reservation was discontinued in 1991; Apache trout were stocked in waters throughout the White Mountains on the Fort Apache Indian Reservation. Williams Creek National Fish Hatchery presently maintains 4-year classes of Apache trout broodstocK, approximately 18,000 fish. Not only does the hatchery produce fish for recovery and enhancement introductions, it provides a refugium population also. To maintain genetic material from all nine endemic Apache trout populations, sperm have been preserved cryogenically at Williams Creek National Fish hatchery from four populations; similar preservations are scheduled from the remaining five populations in 1993. In addition, 15,000 Apache trout fingerlings and 250,000 eyed-eggs are being provided annually to the Arizona Game and Fish Department for recovery and enhancement stockings.

An Apache trout implementation plan has been completed for waters within the White Mountains. Although this plan has not been officially approved by the various land management agencies, it provides guidance and sets forth specific actions believed necessary to recovery Apache trout.

Collectively, these actions have contributed toward recovering Apache trout; however, much remains to be accomplished. Brown trout are a major predator and formidable obstacle to maintaining Apache trout populations. Brown trout and other non-native fish predators/competitors must be controlled. Renovation will be necessary in some streams.

Some additional genetic analyses must be conducted on populations where genetic purity is in question. Management objectives are needed for these populations to determine how they will contribute to the conservation of Apache trout.

We in the U.S. Fish and Wildlife Service believe Apache trout can be recovered and delisted. A proposal was submitted to the Regional Director on February 28, 1992 specifying actions deemed necessary and funds and personnel required to delist the species. With the continued cooperation of all concerned, we look forward to the day when Apache trout will again be secure in streams throughout the White Mountains.

HANSEN, J. (U.S. fish and Wildlife Service, Arizona Fishery Resources Office, Pinetop, AZ)

Implementation of recovery and management on tribal lands in the White Mountains.

KEYWORDS: Apache trout; recovery; management; White Mountains

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

MEYER, K. (White Mountain Apache Tribe, Arizona)

Sport fishery for Apache trout on White Mountain Indian tribal lands.

KEYWORDS: Apache trout; sport fishery; White Mountain Apache; tribal lands

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

NOVY, J. (Arizona Game and Fish Department, Pinetop, AZ)

State of Arizona native trout management program.

KEYWORDS: Apache trout; management; Arizona

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

BELL, G. (U.S. Forest Service, Apache-Sitgreaves National Forest)

Forest Service Perspectives on native trout management.

KEYWORDS: Apache trout; Forest Service; management

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

BEHNKE, R.; COHEN, D.; DOWLING, T. E.; HIRSCH, B.; PISTER, E. P. ((RB) Department of Fisheries and Wildlife, Colorado State University, (DC) President, Arizona Flycasters; Board of Directors, Trout Unlimited, Zane Grey Chapter, (TD) Department of Zoology, Arizona State University, (BH) Outdoor Writer, (EPP) California Fish and Game (retired), Desert Fishes Council)

Panel Participants: Management toward recovery of Apache trout *Oncorhynchus apache*.

KEYWORDS: Apache trout; management; recovery

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

ALTENBACH, C. S. (UNM Ichthyofaunal Studies Program, Department of Biology, University of New Mexico, Albuquerque, NM)

Aspects of the reproductive biology of seven species of Pecos River cyprinids, with implications for conservation / Aspectos sobre la biología reproductiva de siete especies de ciprínidos del Río Pecos, con implicaciones para su conservación

KEYWORDS: reproductive biology; Pecos River; New Mexico; *Notropis simus pecosensis*

ABSTRACT

The New Mexico portion of the Pecos River supports one of the most species-rich fish assemblages in the American Southwest. Among the species reported from the river is a guild of seven short-lived, mainstream cyprinids: *Cyprinella lutrensis*, *Hybognathus placitas*, *Macrhybopsis aestivalis*, *Notropis girardi*, *Notropis jemezanus*, *Notropis simus pecosensis*, and *Notropis stramineus*. In 1991, the University of New Mexico's Ichthyofaunal Studies Program (Department of Biology/Museum of Southwestern Biology) undertook a project to study the reproductive biology of this guild of Pecos River cyprinids. This research was part of a comprehensive multi-year conservation program designed to recover *N. simus pecosensis* and maintain the ichthyofaunal species-richness of the Pecos River.

The seven species were induced to spawn in a laboratory environment where information were obtained on mating behavior, spawning mechanisms, egg dispersal strategies (broadcast vs. demersal-adhesive), hatching time, developmental biology, and larval fish growth and habits. Data from this project are being incorporated into other studies (life-history, growth, habitat association, and drift studies) to more fully understand the biology of these taxa.

RESUMEN

La porción de Nuevo México del Río Pecos soporta uno de los asambleas mas ricos en especies en el Suroeste de los Estados Unidos. Entre las especies reportadas de este río esta un grupo de siete ciprínidos de cauce principal de vida-corta: *Cyprinella lutrensis*, *Hybognathus placitas*, *Macrhybopsis aestivalis*, *Notropis girardi*, *Notropis jemezanus*, *Notropis simus pecosensis* y *Notropis stramineus*. En 1991, El Programa de Estudios Ictiofaunísticos de la Universidad

de la Universidad de Nuevo México (Departamento de Biología/Museo de Biología del Suroeste) inició un proyecto para estudiar la biología reproductiva de este grupo de ciprínidos del Río Pecos. Esta investigación fue una parte de un programa de conservación multianual diseñado para recuperar a *N. simus pecosensis* y mantener la riqueza de especies ictiofaunísticas del Río Pecos.

Las siete especies fueron inducidas a desovar en ambiente de laboratorio de la cual se obtuvo información sobre la conducta de reproducción, mecanismo de desove, estrategias de dispersión de huevos (alcance amplio vs. adhesivo-demersal), tiempo de eclosión, biología del desarrollo, y crecimiento y hábitos de las larvas. Datos de este proyecto están siendo incorporados dentro de otros estudios (ciclo de vida, crecimiento, asociación de hábitat, y estudios de deriva) para una mayor conocimiento de la biología de estos taxa.

[HUBBS STUDENT PAPER COMPETITOR]

BARRETT, P. J.*; THRELOFF, D. L. (PJB - U.S. Fish and Wildlife Service, Reno Field Station, Reno, NV; DLT - U.S. Fish and Wildlife Service, Ash Meadows National Wildlife Refuge, Pahrump, NV)

Recent water level fluctuations in Devil's Hole, Death Valley National Monument / Fluctuaciones recientes en el nivel del agua en Devil's Hole, Monumento Nacional de Death Valley

KEYWORDS: Devil's Hole; Devil's Hole pupfish; *Cyprinodon diabolis*

ABSTRACT

Devil's Hole is a water filled chasm in southwestern Nevada managed by the National Park Service and surrounded by the Ash Meadows National Wildlife Refuge. It contains the only natural population of Devil's Hole pupfish (*Cyprinodon diabolis*). A landmark U.S. Supreme Court decision, Cappaert v. United States (426 U.S. 128 [1976]) discussed the impacts of declining water levels induced by local ground water pumping on Federal reserved rights that are necessary to protect the Devil's Hole pupfish. The court decision included a mandate that the "...pool level may be permitted to drop to the extent that the drop does not impair the scientific value of the pool as the natural habitat of the species sought to be preserved." The necessary water level was established as 2.7 feet below a specified copper washer datum.

Recent examinations of the data indicate that the water level in Devil's Hole has been steadily declining since approximately August, 1989. Exacerbating the problem was a series of seismic events in southern California and Nevada on June 28 and 29, 1992. The earthquakes lowered the water level several inches, and it eventually equilibrated near the court-mandated level. Several agencies, led by the National Park Service, have begun investigating the possible causes of the water level decline. The implications of a continued lowering of the water level are discussed.

RESUMEN

El Hoyo del Diablo es una grieta profunda llena de agua en el suroeste de Nevada bajo la administración del Servicio de Parques Nacionales y está rodeado por el Refugio Nacional de Vida Silvestre en Ash Meadows. Posee la única población del cachorrito del Hoyo del Diablo (*Cyprinodon diabolis*). Una decisión del Tribunal Supremo de los Estados Unidos, Cappaert *vs* Estados Unidos (426 U.S. 128[1976]) trató los impactos de la caída en el nivel de agua causada por el bombeo local de agua sobre agua de derechos federales, la cual es necesaria para proteger al cachorrito del Hoyo del Diablo. La decisión del tribunal incluyó un mandato que "permitiera que el nivel del pozo baje al punto en que la caída no disminuya el valor científico del pozo como hábitat de la especie que se solicita ser preservada". El nivel del agua fue establecido a 2.7 pies debajo de la arandela de cobre, el punto de referencia.

La investigación reciente de los datos indica que el nivel del agua en el Hoyo del Diablo ha estado declinando regularmente desde Agosto de 1989. Una serie de sucesos sísmicos agravaron el problema bajando el nivel del agua varias pulgadas y finalmente se equilibró cerca del nivel bajo mandato judicial. Varia agencias encabezadas por el Servicio de Parques Nacionales han comenzado a investigar las posibles causas de la declinación en el nivel del agua. Se comentan las implicaciones de una prolongada caída del nivel del agua.

CLARKSON, R. W.* (Research Branch, Arizona Game and Fish Department, Phoenix, AZ)

Foods of young-of-year native fishes in the Little Colorado River, Arizona, and infestation patterns by Asian fish tapeworm, *Bothriocephalus acheilognathi* / Alimentos de peces nativos jóvenes en el Río Colorado, Arizona, y patrones de infestación por el pez vermiforme asiático, *Bothriocephalus acheilognathi*

KEYWORDS: *Gila cypha*; *Rhinichthys osculus*; *Pantosteus discobolus*; *Bothriocephalus acheilognathi*; food habits; parasites; Little Colorado River

ABSTRACT

Foods and tapeworm infestation rates were examined from stomachs of larvae, early post-larvae, and juvenile speckled dace (*Rhinichthys osculus*), bluehead sucker (*Pantosteus discobolus*), and humpback chub (*Gila cypha*) from the Little Colorado River in 1990-1991. Chironomidae was an important food item for all three species, with the two cyprinids reducing their utilization of this component with age, and bluehead sucker increasing its use with age. Ostracods were used most often by larval and early post-larval dace, and by juvenile chub. Vascular plant material was noteworthy in stomachs of younger dace and chub, while bluehead sucker frequently contained inorganic materials. Asian fish tapeworm suddenly appeared in chub stomachs in 1990. Three larvae, 11 early post-larvae, and 47 adult and sub-adult chub examined from 1989 did not contain tapeworms, while chub larvae collected from May-June 1990 (n=24) exhibited a 91.7% infestation rate, older 1990 young-of-year specimens (n=15) exhibited a 100% infestation rate, and 44% of 18 adults examined from 1990 were infested. In contrast, tapeworms did not appear in 1991 young-of-year chub stomachs until they exceeded 50 mm in length beginning in September. A low incidence in speckled dace was noted in 1991. Effects of the tapeworm on its hosts are not well studied, but may include reduced growth, depressed swimming ability via elevated muscle fatigue, other debilitating effects, and elevated mortality.

RESUMEN

Las tasas de alimentación e infestación por gusanos fueron examinadas a partir de estómagos de larvas, postlarvas tempranas y juveniles del charal moteado (*Rhinichthys osculus*), matalote cabeza azul (*Pantosteus discobolus*), y el charal jorobado (*Gila cypha*) del Río Colorado Pequeño en 1990-1991. Chironomidae fue un grupo trófico importante para las tres especies, con una utilización reducida de este componente por parte de los dos ciprínidos conforme a la edad, y el matalote cabeza azul incrementando su uso conforme a la edad. Los ostrácodos fueron más frecuentemente utilizados por larvas y postlarvas del charalito, y por charales juveniles. El material de plantas vasculares se presentó notablemente en estómagos de los charal y charales más jóvenes, mientras que los de matalotes cabeza azul frecuentemente contenían materiales inorgánicos. De repente, en 1990 apareció el gusano asiático en estómagos de charales. Tres larvas, once postlarvas tempranas y cuarenta y siete adultos y subadultos de charales fueron examinados desde 1989 y no contenían vermes , mientras que larvas de charal durante mayo y junio de 1990 (n = 24) presentaron una tasa de infestación del 91.7 %, los especímenes de juveniles del año más viejos de 1990 (n = 15) exhibieron una tasa de infestación del 100 %, y 44% de 18 adultos examinados de 1990 estuvieron infestados. En contraste, los vermes no aparecieron en estómagos de juveniles del año de charales hasta que excedían los 50 mm en longitud empezando en septiembre. Una incidencia baja en el charalito moteado se notó en 1991. Los efectos de los vermes en sus hospederos no está bien estudiado, pero posiblemente incluye la reducción en crecimiento, disminuye la habilidad de nado mediante una elevada fatiga del músculo, otros efectos debilitativos, y una elevada mortalidad.

HUBBS, CLARK (Department of Zoology, University of Texas at Austin, Austin, TX 78712)

Does birth weight correlate with predation rate? Yes and no / ¿Está correlacionada el peso al nacer con la tasa de depredación? Si y no

KEYWORDS: Poeciliidae; predation; birth weight; cannibalism; Texas; trophic dynamics

ABSTRACT

Gambusia birth weights vary between species and correlate negatively with prey susceptibility and positively with parental predation rates. *Gambusia affinis* birth weights vary extensively between populations and do not correlate with parental predation rates. Those birth weights tend to be negatively associated with prey susceptibility. Similar to *Gambusia affinis* population variations in predation rates, the birth weight data do not correlate with known geographic or environmental patterns. These two data sets (and others now being reported) suggest caution when applying a limited number of populations to the trophic dynamics of a species.

RESUMEN

El peso al nacer de *Gambusia* varia entre especies y se correlaciona negativamente con susceptibilidad de la presa y positivamente con las tasas de depredación de los padres. El peso al nacer de *Gambusia affinis* varia extensivamente entre poblaciones y no se correlaciona con las tasas de depredación de los padres. Estos pesos al nacer tienden a ser asociados negativamente con la susceptibilidad de la presa. Similar a las variaciones de la población de *Gambusia affinis* en las tasas de depredación, los datos de peso al nacer no se correlacionan con el conocimiento geográfico o los patrones

ambientales. Estos dos grupos de datos (y otros que ahora están siendo reportados) sugieren precaución cuando se aplica un número limitado de poblaciones a la trofodinámica de algunas especies.

JAMES, S. R.* (Department of Anthropology, Arizona State University, Tempe, AZ)

Cyprinids and Catostomids from the Prehistoric Hohokam Site of Pueblo Grande in Phoenix, Arizona / Ciprínidos y catostómidos del sitio prehistórico Hohokam de Pueblo Grande en Phoenix, Arizona

KEYWORDS: archaeofauna; prehistoric; Hohokam; Arizona; Cyprinidae; Catostomidae; *Gila robusta*; *Ptychocheilus lucius*; *Xyrauchen texanus*

ABSTRACT

Analysis of archaeofaunal remains from the major Classic period (A.D. 1100-1450) Hohokam site of Pueblo Grande near the Salt River in Phoenix, Arizona, indicates that freshwater fish comprised nearly 30% of 10,000 identified animal bones. Most native minnows and suckers (cyprinids and catostomids) which once inhabited the Salt River were present, including bonytail chub (*Gila elegans*), roundtail chub (*Gila robusta*), Colorado squawfish (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), Gila coarse-scaled sucker (*Catostomus insignis*), flannelmouth sucker (*Catostomus latipinnis*), and Gila mountain sucker (*Catostomus clarki*). These results are the first reported identifications of these taxa from a prehistoric site near the Salt River in the Phoenix Basin although W. L. Minckley and S. J. Olsen identified them from an earlier site (A.D. 1 to A.D. 1100), that of Snaketown on the Gila River.

While a few large fish elements were present in the Pueblo Grande assemblage, measurements indicate that nearly all the fish were small, probably under 250 mm (10 in) in length. In comparison to a few Pre-Classic Hohokam sites, these data tentatively suggest that a decrease in fish size may have occurred through time, so that by the Classic period at Pueblo Grande only relatively small fish were available, perhaps as a result of over-exploitation in the vicinity. Fishing methods employed by the Hohokam which are still a matter of speculation are discussed.

RESUMEN

Análisis de los restos arqueofaunísticos del sitio Hohokam período Clásico mayor (A.D. 1100-1450) cerca del Río Salt en Phoenix, Arizona, indican que los peces dulceacuícolas comprendieron cerca del 30 % 10,000 huesos identificados de animales. Muchos de los de los charalitos y matalotes nativos (ciprínidos y catostómidos) que una vez habitaron el Río Salt estuvieron presentes, incluyendo al charalito cola dura (*Gila elegans*) charal cola redonda (*Gila robusta*) charal del Colorado (*Ptychocheilus lucius*), matalote jorobado (*Xyrauchen texanus*), matalote Sonorense (*Catostomus insignis*), matalote (*Catostomus latipinnis*) y el matalote del desierto (*Catostomus clarki*). Estos resultados son el primer reporte de identificaciones de estos taxa para un sitio prehistórico cerca del Río Salt en la Cuenca del Phoenix aunque W.L. Minckley y S.J. Olsen los identificaron para un sitio temprano (A.D. 1 A.D 1100), el de Snaketown en el Río Gila.

Aunque pocos elementos de peces grandes estuvieron presentes en el asamblea de Pueblo Grande, las mediciones indican que casi todos los peces fueron pequeños, probablemente menores de 250 mm (1 pulgada) de longitud. En comparación con unos pocos sitios Pre-Clásicos Hohokam, estos datos tentativamente sugieren que una reducción del tamaño de los peces ha ocurrido a través del tiempo. Por esto sólo para el período Clásico en Pueblo Grande sólo peces pequeños estuvieron disponibles, quizás como resultado de una sobrexplotación en la vecindad. Se discuten los métodos de pesca empleados por los Hohokam que son tema de especulación.

JOHNSON, J. E.* (U.S. Fish and Wildlife Service)

Proposal to initiate native fish monitoring committee within Desert Fishes Council / Propuesta para iniciar un comité de monitoreo de peces nativos dentro del Consejo de Peces del Desierto

KEYWORDS: monitoring; native fishes; Southwest; population trends

ABSTRACT

I propose creation of the first Desert Fishes Council (DFC) standing committee, a committee to annually monitor selected southwestern fishes and publish the findings in a new Species Account section of the annual Proceedings. In the past, DFC Basin Coordinators have reported on a few or all of the species found in a river system, but the monitoring and data collecting process were informal. Often, the information came by word of mouth from a contractor or as a part of state or federal monitoring effort, and information was presented orally to the annual meetings and not summarized in writing. Frequently, species were not monitored at all for several years.

It can be strongly argued that monitoring of threatened, endangered, or species of special concern is not the job of a private organization like DFC, but instead should be the responsibility of state or federal agencies. Some state and federal agencies are indeed monitoring these rare fishes, usually on their own lands or portions thereof. However, the distribution of many species are not bound by state or regional lines (e.g. Colorado River, Virgin River fishes) and

monitoring is piecemeal or non-existent. Even if a state or federal agency is periodically monitoring a species (e.g. *Cyprinodon diabolis*), the results are not usually published annually.

It must be recognized that this suggestion poses a major task, that based upon Williams, et al. (1989), could include up to 170 taxa of fish in the United States and Mexico. If a single DFC member was designated as coordinator for each species, it would include nearly every dues-paying member of DFC, a monumental undertaking for a relatively small conservation organization. By combining species by basins and localities, the job could be made slightly simpler, but would still be complex. The benefits of a continuous data base of periodic monitoring for trend analysis is obvious. Perhaps special concern species would not need to be monitored annually, but could be placed on an every other year schedule. Funding to cover travel and publication costs for the project may be available from state, federal or private agencies and organizations.

RESUMEN

Propongo la creación de el primer comité permanente del Consejo de los Peces del Desierto (DFC), un comité para monitorear anualmente peces selectos en el Suroeste y publicar los hallazgos en una sección nueva de Conteos de especies en las memorias anuales. En el pasado, los coordinadores de Cuencas del DFC han reportado sobre unas pocas o todas las especies encontradas en una cuenca, pero el proceso de colecta de datos y monitoreo fueron informales. En ocasiones, la información viene de boca de un consultor o como parte de un esfuerzo de monitoreo estatal o federal, siendo presentada oralmente a la reunión anual y no resumida por escrito. Frecuentemente, las especies no fueron monitoreadas del todo por varios años.

Puede ser fuertemente argumentado que el monitoreo de especies amenazadas, en peligro o de atención especial no es trabajo de una organización privada como DFC, pero debería serlo de agencias estatales o federales. Algunas agencias estatales o federales de hecho están monitoreando estos peces raros, usualmente en sus propios terrenos o porciones. Sin embargo la distribución de muchas especies no esta unida por líneas estatales o regionales (ej. El Río Colorado, Peces del Río Virgin) y el monitoreo es solo puntual o no existente. Aún si una agencia estatal o federal está monitoreando periódicamente una especie (e.g. *Cyprinodon diabolis*), el resultado usualmente no es publicado anualmente.

Debe de ser recordado que esta sugerencia posee un trabajo mayor, que basado en Williams, *et al.* (1989), podría incluir a mas de 170 taxas de peces en los Estados Unidos y México. Si un solo miembro del DFC fuera designado como coordinador para cada especie, podría incluir casi a todos los miembros activos del DFC, una acción monumental para una organización de conservación relativamente pequeña.

Combinando especies con cuencas y localidades, el trabajo podría ser realizado fácilmente, pero podría todavía ser complejo, los beneficios de una base de datos continua de monitoreo periódico para análisis de tendencias es obvio. Quizás especies de atención especial no requerirán ser monitoreadas anualmente, pero podrían ser colocados en un calendario anual. El apoyo financiero para cubrir los viajes y los costos de publicación para el proyecto podrían obtenerse de agencias y organizaciones estatales, federales o privadas.

DUNHAM, J. B.* (JBD - Department of Zoology, Arizona State University, Tempe, AZ)

Evolutionary genetics of natural and refugia populations of desert pupfish *Cyprinodon macularius* / Genética evolutiva de poblaciones naturales y de refugio del pez cachorrito del desierto *Cyprinodon macularius*

KEYWORDS: *Cyprinodon*; Colorado River delta; Salton Sea; genetics; artificial refugia; habitat fragmentation

ABSTRACT

Patterns of allozymic variation are described from four natural and nine artificial refugia populations of the Endangered desert pupfish secured from the Colorado River delta, Sonora, Mexico and Salton Sea, California, U.S.A. Genetic variation among delta refugia is largely a result of differences in refugia derived from separate, but geographically proximate collections on the Colorado River delta. Patterns of genetic variation in two of three pupfish refugia established from the Salton Sea are not representative of their source populations. Observed divergence among refugia is most likely a consequence of genetic drift and founder effects. An analysis of associations between four population variables (time since founding, relative habitat size, number of founders and hierarchical position) and observed heterozygosity in the six lower Colorado delta refugia detected only one significant association. The one significant association suggests that variation in some refugia has been lost as a result of serial bottlenecks. The results of this study do not agree with previous studies that detected only minimal levels of allozymic variation among refugia and natural populations of desert pupfish. Differences in electrophoretic technique are undoubtedly responsible for at least part of this discrepancy.

Patterns of genetic variation in natural populations are explained in light of historical processes. It appears likely that habitat fragmentation resulting from river modifications has led to genetic divergence among formerly contiguous natural populations on the lower Colorado delta. In contrast, four natural populations from the recently flooded Salton

Sink are genetically very similar. Results of this study and previous work on related taxa are discussed in relation to the evolutionary importance of human alteration of natural habitats and conservation management.

RESUMEN

Se describen los patrones de variación alozímica de cuatro poblaciones naturales y de nueve poblaciones de refugios artificiales del cachorrito del desierto en peligro de extinción obtenidas del delta del Río Colorado, Sonora, México y Salton Sea, California, U.S.A.. La variación genética entre los refugios del delta es principalmente un resultado de las diferencias en los refugios derivadas de su separación, aunque las colectas del Río Colorado son geográficamente próximas. Los patrones de variación genética en dos de tres peces de los refugios establecidos a partir de el Salton Sea, no son representativos de sus poblaciones originales. La divergencia observada entre los refugios es mas bien una consecuencia de deriva genética y efectos de fundido. Un análisis de las asociaciones entre cuatro variables poblacionales (tiempo desde su establecimiento, tamaño relativo de hábitat, número de colonizadores y posición jerárgica) y la heterocigozidad observada en los seis refugios del bajo Río Colorado, detectaron solamente una asociación significativa. Esta asociación sugiere que estas variaciones en algunos de los refugios han sido perdidas como un resultado de una serie de cuellos de botella. Los resultados de este estudio no concuerdan con estudios previos que detectaron únicamente niveles mínimos de variación alozímicas entre las poblaciones de los refugios y las poblaciones naturales del cachorrito del desierto. Las diferencias en las técnicas electroforéticas son indudablemente responsables de parte de esta discrepancia.

Los patrones de variación genética en poblaciones naturales son explicadas a la luz de procesos históricos. Parece ser que la fragmentación de hábitat resultado de las modificaciones del río ha conducido a una divergencia genética entre poblaciones naturales antes contiguas en el delta del Bajo Río Colorado. En contraste, las cuatro poblaciones naturales de el recientemente inundado Salton Sea, son genéticamente muy similares. Se discuten los resultados de este estudio y trabajos previos sobre taxa relacionados, en relación a la importancia evolutiva de la alteración humana de hábitats naturales y manejo para la conservación.

[HUBBS STUDENT PAPER COMPETITOR]

RINNE, J. N.*; MEDINA, A. L. (JNR and ALM - U.S.D.A. Forest Service, Tempe, Arizona.)

Fire, Fish, Floods: The Dude fire, Arizona, 1990 / Incendio, peces, avenidas: El incendio de Dude, Arizona, 1990

KEYWORDS: wildfire; riparian; aquatic macroinvertebrates; trout; southwestern USA; fisheries management

ABSTRACT

In summer, 1990 a lightning strike ignited a wildfire below the Mogollon Rim, central Arizona. In a few days the Dude fire would become known as the worst in Arizona history. Over 25,000 acres were burnt, over 50 homes destroyed, over 3 m dollars expended and 6 lives were lost.

Although a tragedy, this natural disturbance event provided an excellent opportunity to examine its effects on riparian-stream habitats and biota. Pre-fire data were available on water quality, fishes, and aquatic macroinvertebrates.

Immediate post-fire and pre-monsoon sampling of fishes and macroinvertebrates indicated no marked change in their populations. Marked changes in water quantity and quality accompanying eventual flooding dramatically affected fish populations and macroinvertebrates. A restocking program was initiated in spring 1991. Status of these efforts vary by stream.

Results of study to date will be discussed relative to 1) historic changes in forest vegetation, 2) prescribed fires and 3) fisheries management of streams affected by wildfire.

RESUMEN

En verano, 1990 un rayo inició un incendio al sur del Eje de Mogollon en Arizona Central. En unos pocos días el incendio se convirtió en el peor de toda la historia de Arizona. Mas de 25,000 acres fueron arrasados, mas de 50 casas destruidas, mas de 3 millones de dólares gastados y 6 vidas perdidas. Aunque una tragedia, este evento de perturbación natural proveyó de una excelente oportunidad para examinar sus efectos dentro de los hábitats riberinos y su biota. Datos anteriores al incendio fueron accesibles sobre la calidad del agua, peces, y macroinvertebrados acuáticos.

Muestreos inmediatos de peces y macroinvertebrados post-incendio y pre-monsones no indicaron un cambio marcado en sus poblaciones. Cambios marcados en la cantidad y calidad del agua acompañado de avenidas eventuales afectaron drásticamente las poblaciones de peces e invertebrados. Un programa de repoblación fue iniciado en primavera de 1991. La situación de esos esfuerzos varían por cauce.

Los resultados del estudio a la fecha serán discutidos referente a 1) cambios históricos en la vegetación, 2) incendios prescritos y 3) manejo de pesquerías de cauces afectados por incendios naturales.

MEYER, L. L.* (LLM - Utah State University, Logan, UT)

Reintroduction of bonytail chubs *Gila elegans* into the Green River, UT / Reintroducción de charalitos elegantes *Gila elegans* en el Río Verde, Utah

KEYWORDS: reintroduction; bonytail chub; *Gila elegans*; Dexter National Fish Hatchery; Green River; Utah; New Mexico

ABSTRACT

An experimental stocking study using adult hatchery-reared bonytail chubs *Gila elegans* was conducted in 1988 and 1989. The goal of the study was to evaluate the feasibility of a major reintroduction program. Radio-telemetry was used to monitor habitat use, dispersal and survival of bonytail chubs released into the Green River, UT. One hundred fifty-two fish were transported from the Dexter National Fish Hatchery, Dexter, NM to the Green River near Vernal, UT.

As a reintroduction effort, the study was unsuccessful because nearly all fish died within two weeks after release. We used various methods to try to increase survivability of fish in order to meet the original study objectives. The fate of those fish is described and recommendations for future reintroduction efforts using endangered fishes is discussed.

RESUMEN

Un estudio experimental de repoblamiento utilizando charalitos elegantes *Gila elegans* adultos de una granja reproductora-criadora fue conducido en 1988 y 1989. El objetivo del estudio fue evaluar la factibilidad de un importante programa de reintroducción. Se utilizó radiotelemetría para monitorear uso de hábitat, dispersión y sobrevivencia de los charalitos elegantes liberados en el Río Verde, Utah. Fueron transportados 152 peces desde la Granja Reproductora Nacional de Peces de Dexter, en Dexter Nuevo México, al Río Verde cerca de Vernal, Utah.

Como resultado del esfuerzo de reintroducción, el estudio fue insuficiente porque casi todos los peces murieron en las dos semanas siguientes a su liberación. Utilizamos varios métodos para tratar de incrementar la sobrevivencia de los peces de acuerdo a los objetivos originales del estudio. Se describe el destino de estos peces y se discuten las recomendaciones para esfuerzos futuros de reintroducción utilizando peces en peligro.

[HUBBS STUDENT PAPER COMPETITOR]

TENIENTE-NIVON, E. (Laboratorio de Ecologia, Depto. de Zoologia, Escuela Nacional de Ciencias Biologicas, I.P.N., Mexico, D.F.)

Changes in the estuary of Ria Lagartos Yucatán, as a consecuence of hurricane Gilbert / Cambios en el estero de Ria Lagartos Yucatán, como consecuencia del huracán Gilberto

KEYWORDS: Estero; Estuary; Hurricane; Huracán; Inventario; Inventory; Reserva; Reserve

ABSTRACT

During the years 1989-1990 four survey trips were made in the Ria Lagartos to observe the effects of the pass of hurricane Gilbert. Fishes were collected during each trip and essential physicochemical parameters (oxygen, temperature, salinity, transparency) measured. Data from this survey are compared with those published by Zamacona in 1982.

RESUMEN

Durante 1989-1990 se realizaron cuatro campañas de trabajo en el estero de Ría Lagartos, con el objeto de observar los efectos causados por el paso del Huracan Gilberto, por lo que en cada una de ellas se efectuaron colectas de peces, además de medir los parametros físicoquímicos esenciales (oxígeno, temperatura, salinidad, transparencia), estos ultimos se comparan con los datos publicados por Zamacona (1982).

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* **WILLIAMS, C. M.*** (CMW - Dexter National Fish Hatchery & Technology Center, Dexter NM)

Woundfin, Ich, and Temperature / Charalito, Ich, y temperatura

KEYWORDS: woundfin; *Plagopterus argentissimus*; Cyprinidae; *Ichthyophthirius multifilis*; Dexter NFH; Utah; Arizona; Nevada

ABSTRACT

The woundfin, *Plagopterus argentissimus*, is an endangered cyprinid from the Virgin River system in Utah, Arizona, and Nevada. It was first brought into captivity at Dexter National Fish Hatchery in 1979 to maintain a population for reintroduction purposes. Problems in culture have occurred, ranging from loss in ponds due to excess aquatic vegetation, *Lernaea* infestation, and most notably *Ichthyophthirius multifilis*, or "Ich." Earlier this year the FDA banned the use of some chemotherapeutants traditionally used for Ich. The captive woundfin population is especially prone to acute Ich outbreaks in the spring, so alternative methods of control were investigated. All methods are basically water treatments and act on the free-swimming stage of the parasite. Non-chemical treatments include water ozonation, radiation with UV light, sub-micron filtration, increasing flow, and temperature extremes. This paper will describe the methods and results from an experiment using temperature control, and discuss the disease and reproductive status of woundfin currently at the station.

RESUMEN

El charalito, *Plagopterus argentissimus*, es una especie de ciprínido en peligro de desaparición en el sistema Virgin River, Utah. Esta especie fue mantenida por primera vez en cautiverio en el año de 1979 en la piscifactoría Dexter National Fish Hatchery, para sostener una población viable para propósitos de reintroducción. Diversos problemas concernientes con su cultivo han ocurrido, los cuales van desde la pérdida en los estanques debido a exceso de macrófitas acuáticas, infestación por el copépodo ancla *Lernaea* y más notablemente por el patógeno *Ichthyophthirius multifilis* o "Ich". A principios de 1992 la FDA (Federal Drug Administration) prohibió el uso de algunos quimioterapeúticos tradicionalmente utilizados para el tratamiento de Ich. La población en cautiverio de charalito es especialmente sensible a la fuerte proliferación de Ich en la primavera; por tal motivo, métodos alternativos de control fueron aquí investigados. Todos los métodos son básicamente tratamientos de agua, los cuales actúan en las etapas de nado libre de parásitos. El tratamiento no químico incluye la ozonización del agua, la radiación con luz ultravioleta, filtración sub-micron, incremento del flujo, y temperaturas extremas. Este trabajo, describe los métodos y resultados de un experimento utilizando control de temperatura, y discute el estatus reproductivo y patológico actual de los peces charalito cultivados en la piscifactoría.

CONTRIBUTED PAPER

Woundfin background

The endangered woundfin *Plagopterus argentissimus* is a small cyprinid, first described by Cope in 1874. Its dorsal fin rays are modified into a spine, which is presumably the source of the common name. It is the most highly modified of 3 species in the tribe Plagopterini, and the only species in its genus (Miller and Hubbs, 1960). In the 1800's it was found sporadically throughout the lower Colorado River basin, but is currently limited to a short reach of the Virgin River system, in Utah, Arizona, and Nevada (see Deacon, 1988 for distribution map). At times this unique species has comprised over 90% of the fish fauna in the Virgin River system (Minckley, 1973), and at other times is exceedingly rare. Upstream from Mesquite the populations have not changed much since the 1930's, but below Mesquite populations have decreased significantly (Cross, 1978). In a 1988 paper, Deacon found that since 1983 the population was approximately unchanged only in the 10 km section between Washington Fields Diversion and Quail Creek, and had declined dramatically in more than 60% of its remaining range. The species' decline during this century has been attributed to decreased water flow, introduction of exotic species (especially the red shiner, *Cyprinella lutrensis*), and other forms of habitat destruction (Cross, 1978). The woundfin was placed on the Endangered Species list in 1970 (USFWS, 1984), and the recovery plan for this species includes captive propagation. For this purpose, it was first brought to Dexter National Fish Hatchery in southeastern New Mexico in 1979 (DNFH files).

Dexter and *Ich*

Since that initial collection, there have been many more wild fish taken from the Virgin River (see Table 1). The profusion of fish brought to Dexter during 1988 was collected prior to the fateful red shiner eradication project, and consisted mainly of juveniles. The total population size at the hatchery has fluctuated greatly. As well as natural attrition, individuals have been lost in pond vegetation, overwhelmed with *Lernaea* infestations, killed during episodes of intense nitrogen supersaturation, and the population has been repeatedly decimated by *Ichthyophthirius multifilis*, or *Ich*. The woundfin population is also infected with Asian tapeworms *Bothriocephalus acheilognathi* (R. Major, pers. comm.). This parasite was introduced into the country with grass carp *Ctenopharyngodon idella*, and most likely introduced into the Virgin River drainage with red shiner *Cyprinella lutrensis* (Heckman, et al., 1986). Another species of tapeworm may also be present in the captive population; its identification is pending. Although fish may not die as a direct result of tapeworm infection, the added stress can affect feeding, reproduction, and immune responses. At Dexter, however, *Ich* is the main factor limiting woundfin production (see Figure 1). During the past 5 years, *Ich* outbreaks have occurred at least nine times (1988-2 occurrences, 1989-3, 1990-2, 1991-2).

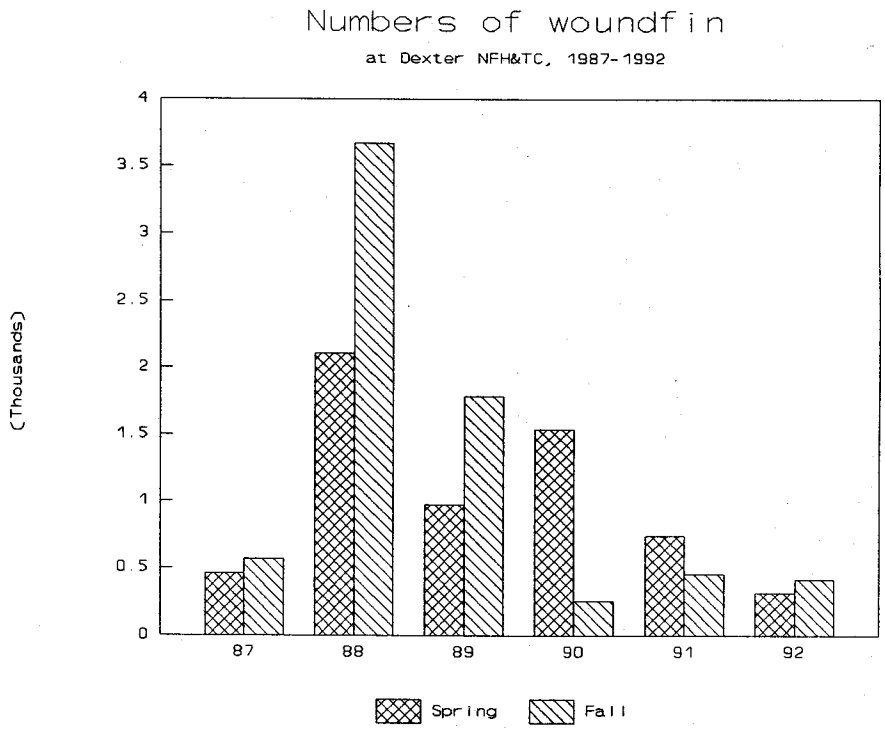

Figure 1

Year	Number	Location
1979	240	Virgin River, AZ
1981	395	Virgin River, AZ
1983	460	Beaver Dam Wash area, AZ
1987	235	Beaver Dam Wash area, AZ
1988	28	St. George area, AZ
1988	415	St. George area, UT
1988	1600+	St. George area, UT
1989	1060	St. George area, UT

Table 1 Numbers of wild woundfin *Plagopterus argentissimus* collected in the Virgin River, and brought to Dexter National Fish Hatchery and Technology Center.

Ich

Ichthyophthirius multifilis Fouquet is a protozoan with worldwide distribution. It is more commonly referred to as the tell-tale symptom which it causes in infected fish: "white spot." Host death occurs as a result of osmoregulatory imbalance, secondary infections, and finally malnutrition. Small-scaled or scaleless fish are more susceptible to *Ich* than those with large scales (Post, 1987). In fact, most *Ich* research is conducted on catfish. The woundfin, too is essentially scaleless, and therefore particularly at risk. It is the only species of 16 presently at Dexter which is chronically affected.

The protozoan life cycle lasts from 4 to 40 days, and is temperature dependent: at 18°C/64°F it is completed in 10-12 days. The embedded stage is called the trophozoite, which burrows into the epithelium of the host, ingesting tissue fluids and epidermal cells (Amlacher, 1970). In response the host produces extra epithelial tissue, which is the source of the white spots. Only recently has there been evidence of reproduction at this stage (Ewing et al, 1988). In general, a mature adult leaves the host. At this free-swimming stage, it is called a trophont, and is positively identified by the horseshoe-shaped nucleus (Meyer and Bullock, 1990). It then becomes submergent

and secretes a cyst wall within 2-6 hours. While encysted, the tomont divides mitotically forming hundreds or thousands of new motile, infective units, called tomites. The tomite stage of this obligate parasite must encounter a fish host within 48 hours or die (Post, 1987). All ich treatments are directed at this free-living life stage, as both the encysted and the embedded stages are much more resistant.

Woundfin at Dexter

The hatchery water is supplied by a number of shallow wells, with pH of 8.5, 3500 mg/l of total dissolved solids, and constant temperature of 18°C/64°F. Woundfin at Dexter NFH are typically maintained in 12 m raceways, and do not spawn until the water reaches above 21°C/70°F. To achieve that temperature during the spawning season (usually April-May), the raceway water is usually recirculated via pumps, and the inflow of cool well water is decreased. Prior to this year, when an *Ich* outbreak was noticed, the fish were treated with a Malachite Green/Formalin bath daily for 10-14 days (DNFH notes). Malachite has a very small margin of safety between host and parasite toxicity (Cross, 1972), and mortality does occur. Dosages were adjusted for woundfin, and each *Ich* outbreak was treated accordingly and eventually dissipated for a time. However, *Ich* seemed always to return. Either the fish continued to harbor the parasite through each successive treatment, or *Ich* reinfection occurs every year.

In the fall of 1991, the Federal Drug Administration (FDA) banned the use of Malachite Green at federal hatcheries, citing its oncogenic, teratogenic, and mutagenic properties. The FDA also banned the use of formalin for all but a few species, for only a few specific uses. Since our chemical arsenal against *Ich* was now emptied, we had to find alternative treatment methods.

Many non-chemical treatments have potential for treating *Ich*. These include filtration (with mesh size that must effectively screen out particles the size of *Ich* tomites, < 1 mm); radiation with ultraviolet light (at 100,000 microwatts/second/cm^2); ozonation; pasteurization; and treatment with temperature extremes. The critical thermal maxima of woundfin is very high, even for a desert adapted fish (Deacon et al., 1987). As the temperature was quickly raised, it did not lose equilibrium (which would lead to death in the wild) until the water reached 39.5°C/103°F. *Ich* dies at 32°C/89.5°F (Meyer, 1984), stops reproducing at 30°C/86°F (Dr. Nick St. Erne, DVM, pers. comm.), and does not infect new fish at 29.4°/85°F (Johnson, 1976). Based on these findings, it was decided to try heat as the non-chemical alternative with which to treat *Ich*.

Methods

Early this spring, in an effort to avoid *Ich* in the first place, none of the aforementioned techniques were used to warm the water. Instead of recirculating between raceways and decreasing the inflow, the inflow of cool water was left open. With flow-through well water, the temperature in the raceways does not get above 20°C/68°F even in the summer. *Ich* was not observed by May, but neither was any spawning behavior. Lockhart (1980) suggested that woundfin live ≈ 2.5 years in the wild. Since the majority of adults at Dexter are 3-4 years old, and this spring was possibly their last spawning season, it was decided then to increase the temperature, and the water inflow was cut down. This would allow spawning to occur, and enable us to try heat treatments as a prophylactic to the inevitable (Hamman, pers. comm.) spring *Ich* outbreak.

From the raceways, most fish were brought into the holding house and held in 70-gallon aquaria; the remainder were left outside as a primary control for this stage of handling. The holding aquaria were maintained at 23°C/73°F. The treatment tanks consisted of 10, 10-gallon aquaria, each with an airstone and a heater. Ten fish were placed in each tank and allowed to acclimate for 3 days. Temperature was then raised and lowered in each of the treatment tanks daily for 5 days (van Duijn, 1967; Amlacher, 1970). The temperature was gradually brought up from 23°C/73°F to at least 31°C/88°F during the course of a day, using 300-watt, thermostatically controlled Visitherm@* heaters, and monitored at two hour intervals. The water temperature was then lowered to the acclimation temperature during the course of 30-60 minutes by making a series of partial water changes. Cross (1972) suggested that changing water may in itself be a treatment (separating the host from the infective stage of the parasite). To test this possibility, two tanks in each trial were held at constant temperature and water changes were made daily. As an additional control, two tanks in each trial were not manipulated at all. Mortalities were recorded, and the maximum temperature tolerated by survivors was compared to that of those that died, using ANOVA. After the 5-day treatment, fish were transferred to 70-gallon aquaria. They were held there for observation before being released into a disinfected raceway. Eventually, all adults (except the primary raceway controls) and 10 juveniles were subjected to the treatments.

Observations and Results

Woundfin behavior changed when subjected to temperature increases. Dissolved oxygen also varied with temperature, from 83 to 75 % saturation at temperatures 23-31.5°C/73-89°F, respectively. When the water first

reached 31°C/87F°, fish would become very active, gilling faster, and taking forays to the surface where they would skim their bodies along the surface. Perhaps this splashing cooled the water. After about 20 minutes at this temperature the fish would calm down, but gilling rate would remain elevated.

First, I conducted a preliminary run by heating just one tank of 10 fish (see Table 2). Two fish died in control tanks during this first week in aquaria. The average daily maximum temperature was 33°C/92°F. A total of three fish died when the temperature reached its peak of 34°C/93°F, on the second and 4th days. Lockhart reported similar results in 1980, when death occurred at 33.8°C/93F° for fish acclimated at 21.5°C/71°F.

The second run included all ten tanks and 100 fish, with tank treatment randomly assigned. Of the heated tanks, the average daily maximum temperature was 32°C/90°F, and a total of 10 fish died. The highest overall temperature reached during this run was 35°C/95°F, after which 5 of the 10 deaths occurred.

The third run included 4 adult tanks and one juvenile (or 1 year old) tank. The average daily maximum temperature was 31°C/87.5°F, overall maximum for the run was 32/90°F, and no mortalities occurred during this treatment.

There appears to be a direct relationship between average maximum temperature and mortality. Of the 13 fish that died, the mean maximum temperature was 34°C/93°F, while that of survivors was 31.5°C/88.6°F, a significant difference ($t = -6.577$, $p < 0.01$, df 53).

Trial	Mean Max Temp	n	Mort	Max Temp
I	33.5°C	10	30%	34°C
II	32°C	60	16%	35°C
III	31°C	40	0%	32°C

Table 2 Results from experimental high temperature treatment for control of Ichthyophthiriasis, at Dexter National Fish Hatchery and Technology Center during spring of 1992 (see text for further explanation).

Discussion

No treated fish got *Ich* this year, however no control fish got *Ich* this year, either. Therefore, at best the results of this experiment on the effectiveness of treating *Ich*-infected woundfin with heat are inconclusive. Some explanations come to mind: It may be that the last malachite/formalin treatment finally did get rid of the parasite. However, after so many unsuccessful trials, this is unlikely. Another possibility is that the usual procedure of recirculating the raceway water gives the tomites a better chance of encountering a host. Continuous flushing (as was done this year) may decrease the chance of such an encounter. Also, water quality would be enhanced by continuous flushing, and therefore minimize that stress on the fish.

Although inconclusive about *Ich*, conducting this experiment did provide some additional insight into the biology of these little-known fish. The woundfin's ability to withstand high temperature is surely an advantage in the Virgin River system. Woundfin have been collected there at 36°C/97°F (Deacon, 1987). The maximum temperature tolerated by woundfin in this experiment was 35°C/95°F, while in Deacon's CTM experiment (1987) it was 39.5°C/103°F. The difference in maximum temperatures obtained in these experiments may be explained by the rate at which temperatures were raised. In this experiment, temperature was raised at an average rate of 0.03°C per minute, while in Deacon's experiment it was raised 1°C per minute. As woundfin can withstand higher temperatures when raised quickly, this would imply a phsiological mechanism in place to buffer against the effects of variable water temperatures.

Even with this thermal treatment and intensive handling this year, the fish still spawned. On the first days of treatment I observed spawning behavior in the aquaria, and after all fish had been cycled through the primary holding aquarium, I found fry. Since the last adults were removed from that aquarium on June 7, the fry were spawned sometime prior to that. On July 7, fry were dipnetted from the raceway of treated fish. This continued until Sept 23, for a total of 257 fry from treated fish. It is possible that some fry could have escaped our nets, making this recruitment number a conservative one. Only 1 fry was observed in the raceway of untreated fish during the same period. At Dexter National Fish Hatchery, fry are usually collected between May 18 and June 20 (DNFHTC files), a period of 4 1/2 weeks. This year's experimentally delayed spawning season was at least 15 weeks long, and therefore the longest recorded season of production at Dexter. Although Lockhart (1980) found peak gonad

maturation in May, he also suggested that under favorable conditions woundfin could spawn over a longer period of time. Perhaps favorable conditions include a delayed summer, as was simulated by these experiments.

I found that upon heating more tapeworms evacuated their hosts. Over the 3 week course of the experiment, I collected 13 independent adult tapeworms. Given that the tapeworm is exotic to the Virgin River system, and has probably been in Utah only since 1984 (Heckmann et al., 1986), it may not be well adapted to the temperature extremes common there and imitated in this experiment. Temperature extremes should be investigated as a non-chemical parasiticide for tapeworms.

I also observed woundfin mouthing, picking at, and ingesting such free-living tapeworms. In the Virgin River system, tapeworms are newcomers to the community, and woundfin feeding behavior probably does not include discrimination of tapeworms from other worms. This may not be the typical mode of tapeworm transmission to a host, but it may be the case for native fish in the Virgin River.

Currently on hand at DNFH&TC, we have on hand 77 adults, 82 juveniles, and 173 y-o-y. The '91 and '92 year classes are being maintained overwinter in 4, $\approx$75 gallon fiberglass aquaria, and the adults are overwintering in an outdoor raceway. Fifty one mixed-age fish were sent to Dr. Steven Vives of Georgia Southern University on Oct 7. There he will conduct experiments on spawning and reproductive behavior.

In order to maintain viable numbers of the captive population, and eventually produce enough fish to begin a restocking program for woundfin, it is necessary to maintain the highest standards of water quality, be ever vigilant for changes in fish behavior, and continue development of alternative treatment methods.

* Use of tradenames does not imply U. S. Government endorsement of commercial products.

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Allozyme variation in populations of the spikedace *Meda fulgida* and the loach minnow *Tiaroga cobitis* / Variación de aloenzimas en poblaciones del charalito picudo *Meda fulgida* y el charalito moteado *Tiaroga cobitis*

KEYWORDS: allozymic variation; population structure; *Meda fulgida*; *Tiaroga cobitis*

ABSTRACT

Due to the threatened status of both the loach minnow *Tiaroga cobitis* and spikedace *Meda fulgida*, information about the genetic characteristics of remaining populations is crucial for successful management of these species. Previous investigations described mitochondrial DNA (mtDNA) variation within and among populations of these fishes. In this study, the distribution of nuclear DNA variation in each species was determined by protein electrophoresis. An initial screening of approximately 30 presumptive loci yielded five that were polymorphic. Individuals collected from most of the remaining populations of loach minnow and spikedace in Arizona and New Mexico were assayed for the polymorphic loci, providing an assessment of the distribution of genetic variation within and among populations of each species. Comparisons between allozyme data and mtDNA data reveal similar patterns of geographic variation within each species. The data indicate a geographic component to population structure of each species. Genetically distinctive units should be managed as separate units to preserve existing genetic variation.

RESUMEN

Además de tener categoría de amenazados el charalito moteado *Tiaroga cobitis* y el charalito picudo *Meda fulgida*, la información acerca de las características genéticas de las poblaciones que permanecen es crucial para el manejo exitoso de estas especies. Investigaciones previas describen variación en el ADN mitocondrial dentro y entre las poblaciones de estos peces. en este estudio, la distribución de la distribución del ADN nuclear en cada especie fue determinada por electroforésis protéica. Un corrimiento inicial de aproximadamente 30 presuntos loci rindió cinco que fueron polimórficos. Los individuos colectados de la mayoría de las poblaciones que permanecen del charalito moteado y el charalito picudo en Arizona y Nuevo México fueron evaluados para el loci polimórfico, proporcionando una evaluación de la distribución de la variación genética dentro y entre las poblaciones de cada especie. Comparaciones entre los datos de aloenzimas y ADN mitocondrial revelan patrones de variación geográfica dentro de cada especie. Los datos indican un componente geográfico para cada estructura poblacional de cada especie. Unidades genéticamente distintivas se pueden manejar como unidades separadas para preservar la variación genética existente.

[HUBBS STUDENT PAPER COMPETITOR]

QUARTARONE, F. G. (Recovery Program for the Endangered Fish of the Upper Colorado River Basin)

Results of a historical research project about the endangered fish of the Upper Colorado River basin / Resultados del proyecto de investigación histórica acerca de los peces en peligro de la Cuenca Alta del Río Colorado

KEYWORDS: history; anecdotes; upper basin; Colorado; Utah; Wyoming; *Ptychocheilus lucius*; *Gila cypha*; *Gila elegans*; *Xyrauchen texanus*

ABSTRACT

Senior citizens familiar with rivers in the upper basin represent important sources of historical data about endangered Colorado squawfish *Ptychocheilus lucius*, razorback suckers *Xyrauchen texanus*, humpback chubs *Gila cypha* and bonytail chubs *Gila elegans*. With the passing of each of these seniors, potential knowledge about the endangered fish is lost.

In the spring of 1992, the Recovery Program for the Endangered Fish of the Upper Colorado River Basin assigned me to complete a historical research project about the fish utilizing senior citizens as a primary data source. As a secondary source, published works, including news clippings, magazine stories and reports (of a non-technical nature) were utilized.

Portions of the research project will be presented and will briefly discuss: Ways the endangered fish were used (food, bait, fertilizer, etc.); historic sizes of endangered fish; possible causes of decline offered by the seniors; common and uncommon names of the fish; and people's attitude toward the fish.

RESUMEN

Los ciudadanos más antiguos familiarizados con los ríos en la cuenca alta representan fuentes importantes de datos histórico acerca de las especies en peligro charal del Colorado *Ptychocheilus lucius*, matalote jorobado *Xyrauchen texanus*, charalito jorobado *Gila cypha* y charalito aleta dura *Gila elegans*. Con al pérdida de cada uno de estos ciudadanos, el conocimiento potencial acerca de peces en peligro está perdido.

En la primavera de 1992, el Programa de Recuperación para Peces en Peligro de la Cuenca Alta del Río Colorado me asignó completar un proyecto de investigación histórica acerca de la utilización de los peces por los ciudadanos antiguos como una fuente primaria de datos. Como una fuente secundaria fueron utilizados trabajos publicados, incluyendo nuevos recortes, reportes e historias periodísticas (de naturaleza no técnica).

Se presentaran porciones del proyecto de investigación y una discusión resumida: Las formas en que los peces en peligro fueron usados (alimento, cebo, abono, etc.); tallas históricas de peces en peligro; causas posibles de declinación ofrecidas por los ciudadanos; nombres comunes y no comunes de los peces; y la actitud de la gente hacia los peces.

MEYER, C. W.*; MILLER, D. D. (CWM and DDM - Wyoming Game and Fish Department, Laramie, WY)

Spinal injury in trout electrofished with a Coffelt VVP-15 or CPS™ system / Daño en la espina de truchas capturadas con el sistema de electropesca Coffelt VVP-15 o CPS™

KEYWORDS: electrofishing; spinal injury; Wyoming; *Oncorhynchus mykiss*; *Salmo trutta*

ABSTRACT

We investigated the occurrence of spinal injuries in rainbow trout *Oncorhynchus mykiss* and brown trout *Salmo trutta* collected by single-pass, pulsed DC electrofishing using a Coffelt VVP-15, or a Coffelt CPS™ shocker, and the occurrence of spinal injuries in trout collected on the fourth pass of a multiple mark-recapture population estimate using a Coffelt VVP-15 shocker. Spinal injuries were determined from x-rays of the collected fish. The mean percentage occurrence of spinal injuries in trout collected from a single electrofishing pass using the VVP-15 was 8% (n=45). A single electrofishing pass using the CPS™ resulted in a mean percentage occurrence of spinal injuries of 13% (n=110). The trout collected and x-rayed on the fourth pass of the multiple mark-recapture population estimate, using the VVP-15, were not recaptures (i.e., were unmarked fish). An average of 30% (n=65) of these trout suffered spinal injuries. We concluded that under the conditions present during this work, the CPS™ and VVP-15 worked comparably (i.e., good electrotaxis and relatively low spinal injury). Also it appeared that fish not netted and handled suffered spinal injuries. We could not categorize these fish as having been shocked similarly to netted and handled fish, but missed by the netter, or as fish that escaped on the fringes of the electric field.

RESUMEN

Investigamos la ocurrencia de daño en la espina de truchas arcoiris *Oncorhynchus mykiss* y truchas café *Salmo trutta* colectadas con electropesca DC de pulsación de paso simple usando un chocador Coffelt VVP-15 o un Coffelt CPSTM, y la ocurrencia de daños en espina en truchas colectadas en el cuarto paso de método de la estimación de población por marcado y recaptura múltiple usando un chocador Coffelt VVP-15. Los daños espinales en truchas colectadas por electropesca simple usando el VVP-15 fue de 8% (n=45). Un electropesca de paso simple usando CPSTM resulto en un porcentaje medio de ocurrencia 13% de daños en espina (N=110). Las truchas colectadas y pasadas por rayos X en el estimador de población múltiple de marca-recaptura de cuarto paso, usando el chocador VVP-15, no fueron recapturadas (ejem. fueron peces no marcados). Un promedio del 30% (n=65) de estas truchas sufrieron daños en la espina. Concluimos que bajo las condiciones presentes durante este trabajo, el CPSTM y el VVP-15 trabajaron de manera comparable (ejem. buena electrotaxis y relativamente bajo daño en la espina). Al parecer también los peces capturados con la red y manejados sufrieron daños en la espina. No podemos categorizar de manera similar a aquellos peces que hayan sido chocados con los que fueros capturados en redes y manejados, sino como perdidos por el manejador de la red, o como peces que escaparon de los límites del campo eléctrico.

WILLIAMS, R. N.*; PROEBSTEL, D. S.; SHIOZAWA, D. K.; EVANS, R. P. (Department of Biology, Boise State University; Department of Fish and Wildlife, Colorado State University; DKS and RPE - Department of Zoology, Brigham Young University)

Genetics and morphological evidence supporting subspecific designation of the Humboldt cutthroat trout / Evidencia genética y morfológica sosteniendo la designación subespecífica de la trucha garganta cortada de Humboldt

KEYWORDS: Humboldt cutthroat trout; Nevada; Lahontan cutthroat trout; mitochondrial DNA; morphological characters; Oregon; California

ABSTRACT

Humboldt cutthroat trout, an unclassified subspecies of the cutthroat trout endemic to northeastern Nevada, differed consistently from adjacent Lahontan cutthroat trout with respect to mitochondrial DNA haplotype and morphological characters including counts of gill rakers and scales. Restriction fragment length polymorphism (RFLP) analysis of mitochondrial DNA (mtDNA) variation revealed consistent differences between Humboldt and Lahontan cutthroat trout at a *Pst* I restriction site. Sixty-two of 64 Humboldt cutthroat trout (96.9%) from seven populations examined shared a composite mtDNA haplotype that differed from the common Lahontan haplotype by 0.13% sequence divergence. The common Lahontan haplotype was observed in 64 of 66 (97.0%) Lahontan cutthroat trout examined from nine populations in northwestern Nevada, southeastern Oregon, and eastern California. Similarly, discriminant function analysis of morphological characters (total number of gill rakers in the first arch, number of scales above the lateral line, and number of scales in the lateral line series) also differentiated from Lahontan cutthroat trout (95.8% and 93.2% correct classification, respectively). These results show that Humboldt cutthroat trout share evolutionarily derived genetic and morphological traits that separate them systematically from the adjacent Lahontan cutthroat trout. On this basis, the Humboldt cutthroat trout warrants formal recognition and classification as a unique subspecies of cutthroat trout.

RESUMEN

La Trucha garganta cortada de Humboldt, una subespecie de trucha garganta cortada endémica del Nordeste de Nevada, difiere consistentemente de la adyacente trucha garganta cortada de Lahontan respecto al haplotipo del ADN mitocondrial y caracteres morfológicos que incluyen conteos de arcos branquiales y escamas. Análisis del polimorfismo de restricción de la longitud del fragmento (PRLF) de la variación del ADN mitocondrial (ADN mt) revelaron diferencias consistentes entre las truchas garganta cortada de Humboldt y Lahontan en un sitio de restricción *Pst* I. Sesenta y dos de 64 truchas garganta cortada de Humboldt (96.9%) de 7 poblaciones examinadas comparten un haplotipo de ADN mt que difiere del haplotipo común Lahontan por 0.13% de secuencia de divergencia. El haplotipo común Lahontan fue observado en 64 de 66 (97%) de las truchas garganta cortada Lahontan examinadas de 9 poblaciones del noroeste de Nevada, sureste de Oregon y este de California. Similarmente análisis de funciones discriminantes de caracteres morfológicos (número total de branquiespinas en el primer arco, número de escamas por arriba de la línea lateral y número de escamas en la línea lateral) también diferenciaron a la trucha garganta cortada Lahontan (95.8% y 93.2% clasificación correcta respectivamente). Estos resultados muestran que la trucha garganta cortada de Humboldt comparte deriva genética evolucionaria y rasgos morfológicos que las separa sistemáticamente de la adyacente trucha garganta cortada de Lahontan. Con estas bases la trucha garganta cortada de Humboldt garantiza el reconocimiento formal y clasificación como una subespecie única de trucha garganta cortada.

ROBINSON, A. T. (Research Branch, Arizona Game and Fish Department, 310 Lake Mary Rd, Flagstaff, AZ)

The feeding behavior and ecology of young-of-the-year native fish in the Little Colorado River of the Grand Canyon / El comportamiento alimentario y ecología de juveniles de peces nativos de un año en el Pequeño Río Colorado del Gran Cañón

KEYWORDS: Feeding ecology; diet; *Gila cypha*; *Rhinichthys osculus*; *Catostomus discobolus*

ABSTRACT

The feeding behavior and ecology of three YOY native fish species (*Gila cypha*, *Rhinichthys osculus*, *Catostomus discobolus*) was studied in the Little Colorado River of the Grand Canyon. Feeding behavior was recorded within four general habitat localities: bottom, plants, water column, and surface. A habitat variable, vertical position in the water column, was noted as individuals began new behaviors. Specimens of each species were collected and preserved, and their stomach contents were analyzed in the laboratory. Drift samples were collected and analyzed for invertebrate composition.

Foraging humpback chubs partition their habitat by feeding primarily on the surface of the water and on the bottom. Speckled dace are similar to chubs but they also spend feed extensively off of vegetation. Bluehead suckers on the other hand feed primarily on the bottom, and to a lesser extent on algae and aquatic macrophytes. Humpback chub and speckled dace YOY utilize the upper pelagic and surface zones preferentially to other vertical zones in the water column, whereas bluehead suckers utilize the benthic zones preferentially to other vertical zones. Humpback chubs and speckled dace had diets that did not differ significantly from each other, however, both species differed from bluehead suckers. Humpback chubs had diets that were most similar in invertebrate composition to what occurred in the drift samples. The behavioral, spacial use, and diet differences may help to reduce any possible competition between the species.

RESUMEN

El comportamiento alimentario y ecología de tres especies de peces nativos del año (*Gila cypha*, *Rhinichthys osculus*, *Catostomus discobolus*) fue estudiado en el Pequeño Río Colorado del Gran Cañón. El comportamiento alimentario fue registrado para cuatro localidades de hábitats generales: substratos, plantas, columna de agua, y superficie. Un hábitat variable, la posición vertical en la columna de agua, fue observado como inicios individuales de nuevos comportamientos. Los especímenes de cada especie fueron colectados y analizados, y sus contenidos estomacales fueron analizados en el laboratorio. Muestras de deriva fueron colectados y analizados para la composición de invertebrados.

La alimentación del charalito jorobado fracciona su hábitat, alimentándose primariamente sobre la superficie del agua y sobre el fondo. El charalito moteado es similar a los charalitos, pero ellos también se alimentan extensivamente fuera de la vegetación. El matalote cabeza azul, por otra parte, se alimenta primariamente sobre el fondo, y de manera menos extensa sobre algas y macrofitas acuáticas. Los charalitos jorobados y los charalitos moteados del año, utilizan las zonas pelágicas superiores y las zonas superficiales, preferentemente a otras zonas verticales en la columna de agua, sin embargo, el matalote cabeza azul utiliza las zonas bénticas, preferencialmente a otras zonas verticales. El charalito jorobado y el charalito moteado tuvieron dietas que no se diferencian significativamente entre si, sin embargo, ambas especies difieren del matalote cabeza azul. El charalito jorobado tiene que fueron las mas similares a la composición de invertebrados en las muestras de deriva. El comportamiento, uso espacial, y diferencia entre dietas puede ayudar a reducir cualquier posible competencia entre las especies.

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Interspecific interaction between *Heterandria formosa* and *Gambusia holbrooki*:implications for management of fish species impacted by introduced mosquitofish / Interacción interespecífica entre *Heterandria formosa* y *Gambusia holbrooki*: Implicaciones para el manejo de especies de peces impactadas por la introducción del pez mosquito

KEYWORDS: *Heterandria formosa*; *Gambusia holbrooki*; least killifish; eastern mosquitofish; competition; predation; size-structured interactions; population growth

ABSTRACT

Many studies have examined the effects of introduced mosquitofish on indigenous fish species, but little is known about the form of interactions between mosquitofish and other fish species in the native range of mosquitofish. We examined the interaction between eastern mosquitofish, *Gambusia holbrooki*, and naturally sympatric least killifish, *Heterandria formosa*, two similar sized members of the family Poeciliidae, to determine which form of interspecific interaction was most important - competition or predation. Experimental populations were established in replicate mesocosms (wading pools), and growth and demographic characteristics of killifish populations were examined in the presence and absence of mosquitofish. In pools with mosquitofish, populations of *Heterandria* were small and significantly skewed toward large-bodied females, and relative abundance of males and juveniles was reduced. In populations of *Heterandria* alone, sex ratios and adult to juvenile ratios were about 1:1, individual adult female body sizes were smaller, and populations were large. This combination of population characteristics coincides with those predicted by a strong predator-prey model. We suggest that, even though these species are similar in adult size, diet, and habitat use, the dominant interaction between them is size-selective predation by large *Gambusia* on small *Heterandria*, rather than competition. Managers should consider mosquitofish primarily as predators on small size-classes of similar-sized native species.

RESUMEN

Algunos estudios han examinado los efectos del pez mosquito introducido con especies de peces nativas, pero poco se conoce de la forma de las interacciones entre el pez mosquito y las especies de peces en el rango nativo del pez mosquito. Examinamos la interacción del pez mosquito del este, *Gambusia holbrooki* y la naturalmente simpátrica del guatopote pequeño, *Heterandria formosa*, dos miembros de similar tamaño de la familia Poeciliidae, para determinar cual forma de interacción interespecífica era más importante - competencia o depredación. Fueron establecidas poblaciones experimentales en réplicas "mesocosmos" (estanques en líneas) y se examinaron el crecimiento y características demográficas de las poblaciones de guatopote pequeño en las presencia y ausencia del pez mosquito. En estanque con pez mosquito, las poblaciones de *Heterandria* fueron pequeñas y sesgadas significativamente hacia hembras de cuerpo grande y fue reducida la abundancia relativa de machos y juveniles. En poblaciones de *Heterandria* sola, la taza de sexos y de juvenil a adulto fueron cerca de 1:1, los tamaño individuales de la hembra adulto fueron más pequeños, y las poblaciones fueron más grandes. esta combinación de las características de la población coincide con las características predecidas de un modelo de fuerte depredador-presa. Sugerimos que, aunque estas especies son similares en tamaño adulto, dieta y uso de hábitat; la interacción dominante entre ellos es tamaño selectivo-depredación para *Gambusia* grande sobre *Heterandria* pequeña en vez de competencia. Los manejadores deberán considerar al pez mosquito primeramente como un depredador sobre clases de talla pequeñas de especies nativas de talla similar.

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Non-lethal stomach pumping technique to recover gut contents of roundtail chub / Técnica de bombeo estomacal no letal para recuperar contenidos estomacales del charal aleta redonda

KEYWORDS: roundtail chub; *Gila robusta*; Colorado River; stomach pumping technique; pharyngeal teeth; humpback chub; Grand Canyon

ABSTRACT

Forty adult roundtail chub *Gila robusta*, captured by electrofishing from the Colorado River near the Colorado/Utah state line, were used to evaluate a non-lethal stomach pumping technique for recovering gut content. Twenty chub were used as the test group and subjected to stomach pumping, and twenty were examined as the control group. The stomach pumping technique evacuated 100 percent of the gut content of all fish treated. No damage to the pharyngeal teeth of any test fish was detected. The fish ere not anesthetized for stomach pumping, and no short- term ill effects were observed. The fish were not held for observation of long-term effects. Based on the results of this study, this stomach pumping technique is recommended for recovering gut content of endangered humpback chub *Gila cypha* from the Colorado River in Grand Canyon. These two *Gila* species are closely-related, with nearly identical gut configuration and

pharyngeal mill. Food habits analyses of the Grand Canyon humpback chub are part of the Glen Canyon Environmental Studies.

RESUMEN

Cuarenta charales aleta redonda adultos *Gila robusta* capturados por electropesca del Río Colorado cerca de la línea estatal Colorado/Utah fueron usados para evaluar la técnica de bombeo estomacal no letal para la recuperación de contenidos estomacales. Como grupo de prueba sujeto a bombeo estomacal fueron usados 20 charales y 20 fueron examinados como grupo control. La técnica de bombeo estomacal evacuó el 100 por ciento del contenido estomacal de todos los peces tratados. No se detectó daño en los dientes faríngeos de los peces examinados. Los peces no fueron anestesiados y no se observó efecto dañino a corto plazo. Los peces no fueron retenidos para la observación de los efectos a largo plazo. Basados en los resultados de este estudio, esta técnica de bombeo estomacal se recomienda para la recuperación de contenidos estomacales en el charal jorobado *Gila cypha* en peligro del Río Colorado en el Gran Cañón. Estas dos especies de *Gila* están cercanamente relacionadas, con configuración estomacal y molino faríngeo casi idénticos. Los análisis de los hábitos alimentarios del charal jorobado forman parte de los Estudios Ambientales del Cañón Glen.

BUTH, D. G.*; HAGLUND, T. R.; CASSANO, V. P. F. (DGB, TRH, VPFC - Department of Biology, University of California (UCLA), Los Angeles, California 90024-1606)

Gene expression in the razorback sucker *Xyrauchen texanus* / Expresión de gen en el matalote jorobado *Xyrauchen texanus*

KEYWORDS: allozymes; gene expression; non-lethal sampling; razorback sucker

ABSTRACT

Optimal electrophoretic conditions for the study of enzyme variation in razorback suckers were revealed in a test of 46 enzyme systems under 14 buffer conditions. Optimal conditions were identified for the resolution of products of 94 loci. Eight specimens from Lake Mohave were examined for gene expression in 11 tissues; heart, eye, brain, liver, kidney, gonad, gill, stomach, spleen, and "non-lethal" tissues: skeletal muscle and fin. Liver tissue expressed the greatest number of gene products (64/94). For the two "non-lethal" tissues, skeletal muscle and fin expressed gene products of 50 and 35 of the 94 loci, respectively. In 19 of 35 cases, expression in fin was scored as greater than in skeletal muscle. However, in only 7 of 35 cases could a gene product be unambiguously scored from fin instead of from muscle. Thus, fin alone is a quite limited source of gene products if a non-lethal sampling strategy is pursued. A combination of muscle plus fin tissues is a better sampling protocol. In our limited sample of 8 specimens, 8 of 94 loci revealed allelic polymorphisms. However, only 5 of these polyallelisms could be scored from non-lethal tissues (all 5 from muscle, only 2 also from fin). This information will facilitate studies of population structure in razorback suckers.

RESUMEN

Las condiciones electroforéticas óptimas para el estudio de la variación enzimática en matalote jorobados fueron revelados en un examen de 46 sistemas enzimáticos bajo 14 condiciones amortiguadoras. Las condiciones óptimas fueron identificadas por la resolución de los productos de 94 loci. Ocho especímenes del lago Mohave fueron examinados para expresión del gen en 11 tejidos: corazón, ojo, cerebro, hígado, riñón, gónada, branquias, estómago, bazo, y tejidos "no letales" : músculo esquelético y aleta. El tejido hepático expreso el mayor número de productos de gen (64/94). Para los dos tejidos "no letales", el músculo esquelético y aleta expresaron productos de gen de 50 y 35 de los 94 loci respectivamente. En 19 de 35 casos, la expresión en aletas fue evaluada como mayor que en el músculo esquelético. Sin embargo, en sólo 7 de 35 casos pudo un producto de gen ser no ambiguamente evaluado para aleta o para músculo. Así, la aleta sola es una fuente limitada de productos de gen si se persigue una estrategia de muestreo "no letal". Una combinación de músculo además de aleta es un mejor protocolo de muestreo. En nuestra limitada muestra de 8 especímenes, 8 de 94 loci revelaron polimorfismos alélicos. Sin embargo, solo 5 de estos polialelismos pudieron ser evaluados para tejidos "no letales" (todos los 5 para músculo, solo 2 para aleta). Esta información facilitará estudios de estructura poblacional en matalote jorobados.

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Assessment of Ecosystem Quality and its Impact on Resource Allocation in the Middle Snake River Sub-Basin / Evaluación de la calidad del Ecosistema y su impacto en la localización de recursos en la subcuenca del Río Snake Central

KEYWORDS: Middle Snake River; Milner Dam; King Hill; southern Idaho; risk assessment; water quality model; Geographic Information System (GIS)

ABSTRACT

The Middle Snake River sub-basin is currently ecologically stressed due to numerous point and non-point pollution sources, diversion of water for irrigation or hydropower, and a series of mainstem dams. Management strategies are crucial because of longterm claims on water, non-point source effects and new mainstem hydroelectric project proposals, as well as proposals for additional aquaculture facilities and other development on various tributaries. A multicompartment water quality model and an evaluation of historic biological resources are being used to characterize the ecological risks associated with proposed developments between Milner Dam and King Hill in southern Idaho. Central to the complex anthology of risks are the variability in flow, water quality and quantity, outflow, meteorologic inconsistencies, and model uncertainty compared with the variability in the environmental requirements for indicator organisms. Using Geographic Information System (GIS) techniques, ecological analyses are integrated into a system planning model which will provide a framework for examining management strategies for the sub-basin.

RESUMEN

La subcuenca del Río Snake central se encuentra actualmente estresada ecológicamente, debido a numerosas fuentes puntuales y no puntuales de contaminación, desviación de agua para irrigación o hidroeléctrica, y a una serie de presas prioritarias. Las estrategias de manejo son cruciales debido a los reclamos a largo plazo sobre el agua, los efectos de las fuentes no puntuales y las nuevas propuestas de proyectos hidroeléctricos prioritarios, así como las propuestas para facilidades adicionales para acuicultura y otros desarrollos en varios tributarios. Se están utilizando un modelo de calidad de agua multicompartamental y una evaluación histórica de los recursos biológicos para caracterizar los riesgos ecológicos asociados con los desarrollos propuestos entre la presa Milner y King Hill en el sur de Idaho. Central a la antología compleja de riesgos está la variabilidad en flujos, calidad y cantidad de agua, salidas, inconsistencias metereológicas, y modelo incierto comparado con los requerimientos ambientales para organismos indicadores. Utilizando la técnica del Sistema de Información Geográfica (SIG), los análisis ecológicos son integrados dentro de un modelo de sistema de planeación el cual proporcionará un marco para examinar las estrategias de manejo para la subcuenca.

CONTRIBUTED PAPER

Introduction

The Snake River extends 1,667 km from its origin in western Wyoming to its confluence with the Columbia River at Pasco, Washington. There is an elevation drop of 2,895 meters as the river descends its gradient. For the purposes of this study, the Middle Snake River extends from Milner Dam to King Hill (River Kilometers 1030.4 to 880.7). During its descent in this reach, the river's entrenchment exposes the Snake River Plain Aquifer as hundreds of small tributary springs arising from the north (right) bank (see Covington and Weaver, 1989; 1990a,b,c; 1991). The Snake River Plain Aquifer is an Environmental Protection Agency (EPA)-designated Sole Source Aquifer, providing domestic water for much of south-central Idaho. The tributaries arising from the Aquifer contribute up to 6,500 cfs, however, this has declined in recent years (Kjelstrom, 1992).

Ecosystem Degradation and Historical Perspectives

The Middle Snake River of the present is a transformed ecosystem when compared with its historic fauna and habitat. Since the advent of western exploration there has been an ongoing, synergistic and incremental change in the Middle Snake River ecosystem, including the extinction of enormous seasonal migratory runs of fall chinook and other salmon, white sturgeon and other migratory elements of the Columbia River fauna. Shoshone Falls (64.6 m. high; R.Km. 989.7) was the interior barrier for anadromous fish ascending the Snake River. The Snake River drainage above Shoshone Falls (Upper Snake River fauna) consists of fourteen native fish taxa. Below Shoshone Falls the historic Middle Snake River sub-basin fauna consisted of twenty-four native fish species (Smith [1978] reported twenty-three taxa; *Oncorhynchus kisutch* was subquently verifed from archeological sites, see Plew, 1981). This natural barrier has allowed at least one vicariant speciation; the Utah sucker (*Catostomus ardens* Jordan and Gilbert, 1880) from the Bonneville and Upper Snake River basins is a sister species to the largescale sucker (*Catostomus macrocheilus* Girard, 1857) of the Middle Snake River (see Smith, 1978, for further faunal analysis). Few species occur in both the Upper and Middle Snake River faunas; twenty-two species occur exclusively in one

or the other of these faunal assemblages. Approximately eight of the twenty-four fish species native to the Middle Snake River sub-basin are no longer present. Several others are regarded as sensitive/special concern species by the Idaho Dept. of Fish and Game. The only vertebrate which is a federal Candidate species is the Shoshone sculpin, *Cottus greenei* (Gilbert and Culver) 1898, a narrowly restricted Middle Snake River endemic. By contrast, nearly two dozen non-native fish have been recorded (see Simpson and Wallace, 1978; Bowler, 1992; Bowler and Olmstead, 1990). Among the forty-three native aquatic mollusk taxa, there are four federally listed as Endangered, one as Threatened, and three as Candidate mollusks (U.S. Fish and Wildlife Service, December 14, 1992). All of these species historically sustained healthy populations in the lotic habitats within the gradient (Frest and Bowler, 1993).

When early explorers such as the Hunt Party (1811) and the Bonneville Expedition (1836) first reached this area they reported a river of extraordinary beauty and resources (Murphey, et al., 1992). At the site of Niagara/Crystal Springs, a designated National Natural Landmark (R.Km. 967.6), written accounts of early explorers found the entire river clear and abounding with wildlife resources. Massive runs of fall and summer chinook salmon (*Oncorhynchus tschawytscha*) and steelhead (*Oncorhynchus mykiss*) ascended the Middle Snake River as far upstream as the natural barrier of the 64.6 meter Shoshone Falls (R.Km. 989.7). Although not collected by the early researchers of the 1890s, coho salmon (*Oncorhynchus kisutch*) bones have been found in excavated Native American camps near Bliss (R. Km. 910.9) and at another site in the Middle Snake sub-basin (lew, 1981). Other Columbia River elements included anadromous and resident white sturgeon (*Acipenser transmontanus*) weighing up to 680 kilograms and the Pacific lamprey (*Lampetra tridentata*). The remnant white sturgeon population surviving in this reach appears to be a genotypic stock distinct from sturgeon in the Lower Columbia (G. Gall, pers. comm.), and exists today as isolated sub-populations in a few tailwater reaches.

Although there were year-round resident groups, Native American Shoshoni and Bannock tribes congregated at Upper (R. Km. 935) and Lower Salmon Falls (R. Km. 922.2) to utilize the migratory anadromous fishery. The subsistence provided by the anadromous fishery was the mainstay of their fall and winter existence. Commercial fishery operations by non-Indian pioneers were common along the Middle Snake River from Weiser (R. Km. 565.4) to Glenns Ferry (R.Km. 870.4) to Hagerman (R.Km. 924.1) (Evermann, 1896; Gilbert and Evermann, 1894). Salmon carcasses would line the banks, and were scavanged by eagles, coyotes and other predators. Large numbers of Pacific lamprey were present in the river as far upstream as Shoshone Falls, and their ammocoetes (larvae) served as a rich forage base for sturgeon and other bottom feeding fishes. Prior to their local extirpation in the late 1940s with the closing of Bliss Dam, adult lamprey were highly prized as sturgeon bait.

The U.S. Fish Commission research expeditions to Columbia River headwater sites in the early 1890s were stimulated by severe declines in commercial fishery harvests, so that the early reports of Evermann and his colleagues for the Middle Snake River fishery reflected a severely depleted fall chinook migration (the skewed sex ratio and small size classes of fish reported in Evermann [1896] are also suggestive of a declining fishery). The Fish Commission expedition found the Hagerman Valley the best site in Idaho for establishing hatcheries to supplement the diminishing fishery: "The salmon visit this part of the river in sufficient numbers to furnish roe for hatching, and this is probably the most available point where suitable water and an abundance of fish can be found for such a station in Idaho" (Gilbert and Evermann, 1896). Evermann (1896) observed that, "A little blasting at these falls (Lower Salmon) would make it very much easier for the salmon to ascend...and would result in a considerable increase in salmon supply in the Snake River." Damage to salmon spawning areas in the Hagerman Valley from mining was also evident in the 1890s, as reported by Evermann (1896): "The Indians that come here say the salmon prefer the sandy beds, and that the coarse gravel which the miners have run into the river has caused the salmon to seek other spawning-beds."

The historic anadromous fishery has been absent from the Middle Snake River for nearly half a century (see Table 1). The anadromous salmonids were first severely impacted around 1910 by the construction of Swan Falls Dam (R.Km. 736.9), which lacked a fish ladder. Although a poorly sited ladder was installed a decade or so later, the dam remained a major barrier to migrating salmon and steelhead. A few fall chinook salmon were subsequently reported from the Bruneau River (R.Km.796.5). However, steelhead successfully re-invaded the sub-basin to Lower Salmon Falls. When Lower Salmon Falls Dam was raised in 1948 a fishway was installed; Upper Salmon Dam also had a fish ladder, albeit badly located (see Irving and Cuplin, 1956). Fish and Game surveys of fall chinook salmon spawning redds below Swan Falls Dam in the late 1940s reported extensive siltation of spawning habitat from dam construction in the Hagerman Valley, over 175 river kilometers upstream (see Zimmer, 1950 with supplements in 1951 and 1953 for survey data; Idaho Department of Fish and Game, 1953). The final mainstem hydroelectric developments which terminated the anadromous fishery in the Middle Snake River were the sequential closures of Bliss Dam (R.Km. 902.8; 1949; no fish passage provided), C.J. Strike Dam (R.Km. 729.1; 1952; see Irving and Cuplin, 1956; no fish passage), and ultimately the trilogy of Idaho Power Company projects in Hells Canyon (Brownlee Dam, 1958; Oxbow Dam, 1962; Hells Canyon Dam, 1967).

TABLE 1. The fish fauna native to the Middle Snake River sub–basin, derived from Smith (1978). Anadromous fishery presence is indicated for the Hagerman Valley. Note that the Wood River drainage is excluded because of its isolation (Smith, 1978). A number of the taxa recorded below represent headwater or tributary species not present in the mainstem Snake River. The precise historic distributions and present status of most of the nongame native fishes in the various impoundments and tailwater reaches in the Middle Snake River are not well known. A cutthroat trout hybrid population exists (*Onchorhyncus clarki bouvieri*, the Yellowstone subspecies hybridized with rainbow trout) in the Vineyard Creek and a pure strain of the interior redband trout survives in King Hill Creek with hybridized populations in others (Williams, *et al.*, 1991). Although Smith (1978) included a report of *Salvelinus malma* from Nevada headwater tributaries, it seems likely that this may represent *S. confluentus*. This genus *Salvelinus* apparently did not occur in the mainstem Middle Snake River. For the purposes of this table, the Hagerman Valley is interpreted as the reach from Shoshone Falls (R. Km. 989.7) to the Bliss Dam (R. Km. 902.8).

Native Fish Fauna of the Snake River Drainage Below Shoshone Falls

KEY: + = Present; - = Absent; Ext. = Locally Extinct; CE, SC = Candidate Endangered (CE) or Special Concern (SC); R = Rare

	Hagerman Valley Before Dams	Hagerman Valley after Swan Falls Dam ca. 1910 (before Fish Ladder	Hagerman Valley after Swan Falls Dam Fish Ladder ca. 1924	Hagerman Valley after Bliss Dam ca. 1948-50	Hagerman Valley Today
Acipenseridae					
Acipenser transmontanus Richardson, 1836. White Sturgeon. Resident.	+	+	+	+ R	SC
Acipenser transmontanus Richardson, 1836. White Sturgeon. Anadromous.	+	Ext.	Ext.	Ext.	Ext.
Catostomidae					
Catostomus (Pantosteus) columbianus (Eigenmann and Eigenmann) 1893. Bridgelip Sucker.	+	+	+	+	+
Catostomus macroheilus Girard 1857. Largescale Sucker.	+	+	+	+	+
Catostomus (Pantosteus) platyrhynchus (Cope) 1874. Mountain Sucker.	-	-	-	-	-
Cottidae					
Cottus bairdi Girard 1850. Mottled Sculpin.	+	+	+	+	+
Cottus beldingi Eigenmann and Eigenmann 1891. Paiute Sculpin.	-	-	-	-	-
Cottus confusus Bailey and Bond 1963. Shorthead Sculpin.	-	-	-	-	-
Cottus greenei (Gilbert and Culver) 1898. Shoshone Sculpin.	+	+	+	+	CE, SC
Cottus rhotheus (Smith) 1883. Torrent Sculpin.	-	-	-	-	-
Cyprinidae					
Acrocheilus alutaceus Agassiz and Pickering 1855. Chiselmouth.	+	+	+	+	+
Mylocheilus caurinus Richardson 1836. Peamouth.	+	+	+	+	+
Ptychocheilus oregonensis (Richardson) 1836. Northern Squawfish.	+	+	+	+	+
Richardsonius balteatus (Richardson) 1836. Redside Shiner.	+	+	+	+	+
Rhinichthys cataractae (Valenciennes) 1842. Longnose Dace.	+	+	+	+	+
Rhinichthys falcatus (Eigenmann and Eigenmann) 1893. Leopard Dace.	+	+	+	+	+
Rhinichthys osculus (Girard) 1857. Speckled Dace.	+	+	+	+	+
Petromyzontidae					
Lampetra tridentata tridentata (Gairdner in Richardson) 1836. Pacific Lamprey.	+	-	+	Ext.	Ext.
Salmonidae					
Oncorhynchus clarki (subspecies uncertain)	+	+?	+?	?	SC
Oncorhynchus kisutch (Coho Salmon).	+	Ext.	Ext.	Ext.	Ext.
Oncorhyncus mykiss Rainbow Trout. Resident.	+	+	+	+	+
Oncorhyncus mykiss Rainbow Trout. Steelhead.	+	-	+	Ext.	Ext.
Oncorhynchus sp. Redband Trout.	+?	+?	+?	+?	SC
Oncorhynchus tshawytscha (Walbaum) 1792. Chinook Salmon. Fall Run	+	Ext.	Ext.	Ext.	Ext.
Oncorhynchus tshawytscha (Walbaum) 1792. Chinook Salmon. Summer Run.	+	Ext.	Ext.	Ext.	Ext.
Prosopium williamsoni (Girard) 1857. Mountain Whitefish.	+	+	+	+	+
Salvelinus malma or *confluentus* ? Dolly Varden (or Bull Trout?).	-	-	-	-	-

Modern Ecological Problems: Mollusks and Macrophytes as Bioindicators

As Frest and Bowler (1993) report elsewhere in this volume, the native mollusk fauna of the Middle Snake River is a rich assemblage of forty-three species, but, like the faunal transformation already apparent in the native fishes, there is a habitat and water quality determined change occurring within the molluscan fauna in this river reach. Toward the end of the last decade, there has been a remarkable expansion in enormous populations of the New Zealand mud snail, *Potamopyrgus antipodarum* (Bowler, 1990). First observed in the river in 1987 by D.W. Taylor, within three years this tiny (4-5 mm) gastropod became the dominant invertebrate in this section of the Snake River. As Haynes, et al. (1985) noted, its small size makes it well suited for passive dispersal by birds and

fish. This species is parthenogenetic, and as a live bearer is able to tolerate pollution to a much greater degree than many native taxa. *Potamopyrgus* is reproductively much more successful than the native molluscs with which it co-exists. It is able to rapidly retreat beneath rocks during diurnal water level fluctuations, and appears more resistant to the desiccation caused by raising and lowering river levels to match peak hydroelectric loads than the native snails found in similar shallow riffle habitats. Frest and Johannes (1991) report densities of up to 640,000 individuals per square meter in the river near Thousand Springs. While the large numbers of *Potamopyrgus* would make it superficially seem a potentially significant forage species for organisms higher on the river food chain, it has been shown to be capable of surviving passage through alimentary canals of both trout and yellow perch (Haynes, et al., 1985). This species is overwhelmingly dominant in shallow water habitats and on macrophytes at most sites.

The rapid population building of *Potamopyrgus* was paralleled by a corresponding precipitous decline in populations of indigenous mollusk species which are less pollution-tolerant. Four Middle Snake River gastropods were recently listed as federal Endangered Species (*Physa natricina*, *Pyrgulopsis idahoensis*, *Lanx* n. sp., and *Valvata utahensis*), another was listed as Threatened (the Bliss Rapids snail, an unnamed hydrobiid), and there are three additional taxa which are federal Candidate species (*Anodonta californiensis*, *Fisherola nuttalli*, and *Fluminicola columbiana*). As Frest and Bowler (1993) report in this volume, there are many other lotic, coldwater preferring species which are declining in the Middle Snake River, while a large group of species which are characteristic of warmer, lentic waters are increasing. The large freshwater clam, *Margaritifera falcata*, one of the most abundant clams in Native American archaeological sites, is now virtually eliminated from the Middle Snake River (Bowler, 1990). This may have been a result of the extinction of salmon runs in the area, as *M. falcata* larvae require salmonids as preferred hosts during their brief attachment stage. This species has been replaced by the smaller pelecypod *Gonidea angulata*.

Loss of riparian habitat and a seasonal burgeoning of aquatic macrophytes, especially *Potamogeton* spp., has also occurred as a result of nutrient loading and other agricultural nonpoint source pollution. Extensive blooms of planktonic and periphytic algae appear during the spring and summer, and anoxic bottom conditions occur on the thick sediment blanket as early as April. The oxygen-poor bottom conditions exclude most mollusks, and the fishery is characterized by lentic, eutrophic tolerant taxa, particularly catostomids, squawfish, other native cyprinids, and the non-native carp. Recreational use is seasonally restricted by these conditions, particularly boating, water skiing, swimming, and fishing. Jet boats are more utilitarian than those with propellers due to macrophyte growth during the summer in impoundments or lentic sites in the reach.

Ecological Stresses on the Middle Snake River

The Middle Snake River's ecological stessors, which in concert have led to the decline of water quality and the aquatic ecosystem, are numerous and synergistic. Diversion of the Snake River for irrigation purposes at Milner Dam is an historic practice which dewaters the river downgradient to Shoshone Falls during the agricultural season, although there has always been a limited leakage through the dam, and recent Federal Energy Regulatory Commission rules now require a minimum flow of 300 cfs below Milner. High-lift irrigation pumping from the Snake River occurs in Lower Salmon impoundment to irrigate the Bell Rapids agricultural project on the left bank, and a high-lift pump station in the Bliss impoundment provides irrigation water for other agricultural areas on the left bank of the river between Bliss and King Hill. Kjelstrom (1992) presented data indicating that the annual average ground-water discharge, primarily spring flows from the Snake River Plain Aquifer, have declined significantly in the past decade, but especially during the past five years. This pattern appears strongly evident in Box Canyon and Blue Lakes, two of the largest aquifer tributaries for which there are longterm accurate data, as well as in monitoring wells (Kjelstrom, 1992). Groundwater pumping and the current drought may contribute to this decline.

Primary point and non-point pollution sources include effluent from over 140 fish hatcheries, between 400 and 500 dairies and feedlots, irrigated agriculture runoff, municipal sewage discharge, and a series of mainstem dams (see Table 2). Nearly every tributary from the Snake River Plain Aquifer arising on the right or north bank of the river has been extensively developed, particularly with fish rearing facilities. Between June 1, 1990 and July 25, 1991, Brockway and Robison (1992) examined a transect through the reach sampling thirteen mainstem sites, summarizing STORET data for others, and surveying 19 irrigation return flows, 13 tributaries, and 10 aquaculture effluent streams. According to that study, suspended solids at times exceeded 3,000 mg/l in irrigation return flows, with an estimated 350 tons/day transported by the river at King Hill. The total inflow from 18 irrigation return flows was 21,000 tons, from the ten fish farms sampled an estimated 6,000 tons, and from 9 tributaries 53,000 tons (Brockway and Robison, 1992). Total phosphorus increased from 100 tons at Blue Lakes to over 600 tons at King Hill, with the lowest contributions being in July or mid-summer and the highest appearing in the spring. An

TABLE 2. Primary anthropogenic stressors on the Snake River between Milner Dam and King Hill, Idaho.

Irrigated Agriculture	• 560,000 acres irrigated with water withdrawn from the Snake River. • 370,000 acres irrigated with water from the Snake River aquifer. • Return flow from 13 streams and >50 surface drains.
Fish Hatcheries	• 140 privately–owned • Four state and federal.
Hydroelectric Facilities	• Five existing on mainstem. • Seven proposed on mainstem. • Many on tributaries.
Point Sources	• Two municipal sewage treatment plants.
Confined Animal Feeding Operations	• 600 dairies and feedlots with waste equivalent to a population of 5,000,000 humans.

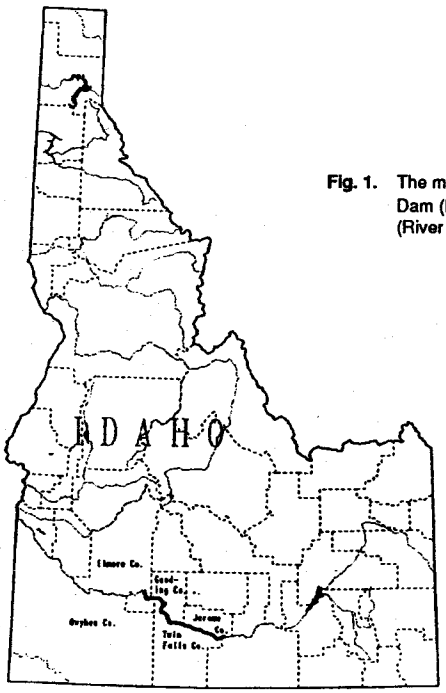


Fig. 1. The mid Snake River extending from Milner Dam (River Kilometer 1030.4) to King Hill (River Kilometer 880.7), Idaho.

estimated 37 tons were contributed by the irrigation return flows sampled, 112 tons from the ten fish hatcheries surveyed, and 219 tons annually from measured tributaries. (It should be noted that return flows from irrigated agriculture have been relatively low in recent years due to drought conditions in southern Idaho; the temporal pattern of pollution input could be altered during wet years, so that periods of intense phosphorus contribution could continue much longer in above median water years. Similarly, "flushing flows" or years with extended runoff could re-suspend nutrient rich sediments which would pass through the system, settling in impoundments and lentic sites down gradient, and, perhaps stimulating algal growth in the process.) In the Brockway and Robison (1992) study, total phosphorus was greater than 0.1 mg/l at all sample sites at some point during the study term; at Murtaugh total P reached 0.33 mg/l, and the mean of all sites was 0.08 mg/l which represented 2 tons/day of total P. Phosphorus values of greater than 0.025 mg/l are considered to be levels promoting growth of algae and macrophytes (see discussion in EPA [1991] and TMDL literature review in Cusimano [1992]), and although there is variation in the current chemistry of the area's springwater, values as low as 0.01 mg/l are reported in STORET and Brockway and Robison (1992).

Nitrate plus nitrite measurements similarly indicated that the 0.3 mg/l level considered as an indicator level of pollution was exceeded at all 13 river sites in all but two samples. The ten fish hatcheries sampled contributed 1,600 tons/year, while 190 tons were generated by irrigation return flows and 3,600 from tributaries (which also reflect agricultural runoff). The EPA and the Idaho Department of Health and Welfare, Division of Environmental Quality (IDHW DEQ) have sponsored several additional studies to further examine the impacts these point source and nonpoint source pollution contributors have upon the Middle Snake River. A literature review and comprehensive bibliographic database for biotic resources in the Middle Snake River ecosystem is presented in Dey and Minshall (1992).

Ecosystem Analysis and Risk Modeling in Resource Allocation

Restoration of the aquatic resources in the Middle Snake River requires environmental planning with an ecosystem perspective. This implies gaining a better understanding of and articulating the basic interactions of this complex ecosystem. It also necessitates developing methods for assessing the impacts of resource allocation upon ecosystem quality. Present understanding of the Middle Snake River is based upon limited hydrologic and water chemistry data. This is because the historical, utilitarian view of the Middle Snake River ecosystem was as an anthropocentric resource whose primary values were irrigation, the generation of hydroelectric power, and for the production of fish in commercial aquaculture hatcheries. The intrinsic values of this unique river segment with its remarkable deciduous riparian forests, endemic mollusks, the historic anadromous fishery, and the surviving vertebrate endemics such as the Shoshone sculpin are only beginning to be understood. To enhance the development of this perspective, as mandated by the Clean Water Act (see EPA [1991] for a discussion of implementing the Clean Water Act sections), the Region 10 Environmental Protection Agency in cooperation with the IDHW DEQ is designing a methodology for characterizing the risk of further altering the ecosystem for known and proposed levels of development.

Goals

The goals of the Middle Snake River restoration project have elements which are short and longterm. The development of a methodology using GIS and other techniques to address the existing and potential, or at least predictable, problems is an immediate challenge. EPA Region 10 has approached this by providing its technical support for: 1) review of permits for licensing existing and proposed hydroelectric projects; 2) evaluation of management plans for identifying and controlling nonpoint source pollution; 3) establishment of Total Maximum Daily Loads (TMDL's) for water quality-limited segments of the river; and 4) assisting in the writing of permits under the National Pollution Discharge Elimination System (NPDES). The longterm goals are to develop an ecosystem perspective for environmental planning which can be applied to tributaries in other river basins or sub-basins throughout the region.

Risk Modeling Assumptions

As in any predictive or descriptive model, the characterization of ecological risk through modeling is based upon assumptions which are the direct products of data from historic and ongoing research. These assumptions include:

1. Major features of the Snake River ecosystem can be described in terms of compartments between which there can be flows of energy, material and information.
2. The flows of energy, material and information can be described mathematically within given bounds of uncertainty.

3. There is sufficient information to characterize the variability of forcing functions associated with meteorology, hydrology and water chemistry.
4. There is sufficient information to characterize the variability of environmental forcing functions associated with important types of human development on the Snake River.
5. Assessment endpoints for biological systems included in the risk analysis are known within given bounds of uncertainty. Where endpoints are not known, surrogates, such as water quality standards can be applied.
6. The principal components of risk arise from uncertainty or variability in driving forces and from uncertainty in the models used to describe the state of the ecosystems.

Objectives and Ecosystem Modeling Strategy: Short-term Objectives

The objectives of the short-term goals are associated with and largely driven by specific requirements of state and federal environmental legislation and the development of comprehensive land-use plans at the county level. They are also determined by the state of our knowledge of the ecosystem and our ability to develop simulation models for the flow of energy, material and information between ecosystem compartments. At present it is possible to accurately apply the methodology to a limited part of this complex ecosystem.

To achieve these objectives within the framework of the risk analysis, a "source-based" strategy is being employed. While this strategy has elements of the traditional approach to the allocation of waste loadings, it also contains elements of risk analysis. The focus of the model is upon water quality including as parameters temperature, dissolved oxygen, nutrients such as nitrate/nitrite N and total P, coliform bacteria, and ammonia toxicity. The State of Idaho's water quality standards are assessment endpoints in this method. The assessment methodology is based upon a mass balance water quality model. Elements of risk are derived from uncertainty and variability in driving forces, and from uncertainty in the mass balance model. The water quality model of Yearsley (1991) utilizes material and energy flows as shown in Figure 2. This model employs standard kinetics theory to simulate temperature, dissolved oxygen, nitrogen, phosphorus, and primary productivity for time scales of hours to decades, vertical length scales of 1-10's of meters and horizontal scales of 100's of meters to 100's of kilometers.

Through this method, measures of the risk of exceeding the State of Idaho's water quality standards can be estimated before and after source control or mitigation. This concept is illustrated in Figure 3 where the probability density of total phosphorus is shown schematically before and after TMDLs have been implemented for nutrient generating sources. The probability densities are estimated empirically by Monte Carlo simulation using variability and uncertainty in driving forces as determined from available data. Model uncertainty will be determined by comparing simulation results with measurements obtained in comprehensive field experiments such as those reported by Brockway and Robison (1992).

Long Term Goals and Objectives

Longterm goals include an analysis of the communities within the mainstem river ecosystem encompassing the benthic, planktonic, and riparian/wetland habitats. Sampling of these habitats was conducted in two separate studies during the spring/summer and fall/winter of 1992. Additional field measurements will be taken during spring/summer of 1993. The results of this research are presently being integrated into the model to refine predictive accuracy. This is particularly critical now that there are four federally listed Endangered and one Threatened species of mollusks in the Middle Snake River, as well as three additional Candidate mollusk species (U.S. Fish and Wildlife Service, 1992).

The objectives associated with longterm goals include increasing our knowledge of the Snake River ecosystem with additional field studies and experiments, and allowing expansion of the scope of simulation methods to encompass more complex compartments such as benthic plants and animals, and higher trophic levels in the river. More complex models will inevitably lead to more comprehensive risk assessment methods.

Comprehensive Management Plan for the Middle Snake River

In addition to the studies of the ecosystem, another component of the long term goals is a comprehensive management plan which involves close coordination of government, public and private interests. To meet this goal, several working groups have been formed.

The Mid-Snake River Planning Group consists of representatives of Twin Falls, Gooding, Lincoln and Jerome Counties, along with federal, state and local government entities. Its purpose is to develop a management plan to prioritize problems in the basin and to provide direction for solving them.

The IDHW, DEQ is in the process of developing a nutrient management plan which includes short-term monitoring and modeling studies in the Snake and several small tributaries, a compilation of existing data, identification of land use data, algal bioassays, identification of regulatory and voluntary solutions to achieve target nutrient level/water quality goals and an assurance of public participation in the process. Executive and Technical

Fig. 2. Schematic diagram for RBM10 in the river basin model.

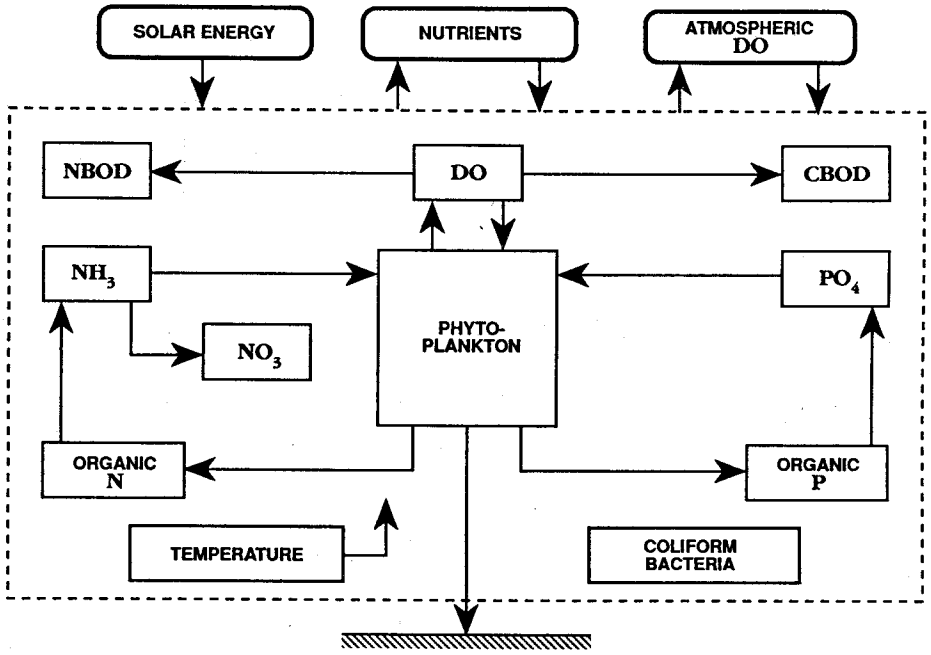
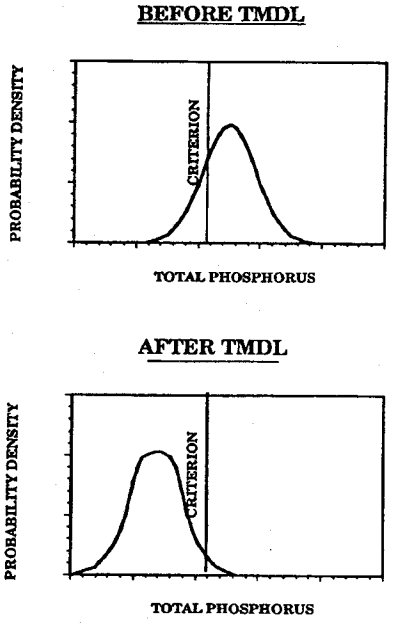


Fig. 3. Conceptualization of risk outcome as applied to the development of a Total Maximum Daily Load (TMDL) for total phosphorus.



Advisory Committees including representatives of private industry, conservation, and other groups allow additional participation.

The Bureau of Land Management has recently undertaken a Wild and Scenic River study of three reaches within the Middle Snake River, which adds another evaluative contributor to the resources of the reach. The Lower Salmon Falls Dam tailwaters were identified as a promising candidate for Wild and Scenic River recognition in the Nationwide River Inventory conducted by the Heritage Conservation Recreation Service in the early 1980s (the Wild and Scenic Rivers Act is now implemented by the National Park Service). This section of the reach was also found to qualify for National Natural Landmark recognition as were Box Canyon (R. Km. 946.6) and Malad Gorge (Snake River Km. 919.6 at the confluence to Big Wood River [Malad} Km. 4.7), though none were formally designated as Landmarks (Bowler, 1981a,b,c).

Summary and Conclusions

Because of human activities during the past century the Middle Snake River and its immediate tributaries exhibit water quality and natural resource problems. These include the extinction of an extraordinary anadromous fishery, the diminishment of mollusk populations and species to a level of endangerment, the reduction of habitat and populations of the endemic Shoshone sculpin, and the diminishment of several other native fishes now accorded sensitive species status. The rapid growth of southern Idaho, as well as the increasing requirements for energy and irrigation resources, places an added urgency upon resolving long-standing problems. It is crucial that all parties very clearly understand the severity of the present ecological stress and the extinctions which have already occurred in this reach.

Acknowledgements

We thank two anonymous reviewers from the Society of Environmental Toxicology and Chemistry and L. W. Barnthouse of Oak Ridge National Laboratory for helpful comments on an early draft of this paper.

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The use of Polymerase Chain Reaction for the identification of catostomid fishes in the Green River system / El uso de la técnica de reacción en cadena de la polimerasa para la identificación de peces Catostómidos en el Sistema Green River

KEYWORDS: Green River; Catostomidae; *Catostomus discobolus*; *Catostomus latipinnis*; *Xyrauchen texanus*; DNA analysis; Polymerase Chain Reaction

ABSTRACT

The identification of larval catostomids has been a significant problem for researchers studying the native fishes of the Green River. Often larval fish collected in the field have not yet developed diagnostic morphological characters and their identification requires that they be reared to a larger size. Mortalities, both from collecting and during rearing, can be high and rearing also delays progress on studies. Any tool that would speed species identifications would be beneficial to the study and management of the native fishes.

We used the polymerase chain reaction (PCR) to amplify a portion of the mitochondrial genome from suckers native to the Colorado system. The PCR product was cut with restriction enzymes and the resulting fragment patterns were compared. Total DNA was extracted from sucker tissues obtained in the late 1980's and archived at BYU. The suckers were originally collected from Cottonwood Creek, Utah, a Green River tributary and the Razorback sucker tissue was provided by the Dexter National Fish Hatchery. DNA was also extracted from tissues taken from larval razorback sucker mortalities at the experimental hatchery operated by the U.S. Fish and Wildlife Service at the Ouray National Wildlife Refuge, Utah. Differences in restriction patterns were found, and while further investigation of the overall variability in the patterns within species are necessary, these preliminary results do show promise.

RESUMEN

La identificación de larvas de catostómidos ha sido un problema fundamental para los investigadores que han estudiado los peces nativos de Green River. Frecuentemente las larvas de peces colectadas en el campo aún no han desarrollado características morfológicas diagnósticas; y su identificación requiere que éstas sean cultivadas hasta que alcancen un tamaño mayor. La mortalidad larval puede ser alta tanto en la colecta como durante el cultivo; asimismo el cultivo puede también retardar los avances sobre su estudio. Cualquier procedimiento que pudiera agilizar el proceso de identificación de las especies sería de gran utilidad para el estudio y manejo de los peces nativos.

En el presente estudio, se utilizó la técnica de reacción en cadena de la polimerasa (PCR) para amplificar una porción del genoma mitocondrial de peces catostómidos nativos del sistema Colorado. El producto de PCR fue cortado con enzimas de restricción y los patrones de los fragmentos resultantes fueron comparados. El ADN total fue extraído de los tejidos de peces catostómidos colectados a finales de 1980 y preservados en Brigham Young University. Los catostómidos fueron originalmente colectados en Cottonwood Creek, Utah, un arroyo tributario de Green River, y los tejidos del matalote jorobado fueron proporcionados por la piscifactoría Dexter National Fish Hatchery. El ADN también fue extraído de tejidos tomados de larvas muertas del matalote jorobado en la piscifactoría experimental operada por U.S. Fish and Wildlife Service en el Refugio Nacional de Vida Silvestre de Ouray, Utah. Se encontraron diferencias en los patrones de restricción, sin embargo es necesario un mayor número de estudios para determinar la variabilidad total en los patrones dentro de las especies. Los resultados preliminares aquí obtenidos son considerados como prometedores.

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The response of native and introduced trout to coarse woody debris: an abiotic and biotic evaluation.

KEYWORDS: Colorado River cutthroat trout; Utah; Wyoming; coarse woody debris; restoration; competition; brook trout

ABSTRACT

Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus* Cope populations have declined considerably in areal extent and overall density. The main hypothesis invoked to explain this decline is that cutthroat trout are susceptible to hybridization with other salmonids. Another potential cause for the observed decline is that introduced salmonids (especially brook trout) compete for food and space. Survey data collected along the north slope of the Uinta Mountains in Utah and Wyoming support the notion of a negative relationship between introduced brook trout and native cutthroat trout. Additionally, we hypothesize that coarse woody debris is a mediating factor in this interaction possibly providing a competitive advantage to brook trout. We conducted two large-scale debris manipulative experiments to determine the role of coarse woody debris on both of these trout species and their potential interactions. A large scale manipulative experiment was performed to evaluate the response of an allopatric population of Colorado River cutthroat trout to the addition of large organic matter. The study was performed over a two year period in a number of streams located along the north slope of the Uinta mountains in Utah and WYoming. Coarse woody debris was added to a series of reaches

located in one of the study streams devoid of any natural wood, while the remaining streams served as controls. The addition of large organic matter resulted in a number of significant abiotic and biotic changes: 1) particle retention significantly increased in those reaches with wood, 2) stream velocities and substrate sizes were more variable in those reaches with wood, 3) the invertebrate composition was altered by the addition of wood, and 4) the density of 1+ cutthroat trout was significantly enhanced by the presence of wood. In addition, we manipulated wood densities and fish community structure (cutthroat alone or with brook trout) to determine if added debris did in fact alter competitive outcomes. All of these results will be discussed in the context of restoration strategies for enhancing existing populations of Colorado River cutthroat trout.

RESUMEN

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A Preliminary Checklist of the Aquatic and Terrestrial Mollusks of the Middle Snake River Sub-Basin / Un Listado Preliminar de los Moluscos Acuáticos y Terrestres de la Subcuenca en Medio del Río Snake

KEYWORDS: Mollusks; Middle Snake River; endangered snails; moluscos; caracoles; snails; clams; almejas

ABSTRACT

The freshwater mollusk fauna as presently understood comprises thirty native and two introduced snail species, and there are at least three additional taxa of non-native snails which inhabit thermal plumes in warmwater aquaculture outfalls. Seventeen native and a single introduced species of Bivalvia (clams) and nine living species of landsnails have been identified from the sub-basin. Several new regional and state records are presented. Mollusk species which are expected to occur but have not yet been verified from the Middle Snake River sub-basin are cited. Half of the eighteen native aquatic species which characteristically require cold, fastwater habitats or sediment sites in free-flowing reaches are presently either proposed for listing or are candidate endangered or threatened species and several others are declining. This is a working checklist to which there will undoubtedly be additions of both terrestrial and aquatic mollusks.

RESUMEN

La fauna malacológica de agua dulce actualmente conocida comprende treinta especies nativas de caracoles y dos introducidas. Además, existen al menos tres taxa de caracoles introducidos que viven en corrientes cálidas de las descargas de la acuacultura. Diecisiete especies nativas de bivalvos (almejas) y nueve especies de caracoles de tierra han sido identificadas para la subcuenca. Se presentan nuevos registros para la región y el estado. Las especies de moluscos que se esperaría encontrar pero que aún no se han verificado en la subcuenca del medio del Río Snake se citan. La mitad de las dieciocho especies acuáticas nativas que característicamente requieren habitats con aguas rápidas y frías o sitios con sedimentos sin flujo están actualmente propuestas para ser enlistadas, o ser candidatas a en peligro o amenazadas, y algunas otras están declinando. Este es un listado de trabajo para el cual habrá indudablemente adiciones de moluscos terrestres y acuáticos.

CONTRIBUTED PAPER

This checklist comprises a working list of the aquatic and terrestrial mollusks presently known from the Middle Snake River ecosystem. For the purposes of this study, the Middle Snake River is considered to include the reach between Milner Dam (River Mile 639.1) and C.J. Strike Reservoir (R.M. 517.6). Within this 121.5 mile reach the river gradient descends 1,680 feet, primarily in the first half of the stretch. There is no doubt that additional aquatic and landsnail species will be identified from the Middle Snake River, and this checklist will be updated as such new records arise. The freshwater mollusk fauna as presently understood comprises twenty seven native and two exotic snail species. There are at least three other exotic snail taxa which inhabit thermal plumes in warmwater aquaculture outfalls. There are fifteen native and a single introduced clam species. Nine living species of landsnails have been identified thus far (see Table 1).

The freshwater mollusc fauna of the mainstem Middle Snake River is now relatively well known, far more completely than that of the terrestrial molluscs. The aquatic fauna is rich in comparison to other drainages in western North America. The fauna is unusually diverse, composed of representatives which are: 1) relicts of the late Pliocene "Lake Idaho" (the Bliss Rapids snail and *Pyrgulopsis idahoensis*, among a few others), Pleistocene lakes and rivers (*Physa natricina*), or are endemics for which fossils have not been found (the *Lanx* n. sp., endemic to a few springs in the Snake River Plain Aquifer); 2) species which reflect the former connection of the present Snake River drainage with Oregon and California (*Vorticifex effusus*, for example); 3) species which are a part of the

Columbia River fauna, such as *Fisherola nuttalli*, which ascended the Snake River after the draining of Lake Idaho, Snake River drainage capture by the Columbia River and the cutting of Hells Canyon; and 4) species with a broad distribution in the Northwest, more than two-thirds of the total number of species.

The mainstem fauna comprises 42 native mollusc species (27 snails in 7 families and 15 clams in 3 families). In the mainstem river there are three non-native taxa (two snails and the Asian clam *Corbicula fluminea*), and several other exotics exist in thermal plumes from warmwater hatcheries. *Corbicula* may have entered the area as a bait bucket release, since it is one of the most abundant molluscs in lower Snake River (eg. Frest and Johannes, 1992b). *Radix auricularia* was undoubtedly an aquarium escapee known from Idaho as early as 1931 (Bowler and Frest, 1992), and *Potamopyrgus antipodarum* could have reached the Middle Snake River in a variety of ways (Bowler, 1991). Frest and Johannes (1991) report concentrations up to 400 individuals per 6.25 sq. cm. in the mainstem river and up to 320 snails per 6.25 sq. cm. in The Nature Conservancy Preserve at Thousand Springs. This species is spreading in the sub-basin and is the dominant mollusc in the Middle Snake River. It appears to build larger populations in the polluted settings of the mainstem river or below fish hatcheries on tributaries, while it is less prolific in the springs above pollution sources. Several additional non-native species have been observed in warmwater aquaculture hatcheries, but have have not as yet been recorded as escapees into the natural environment.

Within the native fauna, the occurrence of the planorbid *Promenetus exacuous* is new to Idaho, and is reported here from the Snake River above Shoshone Falls. This species also occurs in Silver Creek, adjacent the Wood River drainage, and is another intriguing faunal link between the Wood River/Silver Creek sub-basins and the Snake River above Shoshone Falls. A similar local distribution was recorded for the leatherside chub, *Gila copei*, by Hubbs and Miller (1948). *Lymnaea stagnalis appressa*, the great pond snail, was also found in Silver Creek, and is a new record for the region.

In addition to the species inhabiting the maistem Snake River, there are at least eight other snails and five clam taxa known elsewhere in the system, in the headwaters of tributaries, or as thermal endemics (such as *Pyrgulopsis bruneauensis*). The faunas of the headwater settings of many of the more remote tributaries are incompletely known. At least one undescribed *Pyrgulopsis* is known from the tributaries.

Eight living landsnail species and two fossil taxa which have not yet been found living have been identified along the Middle Snake River. Most of the landsnails have regional distributions, and no endemics have been discovered. A few Pleistocene relicts could survive since fossils have been recovered in suitable modern habitat, and there are other landsnail species with regional distributions which likely occur in the area.

Table 1. The compilation of species presented below reflects reports by Taylor (1985), Bowler (1991), Bowler and Frest (1992), Neitzel and Frest (1989) and Frest and Johannes (1991; 1992a). Native species which characteristically require cold, fast water or sediments in free-flowing habitats are indicated in boldface, while many of the other species are more tolerant of eutrophic, warmer conditions (see Frest and Bowler, [1991] and Frest and Johannes [1991]). An asterix proceeds the name of non-native taxa. Candidate or Federal Threatened or Endangered Species are indicated by a + before the taxonomic name. Federally listed Endangered or Threatened Species are indicated by an E or a T in bold print.

Aquatic Snails

Class Gastropoda (Snails)

Ancylidae

Ferrissia parallelus (Haldeman, 1841)

Ferrissia rivularis (Say, 1817)

Hydrobiidae

+*Fluminicola columbiana* Hemphill(in Pilsbry)1899

***Fluminicola hindsi* (Baird,1863)**

******Potamopyrgus antipodarum* (Gray, 1843)**

E*Pyrgulopsis (= Fontelicella) idahoensis* (Pilsbry, 1933)

T Undescribed genus (Bliss Rapids snail)

Lancidae

+*Fisherola nuttalli* (Haldeman, 1841)

E*Lanx* n. sp. (Banbury Springs lanx; Frest, in ed.) Lymnaeidae

Fossaria (Bakerilymnea) bulimoides (Lea, 1841)

Fossaria (B.) dalli (Baker, 1907)

Fossaria (F.) exigua Lea, 1841

Fossaria (F.) modicella Say, 1825

Fossaria (F.) parva(Lea, 1841)

Fossaria (F.) obrussa (Say ,1825) group
***Stagnicola (Hinkleyia) caperata* (Say, 1829)**
Stagnicola (S.) catascopium (Say, 1817)
Stagnicola (S.) hinkleyi (F.C. Baker, 1906)
**Radix auricularia* (Linnaeus, 1758)

Physidae
Physa mexicana (Phillippi, 1841)
EPhysa natricina* Taylor, 1988
Physella (Physella) gyrina (Say, 1821)
Physella (Costatella) integra (Haldeman, 1841)

Planorbidae
Gyraulus (Torquis) parvus (Say, 1817)
Planorbella (Piersoma) subcrenatum (Carpenter, 1857)
Promenetus exacuous (Say, 1821)
***Vorticifex effusus* (Lea, 1856)**

Valvatidae
***Valvata humeralis* Say, 1829**
EValvata utahensis* Call, 1884

Class Bivalvia (Clams)

Corbiculidae
**Corbicula fluminea* (Muller, 1774)

Margaritiferidae
***Margaritifera falcata* (Gould, 1850)**

Sphaeriidae
Musculium lacustre (Muller, 1774)
Musculium securis Prime, 1852)
Pisidium (Cyclocalyx) caesertanum (Poli, 1795)
***Pisidium (C.) compressum* Prime, 1852**
Pisidium (Neopsidium) insigne Gabb, 1868
***Pisidium (C.) nitidum*Jenyns, 1832**
***Pisidium (C.) pauperculum* Sterki, 1896**
Pisidium (N.) punctatum Sterki, 1895
Pisidium (C.) variabile Prime, 1852
Sphaerium nitidum Clessin, 1876
Sphaerium patella(Gould, 1850)
***Sphaerium striatinum* (Lamarck, 1818)**

Unionidae
+Anodonta californiensis* Lea, 1852
***Gonidea angulata* (Lea, 1839)**

Landsnails

Cochlicopidae
Cochlicopa lubrica (Muller, 1774)
Deroceras laeve (Muller, 1774)

Discidae
Discus cronkhitei (Newcomb, 1865)

Oreohelicidae
Oreohelix strigosa depressa (Cockerell, 1890)

Pupillidae
*Vertigo elatior*Sterki, 1892 [fossil, not living] Succineidae
Catinella gelida (Baker, 1927) [fossil, not living]
Oxyloma haydeni (Binney, 1858)

Valloniidae
Vallonia cyclophorella(Sterki, 1892)

Zonitidae
Hawaiia minuscula (Binney, 1840)

Zonitoides arboreus (Say, 1816)

There are numerous other landsnail taxa which likely occur along the Middle Snake River and its spring tributaries. There is at least one additional species of *Oxyloma* which occurs in the Middle Snake River and its tributaries, and *Vertigo idahoensis* and *V. concinnula* are widespread species which could inhabit the area (see Frest and Johannes [1992a] for additional discussion of landsnails).

Table 2. Non-native aquatic taxa occurring in warm-water hatcheries and the thermal plumes at their outfalls into the Snake River (adapted from Bowler and Frest, 1992).

Thiaridae
- **Tarebia granifera* (Lamarck, 1822)

Physidae
- **Physella* sp. (not native)

Planorbidae
- **Biomphalaria glabrata* (Say, 1818)
- **Biomphalaria havanensis* (Pfeiffer, 1839)
- **Marisa cornuarietis* (Linne, 1758)
- **Pomacea* sp. (several color forms)

There are a number of additional exotic species yet to be identified which occur in warm-water hatcheries in the area.

Table 3. Additional aquatic mollusc species occurring outside the mainstem Middle Snake River in the sub-basin.

Gyraulus "vermicularis"	Hot Creek, Bruneau River drainage (Bowler and Olmstead, 1991)
Lymnaea stagnalis appressa Say,1821	Silver Creek
Menetus callioglyptus (Vanatta, 1895)	In the system elsewhere
Musculium transversum (Say, 1829)	"
Pisidium (P.) idahoense Roper, 1890	"
Pisidium (C.) ferrugineum Prime, 1852	"
Pisidium (C.) lilleborgi Clessin, 1886	"
Pisidium (C.) rotundatum Prime, 1852	"
Pyrgulopsis bruneauensis Hershler, 1991	Thermal \endemic (Hot Creek)
Pyrgulopsis intermedia (Tryon, 1865)	Owyhee River drainage
Pyrgulopsis hendersoni (Pilsbry, 1933)	Harney and Malheur Lake drainages
Stagnicola (Hinkleyia) montanensis (F.C. Baker, 1913)	Taylor, Walter, and Burch (1963)

The Middle Snake River has a suite of coldwater lotic species which is now in severe decline; some are endemics (such as the Bliss Rapids snail) and others are disjuncts. This group was formerly characteristic of the mainstem river. There is an apparent shift in the mollusc fauna in the Middle Snake River from a predominance of coldwater, lotic species to species which are characteristic of warm, shallow lakes. Within the native fauna at least eight are endangered, with one apparently locally extirpated, six are declining, 11 species appear to be increasing (a guild of lentic taxa), and there is inadequate data to understand trends in the remainder. Among the lotic species are three Candidate, four Endangered, and one Threatened species. In general, the area from Milner Dam to Shoshone Falls is species poor. The reach from Shoshone Falls to Upper Salmon impoundment has a depauperate, declining lotic fauna shifting to a lentic suite of species. The reach from Lower Salmon Falls Dam to the Bliss impoundment and from Bliss Dam to around Clover Creek still has a nearly complete remnant of the historic lotic fauna, though it is decreasing in both of these reaches. The impoundments are depauperate, with few species represented. Sub-fossil shells and early collections indicate that the lotic fauna was present until recently at least to Shoshone Falls. The diversion of the Snake River at Milner Dam for the past 80 years makes reconstructing the historic fauna difficult, though a few of the lotic taxa characteristic of the lower Middle Snake River were collected from the area by early collectors.

The shift in the mollusc fauna from a coldwater, lotic group to warmer water, lentic taxa mirrors a similar transformation in the aquatic environment. Many factors have contributed to present conditions, ranging from irrigation diversions and return flows, aquaculture developments on tributaries, hydroelectric projects, dairies and confined feedlots, to municipal sewage. Seasonal algal and macrophyte blooms, and anoxic bottom conditions also have an impact on mollusc survival. An organic-rich blanket of silt covers most of the river bottom from Upper

Salmon Falls Dam to Shoshone Falls. In this reach species diversity is now low. In a study of fifteen sites Frest and Johannes (1991) found maximum species richness to range from 1 to 12 species, which is very poor considering a species pool of 42 taxa in the local fauna.

As Frest and Johannes (1991) noted in a study of three fastwater sites in this reach: "...The most notable mollusc faunal change from 1986 to the present is the tremendous expansion in numbers and distribution of the introduced *Potamopyrgus antipodarum*. The species was just becoming established in this stretch in 1986. It is now by far the most abundant species encountered in nearly all habitats....Areas of clear-water, cobble and boulder substrate habitat have decreased, while shallow water, soft-sediment habitats are now more widespread. Such areas often have reducing conditions, subsurface methane gas generation, and few live molluscs except for occasional sphaeriids....At best, present conditions are more like those of large, shallow lakes than of cold water rivers. As much of the endemic fauna of the Middle Snake River (including many of the candidates) is adapted to cold water river conditions, most cannot compete successfully under current conditions. Among the molluscs, large-scale faunal turnover appears to have begun."

"It should be emphasized that this stretch of the Snake River is now becoming marginal mollusc habitat, particularly for cold water species, including the stream-dwelling candidates. Faunal changes have been described

TABLE 4.
A summary of the distribution of selected freshwater mollusk species in the Middle Snake River. Snail species are underlined, clams are not; federal Candidate, Endangered, and Threatened species appear in bold. This Table incorporates data from Taylor's status reviews in the early 1980s, Frest and Johannes (1991, 1992a), and collections of early workers who found live animals at sites where these species no longer occur are listed with superscripts as follows: Hemphill, 1989 = H; J. Henderson, 1928 = J; Stanford, 1942 = S. The lower line for each species represents Taylor's record as of 1980–82; the upper line are records from the last couple of years.

SPECIES	Boulder Rapids, RM 597	Empire Rapids, RM 594.5	Kanaka Rapids, RM 592	Banbury Springs, RM 589	Below 1000 Springs	Upper Salmon Falls, RM 581	Malad River, 571.4	Bliss	Bliss Bridge, RM 566	Bancroft Springs, RM553	Clover Creek, RM 547.7	Alkali Creek	Indian Cove Bridge, RM 525.4	Indian Cove	C.J. Strike Reservoir, RM 517.6	Below Strike Reservoir	Grandview, RM 486.6	Walters Ferry, RM 442	Marsing, RM 424	Homedale, RM 414	Boise River	Nyssa	Weiser	TREND IN MIDDLE SNAKE
	BUHL REACH						HAGERMAN REACH			KING HILL REACH					(Below C.J. Strike Dam the river is still essentially sterile; *Physella gyrina* has recolonized the area.)									
Valvata humeralis	O				O +																			↓ End.
Pisidium compressum	O		+																					↑
				+	+				+	+		+	+				O		O	O		O[S]		
Sphaerium striatinum					+			O	+	+	O		O	O		+	O							↑
Pisidium pauperculum					+								O											?
Gonidea angulata	+	+	+					↓	+				+											↓
						+		O	+	+	+	+	+	O		O	O		O	O			O[J]	
Anodonta californiensis	+	+	+					↓	+				O											↓
				+	+	+		O	+	+		+	O	O									O[J]	
Margaritifera falcata	O			O		O	O						O				O			O			O[H]	↓ Ext.
						O							O											
Fluminicola hindsi	↓	↓	↓				↓	↓	↓	↓	↓		↓												↓ End.
					+	+	+	+	+	+	+	+	+	+			O	O	O	O		O[S]	+		
Vorticifex effusus	↓	↓	↓				↓	↓	↓	↓	↓														↓ End.
					+	+	+	+	+	+	+	+	+	+	+	+	O	O	+	O	+				
Stagnicola binkleyi								+	+																↓ End.
								+	+	+	+		O				O		O	O					
Pyrgulopsis idahoensis										O↓	?↓	O	O							O					↓ End.
										+	+	+	+			O	O	O	O	O					
Valvata utahensis		O	+		↓		O																		↓ End.
					+									O			O								
Bliss Rapids snail							+	↓	+	↓	+														↓ End.
								+	+	+	+														
Fisherola nuttalli	O		+,O					↓		↓															↓ End.
								+	+	+	O		O												
Physa natricina								↓	+		O														↓ End.
							O	+	+				O				O								
Potamopyrgus antipodarum	+	+	+	+	+	+	+	+	+	+	+		+		(Patchily present to Weiser, but not as far as Hells Canyon)										↑↑

above, as has the general rarity of cold water taxa and relative abundance of eurytropic native taxa and one introduced taxon. In [our] opinion, water quality has deteriorated since 1986. This is noticeable in the mollusc fauna

and also in the visually apparent massive increases in filamentous algae and in sediment influx in this stretch. With continued deterioration of water quality, the cold water fauna and all of the candidates and/or Snake River endemic taxa now present could soon be locally extirpated. If it is desirable to sustain the original river mollusc fauna, including candidate taxa, water quality should not be permitted to deteriorate further. Among other factors that could cause deterioration of water quality, decrease in flow, increase in nitrates, phosphates, or other forms of agricultural and piscicultural chemical pollution, and increases in siltation from any cause should be avoided."

Coldwater taxa formerly common and characteristic of the Middle Snake River which are now in rapid decline include species such as *Fluminicola hindsi* and *Vorticifex effusus* (see Table 4). The recently listed federal Endangered taxa are *Valvata utahensis*, *Pyrgulopsis idahoensis*, *Lanx* n. sp., and *Physa natricina*, and the Bliss Rapids snail was listed as Threatened. *Fisherola nuttalli*, *Fluminicola columbiana*, *Anodonta californiensis* are federal Candidate taxa. *Valvata humeralis*, historically known from much of the Middle Snake River, is now near local extinction. *Stagnicola (S.) hinkleyi*, a Snake River system endemic which our research indicates is endangered, had historic populations now apparently extirpated above Upper Salmon Falls, though a population still occurs in the reach below Lower Salmon Dam. *Margaritifera falcata*, a large clam found in abundance in Native American camps along the Middle Snake River, is now extirpated in this area of the river. *Fluminicola columbiana* has only been found living in the reach between Lower Salmon Dam and the Bliss impoundment, though it undoubtedly had an historic distribution up and down-gradient in the Middle Snake River.

In conclusion, the Middle Snake River has a remarkably diverse aquatic mollusc fauna of 42 species, among which those taxa requiring, cold, fast water settings are endangered or declining, with a concurrent increase in a group of more pollution-tolerant species characteristic of warm, shallow lakes. Eight living landsnail taxa have been identified from this area, and there are likely a number of additions which will be made to this preliminary list.

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PETERSEN, M.; CROWL, T. A. (The Ecology Center, Utah State University, Logan, UT)

Foodweb interactions of the endangered June sucker.

KEYWORDS: June sucker; gizzard shad; Utah; Utah Lake; competition; predation; exotic species

ABSTRACT

The June sucker *Chasmistes liorus* is an endangered fish endemic to Utah Lake, Utah. Increased human water usage and habitat disturbance have played a role in its decline; however, evidence suggests that the introduction of white bass *Morone chrysops* is also of major concern. In addition, other exotic species such as the gizzard shad *Dorosoma cepedianum* are currently being considered for introduction into this already devastated lake system. For the past two years, we have been conducting experiments to determine the feeding ecology, reproductive biology and general foodweb interactions of June sucker. Feeding experiments conducted in limnocorrals indicated that June suckers show very strong preferences for *Ceriodaphnia* and *Bosmina* two of the smallest daphnids available. While direct competitive interactions with gizzard shad were not strong, the potential exists for shad to alter the foodweb by changing phytoplankton species composition and size structure and altering the size structure of the zooplankton community. If the zooplankton community becomes dominated by large-bodied daphnids, it is unclear whether June suckers could effectively forage. In addition to the competition experiments, predation experiments were performed to test the hypothesis that white bass predation has a significant impact on sucker recruitment. We also wanted to predict how the possible introduction of gizzard shad may affect the predator/prey dynamics by considering prey switching possibilities. These experiments were conducted in 800 gallon tanks and suggest that predation on juvenile suckers and gizzard shad by white bass was limited only by gape size of the predator. Using a "gape-limitation hypothesis," a model of relative predation windows of gizzard shad and June sucker to white bass was formulated. Selectivity experiments were also carried out, showing that white bass fed preferentially on gizzard shad (Chesson's alpha 0.677) over June sucker (Chesson's alpha 0.322). We sue the results of all of these experiments to hypothesize a variety of possible scenarios in Utah Lake should additional fish introductions be carried out.

RESUMEN

RECEIVED TOO LATE TO BE TRANSLATED

MODDE, T.*; WICK, E. (TM - Colorado River Fish Project, U.S. Fish and Wildlife Service; EW - U.S. Park Service)

Status review of the razorback sucker, *Xyrauchen texanus*, in the upper Green River / Revisión de la situación actual del matalote jorobado, *Xyrauchen texanus*, en el Alto Río Verde

KEYWORDS: razorback; growth; survival; recruitment; population; discharge; Green River

ABSTRACT

Growth, recruitment and survival of razorback sucker in the upper Green River was reviewed using capture and recapture data collected from 1980 through 1992 by the CRFP. The population appears to consist of a declining number of older individuals with some indications of limited recruitment. Total population size has decreased 50% since 1988. Small but consistent growth occurred among individuals through time, yet, length frequency distributions of fish collected at a primary spawning bar has remained the same. The maximum time period between initial capture and recapture has continued to decline during the last ten years, however, the incidence of recapture on smaller individuals collected (those less than 475 mm) is significantly lower than larger individuals (greater than 475 mm). A significant positive correlation exists between the number of fish less than 475 mm and mean monthly discharge in the Green River during the month of May.

RESUMEN

Fue analizado el crecimiento, reclutamiento y sobrevivencia del matalote jorobado en el Alto Río Verde utilizando los datos de captura y recaptura, colectados desde 1980 hasta 1992 por el CRFP. La población aparentemente contiene una declinación en el número de individuos más viejos con algunos indicadores del límite de reclutamiento. El tamaño poblacional ha disminuido 50 % desde 1988. Un pequeño pero consistente crecimiento ocurrió entre individuos a través del tiempo, aunque, la distribución de frecuencias de longitud de los peces colectados en la barra de desove primaria ha permanecido igual. El período de tiempo máximo entre la captura inicial y la recaptura ha continuado declinando durante los últimos diez años, sin embargo, la incidencia de recaptura de individuos pequeños (menores de 475 mm) es significativamente menor que los individuos grandes (mayores de 475 mm). Una significativa correlación positiva existe entre el número de peces menores de 475 mm y la descarga media mensuales el Río Verde durante el mes de Mayo.

MUELLER, G.*; BURKE, T.; KAHL, J., JR.; HORN, M.; MARSH, P. C. (GM - Bureau of Reclamation, Denver, CO; TB and JK - Bureau of Reclamation, Boulder City, NV; MH and PM - Arizona State University, Tempe, AZ)

The collection of razorback sucker larvae (*Xyrauchen texanus*) using different light intensities in Lake Mohave, Arizona / La colección de larvas de matalote jorobado *Xyrauchen texanus* usando diferentes intensidades de luz en el Lago Mohave, Arizona

KEYWORDS: Colorado River Basin; larvae; light traps; razorback sucker; zooplankton; Lake Mohave; Odonata; Hemiptera; Bufonidae

ABSTRACT

The razorback sucker (*Xyrauchen texanus*) is a large endangered catostomid found in the Colorado River Basin. Sucker larvae are phototaxic until they reach approximately 14 mm in length. Researchers have generally used hand-held spotlights and aquarium dip nets to collect sucker larvae. Previous attempts using light traps have met with only limited success. PVC light traps were constructed and tested with four types of attractants: Cyalume light sticks (green), dry dog food, and two intensities (12 and 55 watt) of white light powered by 12-volt gel-cell batteries as a method of monitoring larval densities.

A total of 226 trap sets were completed representing a total of 1,327.6 trap hours of effort. Data showed sucker larvae were only attracted to white lights and did not respond to bait nor cyalume light sticks. However, other aquatic organisms, including Odonata (both Anisoptera and Zygoptera), Hemiptera, Bufonidae, and zooplankton were attracted to all light sources.

RESUMEN

El matalote jorobado *Xyrauchen texanus* es un catostómido grande en peligro encontrado en la Cuenca del Río Colorado. Las larvas de matalote son fototáxicas hasta que alcanzan aproximadamente 14 mm en longitud. Los investigadores han usado generalmente reflectores de mano y redes de acuario para colectar larvas de matalote. Se conocen intentos previos usando trampas de luz con limitado éxito. Se construyeron trampas de luz de PVC y se probaron con cuatro tipos de atrayentes: bastones de luz Cyalume (verde), comida para perros seca y dos intensidades (12 y 55 watt) de luz blanca proporcionada por baterías de celdas-gel de 12 voltios como método de monitoreo de densidades de larvas.

Se completaron un total de 226 juegos de trampas representando un total de 1327.6 horas de esfuerzo de trampa. Los datos mostraron que las larvas de matalote fueron sólo atraídas por las luces blancas y no respondieron a la carnada ni a los bastones de luz Cyalume. Sin embargo, otros organismos acuáticos, incluyendo Odonatos (Anisoptera y Zygoptera), Hemiptera, Bufonidae y zooplancton fueron atraídos por todas las fuentes de luz.

SMITH, D. M. (DMS - Zoology Department, Arizona State University)

Predator avoidance behavior in larval fishes / Conducta de evasión de depredadores en larvas de peces

KEYWORDS: larvae; schooling; Southwestern United States; predation; predator avoidance behavior; behavior; native; introduced; exotic

ABSTRACT

Larvae of native southwestern fishes (*Ptychocheilus lucius, Gila elegans* and *Xyrauchen texanus*) were compared to those native to the Mississippi River system (*Catostomus commersoni* and *Cyprinella lutrensis*) in selected aspects of predator avoidance. Larvae of southwestern fishes evolved in a depauperate fauna with few piscine predators, whereas those native to the Mississippi River system had long evolutionary experience with larger numbers of piscivorous species. It was therefore hypothesized that southwestern larvae would be more "predator naive," and exhibit a less elaborate and well developed set of predator avoidance behaviors. Results, however, showed a trend toward equal or greater expression of predator avoidance for southwestern larvae. This tendency was only mildly evident in terms of survival and in distance maintained from the predator, but was strongly expressed in schooling differences. So, with those species tested and in the parameters used in this study, the hypothesis of "naivete" of larvae of native southwestern fishes was not supported.

RESUMEN

Larvas de peces nativos al suroeste (*Ptychocheilus lucius, Gila elegans* and *Xyrauchen texanus*) fueron comparados con los nativos al sistema del Río Mississippi (*Catostomus commersoni* and *Cyprinella lutrensis*) en aspectos seleccionados de la evasión del depredador. Las larvas de los peces del suroeste evolucionaron en una fauna depauperada con pocos depredadores ictiófagos, a diferencia de las nativas al sistema del Río Mississippi que han tenido una larga experiencia evolutiva con mayores números de especies piscívoras. Por lo tanto fue hipotetizado que las larvas del suroeste serán más "ingenuas a depredadores", y exhiben un menos elaborado y bien desarrollado juego de comportamiento de evasión de depredadores. Los resultados, sin embargo, muestran una tendencia hacia una expresión igual o mayor de evasión de depredadores para larvas del suroeste. Esta tendencia fue sólo medianamente evidente en términos de sobrevivencia y en distancia mantenida hacia el depredador, pero fue fuertemente expresada en diferencias

de cardúmenes. Así, con las especies evaluadas y en los parámetros usados en este estudio, la hipótesis de "ingenuidad" de larvas de peces nativos del suroeste no fue confirmada.
[HUBBS STUDENT PAPER COMPETITOR]

VALDEZ, R. A. (RAV - BIO/WEST, Inc., 1063 W. 1400 N., Logan, UT)

Use of scales to determine emigration of juvenile humpback chub *Gila cypha* from the Little Colorado River in Grand Canyon, AZ / Uso de escamas para determinar emigración de juveniles del charalito jorobado en el Pequeño Río Colorado en el Gran Cañón, Arizona

KEYWORDS: humpback chub; *Gila cypha*; scales; Colorado River; Grand Canyon; aging

ABSTRACT

Scales from age groups 0, I, and II humpback chub *Gila cypha*, examined microscopically, revealed marks or checks believed to represent emigration from spawning and nursery areas in the Little Colorado River to the mainstem Colorado River in Grand Canyon. The checks were identified by closely-spaced and incomplete circular rings believed to be formed when individual fish descended from LCR temperatures of about 20 C to mainstem temperatures of 10 C. Aging was coordinated with length-frequency histograms. Determining timing and size of descent by young- and adult-humpback chub may reveal size-specific survival of emigrating chub.

RESUMEN

Escamas de grupos de edad del charalito jorobado *Gila cypha* examinados microscópicamente revelaron marcas o muescas que se cree representan emigración de áreas de desove a áreas de crianza en el Pequeño Río Colorado al cauce principal del Río Colorado en el Gran Cañón. Las muescas fueron identificadas por anillos circulares incompletos y cercanamente espaciados que se cree son formados cuando un pez individualmente desciende de temperaturas de 20 C en el PRC a temperaturas de 10 C en el cauce principal. La determinación de edad fue coordenada con histogramas de longitud-frecuencia. Determinando la época y talla del descenso de juveniles y adultos del charalito jorobado puede revelarse la sobrevivencia específica de los charalitos emigrando.

YOUNG, D. A.*; FRITZ, K. J.; GARRETT, GARY P.; HUBBS, CLARK (DAY - Bureau of Reclamation, Upper Colorado Regional Office, Salt Lake City, UT; KJF - Bureau of Reclamation, Rio Grande Projects Office, El Paso, TX; GPG - Texas Parks and Wildlife Department, Heart of the Hills Research Station, Ingram, TX; CH - Department of Zoology, The University of Texas at Austin, Austin TX)

Development of an endangered fish refugium channel at Phantom Lake Spring, Texas / Construcción de un canal de refugio para un pez en peligro de Extinción en el nacimiento del Lago Phantom, Texas

KEYWORDS: *Cyprinodon elegans*; *Gambusia nobilis*; Phantom Lake Spring; Texas; refugium

ABSTRACT

Two endangered fish species, Comanche Springs pupfish *Cyprinodon elegans* and Pecos gambusia *Gambusia nobilis* occupy Phantom Lake Spring, Texas. A Bureau of Reclamation water project currently diverts water from the spring for agricultural purposes. The concrete-lined diversion canal provides marginal habitat for native aquatic species while creating extensive low velocity, deep water habitat for predaceous species. A project supervised by the Rio Grande Fishes Recovery Team is currently underway to design, construct, and maintain an endangered fish refugium channel downstream of Phantom Lake Spring. The refugium is designed to maximize suitable endangered species habitat over a wide range of flows, exclude predaceous and other undesirable fishes, and minimize evaporative water losses to downstream water users. Discussion will include review of fish habitat criteria, design of refugium, utilization of a unique channel lining material, transfer of fishes, and long term management of the refugium.

RESUMEN

Las especies en peligro de extinción, cachorrito Comanche *Cyprinodon elegans* y pez mosquito de Pecos *Gambusia nobilis* ocupan el nacimiento del Lago Phantom, Texas. Un proyecto de agua del Buró de Reclamaciones actualmente desvía agua del nacimiento del lago para propósitos agrícolas. El canal de desviación de concreto proporciona hábitat marginales para especies acuáticas nativas, al crearse una baja velocidad extensiva, hábitat de aguas profundas para especies depredadoras. Un proyecto supervisado por el Equipo de Recuperación de Peces de Río Grande esta actualmente en vías de diseñar, construir y mantener un canal de refugio para especies en peligro, aguas abajo del nacimiento del Lago Phantom. El Refugio esta diseñado para maximizar hábitats adecuado para especies en peligro en un amplio rango de flujos, excluir depredadores y otros peces indeseables, y minimizar las pérdidas de agua por evaporación para usuarios del agua corriente abajo. En la discusión se incluirá una revisión de los criterios de hábitat, diseño del refugio, utilización de un material único de revestimiento para el canal, transferencia de peces, y un manejo del refugio a largo plazo.

YRURETAGOYENA, C. (Ecodes, S.P., Mexicali, B.C., México)

Hydrology of Cañon de Guadalupe, Valle de Mexicali, Baja California, México

KEYWORDS: hydrology; Cañon de Guadalupe; Baja California; México

ABSTRACT

NO ABSTRACT RECEIVED BUT PAPER PRESENTED

KENNEDY, T. B.*; VINYARD, G. L.; STERN, M. (TBK and GLV - Dept. of Biology, University of Nevada-Reno, Reno,NV; M. Stern-The Nature Conservancy, Portland,OR)

Drift behavior of Warner sucker larvae *Catostomus warnerensis* in the Warner Valley, Oregon / Comportamiento de deriva de larvas del matalote de Warner *Catostomus warnerensis* en el Valle Warner, Oregon

KEYWORDS: *Catostomus warnerensis*; Warner Valley; Oregon; larval drift behavior; drift nets; flow experiments

ABSTRACT

The drift behavior of Warner sucker larvae *C. warnerensis* was studied from 24 May to 3 July 1992 by sampling passive migration and by conducting flow experiments. Migration was assessed using drift net sets that were staked to the substrate, with nets positioned at various depths of the water column. Initial samples were collected during diurnal and nighttime hours at Twelve-mile creek (24-26 May). Additional samples were collected at night from the 3 major drainages of the Warner Valley on 3-4 June. Differences in larval fish catch among and within the 3 creeks are discussed. Five flow experiments were conducted from 30 May to 3 July after it was determined that samples from the drift nets may not be capturing larvae due to the heterogeneity of stream flow conditions. By manually placing larvae at the head of a run in both 12 mile and Honey creeks, I was able to track and quantify the extent of larval movement using snorkeling gear. Comparisons between mean distance traveled (m) and length of time spent drifting (s) are discussed.

These data are compared to other studies where larval sucker species are present and drift behavior may have been influenced by involuntary passive entrainment into the current of the watersheds. The behavior patterns of Warner sucker larvae in low flow conditions of the Warner Valley may allow for elucidation of active and passive processes.

RESUMEN

El comportamiento de deriva de la larva del matalote de Warner *C. warnerensis* se estudió del 24 de Mayo al 3 de Julio de 1992 muestreando la migración pasiva y mediante la realización de experimentos de flujo. La migración se evaluó usando equipos de redes de deriva que fueron anclados al substrato, con las redes puestas a diferentes profundidades en la columna de agua. Las muestras iniciales fueron colectadas durante el día y la noche en el arroyo Milla doce (24-26 de mayo). El 3-4 de junio se colectaron muestras adicionales en la noche en los tres mayores afluentes del Valle Warner. Se discuten las diferencias de las capturas de larvas de peces dentro y entre los tres arroyos. Se llevaron a cabo cinco experimentos de flujo del 30 de mayo al 3 de julio después de que se determinó que en las muestras provenientes de las redes de deriva no deberían estar capturándose larvas debido a la heterogeneidad de las condiciones del flujo del arroyo. Colocando las larvas manualmente en la cabeza de un rápido tanto en el arroyo Milla 12 y arroyo Miel, tuve la oportunidad de seguir la huella y cuantificar la extensión del movimiento larval usando equipo básico de buceo. Se discute la comparación entre el promedio de la distancia viajada (m) y el tiempo invertido en la deriva (s).

Estos datos se compararon con los de otros estudios donde se presentan larvas de especies de matalotes y donde el comportamiento de deriva puede estar influenciado por un entrada involuntaria pasiva dentro de la corriente de los cuerpos de agua. Los patrones de comportamiento de las larvas del matalote de Warner en condiciones de poco flujo en el Valle de Warner podrían permitir elucidar acerca de los procesos activos y pasivos de la deriva.

[HUBBS STUDENT PAPER COMPETITOR]

ACUCA, V. D.; GODÍNEZ RODRÍGUEZ, M. A.*; VAZQUEZ, S. M.; APAEZ, D. D. (Escuela Nacional de Ciencias Biológicas, I.P.N., Laboratorio de Ictiología y Limnología, México, D.F.)

Descriptive histology of the alimentary canal of *Goodea atripinnis* (Pisces: Goodeidae) / Histología descriptiva del tubo digestivo de *Goodea atripinnis* (Pisces: Goodeidae)

KEYWORDS: histology; alimentary canal; metabolic activity

ABSTRACT

The objective of this study is the histological description of the alimentary tract of *G. atripinnis* and its relationship to food habits. The digestive tract is macroscopically described and common histological techniques applied on sections of seven and the H-E technique applied. The histological structural plan of the alimentary canal is that common to all vertebrate groups. Analyses of the liver and pancreas reveal that this organism has a high metabolic activity canalized to obtain nutrients. Experimental observations support these conclusions.

RESUMEN

El objetivo es describir histológicamente el tubo digestivo de *G. atripinnis* y relacionarlo con sus hábitos alimentarios. Se describe macroscopicamente el tubo digestivo; se aplicó una tecnica histológica habitual, se revisaron cortes de siete y su posterior tinsión con la técnica H.E. Histológicamente el plan estructural del tubo digestivo es semejante a otros grupos de vertebrados; respecto al higado y pancreas su análisis revela que éste organismo tiene una actividad metabolica elevada canalizada para la obtención de alimento. Observaciones experimentada apoyan lo anterior.

CREEF, E. D.; CLARKSON, R. W. (EDC and RC - Research Branch, Arizona Game & Fish Department, 310 Lake Mary Rd., Flagstaff, Az.)

Movement patterns and habitat use of razorback suckers (*Xyrauchen texanus*) in the Verde River, Arizona / Patrones de movimiento y uso de hábitat de los matalotes jorobados (*Xyrauchen texanus*) en el Río Verde, Arizona

KEYWORDS: *Xyrauchen texanus*; radiotransmitter; Verde River; movement; habitat

ABSTRACT

Eighteen razorback suckers greater than 355mm in total length were implanted with radiotransmitters and released into the Verde River, Arizona from May 1991 through March 1992. Monitoring efforts on these fish were conducted from May 1991 through May 1992.

Radio-tagged razorbacks exhibited a mean downstream movement rate of 1.11 kilometers per week, and a mean upstream movement rate of 0.76 kilometers per week. Razorbacks were also found to exhibit diel differences in their movement patterns. They were more active during nighttime hours than during daylight hours. Razorbacks were found to preferentially utilize pool and glide habitats in the Verde River.

RESUMEN

A dieciocho matalotes jorobados mayores de 355 mm de longitud patrón se les implantaron radiotransmisores y se les liberó en el Río Verde, Arizona de Mayo 1991 a Marzo de 1992. Los esfuerzos de monitoreo de estos peces se llevaron a cabo de Mayo 1991 a Mayo de 1992. Los matalotes marcados presentaron movimientos río abajo a una taza promedio de 1.11 kilómetros por semana y un movimiento río arriba con una taza promedio de 0.76 kilómetros por semana. Se encontró que los matalotes también presentaron diferencias a lo largo del día en sus patrones de movimiento. Fueron más activos durante las horas de la noche que durante las horas de la mañana. Se encontró que los matalotes utilizan preferentemente posas y hábitat de deslizamiento en el Río Verde.

CALAMUSSO, B.* (USDA Forest Service, Carson National Forest, Taos, NM 87571)

Current distribution of *Catostomus plebeius* and *Gila pandora* on the Carson National Forest, New Mexico with preliminary comments on habitat preferences / Distribución actual de *Catostomus plebeius* y *Gila pandora* en el Bosque Nacional Carson, Nuevo México, con comentarios preliminares sobre preferencias de habitat

KEYWORDS: New Mexico; Catostomidae; Cyprinidae; *Gila pandora*; *Catostomus plebeius*; Forest Service

ABSTRACT

The first year of a two year field study on the distribution and habitat preferences of *Catostomus plebeius* and *Gila pandora* on the Carson National Forest was begun in June 1992. Both species were found to be confined to the Rio Grande Drainage. *Gila pandora* was sampled at a total of 24 sites (n=536) in seven watersheds. Two of these watersheds sampled were not listed in the historical record. *Catostomus plebeius* was sampled at 14 sites (n=149) in four watersheds. Historical records indicate that *Catostomus plebeius* was once found in six watersheds. Sampling in El Rito Creek and the Rio Grande Del Rancho found no evidence of *Catostomus plebeius*, although historical records indicate its presence. Subjective observations concerning population status of these species indicate that *Gila pandora* is stable while the population of *Catostomus plebeius* is decreasing as evidenced by its absence in two major watersheds. *Gila pandora* and *Catostomus plebeius* were found in association with the following species: *Salmo trutta*, *Oncorhynchus mykiss*, *Oncorhynchus clarki virginalis*, *Salvelinus fontinalis*, *Rhinichthys cataractae*, *Pimephales promelas*, *Platygobio gracilis* and *Catostomus commersoni*. It was noted that where large numbers of *Catostomus commersoni* were found, a non-native to the Rio Grande Drainage, *Catostomus plebeius* was either absent or found in few numbers. Further research is needed to determine if *Catostomus commersoni* is negatively impacting *Catostomus plebeius* populations. Gross habitat characteristics such as substrate and gradient were measured to qualify macrohabitat for both species. Both species were found to choose habitats with a gradient of 2% or less in association with a cobble/rubble/gravel substrate. In this habitat *Gila pandora* preferred pools while *Catostomus plebeius* selected riffle/runs.

RESUMEN

El primer año de un estudio de campo bianual sobre distribución y preferencias de habitat de *Catostomus plebeius* y *Gila pandora* en el Bosque Nacional Carson inició en Junio de 1992. Ambas especies se encontraron confinadas a la cuenca del Río Grande. *Gila pandora* fue muestreada en un total de 24 sitios (n=536) en siete cuencas. Dos de las

cuencas muestreadas no estuvieron listadas en los registros históricos. *Catostomus plebeius* fue muestreada en 14 sitios (n=149) en cuatro cuencas. Los registros históricos indican que *Catostomus plebeius* fue una vez encontrado en seis cuencas. Muestreos en Arroyo el Rito y el Río Grande del Rancho no encontraron evidencia de *Catostomus plebeius* aunque los registros históricos indican su presencia. Observaciones subjetivas concernientes a la situación actual de las poblaciones de estas especies indican que *Gila pandora* es estable aunque la población de *Catostomus plebeius* está decreciendo como es evidenciado por su ausencia en dos cuencas principales. *Gila pandora* y *Catostomus plebeius* fueron encontrados en asociación con las siguientes especies: *Salmo trutta*, *Oncorhynchus mykiss*, *Oncorhynchus clarki virginalis*, *Salvelinus fontinalis*, *Rhinichthys cataractae*, *Pimephales promelas*, *Platygobio gracilis* y *Catostomus commersoni*. Fue observado que donde se encontraron grandes números de *Catostomus commersoni*, un no-nativo a la cuenca del Río Grande, *Catostomus plebeius* estuvo siempre ausente o encontrado en bajos números. Se necesitan de investigaciones posteriores para determinar si *Catostomus commersoni* está impactando negativamente las poblaciones de *Catostomus plebeius* características generales de habitat como substrato y gradiente fueron medidos para cuantificar macrohabitat para ambas especies. Ambas especies fueron encontradas escogiendo habitats con gradientes de 2% o menos en asociación con substrato Guijarros/ piedra/grava. En este habitat *Gila pandora* prefiere pozas mientras *Catostomus plebeius* seleccionó corrientes/rápidos.

DOWLING, T. E.*; MINCKLEY, W. L. (TED and WLM - Department of Zoology, Arizona State University, Tempe, Arizona 85287-1501)

Mitochondrial DNA diversity within and among populations of the razorback sucker, *Xyrauchen texanus* / Diversidad del ADN mitocondrial dentro y entre poblaciones del matalote jorobado *Xyrauchen texanus*

KEYWORDS: mitochondrial DNA; genetic diversity; Colorado River; Catostomidae; *Xyrauchen texanus*

ABSTRACT

Restriction endonuclease analysis of mitochondrial DNA (mtDNA) was used to assess levels of genetic variation within and among major remaining populations of the razorback sucker: Lake Mohave, Lake Mead, Lake Powell, Green/Yampa Rivers, and upper Colorado River area near Grand Junction. This species was found to be highly diverse, exhibiting many mtDNA genotypes. The population from Lake Mohave was the most diverse, where most individuals exhibited a different genotype. Most fish from other populations possessed genotypes identical to those found in Lake Mohave; unique genotypes rarely found in other populations were similar to Lake Mohave genotypes. Diversity was reduced in a clinal pattern from south to the north as indicated by progressively fewer unique genotypes and reduction in diversity. This pattern could be explained by progressive reinvasion up the Colorado River following Pleistocene glaciation or a historic cline in effective population size, with larger populations to the south.

RESUMEN

Para medir la variación genética dentro y entre las poblaciones remanentes más importantes del matalote jorobado se usó el análisis de restricción de endonucleasa de ADN mitocondrial (ADN mt) en: Lago Mohave, Lago Mead, Lago Powell, Ríos Verde/Yampa y el área del alto río Colorado cercana a la Gran Unión. Estas especies se encontraron altamente diversas, exhibiendo muchos genotipos de ADN mitocondrial. La población del Lago Mohave fue la más diversa, donde la mayoría de los individuos exhibieron un genotipo diferente. La mayoría de los peces de las otras poblaciones tuvieron genotipos idénticos a los encontrados en el Lago Mohave; los genotipos únicos raramente encontrados en otras poblaciones fueron similares a los genotipos del Lago Mohave. La diversidad fue reducida en un patrón clinal desde el sur al norte como es indicado por los progresivamente menos genotipos únicos y reducción en la diversidad. Este patrón puede ser explicado por una reinvasión progresiva arriba en el Río Colorado siguiendo una glaciación pleistocénica o una clina histórica en tamaño poblacional efectivo, con grandes poblaciones en el sur.

FILIPSKI, A. J.*; DOWLING, T. E. (AJF and TED - GTX Corporation, 8836 North 23rd Ave., Phoenix, Arizona 85021 and Department of Zoology, Arizona State University, Tempe, Arizona 85287-1501)

Tests of models explaining patterns of mitochondrial DNA diversity among populations of razorback sucker by computer simulation / Pruebas de los modelos explicando de los patrones de la diversidad el ADN mitocondrial entre poblaciones del matalote jorobado mediante simulación por computadora

KEYWORDS: razorback sucker; *Xyrauchen texanus*; genetic; diversity; mitochondrial DNA; computer simulation

ABSTRACT

We use a stepping-stone migration model to test patterns of mitochondrial DNA diversity among razorback sucker populations as found by Dowling and Minckley. First, we summarize the data in the form of a matrix of kinship coefficients (probabilities of identity of mtDNA from each pair of demes), then use a combination of deterministic and stochastic computer models to estimate migration rates between adjacent demes. The models show that both null hypotheses (equilibrium panmixia and equilibrium isolated demes) are untenable, but that migration rates in the range

0 <= Nm < 10 can explain all aspects of the data except the high mtDNA diversity in the Lake Mohave deme. This anomalously high diversity is consistent with observations that the population there is in decline and consists only of older individuals. Simulations are presented which show that, in such a situation, the (Nei) diversity measure retains a high value despite a steady loss of genotypes from the population, and declines rapidly only when the population is near extinction. Finally, the models are used to demonstrate that hypothesized colonization events following the last ice age are compatible with, but not necessary for, this explanation of the diversity patterns.

RESUMEN

Utilizamos un modelo de "stepping-stone" para probar los patrones de diversidad de ADN mitocondrial entre poblaciones de matalote jorobado encontradas por Dowling y Minckley. Primero, sumarizamos los datos en la forma de una matriz de coeficientes de kinship (probabilidades de identidad del ADN mt para cada par de demos), después se utilizó una combinación de modelos computacionales estocásticos y determinísticos para estimar la tasa de migración entre demos adyacentes. Los modelos muestran que ambas hipótesis nulas (demos en equilibrio de panmixia y en equilibrio aislado) no son sustentables, pero que las tasas de migración en el intervalo 0 < = Nm < 10 pueden explicar todos los aspectos de los datos excepto la alta diversidad de ADN mt en el demo del lago Mohave. Esta alta diversidad anómala concuerda con observaciones de que la población allí está declinando y consiste únicamente de los individuos más viejos. Las simulaciones son presentadas de manera que muestran que, en tal situación, la mediad de diversidad (Nei) retiene un alto valor a pesar de una pérdida fija de genotipos de la población, y declina rápidamente sólo cuando la población esta cerca a la extinción. Finalmente, los modelos son utilizados para demostrar que los eventos de colonización hipotetizados que siguieron a la última glaciación son compatibles con, pero no necesariamente para, esta explicación de los patrones de diversidad.

COWDELL, B. R.*; VALDEZ, R. A.; MASSLICH, W. J.; WASOWICZ, T. (BRC, RAV, WJM, and TW - BIO/WEST, Inc. 1063 W. 1400 N. Logan, UT)

Effects of pulsed DC electroshock on adult roundtail chub / Efectos de descargas eléctricas pulsadas de DC sobre adultos de charal aleta redonda

KEYWORDS: roundtail chub; *Gila robusta*; Colorado River; electrofishing

ABSTRACT

Forty adult roundtail chub *Gila robusta*, captured by pulsed DC electroshock from the Colorado River near the Colorado/Utah state line, were analyzed for spinal injury using necropsy examination and X-ray photography. The electrofishing gear had a pulsed DC output of 120 V and 8 amps. No burns or abnormal behavior were noted immediately after electroshocking. Internal examination revealed hemorrhaging around the spine in 5% of the fish. No dislocated or splintered vertebra were observed in the X-ray photographs.

RESUMEN

Catorce charales aleta redonda *Gila robusta* adultos, capturados con descargas eléctricas pulsadas de DC en el Río Colorado cerca de la línea estatal Colorado/Utah, fueron analizados para observar lesión espinal utilizando examen por necropsia y fotografía de rayos-X. El equipo de electropesca registró una salida DC pulsada de 120 V y 8 amperios. No se observaron quemaduras o comportamiento anormal después de la descarga eléctrica. El examen interno reveló hemorragias alrededor de la espina dorsal en el 5% de los peces. No se observaron vértebras dislocadas o astilladas en las fotografías de rayos-X.

DOUGLAS, M. E.*; MARSH, P. C. (MED - Department of Zoology & Museum, Arizona State University; PCM - Center for Environmental Studies, Arizona State University;)

Monthly population estimates of endangered humpback chub (*Gila cypha*) in the Little Colorado River of AZ / Estimados poblacionales mensuales del charalito jorobado en peligro (*Gila cypha*) en el Pequeño Río Colorado de Arizona

KEYWORDS: humpback chub; population size estimation; movements; Little Colorado River; Grand Canyon; mark-recapture

ABSTRACT

Gila cypha (the humpback chub) is restricted in distribution to tight, canyon-bound reaches of the Colorado River and its tributaries. This fish achieves greatest abundance in the lower basin where it utilizes the Little Colorado River (LCR: a tributary of the Colorado River in the northern Grand Canyon) for spring reproduction and summer residence. However, the onset of its reproductive movements within this important river and its seasonal variance in population density remain unquantified and anecdotal. An understanding of these factors is clearly imperative for proper management of this endangered species. To remedy this, humpback chub were captured by hoop and trammel nets at monthly intervals from July 1991 to present in three study reaches of the LCR: the Confluence (from 0.0 to 1.4 km upriver); Powell Canyon (1.5 to 7.0 km above confluence on the Navajo Indian Reservation); and Salt Canyon (8.0 to 15.0 km above confluence on the Navajo Indian Reservation). Fish were PIT-tagged and standard monitoring data collected. Monthly

population estimates were derived from tag/recapture data by applying the best-fitting of 7 different models, using the computer program CAPTURE. For computational purposes, fish collected within each reach were considered to be from closed populations (i.e., with no immigration or emigration). This assumption is valid given the brevity of monthly sampling periods (i.e., from 6-8 days). During 1992, chub density peaked at the confluence during early March when adults staged for movement upriver but declined by May. Density at Powell Canyon peaked in late March and gradually declined into July, while density at Salt Canyon peaked in April and remained high through summer months. These data indicate that chubs migrate into the LCR during spring and remain in residence within upper reaches throughout summer.

RESUMEN

Gila cypha (charalito jorobado) está restringido en distribución a estrechas extensiones de saltos de cañones del Río Colorado y sus tributarios. Este pez registra su mayor abundancia en la cuenca baja donde utiliza el Pequeño Río Colorado (PRC: tributario del Río Colorado en el norte del Gran Cañón) para reproducción en primavera y residencia en verano. Sin embargo, el arranque de sus movimientos reproductivos en este importante río y su variación estacional en la densidad poblacional permanece sin cuantificar y anecdótica. Un entendimiento de estos factores es claramente imperativo para proponer el manejo de esta especie en peligro. Para remediar esto, el charalito jorobado fue capturado con trampas y redes de cerco en intervalos mensuales desde Julio de 1991 al presente en tres extensiones de estudio del PRC: la confluencia (desde 0.0 a 1.4 km río arriba); Cañón Powell (1.5 a 7.0 km arriba de confluencia en la Reservación India Navajo); y Cañón Salado (8.0 a 15.0 km arriba de la confluencia en la Reservación India Navajo). Los peces fueron marcados y colectados datos estándares de monitoreo. Estimados poblacionales fueron derivados de datos de recaptura de marcas aplicando el mejor ajuste de siete modelos diferentes, usando el programa computacional CAPTURE. Para propósitos computacionales, los peces colectados dentro de cada extensión fueron considerados provenientes de un población cerrada (i.e., con no inmigración o emigración). Esta suposición es válida dada la brevedad de los períodos mensuales de muestreo (i.e., 6-8 días). Durante 1992, la máxima densidad de charalitos en la confluencia fue durante los inicios de Marzo cuando la fase de adultos para movimientos río arriba, pero declinaron para Mayo. La densidad máxima en Cañón Powell fue a finales de Marzo y gradualmente declinó en Julio, aunque la densidad fue máxima en Cañón Salado en Abril y permaneció alta en los meses de verano. Estos datos indican que los charalitos migran al RLC durante primavera y permanecen en residencia en las extensiones altas a lo largo del verano.

VALDEZ, R. A.*; MASSLICH, W. J.; LEIBFRIED, W. (RAV and WJM - BIO/WEST, Inc., 1063 W. 1440 N., Logan, UT; WL - Leibfried Environmental Services, 9 1/2 Aspen, Suite 4, Flagstaff, AZ)

Present distribution of humpback chub *Gila cypha* in the mainstem Colorado River, Grand Canyon, Arizona / Distribución actual del charalito jorobado *Gila cypha* en el cauce principal del Río Colorado, Gran Cañón, Arizona

KEYWORDS: Humpback chub; *Gila cypha*; distribution; Grand Canyon; Colorado River

ABSTRACT

Ninety-five percent (1,324) of 1,392 humpback chub *Gila cypha* captured from the mainstem Colorado River in Grand Canyon, from October 1990 through June 1992, were found in a 13-km reach between River Mile (RM) 57 and 65, about equidistance upstream and downstream of the confluence with the Little Colorado River (LCR, RM 61.3). Bimonthly sampling conducted between RM 56 and 226 revealed that chubs were distributed between RM 57.0 and 221.8. Concentrations of chubs downstream of the LCR were encountered at Bright Angel Creek inflow (RM 87-88), Shinumo Creek inflow (RM 108-109), above Blacktail Canyon (RM 119-120), Middle Granite Gorge (RM 126-127), Havasu Creek inflow (RM 155- 157), and near Pumpkin Spring (RM 213-214). Present distribution of humpback chub in the mainstem Colorado River is compared with historic distribution.

RESUMEN

El noventa y cinco porciento (1324) de 1392 charalitos jorobados *Gila cypha* capturados en el cauce principal del Río Colorado en el Gran Cañón, de octubre de 1990 a Junio de 1992, fueron encontrados en un área de 13 Km entre las Millas 57 y 65 del Río (MR), equidistante arroyo arriba y arroyo abajo de la confluencia con el Pequeño Río Colorado (PRC, MR 61.3). Muestreos bimensuales conducidos entre MR 56 y 226 revelaron que los charalitos se distribuyeron entre MR 57.0 y 221.8. Se encontraron concentraciones de Charalitos arroyo abajo del PRC en al entrada Arroyo Angel Claro (MR 87-88), entrada a Arroyo Shinumo (MR 108-109), arriba de Cañón Cola Negra (MR 119-120), Barranco Granito del Medio (MR 126-127), entrada a Arroyo Havasu (MR 155-157) y cerca del Manantial Calabaza (MR 213-214). La distribución actual del charalito jorobado en el cauce principal del Río Colorado, se compara con la distribución histórica.

DEMARAIS, B. D.*; DOWLING, T. E. (BDD and TED - Department of Zoology, Arizona State University, Tempe, AZ, 85287-1501)

Introgressive hybridization and evolution of Colorado River basin *Gila* (Teleostei: Cyprinidae) / Hibridización introgresiva y evolución de *Gila* (Teleostei: Cyprinidae) de la Cuenca del Río Colorado

KEYWORDS: allozymes; mtDNA; *Gila*; introgression

ABSTRACT

Allozymes and mitochondrial DNA (mtDNA) were used to assess population and phylogenetic relationships among *Gila elegans*, *Gila cypha*, and stocks of *Gila robusta* from the Colorado River basin. Admixture of molecular markers diagnostic for these three species in stocks of *G. robusta* and discordance of phylogenetic topologies for allozymes and mtDNA resulted from introgressive hybridization. Examples of relatively recent as well as evolutionarily old hybridization have been identified; therefore, interspecific gene flow may have been an important evolutionary force that has contributed to morphological diversity in these fishes.

RESUMEN

Se analizaron aloenzimas y ADN mitocondrial (ADN mt) para evaluar las relaciones poblacionales y filogenéticas entre *Gila elegans*, *Gila cypha* y poblaciones de *Gila robusta* de la cuenca del Río Colorado. La mezcla de diagnóstico de marcadores moleculares para estas tres especies en poblaciones de *Gila robusta* y discordancia de topologías filogenéticas para aloenzímas y ADN mt resultaron como hibridización introgresiva. Ejemplos de hibridización relativamente reciente, así como evolucionariamente vieja ha sido identificada; por esto el flujo genético interespecífico ha sido una fuerza evolucionaria importante que ha contribuido a la diversidad morfológica en estos peces.

KUDA, D. B. (Department of Biological Sciences, Idaho State University, Pocatello, ID)

Shoshone sculpin *Cottus greenei* distribution, ecology, and reproductive biology / Distribución, ecología y biología reproductiva del coto Shoshone *Cottus greenei*

KEYWORDS: Sculpin; *Cottus greenei*; *Cottus bairdi*; sympatric; spawning; Thousand Springs; Snake River; Idaho

ABSTRACT

The Shoshone sculpin is found primarily in the spring systems of the Thousand Springs Formation that enter at the north bank of the Middle Snake River. *Cottus greenei* are sympatric with mottled sculpin *Cottus bairdi* in several of the springs entering along a 55 km section of the Snake River. Shoshone sculpin have been found to be capable of spawning more than once each year through direct observation.

RESUMEN

El coto Shoshone se encuentra principalmente en sistema de la Formación Thousand Springs que penetra al banco del norte del Medio Río Snake. *Cottus greenei* es simpátrica con el coto *Cottus bairdi* en varios de los manantiales que penetran de una sección de 55 Km del Río Snake. El coto Shoshone, se encontró a través de observación directa, es capaz de desovar más de una vez cada año.

[HUBBS STUDENT PAPER COMPETITOR]

STOCKWELL, C. A. (Program in Ecology, Evolution and Conservation Biology University of Nevada, Reno, NV 89557)

A RAPD assessment of genetic diversity within and between recently isolated populations of mosquitofish / Una evaluación RAPD de la diversidad genética dentro y entre poblaciones de pez mosquito recientemente aisladas

KEYWORDS: translocation; mosquitofish; *Gambusia affinis*; RAPD

ABSTRACT

The translocation of rare fishes has become a widely practiced conservation tool. However, the genetic consequences of this practice are not completely understood. Here, I report the genetic patterns of recently translocated populations of mosquitofish *Gambusia affinis*. Mosquitofish were first introduced to Nevada in 1934 (La Rivers 1962). Since that time many populations were established and have been isolated for over 50 years. I recently surveyed 4 of these populations for genetic diversity using the PCR based RAPD technique and compared these data against known introduction histories. These data are discussed with regard to the effects of translocation on population genetics.

RESUMEN

La traslocación de peces raros ha llegado a ser ampliamente practicada como herramienta de conservación. Sin embargo, las consecuencias genéticas de esta práctica no está entendida por completo. Aquí, reporto los patrones genéticos de poblaciones de pez mosquito *Gambusia affinis* recientemente traslocadas. Los peces mosquito fueron inicialmente introducidos en Nevada en 1934 (La Rivers 1962). Desde ese tiempo muchas poblaciones se establecieron y han estado aisladas por más de 50 años. Recientemente estudié cuatro de estas poblaciones para investigar sobre diversidad genética utilizando el PCR basado en la técnica RAPD y se compararon estos datos contra las historias

conocidas de introducción. Estos datos se discuten en referencia a los efectos de traslocación en la genética de la población.

[HUBBS STUDENT PAPER COMPETITOR]

GUTERMUTH, F. B.*; LENTSCH, L. D. (FBG and LDL Utah Division of Wildlife Resources)

Status of efforts and techniques used for June sucker *Chasmistes liorus* propagation / Estado de los esfuerzos y técnicas utilizadas para la propagación del matalote Junio *Chasmistes liorus*

KEYWORDS: June sucker; propagation; reproductive biology; Utah; *Chasmistes*

ABSTRACT

The Utah Division of Wildlife Resources (UDWR) initiated efforts to propagate June sucker *Chasmistes liorus* in the early 1980's. Adult spawners have been studied in the Provo River, a tributary to Utah Lake, since 1978. Progeny have been produced from spawning adults since 1985. Individuals from cohorts produced from gametes collected during 1985, 1987, 1989, 1991, and 1992 are currently being held in UDWR facilities. Age and growth analysis of adult spawners has indicated that senility may be an imminent threat to the population. Recruitment into the adult life stage has not been documented since studies on June sucker were initiated in 1978.

Because of the urgent need to preserve and recover the June sucker, the UDWR intensified and enhanced their propagation program in 1991. Components of the intensified program include: a) Capture of spawning adults in the Provo River through operation of a fish trap; b) Selective collection of gametes and adherence to specific breeding strategies for production of offspring; and c) Development of propagation facilities and techniques to enhance survival and growth of artificially produced progeny. This paper summarizes efforts by the UDWR to propagate June sucker and outlines specific details of the intensified program.

RESUMEN

La división de Recursos de Vida Silvestre de Utah (UDWR) inició esfuerzos para propagar al matalote de Junio *Chasmistes liorus* al inicio de los años ochentas. Los desovantes adultos han sido estudiados en el Río Provo, un tributario del Lago Utah, desde 1978. La progenie ha sido producida a partir de adultos desovantes desde 1985. Los individuos de cohortes producidas de gametos colectados durante 1895, 1987, 1989, 1991 y 1992 están actualmente mantenidos en las instalaciones de UDWR. El análisis de edad y crecimiento de adultos desovantes ha indicado que la senilidad puede ser una amenaza inminente para la población. El reclutamiento para los estadios de vida adultos no ha sido documentado desde que se iniciaron los estudios sobre el matalote de Junio en 1978.

Debido a la necesidad de preservar y recuperar al matalote de Junio, la UDWR intensificó e incrementó su programa de propagación en 1991. Los componentes del programa intensificado incluyen: a) Captura de adultos desovantes en el Río Provo por medio de la operación de trampas de peces; b) Colecta selectiva de gametos y adherencia a estrategias específicas de apareamiento para la producción de la generación; y c) Desarrollo de técnicas e instrumentos de propagación para incrementar la sobrevivencia y crecimiento de progenie producida artificialmente. Este artículo resume los esfuerzos de la UDWR para propagar al matalote de Junio y subraya los detalles específicos del programa intensificado.

MASSLICH, W. J.*; COWDELL, B. R.; VALDEZ, R. A. (WJM, BC and RAV - BIO/West, Inc., 1063 W. 1400 N. Logan, UT)

Radiotelemetry studies of humpback chub *Gila cypha* in the Colorado River, Grand Canyon, Arizona / Estudios de radiotelemetría del charalito jorobado *Gila cypha* en el Río Colorado, Gran Cañón, Arizona

KEYWORDS: radiotelemetry; humpback chub; Colorado River; Grand Canyon; diel movement; long range and local movements; vertical movement; movement

ABSTRACT

Radiotelemetry was used to study the movement and habitat use of humpback chub in the Colorado River, Grand Canyon, Arizona as part of the Glen Canyon Environmental Studies. A total of 48 radiotagged adults, implanted between October 1990 and September 1991, were used to evaluate magnitude and timing of long range and local movements relative to factors including time of year and river stage change. Vertical movement patterns were also evaluated relative to diel periodicity and turbidity. Telemetry studies involved sustained observations (24 to 48 hours) of one or more individuals, short term daily contact with numerous individuals, and monitoring via three remote telemetry stations.

Adult humpback chub exhibited a high degree of fidelity for specific river locales. Mean net displacement (direct horizontal distance from release point to last contact) for 48 radiotagged adults observed an average of 86 days (5-178 days) was 1.34 km (0-5.55 km), and mean gross displacement (sum of horizontal movements) was 4.23 km (0-16.33 km). Of these 48 fish, 83.3 percent exhibited net displacement of less than 2 km.

Near-surface local movement of radiotagged humpback chub appeared to be influence by time of day, changes in river stage, flow magnitude and turbidity. The fish were more active at night than in the day, with increased activity during periods of high turbidity. The effect of stage change on near-surface activity could not be identified conclusively since times of greatest flow change often occurred during crepuscular periods, when fish activity was usually greatest.

RESUMEN

Se usó radiotelemetría para estudiar el movimiento y uso de hábitat del charalito jorobado en el Río Colorado, Gran Cañón, Arizona como parte de los Estudios Ambientales de Cañón Glen. Un total de 48 adultos radiomarcadas colocadas entre Octubre de 1990 y Septiembre de 1991, fueron usados para evaluar la magnitud y época de los movimientos locales y de rango largo relativo a factores incluyendo época del año y cambio de estación. Los patrones de movimiento vertical también fueron evaluados relacionados a la periodicidad diaria y turbidez. Los estudios de telemetría involucran observaciones sostenidas (24 a 48 horas) de uno o más individuos, contactos diarios cortos con muchos individuos y monitoreo vía tres estaciones telemétricas.

Los adultos del charalito jorobado muestran un alto grado de fidelidad por ríos específicos locales. La media del desplazamiento red (distancia horizontal directa desde el punto de liberación a el último contacto) para 48 adultos radiomarcados muestra un promedio de 86 días (5-178 días) fue 1.34 Km (0-5.55 Km), la media del desplazamiento grueso (la suma de los movimientos horizontales) fue 4.23 Km (0-16.33 Km). De estos 48 peces, 83.3 porciento muestran desplazamiento red menor de 2 Km.

Los movimientos locales cerca de la superficie de charalitos jorobados radiomarcados parecen estar influenciados por la hora del día, cambios en la estación del río, magnitud del flujo y turbidez. Los peces fueron más activos en la noche que en el día, con un incremento en las actividades durante períodos de alta turbidez. El efecto de cambio de estación sobre las actividades cerca de la superficie pudo no haber sido identificada concluyentemente porque las épocas de mayor cambio de flujo frecuentemente ocurren durante períodos crepusculares, cuando las actividades de los peces fueron usualmente mayores.

GARDUÑO-FRANCO, J. C.; RUIZ-CAMPOS, G.*; ALANIS-GARCIA, J.; VALDES-GONZALEZ, A. (JCG-F, GR-C, and JA-G - Facultad de Ciencias, Universidad Autónoma de Baja California, Ensenada, B.C., México; AV-G - Facultad de Ciencias Biológicas, Universidad Autónoma de Neuvo León, San Nicolas de las Garza, Nuevo León, México)

Artificial spawning of San Pedro Mártir rainbow trout: *Oncorhynchus mykiss nelsoni* (Evermann) / Desove artificial de la trucha arcoiris de San Pedro Mártir; *Oncorhynchus mykiss nelsoni* (Everman)

KEYWORDS: *Oncorhynchus mykiss nelsoni*; rainbow trout; Sierra San Pedro Mártir; Baja California; México; Arroyo San Rafael; artificial spawning; growth rate; von Bertalanffy model

ABSTRACT

Oncorhynchus mykiss nelsoni, an endemic rainbow trout subspecies from the western slope of the Sierra San Pedro Mártir (Baja California, México) recently considered for the category of special concern (Williams *et al.*, 1989), was studied in *ex situ* reproduction experiments. Ripe trouts were captured in January 1992 in the Arroyo San Rafael and transported live to the laboratory for artificial spawning after hormone (HCG) injection. After 24-h the gametes (both sexes) were released by abdominal pressure and fertilized by means of the dry method. Eggs were incubated at 14.04 + 0.95 C and their development was registered daily. Larvae length was measured every third day. The hatch time was 23 days after fertilization and the yolk- sac absorption of larvae was registered 39 days post-fertilization. The daily growth rate of larvae was 0.46 mm and their growth parameters (von Bertalanffy model) were $k = 0.112$ and $t_o = -5.815$ ($r^2 = 0.813$). The time of hatching and yolk-sac absorption was very similar to that registered for others rainbow trout stocks in North America under the same experimental conditions.

RESUMEN

Oncorhynchus mykiss nelsoni, es una subespecie de trucha arcoiris endémica de la pendiente oeste de la Sierra San Pedro Mártir (Baja California, México) recientemente considerada en la categoría de interés especial (Williams *et al.* 1989), fue estudiada en experimentos de reproducción *ex situ*. Las truchas maduras fueron capturadas en enero de 1992 en el Arroyo San Rafael y transportadas vivas al laboratorio para el desove artificial después de inyectar hormonas (HCG). Después de 24 horas los gametos (ambos sexos) fueron liberados por presión abdominal y fertilizados por medio del método seco. Los huevos fueron incubados a 14.04 + 0.95 °C y su desarrollo fue registrado diariamente. La longitud de las larvas fue medida cada tercer día. El tiempo de eclosión fue de 23 días después de la fertilización y la absorción del saco vitelino de las larvas se registró 39 días posteriores a la fertilización. La tasa de crecimiento diaria de las larvas fue de 0.46 mm y sus parámetros de crecimiento (modelo von Bertalanffy) fueron $K = 0.112$ y $t_o = -5.815$ ($r_2 = 0.813$). El tiempo de eclosión y absorción del saco vitelino fue muy similar al registrado para otras poblaciones de trucha arcoiris bajo las mismas condiciones experimentales.

GOBALET, K. W. (KWG - Department of Biology, California State University, Bakersfield, CA)

Additional evidence for endemic fishes of California Central Valley in the coastal Pajaro-Salinas basin / Evidencia adicional para peces endémicos del Valle Central de California en la cuenca costera Pájaro-Salinas

KEYWORDS: Pajaro-Salinas; Sacramento-San Joaquin; California; *Ptychocheilus grandis*; *Gila crassicauda*; *Mylopharodon conocephalus*; *Pogonichthys macrolepidotus*; zooarchaeology

ABSTRACT

Though the Pajaro-Salinas River system of coastal central California is considered part of the Sacramento-San Joaquin ichthyological province, several expected species have not been found. Limited early surveys of the Pajaro-Salinas system that preceded catastrophic habitat alteration and exotic species introduction, failed to record thicktail chub *Gila crassicauda*, splittail *Pogonichthys macrolepidotus*, or hardhead *Mylopharodon conocephalus*. Prehistoric fish remains recovered from archaeological sites have proven useful in establishing fish distributions where contemporary surveys postdate extinctions or extirpations. In a previous study on fish remains from archaeological site MNT-229, formerly along the Salinas River, Gobalet (Copeia 1990: 680-685) documented the prehistoric presence of thicktail chub in the drainage. Two additional archaeological sites in the Salinas River drainage have been excavated (MNT-228, MNT-1570) and the fish remains examined in part to further confirm the native status of thicktail chub and to establish the presence of splittail and hardhead. Both archaeological sites date to 7,500 years before present and clearly predate the significant environmental perturbation of the last 140 years. Splittail remains have not been found though appropriate habitat for sympatric species as in the Sacramento-San Joaquin system was present. Splittail thus were extirpated prior to 7,500 years before present or were never present in the drainage. The lack of hardhead is considered inconclusive and the lack of diagnostic elements of the squawfish *Ptychocheilus grandis* has cast doubt on its native status. Overall, these archaeological sites contained remains of at least six freshwater, nine euryhaline and 17 marine species. The identification of sturgeon scutes *Acipenser* sp. suggests that sturgeons entered the former estuary of the Salinas River, an area where sturgeons are unknown today.

RESUMEN

Aunque el sistema Pájaro-Salina de la Costa Central de California es considerado parte de la Provincia ictiológica Sacramento-San Joaquín, algunas especies probables no han sido encontradas. Reconocimientos iniciales limitados del sistema Pájaro-Salinas, que preceden alteraciones catastróficas de hábitat e introducción de especies exóticas, fallaron en registrar charalito cola gruesa *Gila crassicauda*, cola dividida *Pogonichthys macrolepidotus* o cara dura *Mylopharodon conocephalus*. Restos prehistóricos de peces han probado ser útiles en el establecimiento de distribuciones de peces donde los reconocimientos contemporáneos son posteriores a extinciones o extirpaciones. En un estudio previo sobre restos de peces del sitio arqueológico MNT-229, anteriormente a lo largo del Río Salinas, Gobalet (Copeia 1990:680-685) documentó la presencia histórica del charalito cola gruesa en el drenaje. Dos sitios arqueológicos adicionales han sido excabados en la cuenca del Río Salinas (MNT-228, MNT-1570) y los restos de peces examinados en parte para confirmar la situación nativa del charalito cola gruesa y para establecer la presencia del cola dividida y el cara dura. Ambos sitios arqueológicos datan de 7,500 años antes del presente y claramente predicen la significativa perturbación ambiental de los últimos 140 años. Los restos del cola dividida no han sido encontrados en hábitat apropiado para especies simpátricas como están presentes en el sistema Sacramento-San Joaquín. Así el cola dividida fue extirpado antes de los 7,500 años antes del presente o nunca estuvo presente en la cuenca. La falta de cabeza dura es considerada inconclusa y la falta de elementos diagnósticos para el charal *Ptychocheilus grandis* ha causado duda sobre su condición nativa. En conjunto, estos sitios arqueológicos contienen restos de al menos seis especies dulceacuícolas, nueve euryhalinas y 17 marinas. La identificación de escudos de esturión *Acipenser* sp. sugiere que los esturiones entraron al antiguo estuario del Río Salinas, un área donde los esturiones son desconocidos hoy en día.

GODÍNEZ RODRÍGUEZ, M. A. (Escuela Nacional de Ciencias Biológicas, I.P.N., Laboratorio de Ictiología y Limnología, México, D.F.)

Current distribution of the family Goodeidae / Distribución actual de la familia Goodeidae

KEYWORDS: México; distribution; pollution; distributional changes; range reductions; Lerma-Santiago drainage

ABSTRACT

This family endemic to the Lerma-Santiago and adjacent drainage systems contains 38 species. The majority (16) are found in the Lerma-Santiago system. Others have localized distributions (Pánuco 3 species, Balsas 4 species, Armería-Coahuayana 4 species, Ameca-Magdalena 5 species). *Xenotoca variata* and *Goodea atripinnis* have the widest distributions. Habitat alterations (pollution) have had serious effects. Range reductions and distributional changes will be discussed.

RESUMEN

38 especies constituyen esta familia endémica originada y restringida al Sistema Lerma-Santiago y cuencas adyacentes; la mayor cantidad de ellas (16) se localizan en el sistema Lerma- Santiago, otras tienen una distributión local (Pánuco 3 especies, Balsas 4 especies, Armería-Coahuayana 4 especies, Ameca-Magdalena 5 especies). *Xenotoca variata*

y *Goodea atripinnis* son las de más amplia distribución. Se discutirán los graves efectos que la alteración de su habitat (contaminación) ha ocasionado, en especial de la reducción y cambios distribucionales.

VALDEZ, R. A. (RAV - BIO/WEST, Inc., 1063 W. 1400 N., Logan, UT)

Humpback chub studies in the mainstem Colorado River, Grand Canyon / Estudios de charalito jorobado en el cauce principal del Río Colorado, Gran Cañón

KEYWORDS: Grand Canyon; Colorado River; Glen Canyon Environmental Studies

ABSTRACT

A poster display will outline the current investigation by BIO/WEST, Inc. in the Grand Canyon as part of the Glen Canyon Environmental Studies.

RESUMEN

Se muestra en un poster las investigaciones actuales de BIO/WEST, Inc. en el Gran Cañón como parte de los estudios ambientales en el Cañón Glen.

MINUTES OF THE BUSINESS MEETING

Chairman's report on the Business Meeting
of the Desert Fishes Council

20 November, 1992 1900 hours

Mesa, Arizona

Members present:

Phil Pister - Executive Secretary
Jack Williams - Outgoing Chairman
John Rinne - Chairman elect

and about 60 members in the audience.

A. Treasurer's Report - Phil Pister

31 checks written to date in 1992

Income for the year:
$1,400 in royalties from the "Battle Against Extinction"
$1,500 from each US Bureau of Land Management and USDA Forest Service as per the MOU (below).
$2,000 from the late W.I. Follett

$16,975 is the DFC account balance as of the date of this business meeting.

FAX and photocopy machines were purchased this year for the Council's office.

A $750 contribution to the Council is anticipated to be received soon from the Arizona Game and Fish Department.

B. Proceedings Update - Dean Hendrickson

All abstracts will appear in English and Spanish. Translations to Spanish will be provided by the Translation Subcommittee, chaired by Alejandro Varela and officially sponsored the Centro Ecológico de Sonora.

Dean proposed leaving OmniPress to use recycled paper and obtain higher quality through another printer. The membership agreed. Dean will investigate.

Dean will obtain an ISSN number so that contents of the Proceedings might begin to be picked up by abstracting services.

Printed Proceedings will be mailed every year in about March or April of the year after the meeting along with the announcement of that year's meeting.

It was the consensus of the membership present <u>not</u> to publish material which was not presented at the annual meeting.

The Proceedings Committee will formulate a publications policy that will be published in the Proceedings.

A 31 December deadline will apply every year for arrival of abstracts and full papers to the editor.

Dean will continue as Chair of the Proceedings Committee.

C. Miscellaneous items - Phil Pister

1. Bill Berg proposed a membership directory to be published every 5 years in the Proceedings, with annual changes noted every year in the Proceedings. There was general agreement on this, and Bill agreed to produce and maintain the membership list.
2. DFC assisted Trout Unlimited on Federal Energy Regulatory Commission proposals and listing petitions on Bonnevile cutthroat trout.
3. Goose Lake Fish Committee - Marty Brittan has represented DFC, and many DFC members are represented in agencies involved in this.
4. Landfill near Joshua Tree (see 10/10/92 L.A. Times) is seen as a potential threat to Desert pupfish. The question of whether a Biological Opinion has been completed was asked. DFC will write a letter to Fish and Wildlife Service (Ventura office) to see if written authorization or a Biological Opinion has been completed.

5. Chevron Conservation Award - DFC sent a letter to Chevron questioning conservation biology considerations in the administration of these awards.
6. Patagonia Inc. requested information about DFC.

D. Resolutions

Three resolutions were proposed for approval of the Desert Fishes Council at the business meeting. The first, from the Aquatic Conservation Network, was not approved, as noted below, while the other two were unanimously approved.

Mr. Rob Huntley, of Aquatic Conservation Network, 540 Roosevelt Avenue, Ottawa, Ontario, Canada K2A 1Z8 (tel. 613/729-4670; FAX 613/729-5613; CompuServe 71022,3537; Internet: Rob@pinetree.org) proposed the resolution printed below regarding the Aquatic Conservation Network. Considerable discussion ensued, the membership indicated that it was not adequately informed regarding activities of ACN, and this resolution was not approved, but tabled until next year. It was suggested that the ACN provide additional information to the DFC regarding its own membership and mission, and, after doing so, once again propose the same, or modified, resolution at a future business meeting. It was suggested that ACN might make present a paper at next year's meeting regarding their activities. Mr. Huntley agreed, and on Dec. 1, 1992, provided the ACN Statement of Principles, which is also printed below, at his request and with the approval of the Executive Secretary.

Relative to professional/non-professional cooperation in aquatic conservation / Relativo a la cooperación profesional/noprofesional en conservación acuática

KEYWORDS: Aquatic Conservation Network; aquarists; conservation; captive breeding

RESOLUTION (NOT APPROVED BY THE DFC - PROVIDED FOR INFORMATION PURPOSES ONLY)

WHEREAS the professional, scientific resources available for the conservation and captive breeding of aquatic organisms are sufficient to respond to only a limited number of aquatic biodiversity issues; and

WHEREAS there is an apparent shift towards financial support of conservation work in the field, leaving captive breeding initiatives insufficiently funded; and

WHEREAS under proper guidance, non-professional aquarists (amateurs and hobby industry) could become a significant adjunct to existing conservation efforts; and

WHEREAS there is a requirement for improved communication between professional and non-professional aquarist activities; and

WHEREAS the Aquatic Conservation Network has established itself as a non-profit corporation representing aquarists who are dedicated to the preservation of aquatic life; therefore be it

RESOLVED that the Desert Fishes Council encourages the Aquatic Conservation Network to further enhance the exchange of information pertaining to threatened aquatic organisms and their habitats among professional and non-professional aquarists and fisheries specialists; and be it further

RESOLVED that the Desert Fishes Council supports in principle the initiatives of the Aquatic Conservation Network to advance non- professional aquarist participation in professionally guided programs in aquatic conservation.

RESOLUCION (NO APROBADA POR EL CONSEJO DE LOS PECES DEL DESIERTO)

CONSIDERANDO QUE los recursos profesionales y científicos para la conservación y reproducción en cautiverio de organismos acuáticos son suficientes para responder sólo un limitado número de asuntos de biodiversidad acuática, y

CONSIDERANDO QUE hay un aparente cambio hacia el soporte financiero del trabajo de conservación en el campo, dejando insuficientemente financiadas las iniciativas de reproducción en cautiverio, y

CONSIDERANDO QUE bajo una guía apropiada, los acuarístas noprofesionales (amateurs e industria de la afición) podrían ser un significativa auxilio a los esfuerzos de conservación existentes, y

CONSIDERANDO QUE hay exigencias para mejorar la comunicación entre actividades de acuarístas profesionales y noprofesionales, y

CONSIDERANDO QUE la Red de Conservación Acuática se ha establecido por si misma como una corporación no lucrativa que representa a acuarístas dedicados a la preservación de la vida acuática, y por esto queda

RESUELTO QUE el Consejo de los Peces del Desierto incita a la Red de Conservación Acuática a promover y mejorar el intercambio de información perteneciente a organismos acuáticos amenazados y sus hábitats entre acuarístas profesionales y noprofesionales, y especialistas en pesquerías; y queda además

RESUELTO QUE el Consejo de los Peces del Desierto apoya en principio las iniciativas de la Red de Conservación Acuática para encaminar la participación de acuarístas noprofesionales en programas profesionalmente guiados en la conservación acuática.

Aquatic Conservation Network
Statement of Principles

The Aquatic Conservation Network (ACN) is a non-profit corporation dedicated to conserving and preserving aquatic life, with particular emphasis on freshwater fish species survival. The organization provides a unique communications linkage between scientific, industry and amateur initiatives and publishes a quarterly bulletin "Aquatic Survival". In doing so, the ACN provides a single forum through which amateur and professional aquarists can share information and expertise, and where concerns regarding amateur and industry programs can be identified and addressed. Further, the ACN offers increased opportunity for the development of joint ventures between private individuals and the scientific community.

By working closely with technical and legal advisors, the ACN aims to develop professionally endorsed programs in species maintenance and conservation breeding; foster appropriate participation by private individuals; establish codes of appropriate behaviour; and make every effort to ensure that participating members operate in compliance with national and other regulatory processes and legal restrictions. The ACN is seeking to establish affiliations and consultative processes with scientific, industry and amateur groups in order to successfully carry out this mandate.

THE FOLLOWING TWO RESOLUTIONS WERE PASSED UNANIMOUSLY BY A VOTE OF THE COUNCIL MEMBERS IN ATTENDANCE AT THE BUSINESS MEETING

Resolution of the Desert Fishes Council, 1992-1: Relative to protection of inland freshwater fishes of the Los Angeles Basin / Resolución del Consejo de los Peces del Desierto, 1992-1: Relativo a la protección de los peces dulceacuícolas continentales de la Cuenca de Los Angeles

KEYWORDS: California; Los Angeles basin; San Gabriel River; Santa Ana River; management; habitat restoration

RESOLUTION - PASSED UNANIMOUSLY

WHEREAS seven species of inland freshwater fishes inhabited the Los Angeles Basin (Los Angeles, San Gabriel, and Santa Ana rivers, in the counties of Los Angeles, Orange, San Bernardino, San Diego, and Riverside) until the late 1940s, whereupon four were extirpated, primarily coinciding with the completion of the major flood control projects in the basin; and

WHEREAS four taxa remain in extralimital areas: steelhead (*Oncorhynchus mykiss*), Pacific lamprey (*Lampetra tridentata*), Pacific brook lamprey (*Lampetra pacifica*), and the endangered unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*); and

WHEREAS the three remaining cyprinoids, arroyo chub (*Gila orcutti*), speckled dace (*Rhinichthys osculus* ssp.), and Santa Ana sucker (*Catostomus santaanae*), all endemic to the area, maintained themselves in all three river drainages until the late 1980s; and

WHEREAS despite continued development of the basin, only slight restriction of the habitat occurred until the mid-1980s; and

WHEREAS the 1986-1991 drought severely restricted their habitat and precipitated other human activities that eliminated many populations such that only the combined east, north, and west forks of the San Gabriel River hold large, stable populations that are not in immediate danger of extirpation; and

WHEREAS only two or three small, remnant populations of arroyo chub remain in the Los Angeles River, and widely scattered remnant populations of all three species exist in the Santa Ana River; and

WHEREAS the California Department of Fish and Game has designated all three taxa as species of special concern, providing an element of protection; and

WHEREAS the U.S. Fish and Wildlife Service in 1985 outlined the plan for recovery of these taxa in the revised recovery plan for the endangered unarmored threespine stickleback; and

WHEREAS given the plethora of agencies with designs that will continue to impinge on the Los Angeles Basin, all three species are in danger of being completely extirpated in their native range; therefore be it

RESOLVED that the Desert Fishes Council, an international society dedicated to the protection of desert aquatic biota, urges the California Department of Fish and Game, U.S. Fish and Wildlife Service, U.S. Forest Service, and the County of Los Angeles to immediately implement protective measures to preserve what remains of the endemic freshwater fish fauna, as well as restoring portions of the Los Angeles and Santa Ana river drainages for re-establishment of stable populations of native fishes.

RESOLUCION - APROBADA POR UNANIMIDAD

CONSIDERANDO QUE siete especies de peces dulceacuícolas continentales habitaron la Cuenca de Los Angeles (Río Los Angeles, San Gabriel y Santa Ana, en los condados de Los Angeles, Orange, San Bernardino, San Diego, and Riverside) hasta los últimos de 1940, donde cerca de cuatro fueron extirpadas, primariamente coincidiendo con la terminación de los proyectos de control de flujo mayor en la cuenca, y

CONSIDERANDO QUE cuatro taxa permanecen en áreas extralimite: cara de acero (*Oncorhynchus mykiss*), lamprea del Pacífico (*Lampetra tridentata*), lamprea de arroyo del Pacífico (*Lampetra pacifica*) y el en peligro espinocho desarmado (*Gasterosteus aculeatus williamsoni*); y

CONSIDERANDO QUE los tres ciprinoideos restantes, charalito de arroyo (*Gila orcutti*); charalito moteado (*Rhinichthys osculus* ssp.) y el matalote de Santa Ana (*Catostomus santaanae*), todos endémicos al área, manteniéndose ellos mismos en las tres cuencas hasta los últimos de 1980, y

CONSIDERANDO QUE a pesar del continuo desarrollo en la cuenca, sólo pequeñas restricciones del hábitat han ocurrido hasta mediados de 1980, y

CONSIDERANDO QUE la sequía de 1986-1991 restringió severamente su hábitat y precipitaron otras actividades humanas que eliminaron muchas poblaciones tal que sólo las bifurcaciones este, norte y oeste del Río San Gabriel mantienen poblaciones grandes y estables que no están en inmediato peligro de extirpación; y

CONSIDERANDO QUE sólo dos o tres pequeñas poblaciones remanentes del charal de arroyo permanecen en el Río los Angeles, y que poblaciones remanentes ampliamente dispersas de las tres especies existen en el Río Santa Ana, y

CONSIDERANDO QUE el Departamento de California de Pesca y Caza ha designado las tres taxa como especies de concepción especial, proveyendo un elemento de protección; y

CONSIDERANDO QUE el Servicio de Pesca y Vida Silvestre de los Estados Unidos delineó el plan para recuperación de estos taxa en el plan de recuperación revisado para el peligro espinocho desarmado; y

CONSIDERANDO QUE dada la plétora de agencias con diseños que continúan tropezando en la Cuenca de Los Angeles, las tres especies están en peligro de estar completamente extirpadas en su rango nativo; y por esto queda

RESUELTO QUE el Consejo de los Peces del Desierto, una sociedad internacional dedicada a la protección de la biota acuática del desierto, apremia al Departamento de California de Pesca y Caza, El Servicio de Pesca y Vida Silvestre de los Estados Unidos, al Servicio Forestal de los Estados Unidos y al Condado de Los Angeles a implementar inmediatamente medidas de protección los remanentes de la ictiofauna dulceacuícola endémica, así como restaurar porciones de las Cuenca de los Ríos Los Angeles y Santa Ana para el restablecimiento de poblaciones estables de peces nativos.

Copies of DFC Resolution 1992-1 were sent to the California Department of Fish and Game, U.S. Fish and Wildlife Service, U.S. Forest Service, and the county of Los Angeles.

Resolution of the Desert Fishes Council, 1992-2: Relative to translation of abstracts for the Proceedings by the Centro Ecológico de Sonora / Resolución del Consejo de los Peces del Desierto, 1992-2: Relativo a la traducción de resúmenes para las Memorias por el Centro Ecológico de Sonora

KEYWORDS: Proceedings of the Desert Fishes Council; México; Centro Ecológico de Sonora; translations; Spanish language

RESOLUTION - PASSED UNANIMOUSLY

WHEREAS the Desert Fishes Council is an international, professional organization of biologists interested in the conservation of aquatic resources of desert ecosystems, and

WHEREAS a large part of the deserts of North America is in México, and

WHEREAS many members of the Desert Fishes Council reside and work in México and other Spanish-speaking countries, and

WHEREAS the mission of the Desert Fishes Council, "to preserve the biological integrity of North America's desert aquatic ecosystems and their associated life forms, to hold symposia to report related research and management endeavors, and to effect rapid dissemination of information concerning activities of the Council and its members," clearly is best served by bilingual publication of its Proceedings; therefore be it

RESOLVED that the Desert Fishes Council heartily thanks the Centro Ecológico de Sonora for its institutional-level assistance in coordinating the establishment and long-term administration of a translations subcommittee to assure that Spanish translations of all abstracts submitted to the Proceedings of the Desert Fishes Council are provided to the editor.

RESOLUCION - APROBADA POR UNANIMIDAD

CONSIDERANDO QUE el Consejo de los Peces del Desierto es una organización internacional y profesional de biólogos interesados en la conservación de recursos acuáticos de los ecosistemas del desierto, y

CONSIDERANDO QUE una gran parte de los desiertos de Norte América están en México, y

CONSIDERANDO QUE muchos miembros del Consejo de los Peces del Desierto residen y trabajan en México y otros países hispano-hablántes, y

CONSIDERANDO QUE la misión del Consejo de los Peces del Desierto, "preservar la integridad biológica de los ecosistemas acuáticos del desierto de Norte América y sus formas de vida asociadas, mantener un simposio para reportar estudios y esfuerzos relacionados al manejo, efectuar diseminación rápida de la información concerniente a actividades del Consejo y sus miembros" claramente es mejor servido por una publicación bilingüe de sus miembros; por lo tanto queda

RESUELTO QUE el Consejo de los Peces del Desierto agradece al Centro Ecológico de Sonora su asistencia a nivel institucional en la coordinación del establecimiento y administración a largo plazo del subcomité de traducciones para asegurar que las traducciones al Español de todos los abstracts sometidos a las memorias del Consejo de los Peces del Desierto sean proveídas al editor.

A copy of DFC Resolution 1992-2 was sent to the Dr. Samuel Ocaña, Director, Centro Ecológico de Sonora.

E. BLM/FS/DFC Memorandum of Understanding - Jerry Stefferud

A committee was established to investigate implementation procedures. On their committee, which will send recommendations to Phil Pister within 6 months are: Jerry Stefferud, Tina Tharalson, Tom Cain, Jack Williams, John Rinne, Jeff Simms, Roy Masinton and Cindy Deacon Williams.

F. Monitoring Committee - Jim Johnson

A committee was formed to investigate methods for monitoring fish populations. Jim Heinrich, Jack Williams, Salvador Contreras, Don Sada, John Rinne, Jim Johnson, Gail Kobetich, Paul Marsh and Steve Platania volunteered to serve on this committee.

G. Phoenix Zoo Award - W. L. Minckley

The Phoenix Zoo has proposed an award honoring the outstanding efforts of an individual in the field of desert fish conservation. W. L. Minckley will draft a letter for Phil in support of this award and offer the assistance of Desert Fishes Council in selecting the individual.

H. Program Committee - Phil Pister

Mike Douglas, Paul Marsh, Salvador Contreras (or anyone he might designate), Nadine Kanim, and Owen Gorman volunteered to serve on this committee to coordinate agency presentations, prepare the announcements of upcoming meetings, set deadlines for receipt of abstracts, assist those unable to provide electronic versions of abstracts, and schedule all paper presentations for all meetings. The committee will work with the Proceedings Committee.

I. Lake Havasu Fish Project - Chuck Minckley

Chuck Minckley will draft a letter and send it to Jack and Phil requesting that a native fish component be an integral part of this project.

J. Resolutions Committee

Walter Courtenay Jr. will continue as chair of this committee.

K. 1993 meeting

Salvador Contreras nominated Monterrey as the site, and the membership in attendance unanimously agreed. The 1993 meeting will be held at Universidad Autónoma de Nuevo Leon in Monterrey, Nuevo Leon, México.

L. Winner of the Hubbs Best Student Paper Award

The winner of this year's Carl L. Hubbs Best Student Paper award was Chris Altenbach of the Ichthyofaunal Studies Program, Department of Biology, University of New Mexico. There were no competitors for the Frances H. Miller award this year. The award was made immediately prior to adjournment of the general meeting, not at the Business meeting.

CONSTITUTION OF THE DESERT FISHES COUNCIL

ARTICLE I

NAME

The name of this organization shall be the DESERT FISHES COUNCIL, and shall be referred to as the Council in this document.

ARTICLE II

PURPOSE AND OBJECTIVES

Section 1. Purpose. Within the framework of an entity organized exclusively for charitable, educational and scientific purposes, including the making of distributions to organizations that qualify as exempt organizations under section 501(c)(3) of the Internal Revenue Code of 1954 (or the corresponding provision of any future United States Internal Revenue Law) the Council exists to provide for the exchange and transmittal of information on the status, protection, and management of desert fishes and their associated ecosystems. For the purpose of this Council the term "desert fishes" is intended to include any endemic fish or aquatic organism, be it species, subspecies, or race, that inhabits drainages of the North American deserts (Basin and Range Province) and additional drainage areas and endemic fishes as determined by the Council. These drainage areas are defined as, but not necessarily limited to: Bonneville; Interbasin (including White River); Death Valley; Oregon Lakes; Lahontan; Sonoran Desert-Mexico; Sonoran Desert-U.S. (including Gila River); Chihuahuan Desert-Mexico; Chihuahuan Desert-U.S. (New Mexico and Texas); Chihuahuan Desert-Isolated Basins; Lower Colorado; and Upper Colorado.

Section 2. Objective. To stimulate and support studies in all phases of life history, ecology, management and protection, recreational, and related intrinsic values of desert fishes, including studies of introduced or exotic species that may be detrimental to desert fishes.

Section 3. Objective. To provide a clearing house of information among all agencies, organizations, and individuals professionally engaged in work on desert fishes through appointment of work committees, preparation of bibliographies and abstracts, and related methods, when desirable.

Section 4. Objective. To function in a professional advisory capacity, where appropriate, on questions involving management, conservation, and protection of desert fishes, and to adopt such measures as shall tend to ensure the continued survival of desert fishes and the maintenance of their associated ecosystems in a natural state.

Section 5. Objective. To publish symposium proceedings and transactions of meetings in order to present current information on problems relating to the preservation of desert fishes and to commend outstanding action, by the public and professionally engaged individuals, supporting the purposes of the Council.

ARTICLE III

MEMBERSHIP

Any person or organization interested in or engaged in the management, protection, or scientific study of desert fishes, or some related phase of desert fish conservation, shall be considered eligible for membership upon application.

ARTICLE IV

OFFICERS

The officers of the Council shall be a Chairman, Chairman-elect, and an Executive Secretary, whose duties are described in the Bylaws.

ARTICLE V

MEETINGS

Annual Meeting. An annual meeting of the Council shall be held.

ARTICLE VI

MANAGEMENT

The Council shall be governed by an Executive committee.

ARTICLE VII

TAX EXEMPT STATUS

The affairs of the Council shall at all times be managed in such a way as to preserve and safeguard its tax-exempt status. Specifically, no part of the net earnings of the Council shall inure to the benefit of, or be distributable to its members, officers, or other private persons, except that the Council shall be authorized and empowered to pay reasonable compensation for services rendered and to make payments and distributions in furtherance of the purposes and objectives set forth in Article II hereof. No substantial part of the activities of the Council shall be the carrying on of propaganda, or otherwise attempting to influence legislation, and the Council shall not participate in, or intervene in (including the publishing or distribution of statements) any political campaign on behalf of any candidate for public office. Notwithstanding any other provision of these articles, the Council shall not, except to an insubstantial degree, engage in any activities or exercise any powers that are not in furtherance of the purposes and objectives of the Council.

ARTICLE VIII

DISSOLUTION

Section 1. Dissolution Defined. The Desert Fishes Council shall be deemed dissolved after a two-thirds vote favoring dissolution by the attending membership at any Annual Meeting and upon the cessation of all administrative functions, provided, however, that in no event shall said administrative functions continue for a period in excess of six months from the date of the dissolution vote.

Section 2. Obligations Upon Dissolution. The Dissolution Committee shall, upon the dissolution of the Council, and after paying or making provision for the payment of all of the liabilities of the Council, dispose of all of the assets of the Council exclusively for the purposes and objectives of the Council in such manner, or to such organization or organizations organized and operated exclusively for charitable, educational, religious, or scientific purposes as shall at the time qualify as an exempt organization or organizations under section 501(c)(3) of the Internal Revenue Code of 1954 (or the corresponding provision of any future United States Internal Revenue Law), as the Dissolution Committee shall determine. Any such assets not so disposed of shall be disposed of by the appropriate Court of the county in which the principal office of the Council is then located, exclusively for such purposes or to such organization or organizations, as said Court shall determine, which are organized and operated exclusively for such purposes.

ARTICLE IX

TAX EXEMPT STATUS - ADDENDUM

Notwithstanding any other provision of these Articles, the organization shall not carry on any other activities not permitted to be carried on (a) by an organization exempt from federal income tax under Section 501(c)(3) of the Internal Revenue Code of 1986 (or the corresponding provision of any future United States Internal Revenue law) or (b) by an organization contributions to which are deductible under Section 170 (c)(2) of the Internal Revenue Code of 1986 (or the corresponding provision of any future United States Internal Revenue law).

As revised to December 1, 1987.

DRK/lcs/0024U(4)

BYLAWS OF THE DESERT FISHES COUNCIL

ARTICLE I

MEMBERSHIP

Applications for membership shall be transmitted in writing to the Executive Secretary on forms provided by the Council.

ARTICLE II

MANAGEMENT

Section 1. Chairman. The Chairman shall have general direction of the Council officers. He shall appoint, with the assistance of the Executive Committee (Article III, Par. 4), Chairmen of all regular and special Committees, and he shall preside at meetings of the Executive Committee and Council and shall be ex-officio a member of all Committees.

Section 2. Chairman-elect. The Chairman-elect shall assist the Chairman in duties where needed. In the absence of the Chairman, or in the event of his inability to act, his duties shall be assumed by the Chairman-elect. The Chairman-elect shall assume the office of Chairman immediately following his installation as Chairman at the annual meeting held in an even year. He shall serve in the office of Chairman for approximately two years, terminating his duties at the conclusion of the next annual meeting held in an even year, at which time the current Chairman-elect shall assume the office of Chairman.

Section 3. Executive Secretary. The Executive Secretary shall serve as general business manager. He shall issue notices of annual or special meetings, and other materials distributed by the Council to its membership, and shall record the minutes of its meetings. He shall be responsible for receiving and disbursing all funds of the Council. A report concerning his activities of the preceding year, and an auditing of accounts for that year, shall be made by the Executive Secretary to the Council at its annual meeting, and at any time requested by the Chairman. In the event neither the Chairman nor the Chairman-elect can serve in their capacity, the Executive Secretary shall serve pro-tempore.

Section 4. Term of Office. The officers shall serve for approximately two years, be installed at the annual meeting, held in an even year, take office immediately thereafter and terminate their duties at the conclusion of the next meeting held in an even year.

Section 5. Vacancies. Vacancies among officers shall be filled by the Chairman, Chairman-elect or Executive Secretary, in the same order of successional responsibility previously indicated for the unexpired term of office. Should all offices be concurrently vacant, they shall be filled by majority vote of the Executive Committee.

Section 6. Nomination. The three-member Nominating Committee (Article III, Par. 6) shall present a slate of no more than two candidates for each elective position, namely Chairman, Chairman-elect, and Executive Secretary.

Section 7. Approval of Nominations. Prior approval shall be obtained from said candidates.

Section 8. Announcement of Nominees. The Committee's list of nominees shall be sent to the Executive Secretary and shall be included in the meeting program.

Section 9. Floor Nominees. Additional nominations from the floor may be placed on the Nominating Committee's slate at the time of the annual meeting. Such nominees must formally accept the nomination while present on the floor. No person can be nominated who is not present at the annual meeting.

Section 10. Balloting. When more than one nominee for an office has been nominated, written ballots shall be received from members present at the Annual Council Meeting by the Executive Secretary and shall be counted by the Executive Secretary and two members appointed by the Chairman. Balloting for an individual nominee (a single candidate for an office) may be taken by a show of hands or indicated by voice.

Section 11. Alternate. If the Executive-Secretary's office is being contested, the Chairman-elect will fill the obligations of Balloting.

Section 12. Election. The nominee receiving the largest number of votes (a plurality) shall be declared elected. No one may hold two elective positions simultaneously in the Council.

Section 13. Order of Business. The order of business at the Annual Business Meeting, unless changed by a majority vote of members present, shall be as follows:

1. Reading of the minutes of the previous meeting.
2. Reports of the Executive Secretary.
3. Reports of the Committees.
4. Election of Officers.
5. Old Business.
6. New business.

Section 14. Files. The Council shall maintain a file containing: Constitution and Bylaws, minutes of all meetings, correspondence pertinent to Council affairs, all committee reports, financial statements and records, and any other material judged by the Executive Committee as pertinent.

Section 15. Resolutions and Public Statements. Council members shall submit resolutions for consideration to the Resolutions Committee (Article III, Section 19, 20, 21, 22). These shall be accepted by the Committee and prepared for submission to the Council members 30 days in advance of the Annual Council Meeting. Information regarding previous actions taken by the Council may be issued by the Executive Secretary upon request.

ARTICLE III

COMMITTEES AND STAFF

Section 1. Appointments. The Chairman shall, with the help of the Executive Committee, appoint Chairmen of all regular standing and special committees, except that the Council Chairman shall appoint the chairman and members of the Nominating Committee.

Section 2. Committee Decisions. Decisions of a committee shall be inviolate, and any desired revision or change would have to be appealed.

Section 3. Appeal. Any appeal to change a committee decision shall have to come from the floor in the form of a motion, at the Annual Meeting, or at any special meeting called by the Chairman for this purpose.

Section 4. Executive Committee. Shall be composed of the officers of the Council and the immediate Past Chairman of the Council.

Section 5. Obligation. The Executive Committee shall conduct its affairs to conform with the provisions of the Constitution and Bylaws. The Executive Committee is authorized to act for the Council between meetings and shall report its interim actions to the members at the succeeding Annual Meeting. Any action of the Executive Committee may be overridden by a two-thirds majority vote of the attending membership.

Section 6. Nominating-Committee. Shall be composed of three members of the Council appointed by the Council Chairman.

Section 7. Obligation. (See Article II, Sections 6, 7, 8 and 9).

Section 8. Publicity Committee. Shall be composed of five members of the Council.

Section 9. Obligation. It shall be the responsibility of the publicity Committee to make public contact through news, radio and television media for publicity.

Section 10. Restriction. Publicity shall be restricted to Council action, programming, awards and announcements. At no time will publicity be released that would discredit any person or organization, a member, State Agency, Federal Agency, or educational institution.

Section 11. Arrangements Committee. Shall be composed of three members of the Council.

Section 12. Obligation. It shall be the responsibility of the Arrangements Committee to make necessary contacts to provide meeting places, accommodations and any arrangements that will promote the success of a meeting. Information pertaining to arrangements shall be given to the Executive Secretary 90 days prior to the meeting.

Section 13. Program Committee. Shall be composed of three members of the Council.

Section 14. Obligation. It shall be the responsibility of the Program Committee to develop an interesting and informative program and agenda for the Annual Meeting. The program agenda shall be given to the Executive Secretary 30 days prior to the meeting date.

Section 15. Constitution Committee. Shall be composed of the Council Chairman and Executive Secretary.

Section 16. Obligation. It shall be the responsibility of the Constitution Committee to draft changes and revisions in the Constitution and Bylaws and present these changes to the Council for vote at the Annual Meeting.

Section 17. Recommendations. Council members may recommend changes to the Constitution or Bylaws by submitting such changes to the Executive Secretary for Committee consideration.

Section 18. Acceptance. Constitution and Bylaws changes must be voted on and passed by two-thirds majority vote.

Section 19. Resolutions Committee. Shall be composed of three members of the Council.

Section 20. Obligation. It shall be the responsibility of the Resolutions Committee to draft resolutions in the accepted form and grammar, and present the resolution for discussion and vote. Resolutions shall be passed either by (l) majority vote of the assembled membership at the annual Council Meeting or (2) majority vote of the Executive Committee.

Section 21. Recommendations. Council members may recommend adoption of resolutions by submitting such to the Chairman of the Resolutions Committee at least 30 days prior to the annual Council Meeting.

Section 22. Limitations. Resolutions will be limited to subjects directly related to the management, conservation and protection of desert fishes or their habitat, or resolutions of gratuity or memorial.

Section 23. Proceedings Committee. Shall be composed of an editor and five assistants of his choice.

Section 24. Obligation. It shall be the responsibility of the Proceedings Committee to publish the annual proceedings.

Section 25. Technical Advisory Committee. Shall be composed of Council members as follows: The Executive Committee, 2 field biologists from separate States, 3 faculty members from educational institutions carrying on research on desert fishes, and 3 individuals selected from the membership at large.

Section 26. Obligations. It shall be the responsibility of the Technical Advisory Committee to the direction of the Chairman in providing assistance technical knowledge and expertise directed toward the serve at and preservation of the desert fishes, and to perform other duties as outlined in the Constitution.

Section 27. Selection. Technical Advisory Committee members shall be selected by the officers of the Council when necessary.

Section 28. Awards Committee. Shall be composed of four members of the Council.

Section 29. Obligations. It shall be the responsibility of the Awards Committee to evaluate and determine qualified Council members for consideration for any recognition deemed suitable to the cause.

Section 30. Dissolution Committee. Shall be an automatic committee and shall be composed of the existing officers of the Council and the Technical Advisory Committee.

Section 31. Obligation. (See Constitution, Article VIII).

Section 32. Miscellaneous Committees. Shall be appointed as needed to fulfill the desires of the Council in pursuing the Objectives and Purposes (See Constitution, Article II).

Section 33. Area Coordinators. Shall be appointed for each of the Great Basin drainage areas designated under the Constitution, Article II, Section 1.

Section 34. Obligation. It shall be the responsibility of the Area Coordinators to function in a liaison capacity between the Great Basin areas involved and the Executive Committee, and as Chairmen of subcommittees appointed by them with the approval of the Chairman assist in carrying out their responsibilities.

Section 35. Accountability. All Committees shall be accountable to the Council Chairman.

Section 36. Tenure. All committees shall serve until new Committees are appointed in their stead, or until the duties assigned have been discharged, in conformance to Article II, Section 4.

ARTICLE IV

MEETINGS

Section 1. Annual Meeting. The Annual Meeting of the Council shall be during the first three weeks of November, as determined by the Executive Committee.

Section 2. Location. The Annual Meeting shall be held at the location determined by the Executive Committee.

Section 3. Meeting Notice. Notice of such meetings shall be given to the Executive Secretary at least six months prior to the Annual Meeting. Council members shall be notified at least ninety days prior to the Annual Meeting.

Section 4. Quorum. The quorum shall be over 50 per cent of the indexed membership or 20 members, whichever is less.

Section 5. Meeting Rules. The rules contained in the latest revision of Roberts' Rules of Order shall govern the Council in all cases in which they are applicable, and in which they are not inconsistent with the Bylaws or the special rules of order of the Council.

Section 6. Special Meetings. Special meetings may be called as necessary by the Chairman or a majority of the full Council, and shall be called whenever requested in writing by 20 members of the Council.

Section 7. Minutes of Meetings. Minutes of all meetings shall be recorded by the Executive Secretary or any member designated by the Chairman. Minutes of Committee meetings shall be recorded by the designated Secretary of such Committee.

ARTICLE V

FINANCES

Section 1. Finance. Funds of the Council shall be under the supervision of the Executive Secretary.

Section 2. Disbursement. The Executive Secretary shall make no disbursements of the Council's funds, other than routine purchases, without authorization of the Chairman. The Executive Secretary shall deposit all funds of the Council in a bank approved by the Executive Committee, at frequent intervals, and in the name of the Council. The Executive Secretary shall balance the accounts at the end of each fiscal year and his report shall reflect the adjustments as required by the annual audit.

Section 3. Audit. An audit of the Council's financial status shall be made at the end of each fiscal year by the officers of the Council.

Section 4. Bond. The Executive Secretary need not be bonded.

Section 5. Funds. Funds shall be derived from dues, special assessments, work projects, and contributions.

Section 6. Dues. Annual dues shall be five dollars for student membership, fifteen dollars for full membership, and twenty-five dollars for sustaining membership, payable at the time of the annual meeting.

Section 7. Publication. The cost of producing and distributing the Transactions of the Council shall be covered through dues, the sale of copies, and contributions.

Section 8. Fiscal Year. The fiscal year Council shall end on September 30.

ARTICLE VI

AMENDMENTS TO THE BYLAWS

Bylaws may be adopted, amended or repealed at any annual business meeting by a majority vote of members present.

As revised to November 16, 1985.

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INSTRUCTIONS TO AUTHORS - PROCEEDINGS OF DFC

ELECTRONIC FORMAT - All abstracts and manuscripts **must** be submitted in electronic format. Deadlines for abstracts for the Annual Meeting are announced in mailings to the membership each year. Special arrangements for submission of hard copy only of abstracts (strictly for those without access to computers) may be made each year with the Chair of the Local Arrangements Committee who will set an earlier deadline for such submissions. Formats accepted include diskette (all DOS or Macintosh formats) or electronic mail. **Abstracts and manuscripts will be accepted in ASCII format only** and must be formatted as described below.

ASCII (American Standard Code for Information Interchange) format files are easily saved from almost any word processor. Often called "Text" or "Text only" files, they are simply files from which all program-specific formatting codes have been stripped. **Do not** send files saved in your word-processor's unique format (the default way of saving files). To save an abstract as an ASCII file, type text in your word processor, formatting as described below. If sending by E-mail, before saving ASCII file, set margins and/or font so all lines have < 80 characters. If sending a floppy, line lengths < 256 characters are acceptable. Instructions for some word processors follow (actual keystrokes are set in upper case, bold and italicized). If you use another program, consult its documentation.

Ami Pro v.2 (Windows) *SAVE AS, ASCII & CR/LF AT LINES & 8 BIT PC-ASCII*
MS Word(Mac)v.5 *SAVE AS,TEXT ONLY*;v.4-*SAVE AS,FILE FORMAT,TEXT ONLY*
MS Word(Windows) *TRANSFER SAVE,TEXT-ONLY-W-LINE-BREAKS*in*FORMAT*
WordPerfect(DOS)(v. 5.0/5.1) *CONTROL-F5* (=Text out), *T* or *1* (=DOS Text)
WordPerfect (Windows) *SAVE AS*, specify *ASCII TEXT (DOS)*
WordStar open non-document file (*N* from the menu), *CONTROL-Q-Q-B*

If submitting a file on floppy disk, name it **"DFCABSTR"** (if > 1 file being submitted on a single disk, use numeric extensions, e.g. DFCABSTR.01, DFCABSTR.02) and put your name and address, the **type of computer** you used (Mac or IBM), and **"DFCABSTR"** on disk label. If E-mail, put "DFC Abstract" in subject line. Receipt of E-mail submissions will be immediately acknowledged via return E-mail. Acknowledgement of receipt of floppy disks will be by ordinary mail. Submission of hard copy is not required, but encouraged since it could be useful if problems are encountered.

ABSTRACT FORMAT REQUIREMENTS - All information must be contained in 8 to 10 blocks (fields) of text **separated from each other by a blank line**. Abstract length is not limited, but recall the definition of "abstract" and the fact that space equals money. Also recall that translation of your abstract is provided by volunteers.

Since diacritical marks are not in the standard ASCII set of characters, use vertical bars (|) around single characters that need accents or other diacritical marks (e.g., "ma|n|ana" will be translated to mañana and "M|e|xico" will become México. All single characters bounded by vertical bars will be translated as in Spanish (áéíóúñ) unless special notice is given of exceptions by submission of highlighted hard copy. Italicized words or phrases should be surrounded by braces ({}), e.g. {Cyprinodon diabolis} = *Cyprinodon diabolis*. Each text string so bounded by braces in any part of the file will be placed in the taxonomic index, so any terms (to be italicized or not) which authors wish to have indexed in the taxonomic index should be bracketed. Do not include > 1 name or taxonomic index entry within a single set of brackets. Order, family, and other category names placed in brackets but not normally italicized will be indexed only. Characters bounded by the caret (^) symbol (e.g. ^superscript^) will be set as $^{\text{superscripts}}$ in final copy, and those bounded by underscores (e.g. _subscript_) will be set as $_{\text{subscripts}}$. Do not use these special characters anywhere in text where these special features are not to be invoked, and always use them in pairs (i.e. start and stop special features). See sample abstract below.

Use **mixed upper and lower case** text throughout (see example). Authors are responsible for checking spelling and grammar. Each line must start on the left margin (i.e. no leading spaces or tabs). **Single blank lines are required between text blocks (do not use multiple blank lines)** and, are allowable within text blocks only in the **abstract text** block. Text blocks must be in the order specified below. Blocks 1-8 are required. Follow instructions carefully.

1. The first block is to contain **complete mailing information** for the author making the presentation or person to whom correspondence should be addressed. Enter as multiple lines exactly as if addressing an envelope.
2. The second block is to contain the **list of authors** for the abstract. Each name is to be entered as surname, a comma, and initials, and (if applicable), another comma and other designation (e.g. Jr.). **Use a semicolon (;) to separate authors' names**, and follow all commas and periods with single spaces. Place an asterisk after name of person presenting paper. Maximum allowable number of authors is six.
3. The third block contains the **affiliations** (Department and Institution or Agency and Office, but not full mailing address) of all authors, in the sequence given in the preceding block of text. Authors' affiliations are to be separated by a semicolon, but use authors initials where possible to indicate multiple authors with the same affiliation.
4. The fourth text block contains the **title** of the presentation. Use mixed case text, **not** upper case only.
5. The fifth block of text contains the actual **abstract text**. Be sure to **always use full taxonomic names at least once for indexing purposes**. Bracketed strings containing periods will be italicized, but not indexed.
6. The sixth block contains **keywords** that describe the research. These will be used to compile a combined subject and geographic index for the Proceedings. Begin this block with "KEYWORDS: ", followed by up to 10 keywords (or key phrases) **separated by semicolons**. There is no need to place taxonomic terms here for indexing since, if they are bracketed elsewhere in the abstract, they will be indexed in the Taxonomic index.
7. The seventh block identifies the **type of presentation**. Begin with "PRESENTATION: ", then "ORAL" or "POSTER".
8. The eighth block determines the **session** in which the presentation will be made. Begin this block with "SESSION: ", then either the word "CONTRIBUTED" or "AGENCY". "AGENCY" refers to presentations made a individual designated by the office of a government or private agency to report on general activities of that office or complex of offices (e.g. a Region). "CONTRIBUTED" refers to reports on individual research or management projects, and not office-wide activity reports, even if the work was done by an agency employee.
9. (Optional) If the presentation is to be considered for a student paper **award**, include a ninth block beginning with "AWARD: " and either "HUBBS", "MILLER", or "BOTH". Eligibility requirements for these awards are given below.
10. (Optional) **other** text. Enter phone/FAX numbers and presentation needs here, but other information and comments are also welcome. Begin block with "OTHER: " then any text you wish. **There is no need for ANY written communication (e.g. Post-it notes, etc.) with submissions - all such extra communications should be entered here).**

ENGLISH/SPANISH - Abstracts will be accepted in either language or both. If submitting both, do so as a single abstract with English and Spanish versions of the title in the title block separated by " / " and with versions of the abstract separated by a blank line in the abstract text block (see sample abstract above). Your submissions will be translated and/or proofed by the Spanish Language subcommittee of the DFC Publications Committee, but please provide bilingual submissions if at all possible.

FULL-LENGTH MANUSCRIPTS - Full length manuscripts of papers or posters presented at the meeting will be accepted for publication in the DFC Proceedings. These must be submitted (to the same address as abstracts) in electronic format (as ASCII files). The deadline for submission of manuscripts of papers presented at annual meetings is December 31 of the year of the meeting. Contact the editor before preparing your manuscript to discuss format for figures and graphs. Other format guidelines follow those of *The Southwestern Naturalist*.

AWARDS - Competitors for the Carl L. Hubbs and Frances H. Miller student paper awards must be the sole author and presenter of the paper and enrolled as a student currently or during the 12 months prior to the presentation. The paper must be based on work done while a student. The Frances H. Miller award additionally stipulates that the recipient be a citizen of a Latin American country. Papers are evaluated by a panel of judges on basis of scientific rigor of research (40%), quality & style of presentation (30%), rigor of analysis and interpretation of data (15%), and quality and use of visual aids (15%). Copies of evaluation forms provided on request.

SAMPLE ABSTRACT

(sample as for floppy submission - reduce lines to < 80 characters for E-mail)

Johnny Fishseed
Agency of Fish and Wildlife Disbursement
Hatchery Row
Somewhere, New Mexico 87107

Fishseed, J. D.^*^;Growem, B. S., Jr.;Stockem, I.

JDF and BSG - Agency of Fish and Wildlife Disbursement, Main office, Somewhere, NM; IS - Arizona Department of Fish and Game, Regional Office, Littletown, AZ

Status of native fish production and stockings in rivers, streams, springs and other habitats all over the place / Estado actual de producci|o|n de peces y su distribuci|o|n a r|i|os, manantiales y otros habitats sobre toda la regi|o|n.

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KEYWORDS: stocking; propagation; New Mexico; Arizona; hatcheries; M|e|xico; Colorado squawfish; razorback sucker; pupfish

PRESENTATION: ORAL

SESSION: AGENCY

AWARD: HUBBS

OTHER: Hey Dean - how's it goin? The electronic abstract submission idea is great! But next time don't reduce the instructions to authors to microfische proportions. If problems, my phone/FAX are 1-800-FOR-FISH/1-800-FOR-FAST; need overhead projector; probably best schedule this at end of a session because it is likely that I'll have to cancel it if my agency travel request isn't approved. It would be nice to have it scheduled right after Jose's talk, since he'll be talking about monitoring of the fish we stock. See you in November.

INSTRUCCIONES A LOS AUTORES PARA LAS MEMORIAS DEL DFC

FORMATO ELECTRONICO - Todos los resúmenes y manuscritos **deberán** ser sometidos en formato electrónico. La fecha límite para los resúmenes para la Reunión Anual está anunciada en los envíos de correspondencia a los miembros cada año. Se harán arreglos especiales para someter mecanuscritos sólo de resúmenes (estrictamente para aquellos sin acceso a computadoras) cada año con el Presidente del Comite Local de Arreglos quien establecerá la fecha límite próxima de estas. Los formatos aceptados incluyen diskette (formatos DOS y Macintosh) o correo electrónico. **Los resúmenes y manuscritos serán aceptados sólo en formato ASCII** y deberán estar formatedos como se describe abajo.

Los archivos en formato ASCII (Código Americano Standard para Intercambio de Información) son fáciles de gravar casi cualquier procesador de palabras. Frecuentemente llamando a un archivo de "Texto" o "sólo de Texto" existen archivos sencillos en los cuales los códigos de formato de programa específico aparecen listados. **No envíe** archivos salvados en el formato de tu procesador de palabras(el camino de default de gravado de archivos). Para gravar un resumen como un archivo ASCII, escribe el texto en tu procesador de palabras formatea como se describe abajo. Si el envío es por Correo-E, antes de salvar el archivo ASCII, inicia márgenes y tipo para que tengan menos de 80 caracteres. Si envías un disco flexible, se aceptan líneas de menos de 256 caracteres. Se indican las instrucciones para algunos procesadores de palabras (teclas actuales están en mayúsculas, negritas y cursivas). Si usas otro programa, consulta la documentación.

Ami Pro v.2 (Windows)SALVA COMO,ASCII Y CR/LF EN LINEAS Y 8 BIT PC-ASCII
MS Word(Mac)v.5SALVA COMO,SOLO TEXTO;v4-SALVA COMO,FORMATO ARCHIVO,SOLO TEXTO
MS Word(Windows)SALVAR TRANSFER,SOLO-TEXTO-W-LINEA-BREAKSinFORMAT
WordPerferct(DOS)(v.5.0/5.1)CONTROL-F5(=Texto fuera),**T** o 1(DOS Texto)
WordPerfect(Windows)SALVA COMO, especificar **TEXTO ASCII (DOS)**
WordStarabrir archivo no-documento (N del menú), **CONTROL-Q-Q-B**

Si sometes un archivo en disco flexible, nómbralo **"DFCABSTR"** (si más de un archivo es sometido en un sólo disco, usa extensiones numéricas, ejem DFCABSTR.01, DFCABSTR.02) y pon tu nombre y dirección, el **tipo de computadora** que usaste (Mac o IBM), y **"DFCABSTR"** en la etiqueta del disco. Si usas Correo-E, pon "DFC Abstract" en la línea de asignación. La recepción de envíos por Correo-E será agradecida inmediatamente vía regreso Correo-E. el agradecimiento de envíos en discos flexibles se hará por correo ordinario. No se requiere el sometimiento de copias de disco duro, aunque será fomentado de ser necesario si se detectan problemas.

FORMATO DE REQUERIMIENTO DEL RESUMEN - Toda la información deberá estar contenida en 8 a 10 bloques (campos) de texto **separados de los otros por un renglón**. La longitud del resumen no está limitada, pero la anulación de la definición de "resumen" y de hecho el espacio, es igual a dinero.

Aunque los signos diacríticos no están en los caracteres ASCII standares, usa barras verticales () alrededor de un caracter que necesite acento u otro signo diacrítico (e.g., ma n ana, será traducido como mañana y M e xico será México. Los caracteres individuales rodeados con barras verticales serán traducidos al Español (áéíóúñ) a menos que un aviso especial muestre las excepciones por sometimiento de copia dura resaltada. Palabras o frases en cursivas deberán rodearse de llaves ({}), e.g., {Cyprinodon diabolis} = *Cyprinodon diabolis*. Cada texto encerrado por llaves en cualquier parte del archivo será puesto en el índice taxonómico, así cualquier término (sea en cursivas o no) que los autores deseen incluir en el indice taxonómico deberá estar entre llaves. No incluya más de un nombre o índice taxonómico dentro de un sólo juego de llaves. Sólo serán indexados ordenes, familias y otros nombres categóricos colocados en llaves pero no en cursivas. Caracteres rodeados por el símbolo ? (e.g. ?superíndice¿) será puesto como $^{\text{superíndice}}$ en copia final, y aquellos rodeados de códigos bajos (e.g. _subíndice_) serán puestos como $_{\text{subíndice}}$. No use estos caracteres especiales en ninguna parte del texto donde estos caracteres no sean invocados, y siempre use los en pares (e.g. rasgos especiales de inicio y alto). Ver resumen de ejemplo abajo.

Use **mayúsculas y minúsculas** a través del texto (ver ejemplo). Los autores son responsables de revisar la ortografía y gramática. Cada línea debe empezar en el margen izquierdo (e.g. sin espacios o tabuladores). **se requiere un renglón en blanco entre párrafos (no use renglones múltiples)** y está permitido sólo dentro de los párrafos del texto en el **texto del resumen**. Los párrafos de texto deberán ir en el orden especificado abajo. Se requieren de 1-8 párrafos. Siga las instrucciones cuidadosamente.

1.El primer bloque es para contener **información completa de la dirección** del autor que hace la presentación o persona a quien corresponda ser enviada. Escriba las líneas exactamente como si rotulara un sobre.
2.El segundo bloque es para contener la **lista de autores** del resumen. Cada nombre será escrito como apellido, una coma, e iniciales, y (si es aplicable) otra coma y otra designación (e.g. Jr.). **Use punto y coma (;) para separar los nombres de los autores**, y las siguientes comas y períodos con espacios simples. Ponga un asterisco después del nombre de la persona que presenta el trabajo. El máximo permitido de autores es seis.
3.El tercer bloque contiene la **afiliación** (Departamento e Institución o Agencia y Oficina, pero no la dirección completa) de todos los autores, en la secuencia dada en el bloque de texto precedente. La afiliación de los autores estará separada por un punto y coma, pero utilice iniciales donde sea posible para indicar muchos autores con la misma afiliación.
4. El cuarto bloque contiene el **título** de la presentación. Use mayúsculas y minúsculas, **no** sólo mayúsculas.
5. El quinto bloque del texto contiene el **texto del resumen**. Asegúrese de **siempre usar nombres taxonómicos completos al menos una vez para propósitos de índice**. Lo tecleado en llaves conteniendo períodos estarán en cursivas, pero no indexadas.
6.El sexto bloque contiene las **palabras claves** que describen la investigación. Esto será usado para compilar un índice de materias y geográfico para las Memorias. Inicie este bloque con "KEYWORDS: " seguido por más de 10 palabras claves (o frases claves) **separadas por punto y coma (;)**. Aquí no se necesita lugar para términos taxonómicos como si están las mismas palabras entre llaves en el resumen, serán incluidos en el Indice Taxonómico.
7.El séptimo bloque identifica el **tipo de presentación**. Inicie con "PRESENTATION: ", y luego "ORAL" o "POSTER".
8.El octavo bloque determina la **sesión** en la cual la presentación será hecha. Inicie este bloque con "SESSION: ", entonces la palabra "CONTRIBUTED" o "AGENCY". "AGENCY" se refiere a la presentación hecha por un individuo designado por la oficina de un gobierno o agencia privada para reportar sobre las actividades generales de la oficina o complejo de oficinas (e.g. una Región). La "CONTRIBUTED" se refiere a los reportes de un sólo investigador o manejador de proyectos, y no reportes de actividades de oficinas, aun si el trabajo fue hecho por un empleado de una agencia.
9.(Opcional) Si al presentación es considerada como un **premio** para presentación de estudiante, incluye un noveno bloque iniciando con "AWARD: " y después "HUBBS", "MILLER" o "AMBOS". Los requerimientos para estos premios se dan a continuación.
10.(Opcional) **otro** texto. Escriba número de teléfono/FAX y las necesidades de la presentación, pero información adicional y comentarios serán bien venidas. Inicia el bloque con "OTHER: " y luego el texto que quiera. **No se necesita NINGUNA comunicación escrita (E.G. notas adheribles, etc.) con los resúmenes sometidos - todas las comunicaciones deberán entrar aquí).**

INGLES/ESPAñOL - Los resúmenes serán aceptados en cualquiera de las dos lenguas. Si somete las dos, hágalo como un sólo resumen con versiones en Inglés y Español para el título en el bloque de título separado por "/" y con versiones del resumen separadas por un renglón en blanco en el bloque de texto del resumen (ver ejemplo de resumen abajo). Tus resúmenes sometidos serán traducidos y/o revisados por el Subcomité de Lenguaje Español del Comité de Publicaciones del DFC, pero por favor someta una versión bilingüe si es posible.

MANUSCRITOS COMPLETOS - Los manuscritos completos de trabajos o carteles presentados en la reunión serán aceptados para su publicación en la Memorias del DFC. Estos deben ser sometidos (al mismo nombre y dirección) en formato electrónico (como archivos ASCII). La fecha límite para someter los manuscritos de presentaciones orales de la reunión es Diciembre 31 del año de la reunión. Contacte al editor antes de preparar su manuscrito para discutir el formato para figuras y gráficas. Otras guías de formato pueden seguirse las de *The Southwestern Naturalist*.

PREMIOS - Los competidores para los premios Carl. L. Hubbs y Frances H. Miller para trabajos de estudiantes serán para sólo un autor y ponente del trabajo e involucrado como un estudiante actualmente o durante los 12 meses anteriores a la presentación. La presentación deberá estar basada en el trabajo hecho cuando es estudiante. El premio Frances H. Miller estipula adicionalmente que el receptor sea ciudadano de un país de América Latina. Los trabajos serán evaluados por un grupo de jueces sobre bases de rigor científico de investigación (40%), calidad y estilo de la presentación (30%), rigor en el análisis e interpretación de los datos(15%) y calidad de uso del material audiovisual. Se proveerán copias de las formas de evaluación bajo requisición.

RESUMEN DE MUESTRA

(muestra como para disco flexible - reduce a menos de 80 carácteres en cada línea para Correo-E)

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KEYWORDS: repoblamiento; propagación; granjas; M|e|xico; charal del Colorado; matalote jorobado; cachorrito

PRESENTATION: ORAL

SESSION: AGENCY

AWARD: HUBBS

OTHER: Hola Dean - ¿Que tal? ¡La idea de someter resúmenes electrónicos es buena! Mi teléfono y FAX son 1-800-FOR-FISH/1-800-FOR-FAST; necesito proyector de cuerpos opacos; probablemente el mejor horario es al final de una sesión porque parece que tendré que cancelar si mi agencia no aprueba mi petición de viaje. Estaría bien quedar colocado justo después de la de José, como el hablará del monitoreo de los peces que sembramos. Nos vemos en Noviembre.

INDEX TO AUTHORS

KEYWORDS INDEX

TAXONOMIC INDEX