# Desert Fishes Council

## 2002 Anual Meeting


## San Luis Potosí, SLP, México

# Contents

# Welcome to the Desert Fishes Council 34th Annual meeting!

For the second time in the history of the Desert Fishes Council, the city of San Luis Potosí has the honour of hosting its annual meeting, in this occasion it's 34th edition. In 1984, the DFC meeting was first held in San Luis Potosí (For the second time in Mexico). It was then the University of San Luis Potosí who hosted it, and the organization was then in charge of Dr. Nicolás Vázquez Rosillo.

My life long love and fascination for fish, and my admiration for the DFC, led me to join the organization several years ago. It was just natural I felt compelled to contribute in any way I could to help fulfil the Desert Fishes Council goal of preserving and understanding the desert fishes and their habitats. I feel honoured I have been given the responsibility by the DFC executive committee to organize the 2002 edition of the meeting.

This meeting is the result of the uninterested effort of many people. I want to thank the Desert Fishes Council executives endless support in the organization (I would hate to think they have to provide the same support given to me year after year). I want to thank my wife Patricia for her help, support and understanding, the beautiful logo, poster and the many designs she created for the occasion. I also want to thank Joseph Vilet for his enthusiasm and his help in putting together this meeting. as well as the many people involved in the several phases of it.

I hope all of you enjoy these days and this effort helps in some way the wonderful desert fish fauna and the people that loves it.

Sincerely

Juan Miguel Artigas Azas

# Program

## Wednesday:

| | |
|---|---|
| 01:00 PM | Hotel special rate starts |

## Thursday:

| | |
|---|---|
| 04:00 PM | Registration |
| 07:00 PM | Welcome cocktail |

## Friday:

| | |
|---|---|
| 07:00 AM | Restaurant open for breakfast |
| 08:00 AM | Congress opening |
| 08:15 AM | Presentations or Visit to city for companions |
| 01:00 PM | Visit to Zoo and Aquarium |
| 04:30 PM | Presentations |
| 07:30 PM | Dinner |
| 09:00 PM | City tour |

## Saturday:

| | |
|---|---|
| 07:00 AM | Restaurant open for breakfast |
| 08:45 AM | Presentations |
| 01:00 PM | Restaurant open for lunch |
| 05:00 PM | DFC Business meeting |
| 06:00 PM | Cash bar cocktail |
| 07:00 PM | Banquet |
| 08:00 PM | Banquet specials |

## Sunday:

| | |
|---|---|
| 07:00 AM | Restaurant open for Breakfast |
| 08:00 AM | Visit to El Aguaje or Visit to Rioverde valley |
| 01:00 PM | Return from El Aguaje |
| 07:00 PM | Return from Rioverde valley |

## Monday:

| | |
|---|---|
| 01:00 PM | Hotel special rate ends |

# Host city

Spanish language text courtesy by the Secretaría de Turismo de San Luis Potosi, more information can be found in the home page http://www.visitasanluispotosi.com.

## The City of San Luis Potosi

In March 1592, the wealthy mines of San Pedro were discovered and as there was no water in the mountains surrounding them, the workers settled in the San Luis Potosi valley. The surge was the origin for the town of San Luis, mines of Potosi, that was the name given then, in November 3, 1592. The name of San Luis was given to honor Louis, king of France, the mountain of Potosi in Bolivia gave it its second name. The city grew fast and in 1531 it was in wealth and importance the third city of the colony. The city title was given in 1556, confirmed by king Felipe IV of Spain in 1658.

## Location

The state San Luis Potosi is situated in the central part of the Republic of Mexico in between parallels 21°11' and 24°34' of north latitude and 98°23' and 102°14' of west longitude. The Tropic of cancer crosses the state it in the northern zone. San Luis Potosi territory, irregularly shaped, extend two thirds into the Mexican plateau.

The other fractions of it's extension are located in the Eastern Mother Ridge and the lowland plains of the gulf of Mexico. The state has a total surface of 62,848 square kilometers, which account for 3.2% of Mexico's total surface. San Luis Potosi is neighbor of nine states; to the north with Coahuila; Northeast Nuevo León and Tamaulipas; East with Veracruz, south with Guanajuato, Querétaro and Hidalgo; Southwest with Jalisco and west with Zacatecas.

The state is well connected with the most important points of Mexico. You can reach San Luis Potosi by road, using highway 57 México-Piedras Negras, highway 70 Tampico-Barra de Navidad, highway 49 San Luis Potosi-Torreon and highway 85 México-Nuevo Laredo.

San Luis Potosi city counts with an international airport with two runaways, hangars, garage, and plane renting facilities. Commercial routes include flights from Mexico city, Monterrey, Guadalajara, Houston and San Antonio.

Because of it's geographical characteristics, the state is divided in four regions; the Huasteca, Middle Zone, Center Zone and the high Plateau, this last the larger, covering two thirds of the state surface. the line of Tropic of cancer crosses the state in its northern extension.

The topography of San Luis Potosi resembles a huge ladder climbing from the Huasteca zone, belonging to the coast plains of the Gulf of Mexico to the Center Plateau, with an average altitude of 1,700 meters over sea level.

This last step is known as the High Plateau, which could be described like a series of wide plains interrupted by step ridges, which form part of the Eastern Mother ridge. The average altitude of these mountains is 2,000 meters over sea level and show a general orientation south-north. Some of these mountain chains get names like San Luis, San Miguelito, Venado, Ipoa and Catorce, where the highest point in the state is found, the so called Cerro Grande, which reaches to 3,180 meters over sea level.

## Weather

The weather in the state shows striking contrasts from rainy and warm in the Huasteca to cold and arid in the High Plateau, enclaved in the southern part of the Chihuahuan desert. The Eastern Mother ridge is a main factor in this weather diversity, as it forms an enormous barrier stopping the atmospheric humidity and reducing the rains in the High Plateau; Nevertheless, there is a rainy season starting in May and ending in November. The average annual temperature is between 18°c to 20°c. with a average maximum of 25.7°c and a minimum of 10.6°c. The air is clean, you can feel cold in the shade and the sun rays are very hot. It could be a great variation of temperature during the day and night and it could be specially warm in the afternoon, the nights are generally cool, in the summer with an average temperature of 24°c., with lower temperatures to be expected in the Autumn and Winter.

# Accommodations

## Rooms:

Accommodations for the 34th Desert Fishes Council meeting are provided at the host hotel, Fiesta Inn San Luis Potosí, at a reduced price.

## Rooms at special rate:

We had agreed to put apart a block of 55 double rooms - 20 single rooms at a special rate for the duration of the event, from November 13 to 18, as follows:

Single/Double room (Maximum 2 adults + 2 kids for room): $579.15 Pesos - $60.33 US Dollars.

There may however be a restriction in the number of rooms available on November 13. The price is given per room per night including taxes as current in May-02. The price in dollars is given taking into consideration an exchange rate current during late May-2002, and it is of course subject to exchange rate variations. Prices are fixed in Mexican Pesos.

Check in time is at 15:00 and check out time at 13:00 hours.

## Room reservations:

Room reservations can only be guarantee with credit card, providing number, expiration date, bank and name of holder. Credit cards taken are Visa, Master Card, American Express and Dinners Club.

· Reservations can be arranged by the following channels:
· Reservations in México: Phone number 01 800 504 5000 (Dialing from within México).
· Reservations in USA: Phone number 1 (800) FIESTA 1 (Dialing from within USA).
· Reservations in site: Phone number +52 (444) 822 1995 Ext 200.
· Reservations via e-mail: e-mail address pcfislp2@fiestainn.com.mx

Deadline to reserve and guarantee reservation is September 30, after that date the hotel reserves the right to cancel blocks of rooms or all remaining.

## Room cancellations:

Room cancellations should be done prior or during November 11. Other-

wise a one night room rate with taxes will be charged to guaranteeing credit card.

## Meals:

The host hotel provides buffet service in his nice restaurant "Café La Fiesta" (located inside the hotel installations) at a reduced price during the duration of the event, as follows;

| | | |
|---|---|---|
| Breakfast | $64.00 ($6.67 US) | From 7:00 to 12:00 am. |
| Lunch | $71.00 ($7.40 US) | From 12:00 to 5:30 pm. |
| Dinner | $71.00 ($7.40 US) | From 5:30 to 12:00 pm. |

Prices does not include tips, which are suggested to be 15% of consumption.

## Installations:

Fiesta Inn is a business class hotel located in San Luis Potosí hotel zone, five minutes away (by car) from San Luis Potosí historical center and 15 minutes away from San Luis Potosí international airport.

Fiesta Inn hotel offers to guests the following services:

· Swimming Pool
· Green areas with games for child
· Business center
· Meeting bowls
· Cradles
· Parking
· Gym
· Baby sitters
· Banquet room
· Tobacco store

For pictures and more information about the hotel you can visit their home page in English language.

## Hotel liaison:

The hotel liaison for the event is Liliana Espinosa Grimaldo, sales submanager of the local site of Fiesta Inn hotel chain.

# Events

## Welcome cocktail

A Welcome cocktail will be offered by the DFC to early arrivals after the onsite registration at Salon "E" at the host hotel Fiesta Inn on Thursday, November 14 at 7:00 pm., DFC courtesy drinks and Mexican canapés will be available and then bar service will be open for per drink pay.

## Zoo and Aquarium visit

On Friday, November 15 at 1:00 pm, just after the morning presentations, bus transportation will be ready to take us to The Mexquitic Zoo (30 minutes away from host hotel) that has arranged a guided visit and a Mexican lunch for DFC attendees, costs are included in registration. The Mexquitic Zoo, owned by Josep Vilet, is managed by his daughter María Eugenia Vilet. The zoo hosts an Aquarium of National fish, with populations of fish species extinct in the wild like *Zoogoneticus tequila* and *Skiffia francesae*. At 3:20 pm, the buses will be ready to take us back to the host hotel for the afternoon presentations.

## City tour

Friday dinner will be held in a downtown restaurant in colonial San Luis Potosí, with cost shared by attendees. A tour of colonial downtown San Luis Potosí will take place after dinner Friday night.

## DFC Business meeting

Host hotel Fiesta Inn has provided its bowl "E" for the Desert Fishes Council Business meeting to take place Saturday November 16 at 17:00 hrs. Saloon "E" has a capacity for 100 seated persons.

## Cash Bar

An hour prior the banquet there will be a cash bar available in one of the hotel lobbies for DFS meeting attendes to socialize.

## Banquet

Saturday evening at 7:00 pm the meeting banquet will take place at the host hotel Fiesta Inn Salon "La Fiesta". We have a choice of two menus available, as follows:

**Menu 1 (Beef)**

· Cream of sweet corn with chili strips (Not hot chili)
· Beef medallions with 3 sauces (lemon, mustard and black pepper)
· Mashed potatoes
· Three milks cake with peaches

**Menu 2 (Fish)**

· Tuna-stuffed avocado
· Fish fillet parmentier (with béchamel sauce and cheese)
· White rice with vegetables
· Ice cream cake

The menu includes water with different fruits.

## Banquet specials

***Celebrating Killifish with a Latin beat***

After dinner, we will have a special banquet presentation, Kit Stowell, a Killifish Specialist and retired Professor of Latin American Studies from San Diego, and also an accomplished harp player, has composed some Killifish songs on base on Latin-American rhythms that he will gracefully play for the audience.

***Ecoloasis, conservation through local action***

Dr. Stowell, will also discuss the non-profit organization "Ecoloasis", which was formed in an attempt to promote the protection of vulnerable killifish habitats by raising consciousness of the local human populations about the biological importance of the unique fish resources and the fragility of the habitats, and to promote captive maintenance of imperiled populations.

***Program of Conservation, Maintenance and Handling of Mexican Goodeids***

Omar Dominguez Domínguez, head of the Program for Conservation, Maintenance and Handling of Mexican Goodeids taking place at the Universidad Michoacana de San Nicolás de Hidalgo, will give an introduction to their program, running successfully from 1997, with the goal to keep a research line for conservation and sustainable use of the Goodeinae, the Mexican Goodeidae, many of them suffering from the same problems that face many fish in desert bodies of water. The universtity lab keeps healthy colonies of 39 of the 40 Goodeinae species. some of them aquarist donations and most collected in the wild by University staff. Some of the species kept are extinct in the wild. Initial Funds for the program were supplied by Fish Ark, an International effort by Aquarists to save endangered fish populations, headed by Ivan Dibble from England.

# Field Trips

Two field trips have been planned to take place during the Desert Fishes Council 2002 annual meeting. One is designed for people who plan to return home early Sunday afternoon, checking out the hotel on time Sunday. And a second longer field trip is intended for those who will return Monday morning. Both trips promise to be equally interesting.

## El aguaje, Rioverde valley

El Aguaje, Rioverde valley. *Photo by Juan Miguel Artigas Azas.*

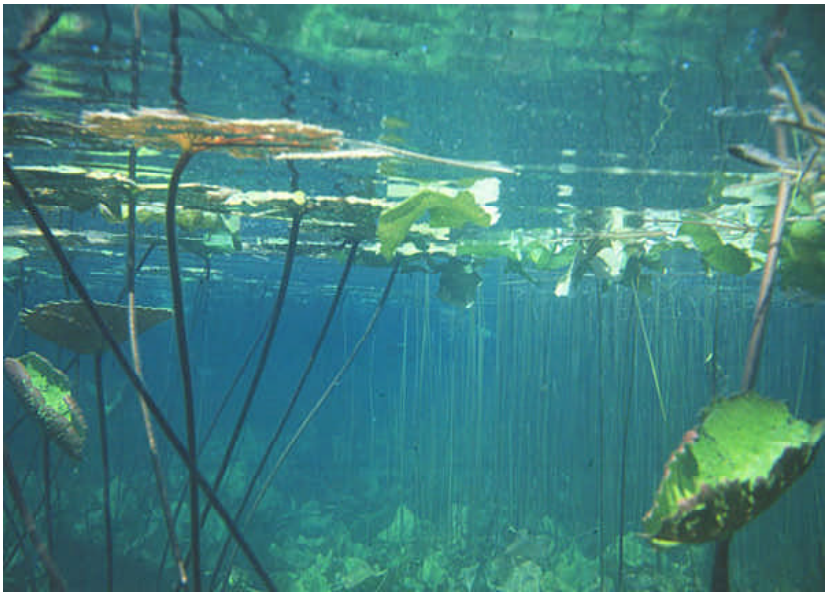
The little creek at El aguaje, near the town of Villa Juarez in the Rioverde valley, is part of the Rioverde fascinating aquatic ecosystem. It has its origin at the close by springs of Puerta del Rio and it is an excellent example of the beautiful and delicate habitats of the Rioverde valley. The species that can be found at the place are: The Poeciilid *Poecilia mexicana*; The Characinid *Astyanax fasciatus*; The Goodeid *Ataeniobius toweri* (endemic and monotypic), The Cyprinodontid *Cualac tesselatus* (endemic and monotypic), the cichlids *Herichthys labridens* (endemic form) and *H. bartoni* (Endemic); the Ictalurid *Ictalurus sp.* and the ubiquitous *Sarotherodon aureus* (introduced). The Rioverde valley is a fertile and a poorly exploited area for research purposes.

This trip is intended for DFC participants who have planned to return to

their places of origin by Sunday, November 17. The transportation will depart Sunday early morning (8:00 am) from the host hotel and will return around midday (13:00 hrs.)

In the town of Villa Juarez bottled water and refreshments are available, as well as junk food in the town's "tiendas". There is nice scenery for picture taking and an abundance of cactus for those interested in them.

## Media Luna Spring



Media Luna spring, *Photo by Juan Miguel Artigas Azas.*

The Medialuna spring is the biggest of the springs of the marvelous Rioverde valley, which is located some 180 kilometers (112 miles) east from the host hotel by a nice highway. The spring, with crystal clear and thermal waters holds a constant temperature of about 86°F (30°C) and has a total depth of 118 feet (36 m), so don't forget to bring your swimming suits, mask and snorkel for an unforgettable event. The spring hosts 13 species of fish, of which three are introduced and six are endemic to the Rioverde valley, two of those endemic species are monotypic. The species found Medialuna spring are: The Poeciilids *Gambusia atrora* (introduced); *Poecilia latipunctata* (Introduced); *Poecilia mexicana*; The Characinid *Astyanax fasciatus*; The Goodeid *Ataeniobius toweri* (endemic and monotypic), The Cyprinodontid *Cualac tesselatus* (endemic and monotypic), The Cypriniids *Dionda mandibularis* (endemic) and *D. dichroma* (endemic); the cichlids *Herichthys labridens* (endemic

form), *H. bartoni* (Endemic) and *H. carpintis* (introduced); the Ictalurid *Ictalurus sp.* and the ubiquitous *Sarotherodon aureus* (introduced). The Rioverde valley is a fertile and a poorly exploited area for research purposes.

This trip will take the full day, so we have to leave the host hotel early in the morning at 8:00 am to come back home after 7:00 PM. If time allows we will make a stop in another beautiful spring in the Rioverde valley at Puerta del Río (on the way), which shows a different frame with most of the valley species (but only one exotic).

We will have lunch at a restaurant in Rioverde, at Medialuna however, being a popular pic nic place. you can find small "tiendas" with all sorts of junk food and refreshments, as well as some souvenirs. There is nice scenery for picture taking and an abundance of cactus for those interested in them.

# Presentation schedule:

## Friday

8:00 DFC openning

*Phil Pister*

8:15 Area report: Oregon. (01)

*Reid, White, Horstman, Allen, Young, Munhall, Chappell.*

8:30 Area report: California. (02)

*Parmenter, SC, Bogan, MT, Bloom, R, Keeney, S & Konno, E.*

8:45 Area report: Nevada. (03)

*Cook, A.E.*; Martinez, C.T.; Sjoberg, J.S.; Goodchild, S.C.; Scoppettone, G.G.; Heinrich, J.E.; Clemmer, G.; French, J.*

9:00 Area report: Bonneville Basin. (04)

*Matthew E. Andersen*

9:15 Area report: Upper Colorado river. (05)

*Pfeifer, F., McAda, C, Birchell G., Propst D. & Modde, T.*

9:30 Area report: Lower Colorado river. (06

*Stefferud, S, Stefferud, J, Clarkson, R, Heinrick, J, Slaughter, J & Bettaso, R.*

9:45 Area report: Upper/Middle Rio Grande and Pecos Rivers. (07)

*Brooks, J, Propst, D, Dudley, R, Hoagstrom, C, Platania, S & Turner, T.*

10:00 Area report: Texas. (08)

*Edwards, RJ, Garrett, GP, Allan, NL & Hubbs, C.*

10:15 Area report: Northwestern Mexico . (09)

*Varela-Romero, A & Ruiz-Campos, G.*

10:30 Area report: Northeastern Mexico. (10)

*Contreras-Balderas, AJ, Lozano-Vilano, MDL, García-Ramírez, M.E.*

10:45 Coffee break

11:00 Discovery of a new population of *Dionda diaboli.* (11)

*Garrett, GP , Edwards, RJ, Hubbs, C*

11:15 Evolutionary functional ecology of the pharyngeal jaw polymorphism in the cichlid fish *Herichthys minckleyi* (12)

*Hulsey, CD & García de León, F.*

11:30 How effective are of constructed barriers at protecting Apache trout? (13)

*Robinson, A*

11:45 Pecos bluntnose shiner: size-related habitat use. (14)

*Hoagstrom, CW*

12:00 Chemical removal of green sunfish (*Lepomis cyanellus*) from O'Donnell Creek, Arizona. (15)

*Blasius, HB*

12:15 Fish need water! Low flow impacts on the native fishes of the Virgin River. (16)

*Golden, ME & Holden, PB*

12:30 Differences in swimming ability and behavior in response to high water velocities among native and nonnative fishes of Arizona. (17)

*Ward, DL , Schultz, AA & Matson, PG*

12:45 Continuing loss of Pecos pupfish populations via hybridization. (18)

*Echelle, AA & Echelle, AF*

13:00 Lunch break

16:30 The High Levee Pond, a native fish habitat located on the lower Colorado River. (19)

*Minckley, CO, Thorson, M, Mueller, G & Carpenter, J.*

16:45 A case of rapid evolution of body shape for the White Sands pupfish? (20)

*Collyer, MC & Stockwell, CA.*

17:00 Vegetation preferences of fountain darters and response to temporary habitat loss from flooding. (21)

*Robertson, MS & Oborny, EO.*

17:15 Oxygen Isotopes in Otoliths Document Gulf Corvina Use Colorado River Habitat (22)

*Rowell, K, Flessa, KW & Dettman, D.*

17:30 Coffee break

17:45 The fishes from Norogachi, Chihuahua region. (23)

*Espinosa, HP, Daza, AC & Hendrickson, AH.*

18:00 Current and potential future effects of reservoir fluctuations on the Lake Mead razorback sucker population, 1996 - 2002. (24)

*Abate, PD, Holden, PB & Welker, TL.*

18:15 Distribution, Status and Conservation of the Sonoyta Mud Turtle

(*Kinosternon sonoriense longifemorale*). (25)

*Knowles, GW, Paredes-Aguilar, R, Hall, DH, Riedle, DR, Rorabaugh, JC & Rosen, PC*

18:30 Effect of the Introduced Western Mosquitofish (*Gambusia affinis*) on the Least Chub (*Iotichthyes phlegethontis*). (26)

*Mills, MD, Belk, MC & Rader, RB.*

18:45 Comparison of the distribution and recapture rates of acclimated and non-acclimated subadult razorback sucker *Xyrauchen texanus* stocked into the Green River, with observations on the feasibility of larval razorback sucker growth and survival with nonnative fishes in floodplain wetlands. (27)

*Modde, T, Birchell, G & Christopherson, K.*

## Saturday

9:00 Standard sampling of desert fish: benefits, recent progress, and a call for action. (28)

*Bonar, SA & Didenko, A.*

9:15 Truchas mexicanas: An international partnership for the study of native trout of southern north America. (29)

*Mayden, R.L.*

9:30 The role of sexual selection in hybridization: evidence for assortative mating between Comanche Springs pupfish and Sheepshead minnow. (30)

*Tech, C.*

9:45 Exotic trout removal from a Sierra Nevada high mountain lake complex using non-chemical means with subsequent responses by native fauna. (31)

*Kiddoo, P.*

10:00 Molecular systematics of the darter subgenus Oligocephalus, with an emphasis on the Southwestern Darter group. (32)

*Lang, NJ, Mayden, RL.*

10:15 Profound physiological differences between Cuatro Cienegas pupfish species: evidence from a reciprocal transplant experiment and implications for hybridization. (33)

*Carson, EW.*

10:30 Impacts on a population of the White River spinedace (*Lepidomeda albivallis*) from predation by double crested cormorants

(*Phalacrocorax auritus*). (34)

*Sjöberg, JC, Hobbs, B, Nielsen, B.*

10:45 Evaluación de la fertilidad y crecimiento de un cruzamiento dialélico completo de dos lineas (*Oncorhynchus mykiss nelsoni* X *O. mykiss*). (35)

*Zamora Balbuena, G.*

11:00 Coffee break

11:15 Participación del Instituto Nacional de la Pesca en la revisión y actualización del marco Legal e institucional que regula la disponibilidad, administración, aprovechamiento, manejo y cuidado del recurso agua. (36)

*De La Garza Montaño, MC, Fuentes Mata, P.*

11:30 Jewel cichlid, *Hemichromis guttatus*, an exotic fish eradicated from Poza San José Del Anteojo, Cuatro Ciénegas Valley, Coahuila, México. (37)

*Lozano-Vilano, MDL, García-Ramírez, ME & Contreras-Balderas, AJ.*

11:45 Can the invasive species, *Gambusia affinis*, eat young-of-the-year least chub? (38)

*Rader, RB, Mills, M & Belk, MC.*

12:00 Range contraction, spatial dynamics, and bilateral asymmetry in the Coahuilan Box Turtle (*Terrapene coahuila* : Emydidae). (39)

*Howeth, JG & Hendrickson, DA.*

12:15 Roundtail Chub in the Lower Colorado River Basin - Present Status and Future Conservation. (40)

*Voeltz, JB & Bettaso, RH.*

12:30 Rio Grande Silvery Minnow, *Hybognathus amarus*, and other Fishes of the Mainstem Rio Grande, Bernalillo to Fort Craig, New Mexico. (41)

*Remshardt, WJ, Smith, JR & Hoagstrom, CW.*

12:45 Lousy Canyon and Other Potential Successful Models for Native Fish Management in Arizona. (42)

*Bettaso, RH, Davidson, RF & Voeltz, JB.*

13:00 Lunch break

17:00 DFC Business meeting

# Abstracts:

## 1. Area report: Oregon.

*Reid, White, Horstman, Allen, Young, Munhall, Chappell.*

Endemic Hutton Springs tui chub and Foskett Springs dace appear to be stable. The BLM and the Service will likely be investigating transplanting a small percentage of Foskett Spring dace into another nearby spring (named Dace Spring) in an attempt to recreate a second refugial population. The 2000 or 2001 report probably provided an update on the Steens Mtn Legislation that included a permanent ban on geothermal exploration in the area of the Borax Lake chub. This very significant news removes probably the greatest single threat identified in the recovery plan. The Oregon State office has recently received funding to conduct a status review of the Borax Lake chub and this will be carried out over the next year, likely in collaboration with the BLM, Oregon Department of Fish and Wildlife (ODFW), and The Nature Conservancy. No research or recovery actions occurred for the Warner sucker this year although random spot sampling by the BLM and ODFW early this spring confirmed that adult suckers survived last years drought conditions in the Warner Lakes. Extremely low water conditions during 2001, and a documented large die-off of introduced warmwater fish during the winter months previously suggested that all fish in the Warner Lakes may have perished. If this next winter is also a dry one, many of the Warner Valley lakes are likely to go dry again next year. Malheur NWR continues its efforts to implement a comprehensive fish screening program (focus on redband trout) on the Donner and Blitzen River, and the USFWS, BLM, ODFW and Roaring Springs Ranch extended an existing redband trout and tui chub conservation agreement for 1 more year. Biggest bull trout management news is an illegal crappie introduction into Beulah Reservoir on the North Fork Malheur River - the reservoir serves as bull trout overwintering habitat for an adfluvial population. Cowhead Lake tui chubs look good with continued cooperation in implementing the conservation agreement and recent surveys indicating strong populations more broadly distributed than previously thought within the drainage. Recovery efforts with the Modoc sucker have confirmed additional new and historical populations, continued genetics studies, and developed broad landowner cooperation. Additional genetic studies are being carried out on speckled dace, Pit River suckers, and Pit/Klamath sculpins.

## 2. Area report: California.

*Parmenter, SC, Bogan, MT, Bloom, R, Keeney, S, Konno, E.*

***Desert pupfish (Cyprinodon macularius)***

During April and May of 2002, approximately ¾ mile of tamarisk was removed from the stretch of salt creek south of the trestle to the power line crossing on section 23 T8S, R11E. CDF fire crews were used on 14 crew days to cut tamarisk and place it on the bank away from the stream channel. Thirty gallons of Rodeo were applied in a cut stump method as the tamarisk was being cut. In June 2002 approximately 80% of the tamarisk had re-sprouted. The re-sprouts were treated with an additional 7.5 gallons of Rodeo as a foliar spray with an approximate 40% success rate. No pupfish were found on a subsequent sampling. On lower salt creek one pupfish was found in the fall of 2001 by USGS sampling efforts.

At Dos Palmas Refuge ponds an experiment is underway to test whether grass carp are an effective means of controlling cattail encroachment on desert ponds. In the first phase of the experiment, nine grass carp were introduced to two ponds (3 and 6 fish) at Dos Palmas in May 2002. Subsequent re-sampling of the vegetation is scheduled for October 2002. The two experimental ponds in the first phase of the experiment do not contain pupfish.

The USGS and the USFWS collected pupfish from the experimental population at Dos Palmas for use in a selenium tolerance study. Approximately 100 fish were removed to breed in laboratory tanks.

Salton Sea trapping found pupfish in a majority of marinas as well as in the main body of the Sea. Pupfish were found in Desert Shores Marina, North Shore Marina, Varner Harbor at Salton Sea State Rec Area, Corvina Estates, and an area just south of Salton City Marina. Pupfish were found at depths ranging from 1 to 3 feet and were captured near shore (5-20 feet from shore). Pupfish were also found in the main body of the Sea near the mouth of Varner Harbor. Pupfish were captured approximately 20 feet from shore; water depth was 2 feet. Pupfish were also found in a few drains at the north end of the Sea. Surveys conducted in two drains found pupfish in both; 1000+ breeding fish were observed in one of the drains.

***Owens pupfish (Cyprinodon radiosus)***

All 5 populations of pupfish (Marvin's Marsh, off channel ponds at BLM Spring, Warm Spring, Mule Spring, and Well 368) are thriving.

BLM Spring channel continues to be infested with largemouth bass, but has

been the focus of a joint CDFG-BLM restoration project. Much of this work was conducted by engineering intern Genevieve Park of MIT. The lower of two dams was breached and emergent vegetation was greatly reduced by mowing. Mechanical removal of bass by electrofishing and spearing was briefly successful at removing bass, which then recolonized through the failing gravel percolation barriers. A low head (~8") fish barrier has been installed and appears to be working.

Calcareous deposits in the Mule Spring water supply pipe required clearing with a power snake.

130 small Tamarisk trees and two Russian Olive trees were removed by weed wrench from Well 368 with little regrowth.

***Mohave chub (Gila mohavensis)***

Mohave chub continue to inhabit Lake Tuendae and "M-C Spring" at Fort Soda in Mojave [sic] National Preserve, The Lark Seep system on China Lake Naval Air Weapons Station, and two artificial ponds at Camp Cady State Wildlife area.

The National Park Service deepened the west half of Lake Tuendae by dredging to counteract encroachment by emergent vegetation, and improve habitat for chubs and Saratoga Springs pupfish. The East half of the "lake" has previously been dredged with very desirable results. Gambusia inexplicably appeared in Lake Tuendae, coincident with an apparent major decline in abundance of Saratoga Springs pupfish at the same site. A 100% infection rate of Asian tapeworm (Bothriocephalus achelognathii) was identified in samples of Lake Tuendae tui chub by the late Dr. Boris Kuperman and Dr. Victoria Matey of San Diego State University.

An unidentified poeciliid, possible an all female clone of Gambusia affinis X holbrooki, was tentatively identified by Dr. Jeff Seigel (Los Angeles County Museum of Natural History) in samples from a fire protection reservoir adjacent to the chub ponds at Camp Cady.

***Owens tui chub (*Gila bicolor snyderi*)***

Putative pure Owens chubs exist in 6 locations: AB Spring and CD Spring at Hot Creek State Fish Hatchery, the Owens River Gorge, White Mountain Research Station, Mule Spring, and Cabin Bar Ranch.

A joint study by CDFG and UC Davis to assess taxonomic status using meristics, morphometry, and DNA approaches is in the final year. Specimens sacrificed for this study are being evaluated for fish parasites by Dr. Victoria Matey, San Diego State University, CA.

Chubs in AB Spring exhibit poor health variously exhibiting excessive intraperitoneal fluid, hypertrophied liver, lesions around anal opening, exopthalmia, red eyes, and curved spinal cord.

Many chubs at Mule Spring exhibit frayed caudal fins, attributed to fin nipping by abundant Owens pupfish.

***Owens speckled dace (Rhinichthys osculus ssp)***

The population known as "Long Valley dace" known only from Whitmore Pond remains abundant but has a high infection rate of both the monogenean Gyrodactylus sp and trematode *Clinostomum sp.*

## 3. Area report: Nevada

*Cook, A.E.*; Martinez, C.T.; Sjoberg, J.S.; Goodchild, S.C.; Scoppettone, G.G.; Heinrich, J.E.; Clemmer, G.; French, J. Nevada Species' Risk*

In April 2002, NatureServe, the umbrella organization for Natural Heritage Programs, published "States of the Union: Ranking America's Biodiversity". This document ranked all 50 states in terms of species diversity, risk, endemism, and extinctions. Nevada ranked third highest in percentage of species at risk, with the fourth highest percentage of fishes and third highest percentage of amphibians at risk in the U.S.

***Ash Meadows***

Restoration efforts continued at Point of Rocks Springs system. The spring outflows were restored in 2001 to enhance habitats for the Ash Meadows naucorid (Ambrysus amargosus) and Ash Meadows Amargosa pupfish (Cyprinodon nevadensis mionectes). Re-vegetation efforts continued during 2002. Introduction of Ash Meadows speckled dace into the lower stream will occur once instream habitat enhancement is completed. No green sunfish have been observed in recently treated waters, although they are still present in Crystal Reservoir. With refuge personnel vacancies, NDOW will be providing cooperative assistance to insure that monitoring for Ash Meadows pupfish and other key species continues on schedule.

***Devils Hole pupfish***

Devils Hole pupfish (Cyprinodon diabolis) summer counts at Devil's Hole have been declining since 1996; the summer 2002 counts through October are extremely low compared to the historical record, although the winter counts show some stability in 2000-2002. It is uncertain if the population in Devils Hole

may show some stability at a lower than previous level. The Death Valley National Park has hosted a workshop to discuss future management actions. Three separate refugia, Point of Rocks, School Springs, and Hoover Dam, contain populations of 103 (stable), 19 (decrease), and 80 (increase) Devils Hole pupfish, respectively.

***Muddy River***

Blue tilapia (Oreochromis aurea) in the Muddy River system continue to have a negative effect on native fishes. All chemical treatments of tributaries in the headwaters have been successful in tilapia eradication. Moapa dace (Moapa coriacea) numbers have responded accordingly, with 1085 dace counted in intra-agency dive counts completed in February 2002, 150 more than in 2001 surveys.

The first phase of spring and stream restoration at the Pederson Unit of the Moapa Valley NWR was completed in April 2002. Native fish populations have responded positively. Future plans include implementing a re-vegetation plan and continuing stream restoration throughout the entire Refuge.

Virgin River chub numbers in the middle Muddy River continue to decline based on 2002 survey efforts to date. A Memorandum of Understanding is being developed between Nevada Power Company, NDOW, and the U.S. Fish and Wildlife Service to establish a refugium for Virgin River chub (Gila seminuda) utilizing the raw water ponds at Reid Gardner Power plant next to the Muddy River at Moapa.

***Pahranagat Valley***

November 2001 Paharanagat River snorkel surveys detected 14 Pahranagat roundtail chub (Gila robusta jordani), indicating a severe decline in the population. Since this census, the landowner has denied access to the property for additional surveys. NDOW is drafting a safe harbor agreement for the entire Valley, which could be used to manage habitat for listed species on private land. Dexter National Fish Hatchery and Technology Center maintains a refugium population of approximately 100 individuals. Additional refugia for the chub are being developed at Pahranagat National Wildlife Refuge and Key Pittman WMA, which would be stocked with fish from Dexter NFH&TC as well as wild fish if found.

Hiko Spring was surveyed in June 2002. The population estimate for Hiko River springfish is down from 6277, in 2000, to 1291; exotic species increased to 64% of the total species composition compared to 44% in 2000.

The refuge population of Hiko WR springfish at Blue Link Spring was surveyed in August 2002. The population was estimated to be 6991.

Crystal Spring springfish numbers have been high for two years in a row; the proposed development at Ash Spring has not occurred and habitat and numbers of springfish have maintained some stability, but the future of the private land part of the outflow is uncertain.

***Pahrump poolfish***

The Shoshone Ponds and Spring Mountain Ranch State Park refugia populations of Pahrump poolfish (Empetrichthys latos) are self-sustaining, containing in excess of 50,000 individuals. A new refugium at Corn Creek Springs on the Desert National Wildlife Range will be completed in fall of 2002, and will replace the population previously lost at this site due to the infestation of predatory non-native species.

***White River Valley***

White River spinedace estimates declined from 1600 in 1999 to 538 in fall 2000 but increased to 914 in March 2002 and 1264 by September 2002 following implementation of cormorant control efforts. Speckled dace and desert suckers also became more abundant throughout the surveyed reaches. Cormorant activity in the area will continue to be monitored.

A rehabilitation project, initiated by the USFWS as a Partners for Fish and Wildlife project at Indian Spring in Preston, is being completed in October 2002 primarily to benefit White River springfish.

A new pipeline to provide water for livestock on adjacent federal lands from South Flag Spring will be constructed in fall 2002. Water will no longer be transported via an old ditch, leaving more water in the main channel for spinedace.

***Railroad Valley***

Monitoring of Railroad Valley springfish was completed in July 2002 at Hay Corral, Big, North, Reynolds and Chimney Springs All numbers were consistent with previous years with the exception of Hay Corral. Habitat at Hay Corral was significantly disturbed in 2001, which may have affected fish numbers and distribution. Springfish were seen in the outflow ditch and pond, but were not common; a combination of factors may be present, although no other habitat changes and/or threats were observed. The landowner at Lockes Ranch, which contains all or part of three key RRV springfish habitats, is willing to sell the property for conservation purposes but has not been able to agree on a price with BLM.

Once again, the Duckwater populations of Railroad Valley springfish were not sampled, due to a lack of permission from the tribe. However, recent negotia-

tions have taken place and a more positive relationship is expected soon.

Big Springs spinedace densities were higher in 2002 than in 2001. Between 280 and 4000 spinedace per kilometer were estimated in August 2002. In August 2001, between 280 and 1920 spinedace per kilometer were estimated. Rainbow trout continue to be found in a few locations in Condor Canyon in very low numbers, but do not appear to represent a significant threat.

Spinedace were only detected in 3 transects in 2002 compared to 4 in 2001, but flows have been reduced because of drought conditions.

***Meadow Valley Wash***

The lower reaches of Meadow Valley Wash were surveyed in March 2002 to determine baseline distribution of native fish in this system in response to projected development in this area. Surveys indicated that distribution of the native fish species was similar to previous monitoring. Meadow Valley speckled dace (Rhinichthys osculus spp.) were found near Hoya/Leith, and Meadow Valley desert sucker (Catostomus clarki ssp.) were found only in the vicinity of Elgin. Several specimens of southwestern toads (Bufo microscaphus microscaphus) were collected from this reach and positively identified by biologists at the University of Nevada, Las Vegas.

***Razorback sucker***

In April 2002, 35 Lake Mead larval sucker (Xyrauchen texanus) were successfully taken from Echo Bay and reared at the Lake Mead Hatchery. Similar numbers of the 1999 and 2001 cohort are being held for future release into Lake Mead. In 2002, 5,000 Lake Mohave sucker were reared at this facility, destined for Beal Lake/Imperial ponds. Larval razorback sucker from Lake Mohave were reared at the Boulder City Golf Course and Veterans Park ponds in cooperation with the Bureau of Reclamation.

***Amargosa toad***

This year 666 more toads were tagged, for a total of 3461 over the past five years at 15 survey sites. Given ongoing drought conditions, toad populations in Oasis Valley are maintaining and doing fairly well. Annual monitoring surveys will be continued in the future on a more limited basis. A species management plan is being developed utilizing long-term monitoring data.

***Other Species***

A conservation agreement for management of the Toiyabe population of spotted frog in Nye County should be completed by the end of 2002.

Efforts to re-establish Virgin spinedace in upper Beaver Dam Wash, below Schroeder Reservoir in Nevada, have not been particularly successful. The strategy and future options are being assessed.

NDOW has received grant funding to develop private land CCAA agreements for tui chub in central Nevada and springfish in upper White River Valley. A new biologist position in Tonopah to be filled this fall will have responsibility for this project along with bird projects.

## 4. Area Report: Bonneville Basin

*Matthew E. Andersen*

The June Sucker (Chasmistes liorus) Recovery Implementation Program has been active during the past year. Utah Division of Wildlife Resources (Division) personnel are still monitoring the annual spawning run of June sucker from Utah Lake up the Provo River by capturing spawning adults and drifting larvae. Gametes are taken from adults for streamside spawning and fertilized eggs are transferred to the Division's Fisheries Experiment Station in Logan. Drifting sucker larvae are also transferred to FES. The JSRIP has been sponsoring a study of morphology and molecular genetics of June sucker. Preliminary results indicate that morphology and molecular markers may not be linked, making the identification of "pure" June sucker, "pure" Utah sucker (Catostomus ardens), and hybrids difficult. Molecular genetic review of the Utah suckers has indicated that the Utah suckers of Utah Lake are distinct from Utah sucker found elsewhere in the state. Another program-sponsored study is indicating that rearing June sucker in cages in Utah Lake is producing higher growth rates than are realized in the hatchery. The Division and the U.S. Fish and Wildlife Service (Service) are cooperating to chair the Bonneville Basin Conservation Team. A Memorandum of Agreement describing the membership and activities should be finalized during 2002. The BBCT seeks to apply ecosystem management principles to conservation of aquatic species in the basin. This approach applies to an exciting discovery from this year, when Chalk Creek was found to have Bonneville cutthroat trout (Oncorhynchus clarki utah), leatherside chub (Gila copei), and boreal toad (Bufo boreas boreas) all in close proximity. Good spawning runs of Bonneville cutthroat trout were observed at at least two locations this spring: Manning Meadow Reservoir in the south and Bear Lake in the north. Great Basin National Park, Nevada Division of Wildlife, the Goshute Tribe, the Forest Service in Idaho, and Wyoming Game and Fish have all implemented Bonneville cutthroat trout restoration actions in 2002. The potential for segregation of leatherside chub into two species continues to increase. Dowling et al. have had an article accepted for Copeia examining mitochondrial DNA markers. Their results suggest that leatherside chub are more closely

related to the Virgin spinedace (Lepidomeda mollispinis mollispinis) of the Virgin River drainage than they are to the leatherside chub of central Utah. The Division and Service (through State Wildlife Grants) are funding a multi-year study of leatherside ecology and taxonomy. Monitoring for least chub (Iotichthys phlegethontis) continues in the West Desert and along the Wasatch Front. Population numbers continue to vary from year to year. Generally, least chub are still present where they have been over the past decade, but drought and demands for water continue to be of concern. Petitioners requested that the Service list the Columbia spotted frog (Rana lutieventris) as threatened or endangered in 2002. The Service conducted a status review and anticipates publishing a finding shortly after this abstract is due. The Division has contributed a great deal of information to the review, and has urged the Service, based on the data, to find not warranted for listing.

## 5. Area report: Upper Colorado River Basin.

*Pfeifer, F., McAda, C, Birchell G., Propst D. & Modde, T.*

Extreme drought conditions in the upper Colorado River basin caused problems for water users and endangered fish alike in 2002. However, water-delivery contracts on the Upper Colorado River worked out by the Recovery Program provided for at least a little flow through areas that would have been completely dewatered in previous years. Water delivered from Reudi Reservoir was bypassed at the lowermost diversion structure (Grand Valley Irrigation Company [GVIC]) on the Colorado River to provide at least 50 to 80 cfs in the upper 15-mile reach. This section of river was completely dewatered under similar conditions in previous years. This was not much water but it kept some flow moving which maintained dissolved oxygen levels and mitigated high water temperatures. Downstream flows gradually increased as irrigation return flows reentered the river. Water was also delivered from Blue Mesa Reservoir to the Redlands fish ladder on the Gunnison River to ensure its continued operation. Flows of about 200-250 cfs were delivered to the ladder during the peak migration period of late June - late August. Flows were limited to about 100 cfs before and after that period to conserve the limited water available for endangered fish. This section of river was also completely dewatered in previous years. A total of 7 Colorado pikeminnow *Ptyochocheilus lucius* and 1 hatchery-produced razorback sucker *Xyruachen texanus* used the ladder in 2002. A fish screen was constructed on the GVIC canal on the Colorado River in winter 2001-2002. Unfortunately, the extremely low flows and some maintenance problems prevented full operation of the screen. This was a concern because the majority of the river flow was entering the canal for most of the summer. Plans are underway to fix the problems and ensure its operation under similar conditions in future years. Planning continues for a fish ladder

and fish screen on the Grand Valley Project dam /Government Highline canal on the Colorado River (uppermost of three diversion dams on the Colorado River). Some preliminary construction will occur in late winter 2002-2003, but construction of both facilities will not be completed until winter 2003-2004. Planning began for a fish screen on the Redlands Canal on the lower Gunnison River. Construction is also planned for winter 2003-2004. An Environmental Assessment has been released for construction of fish passage at Price-Stubb Dam on the Colorado River (middle of the three dams). Construction will begin no sooner than winter 2004-2005. In the Green River subbasin, flows were near historical lows and tributary flows were extremely low limiting adult habitat.

Recovery goals for the large river endangered fishes of the Colorado River Basin were finalized this summer and the notice of their availability will be posted shortly in the Federal Register. Flow recommendations are being developed for the two tributaries to the Green River, the White and Duchesne Rivers. Negotiations between the Fish and Wildlife Service and the Upper Basin Recovery Program continue on the Gunnison River flow recommendations. The Bureau of Reclamation will have a draft Environmental Impact Statement regarding the reoperation of Flaming Gorge Dam in September. The reoperation is based on Green River flow recommendations provided by the Upper Basin Recovery Implementation Program. Population estimates of Colorado Pikeminnow in the Green River have been obtained for the entire Green River system for two complete years. The initial estimate was encouraging, estimates for the second year have not been calculated at this time. In addition, population estimates for three consecutive years were also completed for humpback chub *Gila cypha* in Black Rocks, Westwater and Yampa canyons. The Upper Basin experienced a severe drought in 2002, and nonnatives, particularly smallmouth bass *Micropterus dolomieu* numbers seem to be increasing in the Yampa River. Northern pike *Esox lucius* removal efforts are continuing in the Green and Yampa Rivers. Fewer numbers of northern pike were observed in the Green River, while no difference was observed in the Yampa River. Some encouraging experimental results were observed in applying the 'reset' approach to management of off-channel wetlands to enhance survival of larval and juvenile razorback sucker and bonytail *G. elegans*. Experimental pens were stocked with nonnative densities consistent with expected numbers following initial connection of the river. Larval razorback sucker and bonytail were stocked with nonnatives and survival was encouraging.

Harvest of hatchery-produced razorback sucker from grow-out ponds in Grand Junction has begun. About 3,000 fish (300 + mm TL) have been stocked to date in the Upper Colorado River. An additional 7,000 fish will be harvested and stocked this fall. Stocking plans call for three stocking sites — Colorado River near Rulison, Gunnison River near Delta, and Colorado River near Grand Junction. Because the first two sites are upstream from large diversion canals

taking most of the river flow, all fish have been stocked near Grand Junction to prevent their entrainment in the canals. Larval razorback sucker were collected this spring and are believed to be offspring of stocked fish.

In the San Juan River, augmentation of Colorado pikeminnow and razorback sucker is continuing and results to date are very encouraging. The San Juan River Recovery Implementation Program continues to make significant progress towards recovery.known only from Whitmore Pond remains abundant but has a high infection rate of both the monogenean Gyrodactylus sp and trematode *Clinostomum sp.*

## 6. Area report: Lower Colorado.

*Stefferud, S, Stefferud, J, Clarkson, R, Heinrick, J, Slaughter, J & Bettaso, R.*

Status of fishes in the lower Colorado River basin continues to deteriorate. Despite excellent efforts conducted or ongoing, conflicts continue to escalate and resource consumer groups seeking to delay or halt native fish recovery continue to become more vocal and effective. Nonnative species are increasing in distribution and abundance and limited success has been met in their control or removal. This report indicates nonnative control is an increasingly large part of agency efforts in native fish recovery.

In the Virgin River basin, a five-year effort to repatriate Virgin spinedace *Lepidomeda mollispinis mollispinis* in upper Beaver Dam Wash in Nevada does not appear to have been successful and additional repatriation alternatives are being considered.

In the Virgin River, spring and fall sampling by the Virgin River Recovery Team at three sites in Nevada produced no woundfin *Plagopterus argentissimus* and only a single Virgin River chub *Gila seminuda*, at the Bunkerville Diversion in fall. Mask and snorkel surveys were completed along several mainstem Virgin River segments in Arizona and Nevada to provide baseline inventories for chub. In Arizona, the July survey counted 33 adults and 147 juvenile chub. In Nevada no chub were recorded during the August survey. Most striking was the high number of large channel catfish *Ictalurus punctatus* found throughout the mainstem river. In all 2002 surveys, Tilapia *Tilapia sp.*. the most recent nonnative to invade, was not found along any of the reaches until September 25 when small numbers were found at Halfway Wash. Upstream, red shiner *Cyprinella lutrensis* was found above Washington Fields Diversion in the only area of the river previously free of this species. They are thought to have come from a bait pond. Efforts to propagate woundfin at Utah's Wahweap Hatchery have met with setbacks, but stocks still are held at Dexter National Fish Hatch-

ery.

In the Little Colorado River basin, drought conditions forced salvage operations for Little Colorado spinedace *Lepidomeda vittata* in Yeager, Leonard, and West Leonard Canyons in the East Clear Creek drainage. Less than 46 spinedace (8 from Yeager, 38 from Dines Tank in Leonard Canyon) were placed into the refugia pond at the Flagstaff Arboretum. From West Leonard Canyon, 363 spinedace were captured, of which 200 were placed at the Arboretum and 57 were stocked into Dane Canyon in the East Clear Creek watershed.

No reports were received regarding the Bill Williams River basin. No reports were received regarding the upper Gila River basin in New Mexico.

Within the Gila River basin work has been conducted for a variety of species.

It was a big year for Gila chub *Gila intermedia*. The species was proposed for listing as endangered with critical habitat on August 9, 2002. O'Donnell Creek, a tributary of the Babocomari River in southern Arizona was successfully renovated with antimycin in June 2002 to remove green sunfish *Lepomis cyanellus*. Gila chub and desert sucker *Pantosteus clarki* were restocked in August. Sabino Canyon, a Gila chub habitat was successfully renovated for green sunfish in 1999, reached critically low water levels in lower canyon pools in July 2002. Gila chub were salvaged and held at the Forest Service Ranger Station. A September 2002 survey of Turkey Creek, in the Babocomari River basin failed to find Gila chub, which have not been seen there since 1991, but other surveys confirmed continued existence of Gila chub at Williamson Valley Wash in the upper Verde basin and found new locations in two Verde mid-basin tributaries.

A status report for roundtail chub *Gila robusta* and headwater chub *Gila nigra* was completed and a final report issued in January 2002. That report finds that there are significant declines in both species and substantial threats to most of their habitat.

For spikedace *Meda fulgida* and loach minnow *Tiaroga cobitis*, a survey of Verde River tributaries specifically looking for loach minnow failed to find any remnant populations. Construction plans, site investigations, and planning documents are under way for a fish barrier on the lower Blue River in eastern Arizona. Construction is scheduled to begin in September 2003. The Blue River, which has been identified by the Forest Service for native fish restoration, supports loach minnow and several other native fishes and frogs, is critical habitat for spikedace, and historic habitat for Gila chub.

The recent appearance of Asian tapeworm *Bothriocephalus acheilognathi* in the Verde River has been documented during research that is ongoing on native and nonnative species interactions.

For longfin dace *Agosia chrysogaster* a repatriation stocking was conducted in Martinez Canyon, a tributary of the middle Gila River near Florence. An ongoing crayfish removal project is also taking place in Martinez Canyon by a couple of dedicated volunteers.

Stocking of razorback sucker *Xyrauchen texanus* into the Verde River continues. No successful recruitment has yet been documented from this 15-year program.

A new population of desert pupfish *Cyprindon macularius* was initiated in Lousy Canyon, a tributary of the Agua Fria River. That stocking occurred in October 2001 and appears to have been succesful.

The first sighting of Gila topminnow *Poeciliopsis occidentalis* since 1994 in Sonoita Creek above Patagonia Lake occurred in July 2002. At Sharp Spring on the upper Santa Cruz River, fall surveys found Gila topminnow to still persist, although only 1 topminnow was found to 397 mosquitofish *Gambusia affinis*. In the Redrock Canyon drainage near Patagonia, an additional exclosure to livestock grazing was built to restore Gila topminnow habitat in Oak Grove Canyon. Original exclosure plans included habitat below and above a barrier, with repopulation to occur naturally below the barrier from movement from the main canyon. Above the barrier, repopulation would require stocking. The exclosure as-built does not include any below-barrier habitat, thus substantially reducing recovery value. The Forest Service has declined to rebuild the exclosure.

For Apache trout *Oncorhynchus apache* a renovation project to remove nonnative trouts was conducted in October 2002 on Snake Creek on the Apache-Sitgreaves National Forest.

In the Rio Sonoyta basin, verbal reports indicate the Rio Sonoyta had very little water this summer. Apparently staff of the Pinacate Biosphere Preserve conducted a salvage operation for the Quitobaquito pupfish *Cyprinodon eremus* to hold pending better water conditions.

At Quitobaquito Springs, the fall survey of Quitobaquito pupfish showed that population to be doing well. In this year's survey 2,100 individuals were sampled. The mean of this 10-year effort is 2,280 individuals. Water level is down at the pond, but not enough to cause concern. Of more concern is the increasingly heavy traffic of illegal immigration at Quitobaquito, where even the border fence walk-through has been crushed by vehicle traffic.

In the lower Colorado River itself, a number of efforts are ongoing.

Efforts to rear bonytail chub at Niland Fish Hatchery have been temporarily suspended due to lack of success and severe infestation of the nonnative para-

sitic anchor worm *Lernea cyprinacea*. Efforts are concentrated at Achii Hanyo Hatchery near Parker. Achii Hanyo success rates have been good and parasite problems have been negligible. As of August 13, 2002, 7,728 bonytail chub have been augmented into Lake Havasu. Ongoing stocking efforts have also placed 30,000 razorack sucker into Lake Havasu.

Giant salvinia *Salvinia molesta* continues to be present in the lower Colorado River and irrigation canals downstream of Blythe. Efforts to eradicate it have been limited.

Beal Lake along the lower Colorado, was treated with rotenone in December 2001 to remove a variety of nonnative fish. It was restocked with 10,000 razorback sucker in April 2002. Mosquitofish *Gambusia affinis* were recently discovered to have either survived the treatment or reinvaded from nearby waters. Another 40 acres, at the Imperial Duck Ponds, was renovated in October 2002. Restocking of razorbacks has not yet occurred, but 5,000 are planned.

Recent population census on Lake Mohave estimate a razorback sucker population of 3,000 to 4,000 fish. That is compared to the 6-figure estimates of 20-30 years ago.

Research continues in the Imperial Division of the lower Colorado on habitat selection and overlap between razorback sucker and flathead catfish. Razorback sucker have been found to use off-channel backwaters newly reconnected as part of restoration activities. Flathead catfish *Pylodictus olivarus*, on the other hand, have been found to inhabit main and side-channel habitats and rarely co-occur with razorback sucker. Collection of razorback larvae in Senator Wash has begun with a purpose of quantifying reproduction, determining if it has led to recruitment, and how predation affects that particular area.

Gizzard shad *Dorosoma cepediianum* have now been confirmed as an established population in Lake Powell. This nonnative species was introduced as a contaminant in a shipment of sport fish from Inks Dam National Fish Hatchery to an upstream site on the Navajo Indian Reservation.

The USGS Branch of Biological Survey Fish Control Lab in LaCrosse, Wisconsin has undertaken a major study, through Central Arizona Project mitigation funding, to research and develop innovative techniques and integrated management for nonnative fish control in the Gila basin.

## 7. Area report: Upper/Middle Rio Grande and Pecos Rivers.

*Brooks, J, Propst, D, Dudley, R, Hoagstrom, C, Platania, S & Turner,*

*T.*

As part of the Upper Colorado River Basin recovery effort, razorback sucker *Xyrauchen texanus* augmentation will increase significantly in the coming years. In an effort to examine efficiency, we compared the capture returns of acclimated and non-acclimated razorback sucker in the middle Green River. We feel that floodplain habitats may be important to natural recruitment as well as acclimation. An earlier study by the Utah Division of Wildlife Resources indicated that age-1 razorback sucker grew and survived well in offchannel wetlands in the presence of nonnative predators/competitors. However, larval razorback sucker stocked into the same wetlands were not recovered. This presentation summarizes the capture returns of fish acclimated in the wetland for an entire growing season with those stocked directly from the hatchery, and the experimental results of the 'reset' concept involving stocking larval razorback sucker survival in the presence of predacious nonnative fishes in a newly inundated floodplain wetland.

The distribution and recapture rate of approximately 2,000 subadult/adult razorback sucker (>250 mm) stocked directly into the river between 1997 and 2001 were compared with fish that were stocked as age-1 fingerlings (~ 100 mm) in a natural wetland in the spring of 1999 and accessed the Green River the following spring (approximately 1,100 fish in excess of 300 mm). The entire reach of the Green River between Split Mountain Canyon (rkm 352) and the confluence with the Colorado River was sampled with electrofishing boats during the spring of 2001. Three complete passes were made. Despite the fewer fish accessing the river from the floodplain, nearly three times (74) as many acclimated fish (i.e., floodplain stocked fish) were recaptured than those stocked into the river directly from the hatchery (29). Despite the differences in apparent capture rates the distribution of fish downstream from the stocking area was approximately equal between the two groups. As expected, the majority of post-stocking movement occurred downstream of the stocking site.

Larval razorback sucker were stocked into two 0.1 hectare pens with adult nonnative fishes. The numbers of nonnative fishes were similar to those observed during the first year of inundation following complete drying of the wetland. Each pen was stocked with a different density of larvae (~60,000 = low density, and 450,000 = high density). Larvae and nonnative adult fishes were stocked May and harvested in August. Zooplankton and water chemistry were monitored through out the study period. Following harvesting, 359 and 1,709 age-0 razorback sucker were harvested averaging 70mm and 58mm, respectively from the high and low density ponds. In addition to razorback sucker survival, large numbers of age-0 nonnative fishes were present in the study pens. Although survival was low, the potential for razorback sucker in offchannel wetlands following drought conditions offers management options that may

improve natural recruitment.

## 8. Area report: Texas. Desert Fishes research and management in Texas during 2002.

*Edwards, RJ, Garrett, GP, Allan, NL & Hubbs, C.*

Prolonged drought in the west Texas area continues to stress native species in the region. Phantom Lake Springs, where the endangered Comanche Springs pupfish (*Cyprinodon elegans*) and Pecos gambusia (*Gambusia nobilis*) reside, failed more than two years ago and outflows are being partially maintained by pumps located inside Phantom Cave. Changes in the artificial flow regimes are being attempted in order to provide more constant outflow conditions. The refugium populations at the San Solomon Ciénega are continuing to be monitored and their populations appear robust and stable in this artificially created wetlands habitat. Physicochemical monitoring is continuing at the Diamond Y Springs outflows and Leon Creek to be correlated with the abundance and distribution of the Leon Springs pupfish (*C. bovinus*) and *G. nobilis*. While some of the upper portions of Salt Creek have completely dried, reducing the numbers of the only known pure populations of the Pecos pupfish (*C. pecosensis*) in Texas, a new ciénega was discovered even further upstream in the Salt Creek drainage which contained large numbers of pupfish. The two *C. pecosensis* refugia populations that have been established on private land, through the State's Landowner Incentive Program, remain extant although the numbers of pupfish in the refugia apparently fluctuate widely. A third year inventory of the Devils River was completed in August 2002. Devils River minnow (*Dionda diaboli*) populations were found to be relatively stable and in abundance at various localities within the river. Collections taken in the Pinto Creek headwaters, found a new population of Devils River minnow. Physicochemical measurements were also collected throughout Pinto Creek in order to correlate the distribution of the species with selected water characteristics. The distribution of the species quickly declined when water characteristics became less spring-like. A Recovery Plan for this species is currently being developed. Various other conservation activities are also being conducted in the region including, water chemistry measurements at the Big Bend gambusia (*G. gaigei*) refugium in Big Bend National Park, a Chihuahuan Desert catfish genetic study to better understand the characteristics of the channel (*Ictalurus punctatus*) and headwater catfish (*I. lupus*) in the area, a resurvey of the Nature Conservancy's holdings at Independence Creek, a tributary of the Pecos River, and an evaluation of the potential of the Rio Grande in the Big Bend National Park region to reintroduce the Rio Grande silvery minnow (*Hybognathus amarus*) as a part of the recovery activities for this species.

## 9. Area report: Northwestern Mexico, Estatus de peces nativos enlistados en el Noroeste de México, Sonora y Baja California.

*Varela-Romero, A & Ruiz-Campos, G.*

La ictiofauna dulceacuícola del Noroeste de México correspondiente a los estados de Sonora y Baja California, comprende un total de 47 especies registradas a largo de recolectas iniciadas a finales del siglo XIX hasta la actualidad. Actualmente 38 especies nativas persisten en habitats naturales. El 40 % de las especies de clupéidos, el 33.3% de las especies de salmónidos y el 20.6% de los ciprínidos de México se encuentran en el Noroeste del país. Dentro de las especies con distribución actual, el 59% se encuentra incluido bajo alguna categoría de protección de acuerdo a la NOM-059-2001. Según este recuento oficial, ocho son las especies en peligro de extinción, siete se encuentran amenazadas, seis son consideradas bajo protección especial y sólo una se considera extirpada de territorio nacional. El análisis sistemático de la información sobre la situación actual de las 20 especies del Noroeste de México enlistadas en la Norma Oficial Mexicana, apoyado en Biotica 4.0 y la aplicación del MEER, soporta un cambio en el número de las especies enlistadas por categoría. Ahora se reconocen 5 especies extirpadas de territorio nacional, ocho en peligro de extinción, cuatro amenazadas y sólo dos como protección especial. La aplicación por expertos de esta metodología hacia el resto de las especies nativas mexicanas aún no consideradas en la Norma Oficial Mexicana vigente, seguramente modificará e incrementará la lista actual de especies protegidas.

## 10. Area report: Northeastern Mexico. 2002 NE México and National Coordinator Report.

*Contreras-Balderas, AJ, Lozano-Vilano, MDL, García-Ramírez, M.E.*

The most important item was the little success we had in controlling the growth of the *Hemichromis guttatus* in the Cuatro Ciénegas basin. Between May and September 2002, the task force captured 11383 individuals in Churince, without the populations showing decline. This is the 3d year of the control task force activities and the Jewel Fish is still increasing. We know how difficult is to get control of invasive fish species; however, we have succeeded in eradicating the Jewel Fish from a single midsized posa after the first year of the program. This program may have to be permanent and with little success. However, abandoning it due to its little success may cause a major expanse whose consequences we can not foresee. México has suffered strong changes in policies in 2002. A revised list of Fish Species at Risk, that should have been prom-

ulgated early in 2001, was promulgated in 2002. Of the 506 species known, 168 are at some level of risk, and 25 are believed to be extinct in 2001. The increase was from 114 in 1994. This increase reflects the long drought and conflict for water, population growth, higher pollution that the regulations have not curtailed, and the weak law enforcement that is prevalent. Around the end of 2001, one of us (SCB) was invited to participate in a committee to develop the Carta Nacional Pesquera (CNP or National Fishing Regulation), Freshwater Section, by the Aquaculture Research branch of SEMARNAT. As the single attendant I was able to introduce information on commercial, endemic, and invasive species, and the recommendation to reduce the stocking of more exotic species. This year the CNP was rejected and a new one without the conservation oriented contents, that were striped from the regulations. The strong pressures generated by the operative aquaculture branch and the anti-conservationists. The 3 problems here reported hardly represent sustainability policies. México has signed the international agreements on Sustainability, Agenda XXI, and Biodiversity, however, actions are not congruent and often are conflictive. This year we will have the VIII National Congress of Ichthyology at Puerto Angel, Oaxaca. Our group will present 2 Indexes of Biological Integrity for NE México.

## 11. Discovery of a new population of *Dionda diaboli.*

*Garrett , GP , Edwards , RJ , Hubbs ,*

C. The Devils River minnow, *Dionda diaboli*, is a cyprinid with a limited distribution in Texas and Mexico. It is listed as threatened in the United States and endangered in Mexico. Previously reported locations included the Devils River, San Felipe Creek, Sycamore Creek and Las Moras Creek in Texas and the Río Salado and Río San Carlos drainages in Mexico. It has been extirpated from Las Moras Creek, the lower Devils River and possibly Sycamore Creek. Its current status in Mexico is unknown. Recent collections in previously unavailable locations in the headwaters of nearby Pinto Creek revealed a large population of *D. diaboli*. The fish were found in their typical habitat of fast-flowing, spring-fed waters over gravel substrates, usually associated with aquatic vegetation. This population not only provides additional security for the species, but would likely serve as the source of fish for a re-establishment project in Las Moras Creek. Unfortunately spring flows in Pinto Creek appear to be threatened by excessive pumping from the associated aquifer.

## 12. Evolutionary functional ecology of the pharyngeal jaw

## polymorphism in the cichlid fish *Herichthys minckleyi.*

*Hulsey, CD & García de León, F.*

Polymorphism in feeding structure could be rare because it represents an ephemeral and transitional stage in speciation. Alternatively, intraspecific morphological specialization may be latent in many species and only arise in exceptional ecological settings due to distinct functional demands prey place on predators. In order to unravel these hypotheses, we examined diet specialization in the trophically polymorphic cichlid fish Herichthys minckleyi using gut analysis obtained from fish from eight populations in Cuatrociénegas in Northeastern Mexico. We found papilliform pharyngeal morphs ate a greater percentage of plants compared to molariform morphs. Although snail shell constituted some proportion of the gut contents of all jaw types, papilliform morphs are not often crushing snails. Approximately 90% of molariform morph guts contained crushed snails. Individuals with intermediate pharyngeal morphologies frequently crushed snails indicating their diets reflect their intermediate dentition. Using the snail opercula found in the guts, we estimated both the number of snails eaten and force used by individual H. minckleyi to crush snails. The hardness of the shells of snails inhabiting Cuatrociénegas will be contrasted with those of other molluscs. Additionally, we have developed a phylogenetic hypothesis about the relationship of H. minckleyi to other cichlid fishes. By mapping pharyngeal jaw morphology onto this phylogeny we will discuss what is morphologically and functionally novel about the jaw polymorphism in H. minckleyi. We propose that the functional demands placed on this unique species by the ecology of its unique habitat Cuatrociénegas and the evolutionary history of this fish have both contributed to the evolution and maintenance of this trophic polymorphism.

## 13. How effective are of constructed barriers at protecting Apache trout?

*Robinson, A.*

Barriers have been constructed on many White Mountain streams to protect Apache trout Oncorhynchus apache from nonnative salmonids. These barriers can fail to serve their purpose if fish are able to move through, around, or over the barrier due to poor design, decay of materials, washout, or if anglers move fish upstream of the barrier. In addition, barriers may hinder Apache trout movements and metapopulation dynamics. On each of seven streams, we marked nonnative trout downstream of the barrier and then sampled both below and above the barrier to detect movement nonnative salmonids. We also marked Apache trout upstream of the barrier to detect downstream passage below the

barrier. In two years of study we only detected movement of one marked nonnative trout upstream past a barrier, but several unmarked nonnative trout have been found upstream from barriers on four streams. During autumn 2001, the distribution of length classes of Apache trout in two streams tended to be skewed towards smaller fish below barriers, whereas above the distribution tended towards bigger fish. This may indicate that young fish are dispersing downstream to below the barriers, and if so, could indicate a net loss of a dispersing genotype from the protected areas. ]

## 14. Pecos bluntnose shiner: size-related habitat use.

*Hoagstrom , CW.*

Pecos bluntnose shiner (*Notropis simus pecosensis*) is a small-bodied cyprinid known to occupy fluvial habitats of the mainstem Pecos River, De Baca, Chaves, and Eddy counties, New Mexico. It is a member of a reproductive guild that spawns rapidly developing semi-buoyant eggs. Rapid development has been shown to continue through larval stages, but has not been studied for older individuals. Depth and velocity were measured in association with collections of 947 Pecos bluntnose shiners. Collections were made during a wide range of discharges at six study sites that spanned the range of the species. All 947 Pecos bluntnose shiners were measured to the nearest 0.01 mm standard length (SL) and divided into 5.0 mm SL categories. Comparison of depth/velocity association among categories identified six distinct habitat use length-groups. The three smallest groups each consisted of a single 5.0 mm SL category, suggesting that development and adaptation are rapid. The three larger length-groups were each composed of two 5.0 mm SL categories. The smallest length-group (<15.0 mm SL) concentrated in shallow/slow habitat, while the two subsequent groups (up to 25.0 mm SL) associated with slightly deeper, low-velocity habitat. Above 25.0 mm SL, Pecos bluntnose shiner shifted to shallow/fluvial habitat and depth/velocity association increased with subsequent length-groups. The three smallest habitat use length-groups apparently represent early young-of-the-year associated with nursery habitat, typical of most fishes, while the three larger length-groups fit the pattern of drift-feeding fishes where increasing size allows or requires that fish occupy increased depth/velocity in order to forage successfully. Based on published length frequency/age data (Hatch et al., 1985. Southwestern Naturalist, 30:555-562) and unpublished growth data (Platania, Museum of Southwestern Biology, pers. comm.), Pecos bluntnose shiner reach 25.0 mm SL, the point where they shift from nursery to fluvial habitat, within the first summer of life, possibly within 60 days of hatching. Rapid advancement of Pecos bluntnose shiner from nursery to fluvial habitat is not surprising in light of associated environmental conditions.

## 15. Chemical removal of green sunfish (*Lepomis cyanellus*) from O'Donnell Creek, Arizona.

*Blasius , HB.*

Canelo Hills Cienega Preserve is owned and managed by the Arizona Chapter of the Nature Conservancy (TNC) and is located along O'Donnell Creek, a small grassland stream that originates in Canelo Hills. It is a tributary of the Babocomari River, which flows into the San Pedro River near Fairbank, Arizona. O'Donnell creek supports three species of native fish, Sonora sucker (*Catostomus insignis*), longfin dace (*Agosia chrysogaster*), Gila chub (*Gila intermedia*); and also, one species of frog, Chiricahua leopard frog (*Rana chiricahuensis*); and one species of snail, Huachuca springsnail (*Pyrgulopsis thompsoni*). In 1990 nonnative Green sunfish (*Lepomis cyanellus*) were first observed in O'Donnell Creek. Detrimental impacts from their illegal introduction were soon evident as their numbers increased, while numbers of Sonora sucker and Gila chub decreased, and longfin dace were extirpated. To prevent extirpation of Sonora sucker and Gila chub, the Arizona Game and Fish Department, Coronado National Forest Service, and Arizona Chapter of The Nature Conservancy, chemically renovated O'Donnell Creek in the summer of 2002 to remove the nonnative Green sunfish. Prior to renovation, salvage efforts were attempted to remove Gila chub and Sonora sucker. Approximately 104 Sonora sucker and 126 Gila chub were captured and held temporarily at outdoor exhibition ponds located at International Wildlife Museum. Approximately 1¾ miles of perennial stream and 2½ acres of cienega were treated with Antimycin A. Liquid and sand Antimycin A were applied over a three-day period. Liquid Antimycin was applied by backpack and handheld sprayers to all habitat types. Sand Antimycin was applied by hand and use was concentrated in cienega and deep-water habitats. The renovation resulted in 100% removal of green sunfish. Gila chub and Sonora sucker have been returned to O'Donnell Creek

## 16. Fish need water! Low flow impacts on the native fishes of the Virgin River.

*Golden , ME & Holden , PB.*

Sampling at least monthly in the lower Virgin River from 1999-2002 has shown a substantial decrease in numbers of native fish. While reproduction has been evident for at least some species, recruitment has been lacking. Red shiner has been considered the major factor influencing the decline of native fishes, particularly the endangered woundfin, in the Virgin River. However, low flows create high temperatures and water clarity that may impact recruitment of na-

tive fishes through direct mortality and increased competition. We used flow data from the USGS gage on the Virgin River near Littlefield, AZ to generate a cluster analysis of the summer 50% exceedence flows and seven day spring maximum flows from 1970-2001. We used the cluster analysis to determine which years could be considered drought years. We then compared fall native and nonnative fish numbers from our surveys in the lower Virgin River over the last 9 years, as well as information from areas in Arizona and Utah acquired from the Virgin River Fishes Database. We found that fall red shiner numbers were generally higher in drought years. Fall native fish numbers were significantly lower in drought years at all locations analyzed, including areas which, prior to this year, were not known to have shiner. While it is apparent that red shiner have some impact on native fishes in the Virgin River, long term drought exacerbated by human water use also has a large impact. The synergistic effect of increased red shiner numbers and other adverse conditions caused by low flows helps to explain why native fish populations have been unable to reestablish themselves in the lower Virgin River.

## 17. Differences in swimming ability and behavior in response to high water velocities among native and nonnative fishes of Arizona.

*Ward , DL , Schultz , AA & Matson , PG.*

Flooding may benefit native fishes in some Southwestern streams by disproportionately removing nonnative fishes. The cause of reduced abundance of nonnative fishes after floods is not clearly understood. We conducted swimming performance tests on native and nonnative fishes commonly found in Arizona streams to evaluate the extent of differences in swimming ability among species. Fish of similar length were subjected to stepwise increases in water velocity in a laboratory swim tunnel until fish could no longer maintain position. Nonnative fathead minnow *Pimephales promelas* and red shiner *Cyprinella lutrensis* exhibited swimming abilities similar to native longfin dace *Agosia chrysogaster*, speckled dace *Rhinichthys osculus*, and spikedace *Meda fulgida*. Nonnative mosquitofish *Gambusia affinis* exhibited swimming ability similar to native Gila topminnow *Poeciliopsis occidentalis*. Desert sucker *Catostomus clarki*, bluehead sucker, *Catostomus discobolus* and speckled dace exhibited behavioral responses to high flows that may confer energetic advantages in swift water. Differences in swimming ability do not appear to adequately explain the disproportionate removal of nonnative fishes via flooding. Behavioral responses to high flows are more likely the mechanism that allows native fish to persist in streams during flood events.

## 18. Continuing loss of Pecos pupfish populations via hybridization.

*Echelle, AA & Echelle, AF.*

Since the middle 1980s, the Pecos River and peripheral waters in west Texas have supported a hybrid swarm representing the endemic Pecos pupfish, *Cyprinodon pecosensis*, and an introduced non-native, *C. variegatus*. Genetic introgression recently spread into Salt Creek, a 40-km tributary of the Pecos River where the pupfish previously seemed free of introduced genetic elements. By March 2001, hybrids extended approximately 18 km upstream in Salt Creek. Allozyme and morphological characteristics both demonstrated a cline with higher frequencies of non-native characteristics toward the tailwaters. This apparently reflects genetic introgression by *C. pecosensis x C. variegatus* from the Pecos River, possibly during a period of population expansion following a severe summer drought. Additionally, one of two artificial refuge populations of Pecos pupfish has been lost to hybridization. The history and dynamics of this hybridization system will be discussed.

## 19. The High Levee Pond, a native fish habitat located on the lower Colorado River.

*Minckley, CO, Thorson, M, Mueller, G & Carpenter, J.*

The High Levee Pond is a 2 hectare pond located on Cibola National Wildlife Refuge near Blythe, California. It was estaablished in 1993 as a native fish growout facility for bonytail Gila elegans, and razorback sucker, Xyrauchen texanus. In 1999, it was decided to no longer remove fish from the pond but instead, to allow the population to develop as it may thus providing the opportunity to study in the bonytail in depth, a fish whose biology is virtually unknown, and the early life history stages of both species. This report details the development of this facility, to include the numbers of fish stocked, repatriated to the lower Colorado River, and the information collected on this population after 1998. This information will be used to apply to future native fish habitats being developed in the lower Colorado River basin and to increase the overall knowledge about the biology of these fishes.

## 20. A case of rapid evolution of body shape for the White Sands pupfish?

*Collyer, MC & Stockwell, CA.*

The current distribution of White Sands pupfish (*Cyprinodon tularosa*) con-

sists of four populations: Salt Creek, Malpais Spring, Mound Spring and Lost River. The latter two populations were founded circa 1970 with fish from the Salt Creek population. These recently established populations now occupy habitats that differ considerably from the native habitat at Salt Creek, a moderately-saline fluvial habitat; Lost River is a highly-saline fluvial habitat and Mound Spring is a freshwater spring. A recent landmark-based morphological examination revealed significant differences in pupfish body shapes among the four populations. Body shape was highly conserved for the Salt Creek population introduced into Lost River but significantly diverged in the Mound Spring habitat to a deeper-bodied form. Despite this divergence, the average Mound Spring shape was significantly different than the average deep-bodied shape from fish at Malpais Spring. Further, analysis of generalized morphological distance suggested that although the average Mound Spring shape was as divergent from Salt Creek as the average Malpais Spring shape, there was a greater association of Mound Spring shape with Salt Creek and Lost River shapes than the Malpais Spring shape. Experimental evidence suggests that rapid evolution of body shape in the Mound Spring environment may have led to the divergence in the average Mound Spring shape. Two results support this hypothesis: 1) fish from the two native populations cultured in common garden mesocosms at low and high salinity levels maintained significantly different shapes with no significant effect observed for salinity and 2) experimental populations of Salt Creek fish raised in freshwater ponds did not show a significant shift in shape from the Salt Creek form one year after transfer. We conclude that shape divergence in the Salt Creek population established at Mound Spring did not occur solely because of phenotypic plasticity and shape may have undergone rapid evolutionary divergence in this environment.

## 21. Vegetation preferences of fountain darters and response to temporary habitat loss from flooding.

*Robertson, MS, Oborny, EO.*

Fountain darters (*Etheostoma fonticola*) are listed federally as endangered due to a limited geographical range and a narrow habitat niche. As part of an ongoing study to evaluate habitat availability and other impacts related to variable flow conditions, seasonal “baseline” samples of fountain darter densities and vegetation composition were conducted from August 2000 – August 2002. Sampling was conducted in several reaches in each of two spring-fed ecosystems, the San Marcos and Comal Rivers, TX. This sampling has revealed the relative importance of specific vegetation types as fountain darter habitat in each system and the influence of changes in vegetation composition. Densities of fountain darters vary greatly by plant species, from <1 to nearly 30 individuals per square meter. Those species with a dense matrix of vegetative material

near the substrate support the greatest densities of fountain darters. This includes *Riccia sp.* and filamentous algae, but while these are abundant in the Comal, they are uncommon in the San Marcos River (except in Spring Lake). *Cabomba caroliniana* and *Hygrophila polysperma* generally have highest densities of fountain darters in the San Marcos River.

During the study, two significant flood events impacted the San Marcos River and three affected the Comal River; these events resulted in significant short-term reductions in vegetation coverage and density. In both rivers, the vegetation types that provide the greatest habitat for fountain darters were generally the most significantly impacted; however, the impact to fountain darters differed between rivers. In the San Marcos River, estimates of fountain darter abundance decreased in the two reaches after each event. In the Comal system, estimates of fountain darter abundance did not differ dramatically before and after flooding in most instances. This suggests that fountain darters in the Comal River may have a greater "buffering" capacity to flooding effects than populations in the San Marcos River. One significant factor is the substantial area in the impounded headwaters of the Comal River (Landa Lake) compared to the remaining portion of the range in that system. Fountain darters are numerous in this habitat and it was virtually unimpacted from intense flooding. There is a similar protected pool in the headwaters of the San Marcos River (Spring Lake) which was not sampled using the same methods, but which visually appeared unimpacted following flooding. Snorkeling has shown that fountain darter densities are extremely high in Spring Lake, however, the lake constitutes a much smaller portion of the fountain darter range in the San Marcos River than Landa Lake in the Comal River. Recovery of vegetation following each flood event was rapid and suggests that flushing flows followed by a recovery period does not effectively reduce fountain darter habitat, and may stimulate growth and increase overall habitat availability.

## 22. Oxygen Isotopes in Otoliths Document Gulf Corvina Use Colorado River Habitat.

*Rowell, K, Flessa, KW & Dettman, D.*

Before upstream water diversions, the Colorado River was a major influence on habitats in the northern Gulf of California. Oral traditions of the local fisherman indicate that the endemic sciaenid, Gulf corvina (Cynoscion othonopterus) spawned in the Colorado River. Now the Colorado River barely trickles into the northern Gulf of California. Has the lack of fresh water affected the Gulf corvina? We document that Gulf corvina use the Colorado River brackish-water habitat during spawning and in their juvenile years. We use oxygen isotope values from annual rings of saggital otoliths to track the salinity of the

water corvina inhabit during different life stages. Oxygen isotopes in otolith aragonite function as temperature and salinity indicators of ambient water conditions. Seasons were associated with sub-annual rings from back-calculating since time of capture. Significant variation from expected temperature-influenced ´18O values is a function of increased freshwater influence. The northern Gulf of California winter temperatures are typically 14ºC and would yield, in the absence of any river water, ´18O values of +1.0 to +1.5 permil. We observe winter values that are significantly more negative than expected from temperature alone, indicating the influence of river water during juvenile life stages. These results are consistent with the hypothesis that the lack of Colorado River flow caused the commercial extinction of Gulf corvina from 1960-1992.

## 23. The fishes from Norogachi, Chihuahua region.

*Espinosa, HP, Daza, AC & Hendrickson, AH.*

Norogachi is located at the Sierra Madre Occidental, by the geographic position it has Neotropical and neartic elements, with the rough topography whither we found from desert areas to pine-oak tree forest. The elevation in the area is between 200 to 3000 meters above sea level. All this, give special biological diversity with own characteristics, specially in the two most important water systems in the area: the rivers Fuerte and Conchos. Unfortunately this is one of the fewests studied area of the country from the biological point of view; In spite of that the dynamic economy had cause high levels of environmental damage, and climatic changes had taken place long drought seasons. With the propose to know the diversity of the ichthyofauna, in this priority land and aquatic area for the CONABIO, it has been developed a project to do an inventory, with collects and collection databases review. Until now the results are: 14 families, 28 genus, 46 species. The Cyprinidae family with 15 species, Poeciliidae with 8 species and Ictaluridae with 5 species are the most abundant in the area, besides the environmental impacts already known it has been identified five no indigenous species.

Norogachi se localiza en la Sierra Madre Occidental, por su posicion geografica contiene elementos nearticos y neotropicales, que se conjugan con una topografia muy accidentada que va desde la zona desertica hasta el bosque de pino-encino, con elevaciones entre 200 y 3,000 msnm. Estos factores dan como resultado una diversidad biológica con características unicas, especialmente en los dos principales sistemas hidricos de la region: el rio Fuerte y el rio Conchos. Paradojicamente, esta es una de las regiones menos estudiadas del pais desde el punto de vista biologico, no obstante que la dinamica economica del area ha causado altos niveles de deterioro ambiental, al igual que el cambio climatico

caracterizado por largas sequias. Con el proposito de hacer un reconocimiento de la diversidad de la ictiofauna, dentro de esta region prioritaria terrestre y dulceacuicola, se desarrolla un inventario por medio de un proyecto con la CONABIO, en el cual se han realizado recolectas y se trabaja en la revision critica de las bases de datos de las colecciones, donde se ha depositado material ictico de la region. Hasta el momento se tienen como resultados, la presencia de 14 familias, 28 géneros y 46 especies. Destacan por su abundancia las familias Cyprinidae con 15 especies, Poeciliidae con ocho e Ictaluridae con cinco. Ademas de los impactos reconocidos en la zona, se ha identificado la presencia de cinco especies introducidas.

## 24. Current and potential future effects of reservoir fluctuations on the Lake Mead razorback sucker population, 1996 - 2002

*Abate, PD, Holden, PB & Welker, TL.*

The Southern Nevada Water Authority and the US Bureau of Reclamation have been funding an ongoing cooperative razorback sucker, *Xyrauchen texanus*, research project in Lake Mead, Nevada and Arizona for the past six years. Over the initial five years of the study, two primary populations at Echo Bay and Las Vegas Bay were followed and a third potential population was investigated at the Colorado River inflow area. Spawning locations, larval production, habitat use, limited recruitment, and above average growth were documented for the primary populations. Ages were calculated nonlethally for 20 individual razorback sucker (6 to 20 years of age) indicating that these were young populations that potentially recruited under specific reservoir conditions present in the last twenty years.

Research activities for the 2001-2002 study year were conducted as lake elevation was declining to levels not encountered since the late 1970's. Reservoir elevations decreased 20 feet during the 2001-2002 study year, 31 feet since the beginning of the study in October 1996, and 55 feet since the highest elevation was reached during the study in October 1998. Numbers of larval razorback sucker captured at the Echo Bay and Las Vegas Bay study areas were similar to previous years; however, razorback sucker at Echo Bay utilized a new spawning area because of decreased lake levels. Spawning at Las Vegas Bay probably occurred at a location similar to previous years because of the increased depths at this location. No razorback sucker larvae were collected during spring sampling at the Colorado River inflow area.

Four sonic tagged, impoundment reared, razorback sucker were released at the Colorado River inflow area with the anticipation that these fish would lead us

to wild spawning razorback sucker in the area. After nearly two months of tracking these tagged razorback sucker, they apparently left the area and were not relocated either up-river in the lower 40 miles of the Grand Canyon or down-lake in Gregg or Virgin Basin. The migration of these fish out of the Colorado River inflow area, combined with the fact that no razorback sucker larvae were found in the area this year, suggests that decreasing lake levels negatively affected spawning in this area and may have caused wild razorback sucker to move out of this vicinity.

An additional eighteen razorback sucker were aged during the 2001-2002 study year. These fish had ages ranging from six years, for a juvenile razorback sucker, to 35+ years for the oldest razorback sucker that we have aged during the study. Comparing the years spawned for all aged razorback sucker to historical Lake Mead water elevations provides some evidence that a combination of small annual lake level fluctuations, and larger multi-year changes in lake elevation may influence razorback sucker recruitment. The long tern lake level changes may promote the growth of litoral vegetation which could provide increased habitat for larval and juvenile razorback sucker, resulting in the limited recruitment documented in Lake Mead.

## 25. Distribution, Status and Conservation of the Sonoyta Mud Turtle (*Kinosternon sonoriense longifemorale*).

*Knowles, GW, Paredes-Aguilar, R, Hall, DH, Riedle, DR, Rorabaugh, JC & Rosen, PC.*

The Sonoyta mud turtle, *Kinosternon sonoriense longifemorale* , a candidate for Federal listing, is restricted to Quitobaquito, Organ Pipe Cactus National Monument (OPCNM), and at a similar site in Quitovac and nearby Río Sonoyta, both in Sonora. A conservation team (with representatives from U.S. Fish and Wildlife Service, Instituto del Medio Ambiente y el Desarrollo Sustentable del Estado de Sonora, Reserva de la Biosfera El Pinacate y Gran Desierto de Altar, OPCNM, University of Arizona, and Arizona Game and Fish Department) began field work in October 2001 to determine the turtle's range and status in Mexico. Turtles were discovered in all areas of Río Sonoyta with perennial water, and in adjoining areas with seasonally intermittent water, where they are, however, apparently uncommon or rare. Known range and total population are small; the bulk of the species population is apparently behind a man-made dam, Presa Xochimilco, at Sonoyta. Overexploitation of water remains a threat. A second field visit in March 2002 revealed that drought conditions had largely dried the reservoir at Presa Xochimilco. How this apparent drastic reduction in habitat affected the population is subject to current investigation. The population at Quitovac, a large and isolated spring complex, was newly

discovered in March 2002, and turtles were also found in the Sonoyta sewage lagoon. Further work is planned to better define threats, study population density, demography, and genetics, and produce a brochure emphasizing the unique beauty and need for conservation of the Río Sonoyta for distribution in the United States and Mexico.

## 26. Effect of the Introduced Western Mosquitofish (*Gambusia affinis*) on the Least Chub (*Iotichthyes phlegethontis*).

*Mills, MD, Belk, MC & Rader, RB.*

Least chub (*Iotichthys phlegethontis*) were once widely distributed in the Bonneville Basin of Utah in a variety of habitats. Presently the distribution of least chub is limited to a few spring pools in the west desert and central region of Utah. Due to this large-scale population decline, least chub are candidates for listing as an endangered species. Currently one of the major threats to remaining populations of least chub is the introduced western mosquitofish (*Gambusia affinis*). We evaluated the competitive and predatory effects of western mosquitofish on least chub using seminatural enclosures, containing varied densities of western mosquitofish. It was found that predation played a greater role than competition in the interaction between the two species. The competitive effect that was observed appeared to be independent of western mosquitofish density. These results can be used to shape future management decisions regarding least chub populations and techniques for western mosquitofish removals.

## 27. Comparison of the distribution and recapture rates of acclimated and non-acclimated subadult razorback sucker *Xyrauchen texanus* stocked into the Green River, with observations on the feasibility of larval razorback sucker growth and survival with nonnative fishes in floodplain wetlands.

*Modde, T, Birchell, G & Christopherson, K.*

As part of the Upper Colorado River Basin recovery effort, razorback sucker *Xyrauchen texanus* augmentation will increase significantly in the coming years. In an effort to examine efficiency, we compared the capture returns of acclimated and non-acclimated razorback sucker in the middle Green River. We feel that floodplain habitats may be important to natural recruitment as well as acclimation. An earlier study by the Utah Division of Wildlife Resources indi-

cated that age-1 razorback sucker grew and survived well in offchannel wetlands in the presence of nonnative predators/competitors. However, larval razorback sucker stocked into the same wetlands were not recovered. This presentation summarizes the capture returns of fish acclimated in the wetland for an entire growing season with those stocked directly from the hatchery, and the experimental results of the 'reset' concept involving stocking larval razorback sucker survival in the presence of predacious nonnative fishes in a newly inundated floodplain wetland.

The distribution and recapture rate of approximately 2,000 subadult/adult razorback sucker (>250 mm) stocked directly into the river between 1997 and 2001 were compared with fish that were stocked as age-1 fingerlings (~ 100 mm) in a natural wetland in the spring of 1999 and accessed the Green River the following spring (approximately 1,100 fish in excess of 300 mm). The entire reach of the Green River between Split Mountain Canyon (rkm 352) and the confluence with the Colorado River was sampled with electrofishing boats during the spring of 2001. Three complete passes were made. Despite the fewer fish accessing the river from the floodplain, nearly three times (74) as many acclimated fish (i.e., floodplain stocked fish) were recaptured than those stocked into the river directly from the hatchery (29). Despite the differences in apparent capture rates the distribution of fish downstream from the stocking area was approximately equal between the two groups. As expected, the majority of post-stocking movement occurred downstream of the stocking site.

Larval razorback sucker were stocked into two 0.1 hectare pens with adult nonnative fishes. The numbers of nonnative fishes were similar to those observed during the first year of inundation following complete drying of the wetland. Each pen was stocked with a different density of larvae (~60,000 = low density, and 450,000 = high density). Larvae and nonnative adult fishes were stocked May and harvested in August. Zooplankton and water chemistry were monitored through out the study period. Following harvesting, 359 and 1,709 age-0 razorback sucker were harvested averaging 70mm and 58mm, respectively from the high and low density ponds. In addition to razorback sucker survival, large numbers of age-0 nonnative fishes were present in the study pens. Although survival was low, the potential for razorback sucker in offchannel wetlands following drought conditions offers management options that may improve natural recruitment.

## 28. Standard sampling of desert fish: benefits, recent progress, and a call for action.

*Bonar, SA, Didenko, A.*

There are many examples of how standardization of procedures in production

and data collection have lead to remarkable advances in industry and science, but standardization is lacking regarding protocols for sampling fish populations in inland, freshwater systems. Reasons given why biologists often resist standardized sampling protocols include perceptions that differences in regions invalidate standard techniques; use of standard sampling is costly and reduces innovation by regional biologists; the variation already present in nature masks any gains introduced by standardization; and historical trend data is lost. We examine these reasons and discuss procedures currently used by sport fisheries biologists that may be useful for those monitoring desert fish. Recent advances in this area include development of relative weight (Wr) equations for desert catostomids and cyprinids, and development of relative length frequency (RLF) procedures for desert fish. Standardization can provide clear benefits and we discuss the option of developing nation-wide or continent-wide standards with leadership by the American Fisheries Society.

## 29. Truchas mexicanas: An international partnership for the study of native trout of southern north America.

*Mayden, R.L.*

The diversity and conservation of western trout has long been of interest to biologists from varied disciplines. While considerable knowledge exists for especies and populations in the U.S. and Canada, there is limited knowledge as to the distributions and taxonomic, systematic, and conservation status of native trout populations and species from rivers of México. For over six years, several biologists from Mexico and the United States have worked in close association and in a concerted fashion in building an international partnership for the inventory of populations and species and the taxonomic, systematic, and conservation status of the native species from these drainages. I review for this group the International Partnership Truchas Mexicanas, the concept of the organization, and results from some of our various studies.

## 30. The role of sexual selection in hybridization: evidence for assortative mating between Comanche Springs pupfish and Sheepshead minnow.

*Tech, C.*

The sheepshead minnow (*Cyprinodon variegates*) is a widely distributed species that has been introduced to the native ranges of several pupfishes in Texas and New Mexico. These introductions resulted in hybridization between sheepshead minnow and the native pupfish in every instance. I am studying the

effects of sexual selection and (reduced) hybrid fitness on the rate and direction of hybridization between sheepshead minnow and the Comanche Springs pupfish (*C. elegans*). In one study, I placed 2 males of each species in a large, outdoor tank with 8 females and recorded the number of spawnings, dominance ranks, territoriality, and aggressive interactions of the males over the course of 3 days. Preliminary results from these mating trials suggest that 1) assortative mating (i.e. female choice for conspecific males) occurs, 2) males direct more aggression towards conspecific than heterospecific males, 3) the two species do not differ in overall dominance or aggression, and 4) sheepshead males are more territorial than Comanche males, especially in the absence of physical landmarks. These results suggest that sexual selection may act to reduce the rate of hybridization between sheepshead minnow and the Comanche Springs pupfish.

## 31. Exotic trout removal from a Sierra Nevada high mountain lake complex using non-chemical means with subsequent responses by native fauna.

*Kiddoo, P.*

In 1988 five adult Sierra Nevada mountain yellow-legged frogs *Rana muscosa* were discovered in a small pond in the historically fishless North Fork of Big Pine Creek Basin, Inyo County, California. The frogs in this small pond (area=0.045 ha, max depth=2m), now referred to as Eighth Lake, were found in early spring after a winterkill event that eliminated the lake's fish population. In recognition of the depleted status of these native amphibians, aerial stocking of golden trout *Oncorhynchus aguabonita* by the California Department of Fish and Game into this water body was discontinued. In 1996, Eighth Lake was resurveyed with a newly-devised survey protocol, and the results yielded a fishless lake with a healthy frog population estimated at over 500 adults, 1,000 subadults, and 1,000 larvae. The 1996 surveys of nearby Sixth and Seventh lakes resulted in significantly different findings, with Sixth Lake (area=3.18 ha, max depth=10 m) containing rainbow trout *Oncorhynchus mykiss*, self-sustaining eastern brook trout *Salvelinus fontinalis*, and only seven adult *Rana muscosa*. Seventh Lake (area=1.39ha, max depth=4m) contained a dense population of self-sustaining eastern brook trout and no *Rana muscosa*.

A proposal to remove trout populations from the Sixth and Seventh lake complex to benefit native fauna was incorporated into a California Department of Fish and Game resurce management plan for the Big Pine Creek Basin and was accomplished using only intensive gill netting and electrofishing techniques. Approximately 10,000 trout were removed from 1999 through 2001. During this time amphibian numbers increased dramatically, and successful *Rana muscosa* reproduction was documented in both Sixth and Seventh lakes in 2002.

## 32. Molecular systematics of the darter subgenus Oligocephalus, with an emphasis on the Southwestern Darter group.

*Lang, NJ, Mayden, RL.*

The family Percidae is a dominant member of the fauna of eastern North America. In species number and faunal abundance, it is surpassed only by the minnows and shiners (family Cyprinidae). Of the six native genera, *Etheostoma* is the largest and widest ranging. The genus contains several subgenera, of which only *Oligocephalus* ranges into Mexico. The Southwestern Darter species group, contained within this subgenus, was hypothesized by Steven Norris and Wendell Minckley based on the presence of a hyomandibular spur and several general pigmentation characters (Norris and Minckley 1997). It contains *Etheostoma lepidum* (TX, NM), *E. grahami* (TX, MX), E. australe(MX), *E. lugoi* (MX), *E. segrex* (MX), and *E. pottsi* (MX). These species are found in both upland and endorrheic habitats from western Mexico to central Texas. Initial analyses using the mitochondrial ND2 gene supported the monophyly of this group, although sampling was limited. Results of a more intensive sampling regime using both ND2 and cytochrome b will be presented.

## 33. Profound physiological differences between Cuatro Cienegas pupfish species: evidence from a reciprocal transplant experiment and implications for hybridization.

*Carson, EW.*

*Cyprinodon bifasciatus* and *C. atrorus* are thought to exhibit vast differences in their physiological tolerance thresholds, with the former stenothermic/halic and the latter eurythermic/halic. However, such differences have never been experimentally verified, though documentation and quantification of stenothermic/halic tolerances in *C. bifasciatus* could have important implications for understanding the dynamics of hybridization between these species. To test for evidence of differences in physiological tolerances between *C. bifasciatus* and *C. atrorus*, a reciprocal transplant experiment was conducted. Both species exhibited low mortality in the physicochemically stable environments that typify *C. bifasciatus* habitats. In contrast, *C. bifasciatus* suffered significantly higher ($p < 0.001$) mortality than *C. atrorus* in the severe and fluctuating environments typically inhabited by *C. atrorus*. These results provide empirical evidence that *C. bifasciatus* and *C. atrorus* exhibit profound physiological differences. Such differences may help explain previous observations of limited introgression of *C. bifasciatus* alleles into *C. atrorus* populations. Physiological differences, however, fail to explain why *C. atrorus* alleles have

not introgressed into *C. bifasciatus* populations. Results from this experiment suggests that hybridization dynamics between these species are likely controlled by multiple and complex factors.

## 34. Impacts on a population of the White River spinedace (*Lepidomeda albivallis*) from predation by double crested cormorants (*Phalacrocorax auritus*)

*Sjöberg, JC, Hobbs & B, Nielsen, B.*

Although the double crested cormorant (*Phalacrocorax auritus*) has long been recognized for having significant local impacts on sport fisheries and aquaculture facilities, there is little documentation of predation impacts by cormorants on native desert fish populations. The White River spinedace (*Lepidomeda albivallis*) is restricted to a single spring outflow system, Flag Springs, in upper White River, Nye County, Nevada. Following removal of largemouth bass (*Micropterus salmoides*) from the spring outflow and other management actions, this sole population of spinedace had reached an estimated 1,573 individuals by 1999. Subsequent semi-annual spinedace counts plummeted to an estimated 538 individuals in fall 2000 but intensive surveys of the Flag Spring system failed to identify bass or other aquatic predators. Furthermore, desert suckers (*Catostomus clarki intermedius*) and speckled dace (*Rhinichthys osculus*) remained relatively abundant in the outflow system mitigating against the presence of a generalist aquatic predator. However, observations by management personnel and local residents identified cormorants feeding along the spring outflow channel during winter months when a reservoir 3 miles away, which contained a cormorant rookery of several hundred adult birds, was frozen over. A combination of hazing, habitat manipulation to reduce the size of the cormorant rookery, netting and other actions to reduce access to key spinedace habitat, and direct take of individual birds were implemented beginning in late Spring 2001, following issuance of a permit by the US Fish and Wildlife Service allowing cormorant control. One of the two cormorants taken through control efforts contained a speckled dace in its gut contents, confirming predation on resident native fish species. These efforts resulted in a reduced presence of cormorants around the spring system and also a substantial reduction in the size of the permanent cormorant rookery. September 2001 surveys following the implementation of cormorant control measures enumerated 715 adult fish and by September 2002, monitoring indicated an increase to 1,264 spinedace based on direct observation snorkel counts. Because of their bright coloration and preference for mid-water habitats White River spinedace may be particularly vulnerable to avian predation, and some shift of behavior to use denser shoreline cover may also have contributed to reduced population counts during the period when cormorant predation was intensi-

fied..

## 35. Evaluación de la fertilidad y crecimiento de un cruzamiento dialélico completo de dos lineas (*Oncorhynchus mykiss nelsoni* X *O. mykiss*).

*Zamora Balbuena, G.*

En Noviembre del 2000, se capturarón ejemplares adultos de la subespecie de trucha arcoiris endémica,Oncorhynchus mykiss nelsoni (Evermann),en el arroyo San Rafael, Sierra San Pedro Mártir, B.C., México y se trasladarón vivas al Centro Acuicola el Zarco, perteneciente a la S.A.G.A.R.P.A. en el Estado de México.Se práctico la reproducción artificial usando un cruzamiento dialélico completo de dos lineas, en el mes de Febrero del 2001 usando los reproductores nativos mencionados anteriormente y una línea de trucha arcoiris doméstica (Oncorhynchus mykiss) existente en el mismo centro.El número utilizado reprodutores endémicos fue 17 hembras con un peso de 72 gr con 18 cm (L.T.) y 17 machos de 90 gr con 20 cm (L.T.)en promedio y los reproductores domésticos 4 hembras con un peso 3,200 con 60 cm (L.T.) y los machos de 2,700 gr con 58 cm (L.T) en promedio.El porcentaje de fertilidad de las cruzas puras fue 43% y 93% de las truchas endémicas y domesticas respectivamente. De los cruzamientos recíprocos la cruza hembra doméstica con macho endémico (d x e) tuvo un 93% comparandola con su reciproca (e x d) 28.3 %.En la primera evaluación de crecimiento que fue a los 60 dias de nacidos fue para las crías endémicas un peso de 92 mg con 2.5 cm (L.T.) y las domésticas 542 mg con 3.7 cm (L.T.),para las cruzas recíprocas (d x e)un peso 384 mg con 3.4 cm (L.T.)y (e x d) 106 mg con 2.5 cm en promedio.Al paso de 480 dias la trucha doméstica un peso 292 gr con 29 cm (L.T.) en promedio. No se tomarón en cuenta las endémicas por que sobrevivierón muy pocas. En el cruzamiento (d x e) tuvieron un peso 40 gr con 17.5 cm (L.T.) y (e x d) 64 gr con 18 cm (L.T.) en promedio. La alimentación de las truchas endémicas se basó exclusivamente en alimento vivo y el de las truchas domésticas con las cruzas recíprocas fue alimento balanceado.

## 36. Participación del Instituto Nacional de la Pesca en la revisión y actualización del marco Legal e institucional que regula la disponibilidad, administración, aprovechamiento, manejo y cuidado del recurso agua.

*De La Garza Montaño, MC & Fuentes Mata, P.*

Durante los años 2001 y 2002, el H. Congreso de la Unión del senado de la república, a través de la Comisión de Recursos Hidráulicos, ha realizado diversos

Foros regionales en la República Mexicana con el objetivo de conocer la problemática integral de cada Región Hidrológica del país, a fin de contar con elementos que permitan revisar y adecuar el marco legal e institucional que regula la explotación del recurso agua, su aprovechamiento, manejo y cuidado, así como proponer las acciones para su conservación y desarrollo sustentable. Tras realizar la revisión correspondiente a la actual Ley de Aguas Nacionales, el Instituto Nacional de la Pesca a propuesto varios puntos a considerar en la misma, entre ellos el que el recurso agua sea considerado también en la Ley como substrato y hábitat de las pesquerías y no solamente como un recurso para satisfacer demandas para el consumo humano, industrial, de la agricultura, ganadería, generación de energía eléctica, etc. Así mismo ha señalado que parámetros como el volúmen, velocidad, frecuencia y calidad de las aguas que llegan a los reservorios en que están establecidas pesquerías, son susceptibles de poner en riesgo la sustentabilidad de las mismas.

## 37. Jewel cichlid, *Hemichromis guttatus*, an exotic fish eradicated from Poza San José Del Anteojo, Cuatro Ciénegas Valley, Coahuila, México

*Lozano-Vilano, MDL, García-Ramírez, ME & Contreras-Balderas, AJ.*

The present study was conducted in Poza San José del Anteojo, Cuatro Ciénegas Valley, Coahuila, México, from May 2000 to April 2002 with the objective of eradicating the jewel cichlid, *Hemichromis guttatus*, an African fish introduced in many places in the valley by unknown persons. From the first visit to Poza San Jose del Anteojo we found jewel cichlid and a few individuals of Mexican tetra, *Astyanax mexicanus*., but all other species that had previously occupied this poza had been eliminated by the introduced species. We visited the area 19 times during 3 years in different months throughout each year, collecting fishes by setting 25 minnow traps each day and running them every hour. The population of jewel cichlid varied throughout the study, with first sample in May 2000 containing 3,041 specimens. Only 4 specimens were captured in the last sample in April 2002. In total we collected 19,115 specimens and an unknown number was removed by the owner of the land who helped us in the extraction of the exotic fish by running one trap every day for more than 6 months. Along with the removal of exotics, the first reintroduction of native fishes was made in May 2000 by stocking *Astyanax mexicanus, Ictalurus* sp., *Gambusia marshi* and Cichlasoma minckleyi. No natives were found at the next sampling, so in April 2002 we again reintroduced the same species. On August 2002 *Astyanax mexicanus* and *Gambusia marshi* were abundant. *Ictalurus* sp. released were juveniles and success of the reintroduction can not yet be assessed. *Cichlasoma minckleyi* in nuptial coloration were seen but no broods or eggs were detected.

The jewel cichlid was not found at the last sampling, so we think it was totally eradicated and that this therefore represents the first documented active extirpation of this exotic species.

## 38. Can the invasive species, *Gambusia affinis*, eat young-of-the-year least chub?

*Rader, RB, Mills, M & Belk, MC.*

Native least chub (*Iotichthys phlegethontis*) were once widely distributed in the Bonneville Basin of Utah in a variety of freshwater habitats. They now exist in only a few (5 or 6) isolated desert springs in the Bonneville Basin. Consequently, least chub are candidates for listing as an endangered species in the United States. The spread of mosquitofish (Gambusia affinis) across the Bonneville Basin is thought to have an adverse impact on least chub recovery. We tested the hypothesis that adult mosquitofish can prey on small least chub (15 - 20 mm in length). Replicate trials using behavioral observations of least chub in aquaria indicated that young-of-the-year least chub suffered between 75% and 100% mortality caused by predation over a 3 hour period in aquaria with adult mosquitofish compared to control aquaria without mosquitofish. Dense clusters of filamentous green algae (metaphyton) provided no refuge from predation, whereas “hiding” in clusters of Chara sp. and submersed macrophytes provided minimal protection. Also, large dragonfly nymphs did not consume least chub in this laboratory experiment. This study demonstrates that predation may be one of the primary mechanisms causing the decline of least chub in the presence of mosquitofish.

## 39. Range contraction, spatial dynamics, and bilateral asymmetry in the Coahuilan Box Turtle (*Terrapene coahuila* : Emydidae)

*Howeth, JG & Hendrickson, DA.*

Human-altered landscapes are often characterized by habitat fragmentation. Population level ecological interactions can be disrupted if fragmentation changes the spatial distribution of habitat patches, thus inhibiting interpatch dispersal and migration. We used the valley of Cuatrociénegas, Coahuila, Mexico as a model site to investigate movement of conspecifics between distinct habitat patches within a constricted geographic range. The Coahuilan Box Turtle (*Terrapene coahuila*) is an endangered endemic species that inhabits isolated wetlands nested within a desert matrix. We 1) examined *T. coahuila* range dynamics by comparing 2002 presence/absence data to historic distribution records

from the 1960s; 2) surveyed turtle abundance, movement, and patch dynamics via mark-recapture at both local (d" 2km) and regional (2km e" x e" 15km) spatial scales; and 3) assessed intersite variation in standard chelonian morphological measures. We determined the pattern of range contraction by testing the following biogeographic hypotheses: 1) edge effects from anthropogenic pressures yield collapse towards the ranges' core and 2) anthropogenic disturbance induces range contraction away from the pressure, with populations persisting along the range's periphery. Results support the latter hypothesis with approximately 45% shrinkage towards the southeast portion of the valley and away from anthropogenic disturbance in the north. The impacts of habitat loss on *T. coahuila* are unknown. However, levels of bilateral asymmetry, an established indicator of environmental stress and/or inbreeding, significantly differed across the species' range. Future genetic analyses will aid in elucidating the cause of asymmetry. We conclude that multiple aquatic habitats must be conserved to ensure population viability of the Coahuilan box turtle.

## 40. Roundtail Chub in the Lower Colorado River Basin - Present Status and Future Conservation.

*Voeltz, JB & Bettaso, RH.*

In 1999, the Arizona Game and Fish Department conducted a two-year project to identify the current status of the roundtail chub (*Gila robusta*) in the lower Colorado River basin. Recently completed, this project assembled existing information on the species, identified information gaps that existed and conducted surveys to fill the information gaps. This information is necessary to determine future management needs of the species. This presentation identifies the present status of the roundtail chub and the headwater chub (*Gila nigra*, formerly referred to as *Gila robusta grahami*) in the lower Colorado River basin, with summaries of taxonomy, life history, and historic and current distribution of both species. Additionally, we explore future conservation strategies for the roundtail chub including Endangered Species Act Section 10 conservation tools, the Colorado River basin-wide "three species" Conservation Agreement and Strategy, and hatchery production and stocking into historic habitats.

## 41. Rio Grande Silvery Minnow, *Hybognathus amarus*, and other Fishes of the Mainstem Rio Grande, Bernalillo to Fort Craig, New Mexico.

*Remshardt, WJ, Smith, JR & Hoagstrom, CW.*

Three reaches (Angostura, Isleta, and San Acacia) of the mainstem Rio Grande in New Mexico were surveyed between June 1999 and June 2001. These reaches

represent the remaining core area of the endangered Rio Grande silvery minnow, *Hybognathus amarus*. The historical decline of Rio Grande silvery minnow distribution and abundance coupled with ongoing changes to the Rio Grande where Rio Grande silvery minnow persist has caused concern over the continued survival of the species. Recent declines in the abundance within Angostura and Isleta reaches raised this concern to a higher level and were the primary motivation for this study. The primary goal was to evaluate the fish community of the three reaches where Rio Grande silvery minnow are best known, comparing distribution and relative abundance.

All three reaches represented distinct fish communities with different factors most likely affecting each reach. The San Acacia Reach fish community was most distinct, with highest Rio Grande silvery minnow densities. Red shiner, *Cyprinella lutrensis*, was also abundant in this reach, accounting for 23.7% of fish collected. Isleta Reach had the highest fish community stability with a majority of individuals represented by non-fluvial species red shiner, western mosquitofish, *Gambusia affinis*, and fathead minnow, *Pimephales promelas*. Angostura Reach had low fish community and flow regime stability and was dominated by white sucker, *Catostomus commersoni*. Non-fluvial species thrived in all three reaches while fluvial species such as Rio Grande silvery minnow, flathead chub, *Platygobio gracilis*, and longnose dace, *Rhinichthys cataractae*, declined.

## 42. Lousy Canyon and Other Potential Successful Models for Native Fish Management in Arizona. Bettaso,

*RH, Davidson, RF & Voeltz, JB.*

The Gila topminnow (*Poeciliopsis occidentalis*) and desert pupfish (*Cyprinodon macularius*) are federally listed as endangered, and the Gila chub (*Gila intermedia*) is proposed for listing as endangered. Historically, all three fish species co-existed in cienega habitats in the Gila River basin of Arizona. Due to habitat loss and alteration, and negative impacts from nonnative species, natural desert pupfish populations disappeared from Arizona in the 1950s. Additionally, remaining natural Gila topminnow and Gila chub populations are small, isolated, and fragmented in their distribution. Reestablishing these fishes into protected habitats within their historic range is vital for their recovery. In 1995, the Arizona Game and Fish Department (Department) in cooperation with the U.S. Bureau of Land Management (BLM) stocked Gila chub into Lousy Canyon, a remote and rugged canyon located on the BLM's Agua Fria National Monument in central Arizona. The chub have thrived and expanded their population size and range in the canyon. In 2000, the Department, BLM, U.S. Fish and Wildlife Service, and the U.S. Bureau of Reclamation stocked

Gila topminnow into Lousy Canyon, and in 2001, desert pupfish were stocked into the canyon. Surveys conducted to date have documented persistence, reproduction, recruitment, and expansion of range of all three species within the canyon. This presentation will explore why the Lousy Canyon project has been a success, and how it can be a model for future native fish conservation and recovery actions in the state of Arizona.

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*Cualac tesselatus*

Photo by Juan Miguel Artigas Azas