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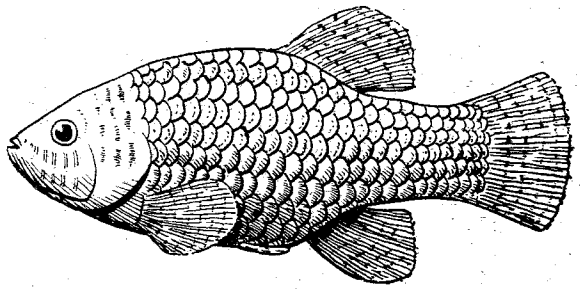

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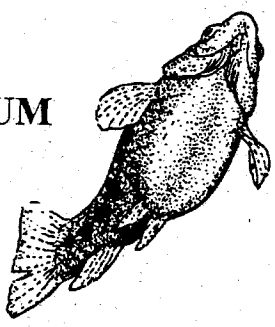

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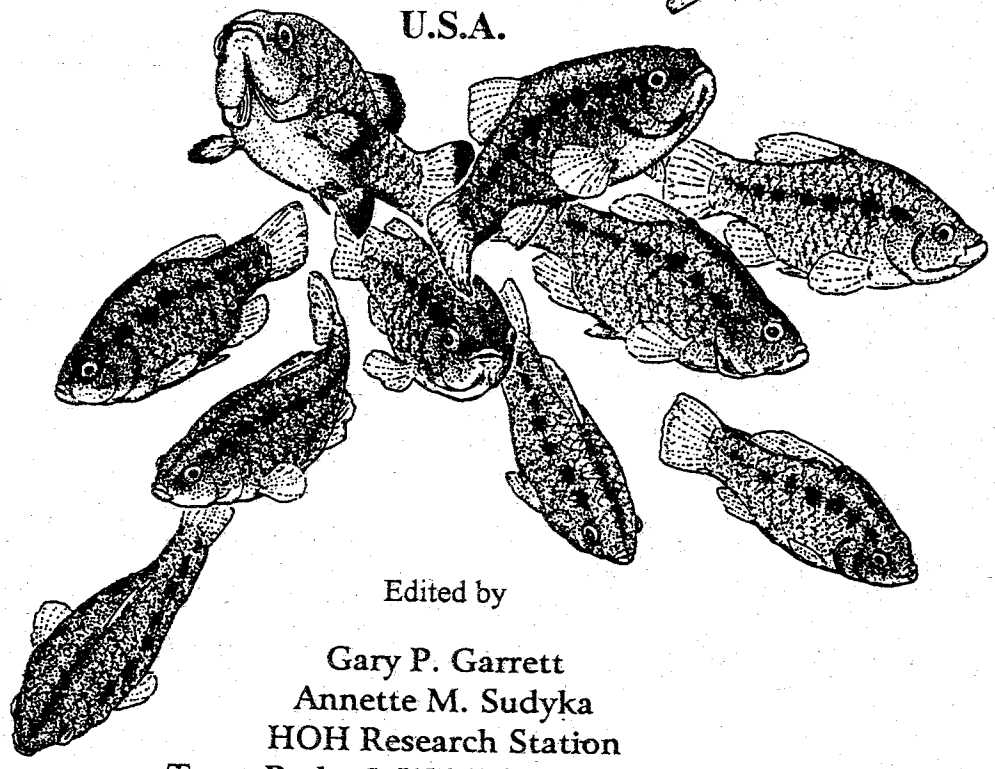

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Geographic Variation in Life History Traits of *Gambusia* Species

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ABSTRACT

Populations of *Gambusia affinis* differ substantially in predation on newborns, birth weight, and interbrood interval. Populations of *G. geiseri* also differ significantly, but to a lesser degree, in the same three factors. Populations of *G. nobilis* differ in predation and birth weight. These factors are not concordant among species and localities; thus these variations are genetic, not environmental. Overall, *G. affinis* is less predaceous, has less heavy young, and has shorter interbrood intervals than *G. nobilis*, and *G. geiseri* is intermediate. However, the factors can be reversed by choosing extreme populations. Data are available on interbrood intervals for six species; they range from long to short by *G. nobilis*, *G. heterochir*, *G. gaigei*, *G. geiseri*, *G. speciosa*, and *G. affinis*. In the same sequence, birth weights vary from heavy to light and predation rates vary from major to less. However, intraspecific variation is not correlated among these factors. Predation susceptibility varies similarly with the heavier newborn being less likely to be eaten than the lighter newborns. However, predation on the relatively heavy but less active *Poecilia* young is the greatest of all.

RESUMEN

Las poblaciones de *Gambusia affinis* difieren substancialmente en la depredación de reciennacidos, peso al momento de nacer e intervalo de las gestaciones. Las poblaciones de *G. geiseri* tambien difieren significativamente, pero a un grado meno, en los mismos tres factores. Las poblaciones de *G. nobilis* difieren en depredación y peso al momento de nacimiento. Estos factores no son concordantes entre especies y localidades; por lo tanto estas variaciones son basadas en genética, no en medio ambiente. En general *G. affinis* es menos depredador, tiene crías con menos peso y tiene intervalos de gestación más cortos que *G. nobilis*, mientras tanto *G. geiseri* se encuentra entre ambos. Sin embargo, los factores pueden ser reversidos al escoger poblaciones extremas. Data de los intervalos de gestación de seis especies es disponible; estos se extienden de largos a cortos de las especies *G. nobilis*, *G. heterochir*, *G. gaigei*, *G. geiseri*, *G. speciosa* y *G. affinis*. En las misma sequencias, el peso al momento de nacimiento varía de pesado a liviano y las proporciones de depredación varían de mayor a menor. Sin embargo, variación intraespecífica no está correlacionada entre estos factores. Susceptibilidad en la depredación varía similarmente con las crías que son más pesadas al haber menos posibilidad de ser comidos que los son más ligéros. Sin embargo, depredación en las relativamente pesadas pero menos activas crías de *Poecilia* es la más grande de todas.

Traditionally, reports on biological problems emphasize the species studied. Some reports, mostly recent, have demonstrated intraspecific variation of life history traits. The classic lizard studies by Tinkle (1969) have shown that variation correlated with environmental factors such as the latitude at which the stocks lived. A few fish studies (Haskins et al., 1961; Houde, 1988; Foster, 1994; Endler and Houde, 1995; Reznick et al., 1996; Reznick and Bryga, 1996) have shown variation in reproductive or predatory activities. Previously, I have shown that populations of *Gambusia affinis* vary in predation on congeneric newborns (Hubbs, 1992) that can be called cannibalism (Hubbs, 1991). In this report I expand on those data by using two other life history traits: birth weight of young and time between broods from females isolated from males. I also expand the number of species used for interpopulation comparisons to include *Gambusia geiseri* and *G. nobilis*. This report also includes comparable data on one population of *G. speciosa*, *G. senilis*, *G. longispinis*, *G.* sp., *G. heterochir*, and *G. gaigei*. The last three species have (or had) limited geographic ranges and consequently only one population could be used. Six of the species (*G. nobilis*, *G. speciosa*, *G. longispinis*, *G. senilis*, *G. gaigei*, and *G.* sp.) are native to the Chihuahuan Desert and five are listed as endangered by the appropriate federal government (all but the extinct *G.* sp.).

Gambusia affinis is widely distributed in the south-central North America. It is used extensively by public health agencies as a biological control for mosquitos. It is possible that some of my populations may have been introduced (one certainly has), but the intraspecific variation in three life history traits suggests limited replacement of native populations by introduced stocks.

Gambusia nobilis occurred in several spring-fed waters in the Pecos valley of West Texas and eastern New Mexico. Presently it occupies two New Mexico areas: Blue Spring and the Bitter Lakes National Wildlife Refuge. It also occurs in two areas in Texas: Diamond-Y Spring and the spring complexes around Balmorhea (Hubbs and Springer, 1957). I have samples from all of these regions except Blue Spring. Two, Bitter Lakes and the Balmorhea complex, have two or more separate populations studied.

G. geiseri occurred in two spring areas in Central Texas: Comal and San Marcos springs. Some time about 1930, stocks were widely released elsewhere in Texas, presumably by public health agencies (Hubbs and Springer, 1957).

Consequently, I have data on native populations of two species (*G. affinis* and *G. nobilis*) and data on two native populations and six introduced sixty years ago of a third species (*G. geiseri*).

Materials and Methods

Stocks were obtained from 48 populations of *Gambusia affinis*, 7 of *G. nobilis*, 10 of *G. geiseri*, and one each of the other six species (Table 1). Five populations had only adults used. Additionally, predation studies were also performed using *Poecilia* young. Most of the samples were from widely-distributed localities in Arizona, New Mexico, Texas, and Arkansas (Map 1). Several localities were relatively close together (Map 1, Insets). The fish were brought into the Austin laboratory and fed heavily with Tetra Min and *Drosophila* larvae and adults.

Predation studies: Three to twenty newborn young were randomly isolated in aquaria with one adult that had been in the laboratory at least one week. Each aquarium (49 by 15 by 17 cm (deep)) had an airstone and a series of snails (*Physa*) that could consume excess food and provide supplemental food for the fish (Hubbs, 1990). Each experiment was fed ca. 20% of total fish biomass daily with flake food and with *Drosophila* larvae. The surviving young were counted 31 days later. About 7% of the experiments had no adult at the end of the 31-day interval; those experiments were excluded from the predation data presentations (Table 2). *Gambusia* seldom live more than two years, and it

is presumed that most of the adult mortality was from natural causes. It is likely that some natural mortality occurred with young as well. I presume that 90% survival is close to the maximum survival rate possible in these types of experiments. At the end of an experiment, the adult was returned to the stock tank and may have been used again. As ten or fewer young were used in most experiments, the number of experiments is about 10% of the number of young reported. The data reported here are survival percentages. Predation would be the inverse.

Young used in predation experiments were tested with available adults. For example, Woman Hollering young might be tested with Egg Nog adults on one date and Cow Creek adults the next. Similarly, Cost adults could prey on Too Much Pond young and then on Fairy young at a later date, or Cut 'n' Shoot combined with Hog Eye and then Uncertain.

Birth weight: Females were isolated in floating breeding chambers that were checked daily. Most of the young were used in predation studies, but some young (at random) were placed in a 40°C drying oven for at least two days and weighed. The birth weight of some individuals in a brood might vary by as much as 800%, but variation among individuals was usually about 10%. The average weight of individual young was recorded. Sample sizes are listed in Table 1.

Interbrood interval: Isolated females were continuously maintained in the breeding chambers. The date of birth of the first individuals in a brood was recorded. The occasional young that were found on the next day were considered part of that brood. A female would then have another brood after an interval of more than three weeks. That was considered a second (third, etc.) brood, and the difference between the dates is reported as the interbrood interval. Occasionally, a female captured during a nonbreeding interval in nature would have a second brood shortly (5 - 10 days) after the first. That interbrood interval was excluded from the data. If a population had more than 10 interbrood intervals, the longest and shortest were deleted, if more than 20, the two longest and shortest were deleted, etc. Sample sizes are listed in Table 1.

Results

Predation: Although many authors (Seale, 1917; Krumholz, 1948; Koster, 1957; Myers, 1965; Axelrod and Schultz, 1971 and 1983; Minckley, 1973; Walters and Legner, 1980; Schoenherr, 1981; Harrington and Harrington, 1982; Meffe and Snelson, 1989) have reported that *Gambusia* adults avidly prey on their own young, Hubbs (1992) reported that half of the experimental young survived a week. Additional data provide a similar result (Table 3). Similarly, I have shown that young with male predators had higher survival than those with females (70% versus 30%) (Table 4). I also contrasted the individual predator-predation comparisons and got the same results (Table 5). This excluded the possibility that tests with one sex as predator came from a more predaceous population than those of the other. Many more individual tests had chi-squared values favoring males having a lower predation rate. It should not be surprising that two of more than 800 contrasts were statistically ($p > 0.01$) the converse of the majority. The same statistical level favoring the conclusion that females were more predaceous was obtained by 394 contrasts. Consequently, predation by adults on young is primarily by *Gambusia* females.

Predation by males on poeciliid young had results similar to but more extensive than those reported previously (Table 6). Survivorship of *Poecilia* young exposed to *G. affinis* predation was the lowest of any with a sample size of over 100 young. Similarly, survivorship of *Poecilia* young was lowest in one of the other three comparisons. Predation rate may be affected by feeding by the predator or escape by the prey (Fuiman and Magurran, 1994). Although *Poecilia* young are relatively large, they are less active in aquaria than are *Gambusia* young. The second-lowest survivorship with male *G. affinis* as predator was conspecific. Predation by *G. nobilis* males was relatively high as young survival with *G. nobilis* as predator was lowest in all but three (*G. nobilis*

with *G. nobilis*, *G. heterochir* and *Poecilia* young) with sample sizes of more than 50. In general, *G. nobilis*, *G. heterochir* and *G. gaigei* males ate more young that did males of *G. affinis*, *G. speciosa*, and *G. geiseri*. Conversely, *G. nobilis*, *G. heterochir* and *G. gaigei* young had a higher survival rate than those of the other three species.

Similarly, predation by females followed the same pattern as that reported previously (Table 7). Survival of *Poecilia* young exposed to *G. affinis* females was lower than that of any *Gambusia* species. Predation by other species was similar, with most survival of *G. affinis* young among the lowest. Predation on *G. affinis* young by congeneric females was substantially higher than that of males. Congeneric predation on *G. affinis* young was higher with *G. geiseri*, *G. nobilis* or *G. gaigei* females than using *G. affinis*, *G. speciosa*, or *G. heterochir* females. In this test, *G. geiseri* went from low to high and *G. heterochir* went from high to low in comparison with male predation. Again, survivorship with *G. nobilis* females was lowest in four of the six tests with sample sizes over 100. The exceptions were *G. nobilis* and *G. gaigei* young, where *G. nobilis* predation was second highest, and *G. nobilis* with *G. heterochir* young. Again, *G. nobilis*, *G. heterochir* and *G. gaigei* young had a higher survival rate than those of the other three species. Conspecific predation was highest by *G. affinis* females (= cannibalism); *G. heterochir* and *G. gaigei* conspecific predation was also quite high.

Extensive variation of survivorship occurred when *G. affinis* young were exposed to female *G. affinis* predation (Table 8). In two tests (Lost River and Big Bend), more than two-thirds of the young survived. In contrast, in seven tests (Bitter #3, Falcon, El Tigre, Fairy, Junction, Middle Creek, and Uncertain), survivorship was below 10%. Survivorship with males as predators tended to be similar with the two high survivors having 79 and 88% survivorship and the six with low figures having 85, 76, 66, 73, 64, 77, and 68% survivorship. Six of the seven survival percentages with male predators were lower than either of the two with high survivorship with female predators. In two other populations (Pecos and Clear Creek) where the survivorship with female predators had percentages above 50, the comparable male tests had survivorships of 81 and 85%. Similarly, Big Bend and Junction females were tested with *G. speciosa* and *G. geiseri* young. In each instance, survivorship with Big Bend females was higher than those with Junction females (61 vs. 18% and 73 vs. 8%). These results remained consistent whether either of two sets of field-caught females or laboratory-raised females (from Big Bend) were used. There is a distinct difference in predation on newborns depending upon the population of adults used. Clearly, the choice of *G. affinis* stocks used for mosquito control would have great influence on average predation on young fishes. It is possible that *G. affinis* predation on other prey such as mosquitos may vary among populations equally. Such tests by mosquito control agencies are now mandated.

The variation of predation by *G. affinis* adults does not have a geographic or ecologic pattern. The two New Mexico populations are from the Bitter Lakes National Wildlife Refuge: one is in the low and the other in the high group. Lazy Pond is one kilometer from the Pecos River site. Survivorship with female predators differs by 43% and is significant at beyond the 0.00001 level ($\chi^2 = 81$). Survivorship based on individual tests is also significant beyond the 0.001 level. Too Much Pond is intermediate geographically and in predation rate.

The four high-survival populations (Lost River - saline, stenothermal; Big Bend - low salinity, stenothermal, elevated temperature; Pecos - moderate salinity, eurythermal; Clear Creek - low salinity stenothermal) have little in common. The seven low survival populations (Bitter #3 - saline, eurythermal; Falcon - moderate salinity, eurythermal; El Tigre - saline, eurythermal; Fairy - low salinity, stenothermal; Middle Creek - low salinity, stenothermal; Uncertain - very low salinity, eurythermal) are equally variable. None of these environmental factors are associated with predation rates.

Predation by female *G. geiseri* on *G. affinis* young also varies substantially. All but one of the

populations had 7 to 28% survival (Table 9). The exceptional population, East Sandia Spring, has a survival rate twice that of the next highest (Toe Nail). It also has the highest survival when males are used as predators. East Sandia Spring has the smallest water volume and presumably the lowest population numbers. On my visit, *G. geiseri* was relatively rare. Conspecific predation by *G. geiseri* also varies widely but has little correlation with predation on *G. affinis*. Variation in predation by *G. geiseri* on *G. affinis* young is substantially less than predation by *G. affinis* when more than 100 young are used: 7% to 28% versus 0% to 69% survival. Presumably the consistency of predation by *G. geiseri* reflects the recent transfer of the fish from San Marcos. Predation rates of females from East Sandia Spring may reflect evolutionary changes in the 50 years since they were released.

Predation by female *G. nobilis* on *G. affinis* young again varies significantly. The five samples with sample sizes more than 100 vary between 0 and 14% survival. The small sample sizes have survival rates between those for large samples. Although the range of survival of *G. affinis* young preyed on by *G. nobilis* is similar to that of young preyed on by *G. geiser*, 14% versus 21%, the relative variation is infinity versus three-fold. If few young survive, a high upper figure cannot occur.

Birth weight: Average birth weights of *Gambusia affinis* also vary extensively from less than 10 milligrams to more than 20 milligrams (Table 10). The two New Mexico populations (Lost River and Bitter Lakes #3) have tiny babies (6.0 and 8.0 milligrams). The other small young are Contrabando Canyon, Fairy, Clymer Meadow, Hanks Bull, Patty's Ranch, Big Brown, Hi Island, and Uncertain. Many of the small young are from east Texas, yet other east Texas fish (Village Creek and Egg Nog) have relatively large young. Only Fairy is stenothermal, but commonly *G. affinis* is absent at stenothermal locations (Hubbs, 1995). All sites have low salinities.

The heaviest young are from Heart of the Hills and San Marcos. Fish from Heart of the Hills (eurythermal) have larger young than those from the nearby Fessenden Spring (stenothermal). The sample location at San Marcos is under the I-35 bridge at a site that is relatively eurythermal for the San Marcos River (Hubbs and Peden, 1969). Again, the variation has little apparent association with geographic or environmental circumstances.

Average birth weights of *Gambusia geiseri* range between 17.1 and 23.3 milligrams. These weights are of the heavier end of those for *G. affinis* but clearly vary far less. No birth weight data are available for East Sandia Spring.

Average birth weights for *G. nobilis* vary but only three populations have data, so comparisons are not readily available.

In general, *G. affinis* and *G. speciosa* birth weights are about 16 milligrams, *G. geiseri* about 20 milligrams, *Poecilia* about 30 milligrams, *G. longispinis* about 25 milligrams, *G. gaigei* about 30 milligrams, *G. heterochir* about 30 milligrams, and *G. nobilis* about 40 milligrams.

Poecilia formosa from San Marcos has heavier young than *P. latipinna* from San Marcos; sailfin molly young from Comal Springs are heaviest of all. Heart of the Hills sailfin Molly young are about the same weight as Comal amazon Molly. Aransas County *P. latipinna* young are much lighter than those from the San Marcos River system.

Interbrood intervals: Average interbrood intervals for *G. affinis* females varies between 27 and 41 days (Table 11). The geographically proximate Phantom and Carpenter Hill populations have no overlap (Hubbs, 1996). Again there is no association of the results with environmental or geographic factors.

Average interbrood intervals for *G. geiseri* females is at the long end of the *G. affinis* range, but the variation is less than for *G. affinis* (8 days vs. 14). The population extreme in predation rate (East Sandia) has no data on interbrood interval.

The interbrood intervals for *G. nobilis* females are similar, but small sample sizes make any interpretations inconclusive.

In general, interbrood intervals are about 35 days for *G. affinis*, 40 days for *G. geiseri*, 44 days

for *G. gaigei*, 47 days for *G. heterochir*, and 52 days for *G. nobilis*.

Numerous interbrood intervals were recorded for *G. affinis* and *G. geiseri*. The maximum number of broods for an isolated *G. affinis* female was 5 (4 interbrood intervals) and 4 (3 interbrood intervals) for isolated *G. geiseri* females. A larger fraction of the isolated *G. affinis* females attained 5 broods than isolated *G. geiseri* females attained 4 broods. Commonly, the last *G. geiseri* brood had one young while the last *G. affinis* brood had a normal number of young. Females of both species have been held in isolation for more than three additional months without producing more broods.

Discussion

Populations of *Gambusia affinis* vary widely in predation on newborn, birth weight, and interbrood intervals. Populations of *G. geiseri* also vary in each factor but at a reduced rate. Populations of *G. nobilis* vary in predation and birth weight. The degree of variation is substantially greater for *G. affinis* than for most introduced populations of *G. geiseri*. The amount of variation for *G. nobilis* is less certain, primarily due to relatively small sample sizes. Several locations have samples of two or three species. The variations of life history traits are not concordant, thus demonstrating that the variation is internal to the species (genetic) and not controlled by the habitat (environmental). For example, I have data on populations from Phantom Cave and Diamond-Y Refugium for all three species and all three traits: Birth weight: *G. affinis* heavy at Diamond-Y, *G. nobilis* and *G. geiseri* heavy at Phantom Cave. Interbrood interval: *G. geiseri* long at Phantom Cave, *G. affinis* and *G. nobilis* long at Diamond-Y. Cannibalism: *G. affinis* extensive at Phantom Cave, *G. geiseri* extensive at Diamond-Y, *G. nobilis* virtually the same.

This report includes comparisons of variation in life history traits for three factors for two species and two factors for one species. All eight vary sufficiently to provide unusual data if one population were to represent the species. For example, *G. affinis* female conspecific predation is about 30% survival, *G. geiseri* predation on *G. affinis* is about 20% survival, and *G. nobilis* predation on *G. affinis* has about 9% survival. In contrast, however, if *G. affinis* were to be represented exclusively by Falcon females, *G. geiseri* and *G. nobilis* by Balmorhea females, the survival rates would be 0% (versus 30%), 12% (versus 20%), and 14% (versus 9%), a reversal of the relative predation rates for the three species as a whole. Similarly, birth weights of newborn *Poecilia* can vary by species depending upon the population used.

Predation rate is associated with birth weight and interbrood interval by species. The most predaceous species, *G. nobilis*, has the heaviest young and takes longer between broods. Conversely, most populations of *G. affinis* have low predation, lighter young and shorter interbrood intervals. The interspecies correlations do not extend to population studies. Contrasts look like a shot gun blast.

Similarly, the birth weight and interbrood intervals for the species as a whole can be reversed by the use of selected populations of *G. affinis* and *G. geiseri*.

Stockwell (1995) showed that introduced populations of *G. affinis* in Nevada varied in minimum size of female maturity and fat content. His populations were introduced about 55 years ago from central Texas. They were initially introduced into one location and then transferred to four others. Two populations were from thermally stable environments, one from a warm spring, and one from a thermally unstable environment. The two from thermally stable environments were similar to each other and differed substantially from those from the unstable environment; the warm spring population was intermediate. He found other differences in field samples that did not recur in laboratory experiments.

These results resemble those reported by Stearns (1983) who showed that introduced populations of *Gambusia affinis* in Hawaii varied in fecundity and in the dry weight of females and of embryos. All of the stocks he analyzed had

been introduced about 70 years earlier (ca. 150 fish from somewhere in Texas). Our dry weight data for *G. affinis* offspring vary to a similar degree. He used embryos and I used newborn young, which should be slightly heavier than embryos (Hubbs, 1971). The fish released into Hawaii came from "Texas," presumably either from the same location or were mixed prior to release, and his results were not caused by differences among the source populations. Stearns tested fish living in stable environments or environments with fluctuating water levels. Clearly, the influence of an environmental variable influenced the life history traits he observed. I found similar levels of variation among native populations of *G. affinis* that did not correlate with environmental factors.

All of us demonstrated variation in life history traits for introduced populations (*G. affinis* for Stearns and Stockwell and *G. geiseri* for me). The degree of variation of life history traits for *G. geiseri* was less than Stearns and Stockwell showed for *G. affinis*. This may have resulted from a) a shorter time since release (50 versus 55 or 70 years), b) the species used, or c) the differences among the environments (quite different for Stearns and Stockwell, virtually identical for me).

It is therefore essential that reports of life history (and perhaps all) traits include a consideration of the population used as well as the species. Furthermore, it is essential that the use of fish for practical applications consider the population as well as the species. This applies to the use of hatchery fish for recreational activities as well as for public health concerns.

It is possible, but unlikely, that the variation of *G. affinis* life history traits reflects species level differences, (i.e., *G. affinis* sensu stricto is a complex of numerous species). If that hypothesis is valid, there should be a correlation among the life history traits and with geographic location; these do not occur. Certainly that cannot apply to the East Sandia Spring population of *G. geiseri*. Even if *G. affinis* is a species complex, these results are merely raised to another evolutionary level, and this variation is among populations of a morphologically-recognized species.

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TABLE 1. Localities from which *Gambusia* stocks were obtained and the number of young used in experiments. The localities are arranged approximately from southwest to northeast within species. All localities are in Texas, except those with state listed.

		Number of Young Used	Young Weighed	Interbrood Intervals
Gambusia affinis				
1.	Bog Hole, Santa Cruz Co., Arizona	552	14	
2a.	Bitter Lake #3 Eddy Co., NM	59	15	
2b.	Lost River, Eddy Co., NM	74	1	
4a.	Carpenter Hill, Reeves Co.	2,107	56	22
4b.	Phantom Cave, Reeves Co.	1,597	143	46
4d.	East Sandia Spring, Reeves Co.			
5.	Diamond-Y Refugium, Pecos Co.	1,613	212	25
6.	Santa Rosa Spring, Pecos Co.	368	27	
7a.	Alamito Creek, Presidio Co.	1,947	113	
7b.	Contrabando Canyon, Presidio Co.	145	25	
8.	Big Bend Refugium, Brewster Co.	1,813	9	15
9.	John's Marina (Rio Grande), Terrell Co.	683	14	
10a.	Lazy Pond, Terrell Co.	322	23	
10b.	Too Much Pond, Terrell Co.	131	8	3
10c.	Pecos River, Terrell Co.	112	16	1
10d.	Chandler Spring, Terrell Co.			
12a.	Toe Nail Trail at Christoval, Tom Green Co.	77	3	
12b.	Anson Spring, Tom Green Co.	86	3	
13a.	Ft. McKavett, Menard Co.	534	221	1
13b.	Clear Creek, Menard Co.	625	24	
13c.	San Saba River at Dry Creek, Menard Co.	534	31	1
14.	Rio Grande at El Indio, Maverick Co.	234	9	
15.	700 Springs at Telegraph, Edwards Co.	302	28	1
16.	Junction, Kimble Co.	1,273	47	8
17a.	James River at Hays Ranch, Mason Co.	322	25	
17b.	James River Bat Cave, Mason Co.	2,044	25	2
18a.	Fessenden Spring, Kerr Co.	949	35	11
18b.	Heart of the Hills Research Station, Kerr Co.	1,010	24	
19.	San Miguel Cr. near Big Foot, Frio Co.	46	3	
20a.	Middle Creek, Travis Co.	2,000	21	27
20b.	Hanks Ranch at Bull Creek, Travis Co.	216	8	
20c.	Cow Creek, Travis Co.	2,331	80	
20d.	Barton Creek, at Patty's Ranch, Travis Co.	111	6	
20e.	Barton Creek at Austin, Travis Co.	262	6	
21.	San Marcos, Hays Co.	706	6	1
22.	Comal Spring, Comal Co.	237	7	
23.	Woman Hollering Creek, Bexar Co.	828	22	15
24.	Cost (Guadalupe River), Gonzales Co.	668	77	7
25.	Clymer Meadow near Lane, Hunt Co.	572	18	

TABLE 1 (continued)

26.	Egg Creek at Fairy, Hamilton Co.	523	38	
27.	Big Brown Reservoir, Freestone Cr.	1,659	12	4
28.	Cut 'n' Shoot (Crystal Cr.), Montgomery Co.	330	9	
29.	Village Creek, Hardin Co.	1,022	24	3
30.	Eggnog Branch, Nacogdoches Co.	154	2	
31.	Caddo Lake at Uncertain, Harrison Co.	358	7	
33.	Hi Island, Chambers Co.	1,110	117	12
34a.	Falcon Reservoir, Zapata Co.	5	1	
34b.	El Tigre, Zapata Co.	80	1	
35.	Illinois River at Hog Eye, AR	33		
Gambusia speciosa				
11.	Devils River State Natural Area, Val Verde Co.	2,330	102	5
Gambusia geiseri				
4a.	Carpenter Hill, Reeves Co.	1,389	264	14
4b.	Phantom Cave, Reeves Co.	298	22	1
4c.	Balmorhea, Reeves Co.	986	68	24
5.	Diamond-Y Refugium, Pecos Co.	1,437	34	3
10a.	Lazy Pond, Terrell Co.	7		
10c.	Chandler Springs, Terrell Co.	369	14	2
12a.	Toe Nail Trail at Christoval, Tom Green Co.	80	2	
12b.	Anson Spring, Tom Green Co.	3,618	198	41
21.	San Marcos, Hays Co.	1,403	64	25
22.	Comal Springs in New Braunfels, Comal Co.	122	6	
Gambusia nobilis				
2c.	Sago Spring, Eddy Co., NM			
2d.	Lake St. Francis, Eddy Co., NM			
4a.	Phantom Spring, Reeves Co.	232	33	1
4b.	Carpenter Hill, Reeves Co.	37		
4c.	Balmorhea, Reeves Co.	479	41	4
4d.	East Sandia Spring, Reeves Co.	22		
5.	Diamond-Y Refugium, Pecos Co.	423	22	4
Gambusia heterochir				
13b.	Clear Creek, Menard Co.	954	51	5
Gambusia gaigei				
8.	Big Bend Refugium, Brewster Co.	3,220	128	10

TABLE 1 (continued)

Gambusia species		
6. Santa Rosa Spring, Pecos Co.		
Gambusia longispinis		
32. Cuatro Cienegas, Coahuila, Mexico	155	4
Gambusia senilis		
Poecilia latipinna		
San Marcos River, Hays Co.	945	195
Comal River, Comal Co.		28
Aransas Co. pond		36
Heart of the Hills Research Station, Kerr Co.		79
Poecilia formosa		
San Marcos River, Hays Co.		218
Comal River, Comal Co.		3

TABLE 2. Comparison of experiments with predator present or absent at end of experiment (in percent).

Total experiments	No predators	Predator present
3	3	3
4	5	4
5	3	4
6	5	5
7	4	6
8	6	6
9	4	6
10	55	52
11	4	4
12	3	3
13	3	2
14	2	1
15	4	5
16+	1	1
Total number young introduced	438	5,520

TABLE 3. Survivorship of poeciliid young exposed to predation by *Gambusia* adults for 30 days.

	# survived	# introduced	% survival
total	25,180	51,359	49

TABLE 4. Survivorship of poeciliid young exposed to predation by *Gambusia* adults for 30 days by sex.

	# survived	# introduced	% survival	chi square value (*P*)
female predator	7,875	26,561	30	8,266 ($1/10^{2755}$)
male predator	17,305	24,798	70	

TABLE 5. Chi square values for sex differences in individual tests using both sexes as predator.

	Higher survival with female		Same	Higher survival with male					
chi square values	10+	1 - 9.9	1 - 1	1 - 9.9	10 - 19.9	20 - 29.9	30 - 39.9	40 - 49.9	50+
number of comparisons	2	38	135	272	179	106	56	28	25

TABLE 6. Survivorship percentages of poeciliid young exposed to male predators.

	Young							
predator	*affinis*	*speciosa*	*geiseri*	*nobilis*	*heterochir*	*gaigei*	*longispinis*	*Poecilia*
affinis	75^{110}	83^{6}	76^{22}	82	90	80^{5}	47	64^{2}
speciosa	76^{4}	82	55	64	90	84		
geiseri	73^{22}	79	77^{12}	64	57	89	38	88
nobilis	25^{14}	2	35^{6}	65	63	73^{2}		60
heterochir	48^{3}	64	48^{2}	72	52	81		
gaigei	53^{3}	47	68	82	62	77		44
longispinis	85		85			100		
"sp"	60							
senilis	12		55					

bold face = > 100 young (The superscript number indicates the number of hundreds when over 200.)
Roman = 50 - 100 young
small type = < 50 young

TABLE 7. Survivorship percentages of poeciliid young exposed to female predators.

	Young							
predator	*affinis*	*speciosa*	*geiseri*	*nobilis*	*heterochir*	*gaigei*	*longispinis*	*Poecilia*
affinis	29^{118}	35^{6}	44^{22}	55^{2}	80	65^{5}	38	24^{3}
speciosa	31^{3}	43	34	47	24	59		
geiseri	20^{21}	37	34^{11}	60	30	58^{2}	20	20
nobilis	9^{16}	22	16^{7}	32	13	25^{3}		19
heterochir	34^{4}	32	25^{2}	27	26	12		
gaigei	17^{3}	7	39^{2}	5	55	20		12
longispinis	28		25		29	45	59	0
"sp"	0							
senilis	4		0					

bold face = > 100 young (The superscript number indicates the number of hundreds when over 200.)
Roman = 50 - 100 young
small type = < 50 young

TABLE 8. Survivorship percentages of young exposed to *Gambusia affinis* adults from various populations southwest to northeast.

	Young					
	G. affinis		*G. speciosa*		*G. geiseri*	
predator	female	male	female	male	female	male
Arizona	102	64				
Bitter #3	0	85			0	94
Lost River	692	792				
Alamito Creek	373	794			77	60
Contraband	10	81				
Big Bend	695	883	61	88	73	81
Phantom Spring	412	822			28	86
Carpenter Hill	25	80	12	81	55	78
East Sandia Spring	232	83			22	100
Diamond-Y	243	682			41	84
Santa Rosa	21	81			28	61
John's Marina	162	61				
Lazy Pond	14	76				
Too Much Pond	292	782			36	70
Chandler Spring	41	65				
Pecos	572	81				
Big Foot	14	782				
El Indio	402	742				
Falcon	0	76				
El Tigre	2	66				
Fairy	62	73				
Toe Nail	212	66			90	
Anson	18	73			28	61
Ft. McKavett	223	723				
Clear Creek	522	852			67	85
Dry Creek	323	783			47	57
700 Springs	252	752			80	90
Junction	42	64	18	92	8	79
Hays	233	783				
Bat Cave	212	752			23	82

Table 8 (continued)

Fessenden	382	792	20	77	**40**	**82**
Heart of the Hills	302	592			41	61
Clymer	452	792				
Cow Creek	312	812			**62**	**85**
Middle Creek	**2**	**77**				
Hanks Bull	**14**	**81**			70	90
Patty's	**18**	512				
Barton	**25**	**79**				
San Marcos	312	762	32	75	42	83
Comal	393	632			27	**68**
Woman Hollering	333	763			**47**	**78**
Cost	162	792				
Big Brown	463	753	59	79	57	80
Cut 'n' Shoot	232	752				
Hi Island	152	732			41	80
Village Creek	373	753	41	88	**28**	**80**
Eggnog Branch	423	792				
Uncertain	**6**	**68**			27	75
Hog Eye	302	**64**			90	90

bold face = >100 young (The superscript number indicates the number of hundreds when over 200.)
Roman = 50 - 100 young
small type = < 50 young

TABLE 9. Survivorship percentages of young exposed to *G. geiseri* and *G. nobilis* adults.

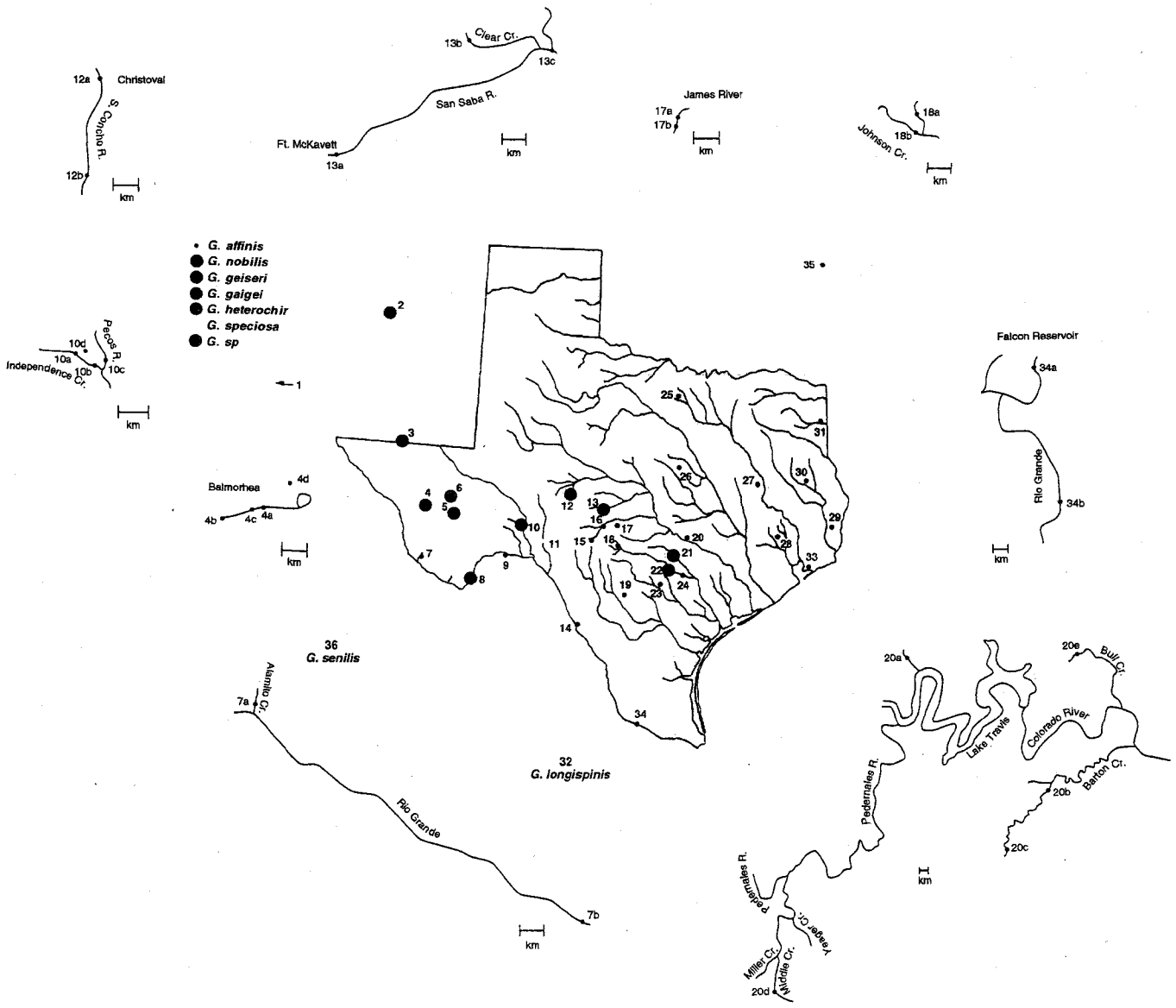
	Young			
	G. affinis		*G. geiseri*	
predator	female	male	female	male
G. geiseri				
Balmorhea	**12**[2]	**61**	**19**	**78**
Carpenter Hill	**7**	**72**	**35**	**74**
Phantom	**11**[2]	**71**[3]	**28**	**71**
East Sandia Spring	**63**	**86**	40	0
Diamond-Y	**24**	**76**	**36**	**75**
Chandler Spring	**20**[2]	**78**[2]	**14**	**93**
Too Much			58	
Toe Nail	**28**	81	69	79
Anson	**13**[4]	**68**[4]	**52**[2]	**72**[2]
San Marcos	**19**[2]	**80**[2]	**39**	**91**
Comal	**22**	**62**	**45**	**60**
G. nobilis				
Sago	10	20	0	
St. Francis	0	48	5	33
Balmorhea	**14**[4]	**27**[3]	**25**	**43**
Carpenter Hill	**12**	**13**	**12**	**33**
Phantom	**6**[3]	**22**[2]	**11**	**39**
East Sandia Spring	**0**[2]	**31**	22	20
Diamond-Y	**8**[3]	**27**[3]	**17**	**32**

bold face = > 100 young (The superscript number indicates the number of hundreds when over 200.)
Roman = 50 - 100 young
small type = < 50 young

Table 11. Average interbrood intervals in days for *Gambusia* females (populations or species).

Fish	Interbrood Interval
Gambusia nobilis	
Diamond-Y	54
Balmorhea	51
Phantom	51
Gambusia heterochir	47
Gambusia gaigei	44
Gambusia geiseri	
Balmorhea	43
Carpenter Hill	48
Phantom	47
Diamond-Y	43
Chandler Srping	40
Anson Spring	40
San Marcos	42
Gambusia speciosa	37
Gambusia affinis	
Big Bend	27
Carpenter Hill	35
Phantom	30
Diamond-Y	33
Too Much Pond	41
Pecos	39
Clear Creek	31
Ft. McKavett	37
Dry Creek	41
700 Springs	40
Junction	40
Bat Cave	39
Fessenden	38
Middle Creek	34
San Marcos	32
Woman Hollering	33
Cost	39
Hi Island	32
Big Brown	30
Village Creek	31

Map 1. Sample localities for *Gambusia* populations. The insets are of localities too close together to show on the large map.



ALPHABETICAL LISTING OF ABSTRACTS

ALANÍZ-GARCÍA, J.*; RUIZ-CAMPOS, G. (Facultad de Ciencias, Universidad Autónoma de Baja California, México)

Food habits of the killifish *Fundulus lima* (Vaillant) in the San Ignacio oasis, Baja California Sur, México

KEYWORDS: feeding habits; San Ignacio oasis; San Ignacio; killifish; Baja California Sur; México

ABSTRACT

The seasonal feeding habits of San Ignacio killifish *Fundulus lima* were studied in the oasis of San Ignacio, Baja California Sur. A total of 108 stomach contents were qualitatively and quantitatively analyzed during an annual cycle. The diet is composed of 16 prey groups. The most important prey groups (biomass and frequency of occurrence) were diatoms, filamentous green algaes and vascular plant remains. Diet composition was significantly similar among size classes (Schoener's overlap index) as well as among seasons. Fish prey were frequently observed in killifish specimens >35 mm SL.

RESUMEN

Se estudiaron los hábitos alimenticios estacionales de la sardinilla de la península, *Fundulus lima* en el oasis de San Ignacio, Baja California Sur. Se analizaron cualitativa y cuantitativamente 108 contenidos estomacales durante un ciclo anual. La dieta está compuesta de 16 tipos de presas, siendo los más importantes en frecuencia y biomasa; las diatomeas, algas verdes filamentosas y restos de plantas vasculares. La composición de la dieta fue significativamente similar entre clases de talla (índice de traslape de Schoener) así como entre las estaciones. Peces presa fueron frecuentemente observados en especímenes de peces lima >35 mm LP.

ANDERSEN, M. E. (Dames & Moore, Las Vegas, NV)

Linear regression model of the Devils Hole pupfish population, 1977-1995

KEYWORDS: Devils Hole; California; Devils Hole pupfish; linear regression; population dynamics

ABSTRACT

Population counts of the Devils Hole pupfish (*Cyprinodon diabolis* Wales, 1930) made later than 1 January 1977 were considered in the present study. The first counts of the day (n=89) were found to be most consistent if more than one count was made in the same day. When all the available first count values were plotted against time, a sine wave was apparent. Over 65% of the information in the first counts data set could be explained by a linear regression model which used the cumulative date as the trend line and the sine function of the yearly cycle as the predictive (independent) variables. The construction of this relatively simple model allows determination of deviations from predicted size, and may identify the timing of ecological events that have a significant impact on the population. Examination of standardized residuals suggests that events in the early 1980's had a negative impact on pupfish population size, but that trend is showing signs of reversal.

RESUMEN

En el presente estudio se consideraron los conteos de población del Devils Hole pupfish (*Cyprinodon diabolis* Wales, 1930) efectuados después de enero 01 de 1977. Los primeros conteos del día (n=89) se observaron más consistentes si mas de un conteo era efectuado al día. Al graficar los valores de los primeros conteos disponibles contra el tiempo, se obtuvo una onda sinusoidal. Arriba del 65% de la información en

los juegos de datos de los primeros conteos puede ser explicado por un modelo de regresión lineal, el cual utiliza datos acumulativos como la línea de tendencia y la función seno del ciclo anual como variables (independientes) predecibles. La construcción de éste modelo relativamente simple permite la determinación de desviaciones del tamaño predicha, y puede identificar el tiempo de eventos ecológicos que tienen impacto significativo en la población. La examinación de residuales estandarizados sugiere que eventos a principio de los 80's tuvieron un impacto negativo en el tamaño de la población de pupfish, pero la tendencia está mostrando ahora señas de lo contrario.

BERGLUND, A. P. (USDI, Bureau of Land Management, Winnemucca District)

Interdisciplinary team and ecosystem approach to manage habitat for a threatened fish species, desert dace *Eremichthys acros*

KEYWORDS: desert dace; ecosystem management and planning; interdisciplinary; planning; Nevada

ABSTRACT

The Soldier Meadows area of the Bureau of Land Management's Winnemucca District is unique for its combination of natural and cultural resources. The area was previously classified a Known Geothermal Resource Area (KGRA). The hot spring complexes within the area provide the only known habitat for a federally listed threatened fish species, the desert dace *Eremichthys acros*. The area is also one of the few habitats for basalt cinquefoil *Potentilla basaltica*, a federally listed category 1 sensitive plant species. The area encompasses a rich array of prehistoric and historic sites. Soldier Meadows is popular as a recreational destination area. Most of the recreation use in the area is in the proximity of the springs and outflows that support populations of desert dace. Livestock grazing has occurred in the area since the late 1800's, and at this time the area provides a portion of the winter pasture for the Soldier Meadows Allotment. To address the multi-resource concerns in the Soldier Meadow area an interdisciplinary team was formed with members from within and outside of the Winnemucca District of the Bureau of Land Management. Preliminary objectives for management of the area are: 1) federal delisting of the desert dace, 2) removing the possibility of formal listing of basalt cinquefoil as a threatened or endangered species, 3) preserving and protecting of the area's cultural resources, 4) integrating all resource management activities for the area, 5) preventing resource degradation, 6) promoting interagency cooperation for management and research in the area, and 7) providing recreational and livestock grazing activities consistent with resource protection.

RESUMEN

El área de Soldier Meadows del Bureau of Land Management en el distrito de Winnemucca es único por su combinación de recursos naturales y culturales. El área fue clasificado previamente como un Area de Recursos Geotermales Conocido (KGRA). El complejo de manantiales de aguas termales dentro del área proveen el único hábitat conocido para una especie de peces enlistada como amenazada por la federación, el desert dace *Eremichthys acros*. El área es incluso uno de los pocos hábitats para *Potentilla basaltica*, una especie de planta muy sensible enlistada en la lista federal en categoría 1. El área encierra un rico arreglo de sitios prehistóricos e históricos. Soldier Meadow es popular como un área de destino recreacional. La mayoría del uso de recreación es en las proximidades de los manantiales y las corrientes que soportan las poblaciones del desert dace. El pastoreo por ganado se ha dado en el área desde finales de los 1800's, y a la fecha, el área provee una porción del pasto invernal de Soldier Meadow. Para dirigir los recursos concernientes a ésta área, se formó un equipo interdiciplinario con miembros internos y externos del Bureau of Land Management del Distrito de Winnemucca. Los objetivos preliminares para el manejo del área son: 1) quitar de la lista de amenazada al desert dace, 2) eliminar la posibilidad de enlistar formalmente del basalt cinquefoil como una especie amenazada o en peligro, 3) preservación y protección de los recursos

culturales del área, 4) integración de todas las actividades de manejo de recursos en el área, 5) prevención de degradación de recursos, 6) promoción de cooperación entre agencias para manejo e investigación en el área, y 7) proveer actividades recreacionales y de pastoreo de ganado consistentes y con énfasis en protección de recursos.

BROUDER, M. J.*; HOFFNAGLE, T. L. (Research Branch, Arizona Game and Fish Department., Flagstaff, AZ)

Distribution and prevalence of the Asian tapeworm, *Bothriocephalus acheilognathi*, in the Colorado River and its tributaries, Grand Canyon

KEYWORDS: Asian tapeworm; Colorado River; Grand Canyon

ABSTRACT

The Asian tapeworm, *Bothriocephalus acheilognathi*, was introduced into the United States via imported grass carp in the early 1970's. It has since become well established in the southeast and mid-south and has been recently found in the southwest. The definitive host in the life cycle of *B. acheilognathi* is cyprinid fishes and therefore, is a potential threat to the federally endangered humpback chub, *Gila cypha*, in the Colorado River, Grand Canyon. In past studies, Arizona Game and Fish Department has found that humpback chub in the Little Colorado River (LCR) were infested with the Asian tapeworm. However, the cold water of the mainstem Colorado River may be limiting their expansion beyond the LCR. This study was conducted to determine the prevalence of *B. acheilognathi* in two cyprinid fishes, fathead minnows, *Pimephales promelas*, and speckled dace, *Rhinichthys osculus*, and determine if it has expanded its distribution to sites outside of the LCR. Preliminary data from 1994 show that 54% of the humpback chub, 27% of the speckled dace, and 6% of the fathead minnows that were caught were infested with the Asian tapeworm. All infested humpback chub were caught in a 15-mile stretch of the Colorado River just downstream from the mouth of the LCR, the likely source of their infestation.

RESUMEN

El Asian tapeworm, *Bothriocephalus acheilognathi*, fue introducido en Estados Unidos vía importación de grass carp a principio de los 1970's. Desde entonces se estableció en el sureste y parte central sur y recientemente se encontró en el Suroeste. El hospedero definitivo en el ciclo de vida de *B. acheilognathi* son los peces ciprinidos y por ello, es una amenaza potencial para el charalito jorobado, *Gila cypha* considerada amenazada por la federación en el Colorado River, Grand Canyon. En estudios anteriores, Arizona Game and Fish Department encontró que el charalito jorobado en el Little Colorado River (LCR) estaba infestado con el Asian tapeworm. Sin embargo, el agua fría de la corriente principal del Colorado River puede estar limitando su expansión a través del LCR. Este estudio se efectuó para determinar la prevalencia de *B. acheilognathi* en dos especies de ciprinidos, los fathead minnows, *Pimephales promelas*, y el speckled dace, *Rhinichthys osculus*, y determinar si ha expandido su distribución a sitios fuera del LCR. Los datos preliminares de 1994, muestran que el 54% de los charalito jorobado, 27% de los speckled dace, y el 6% de los fathead minnows, capturados estaban infestados con el Asian tapeworm. Todos los charalito jorobado infestados fueron capturados en un tramo de 15 millas del Colorado River aguas abajo de la boca del LCR, la que parece ser la fuente de su infestación.

BYERS, S.*; WERDON, S. J.; WITHERS, D. L. (Nevada State Office, U.S. Fish and Wildlife Service, Reno, NV)

Fish species of special concern in northern Nevada

KEYWORDS: Special concern; native fish; status; Nevada

ABSTRACT

Of the 34 native fish species of special concern in Nevada, 15 occur in the unique habitats of northern regions of the state. Included are one sucker, two chub, six tui chub, 1 cutthroat trout, two redband trout, bull trout, relict dace, and one speckled dace. Ten of these fishes are each restricted to only one valley. Unlike many of the species of special concern in southern Nevada, these fish species occur in non-thermal waters. Little is known about the current status of these fishes.

RESUMEN

De las 34 especies de peces nativos de interés especial en Nevada, 15 ocurren en hábitats únicos de las regiones norteñas del Estado. Se incluyen: un sucker, dos chub, seis tiu chub, un cutthroat trout, dos redband trouts, bull trout, relict dace, y un speckled dace. Diez de éstos peces están restringidos únicamente a un valle. A diferencia de muchas de las especies de interés especial que ocurren en el sur de Nevada, éstas especies de peces ocurren en aguas no termales. Poco se conoce acerca del estátus actual de éstas especies.

CARMICHAEL, G. J.*; JENSEN, B. L.; WILLIAMSON, J. H. (GJC - Southwestern Fisheries Technology Center - Mora NFH&TC U. S. Fish and Wildlife Service, Mora, NM; BLJ and JHW - Southwestern Fisheries Technology Center - Dexter NFH&TC, U. S. Fish and Wildlife Service, Dexter, NM)

Production and translocation of fishes: hazards and risks assessed and addressed?

KEYWORDS: Translocation; production; hazards; risks; hatcheries

ABSTRACT

"Translocation" is yet another way to communicate the idea of moving fish from one place to another. Generally, translocation implies direct location to location transfer, although transfer from location to hatchery to location is sometimes included. Hazards and risks, real and theorized, have been identified in production and translocation of fishes, especially when hatcheries and threatened or endangered fishes are involved. Potential genetic hazards associated with traditional hatchery production methods include population extinction, loss of genetic variation within and among populations, and domestication selection. Identification of these potential hazards on hatcheries and their perceived risks has caused concern within the conservation community. Consequently, hatchery propagation and reintroduction using hatchery fish has become less popular as a management tool for recovery purposes. Skepticism remains in spite of successful efforts to remove hazards and minimize risks through systematic implementation of modern fish culture practices. The response of some conservation managers has been to discard hatcheries as a tool and focus on direct location to location transfers. Weak on supporting evolutionary theory and concepts, these "alternative" management efforts may actually increase the risk of genetic hazards to the target populations beyond that of more controlled management methods. On the other hand, fish spawned and reared under controlled conditions can provide, in some instances, product quality superior to that provided by alternative methodologies. New production methods are also being investigated to address concerns regarding environmental effects on fish physiology and behavior. Examples will be presented to encourage a more systematic approach to hazard evaluation and risk reduction in management plans and activities.

RESUMEN

"Traslocación" es también otra manera de comunicar la idea de mover un pez de un lugar a otro. Generalmente, traslocación implica moviemient de una locación directa a otra, sin embargo transferir de

locación a criadero a locación puede incluirse algunas veces. Los peligros y riesgos, actuales y teóricos, tiene que ser identificados en la producción y traslocación de peces, especialmente cuando se trabaja con criaderos, especies amenazadas o en peligro de extinción. Los peligros genéticos potenciales asociados con métodos de producción en criaderos tradicionales incluyen extinción de la población, pérdida de variabilidad genética dentro y entre poblaciones, así como la selección para la domesticación. La identificación de éstos peligros potenciales sobre los criaderos y sus riesgos consecuentes han causado interés dentro de la comunidad conservacionista. Consecuentemente, la propagación en criaderos y reintroducción usando peces de criadero se está haciendo menos popular como herramienta de manejo para propósitos de recuperación. El escepticismo permanece a pesar de esfuerzos satisfactorios para eliminar peligros y miniminizar riesgos a través de la implementación sistemática de modernas prácticas de cultivo de peces. La respuesta de algunos manejadores de conservación ha sido descartar los criaderos como una herramienta y se enfoca en un movimiento directo entre locaciónes. Débil en cuanto a apoyo de la teoría evolucionaria y sus conceptos, éstos esfuerzos de manejo "alternativos" pueden actualmente incrementar el riesgo de peligros genéticos a poblaciones mas que otros métodos de manejo controlado. Por otro lado, los peces que desovan y se crían bajo condiciones controladas pueden proveer, en algunas instancias, productos de calidad superior a la proporcionada por algunas metodologías alternativas. Nuevos métodos de producción están siendo investigados para dirigir intereses referentes a efectos ambientales sobre la fisiología y conducta de los peces. Ejemplos pueden ser presentados para reforzar un esfuerzo más sistemático para evaluación de peligros y reducción de riesgos en actividades y planes de manejo.

CHILDS, M. R.; CLARKSON, R. W. (MRC - Arizona Game and Fish Department, Research Branch, Phoenix, AZ; RWC - U.S. Bureau of Reclamation, Environmental Resources Management Division, Phoenix, AZ)

Temperature effects on swimming performance of larval and juvenile Colorado squawfish: implications for survival and recovery in the Lower Colorado River Basin

KEYWORDS: Colorado squawfish; prolonged swimming; fatigue velocity; temperature effects; larval; juvenile; Glen Canyon Dam; Arizona; Lower Colorado River Basin

ABSTRACT

We determined prolonged swimming ability of larval and two larger age classes of juvenile Colorado squawfish *Ptychocheilus lucius* at 10, 14, and 20°. Fatigue velocity (FV50, cm/s) increased significantly with both water temperature and fish length. Differences in swimming ability between 10 and 14° became less pronounced as fish length increased, but differences remained substantial between these and 20° swimming experiments for all age classes tested. Our results indicate that cold hypolimnetic releases and daily fluctuations in discharge from Glen Canyon Dam, AZ, could significantly reduce prolonged swimming ability of young-of-year Colorado squawfish.

RESUMEN

Determinamos la habilidad de nado prolongado de larvas y dos grandes clases de edad de juveniles del salmon blanco, *Ptychocheilus lucius*, a temperaturas de 10, 14 y 20°. La velocidad de fatiga (FV50, cm/s) se incrementó significativamente tanto con la temperatura del agua así como con el largo del pez. Las diferencias en habilidad entre los 10 y 14° se vio menos pronunciado al irse incrementando la longitud del pez, pero las diferencias permanecieron substanciales entre éstas y los experimentos de nado a 20° para todas las clases de edad examinadas. Nuestros resultados indican que la liberación hipolimnéticas frías y las fluctuaciones diarias en las descargas de Glen Canyon Dam, AZ, pueden significativamente reducir la habilidad de nado prolongado en juveniles de un año del salmon blanco.

CONTRERAS-BALDERAS, S.*; LOZANO-VILANO, M. DE L. (SCB-Bioconservación, A.C., San Nicolás, N.L., México, MLV-Laboratorio de Ictiología. Facultad de Ciencias Biológicas, UANL. San Nicolás, N.L., México)

Survival status of the Sandia and Potosi Valleys' endemic pupfishes and crayfishes from the Mexican plateau in Nuevo León, México, with comments on extinct snails

KEYWORDS: fishes; crayfish; extinction; Mexico; biodiversity

ABSTRACT

Exploration of the arid SW Nuevo León, México has revealed the extinction of a number of recently described new species of living pupfishes and crayfishes, and extinct snails from isolated springs, as follows: Charco Palma: *Cyprinodon longidorsalis*, discovered 1984, extinct 1994. La Trinidad: *C. inmemoriam* and crayfish, discovered 1984, extinct 1986. Charco Azul: *C. veronicae* and crayfish, discovered 1984, barely surviving in 1994; the snails *Valvata beltrani* and *Valvata* sp. were extinct when discovered. La Presa: *C. ceciliae* and crayfish, discovered 1988, extinct 1990. Potosí: *Megupsilon aporus* and *Cyprinodon alvarezi* discovered between 1948 and 1961, almost extinct 1994. Extinction was rapid due to depletion of aquifers for agricultural needs, which is irrational, not sustainable, and illegal. Conservation of this biodiversity, and the agriculture, needs regional management of the geohydrological basins. Also needed is a better interaction of scientists and technicians of the several disciplines on biodiversity - conservation - development and the other stakeholders in order to attain true sustainability.

RESUMEN

Las exploraciones del árido suroeste de Nuevo León, México, han revelado la extinción de un número de especies reciéntemente descritas, de peces cachorritos y acociles vivientes, y caracoles extintos, de manantiales aislados, como sigue: Charco Palma: *Cyprinodon longidorsalis*, descubrimiento 1984, extinción 1994. La Trinidad: *C. inmemoriam* y acocil, descubrimiento 1984, extinción 1986. Charco Azul: *C. veronicae* y acocil, descripción 1984, sobreviviendo en 1994; los extintos caracoles *Valvata beltrani* y *Valvata* sp. fueron descubiertos como conchas secas. La Presa: *C. ceciliae* y acocil, descubrimiento 1988, extinción 1990. Potosí: *Megupsilon aporus* and *Cyprinodon alvarezi* descubrimientos de 1948 a 1961, casi extintos 1994. Las extinciones han sido rápidas a consecuencia de un abatimiento creciente de mantos acuíferos para fines agrícolas, irracional, no sustentable e ilegal. La conservación de ésta biodiversidad, y de la agricultura, requiere de manejo regional integral de las cuencas geohidrológicas. Se requiere mayor interacción de científicos y técnicos de todas las disciplinas relacionadas con biodiversidad - conservación - desarrollo para alcanzar la sustentabilidad.

CONTRERAS-BALDERAS, S. (Bioconservación, A.C., San Nicolás, N.L., México)

Mexican Río Grande Area Coordinator Report - status of some fish communities and environmental legislation

KEYWORDS: México; Chihuahua; drought; pollution; environmental; legislation; sequía; contaminación; legislación

ABSTRACT

The long lasting recent drought in northeastern México had a strong impact on Chihuahuan Desert fishes. Several localities in Chihuahua had been monitored from 1963 to the late 1980's, reporting reductions of the fish communities averaging 57.7%. Several of the Chihuahua-Durango localities were visited in May, 1995, finding the rivers completely dry: Estación Sauz, Río Florido at Jimenez, Río Nazas across from Torreón, Río Carmen near Ahumada. Other localities had been converted into sewage canals and have no fish, such as Río Chuviscar at Chihuahua, and at Aldama.

The Federal Government of México organized a nation-wide series of public hearings as the basis for

updating environmental legislation. The proposals have been abundant, especially at the extremes: from stronger rules and enforcement, a position of ecologists and citizens, to an easement of rules, and suppression of all ecological requirements in view of the economic crisis and social needs, supported by industrialists and non-biologists. The social clash will be strong when the new legislative proposal is processed in late 1995, or early 1996.

RESUMEN

La sequía permanente reciente en el Noreste de México ha tenido un fuerte impacto sobre los peces del Desierto Chihuahuense. Varias localidades en Chihuahua han sido monitoreados desde 1963 hasta finales de 1980's, reportando reducciones de comunidades de peces promediando 57.7%. Varias localidades en Chihuahua y Durango fueron visitadas en mayo de 1995, encontrando los ríos completamente secos: Estación Sauz, Río Florido en Jimenez, Río Nazas cerca de Torreón, Río Carmen cerca de Ahumada. Otras localidades han sido convertidas en canales de desagües y no presentan peces, tales como el Río Chuviscar en Chihuahua, y en Aldama.

El Gobierno Federal de México organizó una serie de audiencias públicas como una base para actualizar la legislación ambiental. Las propuestas han sido abundantes, especialmente en los extremos: desde reglas fuertes y vigilancia, una posición de ecologistas y ciudadanos, hasta una debilidad de reglas, y una supresión de todos los requerimientos ecológicos en vista de la crisis económica y necesidades sociales, apoyado por industriales y no-biólogos. El conflicto social será mas fuerte cuando la nueva propuesta legislativa sea implementada a finales de 1995, o inicios de 1996.

CONVERSE, Y. K.*; HAWKINS, C. P.; VALDEZ, R. (YKC and CPH - Department of Fisheries and Wildlife, Utah State University, Logan, UT; RV - Bio/West Inc., Logan, UT)

The effects of Interim Flow Management on subadult humpback chub habitat in the Colorado River through Grand Canyon

KEYWORDS: humpback chub; subadult; geomorphology; shoreline; habitat; discharge; base flow; Grand Canyon

ABSTRACT

We examined subadult (less than 200 mm TL) humpback chub *Gila cypha* densities along 15 miles of the Colorado River in Grand Canyon to identify relationships between geomorphology, habitat use and Glen Canyon Dam flow operations. We categorized shoreline habitat based on geomorphology. We then measured physical habitat parameters of velocity, depth and cover along all shoreline types over the range of Interim Flow Operations (8,000 to 20,000 cfs) to determine if habitat changes with discharge.

Although cover, depth and velocity were significantly related to subadult humpback chub presence, they explained very little of the overall variation in subadult humpback chub densities. This variance may be partially explained by a significant relationship of discharge with habitat quality. We found that cover decreased with increasing discharge, whereas depth and velocity increased. These results suggest that habitat quality decreases with increasing discharge.

Historically, base flows ranged from 1,000 to 5,000 cfs. Both preferred alternatives of the Glen Canyon Dam Environmental Impact Statement require base flows ranging between 8,000 and 20,000, nearly an order of magnitude higher than pre-dam base flows. Impacts from the reduction of peak flows have been thoroughly assessed in regulated rivers; however, according to our results, artificially high base flows may actually limit habitat quality in Grand Canyon. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

Examinamos densidades de subadultos (menos de 200 mm LT) de charalito jorobado *Gila cypha* a lo largo de 15 millas del Colorado River en el Grand Canyon para identificar relaciones entre la geomorfología, uso de hábitat y operaciones de flujo de la Presa Glen Canyon Dam. Categorizamos el hábitat de la línea de playa basado en la geomorfología. Medimos después parámetros físicos de hábitat de velocidad, profundidad y cobertura a lo largo de todos los tipos de línea de playa sobre un intervalo de Operaciones de Flujo Interino (8,000 a 20,000 cfs) para determinar si existen cambios con la descarga.

Aunque la cobertura, profundidad y velocidad fueron significativamente relacionadas a la presencia de subadultos de charalito jorobado, estos explicaron muy poco de toda la variación general en las densidades de adultos del charalito jorobado. Esta varianza puede ser parcialmente explicada por una significativa relación de descarga con la calidad de hábitat. Encontramos que la cobertura decreció con el incremento la descarga, en cambio la profundidad y la velocidad incrementaron. Estos resultados sugieren que la calidad de hábitat decrece con el incremento en la descarga.

Históricamente, los flujos base fueron desde 1,000 a 5,000 cfs. Las dos alternativas preferidas de la Manifestación de Impacto Ambiental de la Presa Glen Canyon Dam requieren de flujos base desde 8,000 y 20,000, cerca del mismo orden de magnitud más alto que las descargas base antes de la construcción de la presa. Los impactos por la reducción de los máximos flujos han sido ampliamente evaluados en ríos regulados; sin embargo. de acuerdo a nuestros resultados, flujos base artificialmente altos pueden actualmente limitar la calidad de hábitat en el Grand Canyon. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

CROWL, T. A.*; LENTSCH, L. D.; THOMPSON, P.; CONVERSE, Y. (TAC - Utah State University, Logan, UT; LDL, PT and YC - Utah Division of Wildlife Resources, Salt Lake City, UT)

Ecological aspects for the reintroduction of bonytail *Gila elegans* in the upper basin of the Colorado River

KEYWORDS: reintroduction; bonytail; *Gila elegans*; ecology; physiology; competition

ABSTRACT

Since their virtual extirpation from the Upper Colorado River Basin, very little research has been conducted aimed at understanding the basic ecological requirements of bonytail needed for successful reintroduction. Our research has been designed to begin to elucidate such requirements with a specific focus on flow, substrate and food needs and the possible ontogenetic shifts associated with habitat use and competitive interactions with nonnative fish species. These studies are being performed in large, artificial streams located at the USU/BOR/UDWR Endangered Fish Experiment Station, located on the Utah State University campus. Results of our experiments suggest that physiological responses to flow regime, such as changes in the proportion of white and red muscle fibers and their diameters occur very quickly with minimal flow training in young bonytail resulting in individuals that have greatly enhanced swimming abilities. Individuals that have undergone three months of training in intermittent flow (0.07 m/s) selectively inhabit higher velocities in stream channels and feed exclusively in high flow, high turbulent habitats. These changes result in significant reductions in niche overlap with red shiners. Bonytail that have undergone flow training spend a large proportion of their time near the substrate in high velocity, high turbulent areas, feeding on drifting organisms while red shiners show a preference for lower velocity habitats feeding mainly from the mid-water and surface. We discuss these and other ecological considerations that need to be incorporated into reintroduction plans associated with endangered fish species.

RESUMEN

A partir de su virtual extirpación de la Upper Colorado River Basin, muy poca investigación se ha conducido para conocer los requerimientos ecológicos básicos del charalito elegante necesarios para su

reintroducción exitosa. Nuestro estudio ha sido diseñado para iniciar la elucidación tales requerimientos con un foco específico sobre el flujo, substrato y requerimientos de alimentación y los posibles cambios ontogenéticos asociados con el uso de hábitat e interacciones competitivas con peces no-nativas. Estos estudios están siendo efectuados en corrientes artificiales grandes localizadas en la Estación Experimental de Peces en Peligro de Extinción USU/BOR/UDWR localizado en el Campus de la Universidad Estatal de Utah. Resultados de nuestros experimentos sugieren que respuestas fisiológicas al régimen de flujo, tales como cambios en la proporción de fibras musculares blancas y rojas y sus diámetros ocurren muy pronto con un mínimo entrenamiento de flujo en juveniles resultando en individuos que han desarrollado buenas habilidades de nado. Individuos que han permanecido tres meses en entrenamiento en flujo intermitente (0.07 m/s) habitan selectivamente velocidades mas altas en canales de corriente y se alimentan exclusivamente en hábitats de corriente fuerte y alta turbulencia. Estos cambios resultan en reducciones significativas en sobrelapamiento de nicho con las sardinitas rojas. Charalitos que han permanecido en entrenamiento de corriente duran una gran proporción de su tiempo cerca del substrato en áreas de altas velocidades y alta turbulencia, alimentándose de organismos acarreados mientras que las sardinitas rojas muestran una preferencia por hábitats de menor velocidad alimentándose principalmente en media agua o en la superficie. Discutimos estas y otras consideraciones ecológicas que requieren ser incorporadas en los planes de reintroducción asociados con este pez en peligro de extinción.

DICKERSON, B. R.*; VINYARD, G. L.; WEBER, L. A.; HARGIS, M. T. (Department of Biology, University of Nevada, Reno, NV)

Effects of acclimation regime on survival of Lahontan cutthroat trout, *Oncorhynchus clarki henshawi*, to conditions in Walker Lake

KEYWORDS: Walker Lake; cutthroat trout; salinity; stocking; acclimation

ABSTRACT

Walker Lake is an endorheic terminal lake fed by the Walker River. This stream has been subject to high rates of water diversion for irrigated agriculture during the past 80 years. As a result of this, lake levels have declined dramatically, and the dissolved solids (TDS) content of the lake has increased to very high levels. In 1994 TDS levels reached approximately 13,000 mg/L. Also at that time stocking of fingerling cutthroat trout was largely unsuccessful with approximately 95-96% mortality being observed in test groups. Because Lahontan cutthroat trout support an important hatchery-maintained sport fishery in the lake, these high mortality rates prompted state and federal agencies to consider suspending stocking of Walker Lake. To address this problem, we have initiated a series of laboratory studies of Lahontan cutthroat survivorship to a range of concentrations of water from Walker Lake and under various acclimation regimes. Experimental acclimation of Lahontan cutthroat trout in Pyramid Lake water or water intermediate in solids concentration between Walker Lake and the conditions in the hatchery dramatically increased survivorship of fingerlings subsequently exposed to Walker Lake water. Longer acclimation periods also result in higher survivorship. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

El Lago Walker es un lago terminal endorreico alimentado por el Río Walker. Este arroyo ha sido objeto de altas tazas de uso de agua para agricultura de riego durante los pasados 80 años. Como un resultado de esto, los niveles del lago han declinado dramáticamente, y el contenido de sólidos disueltos (CSD) del lago ha incrementado a niveles muy altos. En 1994 los niveles de CSD alcanzaron aproximadamente 13,000 mg/L. También durante ese tiempo la siembra de alevines de trucha cuello cortado fue significativamente inexitosa con aproximadamente 95-96% de mortalidad siendo observada en grupos prueba. Debido a que la trucha de cuello cortado soporta una importante pesquería deportiva

mantenida por una granja en el lago, estas altas tazas de mortalidades promovió que agencias estatales y federales consideraran suspender la siembra en el Lago Walker. Para resolver este problema, iniciamos una serie de estudios en laboratorio de sobrevivencia de truchas cuello cortado de Lahontan a un intervalo de concentraciones de agua del Lago Walker y bajo varios regímenes de aclimatación. La climatación experimental de esta trucha en agua del Lago Pyramid o agua intermedia en concentración de sólidos entre el Lago Walker y las condiciones en la granja incrementó dramáticamente la sobrevivencia de alevines subsecuentemente expuesto a agua del Lago Walker. Períodos largos de aclimatación también resultaron en una alta sobrevivencia. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

DOUGLAS, M. R.*; DOUGLAS, M. E. (Dept. Zoology and Museum, Arizona State University, Tempe, AZ)

Ontogenetic allometry in the endangered cyprinid fish, *Gila cypha*

KEYWORDS: humpback chub; Little Colorado River; morphometrics; allometry; ontogeny

ABSTRACT

Gila cypha (humpback chub) is an endangered cyprinid fish restricted to tight, canyon-bound reaches of the Colorado River and its tributaries in western North America. It reaches greatest abundance in the Little Colorado River (LCR), a tributary of the Colorado in northern Grand Canyon. This study (a) quantified shape change in this cyprinid as a function of ontogeny, and (b) tested the hypothesis that development of the nuchal hump occurs rapidly during maturation. During May/June 1994, 230 chub (85-336 mm SL) were netted, filmed, and released unharmed in the LCR. Images were grouped into 12 growth stanzas (n=9-30; mean=18). For each image, x,y coordinates were digitized for 27 landmarks; 70 inter-landmark distances were also derived. PCA and sheared PCA of distance data showed a strong relationship between shape variation and overall body size. Procrustes superposition of coordinates demonstrated localized shape variation, and was used to produce mean forms for each growth stanza. These, in turn, were compared using relative warp analysis (RWA). Results indicate that nuchal development (a characteristic of this species) is accomplished gradually over time, and is not the product of a growth spurt at any particular point in the ontogenetic trajectory.

RESUMEN

Gila cypha (charalito jorobado) es un pez ciprinido en peligro de extinción restringido a cabeceras del Colorado River Canyon y sus tributarios en el Oeste de Norteamérica. Alcanza su mayor abundancia en el Little Colorado River (LCR), un tributario del Colorado en el norte del Gran Canyon. Este estudio (a) cuantificó cambios de forma en este cyprinido como una función de la ontogenia, y (b) probar la hipótesis que el desarrollo de la joroba nucal ocurre rápidamente durante la maduración. Durante mayo/junio de 1994, 230 charalitos (85-336 mm LP) fueron colectados, filmados, y liberados en el LCR. Las imágenes fueron agrupadas en 12 estadíos de crecimiento (n=9-30; promedio=18). Por cada imagen, se digitalizaron las coordenadas x, y, para 27 mojoneras; 70 distancias inter-mojoneras fueron también derivadas. Los datos PCA y PCA recortados de distancia mostraron una fuerte relación entre la variación de la forma y el tamaño general del cuerpo. La superposición de procrustes de coordenadas demostraron variación localizada en la forma, y fue usada para producir formas medias para cada estadios de crecimiento. Estas, en turno, fueron comparadas usando un análisis de envoltura relativo (RWA). Los resultados indican que el desarrollo nucal (una característica de esta especie) es alcanzada gradualmente en el tiempo, y no es producto de un repentino crecimiento en algún punto en particular en la trayectoria ontogenética.

DOUGLAS, M. E. *; MARSH, P. C. (MED - Dept. Zoology and Museum; PCM - Center for Environ. Studies, Arizona State University, Tempe, AZ)

Seasonal and yearly population estimates for *Catostomus latipinnis* and *Pantosteus discobolus* (Teleostei, Catostomidae) in the Grand Canyon region of Arizona

KEYWORDS: flannelmouth sucker; bluehead sucker; population; estimation; Little Colorado River

ABSTRACT

As a result of habitat disturbance by modern humans, four indigenous big-river fishes of western North America [*Ptychocheilus lucius* (Colorado squawfish), *Gila elegans* (bonytail chub), *Gila cypha* (humpback chub), and *Xyrauchen texanus* (razorback sucker)] are federally listed as endangered. A fifth [*Gila robusta* (roundtail chub)] has been proposed as a candidate for such listing, and a sixth [*Catostomus insignis* (flannelmouth sucker)] is under scrutiny. A seventh [*Pantosteus discobolus* (bluehead sucker)] is believed secure. Life histories are enigmatic for the majority of these fishes, and their densities in most tributaries are relatively unknown. During 1991/95, adult flannelmouth and bluehead suckers were netted, PIT-tagged, and released unharmed on a monthly basis at three locations within the Little Colorado River (LCR), a tributary of the Colorado in the Marble Canyon region of northern Grand Canyon. Tag/recapture data were used to generate seasonal and yearly population estimates based on an open-population model allowing for immigration, emigration, and ontogeny. Estimates were normalized by fishing effort and compared by season and year within- and between-species. Within-species variance in population estimates is a reflection of longevity, while between- species differences are related to life history.

RESUMEN

Como un resultado del disturbio de hábitat por humanos modernos, cuatro peces indígenas de ríos grandes del Oeste de Norteamérica [*Ptychocheilus lucius* (salmon blanco), *Gila elegans* (charalito elegante), *Gila cypha* (charalito jorobado) *Xyrauchen texanus* (matalote jorobado)] están enlistados a nivel federal como en peligro. Un quinto [(*Gila robusta* (charalito aleta redonda)] ha sido propuesto como candidato para esta categoría, y un sexto [(*Catostomus insignis* (matalote boca de franela)] esta bajo revisión. Un séptimo [(*Pantosteus discobolus*) (matalote cabeza azul)] se cree que está seguro. Las etapas del ciclo de vida de la mayoría de estos peces se desconocen y sus densidades en la mayoría de los tributarios son relativamente desconocidas. Durante 1991/95, se capturaron y marcaron con PIT adultos de matalote boca de franela y matalote cabeza azul, y se liberaron sin daño mensualmente en tres localidades dentro del Little Colorado River (LCR), un tributario del Colorado en la región de Marble Canyon en el norte de Grand Canyon. Los datos de marcado/recaptura se utilizaron para generar estimaciones poblacionales estacionales y anuales basados en un modelo de población-abierta permitiendo la inmigración, migración y ontogenia. Las estimaciones se normalizaron por medio del esfuerzo de pesca y se compararon por año y por estación dentro y entre especies. La varianza intra-especies en la estimación poblacional es un reflejo de la longevidad, mientras que las diferencias entre especies se relaciona con los ciclos de vida.

DOWLING, T. E.*; TIBBETS, C. A.; NAYLOR, G. J. P. (Department of Zoology, Arizona State University, Tempe, AZ)

Evolutionary genetics of *Gila* based on mitochondrial DNA restriction site and sequence data: a progress report

KEYWORDS: *Gila* taxonomy; mtDNA; cytochrome b; restriction sites; evolutionary genetics

ABSTRACT

In recent years, researchers have invested considerable effort studying members of the genus *Gila*, especially those species situated in the mainstem Colorado River (*Gila cypha*, *Gila elegans*, *Gila robusta*). Here we discuss preliminary data from the third and final portion of the *Gila* Taxonomy Project [analysis of

mitochondrial DNA (mtDNA) variation] designed to provide information on past and present levels of hybridization among these taxa and evolutionary relationships among these and other members of the genus. The cytochrome b gene was sequenced from representatives of several members of the genus and outgroup taxa. Computer searches of sequences from *G. cypha*, *G. robusta*, and *G. elegans* identified a series of restriction enzymes which diagnosed mtDNA type and were used to survey a large series of samples collected throughout the Colorado River basin. MtDNA species type was almost always consistent with field identification in lower basin samples; however, most specimens collected from the upper basin, including many individuals identified as *G. robusta*, had *G. cypha* mtDNA. Rarely, individuals with *G. elegans* mtDNA were found, raising the possibility that this species is still present in the upper basin. Phylogenetic analysis of cytochrome b sequences provided limited resolution of relationships among these species; however, some interesting groupings were strongly supported. *Gila cypha* and *G. atraria* were found to be closely related, a result consistent with past hybridization of these taxa previously hypothesized from restriction site data. All samples of *G. robusta* from Mexico (six populations) were very different from morphologically similar individuals of this species collected in the U.S. These results might indicate that: 1) *G. robusta* has also been influenced by past hybridization, 2) this morphology represents a shared primitive phenotype, or 3) these morphological features have evolved multiple times in this lineage. Sequences of more rapidly evolving mt genes (ND2) will be used to more closely examine past hybridization and population structure within species throughout the basin.

RESUMEN

En años recientes, los investigadores han invertido considerables esfuerzos en estudiar a los miembros del género *Gila*, especialmente aquellas especies situadas en el Río Colorado (*Gila cypha, Gila elegans, Gila robusta*). Aquí discutimos datos preliminares de un tercio y la porción final del Proyecto Taxonomía del género *Gila*[(análisis de la variación del ADN mitocondrial (ADNmt))] diseñado para proveer información de niveles presentes y pasados de hibridización entre estos taxa y las relaciones evolutivas entre éstos y otros miembros del género. Se secuenció el gen del citocromo b a partir de elementos representativos de varios miembros del género y un grupo externo. Por medio de búsquedas en computadora de las secuencias provenientes de *G. cypha*, *G. robusta* y *G. elegans* se identificaron una serie de enzimas de restricción las cuales diagnosticaron un tipo de ADNmt y fueron usadas para investigar una serie grande de muestras colectadas a lo largo de la cuenca del Río Colorado. El tipo de ADNmt por especies fue casi siempre consistente con la identificación en el campo en las muestras de la cuenca baja; sin embargo, la mayoría de los especímenes colectados de la cuenca alta, incluyendo muchos individuos identificados como *G. robusta*, tenían ADNmt de *G. cypha*. Individuos con ADNmt de *G. elegans* fueron raramente encontrados, indicando la posibilidad de que estas especies estén aún presentes en la cuenca alta. El análisis filogenético de las secuencias del citocromo b proveyó una resolución limitada de las relaciones entre estas especies; sin embargo, algunas agrupaciones estuvieron fuertemente apoyadas. Se encontró que *Gila cypha* y *Gila atraria* estan cercanamente relacionadas, un resultado consistente con la hibridización pasada de estos taxa previamente hipotetizada a partir de datos de sitios de restricción. Todas las muestras de *G. robusta* provenientes de México (seis poblaciones) fueron muy diferentes de individuos morfológicamente similares de especies colectadas en los Estados Unidos. Estos resultados pueden indicar que: 1) *G. robusta* ha estado también influenciada por hibridización pasada, 2) esta morfología representa un fenotipo primitivo compartido, ó 3) estas características morfológicas han evolucionado múltiples veces en este linaje. Las secuencias de los genes mitocondriales (ND2) que evolucionan más rápidamente serán utilizadas para examinar más cercanamente la hibridización pasada y la estructura de la población dentro de las especies a través de la cuenca.

DUNHAM, J. B.*; VINYARD, G. L. (Department of Biology and Program in Ecology, Evolution and Conservation Biology, University of Nevada, Reno, NV)

The self-thinning rule: evidence from stream-living salmonids in harsh environments

KEYWORDS: Salmonidae; self-thinning; body size; population density; metabolism; food limitation; energy flow

ABSTRACT

Self-thinning implies that density dependent rates of birth, mortality and/or emigration adjust population density in response to resource limitation. Slopes of thinning lines in animal populations are often the reciprocal of the slope relating individual metabolic requirements to body mass. This implies that total population energy requirements remain constant as average individual body mass changes (energetic equivalence). We investigated self-thinning by analyzing body size and abundance data for salmonid fishes from the intermountain western United States. Regression of population density on average body mass indicated slopes were consistent with the energetic equivalence hypothesis in only about half of the cases analyzed. Further analyses showed the use of average body size may bias body size- abundance analyses in favor of energetic equivalence. Exceptions to self-thinning and energetic equivalence may be explained by differences among species and alternating periods of physical and biotic control. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

El auto-adelgazamiento implica que las tasas de nacimiento, mortalidad y/o migración que son densodependientes ajustan la densidad de población en respuesta a los recursos limitados. Las pendientes de líneas de adelgazamiento en poblaciones animales son frecuentemente el recíproco de la pendiente que relaciona los requerimientos metabólicos y la masa del cuerpo. Esto implica que los requerimientos totales de energía de la población permanecen constantes como cambios promedio en la masa corporal individual (equivalencia energética). Nosotros investigamos el auto-adelgazamiento analizando datos de tallas y abundancias para peces salmónidos de las montañas interiores del oeste de los Estados Unidos. La regresión de la densidad de la población vs. la masa corporal promedio indicó que las pendientes fueron consistentes con la hipótesis de la equivalencia energética en tan sólo la mitad de los casos analizados. Análisis adicionales mostraron que el uso de la masa promedio puede sesgar los análisis talla-abundancia a favor de equivalencias energéticas. Las excepciones al auto-adelgazamiento y equivalencia energética pueden ser explicadas por la diferencia entre especies y períodos alternativos de control físico y biótico. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

DUNSMOOR, L. (Klamath Tribes Natural Resources, Chiloquin, OR)

Predation by planarian flatworms and fathead minnows on embryos and larvae of endangered suckers in Oregon

KEYWORDS: predation; planarians; fathead minnow; recruitment; catostomids; Lost River sucker; shortnose sucker

ABSTRACT

Research into early life history of two endangered catostomids (Lost River sucker, *Deltistes luxatus* and shortnose sucker, *Chasmistes brevirostris* in the upper Klamath River basin, Oregon) has focused on the influence of predation on recruitment dynamics. Work is not yet complete, but several interesting results merit immediate dissemination among other researchers and managers. Survival of Lost River suckers to emergence in artificially placed substrate is being investigated in a shoreline spring entering Upper Klamath Lake. Initial goals were to assess incubation success relative to degree of spring-water influence, but planarian flatworm (Platyhelminthes, Order Tricladida) predators killed almost all experimental embryos.

Subsequent work directed towards planarian predation on sucker embryos showed nearly 100% mortality of embryos in artificially placed substrates with 0-4% fine (<2 mm) sediments compared to a mean of 12% survival in 'natural' substrates with 54% fines. At present, our working hypothesis is that fines may filter out flatworms, making incubating embryos unavailable to planarian predators. Other work focused on the potential impacts of predation by fathead minnows, *Pimephales promelas*, on sucker larvae. Laboratory experiments demonstrated that fathead minnows readily eat sucker larvae, even in the presence of alternative prey, and that predation is influenced by water depth and cover availability. We had encountered no published papers which would alert us to view flatworms or fathead minnows as significant predators on sucker embryos or larvae. While we have yet to conclude that either predator is driving recruitment dynamics, our results to date are strong enough to send up a warning flag to other researchers and managers, prompting closer scrutiny of these seemingly innocuous creatures.

RESUMEN

La investigación sobre los estadios tempranos de dos especies de catostómidos (matalotes) en peligro (Lost River sucker; *Deltistes luxatus* y shortnose sucker, *Chasmistes brevirostris* en la parte alta de la cuenca del Río Klamath en Oregon) ha sido enfocada en la influencia de la depredación sobre la dinámica del reclutamiento. El trabajo aún no está completo, pero varios resultados interesantes merecen difundirse entre otros investigadores y manejadores. Se está investigando la sobrevivencia del Lost River sucker para eclosionar en substratos artificialmente establecidos a la orilla de un manantial entrando en el Upper Klamath Lake. Las metas iniciales fueron evaluar el éxito de incubación relativo al grado de influencia del agua del manantial, pero las depredadoras planarias (Platyhelminthe, Orden Tricladida) mataron casi a todos los embriones del experimento. Un trabajo subsecuente, dirigido a la depredación de las planarias sobre embriones del matalote mostró que hubo casi un 100% de mortalidad de embriones en los substratos establecidos artificialmente con 0-4% de sedimentos finos (< 2 mm) comparados con un promedio de 12% de sobrevivencia en substratos "naturales" con 54% de sedimentos finos. Actualmente, nuestra hipótesis de trabajo es que los sedimentos finos pueden filtrar las planarias, haciendo que la incubación de los embriones no esté disponible a las planarias depredadoras. Otro trabajo se enfocó en los impactos potenciales de la depredación de las carpitas cabezonas *Pimephales promelas*, sobre las larvas del matalote. Los experimentos de laboratorio demostraron que las carpitas cabezonas comen inmediatamente las larvas del sucker, aún en presencia de otra presa alternativa, y que la depredación está influenciada por la profundidad y cobertura de diponibilidad. No encontramos escritos publicados que pudieran alertarnos sobre las planarias y las carpita cabezonas como depredadores significativos de los embriones y larvas del matalote. Aún cuando tenemos que concluir que aunque un depredador está dirigiendo la dinámica del reclutamiento, nuestros resultados a la fecha son lo suficientemente fuertes para enviar una voz de alerta a otros investigadores y manejadores, hacia un pronto escrutinio cercano de estas criaturas aparentemente inocuas.

ECHELLE, A. A.; ECHELLE, A. F. (Zoology Dept., Oklahoma State University, Oklahoma City, OK)

Genetic introgression of Leon Springs pupfish by introduced sheepshead minnow/Introgresión genética del cachorrito de Leon Springs por bolín introducido

KEYWORDS: genetic introgression; allozymes; mitochondrial DNA; pupfish

ABSTRACT

Allozyme and mtDNA variation in samples of pupfish collected in 1994 from within the historic range of the Leon Springs pupfish *Cyprinodon bovinus* in Diamond Y Draw (Pecos Co., Texas) indicates that the natural populations of this locally endemic species are genetically introgressed by sheepshead minnow *C.*

variegatus. The average frequencies of foreign genetic elements for four diagnostic allozyme loci and mtDNA was 15.1% (range = 6.7-26.7%), 7.4% (5.0-8.3%), and 6.1% (1.4-16.7%) for three samples representing the entire wild population of *C. bovinus*. A captive population of *C. bovinus* established at Dexter, New Mexico appears free of foreign genetic material. Comparisons with past studies of genetic variation in *C. bovinus* indicate that the present situation is largely due to a recent introduction of *C. variegatus* and not a result of an introduction that occurred in the mid-1970s; however, some residual effects from the earlier introduction cannot be completely discounted. The genetic analysis indicates that the source of the introduced *C. variegatus* in Diamond Y Draw is the nearest known population of the species, an introduced stock in Lake Balmorhea, approximately 90 km away. The results demonstrate the potential for small-scale introductions to cause dramatic changes in the genetic structure of endemic species. We discuss some recommendations regarding future efforts to restore and maintain the genetic integrity of *C. bovinus* in its native range.

RESUMEN

La variación aloenzimática y de ADNmt en muestras de pez cachorrito colectados en 1994 de tres sitios dentro del rango histórico de *Cyprinodon bovinus* en Diamond Y Draw (Pecos Co., Texas) indica que las poblaciones naturales de este pez cachorrito localmente endémico están introgresadas por el bolín (*C. variegatus*). Los promedios de las frecuencias de los elementos genéticos ajenos de cuatro loci diagnósticas de aloenzimas y de ADNmt fueron 15.1% (rango = 6.7-26.7%), 7.4% (5.0-8.3%), y 6.1% (1.4-16.7%) de tres muestras representativas de la población silvestre completa de *C. bovinus*. Una población en cautiverio de *C. bovinus* establecida en Dexter,Nuevo México, parece estar libre de materia genética ajena. Las comparaciones con estudios anteriores de variación genética en *C. bovinus* indican que la presente situación se debe en gran parte a la introducción reciente de *C. variegatus* y no como resultado de una introducción que ocurrió a mediados de la década de los 1970; sin embargo, algunos de los efectos residuales de la introducción anterior no se pueden descartarse por completo. El análisis genético indica que la fuente de población de *C. variegatus* introducida en Diamond Y Draw es la más cercana población conocida de esta especie, o sea, un stock introducido en Lake Balmorhea, aproximadamente a 90 km de allí. Los resultados muestran que las introducciones en pequeña escala pueden causar cambios dramáticos en la estructura genética de especies endémicas. Discutimos algunas recomendaciones relativas a los esfuerzos futuros para recuperar y mantener la integridad genética del *C. bovinus* en su rango nativo.

FULLER, P. L.*; BOYDSTUN, C. P.; NICO, L. G.; WILLIAMS, J. D.; BENSON, A. J. (National Biological Service, Southeastern Biological Science Center, Gainesville, FL)

National data base of nonindigenous fishes: A summary of fish introductions in the western United States

KEYWORDS: nonindigenous; exotic; introduction; translocation; data base; GIS; World Wide Web; stocking

ABSTRACT

Since 1978, researchers at National Biological Service's Southeastern Biological Science Center in Gainesville, FL, have been monitoring the status and distribution of nonindigenous fish species in U.S. waters. To facilitate information transfer about nonindigenous species, we are entering all records of nonindigenous fishes taken in open waters of the United States into an electronic data base. Information on each introduction is obtained by searching published and unpublished reports; by contacting state and federal agencies, fisheries biologists, ichthyologists, and museum curators; and by searching laboratory and museum collections, and computer data bases. Our data base currently contains more than 13,500 records of 454 nonindigenous fishes. Each database record includes fields for information on taxonomy, locality, method of collection, disposition of specimens, and status of the introduction (where known), as well as

fields for other pertinent data. The data base is integrated with Geographical Information System (GIS) technology to facilitate monitoring and mapping of nonindigenous species distributions. On-line access to the data set is available to anyone with a computer connected to the INTERNET. Our Uniform Resource Locator (URL) is http://www.nfrcg.gov. users can perform state or basin queries, obtain species synopses and get state-level distribution maps showing native and introduced ranges. Of these 454 nonindigenous species, 263 (58%) are native to the United States but are found outside their native ranges, and 171 (38%) are from other countries; 73 (43%) of these foreign species have become established in U.S. waters. The 19 nonindigenous hybrid fishes represent 4% of the total number of nonindigenous fish species. Of the 454 reported species, at least 259 species have been introduced outside their native range in the 12 western states. Numbers of species introduced in each state are as follows: Arizona (80), California (118), Colorado (79), Idaho (54), Montana (49), Nevada (83), New Mexico 76), Oregon (54), Texas (105), Utah (56), Washington (47), and Wyoming (42). Of the 259 species, 87 (34%) are foreign to this country; 29 of the 87 species (33%) have become established. The most common reason for introduction is sport fishing. Approximately 127 species (49%) of the 259 species were introduced for this purpose or an associated one, such as forage for the stocked fish species, or were introduced accidentally through stock contamination. In conjunction with this, another 20 species (8%) are believed to have been introduced via bait bucket releases. Fifty-five species (21%) were introduced via aquarium releases. Twenty-three species (9%) were introduced for conservation purposes. Other means of introduction include ballast water release, stocking for biocontrol, and escape from aquaculture facilities. Means and reasons for many other introductions remain unknown.

RESUMEN

Desde 1978, investigadores del National Biological Service, Southeastern Biological Science Center en Gainesville, FL, han estado monitoreando el estatus y distribución de especies no-nativas de peces en aguas de los Estados Unidos. Para facilitar la transferencia de información acerca de especies no-nativas, estamos capturando todos los registros de especies no-nativas de peces capturados en aguas abiertas en los Estados Unidos dentro de una base de datos electrónica. la información sobre cada introducción se obtiene buscando reportes publicados y no publicados; contactando agencias federales y estatales, biólogos pesqueros; ictiólogos y curadores de museos; y buscando colecciones de laboratorio y de museo, y bases de datos computarizadas. Nuestra base de datos contiene actualmente más de 13, 500 registros de 454 peces no-nativos. Cada registro en la base de datos incluye campos para información en taxonomía, localidad, método de colecta, disposición de especímenes, y estatus de la introducción (donde se conoce), así como campos para otros datos pertinentes. La base de datos está integrada a la tecnología de un Sistema de Información Geográfica (SIG) para facilitar el monitoreo y mapeo de la distribución de las especies no-indígenas. El acceso a la línea del grupo de datos se encuentra disponible a cualquier persona que esté conectado mediante computadora a INTERNET. Nuestro Localizador Uniforme de Recurso (URL) es http://www.nfrcg.gov. Los usuarios pueden llevar a cabo preguntas sobre el estado o las cuencas, obtener la sinopsis de la especie y obtener mapas de distribución a nivel estatal de mostrando los rangos de nativos e introducidos. De estas 454 especies no-indígenas, 263 (58%) son nativas de los Estados Unidos pero han sido encontradas fuera de su rango nativo de distribución, y 171 (38%) vienen de otros países; 73 (43%) de estas especies foráneas se han establecido en aguas de los Estados Unidos. Las 19 especies híbridos no-indígenas representan 4% del número total de especies de peces no-indígenas. De las 454 especies reportadas, al menos 259 especies han sido introducidas fuera de su rango nativo en los 12 estados de oeste. Los números de las especies introducidas en cada estado son los siguientes: Arizona (80), California (118), Colorado (79), Idaho (54), Montana (49), Nevada (83), Nuevo México (76), Oregon (54), Texas (105), Utah (56), Washington (47), and Wyoming (42). De las 259 especies, 87 (34%) son exóticas para el país; 29 de las 87 especies (33%) ya se han establecido. La razón más común para la introducción de exóticos

es la pesca deportiva. Aproximadamente 127 especies (49%) de las 259 especies fueron introducidas para este propósito o uno asociado, tal como forraje para las especies de peces establecidas, o fueron introducidas accidentalmente a través de la contaminación del estock. En adición a esto, se cree que otras 20 especies (8%) han sido introducidas vía la liberación de camadas. Cincuenta y cinco especies (21%) fueron introducidas vía la liberación de acuarios. Veintitrés especies (9%) fueron introducidas con propósitos conservacionistas. Otros medios de introducción incluyen liberación de agua como lastre, siembras para control biológico, y por escape facilitado por acuacultivos. La forma y las razones para otras muchas introducciones permanecen desconocidas.

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

Agency report for the Texas Parks and Wildlife Department

KEYWORDS: ciénega; Comanche Springs pupfish; Pecos gambusia; stocks at risk

ABSTRACT

The ciénega at Balmorhea State Park has been biologically initiated and the system is going through successional stages. Some of the native fishes as well as aquatic, riparian and terrestrial plants have been introduced. The remainder of the fish fauna will be stocked after Comanche Springs pupfish *Cyprinodon elegans* and Pecos gambusia *Gambusia nobilis* have become well established. Educational and tourism components are also nearing completion.

The Texas Chapter of the American Fisheries Society has created a committee on Texas Fish Stocks at Risk. It is designed to identify fishes that are of conservation concern before they degrade to listing status. Naturally, many of these occur in the Chihuahuan Desert region of the state. We hope not only to identify the taxa and associated problems, but develop innovative solutions that may guide research and agency policy.

RESUMEN

La ciénega del Parque Estatal de Balmorhea se ha iniciado biológicamente y el sistema ha pasado por etapas exitosas. Se han introducido algunos peces nativos así como plantas ribereñas, acuáticas y terrestres. El resto de los peces y la fauna acuática serán abastecidos después de que el Comanche Springs pupfish, *Cyprinodon elegans* y el Pecos gambusia, *Gambusia nobilis*, estén bien establecidos. Los componentes educativos y turísticos están también próximos a concluir.

El Texas Chapter of the American Fisheries Society ha creado el comité "Texas Fish Stocks at Risk". Diseñado para identificar peces que son de interés para conservación antes de ser degradados de la lista de estatus. De manera natural muchos de éstos habitan en la región del Desierto Chihuahuense. Esperamos no sólo identificar los taxa y problemas asociados sino que también desarrollamos soluciones innovadoras que pueden guiar la investigación y a políticas institucionales.

GORMAN, O. T.*; STONE, D. M.; ZDINAK, Z. M.; MERETSKY, V. (U.S. Fish and Wildlife Service, Flagstaff, AZ)

Habitat use by spawning humpback chub *Gila cypha* in the Little Colorado River, Arizona near Grand Canyon

KEYWORDS: Cyprinidae; spawning ecology; reproduction; habitat; endangered species; Grand Canyon; Arizona

ABSTRACT

During the spring months (March, April, May) of 1993, 1994, and 1995, the Service conducted field studies to describe the habitat used by spawning humpback chub in the Little Colorado River. During the

spring spawning season, ripe males congregated in shallow to moderately deep runs and eddies below travertine dam/reef complexes. These habitats had slow currents, complex structure and were associated with the presence of gravel substrates. Most ripe females appeared to be solitary and were captured in deeper downstream pool habitats. Capture of single ripe females in aggregations of ripe males indicated putative spawning sites. This pattern of spawning habitat use and behavior is concordant with published studies of minnow spawning ecology. The results of our work will serve as a model of habitat use by humpback chub and will be useful in efforts to establish additional spawning populations.

RESUMEN

Durante los meses de primavera (marzo, abril, mayo) de 1993, 1994 y 1995, el Servicio llevó a cabo estudios de campo para describir el uso de hábitat por los charalito jorobado desovantes en el Little Colorado River. Durante la época de desoves primaveral, los machos maduros desovantes se congregaron en corridas de agua someras a moderadamente profundas y remolinos abajo de los complejos presa de travertino/arrecife. Estos hábitats tienen corrientes lentas, estructuras complejas y estuvieron asociados a la presencia de substrato de grava. La mayoría de las hembras maduras desovantes parecían estar solitarias y fueron capturadas en hábitats de pozas profundas río abajo. La captura de hembras maduras desovantes solitarias en agregaciones de machos maduros desovantes indicó los sitios putativos de desove. Este patrón de uso de hábitat para desoves y el comportamiento concuerda con los estudios publicados sobre la ecología del desove de los ciprindos. Los resultados de nuestro trabajo pueden servir de modelo del uso del hábitat por el charalito jorobado y serán útiles los esfuerzos para establecer poblaciones desovantes adicionales.

GRAVES, F. F.; ALLAN, N. L.* (U.S. Army Corps of Engineers, Environmental Section, Albuquerque District, NM)

Acequia irrigation systems and fish passage

KEYWORDS: fishway; migration; New Mexico

ABSTRACT

The U.S. Army Corps of Engineers (Corps) participates with the State of New Mexico and local associations in the rehabilitation of community-based acequias (irrigation ditches), which local water users no longer can maintain with hand labor. One common project design is to replace temporary, instream rock and brush diversion structures with concrete-capped dams. The existing dams (pre-project) usually appear to allow upstream fish passage, at least occasionally. Therefore, the Corps incorporates a modified Denil Fishway into the design and construction of the new dam, with assistance from the U.S. Fish and Wildlife Service. This design was selected because of self-regulation, lower flow requirements and relatively low cost. The objective of the fishway is to provide fishes an opportunity to move upstream over the structure and, therefore, reduce project impacts on stream fish populations.

RESUMEN

El U.S. Army Corps of Engineers (Cuerpo) participa con el Estado de New Mexico y asociaciones locales en la rehabilitación de las acequias pertenecientes a la comunidad, a los cuales los usuarios locales no los pueden mantener con labores manuales. Un proyecto común se ha diseñado remplaza temporalmente, rocas dentro de la corriente y estructuras laterales de diversión con presas con revestimiento de concreto. Las presas existentes (pre-proyecto) usualmente parecen permitir el paso de los peces corriente arriba, al menos ocasionalmente. Por lo tanto, el cuerpo ha incorporado una modificación en los caminos de peces "Denil" dentro del diseño y construcción de la nueva presa, con la asistencia del U.S. Fish and Wildlife Service. Este diseño fue seleccionado por causa de su autoregulación, bajos requerimientos de flujo

y un costo relativamente bajo. El objetivo de este caminos de peces es proveer a los peces de una oportunidad para trasladarse corriente arriba sobre las estructuras y, por lo consiguiente, reducir el impacto de los proyectos en las poblaciones de peces de las corrientes.

HARVEY, J. E.*; SHEA, S. P.; SCOPPETTONE, G. G. (National Biological Service, Reno Field Station, Reno, NV)

Status, and habitat use, and life history of White River spinedace *Lepidomeda albivallis*, with information on coinhabiting native fishes

KEYWORDS: White River spinedace; population; distribution; habitat; life history

ABSTRACT

A quarterly sampling program was implemented in 1993 to determine life history parameters and habitat use of White River spinedace *Lepidomeda albivallis*. Benthic and plankton samples were obtained from North Flag Spring to classify and quantify potential food items. Coinhabiting speckled dace and desert sucker were collected in 1993 and 1994 for aging and gut content analysis. Spinedace museum specimens collected in 1938 from North Flag Spring were aged and the gut contents analyzed to determine age class structure and food habits of the historic population and contrast them with the current population. The results will be displayed.

RESUMEN

En 1993 se implementó un programa cuatrimestral de muestreo para determinar los parámetros del ciclo de vida del White River spinedace, *Lepidomeda albivallis*. Se obtuvieron muestras de bentos y plancton en North Flag Spring para clasificar y cuantificar los potenciales componentes de la dieta. En 1993 y 1994 se colectaron individuos cohabitantes del speckled dace y desert sucker para determinación de la estructura de edades y análisis de contenidos estomacales. Se les determinó la edad a especímenes de museo de Spinedace colectados en 1938 en North Flag Spring y se les analizó los contenidos estomacales para determinar la estructura de edades y hábitos alimentarios de la población histórica y contrastarla con la actual. Se discuten los resultados.

HEINRICH, J. E.; SJOBERG, J. C.*; WITHERS, D.; BYERS, S.; WERDON, S.; ST. GEORGE, D. (JH, JS-Nevada Division of Wildlife, Region III, Las Vegas, NV. ;DW, SB, SW-U.S. Fish and Wildlife Service, Region 1, Ecological Services State Office, Reno, NV; DS-Ash Meadows National Wildlife Refuge)

Southern Nevada Eco-region Report

KEYWORDS: dace; Pahranagat Valley; poolfish; sucker; roundtail chub; speckled dace; spinedace; Virgin River; Muddy River; woundfin, White River; pupfish; toad.

ABSTRACT

The Nevada Division of Wildlife (NDOW) currently assists in managing twenty endangered and five threatened species or subspecies of federally listed fish. Activities of the native fish program continue to concentrate on recovery actions or conservation actions dealing with these specific fish and also state sensitive or federal C2 fish. The following species or subspecies, including one amphibian species, received attention in 1994-5:

White River spinedace, *Lepidomeda albivallis* - Estimates continue to indicate less than 50 fish remain in a single spring on State lands at the Kirch Wildlife Management Area. In early 1995, fourteen fish were captured from the springhead and moved to downstream habitat now available after largemouth bass removal. Reproduction and recruitment will be evaluated during September and October 1995. A contract with the National Biological Service (NBS) will continue at this site to gather habitat requirement information and assist in recovery of this species.

White River springfish, *Crenichthys baileyi baileyi* - In 1994, from mark-and-recapture estimates, numbers of springfish were estimated to be at a very respectable 49,000 fish in Ash Spring. One- and two-year-old fish dominate the population. The outflow of this spring (Burns Ranch) contains the only population of Pahranagat roundtail chub, *Gila robusta jordani*. The last dive estimate and extrapolation in October 1994, tallied 152 adults, and 247 juveniles. Juvenile numbers were down substantially.

Hiko White River springfish, *Crenichthys baileyi grandis* - Populations were monitored at Crystal, and Blue Link Springs. At Crystal Spring less than 100 springfish remain. At Blue Link Spring the mark and recapture estimate was over 4,000 springfish in the small pond. The Hiko population was last monitored in 1994 and mark and recapture estimates were 11,340 +/- 1,750 fish. In 1995, NDOW personnel were denied access to this spring by land owners.

Pahrump poolfish, *Empetrichthys latos latos* - In 1995, census work was conducted on two populations of Pahrump poolfish at Corn Creek and Spring Mountain Ranch State Park. These populations were monitored by mark and recapture estimates and are stable at over 5,700 and 19,000 fish, respectively.

Virgin River fishes - In November and December 1994, 3,100 woundfin, *Plagopterus argentissimus*, and 475 roundtail chubs *Gila robusta seminuda*, received from Dexter National Fish Hatchery and Technology Center were marked and released in Nevada reaches of the Virgin River. Fair numbers of marked woundfin were recaptured in February and April, but over time, high flows on the Virgin River seemed to continually reduce numbers of marked fish. During standard recovery team surveys no woundfin were captured in Nevada. Only small numbers of marked adult Virgin River roundtail chubs, *Gila robusta seminuda*, were found in the river below Mesquite, Nevada.

Virgin River spinedace, *Lepidomeda mollispinis mollispinis* - After five years of surveys, no spinedace have been found in Nevada. The NDOW has begun the initial planning of experimental reintroductions in historic habitats below Schroeder Reservoir.

Razorback sucker, *Xyrauchen texanus* - In 1995, four nights and nine net nights were spent on Lake Mead, only a single Echo Bay recaptured adult was taken. In addition, three nights were spent on larval capture at Las Vegas Wash and two larval fish were taken. Efforts over the last 4 years on Lake Mead have resulted in over 50 razorback suckers captured, tagged, and released. In 1995, 40 fish from Floyd Lamb State Park were released into Lake Mead. Good numbers of razorback suckers still remain at this park and in the Boulder City Golf Course ponds.

Big Springs spinedace, *Lepidomeda mollispinis pratensis* - In 1995, good numbers of individuals were observed during spot sampling of stream and pool habitats. A monitoring plan will be developed during this fiscal year to better assess numbers along occupied habitat.

Railroad Valley springfish, *Crenichthys nevadae* - Populations remained stable, as in 1994, in all areas except Duckwater Valley, where numbers continue to remain low.

Relict dace, *Relictus solitarius* - NDOW produced a status and survey report for this species in 1995. Final field study continued in the summer of 1995.

Muddy (Moapa) River - After a serious fire on the Moapa Valley National Wildlife Refuge the Moapa dace, *Moapa coriacea*, appears to have maintained numbers in the Warm Springs area. NDOW fish surveys were terminated in the Muddy River in 1994 since NBS researchers extended their study to include fish species.

Devils Hole pupfish, *Cyprinodon diabolis* - Standard dive counts in September 1994 and April 1995 were 541 and 217, respectively. Afternoon dives resulted in slightly higher counts probably due to better visibility. Refugia counts remained stable at School Spring, 126 and 112, respectively, and at Point of Rocks, 71 and 85 respectively.

Amargosa toad, *Bufo nelsoni* - The Amargosa toad was petitioned for listing in 1994. In a NDOW report, numbers of adult toads in 1993 and 1994 from six sites across the valley were estimated to be 130 and 85,

respectively. Tentative numbers from a week-long survey in August 1995, adding 4 additional sites, produced 40 adult toads. Several other portions of the valley still require survey work.

The United States Fish and Wildlife Service (FWS), Desert National Wildlife Refuge, currently manages nearly 23,000 acres at the Ash Meadows National Wildlife Refuge near Pahrump, Nevada. This refuge was established in 1984 primarily to conserve the threatened and endangered plant and animal species found there. FWS has a variety of ongoing activities to protect and enhance the following four endangered species of fish: the Devils Hole pupfish, *Cyprinodon diabolis*; the Warm Springs pupfish, *Cyprinodon nevadensis pectoralis*; the Amargosa pupfish, *Cyprinodon nevadensis mionectes*; and the Ash Meadows speckled dace, *Rhinichthys osculus nevadensis*. In 1994-5 all native fish surveys using minnow traps showed that pupfish and speckled dace populations remained stable. In addition to annual monitoring programs the Amargosa pupfish refugium was overhauled. The well casing was cleaned, a new pump was installed including an electrical control box and wiring, water pipes were replaced, and a water cooling tank was built.

Considerable blocks of time were also spent on nonnative fish eradication on the refuge. Refuge volunteers removed over 100 largemouth bass and green sunfish from refuge waters. The man-made ponds at Point of Rocks were drained to remove largemouth bass and as part of the process to restore stream habitat for the Ash Meadows naucorid.

The FWS, Nevada Ecological Services State Office, Reno, Nevada was involved in the following activities per each river system. On the Muddy River, the FWS is finalizing a recovery plan for the endangered Moapa dace *Moapa coriacea* and seven aquatic species of special concern, which should be published in late 1995. The Service is also assisting a committee of Moapa Valley residents to study and implement aquatic riparian habitat restoration measures on the Muddy River to benefit rare species as well as local citizens. In a related area, FWS published a notice in the Federal Register (July 24, 1995) proposing changing the name of the Moapa roundtail chub *Gila robusta* ssp. to Virgin River chub *Gila seminuda* based upon genetic studies conducted at the University of Arizona. The notice also changes the listing of Virgin River chub in the Virgin River to a population listing. The comment period closed September 22, 1995.

On the Virgin River, FWS proposed critical habitat for Virgin River chub (Virgin River population only), woundfin *Plagopterus argentissimus*, and Virgin spinedace *Lepidomeda mollispinis mollispinis* in the Federal Register on April 5, 1995. The critical habitat proposal includes habitat in Utah, Arizona, and Nevada. The final rule will be published by December 1, 1995.

In Pahranagat Valley, FWS has published a draft recovery plan for the endangered Pahranagat roundtail chub *Gila robusta jordani*, White River springfish *Crenichthys baileyi baileyi*, and Hiko White River springfish *C. b. grandis* and numerous other aquatic and riparian species of special concern in Pahranagat Valley. Comments on the draft plan are being solicited.

RESUMEN

Nevada Division of Wildlife (NDOW) actualmente asiste en el manejo de veinte especies en peligro y cinco especies o subespecies amenazadas de peces enlistados federalmente. Las actividades del Programa de peces nativos continúan concentradas en acciones de recuperación o conservación en relación a estas especies en particular y también se establecen de manera estatal especies sensibles o peces C2 federales. Las siguientes especies o subespecies, incluyendo una subespecie de anfibio, recibió atención en 1994-5:

White River spinedace, *Lepidomeda albivallis* - Las estimaciones continúan indicando que menos de 50 peces permanecen en un solo manantial en tierras del Estado en el Area de Manejo Kirch Wildlife. A principios de 1995 se capturaron catorce peces en el manantial y se movieron hacia hábitats río abajo que ahora están disponibles después de remover a la lobina. Se evaluará la reproducción y el reclutamiento durante septiembre y octubre de 1995. Continuará un contrato en este sitio con el National Biological Service (NBS) para recabar información sobre requerimientos de hábitat y asistencia en la recuperación de estas especies.

White River springfish, *Crenichthys baileyi baileyi* - En 1994, a partir de estimaciones hechas por el método de marcado-recaptura, se calcularon números bastante respetables de peces, 49,000 en Ash Spring. Los peces de uno y dos años son los dominantes en la población. El flujo de salida de este manantial (Burns Ranch) contiene la única población del Pahranagat roundtail chub, *Gila robusta jordani*. La estimación hecha en el último buceo y la extrapolación en octubre 1994, registraron 152 adultos, y 274 juveniles. El número de juveniles bajó substancialmente.

Hiko White River springfish, *Crenichthys baileyi grandis* - Se monitorearon las poblaciones en Crystal y Blue Link Springs. En Crystal Springs quedaron menos de 100 springfish. Mediante el método de marcaje y recaptura se estimó que la población en Blue Link Spring era mas de 4,000. La población en Hiko fue monitoreado altima vez en 1994 cuando la estimación de poblacion basado en marcaje y recaptura era de 11,349 +/- 1,750. En 1995 los propietarios de Hiko negaron la entrada al personal del NDWO.

Pahrump poolfish, *Empetrichthys latos latos* - En 1995, se llevó a cabo el trabajo de censado de dos poblaciones de Pahrump poolfish en Corn Creek y el Spring Mountain Ranch State Park. Estas poblaciones fueron monitoreadas mediante estimaciones de marcado-recaptura y están estables por arriba de los 5, 700 y 19, 000 peces respectivamente.

Peces del Virgin River - En 1994, se marcaron y liberaron en las cercanías del Virgin River, 3, 100 woundfin, *Plagopterus argentissimus*, y 475 roundtail chubs *Gila robusta seminuda*, los cuales fueron recibidos de la Dexter National Fish Hatchery and Technology Center. Un número pobre de woundfin fue recapturado en febrero y abril, pero flujos altos, fuera de tiempo, en el Virgin River parece que continuamente redujeron el número de peces marcados. Durante las estudios estándar del equipo de recuperación no se capturó woundfin en Nevada. Sólo se encontró un pequeño número de adultos marcados del Virgin River roundtail chub, *Gila robusta seminuda*, en el río abajo de Mesquite, Nevada.

Virgin River spinedace, *Lepidomeda mollispinis mollispinis* - Después de 5 años de estudio, no se ha encontrado spinedace en Nevada. El NDOW ha comenzado la planeación inicial para la reintroducción experimental en hábitats históricos abajo del Reservorio Schroeder.

Matalote jorobado, *Xyrauchen texanus* - En 1995, se utilizaron 4 noches y nueve redes nocturnas en el Lago Mead, y sólo se recapturó un solitario Echo Bay adulto. Se utilizaron adicionalmente tres noches para captura de larvas en Las Vegas Wash y se capturaron dos larvas de peces. Los esfuerzos hechos durante los últimos cuatro años en el Lago Mead han tenido como resultado la captura, marcado y liberación de más de 50 matalotes jorobados. En 1994, fueron liberados 40 peces del Floyd Lamb State Park en el Lago Mead. Aún permanecen buenos números de matalotes jorobados en este parque y en las pozas del Boulder City Golf Course.

Big Springs spinedace, *Lepidomeda mollispinis pratensis* - En 1995, se observó un buen número de individuos durante un muestreo por selección de hábitats de arroyo y pozas. Se desarrollará un plan de monitoreo durante este año fiscal para hacer una mejor evaluación de estos números a lo largo de los hábitats ocupados.

Railroad Valley springfish, *Crenichthys nevadae* - Las poblaciones permanecen estables, como en 1994, en todas las áreas excepto en Duckwater Valley, donde los números se siguen manteniendo bajos.

Relict dace, *Relictus solitarius* - El NDOW produjo un reporte del estatus y estudio para esta especie en 1995. El estudio de campo final continuó este verano de 1995.

Muddy (Moapa) River - Después de un severo fuego en el Moapa Valley National Wildlife Refuge, el Moapa dace, *Moapa coriacea*, parece haber mantenido sus números en el área de Warm Springs. Los estudios del NDOW se terminaron en el Muddy River en 1994 desde que los investigadores del NBS extendieron su estudio para incluir estas especies de peces.

Devils Hole pupfish, *Cyprinodon diabolis* - Los conteos estándar por buceo en septiembre de 1994 y abril 1995 fueron 541 y 217, respectivamente. Los buceos en la tarde resultaron en conteos ligeramente más altos probablemente debido a la mejor visibilidad. Los conteos en el Refugio se mantienen estables en

School Spring, 126 y 112 respectivamente, y en Point of Rocks, 71 y 85 respectivamente.

Amargosa toad, *Bufo nelsoni* - Se solicitó que el Amargosa toad fuera enlistado en 1994. En un reporte del NDOW, el número de sapos adultos en 1993 y 1994 de seis sitios a lo largo del valle se estimaron en 130 y 85 respectivamente. Números tentativos a `partir de un muestreo de una semana en agosto de 1995, adicionaron 4 sitios más, que registraron 40 sapos adultos. Otras varias porciones del valle todavía requieren de ser evaluadas.

El Fish and Wildlife Service de los Estados Unidos (FWS) y el Desert National Wildlife Refuge, acualmente manejan cerca de 23,000 acres en el Ash Meadows National Wildlife Refuge cerca de Pahrump, Nevada. Este refugio se estableció en 1984, primeramente para conservar las especies de plantas y animales en peligro y amenazadas que se encontraban ahí. El FWS tiene una variedad de actividades realizándose para proteger e incrementar las siguientes cuatro especies de peces en peligro: el Devils Hole pupfish, activos *Cyprinodon diabolis*; el Warm Springs pupfish, *Cyprinodon nevadensis pectoralis;* el Amargosa pupfish, *Cyprinodon nevadensis mionectes*; y el Ash Meadows speckled dace, *Rhinichthys osculus nevadensis*. En 1994-5 todos los muestreos de peces nativos utilizando trampas para pececillos (minnow) mostraron que las poblaciones de pupfish y speckled dace permanecen estables. En adición a los programas de monitoreo anual el refugio del Amargosa pupfish fue reparado. El revestimiento del pozo fue limpiado, una bomba nueva se instaló incluyendo una caja de control eléctrico y cableado, se reemplazaron las pipas de agua, y se construyó un tanque de agua fría.

Se dedicaron espacios de tiempo considerables en la erradicación de peces no-nativos en el refugio. Los voluntarios del Refugio sacaron alrededor de 100 lobinas y mojarras verdes de las aguas del refugio. Las pozas artificiales en Point of Rocks se vaciaron para sacar a las lobinas como parte del proceso para restaurar el hábitat del arroyo para el naucorido del Ash Meadows.

El FWS, Nevada Ecological Services State Office, Reno, Nevada, se involucró en las siguientes actividades por cada sistema ribereño. En el Muddy River, el FWS está finalizando un Plan de recuperación para la Moapa dace en peligro *Moapa coricea* y siete especies acuáticas de especial interés, las cuales deberán ser publicadas a finales de 1995. El Servicio está asistiendo también un comité de residentes del Moapa Valley para estudiar e implementar medidas de restauración de hábitats riparios-acuáticos en el Muddy River para beneficio de especies raras así como para ciudadanos locales. En un área relacionada, el FWS publicó un aviso en el registro federal 24 de julio de 1995 proponiendo cambiar el nombre del Moapa roundtail chub *Gila robusta* ssp. a Virgin River chub *Gila seminuda* basándose en estudios genéticos llevados a cabo por la Universidad de Arizona. El aviso también cambia del listado al Virgin River Chub a enlistar una población. El período para comentarios se cerró el 22 de septiembre de 1995.

En el Virgin River, el FWS propuso hábitats críticos para el Virgin River Chub (sólo la población en el Virgin River), wounfind *Plagopterus argentissimus*, y para el Virgin spinedance *Lepidomeda mollispinis mollispinis* en el registro federal el 5 de abril de 1995. La propuesta de hábitats críticos incluye hábitats en Yuta, Arizona y Nevada. La norma final será publicada el primero de diciembre de 1995.

En el Pahranagat Valley, el FWS ha publicado un borrador del plan de recuperación para las especies en peligro: Pahranagat roundtail chub *Gila robusta jordani*, White River springfish *Crenichthys baileyi baileyi*, y para el Hiko White River springfish *C. b. grandis* y para otro número de especies acuáticas y riparias de especial interés en el Pahranagat Valley. Los comentarios sobre el borrador del plan han sido solicitados.

HEINRICH, J. E.; SJOBERG, J. C. (Nevada Division of Wildlife, Region III, Las Vegas, NV)

Recovery efforts for the White River spinedace

KEYWORDS: spinedace; recovery; habitat; barriers; nonnatives; Nevada

ABSTRACT

The White River spinedace, *Lepidomeda albivallis*, is endemic to the White River Valley, the headwaters of the Pluvial White River. This spinedace historically occurred from mountain streams, such as Ellison Creek, to valley-floor meadows and springs such as Sunnyside Creek. In 1985, the White River spinedace was federally listed as Endangered primarily because surveys indicated that only two small spring systems contained this now rare fish. Follow-up studies in 1992 indicated that distribution was reduced to a single location and was further restricted to only 2 headwater pools.

Since habitats and numbers of spinedace were so restricted, a limited number of alternatives were available to fisheries managers to enhance recovery. Any recovery or research activities required little to no handling of remaining fish. Managers undertook a variety of activities to improve habitats and encourage recruitment. Habitats that once contained spinedace were rehabilitated in a number of ways including: native and nonnative fish removal, physical stream reconstruction, removal of man-made control structures, substrate modification, and vegetation control. In addition, other measures were completed to protect the remaining population of spinedace, including: fish barrier modification and construction, protective netting installed on the main springhead to prevent bird predation, and periodic dive surveys to monitor and remove downstream predators. To date, no indication of recruitment has occurred along this short section of North Flag Spring. At this time the entire population of White River spinedace may be as low as 25 individuals.

RESUMEN

El White River spinedace, *Lepidomeda albivallis*, es endémico al White River Valley, la cabecera de cuenca del Pluvial White River. Este spinedace históricamente ocurrió desde las corrientes montañosas, como Ellison Creek, a los prados del valle y manantiales tales como Sunnyside Creek. En 1985, el White River spinedace fue listado federalmente como En Peligro, principalmente debido a que las evaluaciones indicaron que únicamente dos pequeños sistemas de manantiales contenían este raro pez. Estudios siguientes en 1992 indicaron que la distribución fue reducida a una sola localidad y aún más restringido a solo dos pozas de manantial.

Debido a que los hábitats y los números de spinedace fueron muy restringidos, un número limitado de alternativas estuvieron disponibles a los manejadores de pesquerías para mejorar su recuperación. Cualquier actividad de investigación o recuperación requirió poca a ninguna manipulación de los peces restantes. Los manejadores emprendieron una variedad de actividades para mejorar hábitats y fomentar el reclutamiento. Los hábitats que una vez contuvieron al spinedace se rehabilitaron de diversas maneras, incluyendo: remoción de peces nativos y no-nativos, reconstrucción física de arroyos, remoción de estructuras de control hechas por el hombre, modificación del substrato, y control de la vegetación. Adicionalmente, se completaron otras medidas para proteger la población restante de spinedace, incluyendo: la construcción y modificación de barrera para peces, redes protectoras instaladas en los principales manantiales para impedir la depredación por aves, y buceos periódicos para monitorear y remover predadores provenientes de corriente abajo. A la fecha, no hay indicios de que haya ocurrido reclutamiento a lo largo de esta corta sección del North Flag Spring. En este momento la población entera del White River spinedace quizás sea tan baja como 25 individuos.

HEKI, L. G. (U.S. Fish and Wildlife Service, Northern Nevada Fishery Resource Office, Reno, NV)

Management of *Chasmistes cujus* spawning migrations through Marble Bluff Fish Facility, Pyramid Lake, Nevada, 1993 through 1995

KEYWORDS: cui-ui; Marble Bluff Fish Facility; spawning migration

ABSTRACT

Management of cui-ui, *Chasmistes cujus* spawning migrations through Marble Bluff Fish Facility has been altered over the last two spawning seasons to enhance passage of large numbers of cui-ui. The population has increased significantly since the construction of Marble Bluff Fish Facility. The adult population has grown from an estimated 90,000 in the 1970's to its current level of approximately 1.1 million. Many reached adult spawning age during the drought period from 1987 to 1992. The Facility is composed of a 3.1 mile long fishway which has four ladders interspersed along its length, Marble Bluff Dam, and the fish handling building. The dramatic increase in the cui-ui population required modification to facility operations and design. Fish and Wildlife Service personnel and volunteers assisted 66,000 cui-ui in 1994 and 122,000 cui-ui in 1995 into their historic spawning habitat in the lower Truckee River.

RESUMEN

El manejo de las migraciones de desove del cui-ui, *Chasmistes cujus,* mediante las instalaciones Marble Bluff Fish Facility ha sido alterado en las ultimas dos estaciones de desove para mejorar el paso de un gran número de cui-ui. La población ha aumentado significativamente desde la construcción de Marble Bluff Fish Facility. La población adulta ha crecido desde un estimado de 90,000 en los años 70's a su nivel actual de aproximadamente 1.1 millones. Muchos adultos alcanzaron la edad de desove durante el período de sequía de 1987 a 1992. Las instalaciones se componen de un canal para peces de 3.1 millas de largo, el cual tiene cuatro escaleras interespaciadas a lo largo de su longitud, el embalse Marble Bluff Dam, y el edificio de manejo de peces. El aumento dramático en la población del cui-ui requiere de modificación y diseño a la operación de la instalación. El personal de Fish and Wildlife Service y los voluntarios ayudaron a 66,000 cui-ui en 1994 y a 122,000 en 1995 en su hábitat histórico de desove en el lower Truckee River.

HEKI, L. G.; GOURLEY, C. (LGH - U.S. Fish and Wildlife Service, Northern Nevada Fishery Resource Office, Reno, NV; CG - The Nature Conservancy, Northern Nevada Office, Reno, NV)

Status of Lower Truckee River restoration

KEYWORDS: Truckee River; restoration; river corridor management plan; cui-ui; Lahontan cutthroat trout

ABSTRACT

For more than a century the Truckee River has suffered from relentless human impact. Water depletion, urbanization, channelization, and other impacts have changed the character and productivity of the Truckee River. Organized in 1993, the Lower Truckee River Restoration Steering Committee (Committee) developed methods and planned activities to improve the river's condition for the endangered cui-ui and threatened Lahontan cutthroat trout and the ecosystem. After identifying goals and objectives, based on principles of a normal intact river system, the Committee initiated studies to determine cause and effect relationships. Using the results of our studies as a guide, the Committee developed a restoration plan that includes: 1) flow prescriptions required for physical and biological processes, 2) channel modifications using the results of our geomorphic evaluation, 3) river corridor management plan, and 4) habitat improvements. Overview of current activities will be presented.

RESUMEN

Por más de un siglo el Truckee River ha sufrido el impacto humano implacable. El agotamiento de agua, urbanización, canalización, y otros impactos han cambiado el carácter y productividad del Truckee River. Organizado en 1993, el Lower Truckee River Restoration Steering (Commitee) desarrolló métodos y planeó actividades para mejorar las condiciones del río para el pez En Peligro, cui-ui, y la amenazada Lahontan cutthroat trout y el ecosistema. Después de identificar metas y objetivos, con base en principios de un sistema fluvial intacto normal, el Comité inició estudios para determinar causa y efectuar relaciones. Usando los resultados de nuestro estudios como una guía, el Comité desarrolló un plano de restauración que incluye: 1) las prescripciones de flujo requeridas por los procesos físicos y biológicos, 2) modificaciones al cauce, usando los resultados de nuestra evaluación geomorfológica, 3) plan de manejo de corredor de río, y 4) mejoramientos de hábitat. La descripción de actividades actuales será presentada.

HENDRICKSON, D. A. (Texas Natural History Collections, University of Texas, Austin, TX)

International utilization summary for the Desert Fishes Council's World Wide Web system and call for contributions

KEYWORDS: Desert Fishes Council; World Wide Web; INTERNET; public education; information dissemination

ABSTRACT

One year ago, DFC extended its outreach by providing materials to the world via INTERNET. The multimedia offerings of fish photographs, informative text, distribution maps, Proceedings, and meeting information, have proven very popular. Though regular statistics are not compiled, it was evident from comments to the webmaster that the system was being widely seen. The DFC pages are now indexed in most major INTERNET search systems, and are linked to a great diversity of other INTERNET biodiversity-related information services. In addition to links from other systems, approval has been granted to utilize DFC WWW materials in electronically distributed (WWW and CD-ROM) conservation and fish biology course material at four U.S. and Canadian universities.

Detailed file transmission data are routinely recorded on the server, but due to their massive size, are deleted at midnight every day, so thorough summaries over time are not available, however, the author/webmaster, following the deadline for receipt of abstracts at 1800 hours on 9/15/95, reviewed the data for the period of Sept. 7 - 14. In that week, 1,392 files totalling 10.3 megabytes were transmitted. This was not apparently a reflection of members searching for information about submitting abstracts, since daily usage was lowest in the 3 days prior to the deadline, and had been highest on Sunday. The failure of many abstracts to follow format criteria further substantiated this conclusion. Averaged over the week, peaks in usage occurred around 8-9 AM (Central Time) and 5-6 PM. Percentages of total bytes transferred during the week to different domains were as follows: 2.16 - Argentina; 1.65 - Australia; 0.65 - Belgium; 1.08 - Canada; 0.65 - Switzerland; 0.65 - Chile; 0.29 - Finland; 1.22 - Hong Kong; 0.29 - Hungary; 0.72 - Italy; 0.79 Japan; 0.79 - Netherlands; 0.29 - Norway; 1.36 - Sweden; 0.29 - United Kingdom; 1.58 - United States; 0.29 - South Africa; 19.83 - U.S. Commercial; 25.57 - U.S. Educational; 3.45 - U.S. Government; 0.29 - U.S. Military; 6.54 - Network; 0.93 Non-Profit Organization; 24.43 - unresolved; 4.24 - utexas.edu. There seems no reason to conclude that this was anything but an average week, so in excess of 50,000 files may be distributed per year from the system.

Perusing the details of the domains of users, those familiar to the webmaster from e-mail with DFC members were not common. It seems therefore that the outside world is using the system far more than are members. The international nature of utilization is interesting. Perhaps as a reflection of increased international awareness of DFC, by the time of the meeting, DFC WWW will likely have an extensive

Australian chapter, and an African chapter is promised for the near future. Both contributors hope that their WWW contributions might eventually lead to establishment of actual DFC chapters. DFC has truly become international.

Graphics files were popular. Many fish pictures had been accessed, but diverse articles in the Proceedings had also been viewed repeatedly. Distribution maps are also popular, despite the less than desirable indexing of them (soon to change). Users appear aware of the fact that the system lacks completed abstracts with information about the species, since few of those empty format files were accessed.

Members of DFC have been slow to contribute to growth of the system. While some files are awaiting translations to appropriate formats, etc., much of DFC WWW still consists of fish photos in empty abstract forms. This format was originally instituted with the expectation that members, who are intimately familiar with the very basic and brief information necessary to complete these forms, would provide it, but such has not been the case. With the exception of the creators of the system (author and Mike Baltzly; see abstract from previous year), few other members have contributed, but significant contributions have come from non-members. Recent communications indicate that this might be changing. It is becoming increasingly easy to convert diverse electronic textual documents into formats that can be easily distributed on the WWW, and members have easy access to an overwhelming amount of such information that could be useful in this public education and general information-sharing system. The webmaster thus reiterates the solicitation for contributions and offers assistance in translation of existing documents to formats appropriate for WWW. Users aware of relevant materials elsewhere on WWW not currently linked to/from DFC WWW are also encouraged to provide URLs for those sites to the webmaster so links may be installed, thus continuing to assure DFC's continuation as a clearing house for information on imperiled fishes.

RESUMEN

Hace un año, DFC extendió sus alcances, proporcionando materiales al mundo vía INTERNET. Los ofrecimientos multimedia de fotografías de peces, texto informativo, mapas de distribución, Proceedings, e informes sobre reuniones, han probado ser muy populares. Aunque estadísticas regulares no son recopiladas, fue evidente por comentarios al responsable de la red, que el sistema estuvo siendo ampliamente visto. Las páginas del DFC estan ahora indexadas en la mayoría de los sistemas de búsqueda de INTERNET, y hay ligas al sistema del DFC de una gran diversidad de otros servicios INTERNET de información relacionada a la biodiversidad. Además de la vinculación con otros sistemas, la aprobación se ha otorgado para utilizar materiales electrónicamente distribuidos de la WWW del DFC (WWW y CD-ROM) sobre cursos de biología de peces y conservación de cuatro universidades canadienses y estadounidenses.

Los datos de transmisión de archivo detallados se registran rutinariamente sobre el servidor, pero debido a su tamaño masivo, se borran a la medianoche todos los días, por lo cual resúmenes muy completos, a través del tiempo no estan disponibles, sin embargo, el autor/responsable de la red, despues de pasar el límite de las 1800 horas del 15/09/95 para la recepción de resúmenes, revisó los datos para el período de sept. 7-14. En esa semana, 1,392 archivos que totalizaron 10.3 megabytes se transmitieron. Esto no fue aparentemente un reflejo de miembros que buscan información sobre resúmenes sometidos, debido a que el uso diario fue el más bajo en los 3 días antes del plazo de recepción, y a que había sido el más alto en Domingo. El fracaso de muchos resúmenes para seguir los criterios de formato comprobó esta conclusión. Promediados sobre la semana, los picos en el uso ocurrieron alrededor 8-9 AM (Tiempo Central) y 5-6 PM. Los porcentajes del total de bytes transferidos durante la semana a diferentes territorios fueron como sigue: 2.16 - Argentina; 1.65 - Australia; 0.65 - Bélgica; 1.08 - Canadá; 0.65 - Suiza; 0.65 - Chile; 0.29 - Finlandia; 1.22 - Hong Kong; 0.29 - Hungría; 0.72 - Italia; 0.79 - Japón; 0.79 - Países Bajos; 0.29 - Noruega; 1.36 - Suecia; 0.29 - Reino Unido; 1.58 - Estados Unidos; 0.29 - Sudáfrica; 19.83 - Estados Unidos (Comercial); 25.57 - Estados Unidos (Educativo); 3.45 - Estados Unidos (Gubernamental); 0.29 - Estados Unidos

(Militar); 6.54 - Red; 0.93 - Organizaciones no lucrativas; 24.43 - no resuelto; 4.24 - utexas.edu. No existe razón para concluir que esto fue cualquier cosa excepto una semana promedio. Así se puede estimar que en un año serán distriuidos 50,000 archivos desde el sistema.

Examinando con atención los detalles de los campos de los usuarios, aquellos campos familiares a la red maestra del e-mail con los miembros del DFC, no fueron comunes. Parece por lo tanto que el mundo exterior esta usando el sistema mucho más que sus miembros. La naturaleza internacional de utilización es interesante. Quizás como un reflejo de la aumentada conciencia internacional del DFC, por el tiempo de la reunión, la WWW del DFC probablemente tendrá un capítulo Australiano extensivo, y un capítulo Africano se promete para el futuro cercano. Ambos contribuyentes esperan que sus contribuciones con WWW puedan conducir eventualmente al establecimiento de capítulos reales del DFC. DFC ha llegado a ser verdaderamente internacional.

Los archivos gráficos fueron populares. Muchas fotos de peces han sido accesadas, pero también artículos diversos en los Proceedings han sido vistos repetidamente. La distribución de mapas son también populares, a pesar del menos que deseable indexado de estos (pronto a cambiar). Los usuarios parecen conscientes del hecho de que el sistema carece de resúmenes completos con información acerca de las especies, debido a que se accesaron unos pocos de archivos de formato vacío.

Los miembros de DFC han sido lentos para contribuir al crecimiento del sistema. Mientras algunos archivos esperan las traducciones a formatos apropiados, etc., mucho de la WWW del DFC todavía consiste de fotos de peces en formatos de resúmenes. Este formato fue originalmente instituido con la expectativa que los miembros, quien estan íntimamente familiarizados con la muy básica, breve y necesaria información para completar estas formas, la proporcionarían, pero no ha sido el caso. Con la excepción de los creadores del sistema (autor y Mike Baltzly; vea resumen del año pasado), pocos miembros han contribuido, ya que las contribuciones importantes han provenido de no-miembros. Comunicaciones reciente indican que esto quizás este cambiando. Esta llegando a ser cada vez más fácil convertir documentos textuales electrónicos en formatos que pueden fácilmente distribuidos en la WWW, y a que los miembros tengan acceso fácil a una cantidad abrumadora de información útil en educación pública y de el sistema de información en general. El responsable de la red, así reitera la solicitud de contribuciones y el ofrecimiento de asistencia de conversión de documentos existentes a los formatos apropiados de la WWW. Los usuarios informados de los materiales relevantes en la WWW, que regularmente no conectaron de o desde la WWW del DFC son también animados a proveer URLs para aquellos sitios a los que la red maestra así unida pueda ser instalada, y así asegurr la continuación del DFC como una cámara de compensación para la información sobre peces en peligro.

HENDRICKSON, D. A.; VARELA-ROMERO, A.* (DAH - University of Texas, Austin, TX; AVR - Centro de Investigaciones Cientificas y Tecnológicas, Universidad de Sonora, Hermosillo, Sonora, México)

Status of the fish fauna of the Río Fuerte basin, northwestern México

KEYWORDS: Mexico; Río Fuerte; Sinaloa; Sonora; Chihuahua; Mexican golden trout; unisexual *Poeciliopsis*; Yaqui catfish; status survey; exotic fishes

ABSTRACT

The Río Fuerte drains 3,383,585 ha of the western slopes of the Sierra Madre Occidental of Sinaloa, Chihuahua, Durango and southernmost Sonora to the Gulf of California (Sea of Cortéz). While it drains desert of extreme southern Sonora, and arid madrean oak woodland interior areas, much of the drainage is more mesic, including extensive high-elevation headwaters with coniferous forests and extensive Sinaloan thornscrub at middle and lower elevations, producing the large annual average discharge of 5,102 x 10^6 m^3. The fish fauna of the diverse habitats of this river basin has never been systematically surveyed, though the system has already suffered extensive alteration at the hands of man, and this trend is continuing at a rapid

pace. Two large dams now impound the mainstream and another diverts an entire major historic tributary from southern Sonora directly to the Gulf of California, well north of the historic, natural mouth of the river. More major dams are planned, as are inter-basin connections to the adjoining Río Mayo to the north. The lower mainstream is now mostly diverted to large-scale agriculture and little discharge remains in the historic channel. Evidence of the impacts of agricultural pesticides in the lower basin is commonly seen. A large-scale World Bank logging proposal recently threatened broad-scale impacts on the highly remote headwaters. Intermediate remote interior parts of the basin remain relatively little altered, but are now centers of illicit narcotics activities.

We surveyed fish collections in the U.S. and Mexico for records from the basin, obtained records of stockings of exotic species from Mexican government agency officials, and drew on observations from our own collections in the basin, to compile a database of actual fish collection records and introductions and to assess the status of the native fauna. It is not surprising that most historic collections have been made in peripheral parts of this rugged and mostly inaccessible basin. The fauna of interior reaches of the major canyon-bound rivers and tributaries remains mostly undocumented.

While similar to other Pacific tributaries of NW Mexico in having no species-level endemicity, the Río Fuerte basin does have interesting and unusual native ichthyodiversity. It is here that diversity of the well-studied unisexual *Poeciliopsis* clones is highest, and Río Fuerte tributaries have been hosts to the majority of the large number of studies of this scientifically very important complex. Many of the study sites remain physically little altered, and are mostly in foothill tributaries above areas likely to be impacted by reservoir construction, but their unique and complex communities are threatened by exotic fishes. At high elevations, the native Mexican golden trout *Oncorhynchus chrysogaster* has been collected at a number of locations, but we find no recent records, and are unaware of serious attempts in the past three decades to collect it. While the focus of considerable attention in the 1950's and early 1960's, interest in this fish appears to have waned, despite its listing by CITES, and we remain largely ignorant of its current conservation status in the Rio Fuerte basin or in adjacent headwaters of the next two major basins to the south, where it has also been recorded. The lack of records of exotic rainbow trout from the Rio Fuerte basin is an optimistic note, but may also reflect lack of effort. Presumed hybrids between the native catfish *Ictalurus* cf. *pricei* and introduced channel catfish were taken, but not confirmed by preservation of vouchers, during our recent collections. While we have no data on the extent of hybridization, experience from the Río Yaqui suggests that it is probably extensive. We also document establishment of *Gambusia affinis* and other exotics in the basin, but have no data on impacts of these on the native fauna.

RESUMEN

El Río Fuerte desagua 3,383,585 ha de las bajadas occidentales de la Sierra Madre Occidental de Sinaloa, Chihuahua, Durango y parte más sureña de Sonora al Golfo de California (Mar de Cortéz). Mientras desagua el desierto del extremo sur de Sonora, y las áridas áreas interiores de bosques madreanos de encino, gran parte de éste desagüe es mésico, incluyendo extensas cabezas de agua de altas elevaciones con bosques de coníferas y matorral espinoso sinaloense en elevaciones medias y bajas, produciendo la gran descarga promedio anual de $5,102 \times 10^6 m^3$. La ictiofauna de los diversos hábitats de ésta cuenca fluvial nunca se ha estudiado sistemáticamente, aunque el sistema ha sufrido ya una extensa alteración por las manos del hombre, y esta tendencia continúa a una marcha rápida. Hoy en día, dos grandes presas retienen la corriente principal y otra presa desvía completamente un tributario histórico importante desde el sur de Sonora hasta el Golfo de California, más al norte de la boca natural histórica del río. Las presas más grandes son planeadas como conexiones intercuencas al adyacente Río Mayo más al Norte. La corriente principal en la parte más baja es desviada en su mayor parte para agricultura a gran escala y sólo un poco de agua queda en el canal histórico. Es común ver evidencias de los impactos producidos por pesticidas agrícolas en la cuenca baja. Un banco mundial a gran escala registró recientemente una propuesta sobre

los grandes impactos que amenazan las remotas aguas arriba de la cuenca. Las partes interiores intermedias de la cuenca permanecen relativamente poco alteradas, pero son ahora centros de actividades ilícitas de narcóticos.

Nosotros inspeccionamos colecciones ictiológicas en Estados Unidos y México para obtener registros sobre la cuenca, obtuvimos registros de especies exóticas de funcionarios de agencias gubernamentales mexicanas, y usamos nuestras propias observaciones y colecciones de peces de la cuenca, para compilar una base de datos con registros actualizados de colecciones ictiológicas y para evaluar la condición de la fauna nativa. No es sorprendente que la mayoría de las colecciones históricas de peces se hayan hecho en partes periféricas de ésta escabrosa e inaccesible cuenca. La ictiofauna de zonas más remotas de la cuenca y sus tributarios permanecen en su mayoría, sin documentar.

Mientras otros tributarios del Pacífico similares del noroeste de México no tiene especies endémicas, la cuenca del Río Fuerte tiene una interesante e inusitada ictiodiversidad nativa. Es aquí donde la diversidad de clones de los bastante estudiados unisexuales del genero *Poeciliopsis* es más alta, y los tributarios del Río Fuerte han sido anfitriones a la mayoría del gran número de estudios de éste científicamente importante complejo. Muchos de los sitios de estudio permanecen físicamente pocos alterados, y son en su mayoría las áreas arriba de los tributarios al pie de las montañas las que son impactados por la construcción de presas, pero sus únicas y complejas comunidades son amenazadas por especies exóticas. En elevaciones altas, la nativa trucha dorada mexicana, *Oncorhynchus chrysogaster*, se colectó históricamente en un número de localidades, pero no encontramos ningún registro reciente, y son desconocidos intentos hechos en las pasadas tres de décadas para colectarle. Mientras que fue el foco de atención durante los años 50's y principio de los 60's, el interés por ésta especie parece haber menguado, a pesar de estar listada en el CITES, y nosotros permanecemos ignorantes de su condición actual de conservación en la cuenca del Río Fuerte o en las próximas dos cuencas importantes adyacentes al sur, donde también se ha registrado. La carencia de registros de la exótica trucha arco iris en la cuenca del Río Fuerte es una nota optimista, pero puede reflejar también la ausencia de esfuerzos. La presunta hibridación entre el bagre nativo *Ictalurus pricei* y el introducido bagre de canal se ha tomado en cuenta, pero no ha sido confirmados por la conservación de ejemplares, durante recientes colectas. Mientras que no tenemos datos sobre el alcance de ésta hibridación, las experiencias del Río Yaqui sugieren que ésta es probablemente extensa. Nosotros incluso documentamos el establecimiento de *Gambusia affinis* y de otros exóticos en la cuenca, pero no se tienen datos sobre el impacto de éstos sobre la fauna nativa.

HERSHLER, R.; WILLIAMS, J. E. (RH - National Museum of Natural History, Smithsonian Institution, Washington, D.C.; JEW - Bureau of Land Management, Intermountain Research Station, Boise, ID)

Conservation strategies for springsnails in the Great Basin: the challenge and the opportunities

KEYWORDS: conservation strategy; springsnails; reserves; Idaho; Nevada; Oregon; Utah

ABSTRACT

A field survey of springsnails (Gastropoda: Hydrobiidae) throughout the Great Basin was recently conducted to document the diversity and conservation status of the poorly known fauna. The survey revealed a rich, highly endemic, and largely undescribed fauna, much of which is at risk of extinction. Many populations are threatened by surface-disturbing actions, which could be easily ameliorated if protection was afforded to a small portion of individual spring habitats. The survey results reveal numerous opportunities and challenges for proactive conservation measures. In response, a multi-agency effort has been initiated to recognize and evaluate these concerns as well as to encourage and institute local, site-specific conservation efforts. Fortunately, many of the springsnail populations at risk can be protected through relatively uncomplicated means. Efforts to maintain springsnail populations should focus on maintenance of natural springhead integrity, which will improve water quality and may conserve, in

addition to springsnails, a broad array of poorly known species associated with springhead habitats. Once springheads are protected, water may be utilized downflow for multiple uses. If proactive conservation measures are not implemented, many taxa could be lost during lengthy debates to provide regulatory protection pursuant to Endangered Species Act or other legislation.

RESUMEN

Un estudio de campo de caracoles de manantiales (Gastropoda: Hydrobiidae) a través de la Great Basin se llevó a cabo recientemente para documentar la diversidad y condición de conservación de éste grupo tan poco conocido. El estudio reveló una rica, altamente endémica, y gran familia sin describir, muchas de las cuales están en riesgo de extinción. Muchas poblaciones son amenazadas por acciones superficiales, que pueden ser fácilmente aminoradas si la protección se dirige a una porción pequeña de los hábitats primaverales individuales. Los resultados del estudio revelan numerosas oportunidades y desafíos para llevar a cabo numerosas medidas de conservación. En respuesta, un esfuerzo multiinstitucional ha iniciado para reconocer y evaluar estos intereses, así como también para fomentar e instituir esfuerzos de conservación en sitio a nivel local. Afortunadamente, muchas de las poblaciones de caracoles de manantiales en riesgo pueden protegerse mediante medios relativamente sencillos. Los esfuerzos para mantener las poblaciones de caracoles de manantiales debe enfocarse en el mantenimiento de la integridad de los manantiales naturales, que mejorará la calidad del agua y puede conservar, además de los caracoles primavera, a un amplio grupo de especies pobremente conocidas asociados a los hábitats de manantiales. Una vez que los manantiales se protejan, el agua que fluye abajo puede utilizarse para usos múltiples. Si las medidas de conservación no son implementadas, muchas taxa podrían perderse durante las largas discusiones y debates para proveer protección legal conforme a el Endangered Species Act o alguna otra legislación.

HOAGSTROM, C. W. (U.S. Fish and Wildlife Service, New Mexico Fishery Resources Office, Albuquerque, NM)

Fish population interactions in a southeast New Mexican sinkhole

KEYWORDS: sinkhole lake; Pecos gambusia; Pecos pupfish; plains killifish

ABSTRACT

Fish populations inhabiting Lake Saint Francis were monitored beginning in July 1991, in accordance with the Fishery Resources Monitoring Program's Global Change component. Lake Saint Francis, a gypsum sinkhole, is located in southeastern New Mexico on Bitter Lake National Wildlife Refuge near Roswell. The lake has a diameter of 65 m and is 15 m deep. Water temperature ranges between 3 and 28 degrees Celsius while salinity varies from 7 to 10 ppt. Three species of fish, Pecos gambusia *Gambusia nobilis*, Pecos pupfish *Cyprinodon pecosensis*, and plains killifish *Fundulus zebrinus*, occur therein. Baited minnow traps were employed quarterly to detect fish abundance and distribution throughout the lake. Vertical arrays were set at mid-lake at each meter from the surface through 5 m along with traps at 10 and 15 m. On the shoreline traps were set on the surface and at 1 m. A vertical water quality profile (temperature, dissolved oxygen, salinity, and conductivity) was taken monthly to relate climate to the fish community. Some segregation by depth was detected. Pecos gambusia, the most numerous species, dominated at the surface but could be found at any depth above the thermocline (6-7 m). Plains killifish were increasingly common from the surface to 5 m. Pecos pupfish were only common at 10 and 15 m. All three species were more numerous in shoreline sets than sets at mid-lake. Fish abundance increased during the summer months at which time the lake was thermally and oxygenically stratified. During the winter the lake remained mixed and fish numbers were low.

RESUMEN

Las poblaciones de peces que habitan el Lago Saint Francis fue monitoreado en julio de 1991, de acuerdo con el componente de cambio global del Fishery Resources Monitoring Program. El Lago Saint Francis, un cenote de caliza, se ubica en del sureste de New Mexico en Bitter Lake National Wildlife Refuge cerca de Roswell. El lago tiene un diámetro de 65 m y tiene 15 m de profundidad. La temperatura del agua oscila entre 3 y 28 grados Celsius, mientras que la salinidad varía desde 7 a 10 ppt. Tres especies de peces se encuentran allí, Pecos gambusia *Gambusia nobilis*, Pecos pupfish *Cyprinodon pecosensis* y el plains killfish *Fundulus zebrinus*. Se emplearon trampas minnow cebadas de manera trimestral, para detectar la abundancia y distribución de los peces a través de todo el lago. Se establecieron conjuntos de trampas verticales a mitad del lago a cada metro de la superficie con una longitud de 5 m y con trampas a los 10 y 15 m. En las orillas las trampas se instalaron a nivel superficial y a 1 m de profundidad. Se tomó un perfil vertical de calidad de agua (temperatura, oxígeno disuelto, salinidad y conductividad) mensualmente para relacionar el clima con la comunidad de peces. Se detectó algo de segregación por la profundidad. El pez Pecos gambusia, la especie más abundante, dominó en la superficie, pero puede ser encontrado a cualquier profundidad arriba de la termoclina (6-7 m). El plains killfish incrementó el ser común de la superficie a los 5 m. El Pecos pupfish sólo fue común entre los 10 y 15 m. Las tres especies fueron más comunes en las trampas instaladas en las orillas que las establecidas a mitad del lago. La abundancia de peces se incrementó durante los meses de verano, tiempo durante el cual la temperatura y el oxígeno del lago estuvieron estratificados. Durante el invierno el lago permaneció mezclado y los números de peces fueron bajos.

HOLDEN, P. B. (BIO/WEST, Inc., Logan, UT)

Report on 1995 activities in the Bonneville Basin related to desert fishes.

KEYWORDS: Bonneville Basin; area report

ABSTRACT

Colorado Cutthroat Trout - In response to a listing package for this subspecies, a multiagency group in Idaho developed a Conservation Agreement for the Bear River drainage, including a single drainage Agreement for the Thomas Fork drainage. Agencies involved included the Idaho Department of Fish and Game, Idaho Department of Parks and Recreation, U.S. Fish and Wildlife Service, Burea of Land Management, and Forest Service. The Utah Division of Wildlife Resources, U.S. Fish and Wildlife Service, BLM, and the Forest Service are also developing a Conservation Agreement for this subspecies in Utah.

Bear Lake Fishes - A status review of the three endemic Bear Lake *Prosopium* and the Bear Lake cutthroat trout was completed by an interagency team in Idaho. They determined the species were stable and that the U.S. Fish and Wildlife Service designation of "species of special concern" could be removed. Utah is also presently completing a status review of the same species as well as the Bear Lake Sculpin.

Least Chub - A listing package was prepared for this species by the U.S. Fish and Wildlife Service in 1995. The State of Utah, BLM, and the Fish and Wildlife Service are planning on developing a Conservation Agreement for this species. On a very positive note, Chris Keleher of the Utah Division of Wildlife Resources recently discovered a new population of this species in Juab Valley.

Leatherside Chub - A status review for this species is being conducted by the Division of Wildlife Resources through a contract with Brigham Young University.

June Sucker - Studies on various aspects of recovery of June sucker are being conducted and reports on some of these studies are included in the agenda for the 1995 DFC meeting. A few thousand PIT-tagged June suckers were stocked into the Utah Lake system in 1995.

RESUMEN

Colorado Cutthroat Trout - En respuesta a un paquete para enlistar a ésta subespecie, un grupo multi-institucional de Idaho desarrolló un acuerdo de conservación para el Bear River Drainage, incluyendo un acuerdo único de drenaje para el Thomas Fork Drainage. Entre las instituciones involucrados en el proceso incluyen el Idaho Department of Fish and Game, Idaho Department of Parks and recreation, U.S. Fish and Wildlife Service , Bureau of Land Management, y el Forest Service. La Utah Division of Wildlife Resources, United States Fish and Wildlife Service, BLM y Forest Service están incluso desarrollando un acuerdo de conservación para ésta subespecie en Utah.

Peces de Bear Lake - Una revisión del estado actual de tres especies endémicas del *Prosopium* de Bear Lake y el Bear Lake cutthroat trout fue completado por un equipo interinstitucional en Idaho. Ellos determinaron que las especies estaban estables y que la designación de U. S. Fish and Wildlife Service de "Especies de interés especial" podía ser removido. Utah está incluso completando una revisión del estado de la misma especies al igual que el Sculpin de Bear Lake.

Least Chub - Un paquete para enlistar a ésta especie fue preparado por U. S. Fish and Wildlife Service en 1995. El Estado de Utah, BLM y United States Fish and Wildlife Service están planeando desarrollar un acuerdo de conservación para ésta especie. En una nota muy positiva, Chris Keleher de la Utah Division of Wildlife Resources, recientemente descubrió una nueva población de ésta especie en Juab Valley.

Leatherside Chub - Una revisón del estado actual para ésta especie está siendo dirigido por la Division of Wildlife Resources a través de un contrato con BYU.

June Sucker - Se están efectuando estudios sobre varios aspectos de recuperación de ésta especie y algunos reportes sobre éstos estudios se están incluyendo en la agenda para la reunión de DFC en 1995. Unos pocos de miles de June sucker etiquetados con PIT están abasteciendo el sistema de lagos de Utah en 1995.

HOLDEN, P. B. (BIO/WEST, Inc., Logan, UT)

Changes in native and nonnative fish distribution and abundance following a high spring runoff in the lower Virgin River, 1995

KEYWORDS: Virgin River; woundfin; Virgin spinedace

ABSTRACT

During 1995, the Virgin River experienced a high and long spring runoff. Runoff started in April and flows remained high until July. This spring "flood" altered habitat and redistributed native and nonnative fishes in the Virgin River below Virgin River Gorge, Arizona. Woundfin young-of-the-year were distributed throughout the lower river for the first time in many years, and Virgin spinedace were found below Riverside for the first time ever. Nonnative largemouth bass, common carp, and red shiner numbers also were high, which does not fit the prevailing model that nonnatives are less adapted to high flows in Western rivers.

RESUMEN

Durante 1995, el Virgin River experimentó un escurrimiento grande y prolongado. El escurrimiento comenzó en abril y permaneció alto hasta julio. Este escurrimiento primaveral alteró el hábitat y redistribuyó los peces nativos y no nativos en el Virgin River adelante de Virgin River Gorge, Arizona. Juveniles del año del Woundfin se distribuyeron a lo largo de la parte baja del río por primera vez en muchos años, y el Virgin spinedace se encontró debajo de Riverside por primera vez. También fueron altos los números de individuos de los no nativos lobina negra, carpa común y sardinita roja, que no está de acuerdo con el modelo de prevalencia de que los no nativos están menos adaptados a corrientes altas en ríos occidentales.

HORAN, D. H.*; KERSHNER, J. L.; HAWKINS, C. P.; CROWL, T. A. (Department of Fisheries and Wildlife, Utah State University, Logan, UT)

An assessment of degraded habitat of Colorado River cutthroat trout

KEYWORDS: cutthroat trout; fragmentation; complexity; Colorado River; Utah; Wyoming; native

ABSTRACT

Habitat degradation has fragmented and reduced the complexity of stream ecosystems on the northslope of the Uinta Mountains. Fragmentation has reduced the historic range of cutthroat trout and has eliminated movement among drainages. As available habitat decreases, the condition of the drainage, or its complexity, becomes more important. This study was designed to determine the effects of fragmentation and a loss of habitat complexity on Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus* populations. Seven fragmented streams were studied that contained allopatric populations of cutthroat trout. Adult trout were positively related to habitat area and juveniles were negatively related to area. Adults were found where there were undercut banks and large substrate particles. Large wood appeared to be important to juveniles. Three streams occurred in the High Uintas Wilderness and have suffered less human disturbance than the four lower elevation streams. The Wilderness streams had more stream area, deeper channels, more stable banks, better developed riparian areas and a higher percentage of undercut banks. In contrast, the lower elevation streams have been heavily logged and grazed. They had poorly developed riparian vegetation, higher water temperatures, a higher percentage of surface fines, less particle size variation and more woody debris. Adult density was greater in the wilderness and juvenile density was greater in the nonwilderness. Cutthroat trout in the wilderness streams had a higher mean weight and mean length. As available fish habitat dwindles, we need to focus on the quality of remaining habitat. Restoration of degraded habitat can be effective, but it is important to ensure that high quality habitat does not degenerate.

RESUMEN

La degradación de hábitat ha fragmentado y reducido la complejidad de los ecosistemas de arroyo sobre la pendiente norte de Uinta Mountains. La fragmentación ha reducido el rango histórico de la trucha cutthroat y eliminado el movimiento entre cuencas. Cuando hábitat disponible disminuye, la condición del drenaje, o su complejidad, llega a ser más importante. Este estudio se diseñó para determinar los efectos de fragmentación y pérdida de complejidad de hábitat sobre las poblaciones de la trucha Colorado River cutthroat *Oncorhynchus clarki pleuriticus*. Se estudiaron siete arroyos fragmentados que contenían poblaciones alopátricas de la trucha cutthroat. Las truchas adultas estuvieron positivamente relacionadas al área de hábitat y los juveniles estuvieron negativamente relacionados. Los adultos se encontraron en bancos de socavación y partículas de substrato grandes. Los troncos grandes parecieron ser importantes para los juveniles. Tres arroyos se localizaron en el High Uintas Wilderness y sufrieron menos perturbación humana que los cuatro arroyos de baja elevación. Los arroyos de Wilderness tuvieron más área de arroyo, canales más profundos, bancos más estables, áreas ribereñas mejor desarrolladas y un porcentaje más alto de bancos de socavación. En contraste, los arroyos de baja elevación han sido fuertemente talados y pastoreados. Contienen una vegetación ribereña pobremente desarrollada, altas temperaturas en el agua, un porcentaje más alto de fallas en la superficie, menos variación de tamaño de partícula y mayor detritus de madera. La densidad de adultos fue mayor en el desierto y la densidad de juveniles fue mayor en el no-desierto. La trucha cutthroat en los arroyos de desierto tuvieron un peso promedio mayor y una longitud promedio mayor. Debido a que el hábitat disponible de peces disminuye, necesitamos enfocarnos en la calidad de hábitat restante. La restauración de hábitat degradado puede ser efectiva, pero es importante para asegurar que la alta calidad de hábitat no se degenera.

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Ageing of larval razorback suckers *Xyrauchen texanus* using otoliths

KEYWORDS: Lake Mohave; larval fish; otolith; razorback sucker

ABSTRACT

Razorback sucker *Xyrauchen texanus* populations historically occupied most of the Colorado River and its major tributaries. Since the turn of the century populations have declined or disappeared throughout the species' historic range. In both the upper and lower basin where adult populations still exist, larvae can be found following spawning each year. Survivorship, however, is low and larvae appear to persist for at most only a few weeks. Determining the age at which young fish disappear may help our understanding of the dynamics of the recruitment problem. Otolith aging was attempted for larval razorback suckers using laboratory raised fish obtained from eggs of Lake Mohave wild stock. Larvae were raised at temperatures approximating those of their native Lake Mohave habitat, about 18°C. Three different feeding levels were used to explore potential effects to otolith development: fish were starved, fed a sub-optimal ration, or an ad-libitum ration of brine shrimp. Lapillus and sagittae were present in the earliest larvae examined, and were used to determine if daily rings could be detected. Asteriscus were not used for this analysis because they did not appear until about 2 weeks of age. However, the asteriscus was a quick indicator of relative larval age (<2 wks vs >2 wks of age).

RESUMEN

Las poblaciones del matalote jorobado, *Xyrauchen texanus*, ocuparon históricamente la mayoría del Río Colorado y sus principales tributarios. Desde el cambio de siglo las poblaciones han declinado o desaparecido a lo largo del rango histórico de la especie. En las cuencas alta y baja donde las poblaciones adultas todavía existen, las larvas se encontraron después del desove de cada año. La sobrevivencia, sin embargo, es baja y las larvas parecen persistir por sólo unas semanas. Determinar la edad a la que los peces jóvenes desaparecen, puede ayudar la comprensión de la dinámica del problema de reclutamiento. La determinación de edad por otolitos se intentó para larvas de matalote jorobado usando peces criados en laboratorio y obtenidos de poblaciones silvestres de huevos de Lake Mohave. Las larvas se criaron a temperaturas que aproximan los de su hábitat nativo en el Lake Mohave, sobre 18°C. Tres diferentes niveles de alimentación se usaron para explorar los efectos potenciales en el desarrollo de los otolitos: los peces no se alimentaron, alimentados con una ración subóptima, o a una ración ad libitum de artemia. Lapillus y sagitta estuvieron presentes en las larvas jóvenes examinadas, y se usaron para determinar si los anillos diarios podría detectarse. El asteriscus no fue usado para este análisis porque no aparece sino hasta las 2 semanas de edad. Sin embargo, el asteriscus fue un indicador rápido de la edad relativa de la larva (<2 semanas vs >2 semanas de edad).

HOVINGH, P. (Salt Lake City, UT)

Zoogeographical studies of rivers in the Great Basin, USA: amphibians, mollusks and leeches

KEYWORDS: leeches; mollusks; amphibians; Great Basin rivers; zoogeography; conservation

ABSTRACT

Eleven Great Basin rivers (Sevier, Provo, Weber, and Bear in Bonneville basin; Humboldt, Truckee, Carson, and Walker in Lahontan basin; and Owens, Amargosa and Mojave in the Death Valley basin) were analyzed for geographical distribution of the frogs *Rana pipiens* and *Rana pretiosa*, the mussels *Margaritifera*, *Gonidea*, and *Anodonta*, the gastropods *Fluminicola* and *Ferrissia*, and the Erpobdellid leeches *Erpobdella punctata*, *E. parva*, *E. dubia*, *Nephelopsis obscura*, and *Mooreobdella microstoma*. Ranid amphibians were in very

restricted segments of the rivers which largely reflect habitat exterminations. The Erpobdellid leeches in the Owens, Walker, Carson and Truckee Rivers drainages (*Mooreobdella*), the Humboldt River drainages (*E. punctata*), and the Bonneville basin rivers (*E. punctata, E. dubia, E. parva, N. obscura*) distributions are a result of past geographic events. The mussel *Margaritifera* is largely exterminated while *Anodonta* is widely scattered and rare and *Gonidea* is restricted in the Humboldt River where it was not found in earlier studies in 1912. The limpet *Ferrissia* was common in the Humboldt River and very rare in Provo and Bear rivers.

The river populations of the frogs and mollusks were greatly reduced or exterminated from historic levels and from potential habitat considerations. The leeches were restricted in the use of the rivers. Although these fauna are found in large basins, the Pleistocene lakes did not necessarily allow for basin-wide distribution. The rivers during the glacio-pluvial era were refugiums. The present distribution of the aquatic fauna is related to events preceding the last pluvial cycle and may extend back to the Miocene.

RESUMEN

Once ríos de la Great Basin (Sevier, Provo, Weber, y Bear en la cuenca Bonneville; Humboldt, Truckee, Carson, y Walker en la cuenca Lahontan; y Owens, Amargosa y Mojave en la cuenca de Valle de Muerte) se analizaron para la distribución geográfica de las ranas *Rana pipiens* y *Rana pretiosa*, los mejillones *Margaritifera, Gonidea*, y *Anodonta*, el gasterópodo *Fluminicola* y *Ferrissia*, y las sanguijuelas Erpobdelido *Erpobdella punctata, E. parva, E. dubia, Nephelopsis obscura*, y *Mooreobdella microstoma*. Las ranas anfibias se encontraron en muy restringidos segmentos de los ríos, que en su mayor parte, refleja exterminios de hábitat. Las distribuciones de las sanguijuelas Erpobdelidas en las cuencas de los ríos Owens, Walker, Carson y Truckee (*Mooreobdella*), la cuenca del Río Humboldt (*E. punctata*), y la cuenca del Río Bonneville (*E. punctata, E. dubia, E. parva, N. obscura*) son un resultado de sucesos geográficos pasados. El mejillón *Margaritifera esta* exterminado en su mayor parte, mientras *Anodonta* es escaza y raro, y *Gonidea* se restringe en el Río Humboldt, donde no era encontrado en estudios anteriores en 1912. *Ferrissia* fue muy común en el Río Humboldt y muy raro en los ríos Provo y Bear.

Las poblaciones de las ranas y los moluscos de los ríos fueron reducidas o exterminadas desde niveles históricos y desde consideraciones potenciales de hábitat. Las sanguijuelas se restringieron en el uso de los ríos. Aunque esta fauna se encuentre en cuencas grandes, los lagos del Pleistocene no necesariamente permitieron una distribución amplia en la cuenca. Los ríos durante la era glaci-pluvial eran refugios. La distribución actual de la fauna acuática está a eventos que preceden el último ciclo pluvial y pueden extender hacia el Miocene.

KANIM, N. R.*; YOUNG, K. (NRK - U.S. Fish and Wildlife Service, Klamath River Fish and Wildlife Office, Yreka, CA; KY - U.S. Fish and Wildlife Service, Sacramento Field Office, Sacramento, CA)

1995 Northern California Area Report

KEYWORDS: Northern California; U.S. Fish and Wildlife Service; U.S. Forest Service; U.S. Bureau of Land Management; California Department of Fish and Game; Section 7 Endangered Species Act consultation; recovery plan; endangered and threatened species; Federal candidate species; Species of Special Concern

ABSTRACT

The following report describes conservation efforts undertaken by Federal and State agencies in Northern California arid-land aquatic ecosystems. The geographic area encompassed by this report extends generally from the Tehachapi Mountains on the southern end of the Central Valley to the Oregon border, exclusive of the east side of the Sierra Nevada south of Lake Tahoe.

Because of recent recovery efforts undertaken by the Modoc National Forest and California Department of Fish and Game (Department), the Department is currently reviewing the status of the

Modoc sucker *Catostomus microps* for downlisting from endangered to threatened. The U.S. Fish and Wildlife Service (Service) formally consulted with the Modoc National Forest on the effects of cattle grazing to this federally listed endangered species.

The Service continued its efforts to assist the Goose Lake Fishes Working Group to implement a conservation strategy to protect the endemic fishes of the Goose Lake basin: Goose Lake redband trout *Oncorhynchus mykiss* ssp., Goose Lake sucker *Catostomus occidentalis lacusanserinus*, Goose Lake lamprey *Lampetra tridentata* ssp., and Goose Lake tui chub *Gila bicolor thalassina*. The Working Group funded and participated in various efforts to improve habitat conditions of basin streams. High winter precipitation greatly improved habitat conditions this year.

The Service met with private landowners and U.S. Bureau of Land Management staff to reinitiate conservation actions for protection of the Cowhead Lake tui chub *Gila bicolor vaccaceps*, a Federal category-1 candidate species and State Species of Special Concern.

Maria Ellis, a University of Michigan student and consultant for Pacific Gas and Electric Company, recently reported finding a previously undiscovered population of the federally listed endangered Shasta crayfish *Pacifastacus fortis* in the mainstem Pit River above Pit Falls. Shasta crayfish have been identified as one listed species that may be affected by relicensing of the Pit I hydroelectric project.

On August 7, 1995, the Service published a 90-Day Finding on a petition to list the Eagle Lake rainbow trout *Oncorhynchus mykiss aquilarum* as a threatened or endangered species. The Federal Register notice stated that the petition did not contain substantial information to warrant listing. The species remains a Federal category-2 candidate. The Lassen National Forest prepared a final Environmental Assessment on various habitat improvement activities along Pine Creek, the main spawning tributary to Eagle Lake. The Service continues to be involved with the local Pine Creek Coordinated Resource Management Program planning group to restore a spawning run of Eagle Lake rainbow trout into Pine Creek. The Service provided $25,000 in "pre-listing" funds to conduct habitat, invertebrate, and amphibian surveys in anticipation of a chemical treatment of Pine Creek to eradicate brook trout.

The Service is working with the McCloud River redband trout Core Group to prepare a Conservation Agreement to protect the McCloud River redband trout *Oncorhynchus mykiss* ssp. The Core Group was formed last year in response to the Service's proposal to change the subspecies' candidate status from category-2 to category-1. The Service has agreed to fund a $30,000 habitat and population survey proposed for this fall.

For the second year, the Service has formally consulted with the U.S. Forest Service's Pacific Southwest and Intermountain regional offices concerning grazing activities on National Forest lands affecting listed aquatic species throughout the State. The Service consulted on grazing authorizations for over twenty allotments in California; most through large programmatic biological opinions affecting many species, including: Lahontan cutthroat trout *Oncorhynchus clarki henshawi*, Paiute cutthroat trout *Oncorhynchus clarki seleniris*, Owens tui chub *Gila bicolor snyderi*, Little Kern golden trout *Oncorhynchus aguabonita whitei*, and Modoc sucker *Catostomus microps*. In addition, the Service has completed numerous informal grazing consultations for the Lahontan cutthroat trout on several National Forests.

In response to a request by several State and Federal agencies, the Service is actively seeking 1996 funding to revise the Paiute cutthroat trout recovery plan.

RESUMEN

El informe siguiente describe los esfuerzos de conservación emprendidos por agencias Federales y del Estado en ecosistemas acuáticos de tierras áridas del Norte de California. El área geográfica comprendida por este informe se extiende desde las Montañas Tehachapi al Sur del Valle Central en la frontera de Oregon, exclusivo de la pendiente oriental de la Sierra Nevada al sur de Lake Tahoe.

A causa de los esfuerzos recientes de recuperación emprendidos por el Modoc National Forest y California Department of Fish and Game (Departamento), el Departamento actualmente revisa la situación actual del Modoc sucker *Catostomus microps* para delistarlo de en peligro a amenazado. El U.S. Fish and Wildlife Service (el Servicio) formalmente consultó con el Modoc National Forest sobre los efectos del pastoreo de ganado a estas especies en peligro enlistadas federalmente.

El Servicio continuó sus esfuerzos a ayudar al Goose Lake Fishes Working Group para implementar una estrategia de conservación para proteger los peces endémicos de la cuenca Goose Lake: Goose Lake redband trout *Oncorhynchus mykiss* ssp., Goose Lake sucker *Catostomus occidentalis lacusanserinus*, Goose Lake lamprey *Lampetra tridentata* ssp., y Goose Lake tui chub *Gila bicolor thalassina*. El Working Group se fundó y participó en diversos esfuerzos para mejorar condiciones de hábitat de arroyos de la cuenca. La alta precipitación invernal mejoró mucho las condiciones de hábitat este año.

El Servicio se reunió con propietarios privados y miembros del U.S.Bureau of Land Management para reiniciar acciones de conservación para la protección del Cowhead Lake tui chub *Gila bicolor vaccaceps*, una especie candidata a la categoría Federal 1 y Especie Estatal de Interés Especial.

Maria Ellis, estudiante de la University of Michigan y consultor para el Pacific Gas and Electric Company, recientemente informó encontrar una población no descubierta previamente del Shasta crawfish, federalmente enlistada como en peligro *Pacifastacus fortis* en el cauce principal del Pit River arriba de Pit Falls. El Shasta crawfish se ha identificado como una de las especies enlistadas que pueden estar afectadas por la reautorización del proyecto hidroeléctrico Pit I.

El 7 de agosto de 1995, el Servicio publicó una lista de consulta de 90 días sobre una solicitud para enlistar a la trucha arco iris de Eagle Lake *Oncorhynchus mykiss aquilarum* como una especie amenazada o en peligro. La noticia del Registro Federal constata que la petición no contuvo la información suficiente para garantizar su inclusión en la lista. La especie permanece como un candidato Federal a la categoría-2. El Lassen National Forest preparó una Evaluación Ambiental final sobre varias actividades de mejoramiento de hábitat a lo largo de Pine Creek, el tributario principal para el desove de Eagle Lake. El Servicio se mantiene involucrado con grupo de planificación local del Programa Coordinado de Manejo de Recursos de Pine Creek para restaurar una corrida de desove de la trucha arco iris de Eagle Lake en Pine Creek. El Servicio proveyó $25,000 en como financiamiento inicial para conducir estudios de hábitat, invertebrados, y anfibios en el anticipación a un tratamiento químico de Pine Creek para erradicar trucha de arroyo.

El Servicio trabaja con el Grupo Núcleo de la trucha redband del McCloud River para preparar un Acuerdo de Conservación para proteger la trucha reband del McCloud River *Oncorhynchus mykiss* ssp. El Grupo Núcleo se formó el año pasado en respuesta a una propuesta de Servicio para cambiar el estatus de las subespecies candidatas de categoría-2 a categoría-1. El Servicio ha acordado respaldar con $30,000 estudios de hábitat y poblacionales propuestos para este otoño.

Por segundo año, el Servicio ha consultado formalmente con las oficinas regionales del U.S. Forest Service Pacific and Intermountain, en lo que concierne a las actividades de pastoreo en las tierras del National Forest que afectan especies acuáticas enlistadas a lo largo del Estado. El Servicio consultó sobre autorizaciones de pastoreo en veinte asignaciones en California; la mayoría mediante opiniones biológicas programadas que afectan muchas especies, incluyendo: Trucha Lahontan cutthroat *Oncorhynchus clarki henshawi*, trucha Paiute cutthroat *Oncorhynchus clarki seleniris*, Owens tui chub *Gila bicolor snyderi*, Trucha Little Kern golden trout *Oncorhynchus aguabonita whitei*, y Modoc sucker *Catostomus microps*. Además, el Servicio ha completado numerosas consultas informales sobre pastoreo para la trucha Lahontan cutthroat sobre varios Bosques Nacionales.

Con respecto a un pedido por varias agencias del Estado y Federales, el Servicio busca activamente el financiamiento para busca 1996 para revisar el plan de recuperación de la trucha Paiute cutthroat.

KANN, J. (Klamath Tribes Natural Resources, Chiloquin, OR)

Effect of lake level management on water quality and endangered suckers in upper Klamath Lake, Oregon

KEYWORDS: limnology; Klamath Lake; habitat quality; catostomids

ABSTRACT

Lake volume and mean depth (elevation) have a direct effect on physical, chemical, and biological processes in lacustrine ecosystems. In addition to the direct reduction of shoreline rearing habitat available for larval and juvenile endangered sucker species as lake elevation is lowered in Upper Klamath Lake, various productivity related water quality problems are also exacerbated. Dissolved oxygen, pH and unionized ammonia frequently exceed critical values due to massive blue-green algal blooms of the species *Aphanizomenon flos-aquae*. Results from current limnological studies indicate that: 1) Maximum algal biomass during June bloom periods was lower when higher June lake volumes were maintained. Reduced bloom magnitude is critical to reduce the incidence of lethal pH levels experienced by the more water quality sensitive larval suckers emigrating to the lake during the late spring period; 2) Low lake volume, through enhancement of internal (sediment) phosphorus loading, exerted a positive influence on in-lake phosphorus concentration at high (>100 mg/m^3 of chlorophyll *a)* algal biomass levels; 3) The frequency of lethal dissolved oxygen levels in July and August increased during low lake elevation years; 4) The frequency of lethal pH levels in June increased during low lake elevation years. Existing information at this time points to the need for maintenance of greater water volumes in Upper Klamath Lake to maintain physical and chemical habitat for fish, and to reduce algal production and its consequences.

RESUMEN

El volumen de lago y la profundidad promedio (elevación) tienen un efecto directo sobre los procesos físicos, químicos, y biológicos en ecosistemas lacustres. Además, de la reducción directa a la disponibilidad de hábitat de crianza para larvas y juveniles para especies de matalotes en peligro, como la disminución de la elevación en el Klamath Lake Superior, variada productividad relacionada con problemas de calidad de agua están agrabados. El oxígeno disuelto, pH y el amonia deionizado frecuentemente exceden valores críticos debido a los florecimientos masivos de algas azules de las especies *Aphanizomenon flos-aquae*. Los resultados de los actuales estudios limnológicos indican que: 1) La biomasa máxima algal durante el florecimiento de junio los períodos fue menor cuando se mantuvieron mayores volúmenes de lago en junio. La reducción de la magnitud del florecimiento es crítica para reducir la incidencia letal de niveles de pH experimentados por la mayor sensibilidad a la calidad del agua de las larvas de matalotes emigrantes al lago durante el último período de primavera; 2) Bajos volúmenes de lago, mediante el aumento de interno (sedimento) de la carga de fósforo, ejerce una influencia positiva sobre la concentración interna de fósforo del lago a altos (>100 mg/m^3 de clorofila a) niveles de biomasa algal; 3) La frecuencia de niveles de oxígeno disuelto letal en julio y agosto aumentaron durante los años de baja elevación en lago; 4) La frecuencia niveles letales de pH en junio aumentó durante años de baja elevación de lago. La existencia de información en este momento, indica a la necesidad de mantenimiento de volúmenes mayores de agua en el Klamath Lake Superior para mantener hábitat físico y químico para los peces, y reducir la producción algal y sus consecuencias.

KITCHEYAN, D. C.*; MAUGHAN, O. E.; LEON, S. C.; LANDYE, J. J.; MAJOR, R. D. (DCK and OEM - Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ; SCL - Arizona Fishery Resources Office, Pinetop, AZ; JJL and RDM - Pinetop Fish Health Center, Pinetop, AZ)

The growth and survival of Apache trout following stream rehabilitation to remove brown trout

KEYWORDS: antimycin; Apache trout; Flash Creek; Fort Apache; Indian Reservation; interspecific competition; reintroduced; renovation; Squaw Creek

ABSTRACT

The historic distribution of the Apache trout *Oncorhynchus apache* includes the White Mountains on the Fort Apache Indian Reservation and the Apache-Sitgreaves National Forest. Physical modifications of habitat, interspecific competition with brown trout *Salmo trutta* and brook trout *Salvelinus fontinalis* and hybridization with rainbow trout *Oncorhynchus mykiss* have reduced historic distribution to a fraction of that area. Land management agencies on the reservation attempted to increase available habitat and decrease the potential for interspecific competition.

In 1994 Apache trout had nearly disappeared from the Big Bonito drainage of the Fort Apache Indian Reservation. On June 28, 1995 the last known pure stock of Apache trout in the Big Bonito drainage was located in the extreme upper reaches of Flash Creek. To restore Apache trout to the Big Bonito Drainage, Flash and Squaw creeks were renovated with antimycin to remove all brown trout. To ensure a complete kill, a bioassay was performed at 4-25 meter intervals with 3 to 5 fish placed in live wells. The purpose of bioassay was to determine if the concentration of antimycin used would kill all brown trout. Brown trout were also collected for viral and bacterial samples and to identify stomach contents and parasite loads.

Prior to renovation, benthos were collected with a surber sampler. They will continue to be collected following renovation to determine the rate of benthos recovery in these streams. Re-introduced Apache trout will be dispersed throughout the rehabilitated streams and population levels periodically estimated based on mark-recapture, catch per unit effort, or per unit area. Habitat use will be determined by capture and visual observation and measurements of physical characteristics including water depth, water velocity, substrate type, and cover. Habitat availability at the time of sampling will be estimated along transects in the capture area. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

La distribución histórica de la trucha de Apache *Oncorhynchus apache* incluye las White Mountains en el Fort Apache Indian Reservation y el Apache-Sitgreaves National Forest. Las modificaciones físicas de hábitat, la competencia interspecífica la trucha brown *Salmo trutta* y la trucha brook *Salvelinus fontinalis* y la hibridización con la trucha arco iris *Oncorhynchus mykiss* ha reducido su distribución histórica a una fracción de su área. Las agencias de manejo de la tierra intentaron aumentar la disponibilidad de hábitat y disminuir la potencialidad por competencia interspecífica.

En 1994, la trucha Apache casi había desaparecido desde la cuenca Big Bonito del Fort Apache Indian Reservation. En junio 28 de 1995, la última población pura conocida de trucha Apache en la cuenca Big Bonito se ubicó en los tributarios superiores de Flash Creek. Para restaurar trucha Apache a la cuenca Big Bonito, se renovaron los arroyos Flash y Squaw con antimicina para eliminar toda la trucha brown. Para asegurar una matanza completa, se diseñaron bioensayos a intervalos de 4-25 metros con 3 a 5 peces colocados en pozos vivos. El propósito del bioensayo fue para determinar si la concentración de antimicina usada mataba toda la trucha brown. La trucha brown fue también colectada para muestreos de virales y bacteriológicos y para identificar contenidos estómacales y cargas de parásitos.

Con anterioridad a la renovación, se colectó bentos con un muestreador. Se continuarán las colectas siguientes a la renovación para determinar la tasa de recuperación del bentos en estos arroyos. La trucha Apache reintroducida se dispersará a lo largo de los arroyos rehabilitados y se estimarán periódicamente los

niveles poblacionales con base en marcado y recaptura, por captura por unidad de esfuerzo, o por unidad de área. El uso de hábitat será determinado por captura y observación visual y medición de las características físicas incluyendo la profundidad del agua, velocidad de agua, tipo de substrato, y cobertura. La disponibilidad de hábitat al tiempo del muestreo se estimará a lo largo de transectos en el área de captura. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

KOBETICH, G. C. (U.S. Fish and Wildlife Service, Ecological Services, Carlsbad Field Office, CA)

The Natural Communities Conservation Planning and Habitat Conservation Planning process in southern California

KEYWORDS: conservation planning; California; natural communities; habitat conservation planning

ABSTRACT

Large scale planning for conservation of natural resources was started in San Diego County in 1991 as a result of cumulative impacts associated with an expanded sewage system. The initial planning effort was incorporated into the State of California's Natural Communities Conservation Planning (NCCP) process and the Fish and Wildlife Service Habitat Conservation Planning (HCP) process in 1992. Because of the size and complexity of issues in San Diego County, the County has been divided into three planning areas with a plan for each area. These three planning efforts are being coordinated across their boundaries.

Similar conservation planning processes have been initiated in Orange, Riverside, and San Bernardino counties. One of the two major Orange County plans is nearing completion. A major HCP for the Stephens kangaroo rat is in final draft in Riverside County. San Bernardino County is in the initial stages of preparing an NCCP/HCP.

RESUMEN

La planeación a gran escala para la conservación de los recursos naturales, inició en el Condado de San Diego en 1991 como resultado de un cúmulo de impactos asociados con la expansión del sistema de drenaje. El esfuerzo inicial de planeación fue incorporado en State of California's Natural Communities Conservation Planning (NCCP) y en el Fish and Wildlife Service Habitat Conservation Planning (HCP) in 1992. Debido al tamaño y complejidad del problema en el Condado de San Diego, el Condado ha sido dividido en tres áreas, con un plan en cada una de ellas. Estos tres esfuerzos de planeación están empezando a coordinarse más allá de sus fronteras.

Procesos de planificación para conservación similares, iniciaron en los condados de Orange, Riverside, y San Bernardino. Uno de los dos mejores planes del Condado de Orange, está cercano a terminarse. Un mejor HCP para la rata Stephens kangaroo está en borrador final en el Condado de Riverside, el del Condado de San Bernardino está en la etapa inicial de preparación de un NCCP/HCP.

LEBERG, P. L. (Department of Biology, University of Southwestern Louisiana, Lafayette, LA)

Genetic effects of translocations: Lessons from experiments and past translocations

KEYWORDS: translocation; genetics; *Gambusia*; inbreeding; viability

ABSTRACT

Translocations can have diverse effects on the genetics and viability of populations. I will discuss how experiments with *Gambusia affinis* and *holbrooki*, as well as studies of past translocations, demonstrate that the release of a small effective number of individuals to establish a population can lead to low genetic diversity within a population and high genetic differentiation of the new population from other translocated

and native populations. These genetic effects can have consequences on the viability of populations. Experimental populations established with low genetic diversity tend to have lower population growth rates. Increasing genetic diversity, by founding a population with multiple genetic stocks has been proposed as a means to increase genetic diversity, however, in experiments with *Gambusia* this approach sometimes leads to reduced population growth. Other experiments suggest that random choices of individuals used to establish populations can affect the growth rates of translocated populations. These differences in growth rates persist in time and the genetic composition of a population's founders can affect its viability for many generations. Few management practices are as likely to have an influence on genetic diversity as are translocations; resource biologists should be aware of the potential consequences of various reintroduction strategies.

RESUMEN

Los trasplantes pueden tener diversos efectos en la genética y viabilidad de las poblaciones. Discutiré como los experimentos con *Gambusia affinis* y *holbrooki*, asi como con estudios de trasplantes pasados, demuestran que la liberación de un pequeño número efectivo de individuos para establecer una población puede mantener una baja diversidad genética dentro de una población y alta diferenciación genética de la nueva población de otras poblaciones trasplantadas y nativas. Estos efectos genéticos pueden tener consecuencias en la viabilidad de poblaciones. Poblaciones experimentales establecidas con baja diversidad genética tienden a tener bajos tamaños de crecimiento de población. Incrementando la diversidad genética, por fusión con una población con múltiples Stocks genéticos ha sido propuesta como un medio para incrementar la diversidad genética, sin embargo, en experimentos con *Gambusia*, esta se acerca algunas veces dirigidas para reducir el crecimiento de la población. Otros experimentos sugieren que opciones al azar de individuos usados para establecer poblaciones, pueden afectar los rangos de crecimiento de poblaciones trasplantadas. Estas diferencias en tasas de crecimiento persisten en tiempo y composición genética de una población fusionada, puede afectar su viabilidad por algunas generaciones. Pocas prácticas de manejo probablemente tienen influencia en la diversidad genética como los trasplantes; los biólogos de recursos naturales deben estar consientes de las consecuencias potenciales de varias estrategias de reintroducción.

MATHEWS, N. (Rivers Program Manager, The Trust for Public Land, San Francisco, CA)

Buying dirt and water for fish

KEYWORDS: acquisition of water rights and real estate; private; nonprofits; partnerships; tools for conservation

ABSTRACT

Acquisition of either conservation easements or outright ownership of key watershed and riparian properties is a powerful tool for preservation of these resources. Numerous mechanisms are available to resource managers interested in acquiring control over water and land. By working in partnership with private nonprofit land trusts and conservancies, agencies can stretch their funding and gain greater flexibility in purchasing these property rights. Private nonprofits can take financial risks as well as structure transactions to match agency funding and property owner needs. Nonprofits can also develop the political and technical support necessary to garner scarce public funding for such projects. As the political pendulum continues to swing against regulatory approaches to species preservation, acquisition can be politically viable and ecologically effective. The Trust for Public Land, a national nonprofit conservation organization, has worked and is working with agencies to acquire key riparian properties and water rights in California and Nevada.

RESUMEN

La adquisición de parcelas para conservación o derechos de propietarios de cuencas clave y propiedades riparias, es una poderosa herramienta para el manejo de estos recursos. Numerosos mecanismos estan disponibles a los manejadores de recursos interesados en adquirir el control sobre el agua y la tierra. Trabajando en asociación con créditos para tierra no lucrativas y conservacionistas, las agencias pueden extender sus fondos y ganar más flexibilidad en la compra de los derechos de tierras. Agencias privadas no lucrativas pueden tomar riesgos financieros así como estructuras de transacción para proporcionar fondos y cubrir necesidades de los propietarios. Las no lucrativas pueden también desarrollar el apoyo político y técnico necesario para cosechar los escasos fondos públicos para semejantes proyectos. Como el péndulo político continúe oscilando en contra del aprovechamiento regulado para la preservación de especies, la adquisición puede ser políticamente viable y ecológicamente efectiva. La Trust for Public Land, una organización nacional de conservación no lucrativa, trabajó y está trabajando con agencias para adquirir propiedades riparias clave y derechos de agua en California y Nevada.

MERETSKY, V. J.*; GORMAN, O. T.; STONE, D. M.; ZDINAK, Z. (U.S. Fish and Wildlife Service, Arizona Fishery Resources Office, AZ)

Condition of humpback chub captured in the Little Colorado River

KEYWORDS: condition; inter-basin comparison; Little Colorado River

ABSTRACT

Fish and Wildlife Service biologists collected 15,921 post-larval humpback chub *Gila cypha* in the Little Colorado River during July 1991 - May 1995. We used a grid of passive sampling devices (minnow traps and small hoop nets) to sample evenly throughout two study areas. We will present analyses of condition factors as a function of size and season, and compare our results to condition factors reported by Valdez and others for the mainstem Colorado River within Grand Canyon and in the Upper Basin.

RESUMEN

Biólogos del Fish and Wildlife Service, colectaron 15,921 post-larvas de chub jorobado *Gila cypha*, en el Little Colorado River durante julio de 1991- mayo de 1995. Nosotros usamos una malla de muestreo pasivo mecánico (trampas minnow y pequeñas redes hoop) para muestrear eventualmente a través de dos áreas de estudio. Nosotros presentamos el análisis de la condición de los factores como una función del tamaño y estación, y comparamos nuestros resultados con la condición de los factores reportados por Valdéz y otros para el canal principal del Colorado River en el Grand Canyon en la cuenca alta.

MERETSKY, V. J.*; GORMAN, O. T.; STONE, D. M.; ZDINAK, Z. (U.S. Fish and Wildlife Service, Arizona Fishery Resources Office, AZ)

Recaptures of PIT-tagged humpback chub in the Little Colorado River: preliminary analysis

KEYWORDS: recapture; PIT tag; movement; range; Little Colorado River

ABSTRACT

Fish and Wildlife Service biologists collected post-larval humpback chub *Gila cypha* in the Little Colorado River during July 1991 - May 1995. We used a grid of passive sampling devices (minnow traps and small hoop nets) to sample evenly throughout two study areas. Fish > 150 mm total length were implanted with PIT tags. During the study period, we recorded 317 recaptures of 218 fish. Median time between recaptures was 63 days. Median distance between successive recaptures was 0.086 km; maximum distance was 9.2 km. We will present preliminary analysis of recapture data, investigating relationships among time between recaptures, distance between recaptures, size class and season. We expect that further

exploration of recapture data will involve other researchers and databases.

RESUMEN

Biólogos del Fish and Wildlife Sevice colectaron postlarvas decharalito jorobado, *Gila cypha* en el Little Colorado River durante julio de 1991 - mayo 1995. Nosotros usamos una red de implementos de muestreo pasivo mecánico (trampas minnow y trampas de argolla) para muestrear eventualmente a través de las dos áreas de estudio. Peces mayores de 150 mm de largo total fueron marcados con tarjetas PIT. Durante el período de estudio, registramos 317 recapturas de 218 peces. El tiempo medio entre recapturas fue de 63 días. La distancia media entre recapturas sucesivas fue de 0.086 km y la distancia máxima fue de 9.2 km. Presentaremos el análisis preliminar de los datos de recaptura, investigando las relaciones entre el tiempo de las recapturas, distancia entre recapturas, clase de talla y estación. Esperamos que en futuras exploraciones de recaptura, los datos incluirán a otros investigadores y base de datos.

MILLER, R. G.* (Dept. Ecol. & Evol. Biol. University of Arizona, Tucson, AZ)

Great Basin *Cyprinodon*: trends in research and conservation biology

KEYWORDS: *Cyprinodon*; Great Basin; conservation biology; photographic history

ABSTRACT

Charts, maps and photographs are presented showing trends in *Cyprinodon* research at the local level. These have evolved from purely research (species-identification; quantification of thermo-chemical and geologic chacteristics of local populations), through conservation (recognition of rarity; environmental threats; social and legal milestones; translocation trials), to education (public relations and programs of instruction).

Financial support and personnel (both academic and agency) were instrumental in these activities. Active agencies include: U.S. National Park Service; U.S. Forest Service; U.S. Fish and Wildlife Service; Bureau of Land Management; U.S. Geological Survey; Environmental Protection Agency; state game and fish departments. State parks and water engineers acted in support of research findings. One case for protection of habitat was settled in the Supreme Court. Non-government organizations (NGOs) continued advocacy via positions and actions not tenable for government agencies (these include Desert Fishes Council; the endangered species committee of the Sierra Club; The Nature Conservancy; Foresta Institute, and others). Many individuals have served this cause through the years and have acted at the right moment in behalf of research and conservation. These include Phil Pister, Carl Hubbs, Clark Hubbs, R.R. Miller, J.E. Deacon and students, and Tina Nappe, among others.

Future research trends are: plotting of evolutionary trajectories for local populations, cladistic relationships via mitochondrial DNA, and control of alien species.

RESUMEN

Tablas, mapas y fotografías se presentan mostrando las tendencias en el estudio de *Cyprinodon* a nivel local. Estas incluyen investigación básica (identificación de especies; identificación de las características termo-químicas y geológicas de poblaciones locales), mediante investigación (reconocimiento de la rareza); amenazas ambientales; situación legal y social; signos de trasplante), para educación (relaciones públicas y programas de instrucción).

Apoyo financiero y personal (ambos, académica y agencia) instrumentaron éstas actividades. Las agencias activas incluyen: el U.S. National Park Service; U.S. Forest Service; U.S. Fish and Wildlife Service; Bureau of Land Management; U.S. Geological Survey; Environmental Protection Agency, y los departamentos estatales de caza y pesca. Parques estatales e ingeniería del agua actuaron en apoyo en la

investigación aplicada. Un caso para la protección del hábitat fue establecido en la Suprema Corte. Organizaciones no gubernamentales (ONG'S) continúan avocadas en posiciones y acciones viables no atendidas por las agencias del gobierno (estas incluyen al Desert Fishes Council; el comité de las especies en peligro de la Sierra Club; The Nature Conservancy; Foresta Institute, y otros). Muchos individuos han servido a esta causa a través de los años y han actuado en el momento adecuado en nombre de la investigación y la conservación. Estos incluyen a Phil Pister, Carl Hubbs, R.R. Miller, J.E. Deacon y estudiantes, y Tina Nappe, entre otros.

La tendencia de futuros estudios son: los diagramas de las trayectorias evolutivas para poblaciones locales, relaciones genéricas vía ADN mitocondrial, y el control de las especies extrañas.

MINCKLEY, C. O. (U.S. Fish and Wildlife Service)

Native fish status report for the Lower Colorado River Basin

KEYWORDS: Arizona; status; Colorado squawfish; Yaqui chub; Gila trout; Monkey Springs pupfish; lower basin; topminnows; extinct; native fish

ABSTRACT

This report presents the status of the native fish of the Lower Colorado River Basin. It is based on five categories developed by the State of Arizona. Categories range from 1, which represents species which are very rare; to 5, which are species that are demonstrably secure. These data pertain to the 27 species of native freshwater fish still present in the lower basin. The remaining four species were either historically present (i.e., Gila trout, Colorado squawfish, and Yaqui chub) or are extinct (Monkey Springs pupfish).

Based on these rankings, 30% (n=8) are ranked in category 1; 20% (n=5) are in category 2, while 26% (n=7), 22% (n=6) and 2% (n=1) are in categories 3 to 5. Within category 1, 75% (n=6) are minnows, with suckers and pupfish representing 13 and 14% respectively (n=1). Suckers and topminnows represent 40% (n=2) in category 2 followed by minnows at 20% (n=1). In category 3, minnows and topminnows represent 43% (n=3 ea) while trout represent 14% (n=1). Suckers make up 88% of category 4 (n=5) followed by minnows at 12% (n=1). In category 5, minnows (n=1) represent 100% of that category.

The following agencies were contacted to develop this report: Arizona Game and Fish Department, Arizona State University, Bureau of Land Management, The Nature Conservancy, U.S. Fish and Wildlife Service and the U.S. Forest Service. The State of Arizona is particularly thanked for providing their Element Status Designations for this presentation.

RESUMEN

Este reporte presenta el estatus de los peces nativos del Lower Colorado River Basin. Este está basado en cinco categorías desarrolladas por el Estado de Arizona. Categorías de tamaño desde 1, representan especies que son muy raras; hasta 5, son aquellas especies que son demostrablemente seguras. Estos datos pertenecen a las 27 especies de peces nativos de agua dulce presentes en la cuenca baja. Las cuatro especies remanentes estuvieron todas históricamente presentes (i.e., trucha Gila, Colorado squawfish, y la carpa Yaqui) o están extintas (Monkey Springs pupfish).

Basado en estas categorías, 30% (n=8) están categorizados 1; 20% (n=5) están en la categoría 2, mientras que 26% (n=7), 22% (n=6) y 2% (n=1) son categoría 3 a 5. Dentro de la categoría 1, 75% (n=6) son ciprinidos, con matalotes y los pupos representando 13 y 14% respectivamente (n=1). Catostomidos y poecilidos representan el 40% (n=2) en la categoría 2 seguido por ciprinidos con 20% (n=1). En la categoría 3, ciprinidos y poecilidos representan el 43% (n=3 e.g.), mientras que la trucha representa 14% (n=1). Catostomidos representan el 88% de categoría 4 (n=5) seguido por ciprinidos con 12% (n=1). En la categoría 5, ciprinidos (n=1) representan el 100% de esta categoría.

Las siguientes agencias fueron contactadas para desarrollar este reporte: Arizona Game and Fish Department, Arizona State University, Bureau of Land Management, The Nature Conservancy, U.S. Fish and Wildlife Service y the U.S. Forest Service. Al Estado de Arizona se le agradece particularmente por proveer sus Designaciones del Estatus de Elementos para su presentación.

MINCKLEY, C. O.*; LA BARBARA, M.; THORSON, M. (U.S. Fish and Wildlife Service)

The role of the lower Colorado River National Wildlife Refuges and La Paz County, Arizona, in the reintroduction of bonytail chub and razorback suckers into lower basin waters

KEYWORDS: bonytail chub; razorback suckers; Lake Mohave; Bill Williams River; Cibola National Wildlife Refuge; Havasu National Wildlife Refuge; Imperial National Wildlife Refuge; Arizona; California

ABSTRACT

The use of isolated ponds to raise bonytail chub and razorback suckers is well known through the efforts of the Lake Mohave Native Fish Group at Lake Mohave, AZ-NV. This talk presents information on similar efforts on the Bill Williams River, Cibola, Havasu, and Imperial National Wildlife Refuges, and in the La Paz County golf course ponds. It briefly discusses the successes and failures of these areas and reports on the releases made into lower basin waters during 1995. Plans for 1996 are also briefly discussed.

RESUMEN

El uso de estanques aislados para la liberación del charalito elegante y el matalote jorobado, son bien conocidos a través de los esfuerzos del Lake Mohave Native Fish Group en el Lake Mohave AZ-NV. Esta comunicación presenta información sobre esfuerzos similares en el Bill Williams River, Cibola, Havasu, and Imperial National Wildlife Refuges y los estanques del curso de golf de La Paz County. Se discuten brevemente los éxitos y fracasos de estás áreas y los reportes sobre las liberaciones realizadas en las aguas de las cuencas bajas durante 1995. Los planes para 1996 son también brevemente discutidos.

MONDA, D.*; WAGNER, P. (Pyramid Lake Fisheries)

Developing an understanding of the Pyramid Lake ecosystem

KEYWORDS: Pyramid Lake; Lahontan cutthroat trout; cui-ui; nitrogen

ABSTRACT

The Pyramid Lake Fisheries Restoration Project (PLF) was established in 1975 to insure the survival of fish populations in Pyramid Lake. The populations of greatest concern are the cui-ui *Chasmistes cujus* and the Lahontan cutthroat trout *Oncorhynchus clarki henshawi* (LCT). The cui-ui is currently listed as endangered, while the LCT is listed as threatened, so that a sport fishery can be sustained.

Limnological and ecological research conducted by W.F. Siegler and Associates in 1978, D.L. Galat from 1976 to the early 1980's, and the Limnological Research Group at the University of California - Davis from 1989 to 1995 laid the foundation upon which PLF continues to build. It is now well established that Pyramid is a nitrogen-limited lake, and that the Truckee River and internal blooms of the nitrogen-fixing algae *Nodularia spumigena* are the major sources of nitrogen input. Phosphorus is limiting only during intense *Nodularia* blooms. Large amounts of nitrogen can also be lost from the system: during years when lake stratification does not break down and hypolimnetic water does not get mixed, anoxic conditions are created, and denitrifying bacteria convert nitrate and nitrite to nitrogen gas which then diffuses to the atmosphere.

The next step in our research efforts will be to understand how changes in nutrient concentrations are reflected in zooplankton populations, and ultimately in fish growth. During the recent drought (1987-1994) we documented decreases in LCT growth that coincided with decreases in nutrient levels. Understanding the pathway from nutrients to algae to zooplankton to fish will enable us to better manage this magnificent resource.

RESUMEN

El proyecto de restauración de las pesquerías del Pyramid Lake (PPL) fue establecido en 1975 para asegurar la supervivencia de las poblaciones en el Pyramid Lake. Las poblaciones de gran importancia son el cui-ui *Chasmistes cujus* y la trucha Lahontan cutthroat *Oncorhynchus clarki henshawi* (LCT), el cui-ui se encuentra enlistado como en peligro, mientras el LCT es enlistado como amenazado, por tanto una pesquería deportiva puede ser sostenida.

Investigaciones en limnología y ecología conducidas por W.F. Siegler y Asociados en 1978, D.L. Galat desde 1976 hasta principios de los ochentas y el grupo de investigaciones en limnología de la Universidad de California-Davis desde 1989 hasta 1995 liderea la fundación que aun continua reconstruyendo las PPL. Esta ahora bien establecido que el Pyramid Lake es un lago con limitaciones de nitrógeno, y que el Truckee River posee blooms internos del alga fijadora de nitrógeno *Nodularia spumigena* como su mayor fuente de entrada de nitrógeno. El fósforo solo es limitado durante los intensos blooms de *Nodularia*. Grandes cantidades de nitrógeno pueden también perderse del sistema, durante los años cuando la estratificación no es rota y las aguas hipolimneticas no son bien mezcladas, las condiciones anóxicas son creadas y las bacterias desnitrificadoras convierten nitratos y nitritos en nitrógeno gaseoso el cual se difunde a la atmósfera.

El siguiente paso en nuestros esfuerzos de investigación es tratar de entender como los cambios en la concentración de nutrientes se reflejan en las poblaciones de zooplancton y últimamente en el crecimiento de los peces. Durante las recientes sequías (1978-1994) nosotros documentamos decrecimientos en el crecimiento del LCT, lo que coincidió con el decrecimiento en los niveles de nutrientes. Para entender el camino que siguen los nutrientes hacia las algas-al zooplankton-a los peces nosotros debemos desarrollar un mejor manejo de este magnifico recurso.

NORRIS, S. M. (Department of Zoology and Museum, Arizona State University, Tempe, AZ)

Two new darters (Percidae, *Etheostoma*) from Coahuila, México, with a preliminary survey of the Méxican darter fauna

KEYWORDS: darters; systematics; osteology; México; Coahuila; Cuatro Cienegas

ABSTRACT

Three species of *Etheostoma* (all subgenus *Oligocephalus*) are currently recognized from México: *Etheostoma grahami*, *Etheostoma australe* and *Etheostoma pottsii*. A preliminary survey of available specimens demonstrated several additional undescribed or unrecognized species. Here, two undescribed species are diagnosed from Coahuila. One is endemic to the Cuatro Cienegas basin. The other is found in the outflow to the basin (Río Salado des los Nadadores), with its broader distribution not fully determined. Both appear most closely related to *E. grahami*. Cranial osteology of *Oligocephalus* and the *E. grahami/E. lepidum* complex is discussed. The wide-spread occurrence of darters across much of northern and central México make darters a promising group for investigation of regional biogeographic relationships. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

Tres especies de *Etheostoma* (todos del subgenero *Oligocephalus*) son comúnmente reconocidas para México: *Etheostoma grahami, Etheostoma australe* y *Etheostoma pottsii*. Una supervivencia preliminar de especímenes disponibles demuestran algunas especies adicionales no descritas o no reconocidas. Aquí se describen dos especies provenientes de Coahuila. Una es endémica de la cuenca de Cuatro Ciénegas, la otra se encuentra en la corriente de salida de la cuenca (Río Salado de los Nadadores), con una amplia distribución no determinada. Ambos aparentan estar muy cercanamente relacionados con *E. grahami*. La osteología craneal de *Oligocephalus* y el complejo *E. grahami/E. lepidum* es discutida. La amplia dispersión y ocurrencia de darters, a través del Norte y Centro de México hace a los darters un grupo promisorio para la investigación de las relaciones regionales biogeográficas. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

OAKEY, D. D. (Department of Zoology, Arizona State University, Tempe, AZ)

Mitochondrial DNA variation in *Rhinichthys osculus* (Cyprinidae) from western North America: a progress report

KEYWORDS: *Rhinichthys osculus*; mitochondrial DNA; geographic variation; geologic history; tectonism

ABSTRACT

The speckled dace, *Rhinichthys osculus*, is one of the most widespread fishes in western North America. Extensive morphological variation in this form has lead to confusion regarding phylogenetic relationships. A phylogenetic analysis has been initiated to test the hypothesis that large-scale physiographic events have effected existing patterns of geographic variation within and between lineages. Preliminary results are presented for 11 *R. osculus* populations from 7 major western drainages. Three individuals from each population were surveyed for mtDNA restriction site variation, and cleavage maps were constructed for all sites. Samples within basins appear more closely related than those among basin for large, stable drainages (i.e., Columbia, Snake, Humboldt and Colorado rivers). Phylogenetic relationships between populations will be discussed in respect to western drainage patterns that are influenced by tectonism and climate. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

El charalito pinto, *Rhinichthys osculus*, es uno de los peces más ampliamente distribuidos en el Oeste de Norteamérica. Extensas variaciones morfológicas en esta forma ha provocado confusión respecto a las relaciones filogenéticas. Un análisis filogenético ha sido iniciado para probar la hipótesis de que los eventos fisiográficos a gran escala han tenido efecto en los patrones existentes de variaciones geográficas con y entre las líneas de linaje. Los resultados preliminares son presentados para once poblaciones de *R. osculus* de siete de las mayores corrientes en el Oeste (i.e., ríos Columbia, Snake, Humboldt y Colorado). Las relaciones filogenéticas entre poblaciones pueden ser influenciados por tectonismo y clima. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

PERKINS, D. L.*; SCOPPETTONE, G. G.; BUETTNER, M. E. (DLP and GGS - National Biological Service, Northwest Biological Science Center, Reno, NV; MEB - formerly with NBS, currently with Bureau of Reclamation, Klamath Falls, OR)

Ecological segregation of sympatric Lost River and shortnose suckers: feeding habits and associated anatomical differences

KEYWORDS: Klamath; food habits; gill rakers; Cladocera; phenotypic plasticity

ABSTRACT

The endangered Lost River sucker *Deltistes luxatus* and shortnose sucker *Chasmistes brevirostris* are endemic to the Upper Klamath River Basin. Only two lakes support substantial populations of both species,

Clear Lake in northern California and Upper Klamath Lake in southern Oregon. Our studies indicate that the two sucker species have evolved different life history strategies and occupy different niches. Food habit analysis of 23 adult fish from Clear Lake suggest that Lost River suckers are bottom-oriented feeders, with chironomids > 5mm comprising a large proportion of their diet. In contrast, shortnose suckers fed on smaller food items occurring in the water column (e.g., Cladocera). Gut contents of additional suckers are currently being examined. Differences in mouth and gill raker morphology also indicate that the two species have evolved different feeding strategies. Lost River suckers had sub-terminal mouths whereas shortnose suckers mouths were generally more terminal. Individual gill rakers of all Lost River suckers lacked structural complexity, whereas gill rakers of shortnose suckers had many dendritic processes, suggesting that they filter smaller particle sizes. However, the degree of gill raker complexity in shortnose suckers varied depending on the habitat occupied. Sixty-five percent of shortnose suckers captured in Clear Lake had highly dendritic gill rakers compared to only 10% of the shortnose suckers captured in upper Willow Creek (the main tributary to Clear Lake). Presumably the more complex gill rakers allow fish to feed more effectively on zooplankton, which would be advantageous in a lake environment, whereas coarser gill rakers may be more suited to feeding on larger stream invertebrates. This phenotypic plasticity may be one of the factors that has allowed the shortnose suckers to become several times more abundant than Lost River suckers in the Clear Lake environment.

RESUMEN

La especie en peligro *Deltistes luxatus* (Lost River sucker) y *Chamistes brevirostris* (shortnose sucker) son endémicas de la cuenca alta del Klamath River. Solamente dos lagos soportan poblaciones substanciales de ambas especies, el Clear Lake en el Norte de California y el Upper Klamath Lake en el Sur de Oregon. Nuestros estudios indican que las dos especies de matalote tienen diferentes estrategias durante su desarrollo y ocupan diferentes nichos. Los análisis de los hábitos alimenticios de 23 peces adultos del Clear Lake sugieren que los Lost River suckers se alimentan del fondo, con los chironomidos >5 mm comprendiendo estos una gran proporción de su dieta. En contraste el Shortnose sucker se alimenta sobre organismos de pequeño tamaño y que ocurren en la columna de agua (e.g., Cladocera). El contenido de los intestinos de matalotes adicionales fue comúnmente examinado. Las diferencias morfológicas en la boca y espinas branquiales pueden indicar también que las dos especies han desarrollado diferentes estrategias alimenticias. El Lost River sucker posee boca subterminal a diferencia del shortnose sucker que la posee más terminal. Las espinas branquiales del shortnose sucker posee varios procesos dendríticos, ésto sugiere que ellos filtran partículas de pequeño tamaño. Sin embargo el grado de complejidad de las espinas branquiales en los shortnose sucker varia dependiendo del hábitat que ocupan. 65% de los shortnose sucker capturados en el Clear Lake tienen unas espinas branquiales altamente dendríticas comparados con el 10% de los shortnose sucker capturados en el Upper Willow Creek (tributario principal del Clear Lake). Se supone que las agallas con espinas branquiales mas complejas permiten comer con más eficacia el zooplancton, lo cual seria más ventajoso en un ambiente de lago y las agallas con espinas branquiales más burdas quizás serían más adecuados para comer invertebrados grandes de arroyos. Esta plasticidad fenotípica quizás es uno de los factores que ha permitido que los shortnose suckers sean mucho más abundantes que los Lost River suckers en el ambiente del Clear Lake.

PFEIFER, F. K. (U.S. Fish & Wildlife Service, Colorado River Fishery Project Office, Grand Junction, CO)

Endangered Colorado River fishes (upper basin) Annual Report

KEYWORDS: Colorado River; Upper Colorado River Basin; endangered fish; Recovery Implementation Program; Colorado squawfish; razorback sucker; bonytail; humpback chub

ABSTRACT

This report summarizes significant federal and state activities of the past year aimed at recovering the endangered razorback sucker, Colorado squawfish, humpback chub and bonytail in the upper Colorado River basin. Research continued on the life history and seasonal flow needs of these fish in order to facilitate preparation of the Biological Opinions for the re-operation of Flaming Gorge Dam on the Green River, Aspinall on the Gunnison River and Navajo Dam on the San Juan River. These Biological Opinions should be issued by 1998.

In October 1995, construction began on a one million dollar fish ladder over Redlands Diversion Dam on the Gunnison River. When completed in April of 1996 it will provide upstream access to fifty miles of historical habitat that has been blocked since 1918.

Another important recovery effort involves enhancing or restoring natural floodplain habitats; such habitats are a critical component of the riverine ecosystem. An inventory of floodplain features was completed for 869 miles of the Colorado, Green, Gunnison, Yampa and White rivers. Studies and activities to remediate contaminant problems in flooded bottomland habitats and research to determine the feasibility of restoring these areas to benefit endangered fish (rather than nonnatives) were initiated during the year. Pilot projects to demonstrate potential floodplain habitat restoration were started on the Colorado River near Grand Junction and in the Ouray/Jensen area along the Green River. A long-term strategic plan to guide future floodplain habitat restoration activities is scheduled for completion later this year.

Propagation and maintenance of refugia populations of the endangered fish is another element of the upper Colorado River Recovery Program. Currently, "refuge" ponds are maintained at Ouray Endangered Fish Facility in Utah and at Horsethief State Wildlife Area in Colorado. In 1995, ten additional 0.2-acre ponds were constructed at Ouray. Design for additional ponds and hatchery facilities is underway at various sites including Ouray, Utah; Wahweap, Utah; Horsethief SWA and Craig, Colorado. Sixteen adult humpback chubs were collected from the Black Rocks area of the Colorado River and transferred to Horsethief ponds. Small numbers of all four species of Colorado River endangered fish are currently being held in captivity to produce fish for adult broodstock, research, stocking and "genetic refuge" populations that will help prevent extinction in the wild.

In October and November, 1994, 686 razorback suckers (1992 year-class) averaging 400 mm TL were stocked into the San Juan River as part of an experimental re-introduction effort. Subsequent sampling over the next nine months recovered 23 of these fish via electrofishing, seining and trammel netting. These fish were found distributed throughout 100 miles of the San Juan River and appeared to be in excellent condition. Preliminary data suggests stocking fish of this size significantly reduces predation by nonnatives.

Control of nonnative fish species is another important element of the Recovery Program. Research conducted on the San Juan River by New Mexico Game & Fish showed the fish community of secondary channels was similar to that of the main channel during spring runoff, and both were numerically dominated by native flannelmouth and bluehead sucker and nonnative channel catfish and carp. Following spring runoff, secondary-channel fish communities were numerically dominated by nonnative fish species, mainly red shiner and fathead minnow. During low flow periods, considerable reproductive activity by some nonnative fish species was documented, suggesting that these habitats may be a major source of some

of these undesirable fish. Preliminary analysis of data indicate that elevated spring flows annually "reset" San Juan River secondary channel fish communities and may provide a means of limiting abundance of some nonnative fish species.

Three projects to evaluate the effectiveness of mechanically removing nonnative fish were started in 1995. One evaluates channel catfish removal from the San Juan River, a second evaluates smallmouth bass removal from the Green River and the third study is designed to evaluate northern pike removal from the Gunnison River.

The Colorado Division of Wildlife stocked tiger muskie into Harvey Gap Reservoir, located in the Colorado River basin. This was the first time this nonnative predator has been stocked on the western slope of Colorado. The states of Utah, Colorado, Wyoming and the U.S. Fish & Wildlife Service continued efforts to develop "Interim Procedures for Stocking Nonnative Fish Species in the Upper Colorado River Basin" designed to reduce escapement of nonnative fish into habitat occupied by endangered fish.

The National Park Service (NPS) initiated the Lake Powell Native Fish Work Group in 1993. Currently this group is working with NPS and the states of Arizona and Utah to develop a fish management plan for Lake Powell. The level of Lake Powell rose high enough this year to inundate a natural barrier that existed several miles up the San Juan River from its confluence with Lake Powell. As a result, there was a considerable influx of nonnative fish into the San Juan from Lake Powell. Species included striped bass, walleye, largemouth bass and threadfin shad which had previously been rare or absent from the San Juan fish community. By August, these fish had moved up river as much as 50 miles.

In 1995, one juvenile Colorado squawfish was captured in the Price River 2.5 miles upstream from its confluence with the Green River. This capture caused the Service and the Bureau of Reclamation to reevaluate the biological opinion for the Bureau's Narrows Project. As a result the state of Utah will be conducting a 2-year study on the Price River to determine the role of this Green River tributary in squawfish recovery.

The Service, State of Utah and representatives of the Uintah/Ouray Tribe developed preliminary flow recommendations for the Duchesne River.

RESUMEN

Este reporte resume en forma significativa las actividades federales y estatales del año pasado encaminadas a la recuperación de los peces en peligro matalote jorobado,salmon blanco, charalito jorobado y charalito elegante en la cuenca alta del Colorado River. La investigación continua sobre el ciclo de vida y las necesidades estacionales de corrientes o flujo de este pez en orden para facilitar la preparación de las Opiniones Biológicas para la reapertura de la presa Flaming Gorge en el Green River, en Aspinall sobre el Gunnison River y la presa Navajo sobre el San Juan River. Estas Opiniones Biológicas van ha estar para 1998.

En octubre de 1995 empezara la construcción de una escalera para peces con un costo de 1 millón de dólares sobre la presa Redland Diversion en el Gunnison River. Cuando se complete en abril de 1996, proveerá un acceso para 55 millas de hábitats históricos que han permanecido bloqueados desde 1918. Otro importante esfuerzo de recuperación involucra el realce o restauración natural de los hábitats de zonas de inundación; algunos hábitats son un componente crítico de los ecosistemas riberinos. Un inventario de las características de zonas de inundación fue completado para 869 millas de el Colorado, Green, Gunnison, Yampa y White rivers. Estudios y actividades para remediar el problema de los contaminantes en hábitats de tierras bajas inundables e investigaciones para determinar la factibilidad de restauración de estas áreas para beneficiar los peces en peligro (antes que los no nativos) fueron iniciados durante el año. Proyectos pilotos para demostrar el potencial de restauración de los hábitats de zonas de inundación fueron iniciados en el Colorado River cerca de Grand Junction y en el área de Ouray/Jensen a lo largo del Green River. Un plan estratégico a largo plazo para guiar futuras actividades de restauración en los hábitats de zonas de inundación, esta programado para completarse a finales de año.

La propagación y mantenimiento de refugios de poblaciones de peces en peligro es otro elemento del programa de recuperación del Upper Colorado River. Consecuentemente pozas de "refugio" son mantenidos en Ouray Endangered fish facility en Utah; y en Horsethief State Wildlife Area en Colorado. En 1995, 10 estanques adicionales de 0.2 acres fueron construidos en Ouray. Diseños para estanques adicionales y facilidades de reproducción están siendo construidos en Ouray. Diseños para pozas adicionales y facilidades crianza se encuentran en desarrollo en varios sitios incluyendo Ouray, Utah; Wahweap, Utah; Horsethief SWA y Craig, Colorado. 16 adultos de humpback chub fueron colectados del área de Black Rocks de el Colorado River y transferidos a las pozas de Horsethief. Un numero pequeño de todas las cuatro especies de peces en peligro del Colorado River han sido consecuentemente mantenidas en cautiverio para producir peces adultos para un stock de reproducción, investigación, almacenamiento y "refugio genético de poblaciones que ayude a prevenir la extinción en el medio silvestre.

En octubre y noviembre de 1994, 668 matalotes jorobados (clase 1992) midiendo 400 mm LT fueron almacenados dentro del San Juan River como parte de un experimento de esfuerzos de reintroducción. subsecuentemente fueron muestreados a lo largo de los siguientes nueve meses recuperándose 23 de estos peces vía electropesca, recuperados con redes. Estos peces fueron encontrados distribuidos a lo largo de 100 millas en el San Juan River y aparentemente en excelentes condiciones. Datos preliminares sugieren que stocks de peces de esta talla reducen significativamente la predación por peces no nativos (exóticos).

El control de especies de peces no nativas es otro importante elemento de los programas de recuperación. Investigaciones conducidas en el San Juan River por New Mexico Game & Fish muestran que la comunidad de peces de canales secundarias fue similar a la del canal principal durante la primavera pasada y ambos fueron dominados numéricamente por los nativos flannelmouth y bluehead sucker, y los no nativos como la carpa y el bagre de canal. La siguiente primavera las comunidades de peces de canales secundarios fueron numéricamente dominados por peces no nativos, principalmente red shiner y el fathead minnow. Durante los períodos de bajo flujo, se encontró una considerable actividad reproductiva por varios especies no nativas fueron documentadas, sugiriendo que estos hábitats puede ser la mayor fuente de algunas de estos peces no deseables. Análisis preliminares de los datos indican que los elevados flujos anuales de primavera reactivan las comunidades de peces de los canales secundarios del San Juan River y proveen un medio de limitar la abundancia de algunas especies de peces no nativos.

Tres proyectos para evaluar la efectividad de la remoción mecánica de peces no nativos fue iniciada en 1995. Una evaluación de la remoción del bagre de canal del San Juan River, una segunda evaluación de la remoción de smallmouth bass del Green River y un tercer estudio es diseñado para evaluar la remoción del northern pike del Gunnison River.

La división de la vida silvestre de Colorado a almacenado tiger muskie en el reservorio de Harvey Gap, localizado en la cuenca del Colorado River. Esta fue la primera ocasión que el predador no nativo ha sido almacenado en la zona Oeste de Colorado. Los estados de Utah, Colorado Wyoming y el U.S. Fish & Wildlife Service continúan sus esfuerzos para desarrollar "Procedimientos Interinos para Almacenar Especies de Peces No Nativos en el Upper Colorado River Basin" diseñado para reducir el escape de peces no nativos dentro del hábitat ocupado por los peces en peligro. El Servicio Nacional de Parques (SNP) ha iniciado el grupo de trabajo de peces nativos del Lake Powell en 1993. Consecuentemente este grupo ha trabajado con el SNP y el estado de Arizona y Utah para desarrollar un plan de manejo de peces de Lake Powell. El nivel del Lake Powell fue alto este año lo suficiente para inundar la barrera natural que existe varias millas arriba del San Juan River en su confluencia con el Lake Powell. Dando como resultado un considerable flujo de peces no nativos dentro del San Juan River a partir del Lake Powell. Estas especies incluyen el striped bass, walleye, largemouth bass y el threadfin shad los cuales previamente habían sido raros o ausentes de la comunidad de peces del San Juan. Para agosto, estos peces se habían movido río arriba tanto como 50 millas.

En 1995, un juvenil de salmon blanco fue capturado en el Price River 2.5 millas corriente arriba de la confluencia con el Green River. Esta captura causó que el Service and the Bureau of Reclamation revaluara la opinión biológica para el Bureau's Narrow Project. Como un resultado el estado de Utah a conducido un estudio de dos años en el Price River para determinar el rol de este tributario del Green River en la recuperación del salmon blanco.

El Service, el estado de Utah y los representantes de la tribu Uintah/Ouray han desarrollado recomendaciones preliminares para el Duchesne River.

PISTER, E. P. (Desert Fishes Council, Bishop, CA)

A brief history of the Desert Fishes Council: a time to examine our direction

KEYWORDS: Desert Fishes Council; desert fishes; species recovery; Devils Hole; program direction

ABSTRACT

The Desert Fishes Council was founded in 1969 "in the heat of battle", as a group of concerned biologists endeavored to halt a wave of destruction that was well underway and threatened desert aquatic communities throughout the southwestern U.S. and northern Mexico. Death Valley National Park's Devil's Hole served as a focal point. Early Desert Fishes Council proceedings primarily record specific recovery efforts for threatened and endangered fishes. With the advent of the Endangered Species Act in late 1973, and its attention to recovery of affected fishes, direction of the Council shifted strongly into the realm of general research on desert fishes and their habitats. Recovery efforts were relegated primarily to the category of agency reports. Yet, habitat destruction has continued throughout the Southwest during the past 20 years without noticeable improvement in the status of the aquatic fauna we are mandated to protect, a situation aggravated by a chronic lack of funding for recovery efforts and compounded (especially recently) by complacence and outright hostility from legislative bodies, both state and federal. As a Council we know where we have been and where we are now. We need badly to ask ourselves if we are headed in the right direction. There is much wisdom in a recent statement by the Smithsonian Institution's Tom Lovejoy: "While research is a true need, we are far more likely to attain positive response from society if we are seen as wanting to develop the information necessary to produce good public policy rather than as wanting only to pursue our private, esoteric intellectual pleasures." An old saying warns that unless you change direction you will get to where you are going. Is the Desert Fishes Council headed the right way? What course changes should we make?

RESUMEN

El Desert Fishes Council fue fundado en 1969 "en el calor de la batalla", como un grupo de biólogos preocupados por intentar detener una ola de destrucción que estaba en el camino y amenazaba las comunidades acuáticas del desierto desde el suroested de Estados Unidos y Norte de México. El Devis Hole del Death Valley National Park, sirvió como punto focal. Al inicio el Desert Fishes Council procedió principalmente a registrar los esfuerzos de recuperación específicamente de especies de peces amenazadas y en peligro. Con la llegada del Acta de especies en peligro, a finales de 1973, y su atención por recuperar los peces afectados, la dirección del consejo cambió fuertemente dentro del reino de los investigaciones generales sobre peces del desierto y sus hábitats. Los esfuerzos de recuperación fueron relegados principalmente a la categoría de agencia de reportes. Aun, la destrucción de los hábitats ha continuado a través del suroeste, durante los pasados 20 años sin mejoramiento notable en el Status de la fauna acuática que estamos mandando proteger, situación agravada por una ausencia crónica de financiamiento, para los esfuerzos de recuperación y aún más (recientemente) por la complacencia y hostilidad sin reservas de los cuerpos legislativos de ambos, Estado y Federación. Como consejo sabemos donde hemos estado y donde

estamos ahora. Necesitamos con urgencia preguntarnos a nosotros mismos si estamos encabezando (liderando) en la dirección correcta. Hay mucha sabiduría en una declaración reciente de Tom Lovejoy del Smithsonian Institution: "Mientras que la investigación es una verdadera necesidad, es mucho mas probable lograr una respuesta positiva de la sociedad si somos vistos como los que quieren desarrollar la información necesaria para producir una buena política pública en lugar de querer perseguir nuestros propios placeres esotéricos e intelectuales." Un viejo dicho advierte que al menos si tu cambias la dirección llegarás a donde quieres ir. Esta el Desert Fishes Council dirigiendose en la forma correcta? Que cambios en el curso podríamos hacer?

PITTENGER, J. S. (Conservation Services Division, New Mexico Department of Game and Fish, Santa Fe, NM)

Conservation of the White Sands pupfish in New Mexico

KEYWORDS: New Mexico; White Sands pupfish; status; conservation planning; monitoring

ABSTRACT

A cooperative agreement for protection and maintenance of the White Sands pupfish *Cyprinodon tularosa* was executed between the New Mexico Department of Game and Fish, U.S. Fish and Wildlife Service, U.S. Army - White Sands Missile Range, U.S. Air Force - Holloman Air Force Base, and National Park Service - White Sands National Monument in December 1994. The agreement established a conservation team and a framework for protection of the species. Land-use restrictions were instituted within pupfish habitat and development of a monitoring protocol was required. With respect to the latter, monitoring objectives were defined, surveys were conducted to determine distribution of pupfish and pilot sampling was undertaken to determine sample technique and sizes in 1994. A quarterly monitoring program was initiated in 1995. The four extant populations of pupfish were sampled in March, June and October 1995. Resulting relative abundance and length-frequency distribution data were used to refine the monitoring protocol. The monitoring data indicated a marked decline in the Mound Spring Upper Pond population following a disease episode and allowed a preliminary assessment of population status at the three remaining sites.

RESUMEN

Un acuerdo cooperativo para la protección y conservación del White Sands pupfish *Cypronodon tularosa*, fue formalizado entre New Mexico Department of Game and Fish, U.S. Fish and Wildlife Service, U.S. Army - White Sands Missile Range, U.S. Air Force - Holloman Air Force Base y National Park Service - White Sands National Monument en diciembre 1994. El acuerdo estableció un equipo de conservación y un plan de trabajo para la protección de las especies. Restricciones al uso de la tierra fueron instituidas en el hábitat del pupfish y fue requerido el desarrollo de un protocolo de monitoreo. Con respecto al segundo, fueron definidos los objetivos de monitoreo, y conducidas evaluaciones para determinar la distribución del pupo, así como muestreos pilotos para determinar la técnica de muestreo y tamaños en 1994. Un programa de monitoreo trimestral fue iniciado en 1995. Las cuatro poblaciones existente del pupo fueron muestreadas en marzo, junio y octubre de 1995. Como resultado, los datos de abundancia relativa y distribución de frecuencias de longitud fueron usados para refinar el protocolo de monitoreo. Los datos de monitoreo indicaron una marcada declinación en la población de el Mound Spring Upper Pond siguiente a un evento de enfermedad y a una evaluación preliminar del estatus poblacional en los tres sitios remanentes.

PROPST, D. L. (New Mexico Department of Game and Fish, Santa Fe, NM)

Native fish research and management in New Mexico during 1995

KEYWORDS: New Mexico; Pecos River; Rio Grande; Zuni River; Gila River; native fishes

ABSTRACT

During 1995, major multi-agency research and management activities in New Mexico were conducted in the Rio Grande, Pecos, San Juan (reported in Upper Basin 1995 summary), Gila, Zuni, and Tularosa basins. The focus of work in the Rio Grande was to characterize the life history, particularly reproductive biology, of Rio Grande silvery minnow *Hybognathus amarus*. Rio Grande silvery minnow is a pelagic spawner, producing non-adhesive, semi-buoyant eggs. Spawning occurs in late May-early June and coincides with spring runoff. Increased flows in the past two years are believed responsible for the recent increase in abundance of Rio Grande silvery minnow. The Rio Grande Silvery Minnow Recovery Team was formed in 1995 and in response to demands from "stakeholders" includes representatives of water development interests. In upper portions of the Rio Grande drainage, acequia rehabilitation activities have included design and installation of fish bypass structures around small acequia dams. Efforts to restore Rio Grande cutthroat trout *Oncorhynchus clarki virginalis* to portions of its historic range continue with about one stream renovated each year. Research on the Pecos River included continuation of studies to characterize the response of native and nonnative fishes to a variety of irrigation water releases and to describe the reproductive biology of mainstream cyprinids. Mainstream Pecos cyprinids spawn from early spring through summer. Flow spikes are an important cue to initiate spawning. The abundance of Pecos bluntnose shiner *Notropis simus pecosensis* increased during the past year, presumably in response to maintenance of reservoir releases throughout the year. Other work in the Pecos drainage involved long term monitoring of fish populations on Bitter Lake National Wildlife Refuge and in the Pecos River (including "run-of-river" reservoirs) downstream of Carlsbad. Studies to characterize the status and biology of Zuni bluehead sucker *Catostomus discobolus yarrowi* are in their final year. Several planned recovery activities for Gila trout *Oncorhynchus gilae* did not occur in 1995. Although the New Mexico Attorney General determined that a "Pollution Nuisance" ordinance enacted by Grant County to block use of antimycin to remove nonnative salmonids from renovation streams was illegal, the planned renovation of Mogollon Creek was postponed. Wildfire eliminated the relictual South Diamond Creek population of Gila trout and another wildfire may have eliminated a population in Trail Canyon. Development of a hatchery maintained broodstock of Gila trout continues. A population viability study of Gila trout populations was initiated. Long term monitoring of native fish communities at six permanent sites in the Gila-San Francisco drainage continues. Abundance of spikedace *Meda fulgida* appears to be declining in the mainstream Gila River. A study to characterize interactions among native fishes and stocked salmonids in West Fork Gila River was initiated. Recent purchases of property in the Mimbres River valley by The Nature Conservancy tripled the amount of habitat protected for Chihuahua chub *Gila nigrescens*. A cooperative agreement which provides for multi-agency conservation of White Sands pupfish *Cyprinodon tularosa* was finalized in 1995. Monitoring of White Sands pupfish populations and research on its life history were initiated. The Museum of Southwestern Biology serves as a repository for fish specimens collected during research/monitoring activities. It recently completed electronically cataloguing all New Mexico museum fish records. This electronic format not only enables rapid data recording, but facilitates data retrieval via a broad range of "fields." Although the principal entities involved in each project varied, all of the following were actively involved in the conservation of native fishes in New Mexico during 1995: New Mexico Department of Game and Fish, U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, Department of Defense (U.S. Army and U.S. Air Force), U.S. Park Service, U.S. Forest Service, Pueblo of

Zuni, The Nature Conservancy, Museum of Southwestern Biology (University of New Mexico), and New Mexico State University.

RESUMEN

Durante 1995, las principales actividades de investigación y manejo multiagenciales fueron realizadas en el Río Grande, Pecos, San Juan (reportado en el resumen Upper Basin 1995), Gila, Zuni, y Tularosa basin. El enfoque del trabajo en el Río Grande fue caracterizar la historia de la vida, particularmente la biología reproductiva, del Río Grande el silvery minnow *Hybognathus amarus*. El Río Grande el silvery minnow es un desovador pelágico, que produce huevos no adhesivos, semi-flotantes. El desove ocurre a finales de mayo y principios de junio, coincide con los escurrimientos de primavera. Se cree que el incremento en el flujo en los últimos 2 años sea el responsable del reciente incremento en la abundancia de Silvery minnow de Río Grande. El Río Grande Silvery Minnow Recovery Team fue formado en 1995 en respuesta a demandas de "accionistas" que incluye representantes interesados del desarrollo acuífero. En las partes superiores de la cuenca del Río Grande, las actividades de rehabilitación de la acequia han incluido el diseño e instalación de estructuras de desviación de especies alrededor de pequeños diques en las acequias. Los esfuerzos para restaurar a la Río Grande cutthroat trout, *Oncorhynchus clarki virginalis* a partes de su distribución histórica continua con arroyo rehabilitado cada año. Investigaciones sobre Pecos River incluyen la continuación de estudios para caracterizar la respuesta de peces nativos y no nativos y describir la biología reproductiva de los ciprinidos del cauce principal. Los ciprinidos del cauce principal del Pecos desovan desde principio de primavera hasta el verano. Los escurrimientos son una señal importante para iniciar el desove. La abundancia de Pecos bluntnose shiner *Notropis simus pecosensis* incrementó durante el año pasado, presumiblemente en respuesta al mantenimiento de las irrigaciones del represo a través del año. Otro trabajo en el drenaje del Pecos incluye monitoreo a largo plazo de las poblaciones de peces en Bitter Lake National Wildlife Refuge y en el Pecos River (incluyendo los represos que se forman del río), río abajo de Carlsbad. Los estudios para caracterizar el estatus y biología de Zuni bluehead sucker *Catostomus discobolus yarrowi* están en su año final. Varias actividades de recuperación planeadas para Gila trout y *Oncorhynchus gilae* no ocurrieron en 1995. Sin embargo el New México Attorney General determinó que un ordenanza de "contaminación molesta" promulgada por el Condado de Grant para bloquear el uso de antimicina para remover salmonidos no nativos de arroyos de rehabilitación, fue ilegal, pero por eso fue aplazado la renovación planeada de Mogollan Creek. Los fuegos eliminaron la población relicta de South Diamond Creek Gila trout, y otros fuegos tal vez eliminaron una población en Trail Canyon. El desarrollo de un criadero manteniendo el stock de crías de Gila trout continua. Se inició un estudio de viabilidad de población de Gila trout, y el monitoreo de largo plazo de las comunidades de peces nativos en seis sitios permanentes en la cuenca Gila-San Francisco continua. La abundancia de spikedace *Meda fulgida* aparentemente está declinando en el canal principal del Gila River. Un estudio para caracterizar las interacciones entre peces nativos y un stock de salmonidos en West Fork Gila River fue iniciada; compras recientes de propiedad en el Mimbres River Valley por The Nature Conservancy triplica la cantidad de hábitat protegido para Chihuahua chub, *Gila nigrescens*. Se inició un acuerdo cooperativo que provee la conservación de poblaciones de White Sands pupfish y la investigación de su historia de vida. El Museum of Southwestern Biology sirve como un depósito de especímenes de peces colectados durante las actividades de investigación y monitoreo, y recientemente completó un catalogo electrónico de todos sus especimenes. Este formato electrónico no solo permite el registro rápido de los datos, sino que facilita obtener los datos mediante un amplio rango de campos. Aunque las principales entidades involucradas en la variedad de proyectos mencionados arriba fue variable, todas de las siguientes estaban activamente involucradas en la conservación de peces nativos a New México durante 1995: New México Department of Game and Fish, U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, Departament of Defense (U.S. Army and U.S. Air Force), U.S. Park Service, U.S. Forest Service,

Pueblo of Zuni, The Nature Conservancy, Museum of Soutwestern Biology (University of New Mexico), and New Mexico State University.

REIMUS, C. R. (Department of Zoology, Arizona State University, Tempe, AZ)

Morphological variation in the pre-dorsal keel of razorback sucker, *Xyrauchen texanus*

KEYWORDS: razorback sucker; morphometrics; morphological; variation; osteology

ABSTRACT

Razorback suckers are characterized by having an extremely prominent pre-dorsal keel. I tested the influence of size and age on shape change in the osteological components of the keel using geometric morphometric techniques. Marked individual variability was related more closely to age than size. An individual razorback sucker experiencing rapid growth in a favorable setting may share equivalent body size with another that grew slowly for years under adverse conditions. Young fish had less pronounced pre-dorsal keels as compared to old fish, regardless of size. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

Los matalotes jorobados se caracterizan por tener una extremadamente prominente quilla predorsal. Probé la influencia del tamaño y la edad en el cambio de la forma en los componentes osteológicos, utilizando técnicas de morfometría geométrica. La variabilidad de individuos marcados se relaciona mas cercanamente al tamaño y la edad. Un individuo de matalots jorobado que experimenta un rápido crecimiento en un ambiente favorable, puede compartir un tamaño corporal equivalente a otro que creció lentamente por años bajo un ambiente de condiciones adversas. Los peces juveniles tenían una quilla predorsal menos pronunciada en comparación con peces viejos, sin tomar en cuenta su tamaño. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

RISSLER, P. H.*; SCOPPETTONE, G. G. (National Biological Service, Reno Field Station, Reno, NV)

Cui-ui population dynamics and population viability model

KEYWORDS: population; model; Pyramid Lake; Nevada; cui-ui; Truckee River; sucker

ABSTRACT

In 1988, we initiated research on cui-ui *Chasmistes cujus* population dynamics to determine population parameters (population numbers, age distribution, recruitment and survival) needed to develop a population viability model. A systematic netting program was developed to capture cui-ui around Pyramid Lake and at different depths. Cui-ui were marked with a T-bar anchor tag. To date, more than 200,000 cui-ui have been captured with over 130,000 tagged. We currently have over 5,000 recaptures. From 1990 to 1994, estimates of adult cui-ui ranged from 400,000 to 1,400,000. Annual adult survival ranged from 47 to 100%. The current adult population is comprised of fish hatched in the early 1980's. Data from our research effort is still being analyzed and completion of the population viability model is scheduled for September 1996.

RESUMEN

En 1988, se inicio investigaciones sobre la dinámica de la población de cui-ui *Chasmistes cujus* para determinar parámetros (números de la población, distribución de edades, reclutamento y supervivencia) necesarios para construir un modelo de viabilidad de la población. Un programa sistemático de captura en redes fue establecido para capturar cui-ui alrededor del Pyramid Lake y en diferentes profundidades. Cui-ui fueron marcado con una etiqueta de identificación. Hasta la fecha, mas de 200,000 cui-ui han sido capturados y mas de 130,000 marcados con etiqueta. Hasta ahora, hemos recapturado mas de 5,000 cui-ui

con etiquetas. De 1990 hasta 1994, estimaciónes de la población de adultos han variado entre 400,000 and 1,400,000. Supervivencia de adultos se extiende entre 47 a 100%. La población actual de adultos contiene peces nacidos en los primeros años del 1980. Los datos del estudio estan actualmente en analisis y se espera terminar el modelo de viabilidad en septiembre de 1996.

RUIZ-CAMPOS, G. (Facultad de Ciencias, Universidad Autónoma de Baja California; Ensenada, Baja California, México)

Current status of the partially armored threespine stickleback *Gasterosteus aculeatus microcephalus* Girard 1854 (Pisces: Gasterosteidae) in Baja California, México

KEYWORDS: current status; Baja California; México

ABSTRACT

The habitat and current conservation status of the partially armored threespine stickleback, a fluvial subspecies with distribution from the Bering Strait (Alaska) to Arroyo El Rosario, Baja California (Mexico), was monitored during a period of eight years (1987-1995) at the historical localities of distribution in northwestern Baja California. From a total of 11 known localities, the species was found only the arroyos El Descanso and El Rosario where it was always rare. The progressive alteration of the aquatic and riparian ecosystems along the coastal region of northwestern Baja California by anthropogenic impact has reduced the distribution and abundance of this subspecies. Its current conservation status in Baja California is considered as threatened.

RESUMEN

El habitat y estatus actual de conservación del pez espinoso parcialmente armado, una subespecie fluvial con distribución desde el Bering Strait (Alaska) hasta el Arroyo El Rosario, Baja California (México), fueron monitoreados durante un período de ocho años (1987-1995) en las localidades históricas de distribución del noroeste de Baja California. De once localidades históricas, solo dos de ellas (bocanas de los arroyos El Descanso y El Rosario) registraron actualmente la ocurrencia de esta subespecie en cantidades muy bajas. La alteración progresiva de los ecosistemas acuáticos y ribereños por actividades antropogénicas a lo largo de la región noroccidental de Baja California, ha reducido la distribución y abundancia de esta subespecie. Su estatus actual de conservación en Baja California es considerado como amenazado.

SANJUR, O. I.*; DIMEO, C. A.; QUATTRO, J. M.; VRIJENHOEK, R. C. (OIS and RCV - Center for Theoretical & Applied Genetics, Rutgers University New Brunswick, NJ; CAD - University of Delaware, College of Marine Studies-Cannon Lab, Lewes, DE; JMQ - Department of Biology, University of South Carolina, Columbia, SC)

Molecular systematics of the Leptorhaphis Group of *Poeciliopsis* (Pisces: Poeciliidae) and relationships with endangered populations of Arizona

KEYWORDS: restocking; molecular systematics; Arizona; Sonora; México; topminnows; *Poeciliopsis*

ABSTRACT

We investigated evolutionary relationships among populations of the Leptorhaphis species group of topminnows genus: *Poeciliopsis* from western Mexico and southern Arizona. Based on morphological and geographical criteria, this group includes three allopatric species: *Poeciliopsis occidentalis*; *P. lucida*; and *P. infans*. Because these closely related species have the capacity to hybridize in the laboratory, populations from adjacent river systems may have the capacity to intergrade in nature. To assess the genetic boundaries delimiting the three putative species, and to determine the partitioning of genetic diversity within and among populations of each species, we examined allozyme and mitochondrial DNA sequence (D-loop) variation. The genetic relationships among the three species corresponded with their geographical distributions. Relative to outgroup taxa, the most southerly distributed species, *P. infans* (states of Nayarit,

Jalisco, Aguas Calientes, Guanajuato, Queretaro and Michoacan), branches off basally to the species group. The northern species, *P. lucida* (N Sinaloa and S Sonora) and *P. occidentalis* (Sonora and S Arizona), are closely related sister taxa separated from *P. infans* by a 250 km distributional gap. While there is no genetic evidence of intergradation between the three species, relatively deep genetic subdivisions existed within *P. infans* and *P. occidentalis*. Secondary intergradation may exist between evolutionary subdivisions of *P. occidentalis* in Sonora.

Based on the allozyme and mtDNA criteria, endangered populations of *P. o. occidentalis* from the Gila River system (Arizona) exhibited very low levels of genetic diversity. As found in an earlier study of whole mitochondrial RFLP variation, Gila River *P. occidentalis* contained a single D-loop sequence that also occurred in more diverse populations from the Río de la Concepción in Sonora. The D-loop sequences corroborated the high degree of divergence observed previously for P. o. *sonoriensis* from the San Bernardino Wildlife Refuge (SE Arizona) from other *P. occidentalis* populations in the formerly confluent Río Yaqui basin of Sonora. Implications for restocking and restoration efforts are discussed. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

Se investigaron las relaciones evolutivas en poblaciones de especies pertenecientes al grupo Leptorhaphis (genero: *Poeciliopsis*) procedentes del oeste de México y sur de Arizona. En base a criterios morfológicos y geográficos, tres especies alopátricas han sido incluídas dentro de este grupo: *P. occidentalis*, *P. lucida* y *P. infans*. Estas especies estan cercanamente relacionadas y pueden hibridizar en condiciones de laboratorio, por lo tanto es posible que poblaciones de ríos adyacentes puedan mezclarse en la naturaleza. Para establecer las barreras genéticas que delimitan a las tres especies en cuestión y para determinar la partición de la diversidad genética dentro y entre poblaciones de cada especies, se examinaron variaciones en alloenzimas y en secuencias del ADN mitocondrial (D-loop). Las relaciones genéticas entre las tres especies correspondieron con su distribución geográfica.

Con respecto al grupo externo, la especie *P. infans*, localizada al sur del área de distribución geográfica (estados de Nayarit, Jalisco, Aguas Calientes, Guanajuato, Queretaro y Michoacan), aparece en una rama basal del arbol filogenético formado por este grupo de especies. Las especies localizadas al norte del área de distribución, *P. lucida* (N Sinaloa y S Sonora) y *P. occidentalis* (Sonora y S Arizona) mostraron ser especies cercanamente relacionadas que se encuentran separadas de *P. infans* por una brecha geográfica de 250 km. No se encontró evidencia genética de hibridización entre las tres especies. Sin embargo, se observaron profundas subdivisiones genéticas dentro de las especies *P. infans* y *P. occidentalis*. Es posible que mezclas secundarias puedan existir dentro de subdivisiones evolutivas de *P. occidentalis* en Sonora.

Basados en los resultados obtenidos con alloenzimas y ADN mitocondrial, se observó que las poblaciones en peligro de extinción de *P. o. occidentalis* del Gila River en Arizona contienen bajos niveles de diversidad genética. Correspondiente con un estudio anterior utilizando Análisis de Polimorfismos con Enzimas de Restricción (RFLP), se encontró que poblaciones de *P. occidentalis* del Gila River mostraban una misma secuencia de D-loop y que este genotipo se encontraba también en poblaciones genéticamente más diversas de esta especie presentes en el Río de la Concepción, Sonora. La sequencia de D-loop confirmo el alto grado de divergencia observada previamente entre poblaciones de *P. o. sonoriensis* procedentes del San Bernardino Wildlife Refuge (SE Arizona) y otras poblaciones de *P. occidentalis* procedentes del Río Yaqui en Sonora. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

SCOONOVER, M. J. (Office of the Attorney General, California Department of Justice, CA)

Legal tools for resource protection: Case study Mono Lake

KEYWORDS: Mono Lake; environmental law; resource protection

ABSTRACT

In the 70's, scientists began documenting an alarming decline in the health of the Mono Basin ecosystem. In an effort to halt the water diversions they believed were causing the damage, the scientists hired legal counsel and sued. Last September, after more than 20 years of litigation through both state and federal courts, a state administrative agency directed that diversions from the Mono Basin be significantly reduced, and that some of the lake's resources be restored. Scientists, politicians, and lawyers all had a hand in identifying the problems, defining the issues, and crafting the solutions. Clearly, each resource dispute is unique. However, understanding the evolution of lawsuits like Mono Lake and Devils Hole is useful in analyzing other resource disputes and considering preservation options. Multiple federal and state environmental laws paint the landscape of resource protection. But scientific understanding, public awareness, political support and a determined core constituency provide the detail to bring that picture to life.

RESUMEN

En los 70's, los científicos iniciaron la documentación de un alarmante decline en la naturaleza del ecosistema Mono Basin. En un esfuerzo por detener las desviaciones de agua lo cual creen es la que causa el daño, los científicos recomendaron emplear una demanda legal. El pasado septiembre, después de más de 20 años de litigio continuo a través del tribunal de justicia tanto Estatal como Federal, una agencia administrativa estatal señaló que se han reducido significativamente las desviaciones al Mono Basin, y que alguno de los recursos del lago se restaurarán. Científicos, políticos y abogados han intervenido para identificar los problemas, definiendo beneficios y creando soluciones. Claramente cada recurso es único. Sin embargo, se entiende que la evolución del juicio es útil para el Mono Lake y Devils Hole, ya que se analizan otros recursos y se consideran otras opciones de preservación. Las múltiples leyes ambientales estatales y eederales, protegen a los recursos. Pero los científicos comprenden, la sociedad esta conciente, los políticos apoyan y determinan las necesidades para su conservación.

SCOPPETTONE, G. G.*; NIELSEN, M. B. (U.S. National Biological Service, Northwest Biological Science Center, Reno, NV)

The relative abundance and distribution of fishes in the Muddy River, Clark County, Nevada

KEYWORDS: Moapa dace; Virgin River chub; Moapa White River springfish; population estimate; Muddy River; hoop nets; passive integrated transponders

ABSTRACT

The relative abundance and distribution of fishes in the Muddy River, Clark County, Nevada was investigated during the summer of 1994 and the winter of 1995. During August 1994, we snorkeled the headwaters (Warm Springs area) of the Muddy River, where it originates from about 20 thermal springs within a 1 km radius. The distribution of all species observed was noted and only Moapa dace *Moapa coriacae* adults and Virgin River chub *Gila seminuda* of all sizes were enumerated. From November 1994 to March 1995, the mainstem of the Muddy River was systematically hoop-netted, from 1.5 km downstream from its origin to 20 km further downstream. Virgin River chub were estimated through mark and recapture. In the Warm Springs area, we snorkel counted 3,841 adult Moapa dace and over 8,000 mostly juvenile Virgin River chub. Over 4,500 Virgin River chub were captured with hoop nets and 1,174 marked with

passive integrated transponders (PIT tags). The population of the Virgin River chub in our study area was estimated to be 20,593 (CL 13,254 and 27,932). Additionally, over 700 speckled dace *Rhinichthys osculus* were hoop netted. Also observed or captured were the native Moapa White River springfish *Crenichthys baileyi moapae* and eight exotic species. The results will be displayed.

RESUMEN

La abundancia relativa y la distribución de los peces del Muddy River del Condado de Clark en Nevada, fue investigado durante el verano de 1994 y el invierno de 1995. Durante agosto de 1994, se revisaron las aguas (Warm Springs area) del Muddy River, de donde nacen 20 manantiales dentro de 1 km. de radio. La distribución de todos las especies observadas fue anotada y solamente los adultos del Moapa dace *Moapa coriacae* y Virgin River chub *Gila seminuda* de todos tamaños fueron enumerados. Desde noviembre de 1994 a marzo de 1995, el mainstem del Muddy River fue sistemáticamente pescado, desde a 1.5 km de su origen a 20 km río abajo. Virgin River chub fue estimado a través de marcaje y recaptura. En el área de Warm Spring, se contaron 3,841 Moapa dace adultos y más de 8,000 juveniles del Virgin River chub. Más de 4,500 Virgin River chub fueron capturados en redes y 1,174 marcados transportadores integrados pasivos (PIT etiquetas). La población del Virgin River chub dentro del área de estudio fue estimada para ser 20,593 (LC 13,254 y 27,932). Además, más de 700 speckled dace *Rhinichthys osculus* fueron capturados en redes. También fue observado y capturado el nativo Moapa White River springfish *Crenichthyes baileyi moapae*, y ocho especies exóticas. Los resultados serán expuestos.

SCOPPETTONE, G. G.*; RISSLER, P. H. (National Biological Service, Reno Field Station, Reno, NV)

Information on cui-ui *Chasmistes cujus* life history

KEYWORDS: cui-ui; age-growth; Pyramid Lake; year class structure

ABSTRACT

Cui-ui life history patterns have been studied intermittently from 1978 through 1995. During a systematic netting program cui-ui were found at or above the thermocline in summer and fall, and were in shallower water in winter and spring. Food items consumed were zooplankton and chironomids; there was a seasonal shift in relative importance of items consumed. Size at maturity is typically between 480-520 mm FL. Growth rates differ dramatically among year classes, and there is some indication that growth is so retarded in those from the mid-1980's that they will mature extremely late in life (> 20 years) or will not reach maturity at all. A chronology of cui-ui year class structure from 1978 to 1995 will be discussed.

RESUMEN

El ciclo de vida del cui-ui ha sido estudiado intermitentemente desde 1978 a 1995. Durante un programa sistemático de captura en redes, cui-ui fue encontrado por encima de la termoclina en el verano y el otoño, y en aguas menos profundas en invierno y primavera. Las partículas de alimento consumido fue de zooplancton y chironomides; hubo un cambio de acuerdo con la estación del año en importancia relativa en ítemas consumidas. El tamaño de madurez típico es entre 480-520 mm FL. Los rangos de crecimiento se diferencían dramáticamente entre clases anuales, esto indica que el crecimiento se retarda en los peces a mediados de los años de 1980 que aquellos que podrían madurar extremadamente más tarde en su vida (>20 años) o no madurar. Una cronología de cui-ui en su estructura de clases anuales de 1978 a 1995 será discutida.

SHEFFER, R. J.*; HEDRICK, P. W.; MINCKLEY, W. L.; VELASCO, A. J. (Department of Zoology, Arizona State University, Tempe, AZ)

Defining fitness as a criterion for translocation in the endangered Gila topminnow *Poeciliopsis occidentalis occidentalis*

KEYWORDS: translocation; heterozygosity; fitness; Gila topminnow; *Poeciliopsis occidentalis occidentalis*; Arizona

ABSTRACT

In recent years, a number of studies comparing levels of heterozygosity and fitness have produced mixed results. A recent comparison of four quantitative traits related to fitness among four Gila topminnow populations revealed no differences in fitness. This is in contrast to an earlier study which demonstrated significant fitness differences between two of the populations. Discordance may be in part attributable to different laboratory conditions and exemplifies the difficulty in measuring fitness. If loss of heterozygosity is correlated with lowered fitness, how much of a difference in heterozygosity must there be before a difference in fitness can be demonstrated across a range of conditions? Because fitness has been presented as an important factor in selecting populations used in translocation, there needs to be discussion of exactly what fitness means, how it is to be measured, and how it will be used as a criterion for translocations. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

En años recientes, un número de estudios donde se han comparado los niveles de heterozigosidad y adaptabilidad han producido diversos resultados. Una comparación reciente de cuatro rasgos cuantitativos relacionados a la adaptabilidad entre cuatro poblaciones de Guatopote de Sonora, demostraron que no existen diferencias adaptativas. Lo anterior, es lo contrario a un estudio reciente en el cual demostraron diferencias significativas de adaptación entre dos de las poblaciones. Esta discordancia puede ser en parte atribuible a las diferentes condiciones de laboratorio y las ejemplificaciones difíciles en las medidas adaptativas. Si la pérdida del heterozigocidos es correlacionada con la disminución de la adaptabilidad, cuanto heterozigocidad debe obligarse a hacer antes que una diferencia adaptativa pueda ser demostrada sobre un rango de condiciones? Porque la adaptabilidad ha sido presentada como un factor importante en seleccionar poblaciones para usar en traslocación, falta discución sobre exactamente que es la adaptabilidad, como debe ser medido, y como podría ser usado como un criterio para las traslocaciónes. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

STEFFERUD, S. E. (U.S. Fish and Wildlife Service, Phoenix, AZ)

The tangled web: translocation, bureaucracy and politics

KEYWORDS: translocation; reintroduction; stocking; experimental; populations; Endangered Species Act; bureaucracy

ABSTRACT

Translocation of fishes is a major tool in native fish conservation. In addition to biological and technical problems, translocation involves significant bureaucratic and political problems. Because translocation requires cooperation among agencies, organizations, and individuals it is a fertile field for bureaucratic games and political intrigue. Biologists frustrated with bureaucracy and politics and intent upon getting the species into the water become vulnerable to "deals" that may achieve short-term goals at the sacrifice of long-term conservation. Understanding long-term consequences of "deals" surrounding translocation, and avoiding unwanted consequences, requires understanding applicable laws, regulations,

and policies. State laws and regulations regarding native fish translocation differ from state to state. This talk focuses on Federal laws, regulations, and policies. Translocation of native fishes not Federally listed as endangered or threatened is regulated under state law, although transportation across state lines may be subject to the Lacey Act and various land management laws and regulations may apply to translocations on Federal lands. Although little or no Federal regulation is involved, opposition to translocations of species identified as rare or as candidates for Federal listing is rising due to fears of the "wise use," "county supremacy," and other anti-Federal movements regarding possible future Federal involvement. For species listed under the Endangered Species Act, translocation is federally regulated. The major impediment to translocation of Federally listed species comes from fear by federal, state, local, tribal, and private entities that presence of a listed species within their jurisdiction may interfere with other land uses or administrative and private-property rights. This has led to substantial roadblocks being placed in the way of native fish translocations. In dealing with roadblocks, it is important to distinguish among roadblock origins. Those arising from legal and regulatory requirements are generally addressable through prescribed processes that fulfill legal and regulatory requirements. Those motivated by bureaucratic games and political pressures are much more difficult to deal with unless the underlying political pressures can be altered or relieved. Two major avenues for translocation of Federally listed species exist. Section 10(j) of the Endangered Species Act, for establishing experimental nonessential populations of endangered species, has become increasingly popular. This approach in essence delists the translocated population and is generally combined with a "special rule" removing prohibitions against take or harm of the species. Section 7(a)(2) consultation offers a different approach that addresses the translocation and ongoing or foreseeable land management uses and actions at the site. Take incidental to land management or other activities in the area is covered under an incidental take statement and management of the translocation site and the population can be tailored to meet the needs of the land management entity and the species. The relative merits of these two approaches must be considered by the biologists to ensure that long-term conservation goals are realized. The best approach may differ depending upon the goals of the translocation.

RESUMEN

La traslocación de peces es una herramienta principal en la conservación de peces nativos. En adición a los problemas biológicos y técnicos, la traslocación incluye significantes problemas burocráticos y políticos. Porque la traslocación requiere de la cooperación entre agencias, organizaciones e individuos. Es éste un campo fértil para los juegos burocráticos e intrigas políticas. Los biólogos, frustrados con la burocracia y la política y su intento por llevar las especies dentro del agua, se vuelven vulnerables a "convenios" debiendo documentar objetivos a corto plazo sacrificando la conservación con objetivos a largo plazo. Entender las consecuencias, a largo plazo, de los convenios que rodean la traslocación y evitar estas innecesarias consecuencias, requiere del entendimiento de leyes, regulaciones y políticas aplicables. Las leyes estatales y las regulaciones que consideran la traslocación de los peces nativos difieren de estado a estado. La traslocación de peces nativos no listados federalmente como amenazados o en peligro está regulada por la ley del estado, aunque la transportación a través de la línea estatal puede estar sujeta a Lacey Act y varias leyes de manejo del suelo y regulaciones pueden ser aplicables a las traslocaciones sobre terreno federal. Aunque poco o no la regulación federal está involucrada, la oposición a la traslocación de especies identificadas como raras o candidatas para el listado federal, se ha establecido para los temerarios del "uso inteligente", la "Supremacía del Condado" y a otros movimientos antifederales que consideran posible implicar a futuro al Federal. Para las especies listadas en el Acta de Especies en Peligro (ESA), la traslocación se regula federalmente. El principal impedimento para la traslocación de especies listadas por la federación lo viene a representar la defensa de la entidad Federal, Estatal, local y de las tribus que a la presencia de unas especies enlistadas dentro de su jurisdicción, se puede interferir con otros usuarios del terreno o administrativos y derechos de propiedad privada. Esto ha conducido a obstáculos substanciales colocados

en el camino de la traslocación de peces nativos. Sobre el convenio con obstáculos es importante el distinguir entre los orígenes del bloqueo (obstáculo). Aquellos provenientes de requerimientos y regulaciones legales son generalmente tratados a través de procesos prescritos que cumplen los requerimientos legales y regulatorios. Aquellos motivados por juegos burocráticos y presiones políticas son mucho más difíciles de tratar a menos que la presión política fundamental pueda ser alterada o relevada. Existen dos vías principales para la traslocación de especies listadas federalmente. La Sección 10 (j) del Decreto de Especies en Peligro, para el establecimiento experimental en escencial de poblaciones de especies en peligro ha ido en populas aumento. Este acercamiento en escencia deslista la población traslocada y está generalmente combinado con una "regla especial" removiendo las prohibiciones tomadas en contra o en daño de las especies en peligro. La Sección 7(a)(2) de consulta ofrece un acercamiento diferente que conduce la traslocación y contribuye o previene el manejo del suelo, usos y acciones en el sitio. La desición incidental para el manejo del suelo u otras actividades en el área está envuelta en una toma incidental de relación y manejo del sitio de traslocación y la población, puede ser complejo encontrar las necesidades de manejo del suelo y las especies. Los méritos relativos de esas dos deben ser considerados por los biólogos para asegurar que los objetivos de la Conservación a largo plazo serán realizados. La optima aproximación puede diferir dependiendo de los objetivos de la traslocación.

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Evolutionary trajectories in translocated populations: tinkering with evolution

KEYWORDS: translocation; evolutionary trajectories; rapid evolution; mosquitofish; *Gambusia affinis*; life history

ABSTRACT

Despite the widespread use of translocation as a conservation tool, the evolutionary consequences of this practice are not well understood. The combined effects of drift and novel selection pressures may lead to rapid evolutionary responses by populations introduced to novel environments. I report a case of rapid evolution in life history traits for populations of western mosquitofish *Gambusia affinis* that were established approximately 50 years ago. Mosquitofish from thermally stable habitats, Bonham and Garrett springs, were characterized by delayed size at maturity, high fat content, and large embryos. In contrast females from a thermally instable habitat, Wabuska Springs, were characterized by maturity at small size, low fat content, and small embryos. Females from Parker Spring, a warm spring, matured at intermediate sizes, had low fat content and large embryos. To test whether these traits were genetically based or plastic, captive populations were maintained from the four study sites under common garden conditions for two generations. No population differences were found for reproductive allocation or egg weight suggesting that these traits are plastic. However, both size of maturity and fat content differed among populations under common garden conditions, suggesting that these traits are genetically based. Thus, while some traits were plastic, rapid evolution has occurred for size of maturity and fat storage for recently established mosquitofish populations. Other studies have documented rapid evolution for Poeciliids introduced to new localities. Thus, evolutionary trajectories may be altered when populations are translocated to new localities. Conservation biologists should debate if this is a desirable outcome.

RESUMEN

A pesar del extenso uso de la traslocación como una herramienta de conservación, las consecuencias evolutivas de esta práctica no han sido bien entendida. Los efectos combinados de tendencia y la urgente selección original puede aventajar una rápida respuesta evolutiva sobre las poblaciones introducidas a una ambiente original. Reporto un caso de rápida evolución en las características del ciclo de vida en

poblaciones de western mosquito fish *Gambusia affinis* que fue establecido hace aproximadamente 50 años. Mosquitofish de hábitat termicamente estable, Bonham y Garrett springs, fueron caracterizados por tardar en madurar, alto contenido de grasa, y embriones grandes. En contraste las hembras de un habitat termicamente inestable, Wabuska Springs, fueron caracterizadas por madurar en edades pequeñas, bajo contenido en grasa, y embriones pequeños. Las hembras de Parker Spring, en primavera templada, maduran en edades intermedias, tuvieron bajo contenido de grasa y embriones grandes. Para probar si estos características se debe a diferencias genéticas o que son plásticas, se mantuvieron poblaciones en cautiverio de cada sitio de estudio bajo condiciones naturales, durante dos generaciones. No diferencias de población fueron encontradas para la distribución reproductiva o peso del huevo, así sugiriendo que estas características son plasticas. Sin embargo, edad de madurez y contenido de grasa difereron entre las poblaciones bajo condiciones iguales, sugiriendo que estos características son genéticamente determinados. Así, aunque algunas características fueron plasticas, la evolución rápida ocurrió en cuanto a la edad de maduración y almacenamiento de grasa para las recientes establecidas poblaciones de mosquitofish. Otros estudios han documentado una rápida evolución para Poeciliidae introducidos a nuevas localidades. Así, trayectorias evolutivas pueden ser alteradas cuando las poblaciones son traslocadas a nuevas localidades. Los biólogos conservacionistas pueden debatir si estos resultados son los deseados.

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Influence of anthropogenic stress on Rio Grande sucker (*Catostomus plebeius*) food selection and condition

KEYWORDS: Rio Grande sucker; white sucker; anthropogenic stresses; sediment loading; land use; periphyton; diet overlap

ABSTRACT

In fall 1994, the Rio Grande sucker *Catostomus plebeius* was listed as a Colorado state endangered species. Recovery efforts will rely on translocations to increase the number of populations but initial research is locating genetically appropriate donor populations and identifying limiting factors. Work at Hot Creek, Colorado in 1994 showed that Rio Grande sucker abundance was weakly related to mesoscale habitat characteristics prompting us to examine in 1995 how habitat and anthropogenic stresses may interact with food availability to limit Rio Grande sucker populations. Rio Grande sucker is thought to be primarily herbivorous while the exotic white sucker *Catostomus commersoni* is primarily benthivorous. We hypothesized that anthropogenic sediment loading would reduce periphyton availability and increase diet overlap between the two species. We measured turbidity, sedimentation, sucker density and condition, and periphyton standing stock; quantified land use; and collected diet samples from 13 sites in New Mexico and Colorado with and without white suckers. Among sites, substrate composition varied widely (percent fines ranged <1% to 22%), Rio Grande sucker density ranged from 1.7 fish/h/100 m^2 to 107 fish/h/100 m^2 and white sucker density ranged from 0 fish/h/m^2 to 20.8 fish/h/m^2. Midsummer data showed that Rio Grande suckers consumed a high proportion of plant matter (mean=3D78%, SE=3D7) at all sites regardless of white sucker presence. We will present the analysis of all 1995 data and evaluate the effects of anthropogenic stresses on Rio Grande sucker populations.

RESUMEN

En otoño de 1994, el matalote del Río Bravo, *Catostomus plebeius* fue considerada en el estado de Colorado como una especie en peligro. Esfuerzos de recuperación dependerán de traslocaciones para incrementar el número de las poblaciones. Investigaciónes preliminares estan en marcha para localizar a pobalciones donadores geneticamente apropiadas y para identificar los factores limitantes. Trabajos en Hot

Creek, Colorado en 1994, demostraron que la abundancia del matalote fue relacionada a factores de escala media de hábitat, así sugeriendo analises hechos en el próximo año sobre interacciones de habitat y estres antropogénico que afectan alimento disponible para limitar las poblaciones de matalote. Este matalote es principalmente herbívoro y el exótico white sucker *Catostomus commersoni* es bentivoro. Hemos hipotetizado que aumentos antropogénicos de sedimentación podrían reducir la disponibilidad de periphyton y el traslape de la dieta entre las dos especies. Medimos turbidez, sedimentación, densidad y condición de los matalotes, y cantidad de periphyton, cuantificamos uso del suelo, y colectamos muestras de dietas de 13 sitios en Nuevo México y Colorado con y sin white sucker. Entre los sitios, la composición del sustrato varía mucho (el rango de porcentajes de particulos finos esta entre <1% y 22%), los rangos de densidad de matalote del Río Bravo son de 1.7 pez/h/100 m^2 a 107 pez/h/100 m^2 y los rangos de densidad del white sucker son de 0 pez/h/m^2 a 20.8 pez/h/m^2. A mitad del verano, los datos mostraron que el matalote del Río Bravo consumió plantas en gran proporción (media=3D78%, SE=3D7) en los sitios donde el white sucker no estaba presente. Presentaremos el análisis de todo los datos de 1995 y evaluaremos los efectos del estrés antropogénico sobre las poblaciones del matalote del Río Bravo.

THIEDE, G.*; CROWL, T. A.; LENTSCH, L. (GT and TAC - Ecology Center and The Department of Fisheries and Wildlife, Utah State University, Logan, UT; LL - Utah Division of Wildlife Resources, Nongame Division, Salt Lake City, UT)

The potential role of nonnative fish on habitat selection, growth rates and survivorship of juvenile Colorado squawfish *Ptychocheilus lucius* in the Green River, Utah

KEYWORDS: squawfish; habitat selection; predation; nonnatives; Green River; Utah

ABSTRACT

Summer growth rates of young-of-the-year Colorado squawfish *Ptychocheilus lucius* are important for their survival into the next year. Changes to the Colorado River system such as dams and introductions of nonnative fish have been implicated in decreased squawfish growth rates and survivorship. While direct predation is undoubtedly important in affecting the survivorship of these fish, it can not directly explain why growth rates have changed. We suggest that habitat selection exhibited by YOY squawfish has changed as a result of nonnative predators. We provide data from both laboratory and field experiments documenting the direct and indirect effects on nonnatives such as green sunfish, crappie and smallmouth bass.

RESUMEN

Las tasas de crecimiento de verano de jóvenes de un año de salmón blanco, *Ptychocheilus lucius*, son importantes para su supervivencia en el siguiente año. Cambios en el sistema del Río Colorado tales como presas e introducción de peces no nativos han estado implicados en el decrecimiento de las tasas de crecimiento y supervivencia del salmón. Mientras la predación directa indudablemente afecta la supervivencia de este pez, esto no explica directamente porque las tasas de crecimiento han cambiado. Sugerimos que la selección de hábitat exhibida por YOY del salmón ha cambiado como resultado de predadores no nativos. Proveemos datos de experimentos de laboratorio y campo documentando los efectos directos e indirectos sobre especies no nativas, tales como el mojarra verde, crappie y smallmouth bass.

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Trade-offs between habitat restoration and foodweb dynamics: implications for June sucker recovery

KEYWORDS: June sucker; habitat selection; predation; nonnatives; food resources; Utah Lake; Utah

ABSTRACT

The June sucker, *Chasmistes liorus* an endangered lake sucker, is endemic to Utah Lake, Utah. Probable reasons for the decline of the species include changes in water delivery to the lake due to irrigation structures, loss of river spawning habitat and the introduction of nonnative fish predators, especially white bass. We have investigated the potential role of macrophytes in providing a refuge from fish predators through spatial segregation and decreased predation efficiency through enhanced habitat complexity. While the establishment of macrophytes is a management alternative, it is possible that changing the habitat from a pelagic one to a more littoral one could result in large scale changes in the aquatic invertebrate community important to the suckers as the primary food resources. We present laboratory and field data that suggest that habitat alterations could indeed result in changes in the food resource base of the suckers and suggest that trade-offs will likely result. [HUBBS STUDENT PAPER COMPETITOR]

RESUMEN

El June sucker, *Chasmistes liorus*, un matalote amenazado, es endémico del Utah Lake, Utah. Probables razones para la declinación de la especie, incluyen cambios en los envíos de agua al lago debidas a estructuras de irrigación, pérdida de hábitat de desove en río y la introducción de peces predadores no nativos, especialmente white bass. Nosotros investigamos el papel potencial de los macrófitos en proveer un refugio de los peces predadores a través de separación espacial y decreciendo eficientemente la predación mediante una incrementada complejidad del hábitat. Mientras el establecimiento de macrofitos es una alternativa de manejo, es posible que cambiando el hábitat de uno pelágico a uno más litoral pueda resultar en cambios de gran escala en la comunidad de invertebrados acuáticos importante a los matalotes como recursos alimenticios primarios. Presentamos datos de laboratorio y de campo que sugieren que las alteraciones de hábitat pueden en verdad resultar en cambios en los recursos alimenticios base de los matalotes y sugiere igualmente que pueden resultar intercambios. [PAPEL ESTUDIANTIL COMPETIDOR AL PREMIO HUBBS]

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Relationships among members of the cyprinid tribe Plagopterini as detected by allozyme data and cytochrome b sequences

KEYWORDS: Plagopterini; *Meda*; *Plagopterus*; *Lepidomeda*; *Gila*; cytochrome b; allozymes; phylogenetics

ABSTRACT

Members of the tribe Plagopterini are distinguished from all other New World cyprinids by the presence of ossified spine-like rays in the dorsal and pelvic fins. As currently described, this group of Colorado River basin endemics includes the monotypic genera *Meda* and *Plagopterus* and the polytypic genus *Lepidomeda*. Relationships of the Plagopterini to other Western cyprinids are unclear, but closest phylogenetic affinities appear to lie with the genus *Gila*. Allozymes and mitochondrial cytochrome b sequences were used to infer phylogenetic relationships within the Plagopterini and to assess monophyly of the group relative to *Gila* and other Western minnows. Allozyme data indicated the Plagopterini was polyphyletic with *Gila (Snyderichthys) copei* falling among the Plagopterini, most closely related to the *Lepidomeda* clade; DNA analyses provided mostly similar results.

RESUMEN

Miembros del tribu Plagopterini son distinguidos de todos los demás ciprínidos del Nuevo Mundo por la presencia de espinas osificadas como rayos en las aletas dorsal y pélvica. Como generalmente es descrito, este grupo endémico de la cuenca del Río Colorado incluye los géneros monotípicos *Meda* y *Plagopterus* y el género politípico *Lepidomeda*. Las relaciones de los Plagopterini con otros ciprínidos del Oeste no es clara, pero estrechas afinidades filogenéticas parecen situarlo con el género *Gila*. Las alozimas y secuencias de citocromo b mitocondrial fueron usados para inferir las interrelaciones filogenéticas dentro de los Plagopterini y asegurar la monofilia del grupo relativo a *Gila* y otros ciprinidos del Oeste. Los datos de alozima indicaron que los Plagopterini fueron polifiléticos con *Gila* (*Snyderichthys*) *copei* cayendo entre los Plagopterini, y siendo más cercano al clade de los *Lepidomeda*; análisis de ADN arrojaron resultados en su mayoría similares.

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A comparison of North American and Australian riverine desert habitats, fishes, and management

KEYWORDS: Australia; North America; environmental differences; management; riverine habitat; fish distribution

ABSTRACT

Desert rivers differ considerably between Australia and North America. For the purposes of this paper I am comparing the North American Colorado River System and the Australian Lake Eyre Drainage Division. These differences are most obvious in the way abiotic conditions affect and have shaped desert rivers. In turn, this has influenced the evolution of their respective desert fishes. Australia and North America have similar threats to desert fish, however the degree of threat is quite different. While there are still many gaps in our knowledge of the Colorado fauna, it is far superior to that of the Australian fauna. Finally, there are also significant political differences in the way fish populations are managed.

RESUMEN

Los ríos desérticos difieren considerablemente entre Australia y Norteamérica. Para los propósitos de este escrito he comparado el Sistema del Colorado River en Norteamérica y la División de la Cuenca del Lago Eyre de Australia. Estas diferencias son más obvias en la manera en que las condiciones abióticas han afectado y formado ríos del desierto. En turno, esto ha influenciado la evolución de sus respectivos peces desérticos. Australia y Norteamérica tienen similares amenazas a peces del desierto, sin embargo el grado de amenaza es completamente diferente. Mientras aquí falta mucho en cuanto a conocimiento de la fauna del Colorado, esta es superior al conocimiento de la fauna Australiana. Finalmente, existen significantes diferencias políticas en el modo en que las poblaciones de peces son manejadas.

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Ecology and status of the humpback chub in the Colorado River, Grand Canyon, Arizona

KEYWORDS: humpback chub; Colorado River; Little Colorado River; survival; predation; population estimates

ABSTRACT

The population of endangered humpback chub *Gila cypha* in Grand Canyon is the largest of six populations remaining in the Colorado River Basin. The Grand Canyon population is centered in the lower 14.9 km of the Little Colorado River (LCR) where the majority of reproduction takes place and individuals disperse to the mainstem Colorado River. Mainstem reproduction occurs in warm springs near RM 30, and

possibly elsewhere, but survival is probably low. Individuals in the mainstem have originated primarily from the LCR and are distributed as nine aggregations in 308 km from Shinumo Wash. (RM 29) to Granite Springs Canyon (RM 220). Estimated number of adults in the mainstem is 3,300 to 3,800, and numbers of subadults may be as high as 3,000,000 in years of high reproductive success. Estimated annual survival of mainstem adults and subadults is 0.755 and 0.100, respectively. Mainstem survival of subadults is probably insufficient to compensate for mortality of adults and most mainstem recruitment is from young adults descending from the LCR. Brown trout, rainbow trout, and channel catfish consume an estimated 250,000 subadult humpback chub annually.

RESUMEN

La población del amenazado charalito jorobado, *Gila cypha*, en el Grand Canyon es la más grande de las seis poblaciones remanentes en la Cuenca del Colorado River. La población del Grand Canyon está centrada en los 14.9 km inferiores del Little Colorado River (LCR) donde ocurre la mayoría de la reproducción e de donde individuos dispersan a la corriente principal del Colorado. La reproducción en la corriente principal ocurre en manantiales tibias cerca al milla 30 del rio (RM 30), y posiblemente en otra parte, pero la sobrevivencia probablemente es baja. Individuos en la corriente principal se han originado principalmente del LCR y están distribuidas como nueve agregaciones en 308 km desde Shinumo Wash (RM 29) hasta Granite Springs Canyon (RM 220). El número estimado de adultos en la corriente principal es de 3,300 a 3,800, y números de subadultos pueden ser tan altos como 3,000,000 en años de gran éxito reproductivo. Estimación anual de supervivencia de adultos y subadultos en la corriente principal es de 0.755 y 0.100, respectivamente. La supervivencia de subadultos en la corriente principal es probablemente insuficiente para compensar la mortalidad de adultos y el mayor reclutamiento de la corriente principal es de adultos jóvenes descendiendo desde el LCR. El brown trout, trucha arcoiris, y bagre de canal consumen un estimado 250,000 subadultos de charalitos jorobados anualmente.

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Area report for northwestern Mexico

KEYWORDS: northwest Mexico; distribution of native fishes; impacts; listed species; conservation; noroeste de México; distribución de peces nativos; impactos; especies alistadas

ABSTRACT

For purposes of this report, northwest Mexico is defined as the border states of Sonora and Chihuahua. The area has about 18 medium to large hydrologic basins, six of which comprise the majority of the total volume of discharge in the northern part of the country. The region also includes two important deserts, the Chihuahuan and Sonoran, as well as a large part of the Sierra Madre Occidental. The native fish fauna consists of about 119 species, 28 of them endemic to the region. The lack of recent studies in Chihuahua impedes precise estimates of numbers and distribution of exotics there, but the 19 now recorded from Sonora represent about 34% of the total freshwater fish fauna of that state. Despite official declaration of the protection and conservation of natural areas in both states (Upper Gulf of California and Colorado River Delta, Pinacate, Cascadas Basaseachic, Cumbres de Majalca, Barranca del Cobre), conservation of these areas is not assured. Traditional U.S./Mexico border-area impacts on native fishes are present throughout this region (over-utilization of water, pollution, habitat destruction, exotic species). Protection and conservation of the native fauna in this unique area will be dependent on implementation of intensive evaluations of the distribution of freshwater fishes and habitat quality on a basin-by-basin basis. This will give us better knowledge of the actual status and problems. One of the principal limiting factors is the difficulty of assuring funding for basic studies in Mexico.

RESUMEN

Para los propósitos de este reporte, el Noroeste de México esta definido como los estados fronterizos de Sonora y Chihuahua. El área tiene unas 18 cuencas hidrológicas de medianas a grandes, seis de las cuales comprenden la mayor parte del volumen total de descarga en la parte norte del país. La región incluye también dos importantes desiertos, el Chihuahuense y el Sonorense, como además una gran parte de la Sierra Madre Occidental. La fauna de peces nativos consiste aproximadamente de 119 especies, 28 de ellas endémicas de la región. La carencia de estudios recientes en Chihuahua impide estimaciones precisas de los números y la distribución de sus especies exóticas, pero las 19 especies de Sonora que han sido registradas, representan casi un 34% del total de la fauna de peces de agua dulce de este estado. A pesar de la declaración oficial de la protección y conservación de áreas naturales en ambos estados (Alto Golfo de California y Delta del Río Colorado, Pinacate, Cascadas de Basaseachic, Cumbres de Majalca, Barranca del Cobre), la conservación de estas áreas no está asegurada. Impactos tradicionales en el área fronteriza México/E.U.A. sobre peces nativos a través de esta región (sobreutilización de agua, contaminación, destrucción de hábitat, especies exóticas). La protección y conservación de la fauna nativa en esta área única dependerá de la implementación de evaluaciones intensivas en la distribución de peces de agua dulce y calidad de hábitat sobre una base cuenca por cuenca. Esto nos dará un mejor conocimiento del estatus actual y los problemas existentes. Uno de los principales factores limitantes es la dificultad para asegurar fondos para estudios básicos en México.

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Strategies for conservation of desert fishes: Some recent examples from Nevada

KEYWORDS: conservation; native fishes; Nevada

ABSTRACT

Members of the Desert Fishes Council are certainly more aware than most biologists of the practical and theoretical difficulties involved in preserving native fishes and aquatic ecosystems in the arid west. I will describe and report on some recent experience from Nevada. Preservation of fish populations is often difficult because of biological limitations imposed by small population sizes, restricted habitats and harsh environments. The problem is further complicated by impacts resulting from introduced nonnative and exotic species, livestock grazing, habitat loss, and water diversion for agriculture and other uses. In the final analysis, successful preservation of many native fish populations probably results from a fortunate combination of favorable biological circumstances and physical realities. Answering the scientific questions identifying biologically appropriate conservation strategies is only one part of the mix. If biological considerations can be successfully addressed, preservation and protection may also require recognition of the problem by some advocacy group or agency and an adequate resolution to the issues posed by ownership of land and water, and access to aquatic habitats. To date, virtually all successful preservation activities in Nevada have also been greatly assisted by the leverage and political influence provided by the Endangered Species Act. Proposed revisions to this act may severely reduce prospects for preservation of many species. Recent protection efforts for several native fishes in northern Nevada (including desert dace, cui-ui, and Lahontan cutthroat trout among others) can be interpreted in relation to these issues.

RESUMEN

Miembros del Desert Fishes Council estan ciertamente más enterados que la mayoría de los biólogos de las dificultades teóricas y prácticas que envuelven la preservación de los peces nativos y los ecosistemas acuáticos en el árido Oeste. Yo describiré y reportaré experiencias recientes en Nevada. La preservación de poblaciones de peces es bastante difícil a causa de las limitaciones biológicas impuestas por el pequeño tamaño de las poblaciones, habitats restringidos y áspero medio ambiente. El problema se complica más debido a la introducción de peces no nativos y exóticos, el pastoreo de ganado y otros animales, pérdida de habitat y la utilización del agua para agricultura y otros usos. En el análisis final, la preservación exitosa de algunas poblaciones de peces nativas probablemente resulta de una afortunada combinación favorable de circunstancias biológicas y realidades físicas. En respuesta a cuestiones científicas se han identificado biologicamente en forma apropiada estrategias de conservación como una parte de la mezcla. Si las consideraciones biológicas pueden ser exitosamente encaminadas, la preservación y protección requerirá del reconocimiento del problema por algunos grupos avocados o agencias y un adecuada resolución para las consecuencias por los propietarios de la tierra y el agua, y el acceso a los habitats acuáticos. A la fecha, virtualmente todas las actividades exitosas de preservación en Nevada, han sido grandemente asistidas por el poder y la influencia política proveída por el Endangered Species Act. Revisiones propuestas a esta acta pueden reducir severamente prospectos para la preservación de varias especies. Esfuerzos recientes de protección de algunos peces nativos en el Norte de Nevada, (incluyendo el desert dace, cui-ui, y el Lahontan cutthrout trout junto con otros) pueden ser interpretados en relación con estas consecuencias.

VIVES, S. P.*; CANNON, S. L. (Department of Biology, Georgia Southern University, Statesboro, GA)

A test of the dear enemy effect with loach minnows *Tiaroga cobitis*

KEYWORDS: dear enemy effect; breeding behavior; artificial propagation; loach minnow

ABSTRACT

Loach minnows utilize natural and excavated cavities for nesting and shelter. In the laboratory, loach minnows will defend their shelter sites from other loach minnows. Some similarly territorial animals show reduced levels of aggression toward neighbors relative to strangers. This phenomenon is labeled the "dear enemy effect." Pairs of loach minnows were allowed to set up territories under standardized tiles. Half of the subjects experienced the removal of a neighbor and the replacement with a stranger (treatment). The other half experienced the removal and reintroduction of the neighbor (control). Agonistic interactions were tallied for treatment and control conditions. Agonistic actions from resident fishes toward strangers were significantly higher than those directed toward neighbors. This is the first study to establish the "dear enemy effect" in a species of freshwater fish. Implications of these data, and information gained from keeping loach minnows under artificial conditions, for the conservation and propagation of loach minnows will be discussed.

RESUMEN

Loach minnows utilizan cavidades naturales y excavadas para anidar y protegerse. En el laboratorio, loach minnows defenderán sus sitios de protección de los otros loach minnows. Algunos animales territoriales muestran similarmente niveles reducidos de agresión hacia sus vecinos relativo a extranjeros. Este fenómeno es llamado el "efecto del enemigo querido". Pares de loach minnows fueron dejados para establecer territorios bajo tubos estandarizados. La mitad de los ejemplares experimentaron la remoción de un vecino y el reemplazo con un extraño (tratamiento). La otra mitad experimentó la remoción y reintroducción del vecino (control). Las interacciones agonísticas fueron anotadas para las condiciones de tratamiento y control. Las acciones agonísticas de los peces residentes hacia los extranjeros fueron

significativamente más altas que las dirigidas hacia los vecinos. Este es el primer estudio que ha establecido el "efecto del enemigo querido" en una especie de pez de agua dulce. Se discutirán las implicaciones de estos datos y la información obtenida de mantener loach minnow bajo condiciones artificiales para su conservación y propagación.

WHITE, R.*; SATO, G.; OLSON, J.; YOUNG, D.; BENTIVOGLIO, A.; RHEW, R. (RW, AB and RR- USFWS Oregon State Office; GS - Burns District BLM, Burns, OR; JO -Fremont NF, Lakeview, OR; DY- USFWS Klamath Falls Field Office, OR)

1995 Oregon area report to the Desert Fishes Council

KEYWORDS: Oregon; U.S. Fish and Wildlife Service; U.S. Forest Service; U.S. Bureau of Land Management; U.S. Bureau of Reclamation; Oregon Department of Fish and Wildlife; Nature Conservancy; endangered and threatened species

ABSTRACT

This paper briefly summarizes the fish conservation efforts conducted or underway in 1995 in the desert portions of Oregon. The activities reported on were conducted by the Bureau of Land Management (BLM), the Forest Service (FS), the U.S. Fish and Wildlife Service (FWS), the Oregon Chapter of the Nature Conservancy (TNC), the Oregon Department of Fish and Wildlife (ODFW), the U.S. Bureau of Reclamation, and other agencies or organizations. The species discussed include, but are not necessarily limited to: Lost River sucker, *Deltistes luxatus*; shortnose sucker, *Chasmistes brevirostris*; Warner sucker, *Catostomus warnerensis*; Warner Valley redband trout, *Oncorhynchus mykiss* ssp.; Lahontan cutthroat trout, *Oncorhynchus clarki henshawi*; Borax Lake chub, *Gila boraxobius*; Catlow tui chub, *Gila bicolor* ssp.; Catlow Valley redband trout, *Oncorhynchus mykiss* ssp.; Alvord chub, *Gila alvordensis*; Malheur mottled sculpin, *Cottus bairdi* ssp.; interior redband trout, *Oncorhynchus mykiss* ssp.; the Goose Lake fishes; and bull trout, *Salvelinus confluentus*. The actions described represent both successes and failures in fish conservation in both political and biological arenas. We hope that presentation of this report will assist other biologists in meeting the challenges that face them as they try to protect desert fish resources and habitats.

RESUMEN

Este documento resume brevemente los esfuerzos de conservación de peces efectuados previamente o en proceso en 1995 en la porción del desierto de Oregon. Las actividades reportadas que fueron llevadas a cabo por el Bureau of Land Management (BLM), The Forest Service (FS), The U.S. Fish and Wildlife Service (FWS), The Oregon Chapter of the Nature Conservancy (TNC), The Oregon Department of Fish and Wildlife (ODFW), The U:S: Bureau of Reclamation y otras agencias u organizaciones. Las especies discutidas incluyen, pero no necesariamente están limitadas a: Lost River Sucker, *Deltistes luxatus*; shortnose sucker, *Chasmistes brevirostris*; Warner sucker, *Catosotomus warnerensis*; Warner Valley redband trout, *Oncorhynchus mykiss* ssp.; Lahontan cutthroat trout, *Oncorhynchus clarki henshawi;* Borax Lake chub, *Gila boraxobius*; Catlow tui chub, *Gila bicolor* ssp.;Catlow Valley redband trout, *Oncorhynchus mykiss* ssp.; Alvord chub, *Gila alvordensis;* Malheur mottled sculpin, *Cottus bairdi* ssp.; interior redband trout, *Oncorhynchus mykiss* ssp.; the Goose Lake fishes; and bull trout, *Salvelinus confluentus*. Las acciones descritas representan ambos éxitos y fracasos en la conservación de peces en ambos aspectos políticos y biológicos. Esperamos que la presentación de este reporte ayude a otros biólogos en sus tareas de tratar de proteger los recursos de peces del desierto y sus hábitats.

WONG, D. M. (California Department of Fish and Game, Bishop, CA)

Interagency report for Southern California and Eastern Sierra

KEYWORDS: speckled dace; pupfish; California; recovery plan; Owens sucker; chub, refuge; Badwater snail; amphibian; cutthroat trout

ABSTRACT

The U.S. Fish and Wildlife Service (USFWS) - The USFWS with cooperation from California Dept. of Fish and Game and U.S. Bureau of Land Management is preparing a Multispecies Recovery Plan for Owens tui chub *Gila bicolor snyderi* and Owens pupfish *Cyprinodon radiosus*. The plan incorporates strategies to recover and protect these and other candidate and native aquatic and terrestrial species in large Habitat Conservation Areas within the Owens Valley. It should be available for public review this fall. The USFWS will update the Paiute cutthroat trout *Oncorhynchus clarki seleniris* recovery plan, likely emphasizing recovery efforts in Silver King Creek. The USFWS consulted with federal agencies on 25 livestock grazing allotments involving threatened fish.

Bureau of Land Management (BLM) - Largemouth bass have again invaded BLM Spring in Fish Slough, compromising what is currently the best population of Owens pupfish in the Owens Valley. Eradication efforts are ongoing. A controlled burn is planned to reduce vegetation in marsh areas immediately downstream from BLM Spring to restore habitat previously used by pupfish. Owens pupfish were introduced into Mule Spring and are coexisting with Owens tui chub.

Death Valley National Park - A three year study of four of the five pupfish taxa was completed. Pupfish population and habitat parameters were quantified and revealed unique conditions for several Park waters. Population and habitat characteristics for the Badwater snail were quantified in order to determine habitat restoration and protection strategies.

An amphibian survey for all Park lands was conducted during spring 1995 and identified the distribution and abundance of several anuran species which are currently secure. A survey of the Death Valley June beetle resulted in information which may be used as a barometer for gaging the health of Amargosa River riparian areas.

California Department of Fish and Game - To date 46 streams have been surveyed in San Bernardino and Riverside counties for Santa Ana sucker *Catostomus santaanae*, Santa Ana speckled dace *Rhinichthys osculus* ssp., and arroyo chub *Gila orcutti*. Native fishes were found in only nine; twenty more streams will be surveyed. Desert pupfish *Cyprinodon macularius* refuges are doing well, with numbers up in San Felipe Creek; it does not appear that tilapia have moved any further up the drainage.

Owens pupfish refuges are not faring well. Maintenance work in Warm springs has been hampered by bureaucratic red tape, the Owens Valley Native Fishes Sanctuary (OVNFS) in Fish Slough contains neither Owens chub nor Owens pupfish, but pupfish persist in a downstream marsh area. Plans are being made to alter the OVNFS with a flashboard system to allow water level manipulations. This will allow restoration of the original spring stream, and experimentation with non-chemical means of controlling predaceous exotics. Final management actions in Fish Slough are awaiting completion of the Multispecies Recovery Plan.

Owens speckled dace *Rhinichthys osculus* ssp., and Owens sucker *Catostomus fumeiventris* populations are stable. Owens tui chub are stable in Hot Creek headsprings, but were not observed in an extensive survey of the upper Owens River gorge.

Mohave chub *Gila bicolor mohavensis* populations at the China Lake Naval Weapons Center were sampled. Estimates are less than half of those reported in 1990 (2,802 compared to 6,142). Some fish were lost to high water temperatures and low oxygen levels in the upper reaches. The Lark Seep pond was almost dry and contained no chubs.

Restoration efforts for Lahontan cutthroat trout *Oncorhynchus clarki henshawi* in the Walker River watershed are continuing. Following stream renovations, cutthroat trout have been reintroduced into Slinkard, Mill, and Wolf creeks; Silver Creek should be restocked in 1996.

RESUMEN

The U.S. Fish and Wildlife Service (USFWS) - The USFWS en cooperación con el California Department of Fish and Game y U.S. Bureau of Land Management está preparando un Plan de Recuperación de Multiespecies para Owens tui chub *Gila bicolor snyderi* and Owens pupfish *Cyprinodon radiosus*. El plan incorpora estrategias para recuperar y proteger estas y otras especies candidatas, y otras especies nativas acuáticas y terrestres en grandes áreas de conservación de hábitats dentro de Owens Valley. Esto debe ser disponible para revisión pública este otoño. El USFWS actualizará el plan de recuperación para Paiute cutthroat trout *Oncorhynchus clarki seleniris,* probablemente enfatizando los esfuerzos de recuperación en Silver King Creek. El USFWS consultó con agencias federales en 25 parcelas para pastoreo de ganado donde influye a peces amenazados.

Bureau of Land Management (BLM) - Largemouth bass otra vez han invadido a BLM Spring in Fish Slough, así amenazando la mejor población de Owens pupfish en el Owens Valley. Los esfuerzos de erradicación están llevándose a cabo. Está planeado un fuego controlado para reducir la vegetación en áreas mojadas inmediatamente corriente abajo del BLM Spring para restaurar el hábitat previamente usado por pupfish. Owens pupfish fueron introducidos en Mule Spring y están coexistiendo con Owens tui chub.

Death Valley National Park- Un estudio de tres a cuatro años de cinco taxa de pupfish fue realizada. Se cuantificaron las poblaciónes de pupfish y los parámetros del hábitat y revelaron condiciones únicas para diversas aguas del parque. Las características de la población y el hábitat para la Badwater snail fueron cuantificados para determinar estrategias para la restauración y protección del hábitat.

Se llevó a cabo un muestreo de anfibios por todas las tierras del parque durante la primavera de 1995 y se identificó la distribución y abundancia de diversas especies de anuros los cuales están actualmente seguros. Un muestreo del Death Valley June beetle resultó en información que debe ser usada como un barómetro para medir la salud del área riparia de Amargosa River.

California Department of Fish and Game- A la fecha se han muestreado 46 arroyos en los condados de San Bernardino y Riverside para el Santa Ana sucker *Catostomus santaanae,* Santa Ana speckled dace *Rhinichthys osculus* ssp., y arroyo chub *Gila orcutti*. Se encontraron peces nativos en solamente nueve arroyos; veinte arroyos más se muestrearan en el futuro. Los refugios del desert pupfish *Cyprinodon macularis* están bien, con un número más alto en San Felipe Creek; parece que la tilapia no se haya movido más arriba en la cuenca.

Los refugios de Owens pupfish no están en buenas condiciones. El trabajo de mantenimiento en Warm Springs ha sido obstaculizado por trámites burocráticos, el Owens Valley Native Fishes Sanctuary (OVNFS) en Fish Slough no contiene Owens chub ni Owens pupfish, pero el pupfish persiste en un área de ciénega corriente abajo. Actualmente se esta planeando alterar el OVNFS con un sistema que permita manipulaciones del nivel de agua. Esto permitirá la restauración del original Spring Stream y la experimentación con medios no-químicos de control de predadores exóticos. Las acciones finales de manejo en Fish Slough están esperando la finalización del Plan de Recuperación de Multiespecies.

Las poblaciones de Owens speckled dace *Rhinichthys osculus* ssp., y Owens sucker *Catostomus fumeiventris* se encuentran estables. Owens tui chub estan estables en el manantial de Hot Creek, pero no fueron observadas en un muestreo extenso de la parte alta del Owens River gorge.

Las poblaciones de Mohave chub *Gila bicolor mohavensis*, en el China Lake Naval Weapons Center fueron muestreadas. Las estimaciones son menos de la mitad de las reportadas en 1990 (2,802 comparadas con 6,142). Algunos peces fueron perdidos en aguas con altas temperaturas y bajos niveles de oxígeno en las partes altas del sistema. El Lark Seep pond estuvo casi seco y no contenía chubs.

Los esfuerzos de restauración para cutthroat trout *Oncorhynchus clarki henshawi* en la cuenca del Walker River continuan. Despues de las renovaciones, cutthroat trout han sido reintroducidos en Slinkard, Mill y Wolf creeks; Silver Creek debe ser repoblado en 1996.

YOUNG, K. L. (Arizona Game and Fish Department)

Arizona Game and Fish Department activity report

KEYWORDS: Sonora chub; bonytail chub; humpback chub; razorback sucker; Arizona; watershed management

ABSTRACT

On March 28 through March 30, 1995, Arizona Game and Fish Department (AGFD) personnel conducted an inventory survey for Sonora chub *Gila ditaenia* in California Gulch and nearby drainages along the International border in Santa Cruz County. Sonora chub have been previously documented in the United States only from Sycamore Creek and its immediate tributaries. Surveys were conducted in California Gulch, Warsaw Canyon, Holden Canyon, Bonita Canyon, and Alamo Wash in the United States. Sonora chubs were found during this survey in California Gulch, ranging from immediately above the confluence with Warsaw Canyon downstream to the International border with Mexico.

AGFD personnel conducted a survey of Lake Mohave from May 30 to June 1, 1995. Trammel nets were deployed along selected coves and points from Davis Dam upstream to Arrowhead Cove. Eight bonytail chubs *Gila elegans* and two razorback suckers *Xyrauchen texanus* were collected.

Propagation activities for razorback sucker and Colorado squawfish *Ptychocheilus lucius* at Dexter National Fish Hatchery and Technology Center (DNFHTC) and Bubbling Ponds State Hatchery (BPSH) were directed at growing large-sized individuals for stocking. A total of 2,360 razorbacks were stocked into the Verde River at Childs during this segment of the project. A total of 269 razorbacks were provided by and stocked into the Verde River by DNFHTC. All DNFHTC razorbacks were tagged with passive integrated transponder (PIT) tags for individual identification. The balance, totaling 2,091 razorbacks were stocked from Bubbling Ponds State Hatchery and tagged with coded wire tags for stock identification. No squawfish were stocked, and razorback suckers were stocked into the Verde River only. Surveys were conducted on the Salt and Verde rivers and on the Salt River arm of Roosevelt Lake. No razorback or squawfish were recaptured.

The Department is developing an approach to management of fishery resources on a watershed basis. The Verde and Little Colorado basins are the focus of this effort. The approach will incorporate three primary types of activities - Inventory, Monitoring, and Management. Geographical Information Systems (GIS) will be utilized as a tool for identifying management emphasis and implementing management activities. Monitoring activities continued statewide for Gila topminnow *Poeciliopsis occidentalis occidentalis*, and desert pupfish *Cyprinodon macularius macularius*. Monitoring continues in the Little Colorado River Basin - Little Colorado spinedace *Lepidomeda vittata*, and the Upper Verde River - spikedace *Meda fulgida*.

Gila chub *Gila intermedia* were translocated from Silver Creek in an effort to establish additional populations in Larry and Lousy creeks. Larry and Lousy creeks are perennial waters adjacent to Silver Creek in the Agua Fria Basin.

Research activities currently underway include a study to determine habitat use by razorback suckers released into the Imperial Division, Lower Colorado River, and parasite and disease factors affecting recovery of razorback sucker in the Verde River. Glen Canyon Environmental Studies continue on the Colorado River and included humpback chub *Gila cypha* monitoring conducted jointly by AGFD and Bio/West. Samples of speckled dace *Rhinichthys osculus* and fathead minnows *Pimephales promelas* have also been collected and preserved from the Colorado River for examination for Asian tapeworm *Bothriocephalus acheilognathi*.

RESUMEN

Del 28 al 30 de marzo de 1995, el personal del Arizona Game and Fish Department (AGFD) llevó a cabo un inventario para el Sonora chub *Gila ditaenia* en California Gulch y otras cuencas cercanas a la frontera internacional en el condado de Santa Cruz. El Sonora chub ha sido documentado previamente en los Estados Unidos solamente de Sycamore Creek y sus tributarios inmediatos. Se llevaron a cabo muestreos en California Gulch, Warshaw Canyon, Holden Canyon, Bonita Canyon y Alamo Wash en los Estados Unidos. Los Sonora chubs fueron encontrados durante este muestreo en California Gulch, recorriendo desde la confluencia con Warsaw Canyon río abajo hasta la frontera internacional.

Personal del Arizona Game and Fish llevó a cabo muestreos en Lake Mohave desde el 30 de mayo hasta el 1 de junio de 1995. Se desplegaron redes de trasmallo a través de bahias y puntos seleccionados desde Davis Dam hasta Arrowhead Cove. Se colectaron ochocharalitos elegantes, *Gila elegans*, y dos matalotes jorobados, *Xyrauchen texanus*.

Las actividades de propagación para el matalote jorobado y salmon blanco, *Ptychocheilus lucius*, en el Dexter National Fish Hatchery y Technology Center (DNFHTC) y Bubbling Ponds State Hatchery (BPSH) fueron dirigidos a la producción de individuos de talla grande para repoblación. Un total de 2,360 matalotes jorobados fueron poblados en el Verde River en Childs durante esta parte del proyecto. Fueron provistos y poblados un total de 269 matalotes jorobados en el Verde River por el DNFHTC. Todos los matalotes jorobados del DNFHTC fueron marcados con etiquetas transponder pasivas integradas (PIT) para identificación individual. El balance, un total de 2,091 matalotes jorobados fueron poblados desde Bubbling Ponds State Hatchery y etiquetados con etiquetas de alambre codificadas para identificación. No fueron sembrados salmon blanco. Muestreos en los ríos Salt y Verde no recaptaron ningun matalote jorobado o salmon blanco.

El departamento está desarrollando una propuesta para manejar los recursos pesqueros con base en la cuenca. La cuenca de los ríos Verde y Little Colorado son enfoques de este esfuerzo. La propuesta incorporará tres tipos primarios de actividades- Inventario, Monitoreo y Manejo. Se utilizará un Sistema de Información Geográfica (GIS) como una herramienta para identificar el énfasis del manejo y la implementación de las actividades de manejo. Las actividades de monitoreo continuaron por todo el estado para Gila topminnow, *Poeciliopsis occidentalis occidentalis*, y para el desert pupfish *Cyprinodon macularius macularius*. El monitoreo continuó en el Little Colorado River Basin- Little Colorado spinedace *Lepidomeda vittata* y la parte alta del Río Verde - spikedace *Meda fulgida*.

Gila chub *Gila intermedia* fue translocado desde el Silver Creek en un esfuerzo para establecer poblaciones adicionales en Larry y Lousy Creeks. Larry y Lousy creeks son cuerpos de agua perennes adyacentes al Silver Creek en la cuenca del Río Agua Fría.

Las actividades de investigación que actualmente están realizándose incluyen un estudio para determinar el uso del hábitat por matalotes jorobados liberados en la Imperial Division, Lower Colorado River y los parásitos y factores de enfermedades que afectan la recuperación de matalotes jorobados en el Río Verde. Los estudios ambientales del Glen Canyon continúan en el Río Colorado e incluyen el monitoreo de charalito jorobado, *Gila cypha*, llevado a cabo por el AGFD y el Bio/West. Las muestras de speckeled dace *Rhinichthys osculus* y fathead minnows *Pimephales promelas* también han sido colectados y preservados del Río Colorado para exámen del Asian tapeworm *Bothriocephalus acheilognathi*.

YRURETAGOYENA-UGALDE, C. (Centro Regional De Estudios Ambientales Y Socioeconomicos, Calexico, CA)

The DFC environmental education project, a translocation tool in conservation and knowledge for the preservation of our desert fishes

KEYWORDS: public education; conservation; translocation; educación publica; conservación; traslocación

ABSTRACT

The XXVII DFC meeting will be related to translocation as a conservation tool for preserving native desert fishes. It is fundamental for resource managers, decision makers and field biologists to know and understand the meaning of the word translocation defined by the Velazques dictionary as "the reciprocal mutual relocation of things from one place to the other". In order for translocation to be effective in preserving the desert ecosystems, we scientists, the generators of knowledge and experts in the discipline, must initiate and internalize a parallel translocation mental process. In order to change our focus, an exercise will be required, one that will probably start in our re-education and conceptualization of things. In that way, what ever we offer to the public as knowledge transmitors, might serve as the triggering mechanism for translocation as the conservation tool. My presentation is a proposal to construct an environmental education model that will reconform the experts' knowledge, as to how they see, how they construct knowledge, and how they communicate issues to the public. Therefore we will initiate the process departing from the conceptualization that the different actors in a given bioregion have, in relation to conservation. The project incorporates, as a working tool, a matrix of process correlation mixed with the GIS principle of information gathering. The intention is to assure that translocation between culture, economy and environment takes place as a requirement for sustainability articulated to the conservation of our resources. The project's goal is for the DFC members to contribute in any way in the creation of the council's environmental education program as the missing link for the public's sensibilization. A schematic presentation is presented as the initial mechanics in achieving our objective for translocation as the conservation tool in the preservation of the desert fishes.

RESUMEN

EL Simposium XXVII del DFC estará relacionado con la traslocación como una herramienta de la conservación para preservarlos peces nativos del desierto. Esto es fundamental para los administradores de recursos, tomadores de decisiones y biólogos de campo para conocer y entender el significado de la palabra traslocación definida en el diccionario de Velázquez como "el cambio de sitio mutuo, recíproco de cosas de un lugar a otro". Considero que para que la traslocación sea efectiva en la preservación de los ecosistemas del desierto, nosotros los científicos, los generadores del conocimiento y los expertos en la disciplina, debemos iniciar un proceso mental interno de traslocación. Para ésto se requiere de un ejercicio de cambio de óptica de nuestro enfoque, uno que probablemente empiece por nuestra re-educación y conceptualización de las cosas. De esta manera, lo que ofrezcamos al público como transmisores del conocimiento, servirá también como mecanismo disparador para traslocación como una herramienta de conservación. Mi presentación es una propuesta para construir un modelo de educación ambiental que reconfirmará el conocimiento de los expertos, como ellos lo ven, como ellos construyen el conocimiento y como ellos comunican sus tema al público. Así iniciaremos el proceso partiendo de la conceptualización que los diferentes actores tienen en relación a la conservación en una bioregión dada. El proyecto incorpora, como una herramienta de trabajo, la matriz de correlación mezclada con el principio de obtención de información del GIS. La intención es asegurar que la traslocación entre lo cultural, económico y ambiental tenga lugar como un requisito para la sustentabilidad articulada con la conservación de nuestros recursos. La meta del proyecto es lograr que los miembros del DFC contribuyan en cualquier forma para la creación de programas

de educación ambiental como la unión faltante para la sensibilización pública. Se hace una presentación esquemática como el mecanismo inicial en obtener nuestro objetivo para la traslocación como la herramienta de conservación en la preservación de los peces del desierto.

ZUCKER, S.*; CROWL, T. A.; ARCHER, E.; THIEDE, G. (Ecology Center and The Department of Fisheries and Wildlife, Utah State University, Logan, UT)

The potential effects of floodplain restoration on carbon flow in the Upper Colorado River Basin

KEYWORDS: floodplains; carbon; invertebrate production; resources; Green River; Utah

ABSTRACT

The Upper Basin Recovery Program has placed a high priority on developing and enhancing floodplain habitats within the upper Colorado River Basin. These actions are intended to provide nursery habitats for native fishes as well as to provide enhanced food resources and water quality. We examined the potential role that these habitats might play, specifically in carbon flow during the spring peak flow period of this year. We compare our productivity estimates to the river channel proper, as well as other low velocity habitats such as backwaters formed behind sandbars.

RESUMEN

El programa de recuperación del Upper Basin tiene lcomo prioridad alta el desarrollo y mejoramiento de hábitats de planicies de inundación, dentro de la parte alta de la Cuenca del Río Colorado. Estas acciones están planeadas para proveer hábitat de criadero para peces nativos así como proveer aumento de los recursos alimenticios y la calidad del agua. Examinamos el papel potencial que estos hábitat pueden jugar, específicamente en el flujo del carbón durante el flujo del pico de primavera de este año. Comparamos nuestra productividad estimada para el canal del río, así como también otros hábitat de velocidad baja como agua estancada formada atrás de los bancos de arena.

DESERT FISHES COUNCIL ANNUAL BUSINESS MEETING

Saturday, November 19, 1995

Executive Secretary Phil Pister called the business meeting to order at 15:15 and acknowledged the Local Committee and DFC committees who helped put the meeting together. Special recognition was afforded Glenn Clemmer, Peter Rissler and other local committee members.

The financial report, given by Phil was summarized as: Current balance = $5,600, printing the DFC Proceedings = about $2,000, other costs such as incidental meeting expenses were not available.

Phil read letters from John Rinne, Bob Behnke and Bob Miller expressing their regrets for not being able to attend the 1995 annual meeting.

Dean Hendrickson proposed an amendment to the Constitution/Bylaws to expand the list of Executive Committee officers to:

Executive Secretary
Chairperson
Chairperson-elect
Past-Chairperson
Chair of Proceedings Committee (= Editor)
Chair of Membership Committee
Chair of Program Committee
Chair of Area Coordinators Committee

The amendment was approved without dissent.

Dean commented that limiting the number of papers to assure single session meetings not longer than 3 days on a schedule of 8:30-17:00 (including morning and afternoon coffee breaks) would insure that meetings were enjoyable and that we would have plenty of time for discussion. The issue was left for further discussion and a decision at next year's meeting, which is expected to be small and thus allow for such a schedule anyway. Resolution of this issue will be needed before the call for papers for the 1997 meeting in Death Valley.

Nadine Kanim, Chair Area Coordinators Committee, reported members concurred that they like the Area Coordinators approach and it was recommended to continue it with some attempts made to improve communications and coordination. Nadine reminded members that it was now up to the individuals to make sure that their agencies were aware of the DFC meeting each year. The Area Coordinators will be listed in the Proceedings and it will be up to them to determine how their respective regional reports will be accomplished.

A drop in membership (from 500+ down to 224) was pointed out. We need to remember that registration at the annual meeting is not the same as paying membership dues.

A motion was made to drop "North America" from the mission statement of the Council, and the change was approved unanimously.

Report on next year's meeting in La Paz: Hotel rates ~$60/night; a charter bus trip is a possibility; the meeting will be the first or second week in November.

The Nominating Committee proposed Mike Douglas as the new DFC chairperson-elect. Mike accepted the nomination and was unanimously elected.

The growth of the WWW system was briefly discussed and contributions for the DFC page were solicited. A proposal to create a DFC listserv was explained, and it was decided that such should be established. Subscription will be limited to paid DFC members who submit their e-mail address to Paul Marsh, Membership Committee Chair, for inclusion in the membership database. Paul will provide periodic updates of the database to Dean for updating the list of listserv subscribers. The purpose of the Listserv is to improve discussion, general communications and interactions among DFC members. Dean Hendrickson will establish this service by January, 1996.

W.L. Minckley made a motion that DFC pursue an affiliation with American Rivers, such as a MOU regarding actions of mutual benefit. It was discussed and approved.

Walt Courtenay introduced two resolutions:

RESOLUTION 95-1, Relative to the ANIMAS-LA PLATA PROJECT
-unanimously approved-

RESOLUTION 95-2, Relative to the formal closure of the watershed surrounding Cienega Creek, Pima County, Arizona, to fishing activities
-unanimously approved-

Gary Garrett, Proceedings Committee Chair, provided a brief accounting of new directions and deadlines for the Proceedings. Manuscripts will be peer reviewed and need to be submitted to the editor by February 1st.

The Carl L. Hubbs Best Student Paper Award went to Ruby Sheffer for her paper entitled "Defining fitness as a criterion for translocation in the endangered Gila topminnow *Poeciliopsis occidentalis occidentalis*".

The Constitution and Bylaws reprinted on pages 107-115 reflect the amendment expanding the list of Executive Committee officers and also has been reworded to represent a more generic designation of titles, etc. (e.g., Chairman is now Chairperson).

RESOLUTIONS PASSED AT BUSINESS MEETING

RESOLUTION 95-1 - RELATIVE TO THE ANIMAS-LA PLATA PROJECT

WHEREAS, the proposed Animas-La Plata Project in southwestern Colorado and northwestern New Mexico would cause irreparable harm to the aquatic resources of the Animas, LaPlata, and San Juan rivers; and

WHEREAS, the San Juan and Animas rivers are necessary to recover the endangered Colorado squawfish and razorback sucker; and

WHEREAS, the proposed Animas-LaPlata Project would disrupt traditional small farm irrigation practices in the Animas River valley and thus the economic viability of these enterprises; and

WHEREAS, the justification for the proposed project is to settle Native American water rights claims; and

WHEREAS, proponents of the proposed Animas-LaPlata Project have divided it into two "phases" to ensure continued federal funding and support; and

WHEREAS, the primary beneficiaries of Phase I of the proposed Animas-LaPlata Project are non-Native American entities; and

WHEREAS, the current estimated cost of the proposed Animas-LaPlata Project is in excess of $750,000,000, and the estimated cost:benefit ratio of the proposed Animas-LaPlata Project is only 1:0.30; and

WHEREAS, there are less environmentally damaging and more cost effective means to settle Native American water rights claims; and

WHEREAS, alternative means to settle Native American water rights claims have not been thoroughly investigated nor analyzed;

THEREFORE BE IT RESOLVED that the Desert Fishes Council, an international society composed of professionals from academic, government, and private organizations and private individuals, at its 1995 annual meeting, held in Reno, Nevada, 16 - 19 November, recommends that alternative means of satisfying Native American water rights that fully incorporate the recognition and protection of the values of southwestern desert rivers and the unique life forms they support be developed and implemented; and

BE IT FURTHER RESOLVED that the Desert Fishes Council is opposed to further development of the ill-considered, economically unfeasible, and environmentally devastating Animas-LaPlata project; and

BE IT FURTHER RESOLVED that copies of this resolution be sent to the Secretary of the Interior, Directors of the Bureau of Reclamation and the U.S. Fish and Wildlife Service, Members of the U.S. Congress, and the Governors of the States of Colorado and New Mexico.

PASSED BY UNANIMOUS VOTE

RESOLUTION 95-2 - RELATIVE TO THE FORMAL CLOSURE OF THE WATERSHED SURROUNDING CIENEGA CREEK, PIMA COUNTY, ARIZONA, TO FISHING ACTIVITIES

WHEREAS, Cienega Creek, Pima County, Arizona, supports the largest population of the biologically imperiled Gila topminnow *Poecilliopsis occidentalis* remaining in the State of Arizona, and supports one of the last remaining populations of biologically imperiled Gila chub *Gila intermedia*; and

WHEREAS, this topminnow population is one of the last of nine wild populations left in the United States and one of three not yet contaminated by non-native fish species; and

WHEREAS, non-native fishes are a major factor in the continuing decline of native fishes including Gila topminnow and Gila chub; and

WHEREAS, the activity of fishing in proximity to waters with threatened and endangered native fishes greatly increases the opportunity for spread of non-native sport and bait species that are likely to further imperil these two fishes through establishment in Cienega Creek via human transfer or flood events; and

WHEREAS, control of fish transfers by humans is difficult to regulate, but fishing activities, which constitute the impetus for many fish transfers, can be effectively controlled;

THEREFORE BE IT RESOLVED that the Desert Fishes Council, an international society composed of professionals from academic, government, and private organizations and private individuals, at its 1995 annual meeting, held in Reno, Nevada, 16-19 November, strongly recommends that the Arizona Game and Fish Commission formally close the Cienega Creek watershed, or an appropriate portion thereof, to sport fishing for the conservation of Gila topminnow and Gila chub; and

BE IT FURTHER RESOLVED that other native fish communities in other basins in Arizona are in need of like protection from further spread of non-native sport and bait fishes.

PASSED BY UNANIMOUS VOTE

RESOLUCIONES PASADAS A LA REUNION DE NEGOCIOS
(Traducción al Español)

RESOLUCION 95-1 - RELATIVAS AL PROYECTO ANIMAS-LA PLATA

CONSIDERANDO QUE, el proyecto propuesto de Animas-La Plata en el suroeste de Colorado y Noroeste de Nuevo México podría causar daño irreparable a los recursos acuáticos de los ríos Animas, La Plata y San Juan; y

CONSIDERANDO QUE, los ríos San Juan y Animas son necesarios para recuperar los peces en peligro, salmon blanco y matalote jorobado; y

CONSIDERANDO QUE, el proyecto propuesto Animas-La Plata podría interrumpir pequeñas granjas tradicionales de prácticas de irrigación en el valle del Río Animas y además la viabilidad económica de estas empresas; y

CONSIDERANDO QUE, la justificación para el proyecto propuesto es establecer demandas de derechos de agua para Americanos Nativos; y

CONSIDERANDO QUE, proponentes del proyecto propuesto Animas-La Plata lo han dividido en dos "fases" para asegurar la continuación de los fondos federales y el apoyo; y

CONSIDERANDO QUE, los beneficiarios primarios de la fase I del proyecto propuesto Animas-La Plata son entidades para Americanos no nativos; y

CONSIDERANDO QUE, el costo actual estimado del proyecto propuesto de Animas-La Plata es mayor de $750,000,000 y la tasa de costo:beneficio estimado del proyecto es solamente 1:0.30; y

CONSIDERANDO QUE, haya menos daño ambiental y hay otras maneras mas efectivas en cuanto a costos de establecer las demandas de derechos de aguas para los Americanos nativos; y

CONSIDERANDO QUE, el significado de las alternativas para asegurar las demandas de los derechos de agua de los Americanos Nativos no han sido investigadas o analizadas directamente; y

POR LO TANTO SE RESUELVE QUE el Desert Fishes Council, una sociedad internacional compuesta de profesionales y académicos, gobierno, organizaciones privadas e individuos privados en la reunión anual de 1995, efectuada en Reno, Nevada, del 16 al 19 de noviembre, recomienda que se desarrollan e implementan maneras alternativas de satisfacer a los derechos de agua de los Americanos Nativos que incorporan completamente el reconocimiento y protección de los valores de los ríos del suroeste del desierto y la forma de vida única que ellos soportan; y

ADEMAS SE RESUELVE QUE el Desert Fishes Council se opone a seguir con el desarrollo de este proyecto mal-considerado, económicamente infactible, y ambientalmente devastadoro; y

ADEMAS SE RESUELVE QUE copias de esta resolución serán enviadas a la Secretaría del Interior (Secretary of the Interior), Directores del Bureau of Reclamation and The U.S. Fish and Wildlife Service, miembros del Congreso y los Gobernadores de los Estados de Colorado y Nuevo México.

APROBADA POR UNANIMIDAD

RESOLUCION 95-2 - RELATIVO A LA CLAUSURA FORMAL DE LA CUENCA QUE RODEA A CIENEGA CREEK, PIMA COUNTY, ARIZONA, PARA ACTIVIDADES DE PESCA

CONSIDERANDO QUE, Cienega Creek, Pima County, Arizona, soporta la mas grande población del biológicamente en riesgo Gila topminnow *Poecilliopsis occidentalis*, que queda en el estado de Arizona, y que soporta una de las últimas poblaciones remanentes del biológicamente en riesgo Gila chub *Gila intermedia;* y

CONSIDERANDO QUE, esta población de topminnow es una de las últimas de nueve poblaciones silvestres dejadas en los Estados Unidos y una de las tres que no están todavía contaminadas por peces no-nativos; y

CONSIDERANDO QUE, la actividad de pesca en la proximidad de aguas con peces nativos amenazados o en peligro de extinción, incrementa grandemente la oportunidad para dispersar especies no-nativos que aumentará el riesgo aún de su establecimiento en Cienega Creek pro medio de la transferencia vía humana o eventos de flujo; y

CONSIDERANDO QUE, el control de la transferencia de peces por humanos es difícil de regular, pero las actividades de pesca, las cuales constituyen el estímulo para muchos transportistas de peces, puede ser efectivamente controlado;

POR LO TANTO SE RESUELVE QUE, el Desert Fishes Council, una sociedad internacional compuesta por profesionales de academias, gobierno, organizaciones privadas e individuos privados, en la reunión anual 1995, llevada a cabo en Reno, Nevada del 16 al 19 de noviembre, recomienda fuertemente que la Comisión del Arizona Game and Fish formalmente prohibe la pesca deportiva en la cuenca ed Cienega Creek, o una porción apropiada para la conservación de Gila topminnow y Gila chub; y

Y ADEMAS, SE RESUELVE QUE, otras comunidades de peces nativos de otras cuencas en Arizona también necesitan protección similar contra la introducción a sus habitats de peces no-nativos de deporte o de cebo.

APROBADA POR UNANIMIDAD

CONSTITUTION OF THE DESERT FISHES COUNCIL

ARTICLE I

NAME

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

ARTICLE II

PURPOSE AND OBJECTIVES

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

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

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

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

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

ARTICLE III

MEMBERSHIP

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

ARTICLE IV

OFFICERS

The officers of the Council shall be a Chairperson, Chairperson-elect, Executive Secretary, Proceedings Committee Chairperson, Membership Committee Chairperson, Program Committee Chairperson, and Area Coordinator Committee Chairperson, whose duties are described in the Bylaws.

ARTICLE V

MEETINGS

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

ARTICLE VI

MANAGEMENT

The Council shall be governed by an Executive committee.

ARTICLE VII

TAX EXEMPT STATUS

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

ARTICLE VIII

DISSOLUTION

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

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

ARTICLE IX

TAX EXEMPT STATUS - ADDENDUM

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

As revised to November 19, 1995.

BYLAWS OF THE DESERT FISHES COUNCIL

ARTICLE I

MEMBERSHIP

Applications for membership shall be transmitted in writing to the Membership Committee Chairperson on forms provided by the Council.

ARTICLE II

MANAGEMENT

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ARTICLE III

COMMITTEES AND STAFF

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Section 21. Recommendations. Council members may recommend adoption of resolutions by submitting such to the Chairperson of the Resolutions Committee at least 30 days prior to the annual Council Meeting.

Section 22. Limitations. Resolutions will be limited to subjects directly related to the management, conservation and protection of desert fishes or their habitat, or resolutions of gratuity or memorial.

Section 23. Proceedings Committee. Shall be composed of an editor and five assistants chosen by the Committee chairperson.

Section 24. Obligation. It shall be the responsibility of the Proceedings Committee to publish the annual proceedings.

Section 25. Technical Advisory Committee. Shall be composed of Council members as follows: The Executive Committee, 2 field biologists from separate States, 3 faculty members from educational institutions carrying on research on desert fishes, and 3 individuals selected from the membership at large.

Section 26. Obligations. It shall be the responsibility of the Technical Advisory Committee to the direction of the Chairperson in providing assistance technical knowledge and expertise directed toward the serve at and preservation of the desert fishes, and to perform other duties as outlined in the Constitution.

Section 27. Selection. Technical Advisory Committee members shall be selected by the officers of the Council when necessary.

Section 28. Awards Committee. Shall be composed of four members of the Council.

Section 29. Obligations. It shall be the responsibility of the Awards Committee to evaluate and determine qualified Council members for consideration for any recognition deemed suitable to the cause.

Section 30. Dissolution Committee. Shall be an automatic committee and shall be composed of the existing officers of the Council and the Technical Advisory Committee.

Section 31. Obligation. (See Constitution, Article VIII).

Section 32. Area Coordinators Committee. Shall be appointed consisting of one representative from each drainage area designated under the Constitution, Article II, Section 1, and from other areas considered by the Chairperson to be of interest to the Council.

Section 33. Obligation. It shall be the responsibility of the Area Coordinators Committee to function in a liaison capacity between all members working in the areas involved and the Executive Committee, and as Chairmen of subcommittees appointed by them with the approval of the Chairperson, to assist in compiling annual area reports to be presented at each meeting and assuring rapid dissemination of information among members within and among areas.

Section 34. Membership Committee. Shall be appointed by the Executive Secretary.

Section 35. Obligation. It shall be the responsibility of the Membership Committee to assure that members are notified of the lapse of their membership, and to collect and account for all membership dues payments, to maintain the membership directory and mailing database, and to coordinate with meeting planners and the Executive Committee, and to provide data from the membership database to members and others as approved by the Executive Committee.

Section 36. Miscellaneous Committees. Shall be appointed as needed to fulfill the desires of the Council in pursuing the Objectives and Purposes (See Constitution, Article II).

Section 37. Accountability. All Committees shall be accountable to the Council Chairperson.

Section 38. Tenure. All committees shall serve until new Committees are appointed in their stead, or until the duties assigned have been discharged, in conformance to Article II, Section 4.

ARTICLE IV

MEETINGS

Section 1. Annual Meeting. The Annual Meeting of the Council shall be during the first three weeks of November, as determined by the Executive Committee.

Section 2. Location. The Annual Meeting shall be held at the location determined by the Executive Committee.

Section 3. Meeting Notice. Notice of such meetings shall be given to the Executive Secretary at least six months prior to the Annual Meeting. Council members shall be notified at least ninety days prior to the Annual Meeting.

Section 4. Quorum. The quorum shall be over 50 per cent of the indexed membership or 20 members, whichever is less.

Section 5. Meeting Rules. The rules contained in the latest revision of Roberts' Rules of Order shall govern the Council in all cases in which they are applicable, and in which they are not inconsistent with the Bylaws or the special rules of order of the Council.

Section 6. Special Meetings. Special meetings may be called as necessary by the Chairperson or a majority of the full Council, and shall be called whenever requested in writing by 20 members of the Council.

Section 7. Minutes of Meetings. Minutes of all meetings shall be recorded by the Executive Secretary or any member designated by the Chairperson. Minutes of Committee meetings shall be recorded by the designated Secretary of such Committee.

ARTICLE V

FINANCES

Section 1. Finance. Funds of the Council shall be under the supervision of the Executive Secretary.

Section 2. Disbursement. The Executive Secretary shall make no disbursements of the Council's funds, other than routine purchases, without authorization of the Chairperson. The Executive Secretary shall deposit all funds of the Council in a bank approved by the Executive Committee, at frequent intervals, and in the name of the Council. The Executive Secretary shall balance the accounts at the end of each fiscal year and the report of the Executive Secretary shall reflect the adjustments as required by the annual audit.

Section 3. Audit. An audit of the Council's financial status shall be made at the end of each fiscal year by the officers of the Council.

Section 4. Bond. The Executive Secretary need not be bonded.

Section 5. Funds. Funds shall be derived from dues, special assessments, work projects, and contributions.

Section 6. Dues. Annual dues shall be fifteen dollars for student membership, twenty-five dollars for full membership (foreign or domestic), thirty-five dollars for sustaining membership, and 25 times the annual full membership dues for life membership, payable at the time of the annual meeting. Patron membership is available to companies and corporations for a single payment of one thousand dollars ($1,000).

Section 7. Publication. The cost of producing and distributing the Transactions of the Council shall be covered through dues, the sale of copies, and contributions.

Section 8. Fiscal Year. The fiscal year Council shall end on September 30.

ARTICLE VI

AMENDMENTS TO THE BYLAWS

Bylaws may be adopted, amended or repealed at any annual business meeting by a majority vote of members present.

As revised to November 19, 1995.

INSTRUCTIONS TO AUTHORS - PROCEEDINGS OF DFC

ELECTRONIC FORMAT - All abstracts and manuscripts **must** be submitted in electronic format. Deadlines for abstracts for the Annual Meeting are announced in mailings to the membership each year. Special arrangements for submission of hard copy only of abstracts (strictly for those without access to computers) may be made each year with the Chair of the Local Arrangements Committee who will set an earlier deadline for such submissions. Formats accepted include diskette (all DOS or Macintosh formats) or electronic mail. **Abstracts and manuscripts will be accepted in ASCII format only** and must be formatted as described below.

ASCII (American Standard Code for Information Interchange) format files are easily saved from almost any word processor. Often called "Text" or "Text only" files, they are simply files from which all program-specific formatting codes have been stripped. **Do not** send files saved in your word-processor's unique format (the default way of saving files). To save an abstract as an ASCII file, type text in your word processor, formatting as described below. If sending by E-mail, before saving ASCII file, set margins and/or font so all lines have < 80 characters. If sending a floppy, line lengths < 256 characters are acceptable. Instructions for some word processors follow (actual keystrokes are set in upper case, bold and italicized). If you use another program, consult its documentation.

Ami Pro v.2 (Windows)	*SAVE AS, ASCII & CR/LF AT LINES & 8 BIT PC-ASCII*
MS Word(Mac)v.5	*SAVE AS,TEXT ONLY;*v.4-*SAVE AS,FILE FORMAT,TEXT ONLY*
MS Word(Windows)	*TRANSFER SAVE,TEXT-ONLY-W-LINE-BREAKSinFORMAT*
WordPerfect(DOS)(v. 5.0/5.1)	*CONTROL-F5* (=Text out), *T* or *1* (=DOS Text)
WordPerfect (Windows)	*SAVE AS, ASCII TEXT (DOS)*
WordStar	open non-document file (*N* from the menu), *CONTROL-Q-Q-B*

If submitting a file on floppy disk, name it **"DFCABSTR"** (if > 1 file being submitted on a single disk, use numeric extensions, e.g., DFCABSTR.01, DFCABSTR.02) and put your name and address, the **type of computer** you used (Mac or IBM), and **"DFCABSTR"** on disk label. If E-mail, put "DFC Abstract" in subject line. Receipt of E-mail submissions will be immediately acknowledged via return E-mail. Acknowledgement of receipt of floppy disks will be by ordinary mail. Submission of hard copy is not required, but encouraged since it could be useful if problems are encountered.

ABSTRACT FORMAT REQUIREMENTS - All information must be contained in 8 to 10 blocks (fields) of text **separated from each other by a blank line**. Abstract length is not limited, but recall the definition of "abstract" and the fact that space equals money. Also recall that translation of your abstract is provided by volunteers.

Since diacritical marks are not in the standard ASCII set of characters, use vertical bars (|) around single characters that need accents or other diacritical marks (e.g., "ma|n|ana" will be translated to mañana and "M|e|xico" will become México. All single characters bounded by vertical bars will be translated as in Spanish (áéíóúñ) unless special notice is given of exceptions by submission of highlighted hard copy. Italicized words or phrases should be surrounded by braces ({}), e.g., {Cyprinodon diabolis} = *Cyprinodon diabolis*. Each text string so bounded by braces in any part of the file will be placed in the taxonomic index, so any terms (to be italicized or not) which authors wish to have indexed in the taxonomic index should be bracketed. Do not include > 1 name or taxonomic index entry within a single set of brackets. Order, family, and other category names placed in brackets but not normally italicized will be indexed only. Characters bounded by the caret (^) symbol (e.g., ^superscript^) will be set as $^{\text{superscript}}$ in final copy, and those bounded by underscores (e.g., _subscript_) will be set as $_{\text{subscript}}$. Do not use these special characters anywhere in text where these special features are not to be invoked, and always use them in pairs (e.g., start and stop special features). See sample abstract below.

INSTRUCTIONS TO AUTHORS

Use **mixed upper and lower case** text throughout (see example). Authors are responsible for checking spelling and grammar. Each line must start on the left margin (i.e., no leading spaces or tabs). **Single blank lines are required between text blocks (do not use multiple blank lines)** and, are allowable within text blocks only in the **abstract text** block. Text blocks must be in the order specified below. Blocks 1-8 are required. Follow instructions carefully.

1. The first block is to contain **complete mailing information** for the author making the presentation or person to whom correspondence should be addressed. Enter as multiple lines exactly as if addressing an envelope.
2. The second block is to contain the **list of authors** for the abstract. Each name is to be entered as surname, a comma, and initials, and (if applicable), another comma and other designation (e.g., Jr.). **Use a semicolon (;) to separate authors' names**, and follow all commas and periods with single spaces. Place an asterisk after name of person presenting paper. Maximum allowable number of authors is six.
3. The third block contains the **affiliations** (Department and Institution or Agency and Office, but not full mailing address) of all authors, in the sequence given in the preceding block of text. Authors' affiliations are to be separated by a semicolon, but use authors initials where possible to indicate multiple authors with the same affiliation.
4. The fourth text block contains the **title** of the presentation. Use mixed case text, **not** upper case only.
5. The fifth block of text contains the actual **abstract text**. Be sure to **always use full taxonomic names at least once for indexing purposes**. Bracketed strings containing periods will be italicized, but not indexed.
6. The sixth block contains **keywords** that describe the research. These will be used to compile a combined subject and geographic index for the Proceedings. Begin this block with "KEYWORDS:", followed by up to 10 keywords (or key phrases) **separated by semicolons**. There is no need to place taxonomic terms here for indexing since, if they are bracketed elsewhere in the abstract, they will be indexed in the Taxonomic index. Please do not use obvious keywords like "fishes" - this IS the Proceedings of the Desert Fishes Council, and it can be expected that most papers will contain the word "fishes." If one author uses "fishes," or other similar words common to many papers (desert, river, etc.) as a keyword, all occurrences of it in the volume will be indexed. KEYWORDS are words which characterize the key topics of your paper, and which distinguish it from the others.
7. The seventh block identifies the **type of presentation**. Begin with "PRESENTATION:", then "ORAL" or "POSTER".
8. The eighth block determines the **session** in which the presentation will be made. Begin this block with "SESSION:", then either the word "CONTRIBUTED" or "AGENCY". "AGENCY" refers to presentations made a individual designated by the office of a government or private agency to report on general activities of that office or complex of offices (e.g., a Region). "CONTRIBUTED" refers to reports on individual research or management projects, and not office-wide activity reports, even if the work was done by an agency employee.
9. (Optional) If the presentation is to be considered for a student paper **award**, include a ninth block beginning with "AWARD: " and either "HUBBS", "MILLER", or "BOTH". Eligibility requirements for these awards are given below.
10. (Optional) **Other** text. Enter phone/FAX numbers and presentation needs here, but other information and comments are also welcome. Begin block with "OTHER: " then any text you wish. **There is no need for ANY written communication (e.g., Post-it notes, etc.) with submissions - all such extra communications should be entered here).**

ENGLISH/SPANISH - Abstracts will be accepted in either language or both. If submitting both, do so as a single abstract with English and Spanish versions of the title in the title block separated by " / " and with versions of the abstract separated by a blank line in the abstract text block (see sample abstract below). Your submissions will be translated and/or proofed by the Spanish Language subcommittee of the DFC Publications Committee, but please provide bilingual submissions if at all possible.

FULL-LENGTH MANUSCRIPTS - Full length manuscripts of papers or posters presented at the meeting will be accepted for publication in the DFC Proceedings. These must be submitted (to the same address as abstracts) in

electronic format (as ASCII or word processor files after consultation with the editor). All tables and figures must be done using appropriate word-processor features for tables and figures - do not use spaces and tabs to construct tables. The deadline for submission of manuscripts of papers presented at annual meetings is December 31 of the year of the meeting. Contact the editor before preparing your manuscript to discuss format for figures and graphs. Other format guidelines follow those of *The Southwestern Naturalist*.

AWARDS - Competitors for the Carl L. Hubbs and Frances H. Miller student paper awards must be the sole author and presenter of the paper and enrolled as a student currently or during the 12 months prior to the presentation. The paper must be based on work done while a student. The Frances H. Miller award additionally stipulates that the recipient be a citizen of a Latin American country. Papers are evaluated by a panel of judges on basis of scientific rigor of research (40%), quality & style of presentation (30%), rigor of analysis and interpretation of data (15%), and quality and use of visual aids (15%). Copies of evaluation forms provided on request.

SAMPLE ABSTRACT

(sample as for floppy submission - reduce lines to < 80 characters for E-mail)

Johnny Fishseed
Agency of Fish and Wildlife Disbursement
Hatchery Row
Somewhere, New Mexico 87107

Fishseed,J.D.*^;Growem,B.S.,Jr.;Stockem,I.

JDF and BSG - Agency of Fish and Wildlife Disbursement, Main office, Somewhere, NM; IS - Arizona Department of Fish and Game, Regional Office, Littletown, AZ

Status of native fish production and stockings in rivers, streams, springs and other habitats all over the place / Estado actual de producci|o|n de peces y su distribuci|o|n a r|i|os, manantiales y otros habitats sobre toda la regi|o|n

Twenty seven species native to our area have been produced by the billions (10^9^) at our hatchery and stocked all over the place. Some stockings have worked, others have not. Some fish lived, some died for lack of water (H_2_O). Results will be discussed. Future plans include work with {Cyprinodon} species from M|e|xico.

Se han producido billones (10^9^) de ejemplares de 27 especies nativas a nuestra |a|rea en nuestra estaci|o|n de acuacultura, los cuales se han distribuido a muchos lugares. Algunos introducciones han establecido, otros no. Algunos peces sobrevivieron, otros se murieron por falta de agua (H_2_O). Se discutir|a|n los resultados. Planes futuros incluyen trabajos con especies de {Cyprinodon} de M|e|xico.

KEYWORDS: stocking; propagation; New Mexico; Arizona; hatcheries; M|e|xico; Colorado squawfish; razorback sucker; pupfish

PRESENTATION: ORAL

SESSION: AGENCY

AWARD: BOTH

OTHER: Hey Dean - how's it goin? The electronic abstract submission idea is great! But next time don't reduce the instructions to authors to microfische proportions. If problems, my phone/FAX are 1-800-FOR-FISH/1-800-FOR-FAST; need overhead projector; probably best schedule this at end of a session because it is likely that I'll have to cancel it if my agency travel request isn't approved. It would be nice to have it scheduled right after Jose's talk, since he'll be talking about monitoring of the fish we stock. See you in November.

INSTRUCCIONES A LOS AUTORES PARA LAS MEMORIAS DEL DFC

FORMATO ELECTRONICO - Todos los resúmenes y manuscritos deberán ser sometidos en formato electrónico. La fecha límite para los resúmenes para la Reunión Anual está anunciada en los envíos de correspondencia a los miembros cada año. Se harán arreglos especiales para someter mecanuscritos sólo de resúmenes (estrictamente para aquellos sin acceso a computadoras) cada año con el Presidente del Comite Local de Arreglos quien establecerá la fecha límite próxima de estas. Los formatos aceptados incluyen diskette (formatos DOS y Macintosh) o correo electrónico. **Los resúmenes y manuscritos serán aceptados sólo en formato ASCII** y deberán estar formatedos como se describe abajo.

Los archivos en formato ASCII (Código Americano Standard para Intercambio de Información) son fáciles de gravar usando casi cualquier procesador de palabras. Frecuentemente llamados archivo de "Texto" o "sólo de Texto" son archivos sencillos que no incluyen códigos especiales de uno u otro programa específico, sino codigos que todos programas pueden interpretar. No envíe archivos salvados en el formato nativo de tu procesador de palabras (el camino de default de gravado de archivos). Para gravar un resumen como un archivo ASCII, escribe el texto en tu procesador de palabras formateando como se describe abajo. Si el envío es por Correo-E, antes de salvar el archivo ASCII, inicia márgenes y tipo para que tengan renglones menos de 80 caracteres. Si envías un disco flexible, se aceptan líneas de menos de 256 caracteres. Se indican las instrucciones para algunos procesadores de palabras (teclas actuales están en mayúsculas, negritas y cursivas). Si usas otro programa, consulta la documentación.

Ami Pro v.2 (Windows)	SALVA COMO,ASCII Y CR/LF EN LINEAS Y 8 BIT PC-ASCII
MS Word(Mac)v.5	SALVA COMO, SOLO TEXTO; v.4-SALVA COMO, FORMATO ARCHIVO, SOLO TEXTO
MS Word(Windows)	SALVAR TRANSFER,SOLO-TEXTO-W-LINEA-BREAKSinFORMAT
WordPerferct(DOS) (v.5.0/5.1)	CONTROL-F5(=Texto fuera),T o 1(DOS Texto)
WordPerfect(Windows	SALVA COMO, especificar **TEXTO ASCII (DOS)**
WordStar	abrir archivo no-documento (N del menú), **CONTROL-Q-Q-B**

Si sometes un archivo en disco flexible, nómbralo **"DFCABSTR"** (si más de un archivo es sometido en un sólo disco, usa extensiones numéricas, ejem DFCABSTR.01, DFCABSTR.02) y pon tu nombre y dirección, el **tipo de computadora** que usaste (Mac o IBM), y **"DFCABSTR"** en la etiqueta del disco. Si usas Correo-E, pon "DFC Abstract" en la línea de asignación. La recepción de envíos por Correo-E será agradecida inmediatamente vía regreso Correo-E. el agradecimiento de envíos en discos flexibles se hará por correo ordinario. No se requiere el sometimiento de copias de disco duro, aunque será fomentado de ser necesario si se detectan problemas.

FORMATO DE REQUERIMIENTO DEL RESUMEN - Toda la información deberá estar contenida en 8 a 10 bloques (campos) de texto **separados de los otros por un renglón**. La longitud del resumen no está limitada, pero la anulación de la definición de "resumen" y de hecho el espacio, es igual a dinero.

Aunque los signos diacríticos no están en los caracteres ASCII standares, usa barras verticales (|) alrededor de un caracter que necesite acento u otro signo diacrítico (e.g., ma|n|ana, será traducido como mañana y M|e|xico será México. Los caracteres individuales rodeados con barras verticales serán traducidos al Español (áéíóúñ) a menos que un aviso especial muestre las excepciones por sometimiento de copia dura resaltada. Palabras o frases en cursivas deberán rodearse de llaves ({}), e.g., {Cyprinodon diabolis} = *Cyprinodon diabolis*. Cada texto encerrado por llaves en cualquier parte del archivo será puesto en el índice taxonómico, así cualquier término (sea en cursivas o no) que los autores deseen incluir en el indice taxonómico deberá estar entre llaves. No incluya más de un nombre o índice taxonómico dentro de un sólo juego de llaves. Sólo serán indexados ordenes, familias y otros nombres categóricos colocados en llaves pero no en cursivas. Caracteres rodeados por el símbolo ^ (e.g., ^superíndice^) serán puestos como $^{\text{superíndice}}$ en copia final, y aquellos rodeados de códigos bajos (e.g., _subíndice_) serán puestos como $_{\text{subíndice}}$. No use estos caracteres especiales en ninguna parte del texto donde estos caracteres no sean invocados, y siempre use

los en pares (e.g., rasgos especiales de inicio y alto). Ver resumen de ejemplo abajo.

Use **mayúsculas y minúsculas** a través del texto (ver ejemplo). Los autores son responsables de revisar la ortografía y gramática. Cada línea debe empezar en el margen izquierdo (e.g., sin espacios o tabuladores). **Se requiere un renglón en blanco entre párrafos (no use renglones múltiples)** y está permitido sólo dentro de los párrafos del texto en el **texto del resumen**. Los párrafos de texto deberán ir en el orden especificado abajo. Se requieren los primeros 8 párrafos. Siga las instrucciones cuidadosamente.

1. El primer bloque es para contener **información completa de la dirección** del autor que hace la presentación o persona a quien corresponda ser enviada. Escriba las líneas exactamente como si rotulara un sobre.
2. El segundo bloque contiene la **lista de autores** del resumen. Cada nombre será escrito como apellido, una coma, e iniciales, y (si es aplicable) otra coma y otra designación (e.g., Jr.). **Use punto y coma (;) para separar los nombres de los autores**, y las siguientes comas y períodos con espacios simples. Ponga un asterisco después del nombre de la persona que presenta el trabajo. El máximo permitido de autores es seis.
3. El tercer bloque contiene la **afiliación** (Departamento e Institución o Agencia y Oficina, pero no la dirección completa) de todos los autores, en la secuencia dada en el bloque de texto precedente. La afiliación de los autores estará separada por un punto y coma, pero utilice iniciales donde sea posible para indicar muchos autores con la misma afiliación.
4. El cuarto bloque contiene el **título** de la presentación. Use mayúsculas y minúsculas, **no** sólo mayúsculas.
5. El quinto bloque del texto contiene el **texto del resumen**. Asegúrese de **siempre usar nombres taxonómicos completos al menos una vez para propósitos de índice**. Lo tecleado en llaves conteniendo períodos estarán en cursivas, pero no indexadas.
6. El sexto bloque contiene las **palabras claves** que describen la investigación. Esto será usado para compilar un índice de materias y geográfico para las Memorias. Inicie este bloque con "KEYWORDS: " seguido por más de 10 palabras claves (o frases claves) **separadas por punto y coma (;)**. Aquí no se necesita lugar para términos taxonómicos como si están las mismas palabras entre llaves en el resumen, serán incluidos en el Indice Taxonómico. Favor usar palabras claves sensibles. Estos es el Proceedings del Consejo de los Peces del Desierto, y si un autor usa la palabra clave "peces" generará indexo a todos los trabajos que contengan esa palabra, o sera a casi todos. Palabras claves son las palabras que caracterizan su trabajo y que lo distinguen de los demas.
7. El séptimo bloque identifica el **tipo de presentación**. Inicie con "PRESENTATION: ", y luego "ORAL" o "POSTER".
8. El octavo bloque determina la **sesión** en la cual la presentación será hecha. Inicie este bloque con "SESSION: ", entonces la palabra "CONTRIBUTED" o "AGENCY". "AGENCY" se refiere a la presentación hecha por un individuo designado por la oficina de un gobierno o agencia privada para reportar sobre las actividades generales de la oficina o complejo de oficinas (e.g., una Región). La "CONTRIBUTED" se refiere a los reportes de un sólo investigador o manejador de proyectos, y no reportes de actividades de oficinas, aun si el trabajo fue hecho por un empleado de una agencia.
9. (Opcional) Si la presentación es considerada como un **premio** para presentación de estudiante, incluye un noveno bloque iniciando con "AWARD: " y después "HUBBS", "MILLER" o "BOTH" (=AMBOS). Los requerimientos para estos premios se dan a continuación.
10. (Opcional) **Otro** texto. Escriba número de teléfono/FAX y las necesidades de la presentación, pero información adicional y comentarios serán bien venidas. Inicia el bloque con "OTHER: " y luego el texto que quiera. **No se necesita NINGUNA comunicación escrita (e.g., notas adheribles, etc.) con los resúmenes sometidos - todas las comunicaciones deberán entrar aquí).**

INGLES/ESPAÑOL - Los resúmenes serán aceptados en cualquiera de las dos lenguas. Si somete las dos, hágalo como un sólo resumen con versiones en Inglés y Español para el título en el bloque de título separado por "/" y con versiones del resumen separadas por un renglón en blanco en el bloque de texto del resumen (ver ejemplo de resumen abajo). Tus resúmenes sometidos serán traducidos y/o revisados por el Subcomité de Lenguaje Español del Comité de Publicaciones del DFC, pero por favor someta una versión bilingüe si es posible.

MANUSCRITOS COMPLETOS - Los manuscritos completos de trabajos o carteles presentados en la reunión serán aceptados para su publicación en la Memorias del DFC. Estos deben ser sometidos (al mismo nombre y dirección) en formato electrónico (como archivos ASCII). La fecha límite para someter los manuscritos de presentaciones orales de la reunión es diciembre 31 del año de la reunión. Contacte al editor antes de preparar su manuscrito para discutir el formato para figuras y gráficas. Otras guías de formato siguen las de *The Southwestern Naturalist*.

PREMIOS - Los competidores para los premios Carl. L. Hubbs y Frances H. Miller para trabajos de estudiantes serán para sólo un autor y ponente del trabajo e involucrado como un estudiante actualmente o durante los 12 meses anteriores a la presentación. La presentación deberá estar basada en el trabajo hecho cuando es estudiante. El premio Frances H. Miller estipula adicionalmente que el receptor sea ciudadano de un país de América Latina. Los trabajos serán evaluados por un grupo de jueces sobre bases de rigor científico de investigación (40%), calidad y estilo de la presentación (30%), rigor en el análisis e interpretación de los datos (15%) y calidad de uso del material audiovisual. Se proveerán copias de las formas de evaluación bajo requisición.

RESUMEN DE MUESTRA

(muestra como para disco flexible - reduce a menos de 80 carácteres en cada línea para Correo-E)

Johnny Fishseed
Agency of Fish and Wildlife Disbursement
Hatchery Row
Somewhere, New Mexico 87107

Fishseed,J.D.^*^;Growem,B.S.,Jr.;Stockem,I.

JDF and BSG - Agency of Fish and Wildlife Disbursement, Main office, Somewhere, NM; IS - Arizona Department of Fish and Game, Regional Office, Littletown, AZ

Status of native fish production and stockings in rivers, streams, springs and other habitats all over the place / Estado actual de producci|o|n de peces y su distribuci|o|n a r|i|os, manantiales y otros habitats sobre toda la regi|o|n

Twenty seven species native to our area have been produced by the billions (10^9^) at our hatchery and stocked all over the place. Some stockings have worked, others have not. Some fish lived, some died for lack of water (H_2_O). Results will be discussed. Future plans include work with {Cyprinodon} species from M|e|xico.

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KEYWORDS: repoblamiento; propagación; granjas; M|e|xico; charal del Colorado; matalote jorobado; cachorrito

PRESENTATION: ORAL

SESSION: AGENCY

AWARD: BOTH

OTHER: Hola Dean - ¿Que tal? ¡La idea de someter resúmenes electrónicos es buena! Mi teléfono y FAX son 1-800-FOR-FISH/1-800-FOR-FAST; necesito proyector de cuerpos opacos; *probablemente el mejor horario es al final de una sesión* porque parece que tendré que cancelar si mi agencia no aprueba mi petición de viaje. Estaría bien quedar colocado justo después de la de José, como el hablará del monitoreo de los peces que sembramos. Nos vemos en Noviembre.

AUTHOR INDEX / INDICE DE AUTORES

KEYWORD INDEX / INDICE DE PALABRAS CLAVES

TAXONOMIC INDEX / INDICE TAXONOMICO

Gibbs Award for Excellence in Systematic Ichthyology

Nominations are invited for the **American Society of Ichthyologists and Herpetologists** (ASIH) Robert H. Gibbs, Jr. Memorial Award for Excellence in Systematic Ichthyology.

Prizes are awarded for an outstanding body of published work in systematic ichthyology by a citizen of a Western Hemisphere nation who has not been a recipient of the award. The award is offered annually and consists of an appropriate plaque and a cash sum. The award recipient is announced at the annual meeting of the ASIH. The award for 1996, including a plaque and $6,000, was presented to Dr. William A. Goslin, Museum of Zoology, University of Michigan, Ann Arbor, for his many contributions to teleost phylogeny and functional morphology.

Nominations may be made by any ichthyologist, including self nominations, and should include the nominee's curriculum vitae, and detail the nominee's specific contributions and their impact on systematic ichthyology. Nominations must be received by March 1 of the year to be eligible for the award for that year. Nominations will be effective for three award periods. Four copies of each nomination should be sent to Dr. Dean Hendrickson, Texas Natural History Collections - R4000; University of Texas at Austin; Austin, Texas 78712-1100, U.S.A.