Department of Defense
Legacy Resource Management Program

05-112

Conserving Integral Units of Chihuahuan Desert Biodiversity:
Population dynamics for recently introduced populations of White Sands pupfish

Preliminary Report

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February 2006

POPULATION DYNAMICS FOR RECENTLY INTRODUCED POPULATIONS OF WHITE SANDS PUPFISH: A PRELIMINARY REPORT

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Submitted to Department of Defense Legacy

February 2006

Introduction

The translocation of wild animals to establish or re-establish additional populations has become a common management strategy (Williams et al. 1988; Minckley 1995: Stockwell & Leberg 2002), and yet such populations are rarely well monitored. This is especially critical during early establishment as such populations may experience un-documented demographic bottlenecks and a loss of genetic variation (Stockwell et al. 1996). Desert fish have been extensively translocated (Hendrickson and Brooks 1991; Stockwell et al. 1996). Many of these transplant attempts have failed, often soon after the initial transplant. The genetic effects of such transplants have been studied for various pupfish species (Turner, 1984; Ashbaugh et al. 1995; Stockwell et al. 1998; Heilveil and Stockwell, submitted); however, replicated transplants have rarely been conducted offering an opportunity to evaluate the likelihood that such populations diverge from each other as well as from the source population.

Here I report demographic data for 7 experimental populations of the White Sands pupfish (*Cyprinodon tularosa*). These ponds were established to evaluate demographic and evolutionary responses of pupfish to relatively novel habitats. Fish were transplanted from a saline river to a series of brackish ponds. This experiment was conducted to replicate a historic translocation of fish from Salt Creek to Mound Spring (Stockwell et al. 1998; Pittenger and Springer 1999), which had both ecological and evolutionary implications in terms of altered parasite loads and rapid evolutionary divergence (Stockwell et al. 1998; Stockwell and Mulvey 1998; Stockwell & Leberg 2002; Collyer et al. 2005; Rogowski & Stockwell 2006).

STUDY SYSTEM

Fifteen ponds were established with 9 and 6 ponds, each pond hosting fish from Salt Creek and Lost River, respectively. Each population was founded by 100 female and 100 male fish (all approximately 30-40mm in size). In fall of 2001, a record setting flood connected 5 of these ponds (2 Salt Creek and 3 Lost River) which were thus lost to the experiment. Of the remaining 3 Lost River ponds, 1 pond underwent a natural extinction. Thus, the current report focuses on the population dynamics of the 7 Salt Creek ponds.

For each of the experimental ponds, I conducted mark-recapture on a bi-annual basis starting during summer, 2002 (Table 1). Each pond was sampled by using 22 un-baited minnow traps deployed from the shore. In general, traps were deployed in the morning and fish removed, counted and marked in late afternoon. With the exception of one occasion, trap mortality was relatively low. Each fish was marked by removing a small piece of the caudal fin. Fins apparently regenerated between sampling periods, as marked fish were only occasionally observed in the subsequent seasonal sampling session. Recapture sessions were conducted between 2 and 6 days after the marking session. As the ponds were relatively small (~ 8m X 12m), this was more than sufficient time for population mixing to occur.

RESULTS

Pond population sizes fluctuated widely, but most showed considerable growth beginning in 2005 (Table 1, Figure 1). Three populations had population sizes below the founding size of 200 individuals (Ponds 11, 16 and 17), and the latter two populations dipped below 50 individuals (Table 1, Figure 1). All three of these populations recovered to large sizes. Populations 16 & 17 which both dropped in number also showed signed of a genetic bottleneck as measured by reduced genetic diversity and altered allele frequencies (Stockwell and Heilveil, unpublished data).

FOLLOWUP WORK

Of the seven ponds that were continuously monitored, 3 underwent population declines and two of the seven (ponds 16 & 17) declined to under 50 fish. A separate data genetic genetic data set is consistent with this observation and shows that ponds 16 and 17 also experienced severe genetic bottlenecks as reflected in loss of alleles and a change in gene frequencies (Stockwell and Heilveil unpublished data). These demographic and genetic data will be included in a final manuscript to be submitted for publication in 2007.

ACKNOWLEDGMENTS

We thank H. Reiser for her assistance in obtaining funding and establishing the experimental ponds. Special thanks to C. Teske for his assistance in maintaining the experimental pools. K. Messer, H. Reiser, D. Rogowski, M. Collyer, R. Wilson, S. Teske, also assisted in maintaining the experimental pools. M. Collyer, D. Harstad, D. Moen, H. Reiser, D. Rogowski and J. Terfehr all assisted with transplanting fish into the experimental ponds. K. Messer, H. Reiser, J. Stockwell, B. Stockwell, C. Teske, S. Teske, J. C. Teske, J. Terfehr, J. Vinje all assisted with the mark-recapture sessions. We are grateful to R. Myers (Range Geologist, Environmental Stewardship Division) and T. A. Ladd (Director, Environment and Safety Directorate, U. S. Army, White Sands Missile Range), J. Dye and H. Rieser (CES/CEV, Holloman AFB) for arrangement of range visitation. Laboratory support was provided by Holloman Air Force Base. Research was supported by U. S. Department of Defense Legacy Program funding No. DACA87-00-H-0014 to C. A. S., administered by M. H. Reiser and J. Dye, 49 CES/CEV, Environmental Flight, Holloman AFB, NM.

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Table 1. Population estimates based on mark recapture. Lower and upper values represent range of estimates with 95% confidence.

Pond No.	2001 Summer	2002 Summer	2003 Winter	2003 Summer	2004 Winter	2004 Summer	2005 Winter	2 Su
Pond 8	200	1994 - 2344	510 – 552	1812 – 1839	2502 – 3188	2904 - 3025	3380 – 4740	4099
Pond 9	200	455 – 470	637 – 759	1839 – 1979	1240 – 2090	721 – 2610	1141 – 2003	2987
Pond 11	200	336 – 350	**166 – 284**	412 – 417	463 – 1314	1355 – 1825	1719 – 2620	5046
Pond 14	200	888 – 970	1820 - 2127	1692 – 1716	1039 – 1060	1256 - 1304	2002 – 2251	3298
Pond 16	200	**139 – 142**	**21 – 217**	**20 – 33**	**6 – 40**	**88 - 107**	199 - 289	3427
Pond 17	200	680 – 707	166 – 425	144 – 166	**47 – 105**	588 – 627	1166 - 1250	4675
Pond 18	200	580 - 582	237 - 283	396 - 410	519 - 4663	678 - 959	2579 - 3299	1671

Figure 1. The estimated minimum estimate based on mark-recapture work is provided for each of the 7 populations that were descended from Salt Creek.