3 August 1993

To: Manager, Desert Refuge Complex
From: Fish and Wildlife Biologist, Ash Meadows Refuge
Subj: Biannual Fish Survey, Spring 1993

Summary

A total of 3378 Ash Meadows Amargosa Pupfish (Cyprinodon nevadensis mionectes), 187 Warm Spring Pupfish (C.n. pectoralis) and 427 Ash Meadows Speckled Dace (Rhinichthys osculus nevadaensis) were trapped at 10 springs between 6 April and 4 May at Ash Meadows NWR. Amargosa pupfish numbers were up in 4 of 5 springs, Warm Spring pupfish numbers were down in 3 of 4 springs and speckled dace numbers were down slightly in all 5 spring locations compared to 1991-92 spring surveys. Numbers of juveniles were down in all 10 springs compared to 1991-92 spring surveys. Exotic fish trapped and removed included 83 sailfin molly (Poecelia latipinna), 588 mosquitofish (Gambusia affinis) and 764 crayfish (Procambarus clarkii).

Introduction

The biannual fish survey was initiated in 1989 to monitor population trends of federally endangered fish species at Ash Meadows NWR. Item 421 of the Draft Recovery Plan for the Endangered and Threatened Species of Ash Meadows, Nevada states that representative endangered fish populations should be monitored on a biannual basis. Six spring pools were initially selected due to their vulnerabilities, such as exposure to exotic fish species, tendency to become overgrown with terrestrial vegetation or their potential to become the focus of future recovery actions. These included Longstreet, Jackrabbit, Marsh, Crystal, South Scruggs and Bradford Springs.

This spring, Rogers, Tubbs, Indian and School Springs and King's Pool were also surveyed. These springs had not been surveyed since 1989-90.

Methods

Fish surveys were conducted from 5 April to 4 May 1993. Spring pools were censused using baited minnow traps lined with 1mm mesh. The number of traps used per spring varied, with larger springs requiring a greater number of traps. Traps were placed in the water for a minimum of 3 hours. Trapped fish were sorted to species, age and sex when possible. Adult pupfish, sailfin mollies and mosquitofish were considered to be greater than 25mm in total length. Speckled dace greater than 40mm were judged to be adults. Adult pupfish were sexed according to body shape, color and the presence or absence of a black terminal band on the caudal fin.

Populations of pupfish and speckled dace were estimated using the mark-recapture Peterson method (Everhart et. al. 1975). Adults and larger juveniles were marked by clipping a small portion of the caudal fin. The following day, the site was retrapped and fish were sorted as to being marked or unmarked.

Population estimates of native fish were determined using the formula N=MC/R, where N was the estimate of population size, M the number of fish marked and released, C the recapture size (both marked and unmarked fish) and R the number of recaptured, marked fish. Variance was calculated using the formula:

$$V(N) = N_2 \frac{(N-M)(N-C)}{MC(N-1)}$$

A 95% confidence interval was calculated as $N \pm 1.96\ V(N)$.

Results

Longstreet Spring was surveyed on 5 and 6 April using 12 lined minnow traps. The weather was mostly sunny, 65°F with a north breeze. Water temperature was 81°F. Amargosa pupfish population estimate was 826 ± 18, up slightly from 1991-92 spring surveys (Table 1). The adult to juvenile ratio of 1:0.34 was the lowest in 3 years and the male to female ratio of 1:1.56 was slightly below 1992 and above 1991 spring surveys. Exotic species removed included 28 sailfin mollies, 238 mosquitofish and 124 crayfish.

Jackrabbit Spring was surveyed on 7 and 8 April using 7 lined minnow traps. The weather was sunny, 70°F with a north breeze. Water temperature was 81°F. Amargosa pupfish population estimate was 738 ± 10, up from both 1991 and 1992 spring surveys (Table 1). The adult to juvenile ratio of 1:0.48 was the lowest in 3 years and the male to female ratio of 1:1.60 was slightly below 1992 and above 1991 spring surveys. Two speckled dace were captured, down from 1991 and 1992 spring surveys. Exotic species removed included 45 mosquitofish and 25 crayfish.

King's Pool was surveyed on 12 and 13 April using 7 lined minnow traps. The weather was clear, 70°F, with a north wind. Water temperature was 90°F. Amargosa pupfish population estimate was 198 ± 10, far below the September, and above the December 1989 surveys (Table 1). The adult to juvenile and male to female ratios were below the 1989 survey (Table 1). Exotic species trapped included 40 sailfin mollies, 10 mosquitofish and 4 crayfish. At least 50 to 60% of this spring pool is inundated with cattails.

The large decline in pupfish between September and December of 1989 is thought to be due to cold water that ran into King's Pool from the nearby Point of Rocks Ponds. The pupfish appeared to move out of King's Pool and into the irrigation ditch. During this survey, water was running into the pool from the Point of Rocks ponds.

Roger's Spring was surveyed on 15 and 16 April with 4 lined minnow traps. This was only the second survey conducted at this spring. The weather was sunny, 70°F, and calm. Water temperature was 83°F. Amargosa pupfish population estimate was 139 ± 7, up slightly from the August 1989 survey. No juveniles were trapped this year, and only a few were trapped in 1989. Male to female ratio was 1:1, up slightly from the 1989 survey (Table 1). Exotic species removed included 28 mosquitofish and 48 crayfish.

Tubb's Spring was surveyed on 15 and 16 April with 4 lined minnow traps. This was only the second survey conducted at this spring. Water temperature was 66^0F. Speckled dace population estimate was 15 $\pm$ 1, down from the 1990 survey (Table 1). No juveniles were trapped. Exotic fish species removed included 7 sailfin mollies, 29 mosquitofish and 49 crayfish.

This spring is located in a hole in a weedy field 50 yards east of Bradford Springs. There is no overland stream outflow from the spring. The water is piped to the Point of Rocks dirt ditch to the south. At one time, Tubb's Spring was probably connected to Bradford Springs. The bottom of the spring is filled with large tumbleweeds, and may require cleaning.

Bradford Springs were surveyed on 19 and 20 April using 5 lined minnow traps in spring #1, 5 traps in spring #2 and 3 traps in spring #3. The weather was sunny, 75^0F, with a north wind. Water temperature was 66^0F. Speckled dace population estimate for spring #1 was 189 $\pm$ 15, down slightly from 1991 and 1992 spring surveys. Spring #2 population estimate was 260 $\pm$ 14, down slightly from 1991 and 1992 spring surveys. No fish were trapped in spring #3 this spring or last fall (Table 1). The water in spring #3 was murky and stagnant. In the spring of 1992 it supported an estimated population of 96 speckled dace. Adult to juvenile ratios were down in springs #1 and #2 compared to 1991 and 1992 spring surveys (Table 1). Four adult Amargosa pupfish were caught in spring #1. Exotic species removed included 15 mosquitofish and 162 crayfish.

Crystal Spring was surveyed on 26 and 28 April using 13 lined and 4 unlined minnow traps. The weather was sunny, 80^0F and calm. Water temperature was 84^0F. The Amargosa pupfish population estimate was 1748 $\pm$ 43, up from 1991 and 1992 spring surveys (Table 1). The adult to juvenile ratio was 1:0.2, below 1991 and 92 spring surveys. The crayfish population in this spring is very high and may be partly responsible for the low adult to juvenile ratio. The male to female ratio was 1:1, with female numbers up slightly from 1991 and 1992 spring surveys (Table 1). Exotic species removed included 8 sailfin mollies, 223 mosquitofish and 230 crayfish.

South Scruggs Spring was surveyed on 3 May using 1 lined minnow trap. The weather was partly cloudy, 85^0F with a south wind. The Warm Springs pupfish population estimate was 22, down from 1991 and 1992 spring surveys (Table 1). The adult to juvenile ratio was 1:0.57, down from 1991 and 1992 spring surveys. Another 100 plus pupfish were observed in the shallow water between the spring and the road 50 yards to the west. No exotic fish were trapped or observed. The spring pool is very small and filling in with silt so that a minnow trap will not be possible to use in the near future. Visual estimates will be continued.

North Scruggs Spring was surveyed on 3 May using 1 lined minnow trap. No fish were trapped or observed in the spring. This spring held no fish in previous trapping attempts, but is reported to contain Warm Spring pupfish.

Indian Spring was surveyed on 3 May using 1 lined minnow trap in a deep hole just downstream from the spring source. The Warm Springs pupfish population estimate was 51, almost the same number trapped in 1989 (Table 1). Adult to juvenile ratio was below 1989 and male to female ratio was 1:2.16 (Table 1). No exotic fish were trapped or observed.

School Spring cement ponds and observation pool were surveyed on 4 May. Two lined minnow traps were placed in the observation pool and 2 traps in each of the 3 cement pools. The weather was partly cloudy, 85^{0}F, with a south wind. The Warm Springs pupfish population estimate for the observation pool was 11 and for the cement pools was 105, down from the August 1989 survey (Table 1). Both adult to juvenile and male to female ratios were down from the 1989 survey (Table 1). Exotic species removed included 35 crayfish in the cement pools and 87 in the observation pool.

Discussion

I have decided to change the timing of the fish survey. For the next few years, all springs will be surveyed only once a year, in late summer-early fall, when adult and juvenile populations are highest. The reasons for this change are based on the need to obtain long term population data on each of the major springs to assist future management decisions. Problems noted during this survey at a majority of springs need to be addressed. They include an increase in exotic fish species, declining native fish populations, declining numbers of juvenile native fish and vegetation encroaching spring pools. Additionally, a once a year survey will afford less disturbance to the fish. Monitoring efforts may be reduced when problems improve.

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Table 1. Population estimates, age and sex ratios of native fish, Ash Meadows NWR, spring 1993

Location/ Date	Pupfish[1]	Speckled Dace	Adult: Juvenile Ratio	Male: Female Ratio
Crystal Spring				
03-26-91	1272±46		1:1.71	1:0.77
03-20-92	1655±55		1:1.72	1:0.68
04-28-93	1748±43		1:0.21	1:1.00
Longstreet Spring				
03-14-91	795±35		1:0.93	1:1.18
03-25-92	799±26		1:1.17	1:0.73
04-06-93	826±18		1:0.34	1:1.56
Jackrabbit Spring[2]				
03-11-91	506±11	10	1:1.06	1:1.28
03-17-92	660±11	8	1:1.28	1:0.79
04-08-93	738±10	2	1:0.48	1:1.60
Roger's Spring				
08-10-89	114		1:0.51	1:0.67
04-16-93	139±7		1:0	1:1.00
King's Pool				
09-06-89	1124±76		1:2.75	1:0.86
12-14-89	30			
04-13-93	198±10		1:0.78	1:0.63
Bradford Spring #1[3]				
03-18-91		212±20	1:30.8	
04-02-92		228±12	1:16.8	
04-20-93	4	189±15	1:5.66	1:1
Bradford Spring #2				
03-18-91		375±24	1:32.1	
04-02-92		313±16	1:9.0	
04-20-93		260±14	1:1.14	
Bradford Spring #3				
03-18-91		66±10	1:8.75	
04-02-92		96± 6	1:12.2	
04-20-93		0		
Tubb's Spring				
10-23-90		47±3	1:0.62	
04-16-93		15±1	1:0	

Table 1. continued

Location/ Date	Pupfish[1]	Speckled Dace	Adult: Juvenile Ratio	Male: Female Ratio
South Scruggs Spring				
03-18-91	70±9		1:5.00	1:1.55
03-26-92	34±12		1:7.00	1:0.20
05-03-93	122		1:0.57	1:2.50
Indian Spring				
1989	50		1:2.33	
05-03-93	51		1:0.34	1:2.16
School Spring				
08-01-89	390		1:3.15	1:2.20
05-04-93	114		1:0.24	1:1.42

1-Amargosa pupfish at Crystal, Longstreet, Jackrabbit, Bradford, and Roger's Springs and King's Pool. Warm Springs pupfish at South Scruggs, Indian and School Springs.

2-Ratios apply to pupfish only.

3-Adult/juvenile ratios apply to speckled dace; male/female ratio applies to pupfish.

Table 2. Population estimates of exotic fish species, Ash Meadows NWR, spring 1993.

Location/ Date	Mosquitofish[1]		Sailfin Mollies		Crayfish
Crystal Spring					
03-26-91	500*	(48)	500	(24)	23
03-20-92	2500		500		131
04-28-93	4000	(223)	300	(8)	230
Longstreet Spring					
03-14-91	1000	(338)	5000	(126)	30
03-25-92	2000	(534)	7500	(52)	71
04-06-93	3000	(238)	4000	(28)	124
Jackrabbit Spring					
03-11-91	150	(64)			3
03-17-92	200	(79)			31
04-08-93	300	(45)			25
Bradford Springs					
03-18-91	300	(90)			334
04-02-92	200	(70)	20		200
04-20-93	200	(15)			162
Tubbs Spring					
10-23-90	1000	(50)	400		34
04-16-93	1000	(29)	700		49
King's Pool					
09-06-89	500	(114)	2500	(16)	
04-13-93	500	(10)	300	(40)	4
Roger's Spring					
08-10-89		(628)			52
04-16-93	500	(28)			48

1-Number in parentheses refers to number of exotics trapped and removed.
*-Visual population estimate.