

**Effectiveness of Host Snail Removal in the Comal River,
Texas and its Impact on Densities of the Gill Parasite,
Centrocestus formosanus (Trematoda: Heterophyidae)**



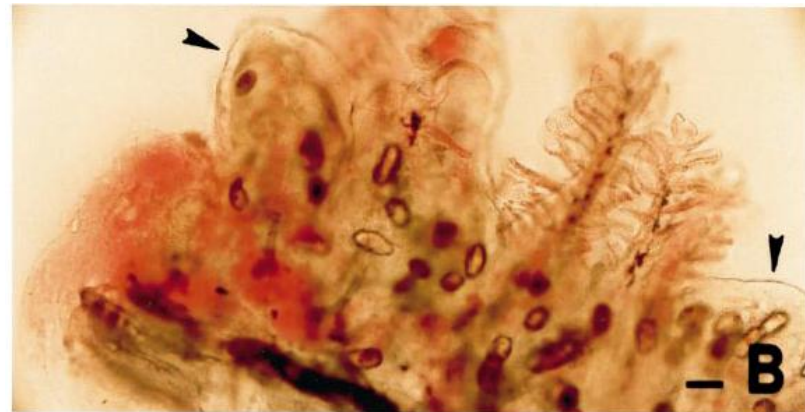
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Background

- Invasive gill parasite: *Centrocestus formosanus*
 - Intermediate host: *Melanoides tuberculata*
- Infects gill tissue of endangered fountain darter
- Cause cartilage hyperplasia resulting in severe gill lesions



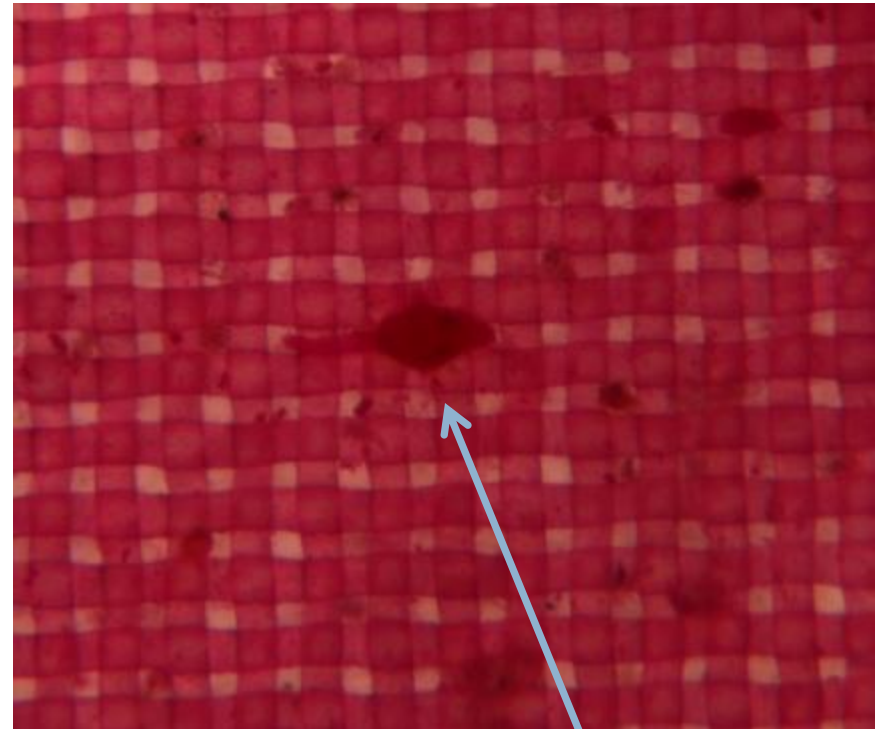
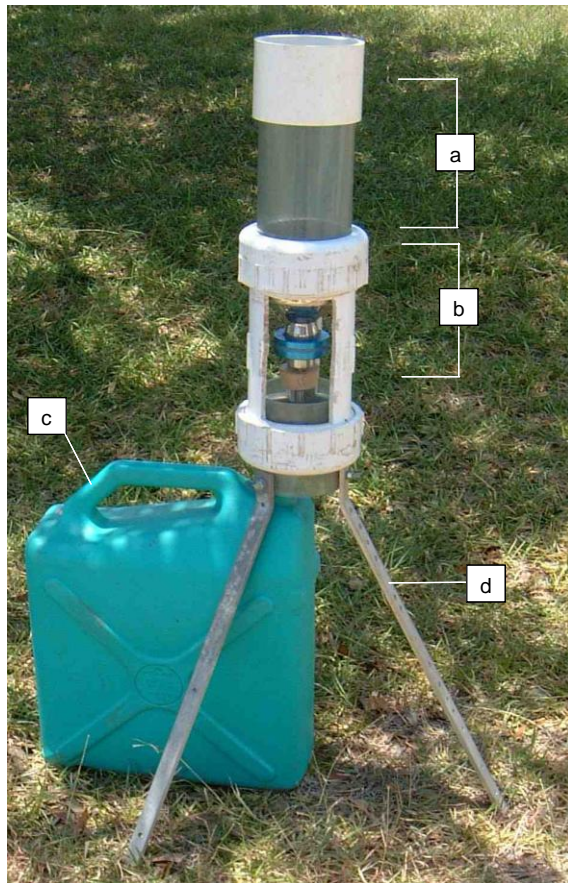
(B) A heavy infection of metacercarial cysts in the gills of a fountain darter.

Scale bar = 100 μ m. Mitchell et al. (2000)

Goal

Evaluate the effectiveness of host snail removal on the reduction of the gill parasite in the water column

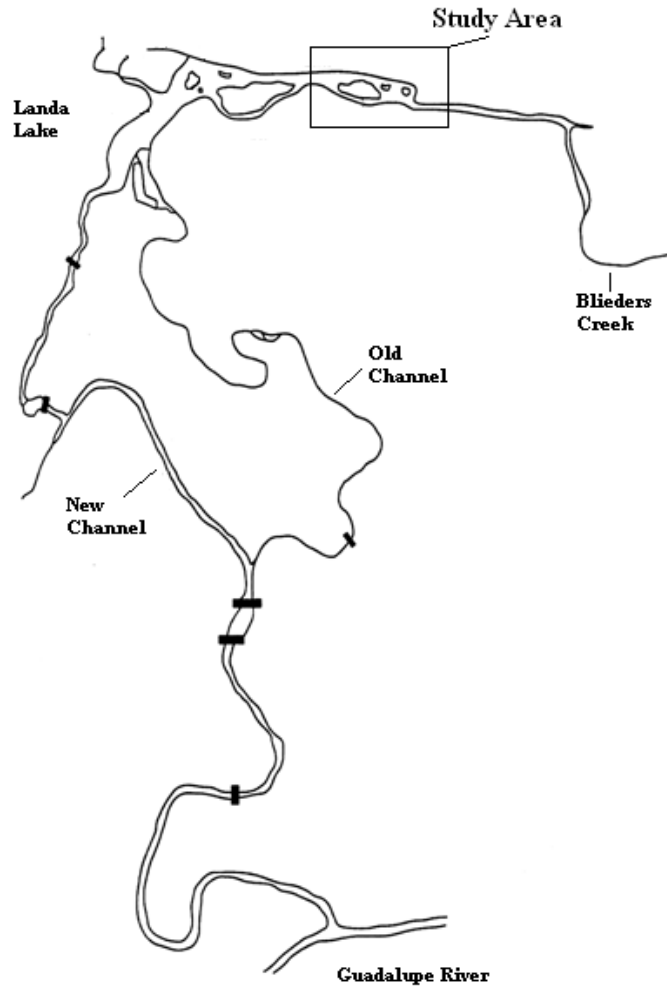
Methods



C. formosanus cercaria

Modified filtration apparatus. a) prefilters (220µm and 86µm). b) sample filter mount with 30 µm monofilament filter. c) 22.7 L formalin collection container. d) filter apparatus support.

Study Area





Pilot Study Results

Oct 18, 2010

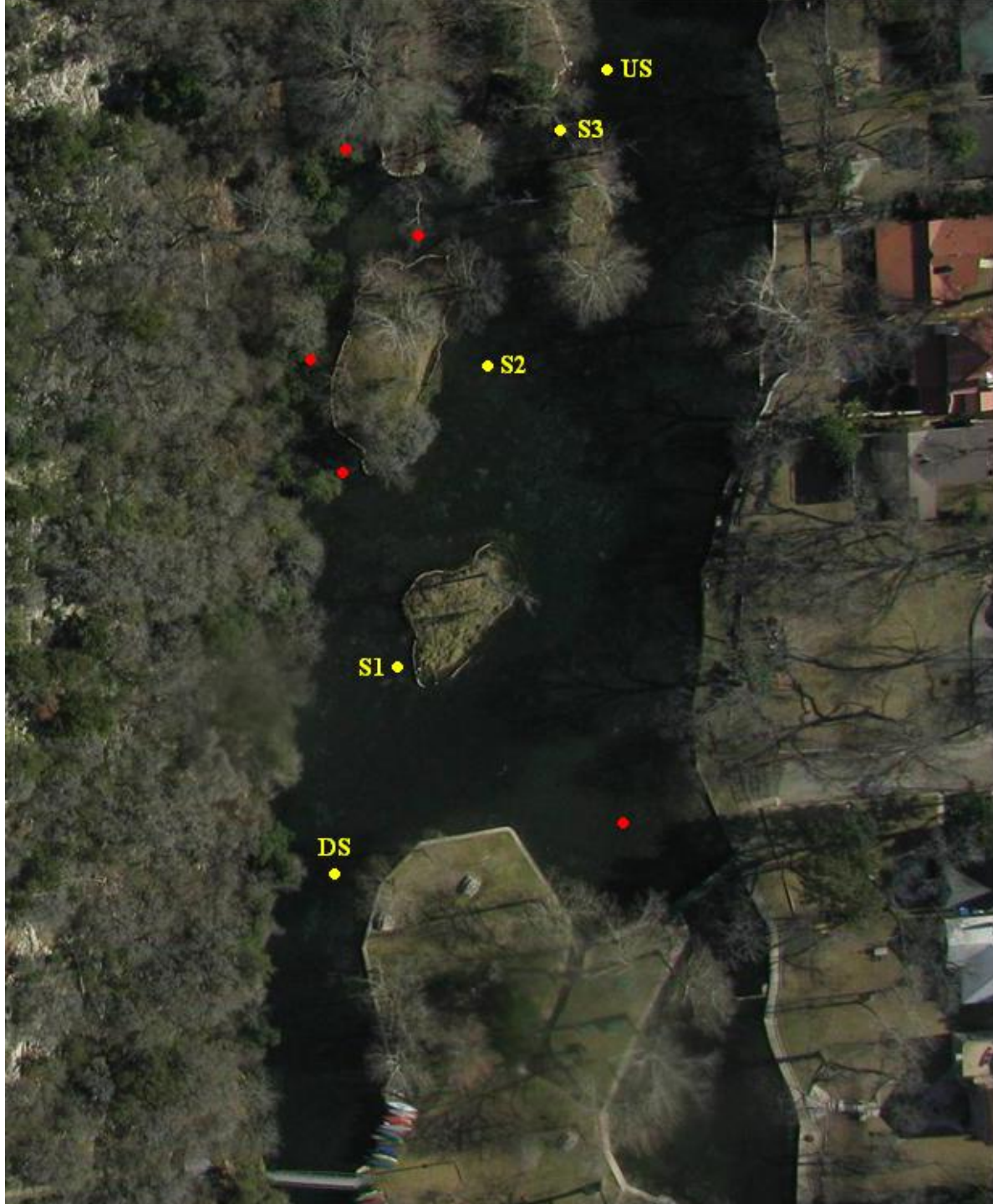
Nov 9, 2010

| Sample | Total <i>C. formosanus</i> | <i>C. formosanus</i> /L |
|-----------|-------------------------------|-------------------------|
| US1 | 12 | 2.4 |
| US2 | 5 | 1.0 |
| S1 | 56 | 11.2 |
| S2 | 13 | 2.6 |
| S3 | 3 | 0.6 |
| S4 | 55 | 11.0 |
| S5 | 4 | 0.8 |
| S6 | 1 | 0.2 |
| S7 | 4 | 0.8 |
| S8 | 31 | 6.2 |

| Sample | Total <i>C. formosanus</i> | <i>C. formosanus</i> /L | Mean |
|--------|-------------------------------|-------------------------|--------------------|
| US 1 | 3 | 0.6 | |
| US 2 | 5 | 1.0 | 0.73a ¹ |
| US 3 | 3 | 0.6 | |
| DS 1-1 | 26 | 5.2 | |
| DS 1-2 | 16 | 3.2 | 3.66b |
| DS 1-3 | 13 | 2.6 | |
| DS 2-1 | 7 | 1.4 | |
| DS 2-2 | 1 | 0.2 | 0.53a |
| DS 2-3 | 0 | 0.0 | |

$F = 11.16; p = 0.0095$

¹ One-way ANOVA; $p < 0.05$ means significant difference; different letters denote significant differences as determined by Fisher's LSD multiple comparisons testing

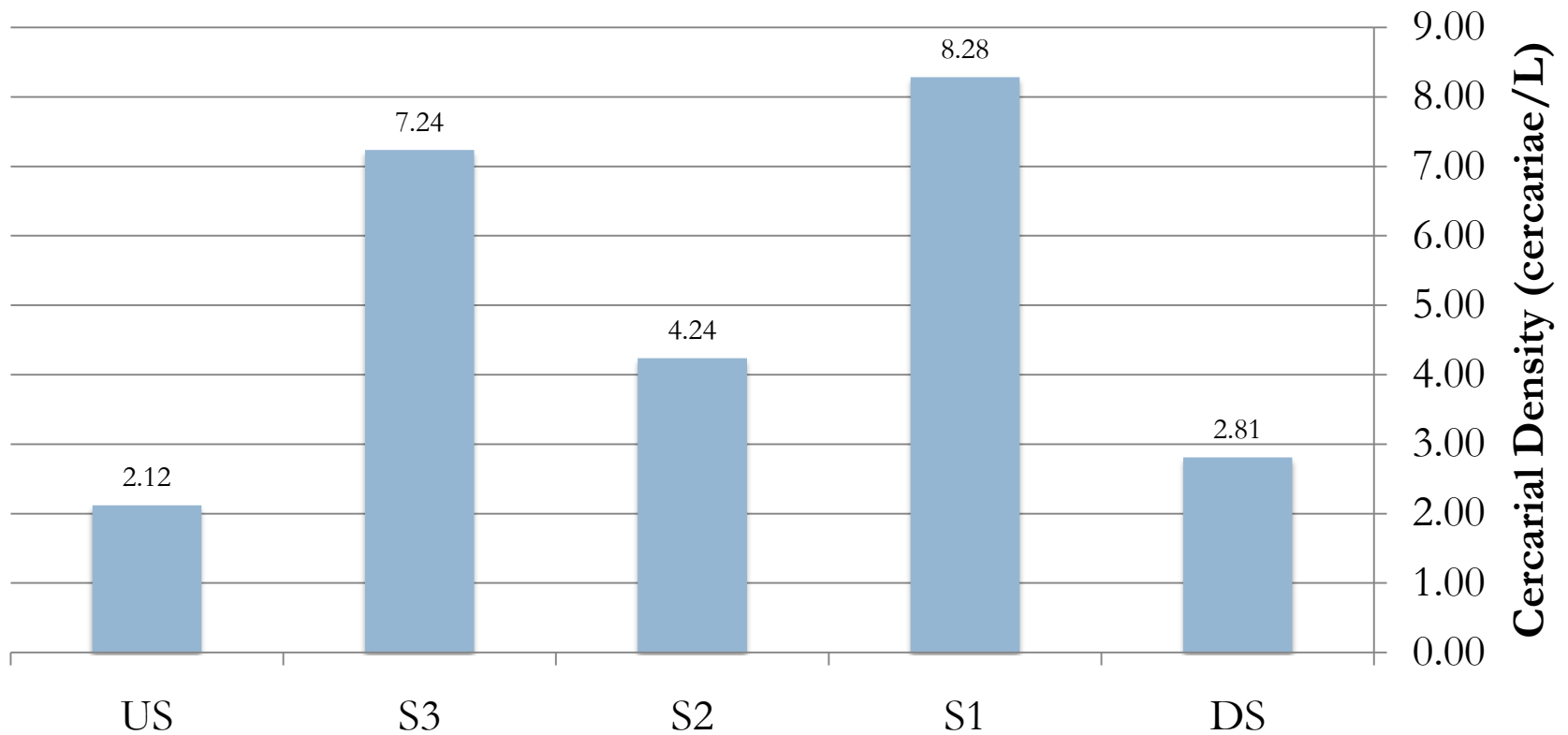


Sampling Schedule

- Sample 3 consecutive days (Nov. 9-11)
 - Sampled 3 points at each site
 - Sample 3 times a day (9:00AM, 11:00AM, 1:00PM)
- Remove Snails (Nov. 12)
 - Used drop-nets and dip-nets to remove snails from a 10 m² area surrounding sampling points
- Repeat sampling (Nov. 15-17)

Results

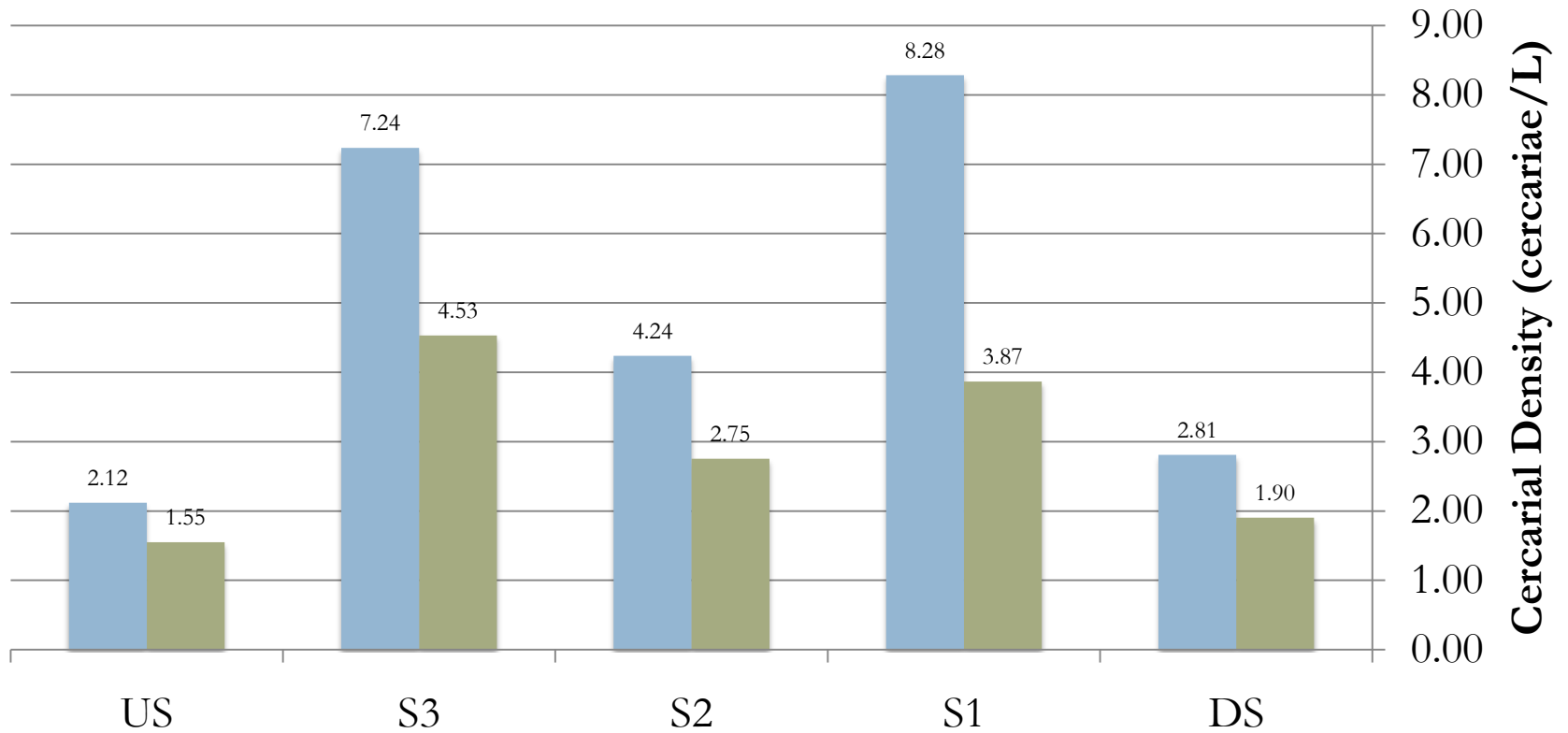
Initial Cercarial Densities



- 270 samples taken
- 5454 cercariae collected
- 2208 snails removed
 - ~85% large enough to be infected by parasite (> 17mm)

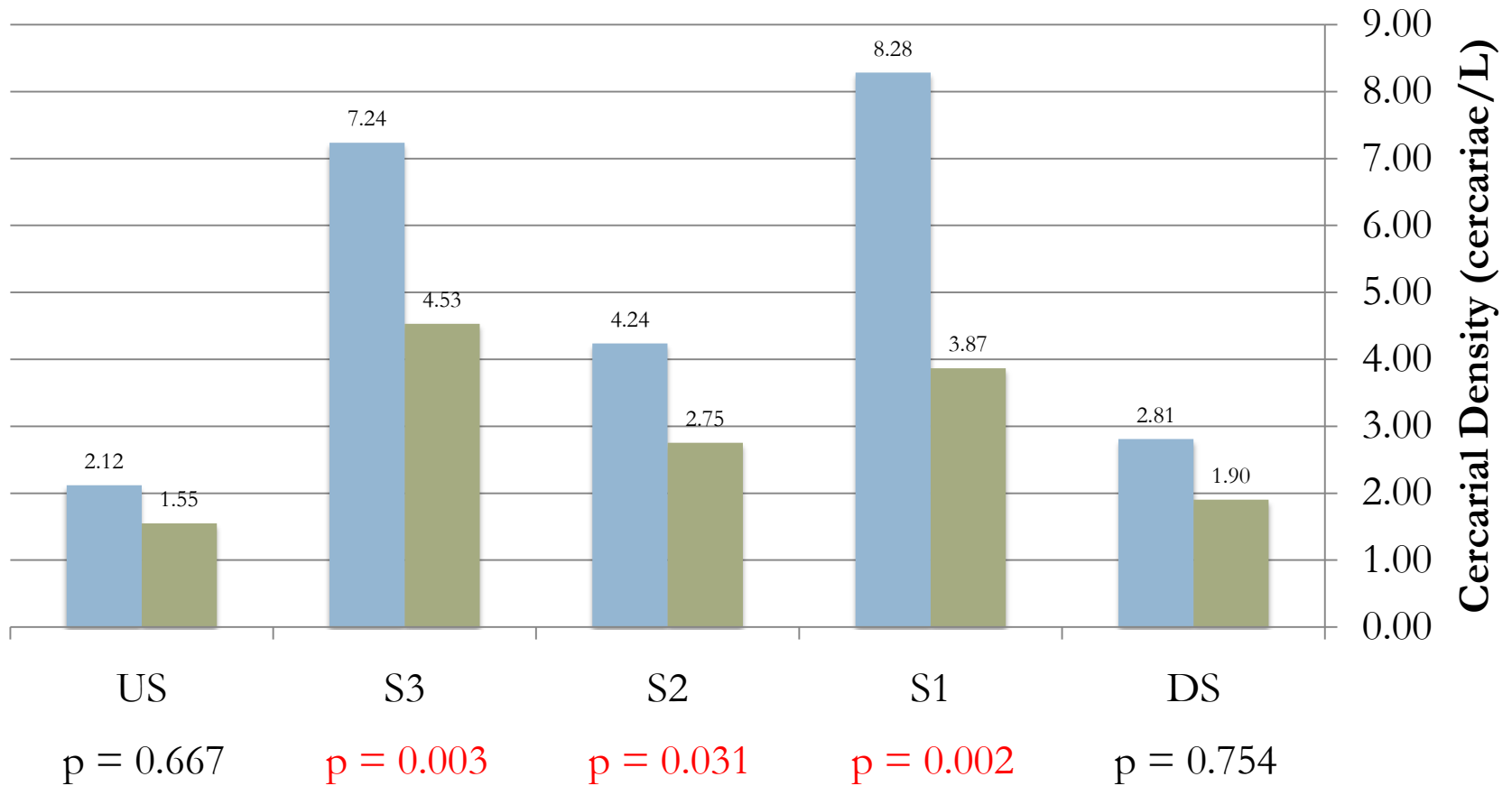
Results

Cercarial Densities: Pre- and Post-Removal



Results

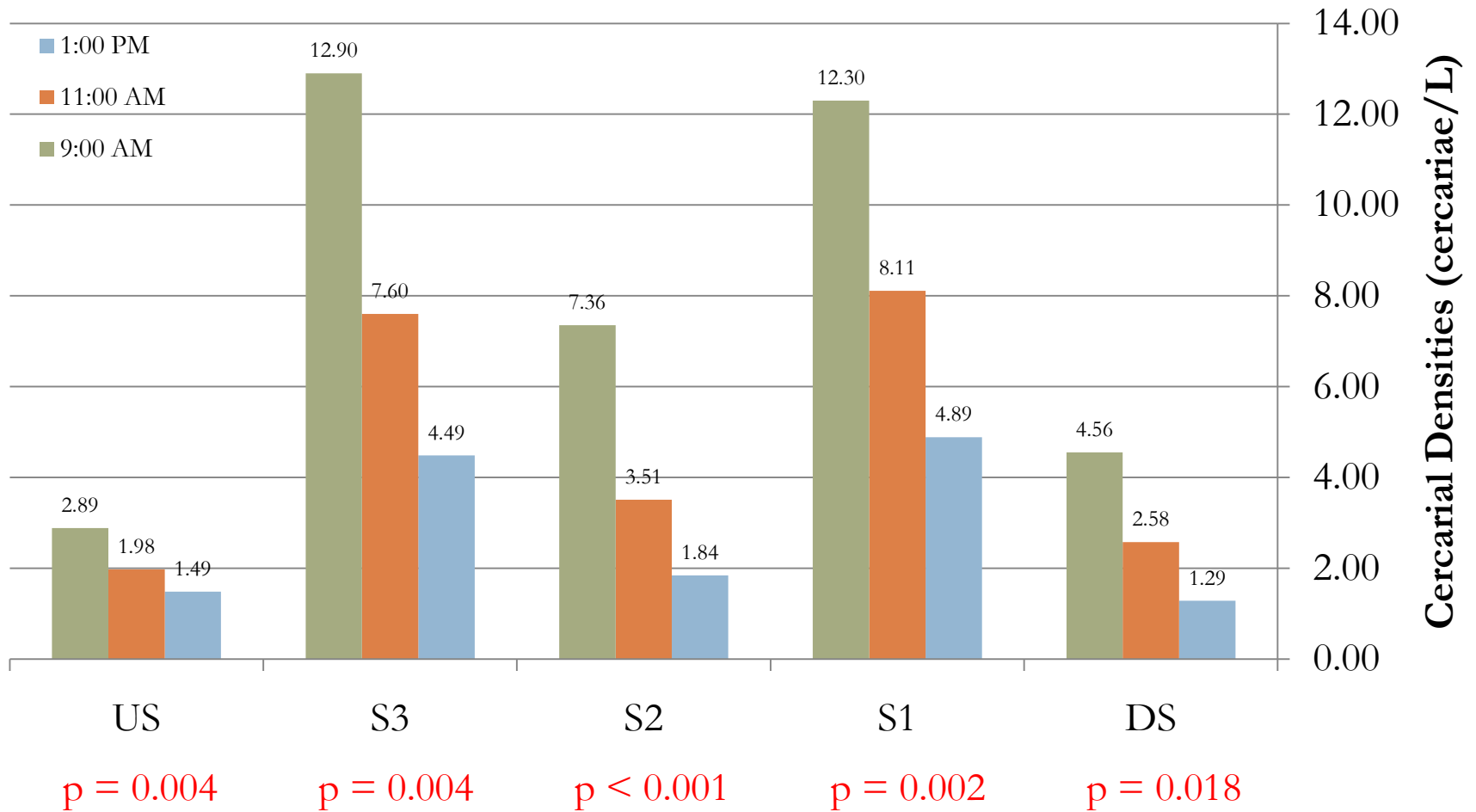
Cercarial Densities: Pre- and Post-Removal¹



¹Paired t-test; p < 0.05 considered significantly different

Results

Cercarial Densities vs. Collection Time¹



¹ One-way ANOVA; $p < 0.05$ considered significant

Conclusions

- Removing snails can impact cercarial densities
 - Removal effects appear to be localized
 - Statistical vs Ecological significance?
 - How long do effects last?
- Collection times affect observed densities
 - Densities peak around 9:00 AM
- Density values are very localized

Example

Site S3

| Time | Sample | 9-Nov | 10-Nov | 11-Nov | 15-Nov | 16-Nov | 17-Nov |
|---------|--------|-------|--------|--------|--------|--------|--------|
| 1:00 PM | a | 23 | 44 | 21 | 7 | 15 | 16 |
| | b | 25 | 23 | 8 | 15 | 12 | 28 |
| | c | 25 | 37 | 14 | 4 | 12 | 26 |

Recommendations

- Monitor cercariae densities at multiple areas
 - Snail populations with densities > 10 snails/m²
 - Occasionally perform river-wide survey to identify new snail populations
- Complete cercarial monitoring in concordance with fountain darter monitoring
 - Conduct snail removal when fish show infected gill tissues extended beyond operculum
- Monitor water temperature, light intensity, water velocity, depth and dissolved oxygen while monitoring snail and cercarial densities
- Monitoring frequency should be dependent upon spring flow levels
 - Semi-Annual in regular conditions
 - Frequently when flows < 150 cfs
- Important to sample same locations and times of day
- Research additional snail removal methods

Questions?