MONTANE MOLLUSK AND CRUSTACEAN SURVEY OF WESTERN COLORADO

2003 ANNUAL REPORT

A Report to the Colorado Division of Wildlife

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Cover photo: A researcher collects freshwater specimens (*Pisidium*) at Long Slough Reservoir on the Grand Mesa of Colorado's West Slope.

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INTRODUCTION

As a group mollusks and crustaceans have not been well studied in Colorado. Much of the mapped distributional data for Colorado dates from the 1980s (Saunders 1981, Sanders and Wu 1984, Unger 1978, Wu and Liu 1989, Wu et al. 1980, Wu et al. 1982) and much of this work is based on museum specimens collected in earlier years. Recently work has been conducted on the distribution of mollusks on the eastern plains of Colorado (Clarke et al. 2003, Cordeiro 1999), however, gaps in information exist for mollusks and crustaceans in western Colorado where these taxa are understudied. Because there is little information on distribution, and in some cases the ecology and biology of some mollusk and crustacean species and subspecies, it is difficult to determine the best strategies for conservation. A better understanding of mollusk and crustacean distributions through out western Colorado should allow the development of more comprehensive and successful statewide conservation strategies for these invertebrates.

The objective of this project is to survey for mollusk and crustacean distributions in western Colorado (for purposes of this project, defined as all areas west of the Continental Divide and all areas above 6,000' east of the continental divide). In this Annual Report, the tasks to be completed in Year 1 are reiterated and the outcome of the 2003 sampling period is presented.

According to the original proposal, the work to be completed during the first year (FY 02-03) is as follows:

- Compilation and review of all existing published information and other occurrence data on mollusks and crayfish in western Colorado (for the purposes of this project, defined as all areas west of the Continental Divide and all areas above 6,000' east of the Continental Divide).
- Development of a detailed work plan, including protocols for conducting field survey work.
- Initiation of field survey work in western Colorado
- Completion of a progress report

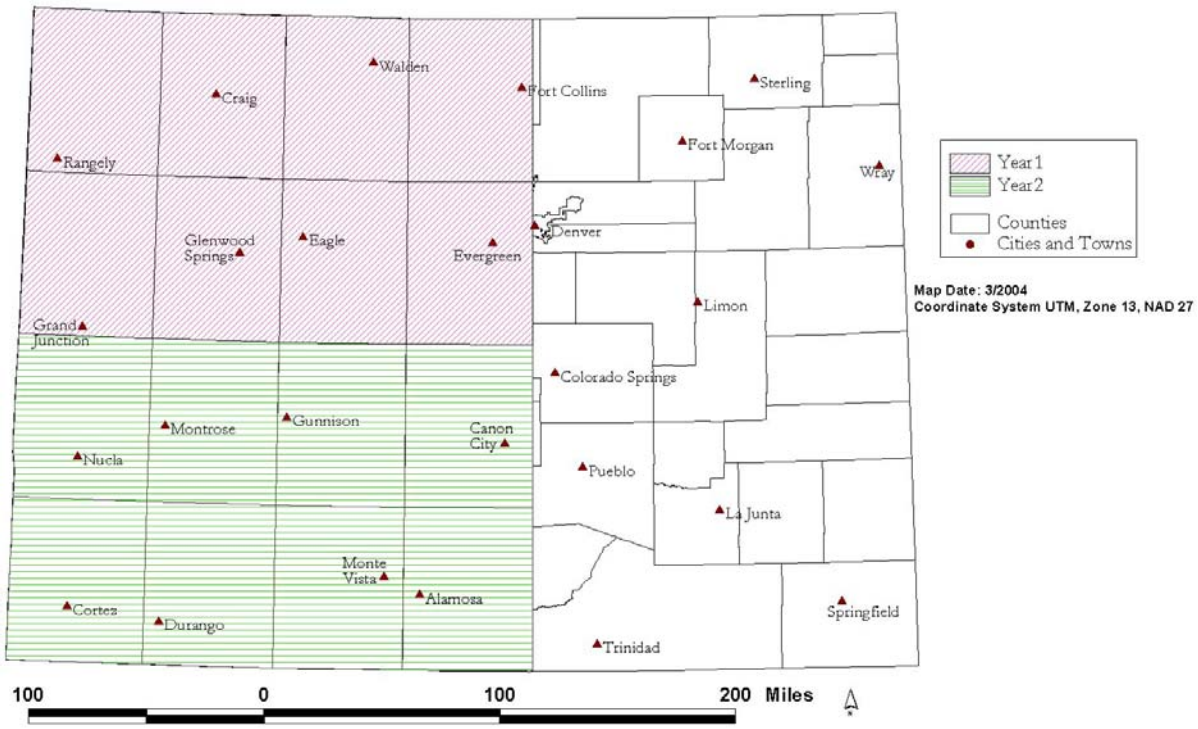
Here we report the results of the project's first full season of field surveys conducted from May to September 2003. The taxonomic classes addressed in this study are Gastropoda (snails), Bivalvia (freshwater bivalves), Malacostraca (crayfish, amphipods, isopods), and Branchiopoda (fairy shrimp). The less-common species and subspecies have been prioritized in order to better inform conservation strategies for mollusks and crustaceans, but this project will attempt to clarify the ranges of many mollusks and crustaceans.

METHODS

Study Area

The methods follow those outlined by Sovell and Guralnick (2003). By virtue of the study areas size, which includes all of western Colorado (Fig 1), and given constraints of time and funding it is not possible to comprehensively sample the entire area; however, it is important to acquire a representative sample. To focus sampling efforts and assure proper

Fig. 1. Latilong block groupings for western Colorado mollusks and crustaceans survey.



representation, a list of 22 priority species was compiled (Appendix I).

Field crews visited from between 3 to 5 sites per day during the course of the summer field season. To focus sampling effort in such a large area a target species list based on species rarity and habitat affinity was compiled (Appendix I). This list relies heavily upon the species of special concern listed in the Colorado Natural Heritage Program's Conservation Status Handbook (1999). In addition, to assure sampling efforts are representative of suitable habitat found in the study area, species habitat affinities were also considered. Representative species with habitat affinities not typical of rare species on the target list were also included. Habitats taken into consideration when compiling the list include seeps, springs, fens, marshes, swamps, sloughs, talus slopes, hot springs, and lakes and reservoirs. This protocol should accomplish a representative, if not dense, sample of the entire study area.

A total of sixteen latilong-blocks will be sampled during the two plus years of the project. In 2003 efforts were focused on the northern eight latilong-blocks of the study area (Fig. 1).

Within latilong-blocks, appropriate habitat was sampled to gain a representative sample of the entire block. In latilong-blocks with numerous target species little area will be left outside the target species distributions and sampling effort will concentrate on the target species. In these latilongs limited samples will be taken from outside the target species distributions. We spent approximately two weeks (10 days) sampling within each latilong-block surveyed during 2003. We also expect to collect multiple samples from at least 10 separate areas in representative habitat within every latilong-block.

Field Survey Techniques

Two to five person survey teams spent the period from late May to early September visiting sample locations throughout northern Colorado west of Fort Collins and Denver. Each sample trip consisted of a continuous five to 10 day sampling period. At each sample location teams spent approximately 30 to 45 person minutes surveying the aquatic habitat. Each member of the survey team used a fine sieve kitchen colander to scrap flocculent and bottom substrate from the shoreline to a depth of approximately 3.5 feet, which occurred at varying distances from the shoreline depending upon bottom topography. Each colander sample was examined for the occurrence of mollusk and crustaceans. Specimens were removed and placed in damp paper towels and secured in a 0.25-pint plastic ziplock bag. At the end of each sample day specimens were removed from the plastic bag and placed into a 100ml glass vial with 70% ethanol. During the course of the field season it was noted that fairy shrimp, due to their delicacy, would not tolerate storage within a plastic bag without deteriorating; subsequently such specimens were removed directly from colander samples to small glass vials with 70% ethanol. In addition to colander sampling, a targeted effort was undertaken to observe and collect grayfish within their preferred habitats at each location.

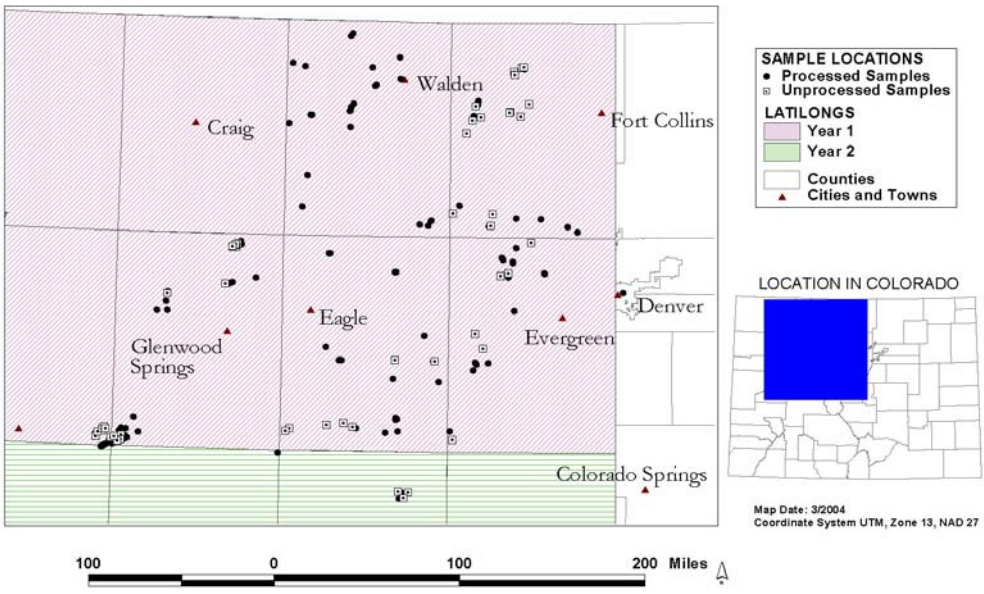
The data collected with each sample included UTM coordinates, county, state, collector(s), date and a preliminary assessment of genera collected. In addition at each aquatic habitat sampled, an attempt was made to collect data on water temperature, pH and conductivity. Equipment malfunction prevented collection of this data from some sampled sites.

RESULTS

Sampling Effort

Five latilong-blocks within the north half of the study area were surveyed extensively during the 2003 field season (Fig. 2). In addition, a few samples were collected from three other latilong-blocks including two in the south half of the project area. During some sampling

Fig 2. Locations sampled during year one of the montane mollusk and crustacean project.



trips the ease of access to quality habitat in latilongs of the south project area dictated sample collection from these southern areas to assure efficient use of time. Approximately 200 locales were sampled in 2003 (see Fig. 2) of which approximately 85 still require processing. Of these 85 areas approximately 20 are not represented by dot locations in Fig. 2, as this information has yet to be compiled.

Survey Results

Approximately 3,350 mollusk specimens and 865 crustacean specimens representing 14 genera have been collected and identified to date (Table 1), while additional samples from approximately 85 locations still require processing. In addition, pea clam (*Pisidium*) specimens have been identified to include six separate species. The majority of crustacean specimens have been identified to species. Most of the mollusk genera were widely distributed throughout the sampled area, except for *Helisoma, Oreohelix* and *Valvata*. In contrast, the crustacean genera genera *Hyalella* and *Gammarus* were common in the area sampled during 2003.

	# Specimens	# Locales
MOLLUSKS		
Gyraulus	507	56
Helisoma	128	4
Lymnaea	572	40
Oreohelix	180	12
Physa	912	63
Pisidium	1,048	61
Valvata	2	1
CRUSTACEANS		
Branchinecta	39	9
Caecidotea	15	4
Eubranchipus	2	2
Eurycerus	1	1
Gammarus	241	29
Hyalella	442	48
Orconectes	115	13
Damselflies	6	1

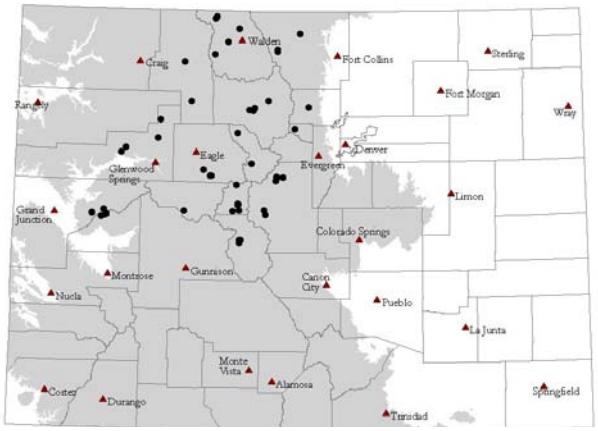
Table 1. Mollusk and crustacean samples collected during 2003

In addition, six larval damselfly (Odonata:Zygoptera) specimens were collected from the sampled area. Collection methods did not emphasize insects and most insect larva (e. g. damselflies) were removed from colander samples during collection. Consequently, the reported damselfly numbers are not representative of their abundance and distribution within the sampling area.

Mollusk Distribution by Genus

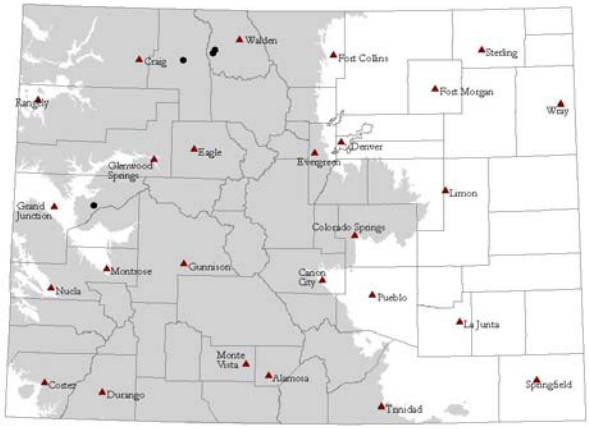
Gyraulus: This genus was commonly distributed throughout the sampled area and was collected from every latilong-block sampled in 2003. Members of the genus were collected from every habitat sampled including lakes, rivers, creeks/streams, marshes, beaver ponds, ponds, wetlands, fens and reservoirs. A total of 507 specimens were collected from 56 locales during 2003 (Fig. 3). This genus is extremely common in Colorado and has been reported from approximately 300 locales in the state (Wu and Liu 1989, Wu et al. 1982). Species of *Gyraulus* recorded from Colorado include *G. circumstriatus* and *G. parvus*.

Fig. 3. *Gyraulus* spp. collection locations during 2003. The entire study area is shown in gray.



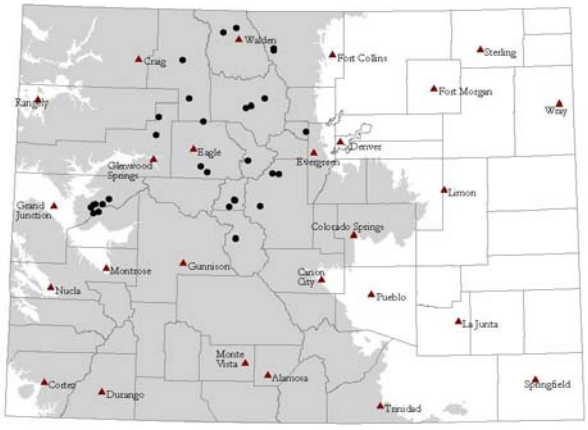
Helisoma: This genus was extremely rare in the 2003 sampling area and was collected from only four locations (Fig 4). *Helisoma* occurred only in the Walden latilong-block and 128 specimens were collected during the 2003 sampling effort. The only habitats within which *Helisoma* occurred were marshes and small lakes at elevations from 2,036 to 3,033 meters. Past collections of *Helisoma* indicate that the genus was common and wide ranging in Colorado with records from approximately 100 sample localities spread throughout the state (Wu and Liu 1989, Wu et al. 1982). Species represented in these past collections include *Helisoma anceps, H. scalare, H. subcrenatum* and *H trivolvis*.

Fig. 4. *Helisoma* spp. collection locations during 2003. The entire study area is shown in gray.



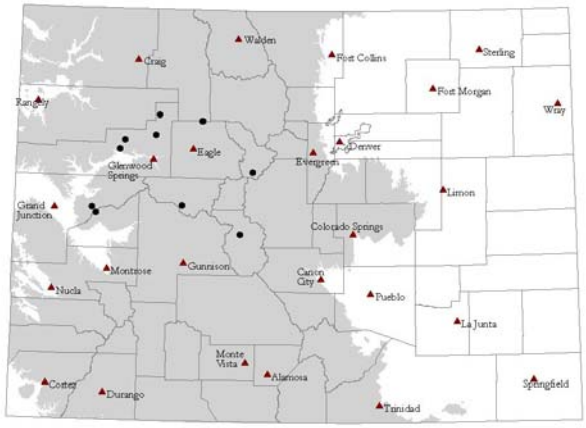
Lymnaea: This genus was common and widely distributed throughout the 2003 sampling area and was reported from 40 localities (Fig, 5) with 572 collected specimens identified to date in the 2003 collections. *Lymnaea* were collected from most habitats sampled including both disturbed sites like fish hatcheries and small reservoirs, and undisturbed locales such as rich fens, ponds, beaver ponds, marshes, creeks/streams and lakes. Past collections of *Lymnaea* indicate that the genus is extremely common and wide ranging in Colorado with records from over 500 sample locales spread throughout the state (Wu and Liu 1989, Wu et al. 1982).

Fig. 5. *Lymnaea* spp. collection locations during 2003. The entire study area is shown in gray.



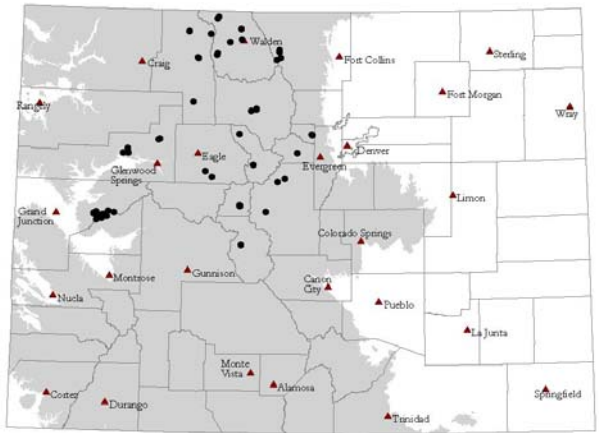
Oreohelix: *Oreohelix* is a terrestrial genus of snails that are common and widespread in western Colorado and that have been recorded from over 350 locales. During 2003, 180 specimens of *Oreohelix* were collected from 12 locales (Fig 6). Sampling effort was limited and additional effort might indicate a more common and widespread distribution of *Oreohelix* than indicated by this sample. Past collections have identified two species of *Oreohelix* in Colorado, *O. haydeni*and *O. strigosa*, although the taxonomy of the genus is in need of revision.

Fig. 6. *Oreohelix* spp. collection locations during 2003. The entire study area is shown in gray.



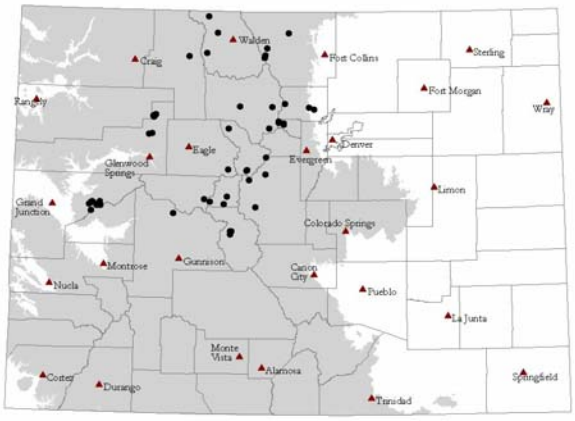
Physa: This genus of freshwater snails is extremely common and widespread in Colorado. Presently, 912 specimens of *Physa* have been identified from 63 locales in the 2003 sampling area (Fig 7). *Physa* was the second most abundant genus of all mollusk genera collected in the 2003 sample. *Physa* have been recorded from over 550 locales in Colorado and they are widespread and abundant throughout the state. *Physa* species that have been identified in Colorado include *P. acuti, P. anatina, P. columbiana P. cupreonitens P. heterostropha, P. gouldi, P. gyrina, P. integra, P. skinneri, P. utahensis* and *P. virgata*. However, the taxonomy is in need of revision and the actual number of genera represented in Colorado may be less than those based on the current taxonomy.

Fig. 7. *Physa* spp. collection locations during 2003. The entire study area is shown in gray.



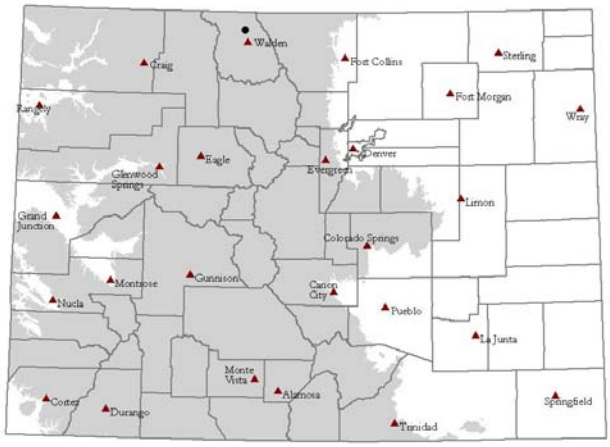
Pisidium: This genus of small bivalves known as 'peaclams' is ubiquitous in Colorado. During the 2003 sampling effort 1,048 specimens of physid sanils were collected from 61 locales (Fig. 8). *Pisidium* were the most abundant of all mollusk genera collected in 2003. This genus is extremely common in Colorado and has been reported from approximately 600 locales in the state (Wu and Liu 1989, Wu et al. 1982). Species of *Pisidium* recorded from Colorado include *P. casertsanum*, *P. compressum*, *P. milium P. natiium*, *P. variabile*. *Pisidium* were collected from all habitats sampled in 2003 including beaver ponds, ponds, creeks/streams, fens, lakes, marshes, reservoirs, rivers and wetlands.

Fig. 8. *Pisidium* spp. collection locations during 2003.
The entire study area is shown in gray.



Valvata: This genus of freshwater snails is represented in Colorado by only two recorded species, *Valvata sincera* and *V. tricarinata*. *Valvata* were known form only 11 locales in the state. *Valvata sincera* is recorded from 10 locations in western Colorado and *V. tricarinata* from one location in the South Platte River Basin in northeastern Colorado (Wu and Liu 1989, Wu et al. 1982). During 2003 only two specimens of *Valvata* were collected, both from the same locale in the Walden latilong-block (Fig 9). As noted above, *Valvata* are extremely rare in Colorado and the specimens collected in 2003 were from Cowdrey Lake in Jackson County. Cowdrey Lake is an impounded water body at 2400 meters in elevation in North Park approximately 7 miles north of Walden.

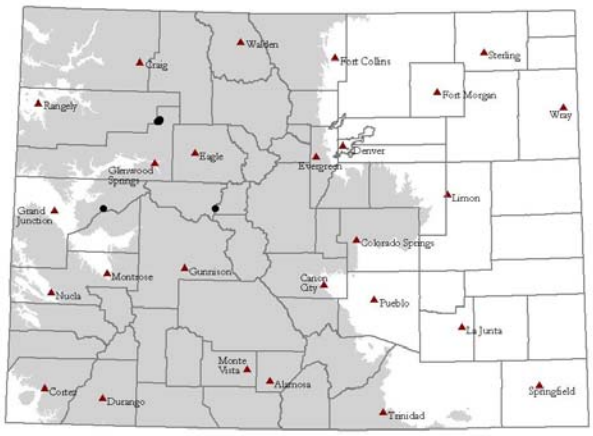
Fig. 9. *Valvata* spp. collection locations during 2003.
The entire study area is shown in gray.



Crustacean Distributions by Genus

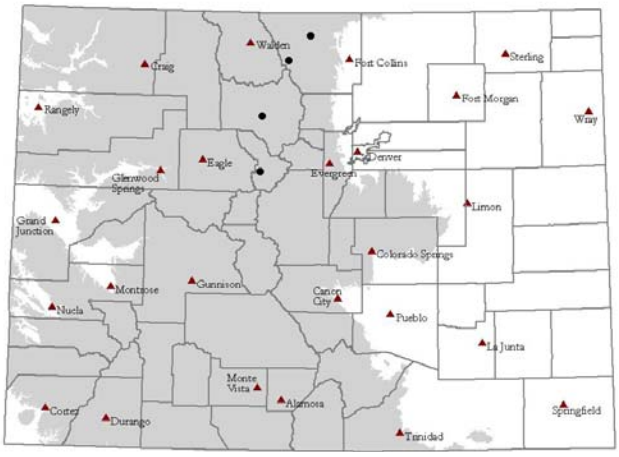
Branchinecta coloradensis: This Anostracan or 'fairy shrimp' is abundant and widespread throughout western North America, although information on their abundance and distribution in Colorado is sparse. The Colorado Natural Heritage Program considers this species to be an S? because information on its biogeography in the state is lacking. *Branchinecta* have been recorded from 20 locales throughout Colorado and *Branchinecta coloradensis* has been recorded from seven locales in the Rocky Mountains of central Colorado (Saunders 1981). During 2003, 39 specimens of *B. coloradensis* were collected from nine locales in the sampled area (Fig. 10). Most of these collections were from undisturbed sites in the Flat Tops Wilderness or on Grand Mesa; one was from Independence Pass. Although information on tolerance of fairy shrimp to pollution and disturbance is lacking, high sensitivity of Anostracan's to pollutants and disturbance is probable, and the occurrence of fairy shrimp is probably an indication of high biotic integrity (EPA 1998). All *B. coloradensis* collected in 2003 were from small high elevation lakes or ponds above 3,050 meters. This is not unexpected as Anostraca are restricted to temporary ponds or to those that freeze extensively because of their sensitivity to predation (e. g. as by fish).

Fig. 10. *Branchinecta coloradensis* collection locations during 2004. The entire study area is shown in gray.



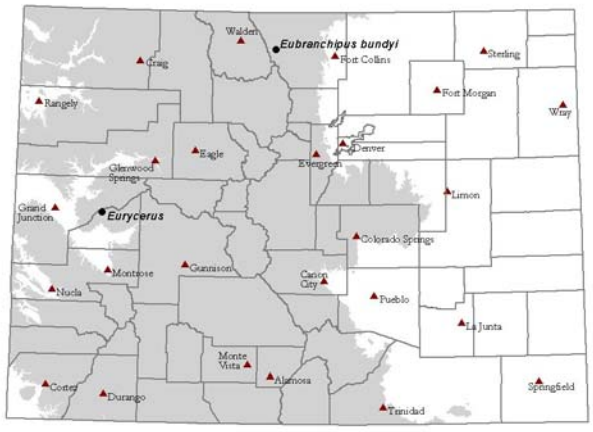
Caecidotea: Little information is available on the abundance and distribution of these isopods in either Colorado or North America, although it appears to occur throughout the U. S. Fifteen *Caecidotea* were collected at five locations in the sampled area (Fig. 11). At two of these locations the specimens were identified as *C. communis*. *Caecidotea* were collected from marshes, ponds, a lake and a wetland.

Fig. 11. *Caecidotea* spp. collection locations during 2004. The entire study area is shown in gray.



Eubranchipus bundyi: This Anostracan or 'fairy shrimp' is abundant and widespread throughout western North America, but information on their abundance and distribution in Colorado is lacking. Only two specimens of *E. bundyi* were collected during 2003, both from Twin Lakes in the Fort Collins latilong-block (Fig. 12) at an elevation of 2,890 meters. Although information on tolerance of fairy shrimp to pollution and disturbance is lacking, high sensitivity of Anostracan's to pollutants and disturbance is probable, and the occurrence of fairy shrimp is probably an indication of high biotic integrity (EPA 1998).

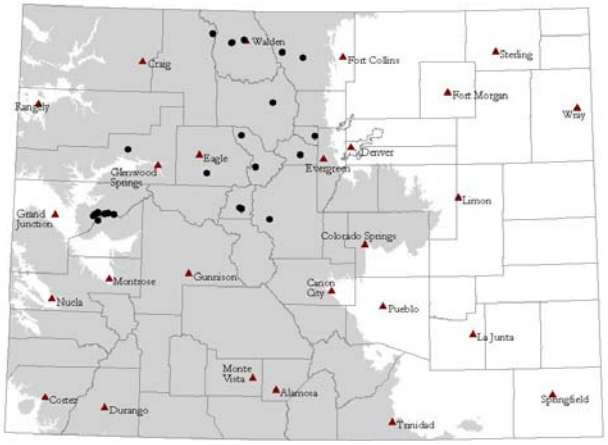
Fig. 12. *Eubranchipus Bundyi and Eurycerus* spp. collection locations during 2003. The entire study area is shown in gray.



Eurycerus: This genus of Cladocerans or 'clam shrimp' is represented in the 2003 sample by only two specimens from Womack Reservoir # 2, a small impounded water body on the Grand Mesa (Fig. 12). Little information is available on the abundance and distribution of this cladoceran in either Colorado or North America.

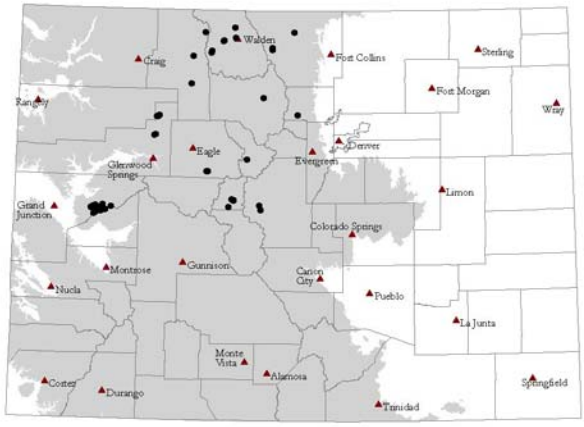
Gammarus: This genus of Amphipods was the second most common crustacean collected in 2003 with 241 specimens collected at 29 locales (Fig. 13). Amphipods are extremely diverse, abundant and widespread crustaceans and although information on distributions in Colorado are sparse, they are likely widespread and abundant in the state. Collections of *Gammarus* occurred from throughout the sampled area with most coming from lakes and reservoir, while three collections were from ponds.

Fig. 13. *Gammarus* spp. collection locations during 2003. The entire study area is shown in gray.



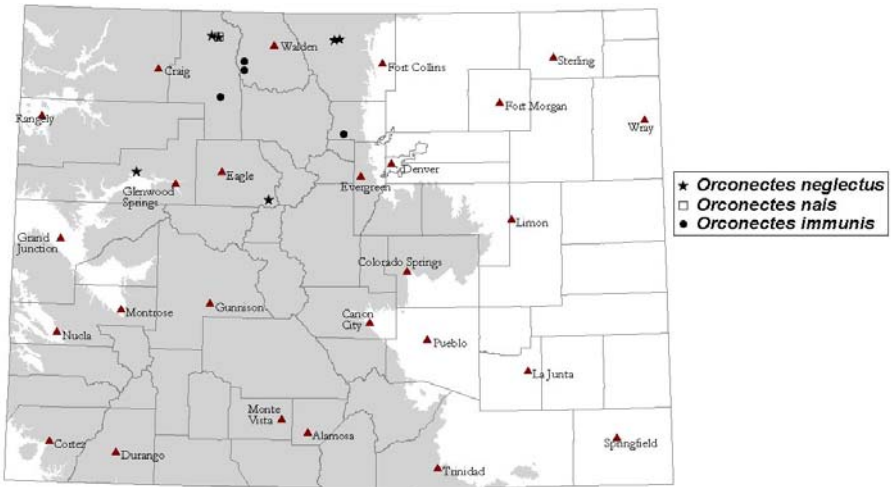
Hyalella: This genus of Amphipods was the most common crustacean collected in 2003 with 442 specimens collected at 48 locales (Fig. 14). Amphipods are extremely diverse, abundant and widespread crustaceans and although information on distributions in Colorado are sparse, they are likely widespread and abundant in the state. Collections of *Hyalella* occurred from throughout the sampled area with most coming from lakes and reservoirs, while nine collections in total were either from creeks/streams, fens or ponds.

Fig. 14. *Hyalella* spp. collection locations during 2003.
The entire study area is shown in gray.



***Orconectes*:** Three species of crayfish *(O. immunis, O. nais* and *O. neglectus*) were collected from the sampled area in 2003. *Orconectes immunis* was collected from four locales, *O. nais* from one, and *O. neglectes* from six. Information on the abundance and distribution of all three species in Colorado is limited but suggests that *O. imminus* is limited to the plains of eastern Colorado and the mountains of Larimer and Boulder counties (Unger 1978). Distributions recorded during this study extend the western range of *O. immunis*, well into the heart of the Rocky Mountains in Jackson and Routt counties (Fig. 15). *Orconectes nais* is known from a wide range in eastern Colorado and from a population in the San Luis Valley, but current records suggest it is uncommon throughout that range (Unger 1978). In 2003 *O.*

Fig. 15. *Orconectes* spp. collection locations during 2003.
The entire study area is shown in gray.



nais was collected from only one location in Routt County (Fig. 15), extending its known range in northern Colorado nearly 180 miles to the west. Previously, *O. neglectus* was recorded from the plains of eastern Colorado (Unger 1978), but specimens collected during 2003 came from Garfield County west of Glenwood Springs and from Eagle, Larimer and Routt counties (Fig. 15). Crayfish were recorded only from lakes and reservoirs during this survey up to an elevation of 2,800 meters.

DISCUSSION

There is little information on the distribution of crustaceans in western Colorado and the available information on distribution and abundance of mollusks is dated, yet such information is essential to understanding the conservation issues and developing conservation plans for these invertebrates. The purpose of this study, now at the end of its first year, is to fill the gaps in information on the distribution and abundance of mollusk and crustacean species in western Colorado. This study has already produced records that extend ranges for some of the studied taxa. The range fluctuations of these invertebrates is unknown, but it is unlikely given difficulties in dispersal for these non-vagile animals that expansions are common while range contractions may be occurring because of sensitivities of aquatic invertebrates to disturbance and pollution of aquatic habitats (see Diggins and Stewart 1998, Hudson and Ciborowski 1996, EA Mid-Atlantic Regional Operations 1990, Hilsenhoff 1988, Beck 1977).

For crayfish, all 2003 collections were new records from the areas sampled resulting in Colorado range extensions for all three species, *Orconectes immunis, Orconectes nais* and *Orconectes neglectus*. This probably reflects a lack of survey effort and the absence of readily accessible publications on past crustacean surveys in western Colorado. It is unlikely that records represent recent range expansions for the three crayfish species. The distribution and abundance of other crustaceans recorded during 2003 is unsurprising. Although specific data are lacking or are sparse for most of the genera recorded during the 2003 survey the observed distributions were consistent with the what is known about the ecology and biogeography of the represented taxa.

Pisidium spp. were the most common mollusks encountered during 2003. Pea clams are ubiquitous in North America and the results of our survey are not unexpected. Similarly the distribution and abundance of *Lymnaea*, *Gyraulus* and *Physa* reflect the current understanding of their distribution and abundance in Colorado. It is interesting to note that *Helisoma* were under represented in the sample based upon past knowledge of their distribution in Colorado (see Wu et al. 1982, Wu and Liu 1989). Past records identify 50 locales within the area sampled during 2003 from which *Helisoma* were recorded, our collection identified four locales inhabited by *Helisoma*. The explanation for why *Helisoma* appear to have declined is unknown, offering an opportunity for further investigation. *Valvata* were also rare in the 2003 sampling area having been recorded from only one locale. *Valvata* are known to be rare in Colorado and past records identify only one known location for *Valvata* in the area sampled during 2003, thus lending support to our results.

Of interest is the absence of numerous species whose known distributions would suggest their occurrence in the 2003 sample. Species expected from the sampled area, but not observed include *Acroloxus coloradensis, Aplexa elongata, Arion circumscriptus, Catinella* spp., *Cionella lubrica, Columella* spp., *Derocerus* spp., *Discus* spp., *Euconulus fulvus, Ferrissia* spp., *Gastrocopta armifera, Microphysulla ingersolli, Misculium lacustre, Oxyloma* spp., *Promenetus* spp., *Punctum* spp., *Pupilla* spp., *Pupoides inoratus, Retinella* spp., *Sphaerium striatinum, Succinea avara, Vallonia* spp, *Vertigo* spp., *Vitrina* spp., and *Zonitoides arboreas*. Some of these species are extremely rare and will present difficulties in detection under any sampling protocol. Others may require a more focused sampling effort during year two of the project to identify their occurrence in the study area. In the case of *Acroloxus coloradensis* researchers were unsuccessful in securing authorization from private landowners to update records on the population near Eldora, Colorado.

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APPENDIX I

TARGET SPECIES LIST

Order BASOMMATOPHORA

		CNHP Status and Rank	
Scientific Name	**Common Name**	**Global Rank**	**State Rank**
Acroloxus coloradensis	Rocky Mountain Capshell	G1G2	S2
Aplexa elongata	lance aplexa	G5	S4
Ferrissia walkeri	cloche ancylid	G4G5	S3
Ferrissia rivularis	creeping ancylid	G5	S4
Helisoma trivolis	marsh rams-horn	G4Q	
Lymnaea stagnalis	swampy lymnaea	G5	S2
Lymnaea parva	pygmy fossaria	G5	S5
Lymnaea caperata	wrinkled marshsnail	G5	S5
Physa cupreonitens	hot springs physa	G?	S2
Physa skinneri	glass physa	G?	S2
Physa utahensis	banded physa	G1	S1
Promenetus exacuous	sharp sprite	G5	S2
Promenetus umbilicatellus	umbilicate sprite	G4	S3

Order MESOGASTROPODA

		CNHP Status and Rank	
Scientific Name	**Common Name**	**Global Rank**	**State Rank**
Valvata sincera	mossy valvata	G?	S3

Order NEOTAENIOGLOSSA

		CNHP Status and Rank	
Scientific Name	**Common Name**	**Global Rank**	**State Rank**
Melanoides tuberculatus	red-rim melania	G5	SE

Order VENEROIDA

		CNHP Status and Rank	
Scientific Name	**Common Name**	**Global Rank**	**State Rank**
Musculium	fingernail clam	G5	?
Pisidium compressum	ridgebacked peaclam	G5	?
Pisidium milium	quadrangular pillclam	G5	?
Pisidium nitidum	shiny peaclam	G5	?

Pisidium sanguinichristi	Sangre de Christo peaclam	G1Q	S?
Sphaerium striatinum	striated fingernail calm	G5	?

CRAYFISH AND SHRIMP

Order DECAPODA

		CNHP Status and Rank	
Scientific Name	**Common Name**	**Global Rank**	**State Rank**
Orconectes neglectus	a crayfish	G5	S2