A survey of locally endemic Mollusca of Utah, Colorado, Wyoming, Montana, North Dakota, and South Dakota.

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Introduction

This report is a culmination of field, laboratory, and bibliographic work begun in August, 1974. The project as originally contracted called for a survey of Utah and Colorado species, but at the suggestion of Dr. Marc Imlay the survey was expanded to cover the additional states. The task grew in terms of area and taxonomic diversity and its objectives were modified to best use the time and financial resources available. The project objectives became,

1) to determine the status of as many species as possible under the Endangered Species Act of 1973,
2) to identify those rare, localized mollusks that do not merit threatened or endangered status as defined at present (IUCN Rare catagory),
3) to identify present and potential risks to the molluscan fauna,
4) to provide the Office of Endangered Species with a reference for future planning and management in the region,
5) and to recommend taxa, mollusk groups, or geographic areas for further investigation.

Endemic species restricted to small ranges in the region, and hence more vulnerable, are primarily land snails of the genus Oreohelix and species of the aquatic families Physidae, Lymnaeidae, and Hydrobiidae. Many of the endemic forms pose systematic problems beyond the scope and resources of this investigation, however, detailed study of Oreohelix is under way.

The 11 mollusks at risk in the region appear to be a smaller percentage of the total fauna than has been noted in regions exposed to a high degree of human modification. After more thorough systematic revision

of the fauna delineates its composition and a greater density of collecting locates any undescribed elements, I speculate that about 5-8% of the taxa will be threatened or endangered as defined by the 1973 Act. The central and northern Rocky Mountain region is certainly below the apparent national average of 10% threatened or endangered nonmarine Mollusca.

The fauna in general has not been exposed to the same degree of stress from human population encroachment and economic development as some areas of eastern and western coastal North America. The region does not seem to include configurations on the scale of and analogous to certain rivers in southeastern U.S. where several localized bivalve and gastropod species can be put into jeopardy by construction of a single impoundment. In most cases threats are to single species. Most foreseeable threats are from expanding habitation, recreational use, and industrial development. Presumably the societal requirements that demand these types of encroachment will increase through the rest of this century and the resultant pressure will affect several taxa now considered rare by the IUCN definition.

Six of the species reported here are threatened and three are endangered, of which two may be extinct. All of the threatened and endangered species known so far from the study area are at risk wholly or in part because of their extremely localized range. It is possible for one normal act of environmental modification to critically reduce or extripate one of these populations. Only 2 of the 11 mollusks reported so far have ranges that appear relatively free of human alteration, although 7 range in areas that would appear to be remote or "natural" to the casual lay observer. Three of the species are known to be relic populations that have survived natural habitat deterioration while the rest appear to be localized endemics in light of scant or non-existent data on their Quaternary geologic history.

Evaluation of human impact on these animals can be made by checking the number of taxa whose range has been exposed to each of several catagories of human modification common in the region. Two types of activity then emerge in frequency above the others, water management (impoundment, irrigation) and recreational uses. Other human activities seen to actually or potentially affect these species are highway construction, agricultural uses, wildlife habitat management, and municipal development. The interrelationships are complex (between irrigation-agriculture, recreation-wildlife management, highways-municipal development and so forth) but the main sources of detriment are evident. Water management practices can deteriorate or destroy the habitat of some freshwater mollusks and impoundment can destroy habitat of terrestrial forms. Considering the hydrology of the region, the bulk of justifiable modification for management of surface water bodies has been carried out. This is not to say that more, and in some cases environmentally sound, water management won't be undertaken in the future, but rather that it will decline in importance to the Mollusca relative to other negative impacts.

Recreational encroachment is on the increase in this region, and if poorly managed it can reduce the habitat available to land and freshwater mollusks. Five of the 11 threatened or endangered taxa in this region occur in a national park (3), forest (1), or wildlife refuge (1). This may be expected since large portions of the western U.S. are public lands. Several of the others are in close proximity to public or commercial recreational areas. While several natural and man-made factors have operated in varying degrees to the detriment of the threatened and endangered mollusks of the central and northern Rockies, the common thread of human interaction with these taxa in the future promises to be recreational pursuits.

Atypical, unusual, or unique landforms and environments within any region attract interest as recreational areas and in time either fall into public domain and management or become singled out of public land tracts. A cycle of increasing access and use is instituted and reinforced, and the environment is altered from its pre-existing state to a degree established by management practices. The rate at which any deterioration of the environment takes place is controled by environmental parameters. In modern context this is viewed as a problem of conservation that must balance public attainment of a "quality environmental experience" against a need for protection that sometimes dictates exclusion or restriction of human access. A critical aspect of the "park dilemma" is that extraordinary natural areas often are refugia in diminished habitat for relic species, regionally unique ecological configurations, or small but effective zoogeographic barriers or "islands". The same properties that tend to attract recreational use have also operated as factors in the process of genetic isolation and divergence. Historically, the result has been a selective increase in public encroachment on limited habitat that can be critical to the survival of endemic animals and plants.

Methods and Procedures

Published records of mollusks in the study area were examined and all currently recognized taxa with limited known ranges were selected for review. Familiarization with taxa was obtained during a visit to Field Museum of Natural History, Chicago (hereafter FMNH) and the U.S. National Museum of Natural History (USNM). Dr. Alan Solem informed me in 1974 that FMNH houses the University of Utah collections of Chamberlin, Jones, et al. along with extensive lots from other major collections from the region. It was subsequently found to be the single most convenient

Field work commenced shortly after project funds became available in August, 1974 with the bulk of collecting being done in Summer, 1975. One short field trip was undertaken in September, 1976. A total of 176 localities were collected and many more were checked. Since the survey attempts to cover a significant portion of continental United States and all Mollusca therein, field work was rapid and targeted toward certain elements of the fauna. The field techniques employed are standard malacological practice. All live material was relaxed with Chloretone and land mollusks were left to drown for 10-12 hr. Specimens are preserved in 70% isopropyl alcohol.

Some Oreohelix were returned to the laboratory alive and successfully maintained in terraria of 1 gal. widemouth jars (restaurant salad dressing jars) and clear plastic mice trays (similar to plastic shoe boxes). A layer of gravel in the bottom for drainage and wood blocks or twigs to provide cover were the only materials added. The terraria were kept shaded from direct florescent light in a windowless, unheated storeroom with the room lights on a timer that provided 12 hr. of light per day. Light watering weekly and introduction of rolled oats and calcium or cornmeal every month or so sustained the specimens. Low moisture, except for short-term wettings, and good ventilation provided by closing the containers only with screening seem to be critical requirements for maintaining laboratory populations of these snails.

Early in the project an attempt was made to computerize zoogeographic data on the fauna for easy retrieval and analysis (Bickel, 1975). Student personnel changes and budget limitations forced abandonment of the project which had not been budgeted into the contract.

Most manpower resources were devoted to field work and specimen care with anatomical preparation and data gathering consuming the second greatest effort. Literature review and data compilation consumed a significant amount of time but very little funds.

Recommendations

Forms currently in use by the Office of Endangered Species for reporting the status of potentially threatened and endangered species have been completed for 9 of the taxa considered in this report. As such, it is recommended that these mollusks be recognized or given formal status as threatened or endangered animals.

This review also indicates avenues for additional research appropriate to identifying and protecting vulnerable molluscan populations and habitats in Utah, Colorado, Wyoming, Montana, North Dakota, and South Dakota. One genus and two major geographic areas that should receive first priority are, the northern species of Oreohelix, freshwater Mollusca of the Bonnevile basin area, and freshwater Mollusca of the upper Snake River drainage and adjacent Snake-Yellowstone divide. Other than a few species in the continental divide area of western Montana and one or two other exceptions, Oreohelix is the only terrestrial genus in the study area with localized endemic elements. It along with the freshwater assemblages of the upper Snake and Lake Bonneville areas account for 25 of the 31 valid or undetermined species or subspecies considered in this report. These geographic areas and Oreohelix are more likely to include undescribed taxa than are other genera or areas in the region.

Some areas and taxonomic groups include few or no endemic species or subspecies and it is therefore unlikely that they include potentially

vulnerable mollusks. The northern and central Great Plains fauna is composed of relatively wide-ranging species inhabiting a region whose geologic history and physiography make the existence of localized endemics unlikely. No bivalve mollusk in the project area has a localized range or is at risk. Land mollusks other than the oreohelicids appear to include few localized endemics.

Summary of Rare Endemic Taxa

The major publications on the Mollusca of this region recognize about 54 species and forms with ranges restricted to small areas or single localities. These 54 named taxa are discussed here, but only 31 are considered valid or of undetermined taxonomic status. No new taxa are reported. A few land gastropods of westernmost Montana are omitted (such as Magnipelta mycophaga, Hemphillia danielsi, and Discus brunsoni) and are assumed to have been considered by Clarke and Grimm as part of their work in the Pacific Northwest. The distribution of valid or undetermined taxa by family is: Oreohelicidae 17, Physidae 4, Lymnaeidae 3, Hydrobiidae 3, Planorbidae 1, Valvatidae 1, Succineidae 1, and Pupillidae 1. Most taxa judged to be invalid are in the Oreohelicidae and Lymnaeidae. Nine mollusks are reported for the first time as threatened, endangered, or possibly extinct. Two, Physa zionis and Amnicola deserta, were previously reported to the Office of Endangered Species by James J. Landye in a study of freshwater species of southwestern U.S.

Synonymy and nomenclature follow current monographs and regional reports. Reference to Pilsbry's (1939-1948) Land Mollusca of North America and Henderson's (1924, 1936) Mollusca of Colorado, Utah, Montana, Idaho and Wyoming

should satisfy the non-specialist seeking more systematic detail. Nomenclatorial details and formal synonymy are avoided for brevity but also to deemphasize this report as a systematic review. Some taxa that I list as invalid or likely so, still retain status as senior synonyms in the literature. The systematic judgments made here are sound but in some cases based on less new data than I would choose to have before making such decisions in print. These systematic changes are informal at present and intended to assist in planning and establishing priorities for research and management.

Explanation of summary terms

Terms applied here to systematic status, "valid", "undetermined", "invalid", and "disputed" follow the premise that all biologic taxa are subjective approximations of natural relationships based on authoritative assessment of best available data. Valid and invalid indicate a reasonable consensus and stability in the literature or judgment based on new data from this project. Undetermined implies uncertainty on my part about validity of the taxon and that data is lacking or in the process of being gathered and studied. Disputed implies divergent opinion in the literature.

IUCN status catagories are those explained in the Red Data Book, 1972, Preamble 5.

Descriptive terms for current knowledge of geographic ranges are relative to the quality of data available for nonmarine Mollusca in general. Ranges of western U.S. mollusks are generally better known than those of many invertebrates, but often less well-defined than those of vertebrates and many higher plants. "Excellent" indicates that presence-absence data are available on all sides of a taxon's range in sufficient density to permit relatively accurate mapping of range boundaries, including

sufficiently dense regional sampling to demonstrate the absence of other populations. Few, if any, Mollusca in the western fauna are known to this degree. "Good" indicates presence-absence data that permit reliable mapping of range boundaries with a small amount of sound inference. Regional data is less dense but the coverage is good, and the occurrence of outlying populations is improbable. This condition represents what would be described as a well-known molluscan species range. "Fair" suggests that presence-absence data are limited but available for all sides of the range so that boundaries can be inferred. Regional collecting data is spotty, and the absence of additional populations can be inferred (for example, on the basis of ecological information) but not adequately documented. "Poor" implies presence-absence data not sufficient to permit outlining a species range without resorting to inferences with limited reliability. Regional collecting data may be extremely limited and the absence of additional populations cannot be inferred.

Class Gastropoda

Valvatidae

Utah Roundmouth Snail
Valvata utahensis Call
V. utahensis horatii Baily and Baily
Status: valid

Utah - Idaho
Range data: fair
IUCN status: rare or vulnerable.

All evidence indicates that V. utahensis is no longer living in Utah. Call's original description shows that he had live material from Utah Lake. Chamberlin and Jones (1929) report being unable to find living specimens there, and exhaustive collecting in 1974-1976 for this project

did not produce living specimens or evidence of an extant population. Living V. utahensis reported from Fish Springs, Utah by Russell (1971) is evidently based on specimens of V. humeralis. Taylor (1966, p. 21) maps several localities for living V. utahensis on the Snake River and one on Bear River in Idaho, all based on uncited museum records. No attempt was made to verify these records in the field or at the institutions listed by Taylor. At best, this is a rare species now restricted to southern Idaho and possibly the Snake River drainage. Taylor (1966) correctly places V. utahensis horatii in the synonymy of the typical form.

Hydrobiidae

Amnicola deserta: status reported by James J. Landye.

Hoback Canyon Snail — Wyoming, ?Montana-Idaho

Amnicola greggi (Pilsbry) — Range data: poor

Status: valid — IUCN status: indeterminate

The type locality is Cliff Creek Canyon, a fork of Hoback Canyon, south of Jackson, Wyoming. Material collected in 1976 from several springs at the base of Snake River terraces in Grand Teton National Park is referable to this species. It is probably a common inhabitant of terrace springs along the Snake River valley in Wyoming. Taylor (1966b, p. 173) mentions examining material from western Montana and southeastern Idaho but provides no detailed range or locality data. If Taylor's observations are correct, A. greggi is sufficiently widespread to be clear of foreseeable risk.

Bear Lake Snail — Utah - Idaho

"Amnicola" pilsbryi Baily and Baily — Range data: good

(not A. pilsbryi Walker, 1906)

Status: invalid, a synonym of

A. longinqua

This species was described from fossil material collected at Bear Lake by the Bailys who found only empty shells from beach drift there and at Utah Lake (J. Baily, per. comm., 1975). Living mollusks are extremely rare at Bear Lake except for infrequent succineids, lymnaeids, Gyraulus, and Physa that inhabit vegetated flats on the shoreline or pools isolated from the lake proper. My sampling produced only a single living immature Physa from the lake proper, and discussions with other scientists studying the lake confirm the extreme rarity of living mollusks.

Some specimens from Bear Lake show the diagnostic characters given by Baily and Baily (1951). Generally the material does not differ from the common and widespread hydrobiid of Lake Bonneville sediments commonly referred to Amnicola longinqua.

Elk Island Snail — Wyoming

Amnicola robusta (Walker) — Range data: fair - good

Status: valid — IUCN status: vulnerable

See status report form.

Lymnaeidae

Henderson's Pond Snail — Colorado

Lymnaea hendersoni Baker — Range data: poor

Status: invalid

A name applied to a lymnaeid population that occurs somewhere west of Fort Collins, Colorado and not recognized elsewhere. Hubendick (1951, p. 189) places L. hendersoni in the synonymy of Stagnicola bulimoides.

Brunson's Pond Snail — Montana

Lymnaea stagnalis brunsoni Russell — Range data: good - fair

Status: invalid

Clarke (1973, p. 305) places this name in the synonymy of L. stagnalis appressa observing that the distinguishing characters of brunsoni are common variations of L. stagnalis. Brunson's Pond Snail is a population evidently limited to Flathead Lake, Montana.

Warthin's Pond Snail — Wyoming

Stagnicola caperata warthini (Baker) — Range data: good

Status: invalid

Taylor (1952) discusses evidence for his placing this name in the synonymy of Stagnicola binneyi. The population occurs at the base of and above the Upper Falls of the Yellowstone River in Yellowstone National Park.

Button's Pond Snail — Utah

Stagnicola elodes buttoni Baker — Range data: poor

Status: invalid

Button's Pond Snail was named by F. C. Baker from material collected by Henry Hemphill decades earlier from a site described only as near

Salt Lake City, Utah. Hubendick (1951, p. 183) did not recognize the form. Specimens from Hemphill's original series (Stanford #5775, FMNH 178001) were compared with numerous lots of S. elodes (= S. palustris) from the Rocky Mountain region in Field Museum and my collections. The diagnostic shell characters are not unusual in S. elodes and not as distinct in the type lot as Baker's description implies.

Elrod's Pond Snail — Montana

Stagnicola elrodi Baker and Henderson — Range data: good - fair

Status: invalid

Clarke (1973, p. 329) and Hubendick (1951, p. 187) place this name in the synonymy of S. catascopium. The type locality is Flathead Lake, Montana.

Logan Pond Snail — Utah

Stagnicola impedita Baker — Range data: poor

Status: invalid

This form was also named by Baker from material in the Hemphill collection. Examination of a lot from his original material (Stanford #5776, FMNH 178002) supports Hubendick's (1951) placement of it in the synonymy of S. elodes. It is known only from the type series for which the only locality is near Logan, Cashe Co., Utah.

Fish Springs Pond Snail — Utah

Stagnicola pilsbryi (Hemphill) — Range data: fair

Status: valid — IUCN status: Endangered (or extinct)

See status report form.

Utah Pond Snail — Utah

Stagnicola utahensis (Call) — Range data: good

Status: valid — IUCN status: Endangered or extinct

See status report form.

Jackson Lake Pond Snail — Wyoming

Stagnicola jacksonensis (Baker) — Range data: fair

Status: valid (?) — IUCN status: ? Rare

Stagnicola jacksonensis occurs commonly along the Snake River in Jackson's Hole and farther downstream and in Jackson, Coulter Bay, Phelps, and possibly other lakes flanking the Teton Range. Beetle (1961b) also reports it from the Bighorn Mountains in Johnson Co., Wyoming, suggesting a wider range than the Snake River drainage. Its relationship to S. hinkleyi (Baker) from the North Fork of the Snake River in Fremont Co., Idaho has not been determined. Taylor (1952) and Inaba (1969) report S. hinkleyi from Yellowstone Lake and the Snake River in Teton Co., Wyoming. While a detailed survey of this taxon was not attempted, it was found to be fairly common in the Snake River drainage in Jackson's Hole. Stagnicola jacksonensis is not presently at risk although impoundment and related alteration of Jackson Lake and the Snake River evidently eliminated some suitable habitat.

Rodeck's Pond Snail — Montana

Fossaria obrussa rodecki Baker — Range data: fair

Status: invalid

Recognized only from a population in Swan Lake, Lake Co., Montana characterized by overall narrower shell proportions than typical F. obrussa. Hubendick (1951) considers it a synonym of typical F. obrussa.

Planorbidae

Yellowstone Ramshorn Snail — Wyoming

Helisoma subcrenatum perdisjunctum Baker — Range data: fair

Status: invalid

Populations in Yellowstone Lake and the Madison River named by Baker (1945, p. 224) and continued in the Wyoming checklist of Beetle (1961). A junior synonym of typical H. subcrenatum.

Jackson Lake Snail — Wyoming

Carinifex jacksonensis Henderson — Range data: good

Status: valid — IUCN status: Endangered

See status report form.

Physidae

Wellsville Bubble Snail — Colorado

Physa cupraeonitens Cockerell — Range data: fair

Status: probably invalid

The type locality of this species is the warm-water spring at Wellsville, Fremont Co., Colorado. S. Wu and G. Bryce (per. comm., 1975) indicate that they had collected P. cupraeonitens from the type locality and other springs in this area of Colorado, and they expressed doubts about its taxonomic validity. Henderson (1924, p. 183) cites additional localities near Mesa and Hotchkiss, Mesa and Delta Counties, as well as near Poncho [sic] just east of the type locality. No field investigation of this form was undertaken.

Fish Lake Snail — Utah

Physa microstriata (Chamberlin and Jones) — Range data: good

Status: valid — IUCN status: Rare

See status report form.

Wyoming Cave Snail — Wyoming

Physa spelunca Turner and Clench — Range data: good-fair

Status: valid — IUCN status: Rare

See status report form.

Utah Bubble Snail — Utah

Physa utahensis Clench — Range data: fair

Status: valid — IUCN status: Rare or Vulnerable

See status report form.

Physa zionis: Status reported by James J. Landye.

Succineidae

Kanab Amber Snail — Utah

Oxyloma haydeni kanabensis Pilsbry — Range data: fair

Status: valid — IUCN status: Vulnerable

See status report form.

Oreohelicidae

Parawan Mountain Snail — Utah

Oreohelix parawanensis Gregg, 1940 — Range data: fair - good

Status: probably invalid, a synonym of

O. strigosa depressa

The Parawan Mountain Snail was described from a population discovered in rock slides on the southwest slope of Brian Head, Iron Co. Utah. The slope is just below the summit and is barren of cover other than slide debris and shrub vegetation. The specimens are about one-half the size range normally found in oreohelicid populations found at lower elevations and have about one less whorl. Shell morphology and the occurrence of dwarfed populations of Oreohelix in similar alpine situations elsewhere (see O. alpina) suggests that O. parawanensis is a stunted population of the widespread, O. strigosa depressa.

The type locality was collected June 27, 1975 at which time the rock slide holding the population was still covered by several feet of snow, and only a few empty shells were obtained from its margin. In such a habitat the population probably had a maximum total period of annual activity of about 15 weeks in 1975. Years when temperature and precipitation further limit activity are probably not unusual. It can be logically assumed that such conditions could lead to dwarfed colonies even in a genus normally adapted to rigorous subalpine and arid environments.

Montrose Mountain Snail — Colorado

Oreohelix strigosa montrosensis — Range data: poor

Status: undetermined, probably a synonym of O. strigosa depressa

Pilsbry (1939, p. 437) described this form based on 18 specimens collected in 1907 with only Montrose, Montrose Co., Colorado given as the type locality. Specimens clearly referable to montrosensis were collected along the Uncompahgre River just south of Montrose on June 19,

1975 in brush thickets similar to the habitat suggested by Pilsbry. It seems likely that brush-lined drainageways nearby in the Uncompahgre Valley should also hold colonies. The specimens (35) intergrade from the high-spired and large-apertured montrosensis form to the flat spire and smaller aperture of O. strigosa depressa. Anatomical characters are under study but the shell characters are not significantly different from O. strigosa depressa. Retention of the subspecific name would require far more data on the distribution of this form and O. strigosa depressa in southwestern Colorado.

Fragile Mountain Snail — Utah - Idaho

Oreohelix strigosa fragilis — Range data: poor

Status: probably invalid, apparently a synonym of O. strigosa depressa

Oreohelix strigosa fragilis is a form distinguished by having shells that are translucent to varying degrees and thinner than those of O. strigosa depressa. Henderson and Daniels (1916, p. 336) also cite as diagnostic its somewhat reflected columellar lip and slight anatomical differences. They fail to mention the organ systems examined and the nature of the differences. Pilsbry (1939, p. 438) found the genitalia to be like those of O. strigosa depressa and implied that shell translucence is the single diagnostic character. All published localities are evidently within 10 mi. of one another along the Bear River Range at the Utah - Idaho border. No attempt was made to collect the type area around Franklin, Idaho for this project.

Button's Mountain Snail — Utah

Oreohelix strigosa buttoni — Range data: fair

Status: invalid, synonym of O. strigosa depressa

Several colonies of O. strigosa depressa in Ogden, Taylor, and Weber Canyons near Ogden, Utah include a few specimens possessing columellar teeth that vary in form, degree of development, and frequency of occurrence. The specimens otherwise fall within the range of variation in O. strigosa depressa. The structures are too infrequent and inconsistent to be considered taxonomically significant.

Pygmy Mountain Snail — Wyoming - Montana

Oreohelix pygmaea — Range data: fair - poor

O. pygmaea maculata

Status: possibly valid, or a synonym of

O. strigosa cooperi

A small mountain snail of the O. strigosa group that is "widely spread above 4500 ft." (Beetle, 1961b, p. 100) in the Bighorn Mountains. Genitalia, shell morphology, and geographic range suggest a very close relationship to O. strigosa cooperi, the rather compact, O. subrudis-like mountain snail on the northeastern portion of the O. strigosa range. Certain colonies of O. strigosa cooperi in the Black Hills, S. D. are dwarfed at higher elevations and resemble O. pygmaea. Beetle's work shows that the form is not restricted to a position of risk, and no field work was undertaken other than to obtain representative series from the type locality and nearby.

Typical O. pygmaea occurs in the same canyons with the maculata form. The two are separated by the slightly larger size and more developed spiral sculpture of maculata; however, Pilsbry (1939, p. 450) observes that "the relationship is very close". Material from localities in Shell Creek Canyon and White Creek Canyon show size variation between

colonies but no other differences suitable for separating the two.

Coalville Mountain Snail — Utah

Oreohelix peripherica weberiana — Range data: good

Status: valid — IUCN status: Vulnerable or Endangered

See status report form.

Wasatch Mountain Snail — Utah

Oreohelix peripherica newcombi — Range data: poor

O. peripherica wasatchensis

Status: undetermined

Published localities (Chamberlin and Jones, 1929; Pilsbry, 1939) for these populations are: mountains north of Ogden, in Ogden Canyon at its mouth, Wasatch Mountains near Ogden, and S. side of valley about 1 mi. below the mouth of Ogden Canyon on base of river terrace in an oak-maple thicket and upslope to a rock slide. The area in and around the mouth of Ogden Canyon was searched during August, 1974, 1975, and September, 1976 without discovery of either form. The area covered in detail is 1.5 mi. north and south of the canyon mouth and several miles into the canyon. Poorly accessible spots within the canyon and higher elevations above talus slides were not checked. Typical O. peripherica was encountered at several localities in the Ogden area.

"Paratypes" of both forms (FMNH 60078, 60151) illustrate their probable synonymy which is somewhat apparent from Pilsbry's (1939, p. 455-457) descriptions. Size at same whorl count, shell shape, color, and the presence of a raised cord atop the carinate periphery are alike in both. The newcombi form differs from wasatchensis by having a more rounded periphery, and it seems to be gradational between typical O. peripherica

and the extreme, wasatchensis.

The Wasatch Mountain snail is conchologically distinct irregardless of its taxonomic status, and its occurrence in an area that has been well explored for mountain snails in the past hundred years suggests one or a few colonies restricted to a small area. Road construction in Ogden Canyon and expansion of the city to the Cashe National Forest boundary (base of the mountain front) may have extripated the population; however, the colony is most likely located somewhere above 5000 ft. and undisturbed within the National Forest.

Elrod's Mountain Snail — Montana

Oreohelix elrodi — Range data: fair - poor

Status: valid — IUCN status: Rare

Elrod's Mountain Snail occurs in the valley holding McDonald Lake, Lake Co., MT (not McDonald Lake of Glacier National Park) and is reported as most abundant on the northern slopes up to and above 7500 ft. This area is in a remote portion of the Flathead Indian Reservation. R. B. Brunson (per. comm., 1975) mentioned finding colonies elsewhere in western Montana.

The species inhabits open rock outcrops, boulder piles, and cliff interstices, seemingly avoiding vegetative cover. Elrod (1902) provides an extensive habitat description. The shell, radula, and ecology of O. elrodi serve to separate it from other members of the genus. The species was not collected in the course of this project.

Henderson's Mountain Snail — Colorado

Oreohelix hendersoni — Range data: fair - poor

O. hendersoni dakani

Status: undetermined

Localities for this species are in Boulder, Rio Blanco, and Garfield Counties, Colorado. It appears to be a rather widespread form that is similar to O. strigosa depressa in shell shape and proportions, but it has the coloration, sculpture pattern, and genitalia of O. haydeni. Any spiral ornamentation is very light, and the whorls are generally smooth. Pilsbry (1939, p. 462) indicates that the radular teeth are strongly differentiated for the genus and distinct from those of the strigosa species group.

Henderson's Mountain Snail may be a distinct species, a synonym of O. strigosa depressa or O. haydeni, or a subspecies of either. Irregardless, museum records, published localities, and our field work in 1975 show that O. hendersoni probably occurs in western Colorado from the San Juan region to the White River uplift of northwest Colorado and is not at risk. Although Pilsbry (1939) retains both names, Henderson (1924) and he present evidence that shows O. hendersoni dakani to be a synonym of typical O. hendersoni.

Corrugated Mountain Snail — Utah

Oreohelix haydeni corrugata — Range data: poor

Status: undetermined

This population possesses shells that are higher-spired, more narrowly umbilicate, and made up of larger, more rounded whorls than typical O. haydeni and its other forms. Pilsbry (1939, p. 467) illustrates and describes radular differences that suggest "... a rather distinct race." The type locality is southeast of Webster Station (excluded from most

current maps but is located about SE¼, sec. 2, T. 14 N., R. 1 E.), probably at the mouth of High Creek Canyon. A search of the High Creek Canyon area on August 18, 1974 did not produce the colony.

Hybrid Mountain Snail — Utah - Idaho

Oreohelix haydeni hybrida — Range data: fair - poor

Status: invalid, synonym of typical

O. haydeni

The type locality of this form is near the mouth of Logan Canyon, Cashe Co., Utah. It is a name applied to specimens with weaker sculpture than typical O. haydeni. Study of museum specimens and collections made in Weber and Logan Canyons has uncovered no morphological or ecological basis for recognition of hybrida.

Oquirrh Mountain Snail — Utah

Oreohelix haydeni oquirrhensis — Range data: fair

Status: undetermined, may merit recognition

Poorly studied populations of O. haydeni occur in the larger and wetter canyons on the west flank of the Oquirrh Mountains in Tooele Co., Utah. The shells of these populations are more carinate and have finer sculpture than haydeni of the Wasatch Range. The differences in shell morphology are subtle and alone don't strongly support subspecific rank. The genitalia and radula of Oquirrh Range specimens have not been reported.

Records of oquirrhensis in Weber Canyon and from western Montana (Pilsbry, 1939) reflect an earlier and different concept of subspecies. The name, O. haydeni oquirrhensis, should be restricted to populations of the Oquirrh Mountains, and its validity will depend upon future study

providing data to support recognition of these colonies as a geographic race. The Oquirrh Mountains are isolated from the Wasatch Range by about 20 mi. of lake basin lowland, the Jordan River valley. A potential barrier between the populations has existed at least from Lake Bonneville time to the present. These, like other high and isolated mountains in the Bonneville Basin were partially emergent as islands during Lake Bonneville stages. Material collected in June, 1975 is under study.

Bethel's Mountain Snail — Colorado

Oreohelix haydeni betheli — Range data: fair - poor

O. haydeni alta

O. haydeni mixta

Status: undetermined

An outlying colony of O. haydeni occurs at Glenwood Springs, Colorado over 200 mi. east of the range of typical O. haydeni and its other forms. Form betheli occurs on and just upslope from the first prominent rock outcrop east of the city and just north of Interstate 70. This colony has been sampled many times in the past apparently from the rather steep outcrop, and published information implies that this situation represents typical habitat. However, collections on June 18, 1975 show a greater number of active snails and higher densities among shrub-pine-sage patches in shallow drainageways just upslope from the outcrop and roadcut. The total area of the colony is small - about 100 acres.

Oreohelix haydeni betheli possesses the prominent spiral ribs of the typical form but is generally depressed, more strongly carinate, and larger than other populations. East of Glenwood Springs and south of the Colorado River there are transitions from strongly ribbed to smooth shells.

Colonies on the east edge of Glenwood Springs, south of the river, have been formally named alta and mixta. These shells are smaller and generally less depressed than specimens from across the river, as well as being smooth or with weaker spiral sculpture.

The discontinuous range of O. haydeni and its forms presents an interesting systematic problem. The similar-appearing but geographically separated populations probably represent remnants of a species which formerly had a more continuous rangs, and some of the named forms tentatively recognized by Pilsbry (1939) may be true geographic subspecies. Recently published anatomical and cytogenetic data suggest that subtle shell characters of Oreohelix can reflect taxonomic differences that are also manifest in other character systems. On the other hand, O. haydeni could possibly be a recurrent morph of its widespread relative, O. strigosa depressa; although, this "lumping" of the O. strigosa species group is not a widely-held view.

None of the isolated populations of O. haydeni seem to be in any immediate jeopardy so there appears to be no urgent need to recognize them under the Endangered Species Act. These populations, irregardless of their taxonomic status, are unique elements of local faunas whose ranges merit protective measures when necessary. Systematic revision of the O. strigosa group will be essential to future protection of most northern oreohelicids.

Boundary Mountain Snail — Montana, Alberta, B. C.

Oreohelix subrudis limitaris — Range data: fair

O. subrudis apiarium

Status: invalid, synonyms of O. subrudis

Colonies of O. subrudis at Waterton Lake, Alberta (limitaris) and and Glacier National Park (apiarium) differ from the typical form by

possessing high spires. Our field observations bear out Pilsbry's (1939, p. 492) comment that, "Equally high shells occur sporadically in many colonies of subrudis elsewhere, but the high shape appears to be prevalent in Glacier National Park". High-spired colonies appear over the Glacier-Waterton Park system, southward to the Mission Range, and probably over a greater area in the region. Recognition of a subspecies solely on spire height seems unwarrented.

Bitterroot Mountain Snail — Montana

Oreohelix amariradix — Range data: poor

Status: undetermined

According to Pilsbry (1939, p. 500) the radula and genitalia of this taxon has not been examined. Its range is the Bitterroot Mountains near Lolo, about 16-17 mi. SW of Missoula. Pilsbry (ibid.) comments that the shell suggests a relationship to O. jugalis of the Salmon River valley of Idaho. R. B. Brunson (per. comm., 1975) says that he has never found O. amariradix. Specimens of O. amariradix from the type area are under study. In 1975 we found colonies to be fairly common in the Bitterroot Range west of Lolo, MT. Two atypically large specimens (FMNH 84740) from along Lolo Creek in this area are referable to this species.

Alpine Mountain Snail — Montana

Oreohelix alpina — Range data: fair - good

Status: probably invalid

Oreohelix alpina is a small (9.4 mm. width) mountain snail that occurs on Sinyaleamin Mountain and McDonald Peak (Elrod's terminology) of the Mission Range in Lake Co., Montana at elevations between 7800 and

8500 ft. This form and populations of Oreohelix elsewhere at high elevations often tend to be proportionately smaller-sized and thinner-shelled (cf. O. parawanensis and O. pygmaea). This relationship over the range of the genus suggests that alpine environments affect growth in mountain snail populations by providing fewer activity periods than are normally available to populations at lower elevations. Pilsbry (1939, p. 501) proposes that O. alpina may be an ecophenotype of O. subrudis, but geographic proximity and shell morphology also suggest that it may be a population of O. amariradix. R. B. Brunson (per. comm., 1975) doubts its validity, citing the effects of environment on size. The population was not investigated in the field in the course of this project.

Bighorn Mountain Snail (northern forms of Oreohelix yavapai) — Wyoming, Montana, ? Arizona

Range data: fair - poor

O. yavapai extremitatis

O. yavapai magnicornu

O. yavapai mariae

Status: invalid, synonyms of O. yavapai

The data given by Pilsbry (1939, p. 526-530) argue against formal recognition of these relatively depressed and carinate shells of the Bighorn Range and southern Montana as morphologically distinct from O. yavapai of Arizona and the southern Rockies. Beetle (1961b) notes that extremitatis and magnicornu occur along the western rim of the Bighorn Range in Wyoming. Pilsbry (ibid.) essentially put mariae in the synonymy of extremitatis. The populations do not represent faunal elements that are unique from the typical form, and they are not jeopardized by restricted ranges. Field investigation was not undertaken.

Keeled Mountain Snail — Montana

Oreohelix carinifera — Range data: poor

Status: undetermined

Oreohelix carinifera is known from its type locality near Garrison, Powell Co., Mt., elsewhere in western Montana, the Bighorn Range, and Beetle (1957, p. 13) reports it from 15 mi. S. of Jackson, WY. The shell and genitalia of the type population described by Pilsbry (1939, p. 532) are characteristic of forms in the O. yavapai group; however, there appears to be distinct differences in the radula of this colony. Oreohelix carinifera with its widespread referred populations may now be a heterogenous catagory made up of dwarfed populations in the O. yavapai group. If valid, it evidently is not facing foreseeable risk.

There seems to be a close relationship between O. carinifera, various named northern populations of O. yavapai, and possibly "O. hemphilli" of Idaho; all occurring north of the Snake River Plain and possibly linked historically with southern species across the Yellowstone Plateau. The Snake River downwarp has probably functioned as a barrier to genetic interchange between Oreohelix of the Rocky Mountain uplift (or Northern Rockies) and ranges of the Rocky Mountains to the south. The Yellowstone Plateau has probably been a major corridor for interchange around the east side of this barrier since late Tertiary time.

Eureka Mountain Snail — Utah

Oreohelix eurekensis — Range data: fair - poor

O. eurekensis uinta

Status: undetermined, probably a synonym or subspecies of O. yavapai.

The Eureka Mountain Snail is a small, spirally sculptured species that possesses whorls with strongly carinate peripheries and variable shoulders similar to other species in the O. yavapai group. Its genitalia are characteristic of O. yavapai and related species (Pilsbry, 1939). Oreohelix eurekensis occurs in the East Tintic Mountains just south of Eureka, Utah, south of Utah Lake. It is isolated from other areas holding populations of the O. yavapai group, and a rather unique element in the Bonneville Basin - Wasatch Range fauna.

Oreohelix eurekensis uinta occurs on the south margin of the Uinta Range near Whiterocks, Uintah Co. and closely resembles O. eurekensis.

These oreohelicid populations have evidently received little attention. Chamberlin and Jones (1929) do not mention recollecting the type locality. The Eureka Mountain Snail was not investigated in the field.

Pupillidae

Badlands Whorl Snail — ? North Dakota

Vertigo arthuri — Range data: poor

Status: undetermined

Vertigo arthuri was originally described in Europe in 1882 by von Martens from material collected a few years earlier. The locality given was the Little Missouri River at the Northern Pacific Railroad crossing, now Medora, ND. Pilsbry (1948, p. 977) states that the two types were probably collected from river drift, and reports no records for the species other than the type series. No valid records or specimens of V. arthuri have appeared since.

During the past three years, several collections have been made in the type area from river drift and adjacent land mollusk habitat, and from

elsewhere in the Little Missouri valley. In addition, in 1976 a survey of land mollusks of southwestern North Dakota was carried out for a state program, and V. arthuri did not appear at 105 localities sampled in the region.

It seems improbable that V. arthuri is an extant endemic of the Little Missouri valley; although, more detailed collecting may produce a population. The type series possibly came from some locality farther west, perhaps in the Yellowstone River drainage. The possibility of V. arthuri being a Pleistocene fossil is remote since Pleistocene deposits bearing mollusks are apparently rare in southwestern North Dakota. It is even less likely that the two type specimens were washed from non-marine Paleocene strata. Terrestrial Mollusca are rare in these sediments and extensive work in the Williston Basin and elsewhere has not produced Paleocene examples of pupillids in the west American fauna. Pilsbry (ibid.) indicates that V. arthuri appears closely related to V. gouldi basidens which ranges into the mountains of Montana and British Columbia.

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Appendix

Species Status Report Forms

CIRCLE ONE OR MORE: (FRESH WATER,) LAND, MARINE, ESTUARY

COMMON NAME Elk Island Snail

SCIENTIFIC NAME: GENUS Amnicola SPECIES A. robusta SUBSPECIES

PHYLUM Mollusca CLASS Gastropoda ORDER Mesogastropoda FAMILY Hydrobiidae

Are there data suggesting the species (or subspecies) is presently in jeopardy?

Are there data suggesting the species (or subspecies) is potentially in jeopardy?
Threatened status recommended. yes

If either explain why. total range restricted to one lake.

DISTINGUISHING CHARACTERISTICS: large thick shell; large, inflated body whorl; aperture large, ovate.

PRESENT DISTRIBUTION: Jackson Lake, Teton Co., Wyoming; Elk Island and from digestive tract of fish taken at Jackson Lake Dam (Beetle, 1957). During field work in 1975 and 1976 A. robusta was found only off Elk Island.

FORMER DISTRIBUTION: evidently the same.

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? well-known, range data good.

HABITAT REQUIREMENTS OR CHARACTERISTICS: It occurs on the undersides of pebbles and cobbles in very shallow water to depths in excess of 15 ft., where it occurs on submerged aquatic plants. Observations were made September 23, 1976 when water level was 12-18 ft. below summer level.

POPULATION STATUS AND TRENDS: No data exists to demonstrate fluctuations in numbers. Populations off Elk Island seem to be dense and quite viable.

ESTIMATED NUMBERS: approximately 5-50/m^2 along some segments of the NE shore of Elk Island; individuals are less frequent in shallow, exposed areas and most abundant on and among plant beds in deep water.

BREEDING RATE IN THE WILD: unknown.

IF DECLINING, STATE REASONS IF KNOWN: no data indicating a decline.

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: none.

MEASURES PROPOSED: status as a threatened species; protection of its habitat from water-level fluctuations greater than those now produced by Jackson Lake Dam; and general monitoring of recreational activities on Jackson Lake to guard against pollution.

NUMBER IN CAPTIVITY: none.

BREEDING POTENTIAL IN CAPTIVITY: unknown.

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.: Preliminary examination of genitalia shows the assignment to Amnicola to be inappropriate. It is possible that impoundment and recreational use of Jackson Lake had minimal effect on this species unlike Carinifex jacksonensis. However, past density and range data are not available. Henderson (1936, p. 138) states "In 1931 we found it in abundance at the type locality ..." Where on the lake they sampled is unknown.

UNIQUE FEATURES:

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

Walker, B. 1908. Pomatiopsis robusta n. sp. Nautilus v. 22, p. 97.

Dorothy Beetle
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David Bickel
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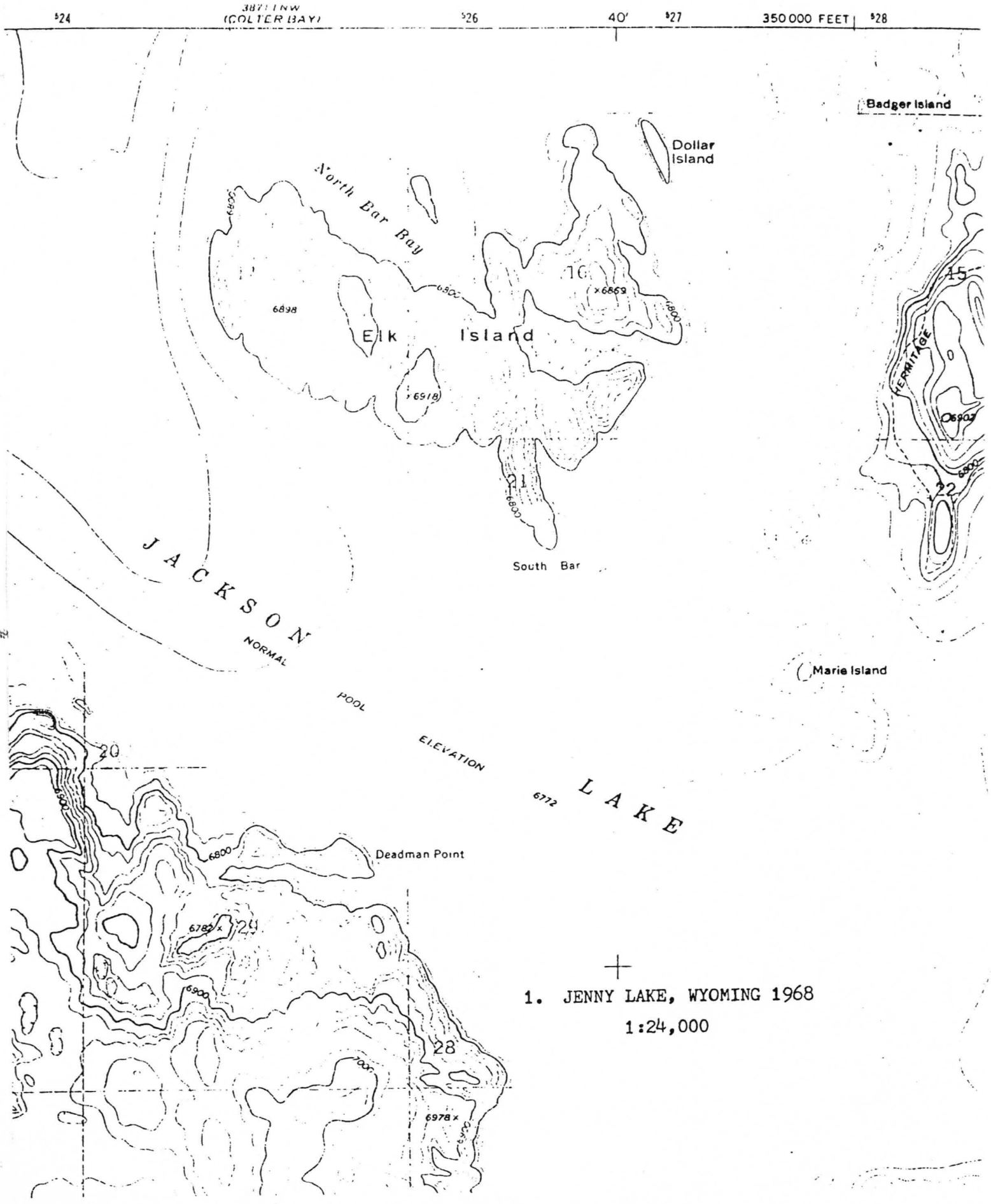
December 27, 1976
DATE



1. JENNY LAKE, WYOMING 1968
1:24,000

CIRCLE ONE OR MORE: (FRESH WATER,) LAND, MARINE, ESTUARY

COMMON NAME Fish Springs Pond Snail marshsnail

SCIENTIFIC NAME: GENUS Stagnicola SPECIES S. pilsbryi SUBSPECIES

PHYLUM Mollusca CLASS Gastropoda ORDER Basommatophora FAMILY Lymnaeidae

Are there data suggesting the species (or subspecies) is presently in jeopardy? yes

Are there data suggesting the species (or subspecies) is potentially in jeopardy? Endangered or extinct

If either explain why. alteration of wetland habitat for waterfowl management at Fish Springs National Wildlife Refuge contributed to mortality and habitat loss of this population.

DISTINGUISHING CHARACTERISTICS: small shell; tall, slender spire; columellar fold weak; spiral sculpture of weak, fine, irregular, incised lines.

PRESENT DISTRIBUTION: Fish Springs, Juab Co., Utah.

FORMER DISTRIBUTION: same.

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? well-known. This species has been found only at Fish Springs. While some uncertainity existed over the location of "Fish Springs", Russell (1971) shows the Juab Co. spring to be the type locality.

HABITAT REQUIREMENTS OR CHARACTERISTICS: Shallow, spring-fed marsh. The area where Russell (1971) obtained specimens was still drained in 1976 and showed signs of past burning. Prior to management, the area was a peat wetland with very shallow water. The springs discharging onto the area are saline.

POPULATION STATUS AND TRENDS: unknown. Live specimens of S. pilsbryi have not been collected and evidently not observed in the field. Russell's (1971) data from fresh dead shells suggest a moderately dense population that existed in only a small area just east of Crater Springs. No specimens were encountered during 4 hrs. of searching and collecting around Crater Springs and nearby areas on the refuge in September, 1976.

ESTIMATED NUMBERS: unknown. Russell (1971) reports collecting 164 empty shells from an area I would estimate to be no more than a few acres.

BREEDING RATE IN THE WILD: unknown.

IF DECLINING, STATE REASONS IF KNOWN: Russell (1971, p. 228) notes that his specimens were collected from an area that " ... had recently been drained and burned over, and only shells could be found."

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: The current refuge manager, Mr. Rolf Kraft, was aware of S. pilsbryi from Russell's paper prior to my inquiry. In attempts to monitor the species, he was confusing it with the similar-appearing hydrobiid, Tyronia protea.

MEASURES PROPOSED: An exhaustive search of the entire Fish Springs area should be carried out to see if a population of this species still survives. Any extant population still surviving in the Fish Springs Basin requires formal recognition as an endangered population.

NUMBER IN CAPTIVITY: none. The total information on this species comes from 167 empty shells.
BREEDING POTENTIAL IN CAPTIVITY: unknown.

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.: The taxonomic validity of S. pilsbryi is not in question, but examination of the animal could verify its position within the family Lymnaeidae proposed by Taylor, et al. (1963).

UNIQUE FEATURES: Systematic significance; see Taylor, et al. (1963).

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

Taylor, D. W., Walter, H. J., and Burch, J. B. 1963. Freshwater snails of the subgenus Hinkleyia (Lymnaeidae: Stagnicola) from the western United States. Malacologia v. 1, p. 237-281.

Russell, R. H. 1971. Mollusca of Fish Springs, Juab County, Utah: rediscovery of Stagnicola pilsbryi (Hemphill, 1890). Great Basin Nat. v. 31, p. 223-236.

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January 3, 1977
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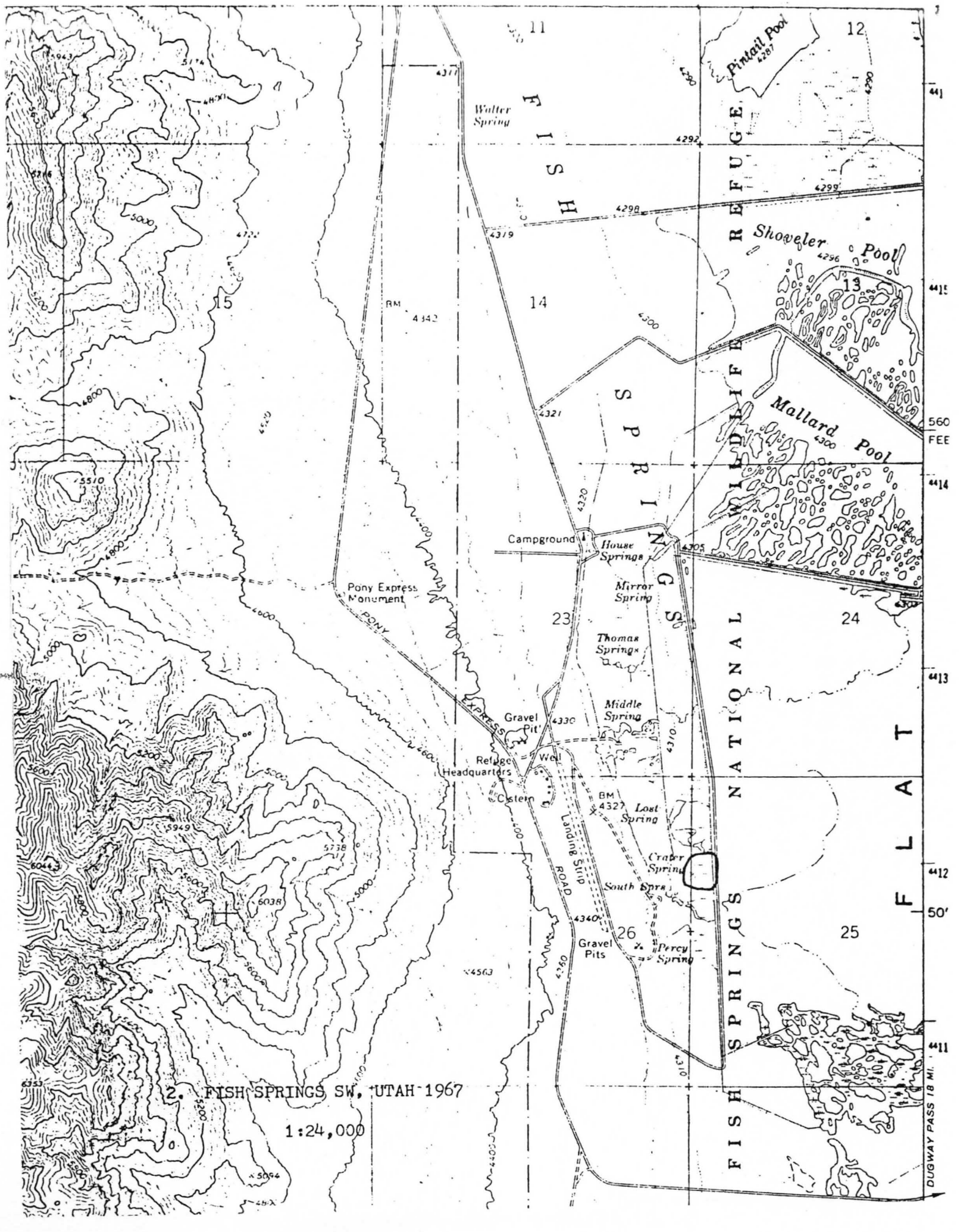

2. FISH SPRINGS SW, UTAH 1967

1:24,000

CIRCLE ONE OR MORE: (FRESH WATER,) LAND, MARINE, ESTUARY

COMMON NAME Utah Pond Snail

SCIENTIFIC NAME: GENUS Stagnicola SPECIES S. utahensis SUBSPECIES

PHYLUM Mollusca CLASS Gastropoda ORDER Basommatophora FAMILY Lymnaeidae

Are there data suggesting the species (or subspecies) is presently in jeopardy? yes

Are there data suggesting the species (or subspecies) is potentially in jeopardy?

Presumably extinct, or endangered

If either explain why. range restricted to Utah Lake (and possibly one spring) in 20th Century. Utah Lake population became extinct when lower lake levels isolated shoreline springs sometime between the early 1930's and present.

DISTINGUISHING CHARACTERISTICS: large body whorl and aperture; spire short to very short for the genus; whorls sculptured with coarse, irregular transverse ribs or costae.

PRESENT DISTRIBUTION: extant population not known at present.

FORMER DISTRIBUTION: Quaternary - Holocene: presumably throughout Lake Bonneville basin. Living specimens: springs south of Pelican Point, west shore, Utah Lake; ? "Conner's Spring, north of Great Salt Lake" (Chamberlin, 1933, Nautilus v. 46, p. 97).

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? in general, well-known. A detailed search of springs in the Salt Lake - Utah Lake area is needed.

HABITAT REQUIREMENTS OR CHARACTERISTICS: freshwater springs.

POPULATION STATUS AND TRENDS: Chamberlin (1933) commenting on the Utah Lake population noted that " several years ago ... the writer with a party of students found it still living in numbers ..." The locality he gives is the springs near Pelican Point. These shoreline springs are now (Sept., 1976) 200-400 yds. from the shoreline and dry or heavily used as stock watering holes. No evidence of S. utahensis living or represented by dead shells could be found. "Conner's Spring" could not be located. One specimen of a live lymnaeid collected at this locality by E. B. Berry in 1932 (FMNH 178021) is not this species.

ESTIMATED NUMBERS: unknown.

BREEDING RATE IN THE WILD: unknown.

IF DECLINING, STATE REASONS IF KNOWN: Falling lake level and/or human alteration of spring habitat for agricultural uses; the factor(s) responsible cannot be defined with certainity.

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: none.

MEASURES PROPOSED: An exhaustive survey of springs and other natural water bodies within the Bonneville Basin is needed to fully assess the status of this and other Lake Bonneville molluscan species.

NUMBER IN CAPTIVITY: none. Chamberlin (1933, p. 98) notes "No unusual difficulty has been experienced in rearing the species from eggs either in balanced aquaria or in those supplied with ordinary tap-water in the laboratory. They thrive on lettuce ..."

BREEDING POTENTIAL IN CAPTIVITY: unknown.

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.: The only taxonomic dispute concerns whether or not S. utahensis and its Pliocene ancestor, S. kingi, should be considered conspecific (see literature below).

One shell from the University of Utah collection (FMNH 178018) contains a dried animal.

UNIQUE FEATURES: Stagnicola utahensis is closely related to or possibly conspecific with S. kingi, a Pliocene species from sediments in the Cashe, Malad, and Bear River Valleys of Utah and Idaho. They represent a lineage that ranges from the Pliocene to the present, and one that has a relatively well-defined geographic range.

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

Chamberlain [sic], R. V. 1933. Observations on Stagnicola kingi (Meek), living and extinct. Nautilus v. 46, p. 97-100.

Henderson, J. 1936. Mollusca of Colorado, Utah, Montana, Idaho and Wyoming - Supplement. Univ. Colorado Stud. v. 23 (2), p. 81-145.

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December 11, 1976
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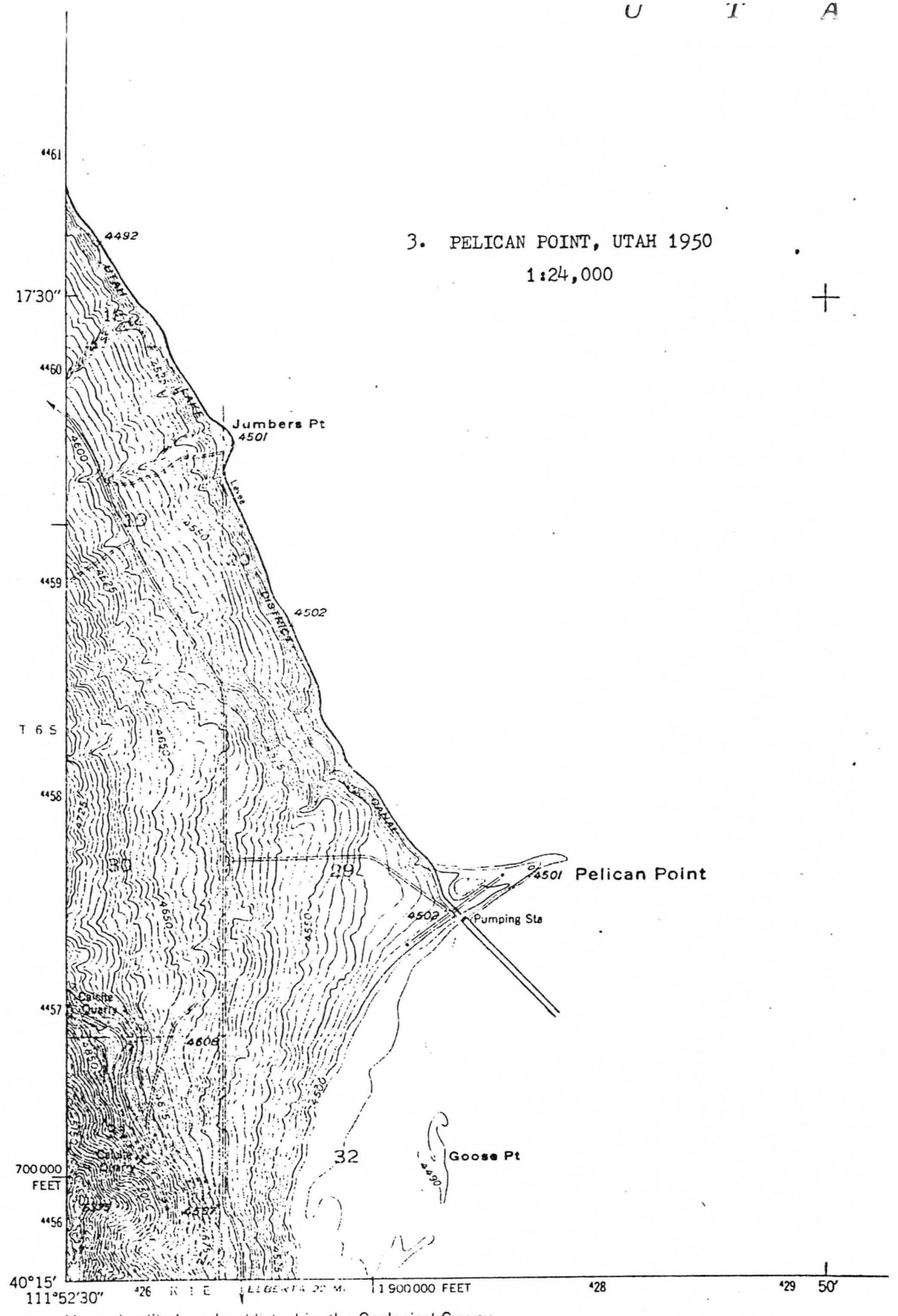
U T A

3. PELICAN POINT, UTAH 1950

1:24,000



Mapped, edited, and published by the Geological Survey

CIRCLE ONE OR MORE: (FRESH WATER,) LAND, MARINE, ESTUARY

COMMON NAME Jackson Lake Snail

SCIENTIFIC NAME: GENUS Carinifex SPECIES C. jacksonensis SUBSPECIES

PHYLUM Mollusca CLASS Gastropoda ORDER Basommatophora FAMILY Planorbidae

Are there data suggesting the species (or subspecies) is presently in jeopardy? yes

Are there data suggesting the species (or subspecies) is potentially in jeopardy? Endangered

If either explain why. Range much reduced, probably to one population within 1 mi.^{2} Habitat has been altered by impoundment and water management on the Snake River and Jackson Lake. The one remaining population (known to exist) may be severely reduced.

DISTINGUISHING CHARACTERISTICS: Those of the western endemic genus, Carinifex; much smaller than the other extant species, C. newberryi.

PRESENT DISTRIBUTION: Northeast shoreline of Elk Island in Jackson Lake, Grand Teton National Park, Teton Co., Wyoming.

FORMER DISTRIBUTION: Jackson Lake shoreline near dam (early 1930's) and probably elsewhere; Coulter Bay Lake (mid 1950's); Snake River immediately downstream from Jackson Lake (mid 1950's).

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? well-known, range data good

HABITAT REQUIREMENTS OR CHARACTERISTICS: coarse gravel and cobbles off shore in Jackson Lake, Wyoming. Its natural depth preference is uncertain since its discovery was after impoundment raised the level of Jackson Lake. Pace (per. comm., 1975) collected it in 20 ft. of water in 1972. Henderson (1932) collected the type series in a few inches of water in late August after fall irrigation drawdown.

POPULATION STATUS AND TRENDS: Pace and Beetle (per. comm.) indicated that C. jacksonensis has only been found in recent years (since the mid 1950's) at the Elk Island locality. My field work in 1975 produced no specimens from Jackson Lake shoreline or the Snake River. In September, 1976 dead specimens were collected along the NE shore and dredged from offshore of Elk Island.

ESTIMATED NUMBERS: Individual specimens are extremely infrequent, exact density is unknown.

BREEDING RATE IN THE WILD: unknown.

IF DECLINING, STATE REASONS IF KNOWN: In 1916 the level of Jackson Lake was raised by a dam across the natural lake spillway into the Snake River. Water level in the basin and downstream discharges through the Snake River have been altered to a regieme of winter-spring storage and late summer-fall drawdowns for downstream irrigation. Seasonal instability of lake levels and disruption of flows in the Snake River (extreme in the past) was evidently a major factor in the decline of this species.

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: National Park Service personnel at Grand Teton National Park have been made aware of the status and locality of C. jacksonensis. Voucher specimens collected in 1976 were deposited in the park collection.

MEASURES PROPOSED: Details of population density, range, and reasons for decline need to be known. Extensive sampling to locate individuals and accurately describe their habitat is needed. Seasonal fluctuations in density and habitat requirements should be monitored. Laboratory rearing and introduction into nearby habitats should be investigated as an alternative. Reintroduction into the Snake River may be feasible with the minimum discharges now being maintained.

NUMBER IN CAPTIVITY: none.

BREEDING POTENTIAL IN CAPTIVITY: unknown.

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.:
Beetle (per. comm., 1976) said she knew of no producing localities for the species other than the one off Elk Island, and Gary Pace (per. comm., 1975) collected the Elk Island locality in 1972. National Geographic, Dec., 1976 (v. 150, no. 6, p. 787) shows an excellent aerial photo of Coulter Bay and the NE shore of Elk Island.

UNIQUE FEATURES: One of two extant and rare species in the genus.

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

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Mrs. Beetle is the only living malacologist with extensive field experience with this species.

Henderson, J. 1932. Carinifex jacksonensis, new species, from Wyoming. Nautlius v. 45, p. 133-134.

Beetle, D. 1957. The Mollusca of Teton County, Wyoming. Nautilus v. 71, p. 12-22.

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December 27, 1976
DATE

CIRCLE ONE OR MORE: (FRESH WATER,) LAND, MARINE, ESTUARY

COMMON NAME Fish Lake Snail

SCIENTIFIC NAME: GENUS Physa SPECIES P. microstriata SUBSPECIES _____

PHYLUM Mollusca CLASS Gastropoda ORDER Basommatophora FAMILY Physidae

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Are there data suggesting the species (or subspecies) is presently in jeopardy? _____

Are there data suggesting the species (or subspecies) is potentially in jeopardy? yes

Threatened

If either explain why. The species is evidently restricted to one lake.

DISTINGUISHING CHARACTERISTICS: dark color, slender spire, wide mantle "skirt."

PRESENT DISTRIBUTION: Fish Lake (T. 26 S., R. 2 E.), Sevier Co., Utah.

FORMER DISTRIBUTION: the same.

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? fairly well-known, range data: good - fair
One impoundment, Johnson Valley Reservoir, about 2.5 mi. NE could possibly hold a population of this species. It has not been searched.

HABITAT REQUIREMENTS OR CHARACTERISTICS: gravel and cobbles along fairly open shoreline in water 0.5-2 ft. or more deep (October 20, 1974). On June 20, 1975, no specimens were found in shallow water. Landye (per. comm., 1975) was also unable to locate the population during a June visit. Seasonal migration evidently occurs between deep and shallow water.

POPULATION STATUS AND TRENDS:
The population appears viable and in good shape, but no data exists to permit analysis of trends.

ESTIMATED NUMBERS: no reliable data; probably 10-20/m^2 in near-shore areas in fall.

BREEDING RATE IN THE WILD: unknown. Probably comparable to other species of Physa.

IF DECLINING, STATE REASONS IF KNOWN: no data.

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: none. Fish Lake is within the boundary of Fish Lake National Forest, and is a popular recreation area. Cottage sites are located on the west shore.

MEASURES PROPOSED: further study is needed to describe the seasonal habitat preferences and density fluctuations of the species; permanent monitoring of water quality and recreational uses of Fish Lake.

NUMBER IN CAPTIVITY: none. Laboratory maintenance should be easy. All of seven specimens survived one week of transportation and three of these were maintained in an aquarium without special care for 6 months.

BREEDING POTENTIAL IN CAPTIVITY: unknown. Probably comparable to other species of Physa. Physa gyrina and P. integra produced an average of 200-300 eggs/month/snail during peak reproductive periods in the laboratory (Clampitt, 1970, Malacologia 10:113-151).

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.:
Specimens obtained October 25, 1974 were identified by Dr. George A. Te (per. comm., 1974) as P. microstriata. This collection represents the first since the type lot was taken. Te notes that the species is is likely derived from or parallel to P. ampullacea.

UNIQUE FEATURES: its diagnostic characters, and its value to the study of speciation in Physa.

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

Dr. George A. Te
(current address unknown)
Mollusk Division
University of Michigan
Ann Arbor, Michigan 48104

Chamberlin, R. V. and Berry, E. G. 1930. Mollusca from the Henry Mountains and some neighboring points in Utah. Bull. Univ. Utah v. 21 (2), p. 3-7.

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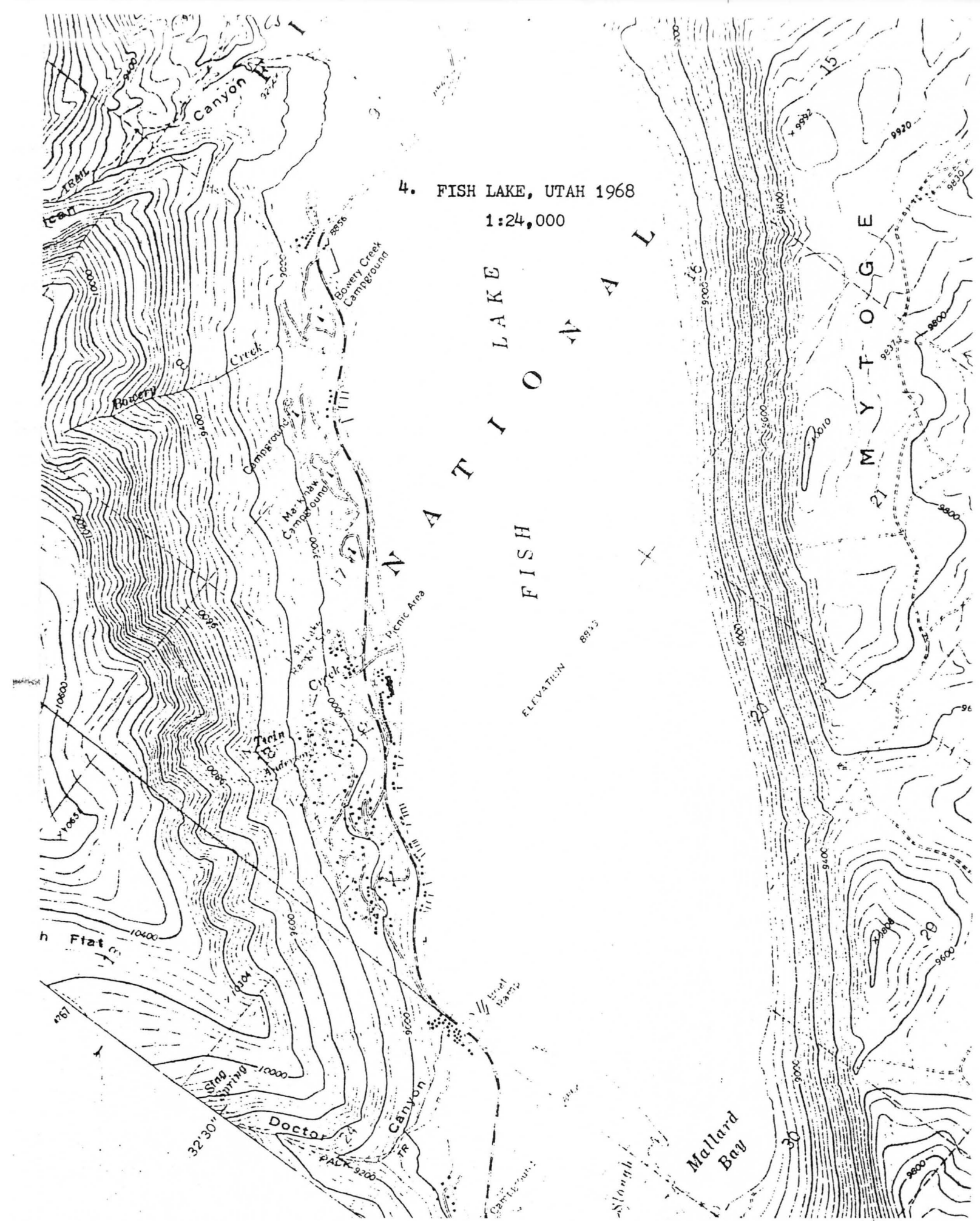
4. FISH LAKE, UTAH 1968
1:24,000
FISH LAKE
NATIONAL
MYTOGE
Bowery Creek Campground
Bowery Creek
Campground
Picnic Area
Flat
Flag Spring
Doctor
Canyon
Mallard Bay
ELEVATION 8913

CIRCLE ONE OR MORE: (FRESH WATER,) LAND, MARINE, ESTUARY

COMMON NAME Wyoming Cave Snail

SCIENTIFIC NAME: GENUS Physa SPECIES P. spelunca SUBSPECIES

PHYLUM Mollusca CLASS Gastropoda ORDER Basommatophora FAMILY Physidae

Are there data suggesting the species (or subspecies) is presently in jeopardy?

Are there data suggesting the species (or subspecies) is potentially in jeopardy?
Threatened yes

If either explain why. Restricted range and susceptibility of its habitat to disturbance by recreational cavers. For a discussion of vandalism of cave environments in Wyoming see Hill, et al. (1976).

DISTINGUISHING CHARACTERISTICS: blind, colorless, transparent shell that lacks ornamentation or sculpture.

PRESENT DISTRIBUTION: Lower Kane Cave, ca. 12 mi. E. of Lovell, Big Horn Co., Wyoming; on the crest of Little Sheep Mountain anticline.

FORMER DISTRIBUTION: no indication of a larger former range.

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? well-known.

HABITAT REQUIREMENTS OR CHARACTERISTICS: warm cave stream (21-22°C) on submerged rocks in rather fast-moving water in the dark zone. The stream occupied is not more than 450 ft. from the cave entrance; although, Turner and Clench (1974) relate a distance of 800-900 ft. from the entrance.

POPULATION STATUS AND TRENDS: no data.

ESTIMATED NUMBERS: unknown.

BREEDING RATE IN THE WILD: unknown.

IF DECLINING, STATE REASONS IF KNOWN: no indication of a decline.

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: none. Lower Kane Cave is on property owned by Burlington Northern Railroad.

MEASURES PROPOSED: Notification of the National Speleological Society for coordination of management-related publicity. Wyoming caving groups should be encouraged to keep visits to a minimum and prohibited from taking specimens. The cave should not attract vandals, but it has been mapped and is generally known through Wyoming Geol. Surv. Bull. 59.

NUMBER IN CAPTIVITY: none.

BREEDING POTENTIAL IN CAPTIVITY: unknown.

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.:
Validity not disputed.

This species was not investigated in the field.

UNIQUE FEATURES: Mollusks adapted to and dependent on the dark-zone cave environment (troglobites) are rare.

Physa spelunca may be the first true troglobitic organism recognized in Wyoming.

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

Turner, R. D. and Clench, W. J. 1974. A new blind Physa from Wyoming with notes on its adaptation to the cave environment. Nautilus v. 88, p. 80-85.

Hill, C., Sutherland, W., and Tierney, L. 1976. Caves of Wyoming. Geol. Surv. Wyoming Bull. 59, 230 p.

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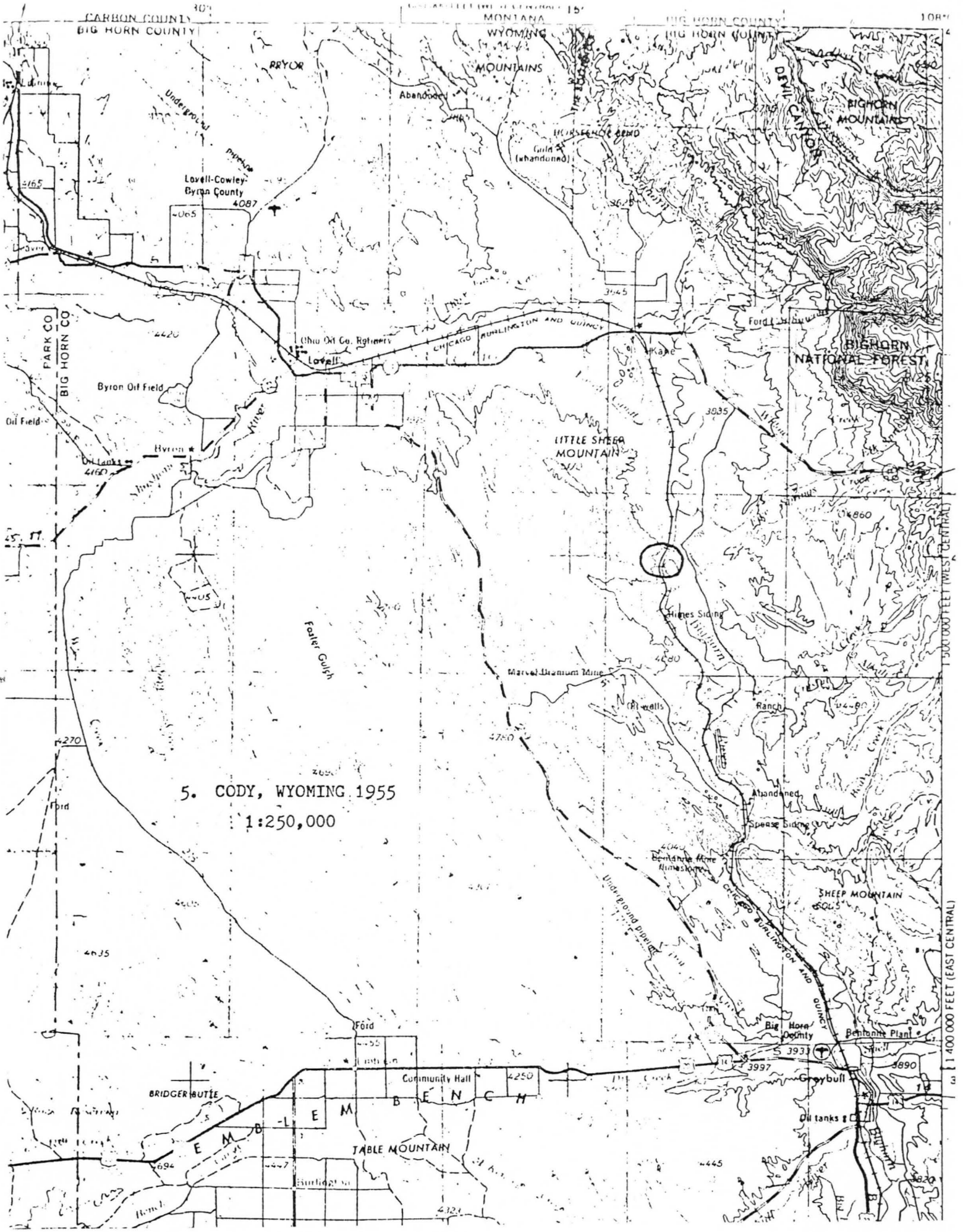
CARBON COUNTY
BIG HORN COUNTY
MONTANA
WYOMING
BIG HORN COUNTY
PRYOR
MOUNTAINS
Abandoned
Underground
pipeline
Lovell-Cowley-
Byron County
4087
4065
4165
BIGHORN
MOUNTAINS
DEVILS
CANYON
HORSESHOE BEND
Gulf
(abandoned)
PARK CO
BIG HORN CO
Ohio Oil Co. Refinery
Lovell
CHICAGO BURLINGTON AND QUINCY
Kane
Ford
BIGHORN
NATIONAL FOREST
Byron Oil Field
Oil Field
Byron
Oil tanks
4160
LITTLE SHEEP
MOUNTAIN
3835
4860
Foster Gulch
Hines Siding
Marvel Uranium Mine
Oil wells
Ranch
4270
4750
5. CODY, WYOMING 1955
1:250,000
Ford
Abandoned
Spease Siding
Bentonite Mine
Limestone
SHEEP MOUNTAIN
Underground pipeline
CHICAGO BURLINGTON AND QUINCY
Big Horn
County
Bentonite Plant
3931
3997
3890
Graybull
Ford
Community Hall
4250
BRIDGER BUTTE
TABLE MOUNTAIN
Oil tanks
4445
1 500 000 FEET (WEST CENTRAL)
1 400 000 FEET (EAST CENTRAL)

CIRCLE ONE OR MORE: (FRESH WATER,) LAND, MARINE, ESTUARY

COMMON NAME Utah Bubble Snail → Utah physa

SCIENTIFIC NAME: GENUS Physa (Physella) SPECIES P. utahensis SUBSPECIES _____

PHYLUM Mollusca CLASS Gastropoda ORDER Basommatophora FAMILY Physidae

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Are there data suggesting the species (or subspecies) is presently in jeopardy? _____

Are there data suggesting the species (or subspecies) is potentially in jeopardy? yes

Threatened

If either explain why. present range restricted to springs and marshlands in Bonneville Basin, possibly to portions of Utah Lake.

DISTINGUISHING CHARACTERISTICS: broad, elevated spire (for Physa); slightly shouldered whorls; strong columella; large, convex body whorl.

PRESENT DISTRIBUTION: Utah Lake, Utah Co.; ? spring 7 mi. south of Junction, Garfield Co.; Fish Springs, Juab Co., Utah.

FORMER DISTRIBUTION: Quaternary: widespread in Lake Bonneville Basin.

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? fair. Numerous springs and other natural water bodies in the Bonneville Basin should be checked for this species.

HABITAT REQUIREMENTS OR CHARACTERISTICS: marshy shoreline flats of Utah Lake, probably similar spring-fed habitats.

POPULATION STATUS AND TRENDS: The population in the shoreline marsh on Utah Lake at Saratoga seems to be the only thriving population in the lake. A few immature specimens were obtained from springs on the west shore (see report on Stagnicola utahensis).

ESTIMATED NUMBERS: densities of 20-50/m^2 were common in the marsh at Saratoga.

BREEDING RATE IN THE WILD: unknown.

IF DECLINING, STATE REASONS IF KNOWN: P. utahensis is a remnant of populations that probably ranged over the 20,000 mi^2 of Lake Bonneville. Reduction to discontinuous populations in a few water bodies in the former lake basin occurred within the last 15,000 yrs. The negative impact of man - water use, irrigation return flows, and urban pollution - cannot be assessed.

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: none.

MEASURES PROPOSED: protection of the population on the north shore of Utah Lake until such time as the existence of populations in other water bodies can be demonstrated.

NUMBER IN CAPTIVITY: none.

BREEDING POTENTIAL IN CAPTIVITY: unknown.

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.: Dr. George A. Te (per. comm., 1974) identified specimens from the Utah Lake population as P. utahensis. Evaluation of previous records should consider the close similarity of of it to the more widespread species, P. ampullacea.

UNIQUE FEATURES: P. utahensis in fossil populations of Lake Bonneville reached a very large size for the genus.

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

Clench, W. J. 1925. Notes on the genus Physa with descriptions of three new subspecies. Occas. Pap. Mus. Zool. Univ. Michigan 161.

Henderson, J. 1936. Mollusca of Colorado, Utah, Montana, Idaho, and Wyoming - Supplement. Univ. Colorado Stud. 23, p. 81-145.

Dr. George A. Te
Museum of Zoology
University of Michigan

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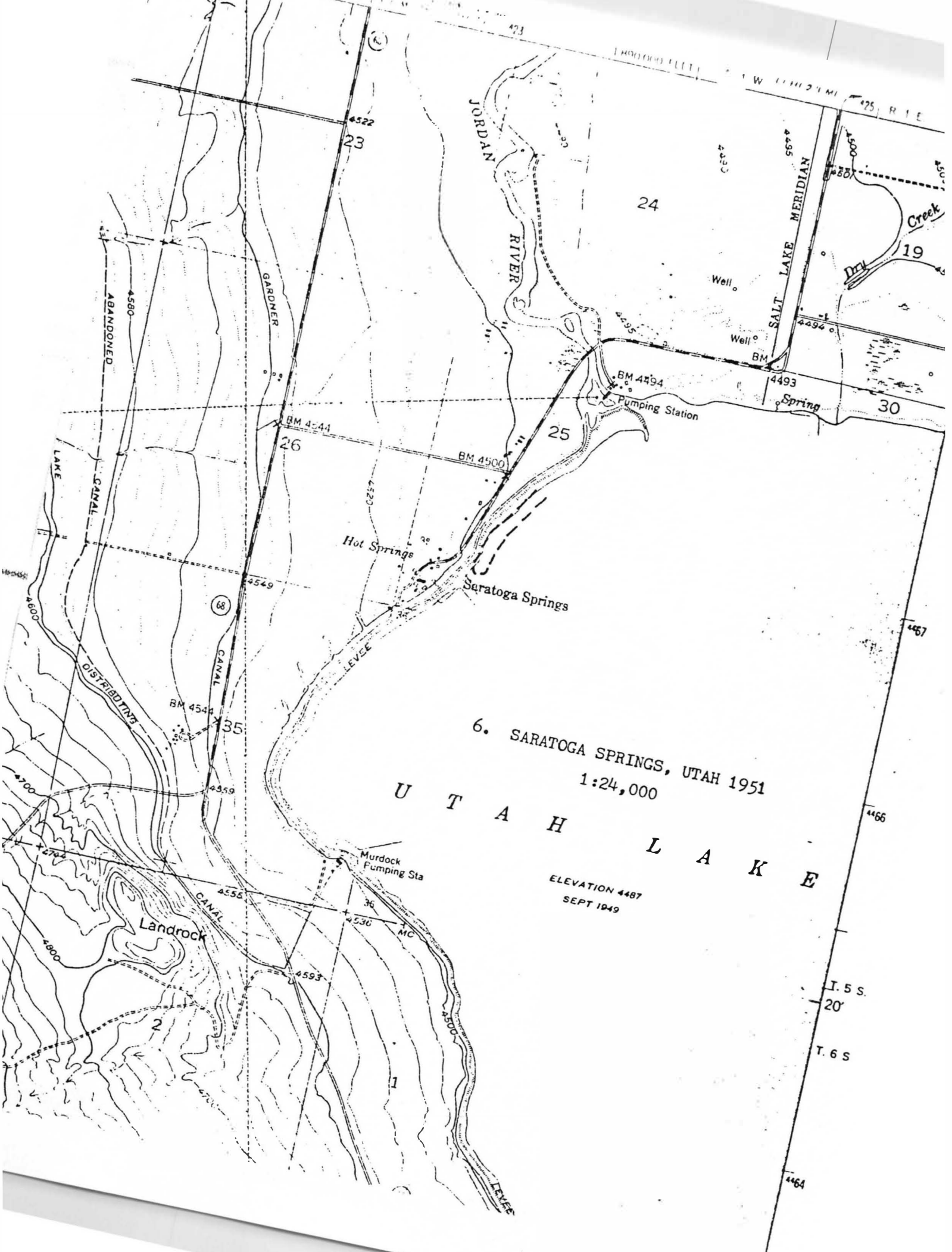

6. SARATOGA SPRINGS, UTAH 1951
1:24,000

U T A H L A K E

ELEVATION 4487
SEPT 1949

CIRCLE ONE OR MORE: FRESH WATER, (LAND,) MARINE, ESTUARY

COMMON NAME Kanab Amber Snail

SCIENTIFIC NAME: GENUS Oxyloma SPECIES O. haydeni SUBSPECIES kanabensis

PHYLUM Mollusca CLASS Gastropoda ORDER Stylommatophora FAMILY Succineidae

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Are there data suggesting the species (or subspecies) is presently in jeopardy?

Are there data suggesting the species (or subspecies) is potentially in jeopardy?
yes

Threatened

If either explain why. limited to one spring seep in an area susceptible to heavy use for livestock production and recreation.

DISTINGUISHING CHARACTERISTICS: shell slender with a more "drawn out" spire than O. haydeni; basal portion of peristome more squared than in the typical form. The penis variations cited by Pilsbry (1948) may be comparable to those that often occur in other isolated populations of O. haydeni.

PRESENT DISTRIBUTION: .3 mi. NNE of SW cor., sec. 32, T. 42 S., R. 6 W., & about 1 mi. N. of Kanab Creek and W. of US89, Kane Co., Utah.

FORMER DISTRIBUTION: the type locality, "6 mi. above Kanab, on Kanab Wash, Utah" was in the area searched for this form.

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? range data fair; until the distribution of O. haydeni in the region is better understood, the range of this form will remain poorly defined.

HABITAT REQUIREMENTS OR CHARACTERISTICS: wet grassland fed by spring seeps and probably shaded by cliffs.

POPULATION STATUS AND TRENDS: no data available to indicate trends; The population sampled was relatively dense, and its habitat seemed in good condition.

ESTIMATED NUMBERS: 60-100/m^2, with the habitat available to the sampled population being about 600 m^2.

BREEDING RATE IN THE WILD: unknown.

IF DECLINING, STATE REASONS IF KNOWN: no evidence of decline. The population appears to be quite viable.

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: none.

MEASURES PROPOSED: heavy agricultural use or modification of the hydrology of the immediate area should be avoided. The area should be surveyed to check further for additional populations, and to locate other suitable habitat.

NUMBER IN CAPTIVITY: none. Specimens survive transport well, but no effort to transplant or maintain laboratory populations has been made.
BREEDING POTENTIAL IN CAPTIVITY: unknown.

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.:
Differences in shell and genitalia that separate this form from typical O. haydeni cannot be fully evaluated until the variation within O. haydeni populations of the Rocky Mountain region is better known.

Dr. Dorothea Franzen (per. comm., 1976) confirmed identification of the specimens.

UNIQUE FEATURES:

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

Pilsbry, H. A. 1948. Land Mollusca of North America. Acad. Nat. Sci. Philadelphia Monogr. 3, v. 2, pt. 2, p. 797-798.

Dr. Dorothea Franzen
Department of Biology
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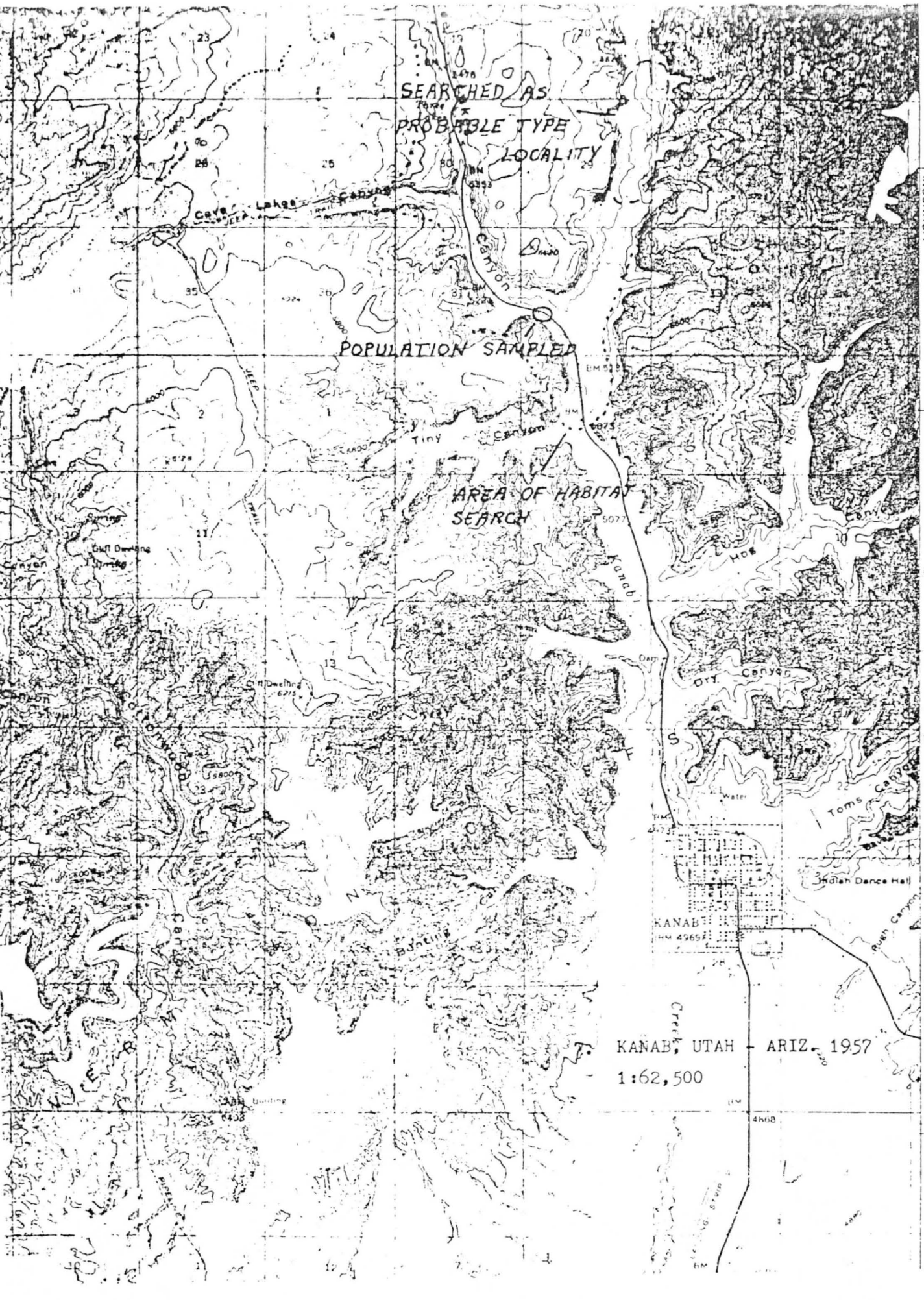
SEARCHED AS
PROBABLE TYPE
LOCALITY
POPULATION SAMPLED
AREA OF HABITAT
SEARCH
KANAB, UTAH - ARIZ. 1957
1:62,500

CIRCLE ONE OR MORE: FRESH WATER, (LAND,) MARINE, ESTUARY

COMMON NAME Coalville Mountain Snail (termed Ribbed Mountain Snail in contract)

SCIENTIFIC NAME: GENUS Oreohelix SPECIES O. peripherica SUBSPECIES weberiana

PHYLUM Mollusca CLASS Gastropoda ORDER Stylommatophora FAMILY Oreohelicidae

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Are there data suggesting the species (or subspecies) is presently in jeopardy? yes

Are there data suggesting the species (or subspecies) is potentially in jeopardy? Threatened

If either explain why. reduction of already restricted habitat

DISTINGUISHING CHARACTERISTICS: smaller than the typical form; spire depressed; sculpture of prominent, coarse, irregular ribs.

PRESENT DISTRIBUTION: west shore of Echo Reservoir, Summit Co., Utah; in sagebrush community from its margin at top of beach scarp, upslope to Interstate 80 grade and including strip between lanes, for about 200 m. along the N. lane rest stop, but not west of the highway.

FORMER DISTRIBUTION: 4 mi. W. of Coalville (Pilsbry, 1939); E. side of Echo Reservoir (Woolstenhulme, 1942). A search along back trails W. of Coalville did not produce a colony, and searches of the reservoir shoreline resulted in only the one colony.

HOW COMPLETELY IS THE DISTRIBUTION KNOWN? good - fair range data
As with most terrestrial organisms, a detailed search - here an acre-by-acre sweep of all sagebrush stands on calcium-rich slopes in the area - would be necessary to assure that another colony does not exist.

HABITAT REQUIREMENTS OR CHARACTERISTICS: sagebrush covered slopes of silty, rocky debris; individuals are closely associated with the larger plants or clumps of sage. In dry periods individuals are buried next to the main stems of the plants.

POPULATION STATUS AND TRENDS: generally unknown. Fewer live individuals and empty shells were encountered in 1975 than 1974 in one hour of collecting at the same locality. The keeping of live specimens was limited to three when the low density became apparent. Examination of the colony in 1976 suggested population levels similar to 1975.

ESTIMATED NUMBERS: population clusters within the colony occur at dense sage patches. In 1974 these spots produced about 12 dead shells and 1-3 living specimens per bush or clump. In 1975-76 the average for each cluster was about 7 dead shells and at best one living snail.
BREEDING RATE IN THE WILD: unknown.

IF DECLINING, STATE REASONS IF KNOWN: Loss of habitat has produced declines in this population. The apparent decline noted between 1974 and 1975 may be a short-term fluctuation in numbers. All collections have been made between mid-August and mid-September. No degradation of remaining habitat occurred between 1974 and 1976.

PROTECTIVE MEASURES, IF ANY, ALREADY TAKEN: none.

MEASURES PROPOSED: Any alteration of remaining known range should be prohibited. The slope below the rest area is particularly vulnerable to landscaping, chemical applications, and alteration for recreational use. Litter from the rest area reaches the colony area, but there was no evidence that small quantities of paper and other debris affected the snail population.

NUMBER IN CAPTIVITY: none.

BREEDING POTENTIAL IN CAPTIVITY: unknown.

HOST FISH (MUSSELS): does not apply.

GENERAL REMARKS, i.e., TAXONOMIC VALIDITY IF DISPUTED, ETC.:

The shell is quite distinct from other forms of O. peripherica. Its anatomy and radular structure are under study.

Only uncertainity about the possible existence of another colony in one of the remote spots not searched prevents my recommending endangered status for this form. Its range is in a most vulnerable location.

UNIQUE FEATURES: the shell characters of this taxon are striking; it and the other forms of O. peripherica pose an interesting systematic problem. Its close association with sagebrush, while not unique in the genus, is interesting.

LITERATURE REFERENCES AND NAMES AND ADDRESSES OF OTHER AUTHORITIES:

Pilsbry, H. A. 1939. Land Mollusca of North America. Acad. Nat. Sci. Philadelphia Monogr. 3, v. 1, pt. 1, p. 454-455.

Woolstenhulme, J. 1942. Uinta Mountain mollusks. Nautilus v. 56, p. 50-55.

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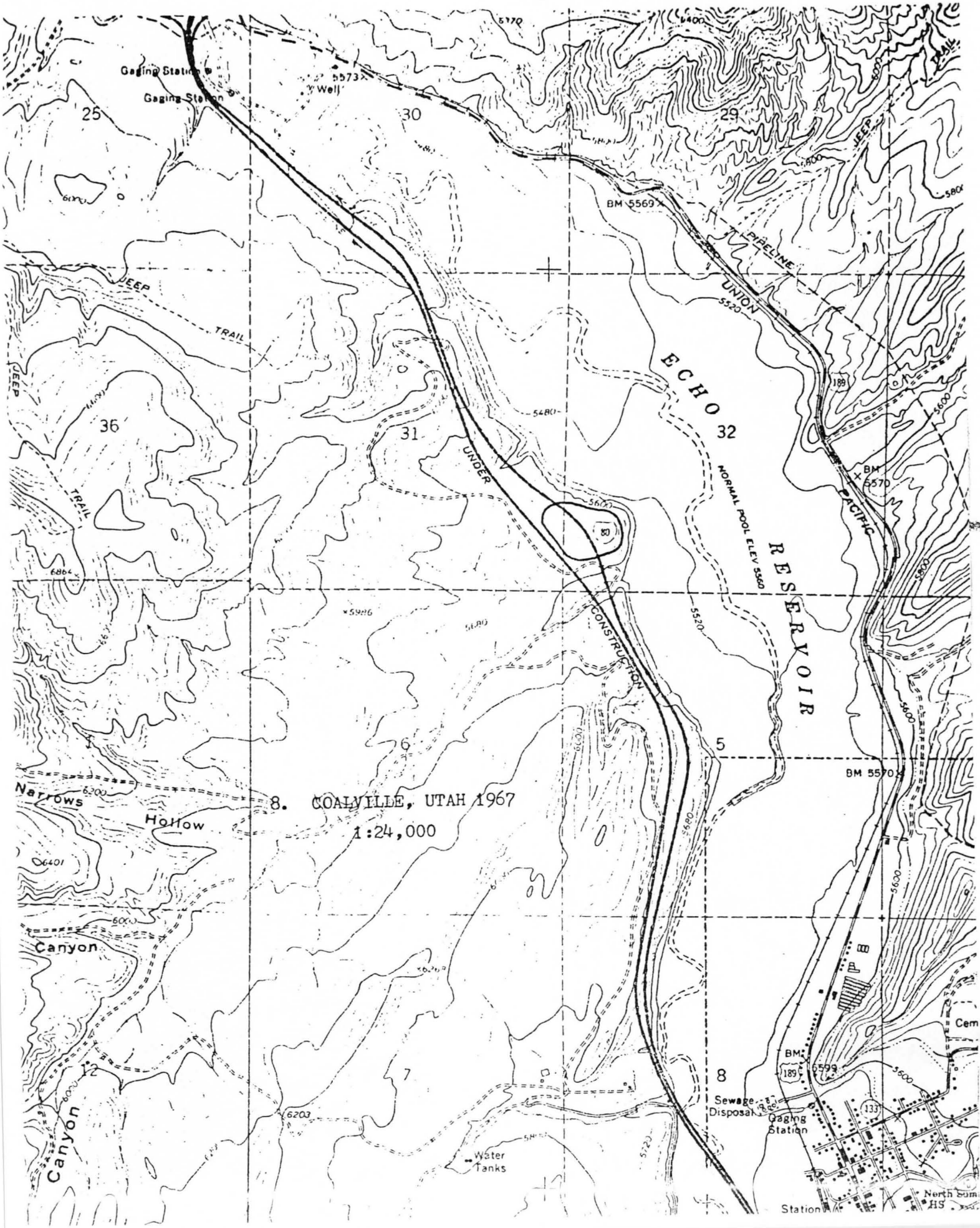

8. COALVILLE, UTAH 1967
1:24,000