

# **Recovery Plan**

**Noonday Snail**  
**(Mesodon clarki nantahala)**

RECOVERY PLAN  
FOR THE  
NOONDAY SNAIL  
MESODON CLARKI NANTHALA

PREPARED BY  
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FOR  
U.S. FISH AND WILDLIFE SERVICE  
SOUTHEAST REGION, ATLANTA, GEORGIA

APPROVED:



Acting Regional Director, Southeast Region

DATE: September 7, 1984

## DISCLAIMER

This is the completed Noonday Snail Recovery Plan. It has been approved by the U.S. Fish and Wildlife Service. It does not necessarily represent official positions or approvals of cooperating agencies who played a role in preparing this plan. This plan is subject to modification as dictated by new findings, changes in species status, and completion of tasks described in the plan. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities, and other constraints.

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## PART I - INTRODUCTION

The noonday snail, Mesodon clarki nantahala, was described by Clench and Banks in 1932 from the cliff ridges of the Blowing Springs area in the Nantahala Gorge, Swain County, North Carolina. This area lies mostly within the Nantahala National Forest. The snail was listed as threatened in the July 3, 1978 Federal Register because of a proposal to widen U.S. Route 19 through the Nantahala Gorge. This would have damaged or destroyed most of the species' known habitat.

Clench and Banks (1932a) named this taxon Polygyra (Triodopsis) nantahala and mentioned that it occurs in the subgeneric group that includes Polygyra elevata Say, P. clarki Lea, and P. pennsylvanica Green. Pilsbry (1940), in his monograph on United States land snails, placed this taxon as a subspecies of Mesodon clarki. Neither Clench and Banks nor Pilsbry gave anatomical drawings or descriptions to substantiate their taxonomic conclusions. Hubricht (1980) believes the taxonomic status of M. c. nantahala to be somewhat uncertain. Essentially nothing is known of the snail's biology.

Description: Mesodon clarki nantahala (Figure 1a, b, c) has a subglobose, imperforate shell of about 5 1/2 whorls. It measures 17 to 18 mm in width and because of its depressed spire is only 11 mm in height. The shell is reddish and can be quite shiny when fresh. The lip of the aperture is sharply reflected and the peristome is white. The peristome of the basal area of the aperture is thickened to form an almost blade-like tooth. The

Figure 1 - Shell Morphology of Similar Mesodons

(a) Mesodon clarki nantahala, lateral view

(b) ventral view

(c) dorsal view

(d) Mesodon clarki clarki, lateral view

(e) ventral view

(f) dorsal view

(g) Mesodon wheatleyi, lateral view

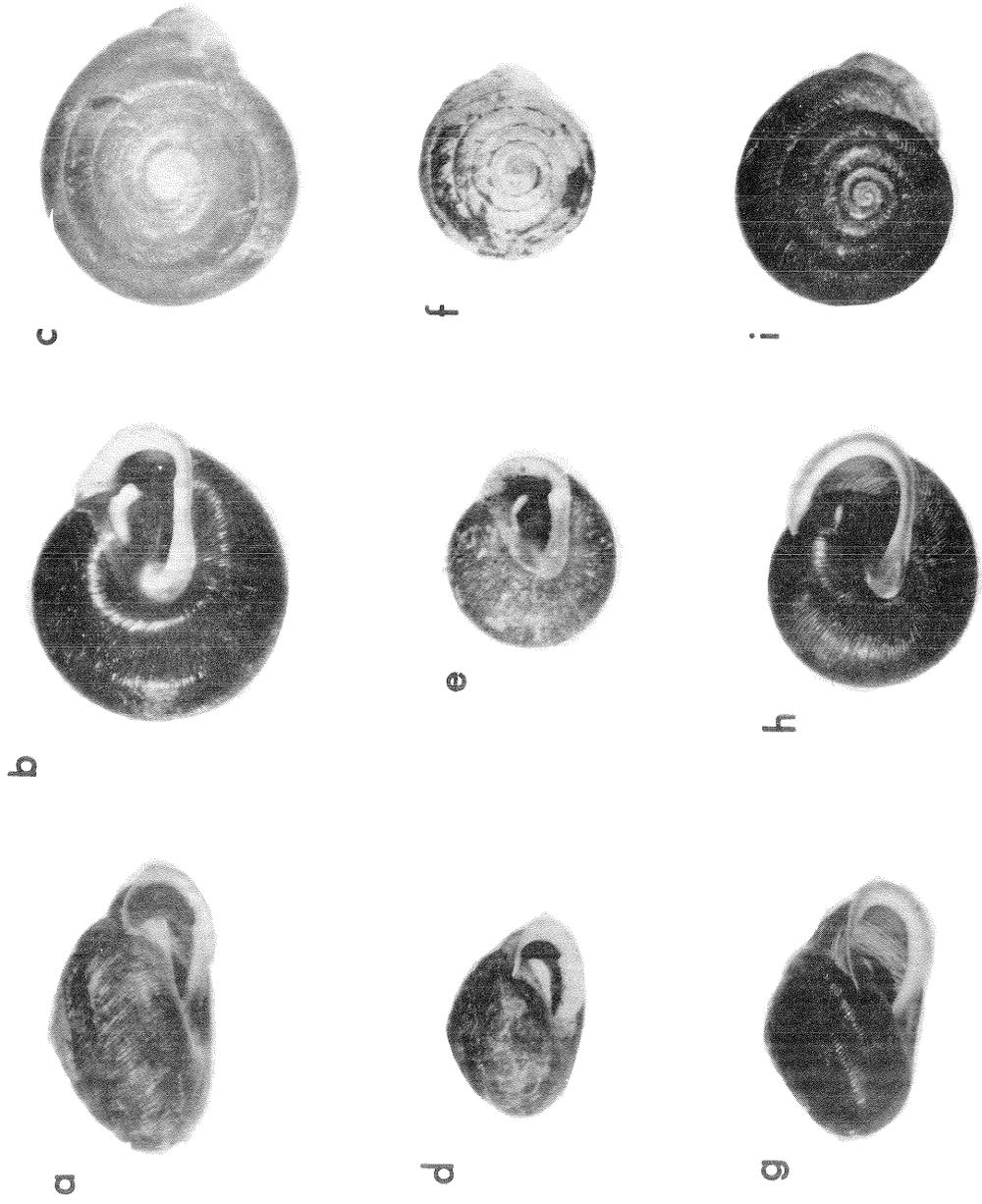
(h) ventral view

(i) dorsal view

Note: Scale at side represents millimeters.



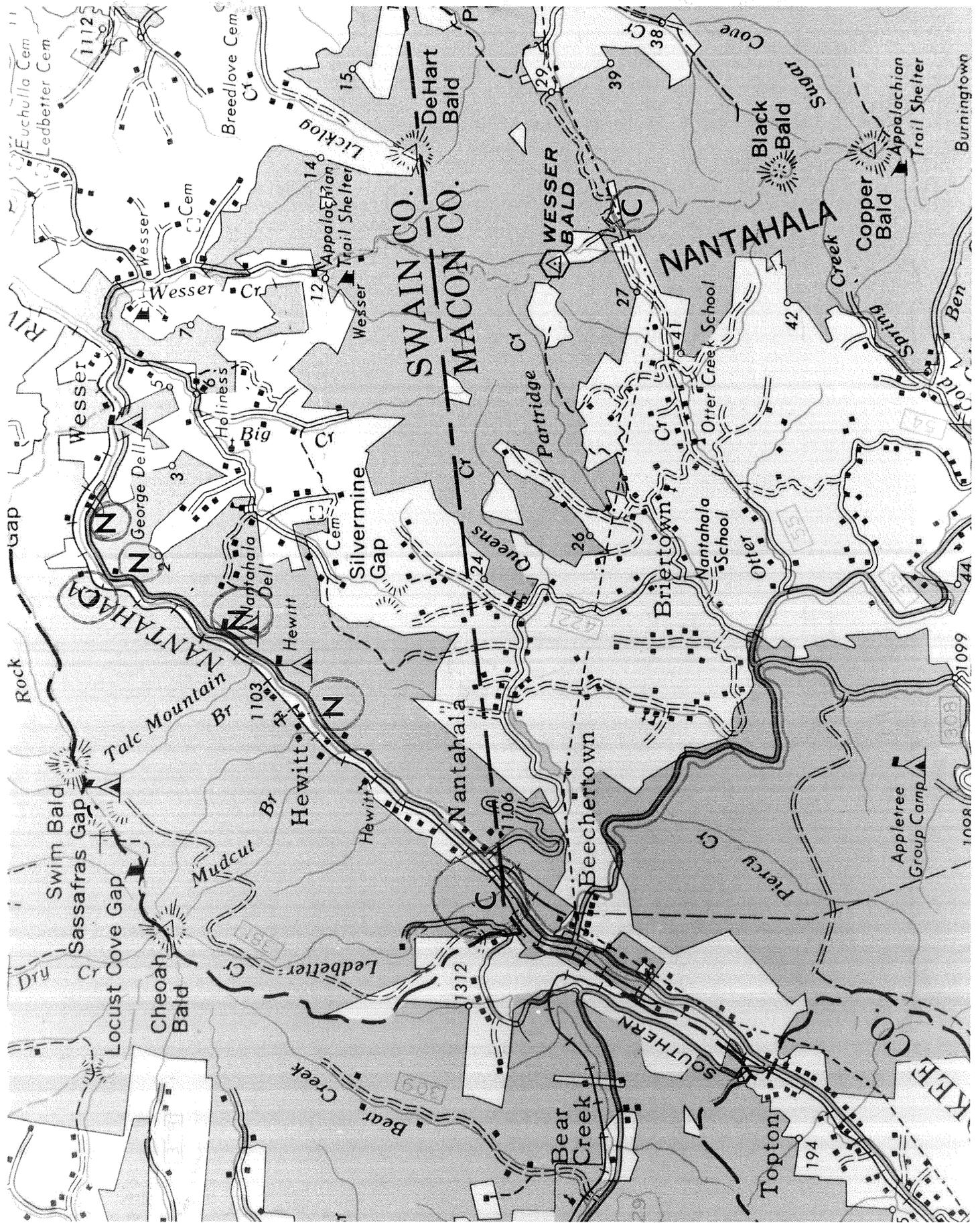
Figure 1



southeastern Tennessee, the extreme western counties of North Carolina and a few sites in northern Georgia. It is generally distributed in this area but is rather uncommon. Mesodon clarki nantahala is known from a much more limited area, having been reported only from the high cliffs (rising from 1,900 to 3,100 feet in only one-half mile) along the southeast bank of the Nantahala River in the Nantahala Gorge. It occurs for about a mile up and a mile down river from the type locality of Blowing Springs. The cliffs are very mesic, interrupted frequently by small streams and waterfalls. There is much exposed rock and the forest floor often has a thick humus layer. During an on-site inspection in the spring of 1983, the area around Blowing Springs was checked for living snails (author). Searches, which began in the vegetation at the very edge of the road and continued for a few hundred feet up the cliff, were attempted where stream cuts gave access to steep areas. The noonday snail was found at all stations, but the distribution was spotty and clumped. Searches were also done on the northwest side of the gorge especially at Handpole Branch, a site mentioned in the Federal listing. No specimens of M. c. nantahala were found on that side of the river, but typical (though quite small) Mesodon c. clarki specimens were found in several places.

Habitat: Mesodon clarki nantahala has only been reported from specific areas of the Nantahala Gorge. The gorge lies at the southern end of the Appalachian Mountains where the Nantahala River cuts between Cheoah Bald and Wesser Bald in the Nantahala Mountains (Figure 2). The Southern Appalachians are very old and are deeply dissected by the Little Tennessee

Figure 2 - Map of Blowing Springs area, Nantahala National Forest, North Carolina (1981). Compiled by U.S. Forest Service. Note that Mesodon clarki clarki (C) and Mesodon clarki nantahala (N) sites are indicated on the map.



River and its tributaries, including the Nantahala River (Braun, 1967). In general, the region is dominated by oak-hickory forest; but in coves and other very mesic areas, the oak-hickory forest tends to be replaced by mixed mesophytic elements with rich herbaceous undergrowth. The cliff ridge with its steep north-facing slopes seems to be a very special example of this replacement. In a 1.5-acre area immediately around Blowing Springs (Morrow, 1983), the dominant trees include Fagus grandifolia (American beech), Ulmus americana (American elm), Tilia heterophylla (basswood), Betula lutea and Betula lenta (yellow and sweet birch), Liriodendron tulipifera (tulip poplar), Aesculus octandra (buckeye), Carpinus caroliniana (blue beech), and Tsuga canadensis (hemlock). Acer saccharum (sugar maple) and Carya ovata (shagbark hickory) were common seedlings. The herbaceous undergrowth includes many ferns (ten species) and such pronounced mesophytes as Trillium, Uvularia, Disporum, Caulophyllum, Astilbe, Dicentra, Tiarella, Viola, Phacelia, Hydrophyllum, Asimina, Rubus odoratus, and Aristolochia. (Some ericaceous elements such as Rhododendron and Leucothoe usually associated with oak-hickory forests are also present). Plants present that are considered rare in North Carolina (Roe and Moore, 1983) include Cymophyllus fraseri (Fraser's sedge), Arabis patens (spreading rockcress), Panax trifolium (dwarf ginseng), Adlumia fungosa (climbing fumatory), Stellaria corei (Core's starwort). Braun (1967) mentioned that this area is strikingly different from the immediately surrounding slopes and speculated that its outstanding richness (when

compared to other very moist slopes nearby) is due to underlying "calcareous" rock as well as slope exposure.

Indeed near Blowing Springs is the only location on the steep eastern side of the gorge where there is an incursion of the Murphy marble geological formation. The Murphy marble (mined nearby at Talc Mountain to the south) forms a band of rock for miles along the western edge of the Nantahala River (Roe and Moore, 1983).

The habitat itself has undergone some change within the last 50 years with unknown results. The railroad and the road (U.S. 19) were put through the gorge, causing an increase in openness of the forest canopy and perhaps different water runoff patterns. The forest, once dominated by chestnut, is different in character due to the destruction of these trees by blight. Non-native plants such as Kudzu and honeysuckle are encroaching particularly along the roadsides.

Exposed rock that produces a rich soil, a complex association of plants, and moist conditions are the very elements that often contribute to a diverse snail community. Clench and Banks (1932b) reported 29 species of snails from the cliff ridges at Blowing Springs, including 5 species of Mesodon.

Interestingly enough, specimens of Mesodon clarki nantahala and Stenotrema stentotrema (f. voluminosa) from Blowing Springs are the largest known examples for each species.

Population Numbers and Trends: No estimates of population size have been made since the exact range has never been determined. Apparently suitable habitat occurs for several miles along the gorge and far higher up the cliffs than has been surveyed. Live snails in several size classes were found, indicating recent recruitment. Mature individuals that had lived two or more winters were rarer than juveniles or newly mature adults.

Food and Foraging Behavior: Nothing is known about the snail's food preferences or feeding behavior. Other species of Mesodon are believed to eat fungal mycelia (Pilsbry, 1940). The snails seem to be active during wet weather, as they were frequently out on the surface of the vegetation (rather than under the litter) during an on-site investigation in mid-April 1983 (author). The weather during that site visit was quite mild and rainy. No activity differences were noticed between day and night.

Shelter Requirements: Mesodon c. nantahala was found in tangles of vegetation or occasionally under rocks or in the leaf litter but never under fallen logs. The area where the noonday snail lives had deeper litter and was wetter and undoubtedly cooler than areas of southern exposure within the gorge.

Reproductive Behavior: Unknown.

Oviposition and Incubation Requirements: Unknown.

Predation and Other Natural Pressures: The snail's predators are not well known though shrews and other small mammals, feral hogs, certain beetles (lampyrid larvae), and some birds (e.g., wood thrushes) have been documented eating snails. Shells of Mesodon clarki clarki that had been cached and gnawed by rodents were found at Handpole Branch. There is one report of Haplotrema concavum, a very common and carnivorous land snail, eating a noonday snail (personal communication, R. W. Van Devender).

Reasons for Current Status: The snail is known at present only from a very limited habitat within the Nantahala Gorge. Human activity within the gorge has increased dramatically over the years as the Nantahala River has become a very popular canoeing and kayaking spot. This increase of activity enhances the threat of forest fire or trampling, which would damage the unusual habitat that the snails need.

## PART II - RECOVERY

## A. Recovery Objectives

The purpose of this recovery plan is to identify those actions that should be undertaken for the protection and recovery of Mesodon clarki nantahala to the point that it can be delisted. The immediate dangers are those threats to its limited and specialized habitat. Unless significant populations (dependent upon population size and condition) of Mesodon clarki nantahala are found outside the Nantahala Gorge, precluding the need for further protection of the species, delisting of the species may not be considered until the following conditions are met:

1. M. c. nantahala and its habitat are protected from human-related or foreseeable natural threats that would jeopardize the species' existence,
2. A population monitoring program is established and conducted for at least five years to establish distribution and baseline abundance for the species and that no downward trend is evident,
3. A means is established to assure that population monitoring will be conducted periodically after delisting, and

4. Collection of the species for scientific or other purposes is controlled or is proven not to threaten the species' continued existence.

B. Step-down Outline

1. Protect, evaluate, and manage the known populations of Mesodon clarki nantahala within the Nantahala Gorge.

- 1.1. Protect the snail's essential habitat on the northwest facing cliffs within the Nantahala Gorge by cooperative agreements with the U.S. Forest Service and State authorities, by designating at least some portion of this area as critical habitat or other feasible means.

- 1.1.1. Aid to the U.S. Forest Service in caring for this unusual area.

- 1.1.2. Continue to utilize existing legislation and regulations (Federal and State endangered species laws) to protect the species and its habitat.

- 1.2. Assess and monitor population levels and habitat quality.

- 1.2.1. Develop monitoring techniques.

1.2.2. Implement monitoring program.

1.3. Manage the snail's habitat if justified.

1.3.1. Conduct preliminary evaluations as to the necessity for management.

1.3.2. Study limiting factors and develop management techniques.

1.4. Determine present and foreseeable threats to the species.

1.4.1. Evaluate potential for overuse of area (especially at Blowing Springs).

1.4.2. Assess other threats.

2. Cooperate with current studies on the status of the noonday snail.

2.1. Contact research scientists such as those at the Invertebrate Section of the Chicago Field Museum of Natural History for results of taxonomic studies.

- 2.2. Evaluate impact of findings on the current status of the taxon.
3. Determine if populations of Mesodon clarki nantahala exist outside the Nantahala Gorge.
  - 3.1. Contact major museums and recognized authorities for existence of additional material.
  - 3.2. Locate sites in the Southern Appalachians where similar habitats exist.
  - 3.3. Survey sites for populations of the noontday snail.
  - 3.4. Investigate status of any newly found population.
4. Reevaluate Recovery Plan if the noontday snail and its habitat are stable and protected or if other populations are found.

C. Narrative

1. Protect, evaluate, and manage the known populations of Mesodon clarki nantahala within the Nantahala gorge. Since the cliff ridges on the northwestern facing side of the Nantahala Gorge

contains the only known population of M. c. nantahala, it is essential to recovery that the snail population and its habitat be protected from disturbance. Forest fires, logging, the destruction of the cliff face for widening the road, the possible exploration for minerals (talc is mined close by), and the increased trampling of the area as human pressures increase are all potential hazards.

1.1. Protect the snail's essential habitat on the northwest facing cliffs within the Nantahala Gorge by cooperative agreements with the U.S. Forest Service and State authorities by designating at least some portion of this areas as critical habitat or other feasible means. This part of the project will probably need to be implemented by the Forest Service with help from the U.S. Fish and Wildlife Service. The North Carolina Natural Heritage Program is drafting a proposal to recommend that the Forest Service designate the area around Blowing Springs as a National Forest Special-Interest Biological Management Area. The State authorities also plan to place the site on the Registry of Natural Heritage Areas (Roe and Moore, 1983). Access to the area and protection may not be a major problem since all the currently known range lies in the Nantahala National Forest.

1.1.1. Aid the U.S. Forest Service in caring for this unusual area. The Natural Heritage Program is

especially concerned that intensive visitation to the area be discouraged. Therefore, publicity about the site (even locational signs along the road) should be kept to a minimum. The Forest Service should be encouraged to continue to defer the area from timber harvest.

1.1.2. Continue to utilize existing legislation and regulations (Federal and State endangered species laws) to protect the species and its habitat. During implementation of this recovery plan the species can be protected by the full enforcement of existing laws and regulations (such as Section 7 of the Endangered Species Act).

1.2. Assess and monitor population levels and habitat quality. Techniques for population monitoring must be developed and baseline population data established if the status of the snail is to be adequately managed. The population in the present habitat is presumed to be healthy (it can be documented to have occurred in the same biological assemblage for more than 30 years). Establishment of a baseline will help pinpoint any population fluctuations.

1.2.1. Develop monitoring techniques. Initial work should concentrate on finding the distribution of the snail within the gorge and estimating population size. The cliff face has been explored only in a few selected sites (see map) and only to a height of 200 to 300 feet above the river. The cliffs in some places extend up another 1,500 feet. Knowledge of the distribution of noonday snails is incomplete, though the present implication is that a single population occurs in a continuous band along one side of the river. Systematic searches must be done further along the gorge for several miles in both directions from Blowing Springs, higher up the cliff face, and on the opposite side of the river. The snails should be censused. Mark-recapture studies need to be initiated during the first season if possible. Monthly samples are probably necessary at first with additional spot checks in unusual conditions to identify activity patterns. After four or five years of data collection, estimates can be made of the population's stability. All samples (usually this will only be shell material) should be marked as to the exact locality and altitude and held for identification.

- 1.2.2. Implement monitoring program. After baseline data have been established, it will be necessary to continue at least periodic monitoring to assure that the population and habitat remain within acceptable limits.
  
- 1.3. Manage the snail's habitat if justified. The need for management will depend on preliminary status results.
  - 1.3.1. Conduct preliminary evaluations as to the necessity for management. The snail was found alive in reasonable numbers. There was no evidence that the present U.S. 19, the railroad, talc mining in the gorge, increased river traffic, or the encroachment of non-native plants (kudzu or Japanese honeysuckle) were causing the snail any present harm. Therefore, unless surveys and censusing turn up severe population depletions, perhaps the best management is to restrict access.
  
  - 1.3.2. Study limiting factors and develop management techniques. Once sufficient data are available on the life history (reproduction, activity patterns, food and habitat requirements, predation, etc.) and population dynamics of the snail, an evaluation should

be made on the possibility of applying management action. Recommendations should be prepared as needed.

- 1.4. Determine present and foreseeable threats to the taxon. The present threat is destruction of habitat, but other threats may become apparent to the investigator working in the area.
  - 1.4.1. Evaluate potential for overuse of area (especially at Blowing Springs). The Blowing Springs itself is a gathering place where people stop to sample the fresh water. If the trampling by many people causes habitat destruction, the spring water should be made more accessible by piping the water to the roadside. Though the cliffs themselves are too steep for trails, access to them could be restricted by fencing.
  - 1.4.2. Assess other threats. One possible danger is that the ownership (and control) of the habitat could pass out of Federal hands. Alternative land uses such as logging and mining should be investigated to determine the probability of these activities occurring in snail habitat. The effects of these activities on this unique habitat are unknown.

1. Cooperate with current studies on the status of the noonday snail.

The taxonomic status of the noonday snail is uncertain and needs clarification.

2.1. Contact research scientists such as those at the Invertebrate

Section of the Chicago Field Museum of Natural History for

results of taxonomic studies. Taxonomic work is currently

being conducted at the Chicago Field Museum on all species of

Allongona, Triodopsis, and Mesodon (the large

polygyrids) using anatomy, electrophoretic data, and shell

morphology. The preliminary data are conflicting. The

results of comparing six separate populations according to

Emberton (1984) of "Mesodon clarki" from Cocke County,

Tennessee, to as far south as Tusquitee Bald, Macon County,

North Carolina, implies that more than one taxon (species) is

involved. The shell size follows a decreasing cline (larger

to the north, smaller to the south) that is interrupted by

huge shells of the noonday snail. The genetic differences

between some of the populations is immense (Nei distances

greater than 0.4--see Nei, 1972) with M. c. nantahala

again quite different from nearby populations. The penial

morphology is somewhat similar to species from Tellico Gap but

quite unlike snails from Handpole Branch. None of this

evidence is conclusive, but it seems that the noonday snail is

not a subspecies of Mesodon clarki but a full species in

itself. Also it is possible that the very small Mesodon clarki specimens from Handpole Branch represent another distinct species.

This interpretation differs greatly from Leslie Hubricht's (1980) viewpoint, which denies even subspecific status to the noonday snail. He believes he has found this to be a widespread ecological variant. To settle this problem, more field work and analysis is needed and more live M. c. nantahala will be needed for comparison.

- 2.2. Evaluate impact of findings on the current status of the taxon. Researchers at the Field Museum believe more variation exists in this population complex than was previously thought. The appropriateness of threatened status may need reevaluation if further systematic studies question the validity of the taxon, or if more variation exists, the new (and unnamed) taxa may need some form of protection.
3. Determine if populations of the noonday snail exist outside the Nantahala Gorge. Discovery of new populations would require reevaluation of recovery objectives and could lead to delisting in the near future. The evaluation of other potential habitat areas could be undertaken along with natural history studies of the noonday snail in the gorge.

- 3.1. Contact major museums and recognized authorities for existence of additional material. Contact with curators at the Philadelphia Academy of Natural Science, the National Museum of Natural History, the Chicago Field Museum of Natural History, and the University of Michigan turned up very few specimens--none from outside the gorge. Specimens reported from Tusquitee Bald from University of Michigan Museum of Zoology were misidentified. Leslie Hubricht (1980) believes the noonday snail to be an ecological variant not even worthy of subspecific status. He claims to have found it in at least 12 sites (unspecified) in North Carolina and Tennessee. Hubricht should be encouraged to make his specimens and data available for study.
  
- 3.2. Locate sites in the Southern Appalachians where similar habitats exist. Incursions of "calcareous" rock with available water that support a rich, mixed mesophytic forest may be indicators of potential habitat. Perhaps the Forest Service, U.S. Geological Survey, or trained naturalists (e.g., Steve Morrow who compiled a plant list for this study and lives in Topton near the gorge) would be of assistance in finding such "islands."

- 3.3. Survey sites for populations of the noonday snail. Likely areas in extreme western North Carolina, southeastern Tennessee, and northern Georgia should be searched for the noonday snail. The assistance of qualified taxonomists may be required to verify the identification of specimens. Series of dead shells should be collected and later compared with known material.
  
- 3.4. Investigate status of any newly found population. Data on population density and range will be required for any new areas prior to any consideration for delisting.
  
4. Reevaluate Recovery Plan if the noonday snail and its habitat are stable and protected or if other populations are found. The present actions assume that the snail is threatened because of threats to its restricted habitat. If new information leads to a different view of the snail's systematic or population status, the recovery objectives may require revision.

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## KEY TO IMPLEMENTATION SCHEDULE COLUMNS 1 AND 4

## General Category (Column 1):

## Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

## Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

## Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

## Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depradation control
6. Disease control
7. Other management

## Priority (Column 4):

- 1 - Those actions absolutely necessary to prevent extinction of the species.
- 2 - Those actions necessary to maintain the species' current population status.
- 3 - All other actions necessary to provide for full recovery of the species.

Noonday snail (Mesodon clarki nantahala) Part III Implementation Schedule

*1 General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency *2		Estimated Fiscal Year Costs			Comments/Notes	
					FWS Region	Program	Other	FY 1	FY 2		FY 3
M3,01 04	Work with the U.S. Forest Service in protecting the snail's habitat, within the Nantahala Gorge, from disturbance.	1.1.1	1	Continuous	4	SE	U.S. Forest Service (FS), North Carolina Resources Commission (NCWRC), and North Carolina Natural Heritage Program (NCNHP)	1,000	1,000	1,000	*1. See general categories for Implementation Schedules. *2. Other agencies' responsibility would be of a cooperative nature or projects funded under a contract or grant program. In some cases contracts could be let to universities or private enterprises.
01-04	Continue to utilize existing legislation and regulations to protect the species and habitat.	1.1.2	1	Continuous	4	SE	FS, NCWRC, and NCNHP	500	500	500	
R1	Develop monitoring techniques.	1.2.1	3	1 yr.	4	SE	FS, NCWRC and NCNHP	---	4,000	---	
I1-I7	Implement monitoring program.	1.2.2	3	Continuous	4	SE	FS, NCWRC and NCNHP	---	---	2,000	
R2	Evaluate necessity for management.	1.3.1	3	1 yr.	4	SE	FS, NCWRC and NCNHP	---	2,000	---	
R4	Develop management techniques	1.3.2	3	1 yr.	4	SE	FS, NCWRC and NCNHP	---	---	Unknown	
M3	Manage habitat if needed.	1.3	3	Unknown	4	SE	FS	---	---	Unknown	
I14, M7	Evaluate overuse of area (especially at Blowing Springs); develop necessary controls.	1.4.1	2	1 yr.	4	SE	FS, NCWRC and NCNHP	---	1,000	---	
I2, I9 I11	Assess other threats.	1.4.2	2	1 yr.	4	SE	FS, NCNHP, and NCNHP	---	1,000	---	

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency		Estimated Fiscal Year Costs	Comments/Notes
					FWS Region	Other		
R5	Investigate results of taxonomic studies and evaluate impact of findings on current status of taxon.	2.1 & 2.2	3	1 yr.	4	SE FS, NCWRC, and NCNHP	1,000	---
I1, I3, I6	Investigate existence of additional material.	3.1	3	1 yr.	4	SE FS, NCWRC, and NCNHP	1,000	---
I6	Determine potential habitat sites outside Nantahala Gorge.	3.2	3	1 yr.	4	SE FS, NCWRC, and NCNHP	1,000	---
I1-I2	Survey potential habitat.	3.3	3	2 yr.	4	SE FS, NCWRC, and NCNHP	2,500	---
I1	Evaluate any new populations.	3.4	3	Unknown	4	SE FS, NCWRC, and NCNHP	2,500	2,500
04	Reevaluate recovery objectives if the noonday snail and habitat are stable or if new populations are found.	4.	3	Continuous	4	SE FS, NCWRC, and NCNHP	250	250

## IV. APPENDIX

## List of Reviewers for the Noonday Snail Recovery Plan

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