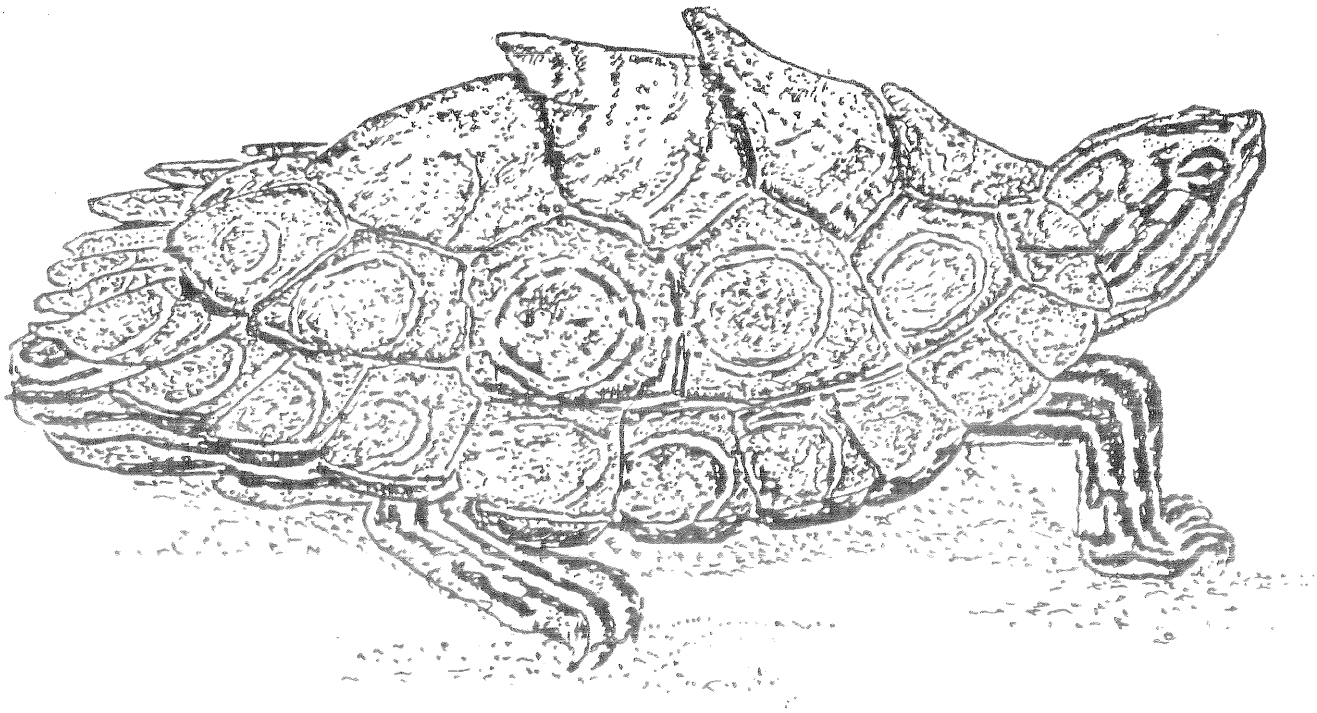
RINGED SAWBACK TURTLE

RECOVERY PLAN



U.S. Fish and Wildlife Service
Atlanta Georgia

A Recovery Plan For The Ringed Sawback Turtle

Graptemys oculifera

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For

Southeast Region

U.S. Fish and Wildlife Service

Atlanta, Georgia

Approved: _____
Regional Director, Southeast Region

Date: April 8, 1988

RECOVERY PLAN EXECUTIVE SUMMARY

1. Point or condition when the species can be considered recovered?

The primary objective of the recovery plan is to provide secure habitat for the ringed sawback turtle in two stretches of the Pearl River for a total protected area of 150 river miles. These reaches must be on opposite ends of Ross Barnett Reservoir at Jackson, and contain a minimum of 30 miles in either reach.

Delisting should occur on a rangewide basis when the two river reaches are protected, there is evidence of a stable or increasing population over a 10 year period, and a monitoring plan is developed and implemented to ensure a continuing stable population.

2. What must be done to reach recovery?

Determine the habitat requirements, including food sources for the various life stages of the ringed sawback turtle, and maintain at least 150 river miles of habitat that meets those requirements.

The primary steps are to characterize physical parameters of required habitat, determine reproductive requirements, food sources, population structure, and activity periods and behavior. On the basis of this information, identify and protect the two river reaches.

Attaining recovery depends upon protection of the required habitat. The areas where the ringed sawback turtle is common are known to some extent. The population status and trends and influencing factors are not known. Regulatory agencies must provide for habitat protection in areas identified as required habitat.

3. What management/maintenance needs have been identified to keep the species recovered?

The required habitat must be protected by the appropriate regulatory agencies. A monitoring plan to track population trends and protection success is a critical element.

Disclaimer

This is the completed ringed sawback turtle 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, and it does not necessarily represent the views of all individuals who played a role in preparing this plan. This plan is subject to modification as dicated 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

Background

On December 23, 1986, the U.S. Fish and Wildlife Service published in the Federal Register a final rule indicating its determination that the ringed sawback turtle (Graptemys oculifera) is a threatened species under the Endangered Species Act of 1973, as amended. The ringed sawback turtle is restricted to the Pearl River and one tributary, the Bogue Chitto River, in Mississippi and Louisiana.

The ringed sawback turtle was described by Baur in 1890 as Malacoclemmys oculifera and renamed Graptemys oculifera in 1893. The type specimens were a group of turtles acquired for the United States National Museum by Gustave Kohn and reportedly came from Mandeville, Louisiana, and Pensacola, Florida (Cagle 1953). On the basis of a 1900 statement to this effect by George E. Beyer, then Curator of the Tulane Museum, Cagle said they were probably purchased in the French Quarter Market in New Orleans, Louisiana. Due to the absence of ringed sawback turtles from collections in southern Alabama and Florida, Cagle considered the Pensacola record to be erroneous, although Kohn had accepted the locality datum of the individual from whom the purchase was made. The Mandeville record probably is from the Pearl River, 26 miles to the east, since there is no suitable habitat near Mandeville.

Description

The ringed sawback turtle is a small turtle (adults 7.5 - 22 cm) having a yellow ring bordered inside and outside with dark olive-brown on each shield of the upper shell or carapace and a yellow undershell or plastron. The head has a large yellow spot behind the eye, two yellow stripes from the orbit backwards and a characteristic yellow stripe covering the whole lower jaw (Cagle 1953). Males are considerably smaller than females.

The only other member of the genus Graptemys in the Pearl River is the Alabama map turtle (G. pulchra). The ringed sawback turtle differs from the Alabama map turtle in the size of yellow markings on the head and the presence of yellow rings on each shield of the carapace. Closely related but distinct species occur in rivers to the east and west of the Pearl River.

Distribution

The ringed sawback turtle has been collected only from the Pearl and Bogue Chitto Rivers. In the Pearl River, it occurs from near coastal salt water influence upstream to Neshoba County, Mississippi (Cliburn 1971). Within the Pearl River, densities are greater above Ross Barnett Reservoir and below the river stretch impacted by the Jackson metropolitan area. In the latter, the population appears to decrease downstream of Bogalusa, Louisiana. In the Bogue Chitto River, this species has been collected as far upstream as Franklinton, Louisiana. The size of the Bogue Chitto River is a possible limiting factor to this species.

Description of the Habitat

The ringed sawback turtle is encountered most frequently in river stretches having a moderate current, numerous basking logs and sand beaches for nesting. The river must be wide enough to allow sun penetration for several hours. The factors influencing suitability of nesting sites for *Graptemys* appear to be sand particle size, elevation above the water level, cover quality and distance from the water's edge (Shealy 1976, Lahanas 1982).

Lahanas (1982) observed *G. nigrinoda* to nest in unvegetated and short grass situations with about equal frequency. The substrate was very fine sand. Nests were constructed from 4.3 to 193 m from shore with most nests within 35 m of shore. The great distances from shore may be a reflection of the large nesting area on Gravine Island. Nests were always located above mean water level with an average elevation of 4.2 m. Elevation selected for nesting appeared to be the result of how far an individual traveled inland, rather than an elevation preference.

Anderson (1958) found nests of *G. oculifera* on the landward margin of sand bars. Cagle (1953) collected one mature female *G. oculifera* that had moved to a clump of grass. Tracking her movements, Cagle found trial nests and a nesting attempt that was apparently abandoned due to interference by roots.

The most consistent characteristic associated with nesting sites of G. pulchra was very fine sand. This sand is easily excavated, forms a fine crust when wetted and retains moisture beneath this crust. Nests of G. pulchra were generally 3-15 m from the water's edge and at an elevation of 2-3 m above the existing water level. If gently sloping banks were present, G. pulchra would travel greater distances to find the desired elevation (Shealy 1976).

Basking sites must be present and relatively safe. G. pulchra were observed to use the tops of toppled trees for basking only when there was some water covering the trunk between the top and the river bank. When water levels dropped and the trunk was continuously exposed, the turtles ceased using the tree for basking (Shealy 1976).

Life History

Cagle (1954), in the descriptions of G. flavimaculata and G. nigrinoda concluded these two species and G. oculifera formed a unique complex that has been referred to by other investigators as the "narrow-head" Graptemys. The most comprehensive study on the "narrow-head" complex is by Lahanas (1982). It is on this study that most of the following life history discussion is based.

The limited information available on G. oculifera is Cagle's work in the early 1950s. Cagle (1953) concluded that G. oculifera males

matured at five years of age and that toe nails and the pre-anal tail length were not always conspicuously elongate. The smallest mature male was 6.52 cm (2.6 inches) plastron length. Cagle did not provide an age at which G. oculifera females reached maturity but did record the smallest mature female at 12.8 cm (5.0 inches) plastron length. He concluded females grew more rapidly than males during their second year and that growth virtually ceased in both sexes at maturity.

Lahanas (1982) found female G. nigrinoda grew at twice the rate of male G. nigrinoda for the first five years. He collected immature female G. nigrinoda that were 6 to 8 years old and 159 to 168 mm (6.2 - 6.5 inches) in plastron length. The smallest sexually mature females collected were 167 to 177 mm (6.5 - 7.0 inches) in plastron length, suggesting they were at least 9 years old. From these data he inferred that female G. nigrinoda mature at 8 or 9 years of age and a plastron length of approximately 170 mm (6.7 inches). Shealy (1976) found G. pulchra males matured in 3 or 4 years while females were 14 years old at maturity. Webb (1961) found male G. ouachitensis in Lake Texoma, Oklahoma, were mature at 2 or 3 years while females were 6 or 7 years of age.

Lahanas (1982) concluded that G. nigrinoda produced 3 or 4 clutches annually with an average clutch size of 5-6 eggs. Cagle (1953) collected a small nesting female G. oculifera that had 3 eggs in the oviduct and 4 enlarged follicles. This turtle probably would have deposited two clutches totalling 7 eggs. Shealy (1976) autopsied a large female G. pulchra that exhibited the potential production of 71 eggs in the

season. Cagle (1952) found reproductive potential of up to 51 eggs with an average of 17 eggs in a season for G. barbouri. The narrow headed Graptemys may have a lower reproductive potential than other species of Graptemys.

In G. nigrinoda, mating likely occurs in late spring and early summer but may occur at any time of the year (Lahanas 1982). G. pulchra likely breeds in September to November with nesting from late April to late July. A single mating may be sufficient for several fertilizations since females can apparently store viable sperm for several months or possibly years. A female G. oculifera collected by Cagle (1953) in April did not yet have eggs in the oviduct, while he observed one nesting in early June. Lahanas (1982) concluded that the nesting season for G. nigrinoda extended from mid-May to early August.

In Graptemys, nesting activity may occur during the day or night but rarely both by the same species. G. nigrinoda always nests after dark with the highest activity during the early hours of darkness (Lahanas 1982). G. pulchra nests during the day (Shealy 1976). The nesting G. oculifera observed by Cagle (1953) was during the day.

Graptemys' nests are about 15 cm (6 inches) deep with the eggs covered with packed sand to the top of the cavity. The egg incubation period for G. oculifera is unknown. Under controlled conditions, Ewert (1979) artificially incubated G. oculifera eggs in 62.8 days. Under similar conditions, Shealy (1976) incubated G. pulchra eggs in 74-79 days.

Lahanas (1982) observed 9 clutches of G. nigrinoda incubating under natural conditions to require an average of 63-65 days. Hatchling turtles remain in the nest for up to several days after pipping to absorb the remaining egg yolk. Shealy (1976) determined the average time between nesting and emergence to be 95 days for G. pulchra. Lahanas (1982) observed G. nigrinoda remained in the nest for 2-5 days after pipping.

Nesting is generally on wide sand beaches (Lahanas 1982, Shealy 1976). Nest temperature is a determining factor in sex determination according to a study on three species of Graptemys (Bull 1985). In a study of G. geographica, G. ouachitensis, and G. pseudogeographica, only males were produced when nest temperatures were below 28^{o}C. If nest temperatures were above 30.5^{o}C, only females were produced. The critical time for nest temperature influence on sex determination was in the 4th to 7th weeks of incubation (Bull 1985).

Egg mortality is an important factor in reproductive success. Shealy (1976) found G. pulchra egg mortality exceeded 90 percent. Eighty-two percent of G. nigrinoda eggs were destroyed (Lahanas 1982). The mortality for G. nigrinoda could have been higher if the investigator had not been on site and disrupting the predatory activities. The effect of long periods of egg inundation under natural conditions is unknown.

Studies of other species of Graptemys indicate a diet of insects, snails, and clams (Cagle 1952, Webb 1961, Shealy 1976). Juveniles and

small males of G. pulchra contained primarily insects while large females fed almost exclusively upon mussels by crushing the shell with their powerful jaws (Shealy 1976). Lahanas (1982) found G. nigrinoda used algae as a primary food and did not regard them as a mollusk specialist. Cagle (1953) found the stomachs of 10 G. oculifera contained only the fragments of insects. Fish and carrion may be an occasional and opportunistic food source.

A major factor in activity is water temperature (Shealy 1976). Although basking may occur during all months, a peak in activity occurs in March and April, continues through July and declines from July to October. Basking probably serves several functions with elevation of the body temperature as a primary function. The drying that occurs with basking also inhibits fungal and algal growth, ectoparasites and infections (Shealy 1976). In G. pulchra, basking did not occur on cloudy days when water temperature exceeded air temperature. This implies basking is primarily for thermoregulation (Shealy 1976). Turtles will quickly drop from basking sites if disturbed and may drop in response to another turtle plunging into the water.

Nocturnal activity of Graptemys is largely unknown. Individuals have been observed lingering close to the surface among tree branches and roots. Adults may feed at night and hide during the day when not basking.

Predation

Nest predation is the dominant factor inhibiting population growth in G. pulchra (Shealy 1976). He found at least 95 percent of all nests were destroyed by predators. Lahanas (1982) found 82 percent of G. nigrinoda destroyed by predators. Primary predators are the fish crow and raccoon. The fish crow will frequently follow a female to the nest site and excavate the eggs after laying. Raccoons apparently locate the nests by the odor of turtle urine. Most nests were destroyed by predators within 12-24 hours of laying. Cagle (1950) found the most important predators of Pseudemys scripta nests were skunks and raccoons.

Predation on hatchlings has not been observed. It is likely that large gars, herons, and alligator snapping turtles occasionally feed upon hatchlings (Shealy 1976). The only significant predator of adult turtles is man who shoots basking turtles and collects them for the commercial turtle trade.

Limiting Factors

Very little competition seems to occur among individuals or species. Because food is generally abundant if the habitat is satisfactory, the major limiting factor appears to be habitat availability. Competition for basking sites probably is not important at the population level in undisturbed habitat. The limitation of G. oculifera to the Pearl River system likely is from drainage isolation and the absence of overland

migratory movements. The degree of adaptability to pond or lake situations has not been determined, but observations suggest G. oculifera marginally survives in such situations (McCoy and Vogt 1980). Nesting site requirements may be limiting factors. Basking sites probably are necessary for health, if not survival, and may be a limiting factor.

Reasons for Decline and Continuing Threats

The decline of the ringed sawback turtle is primarily due to habitat modification and water quality degradation. Construction of Ross Barnett Reservoir, modification of the west channel of the Pearl River to Bogalusa, Louisiana, and floodplain clearing at Jackson, Mississippi have impacted 21 percent of the historic range. Ross Barnett Reservoir modified 30 river miles (RM) to the exclusion of ringed sawback turtles. The channel and floodplain modifications at Bogalusa and Jackson have not eliminated this species but apparently have caused a decline in the population. Cliburn (1971) collected 12 G. oculifera from the Pearl River in the vicinity of the Highway 80 bridge at Jackson. Service biologists were unable to capture any G. oculifera on two occasions when using techniques similar to Cliburn's. Three surveys by Service biologists of basking turtles in the Pearl River at Jackson concluded the G. oculifera population was comprised almost completely of adults. The ringed sawback population in the vicinity of Bogalusa, Louisiana, and downstream has declined (pers. comm. R. Lohoefenor).

Projects planned or authorized will impact up to 28 percent of the remaining Pearl River habitat. Flood control studies on-going or planned for the Pearl River at Slidell, Louisiana and Pearlington, Morgantown, Monticello, Foxworth, Columbia, Carthage, and Leake County, Mississippi continue to threaten this turtle. Authorized channelization of 100 RM of the Bogue Chitto River would likely extirpate the ringed sawback turtle from this stream. Flood control studies on reaches of the Bogue Chitto River at Franklinton, Louisiana and Tylertown, Mississippi may lead to river modifications which would threaten this habitat.

Other threats include continued channelization in the drainage, which produces increased runoff and heavy siltation. Drainage ditches from agriculture fields may increase the amount of pesticides that reach the rivers. Sand and gravel dredging continues to impact reaches of ringed sawback turtle habitat.

Current Status and Population Trends

There are two vigorous population centers in the Pearl River, separated by Ross Barnett Reservoir and the Jackson metropolitan area. Information needed to evaluate current population trends within these centers is lacking. Much of the life history must be determined before we can evaluate trends and take protective action for recovery.

Part II: Recovery

A. Recovery Objective

The objective of this plan is to remove the ringed sawback turtle from the list of threatened species. The criteria for delisting the species are:

(1) Protection of a total of 150 miles of the turtle's habitat in two reaches of the Pearl River. There must be a minimum of 30 miles in either reach with the total protected area totalling 150 river miles.

(2) Evidence of a stable or increasing population over at least a ten year period in these two Pearl River reaches.

(3) An established, continuing plan of periodic monitoring of population trends and habitat to ensure a stable population in these river reaches.

B. Step-down Outline

1. Characterize physical parameters of habitat.

    1.1 Select and characterize five reaches with vigorous ringed sawback turtle populations.

1.2 Select and characterize five reaches that do not support vigorous ringed sawback turtle populations.

1.3 Compare data obtained in 1.1 and 1.2 to determine potentially limiting factors.

2. Determine reproductive requirements.

2.1 Determine nesting locations and prepare physical description of sites.

2.2 Determine nesting requirements.

2.3 Determine effects of environmental changes and of predation on reproductive success.

2.4 Determine where most of the successful reproduction occurs and the influencing factors.

3. Determine food sources.

3.1 Determine the food requirements at various life stages and seasons.

3.2 Determine physical requirements of the major prey species.

3.3 Determine how distribution and abundance of the major prey species correlates with the vigorous turtle populations.

4. Determine population structure.

4.1 Determine sex ratio, size, and age at maturity, and age structure.

4.2 Estimate number of ringed sawback turtles per mile in each of the study reaches.

5. Determine activity periods and behavior.

5.1 Determine seasonal activity.

5.2 Determine daily activity.

5.3 Determine if the species moves any distance during its lifetime and barriers to such movement, if any.

6. From the information gathered, determine and protect at least two river reaches critical to maintaining a stable population.

6.1 Protect these two river reaches from activities that would cause a decline of this species' population.

6.2 Develop and implement a monitoring plan to evaluate effectiveness of protective measures and to track population trends.

C. Narrative Outline

1. Characterize physical parameters of habitat. This section will seek to compare habitat parameters such as water depth, current, water chemistry, bottom composition, numbers of snags per mile, area of sandbars per mile, bank height, sandbar vegetation, average exposure of sandbars and snags to direct sunlight per day and any other factors that may be applicable, to determine the limiting factors for various reaches of the Pearl River.

1.1 Select and characterize five reaches with vigorous ringed sawback turtle populations. The ringed sawback turtle continues to exist in good numbers in an approximate 50 mile reach upstream of Ratliff's Ferry and in a 120 mile reach from near Georgetown, Mississippi downstream to the vicinity of Sandy Hook, Mississippi. Five reaches of at least 3 miles each will be selected to characterize the parameters in 1. These reaches will be in the vicinity of the Highway 35 bridge at Carthage, below the Highway 25 bridge, and near Monticello, Columbia, and Sandy Hook, Mississippi. Within

each selected reach, at least 10 sample stations will be defined to aid in statistical comparisons. Each sample station will be at least 100 yards in length.

1.2 Select and characterize five reaches that do not support vigorous ringed sawback turtle populations. Populations of this turtle have apparently declined and/or were always low in the Pearl River from Ross Barnett Reservoir downstream to near Georgetown and in the Pearl River below Bogalusa. Five reaches of 3 miles each will be selected to characterize the parameters in 1. These reaches will be: between Ross Barnett Reservoir and Lakeland Avenue, Jackson; between the Jackson metropolitan area and Georgetown; downstream of Bogalusa; and near Walkiah Bluff Water Park above Picayune, Mississippi. Sample stations will be designated as in 1.1.

1.3 Compare data obtained in 1.1 and 1.2 to determine limiting factors. Compare the parameters to determine those common to all study areas in 1.1, but lacking in study areas 1.2.

2. Determine reproductive requirements. This section will determine the required and limiting factors to successful reproduction. Two study areas will be selected from those areas in 1.1 with one above and one below Ross Barnett Reservoir.

2.1 Determine nesting locations and prepare physical description of sites. In at least two study areas, determine the characteristics of nest cavity, substrate type, location of nest relative to water, vegetation, and debris, length of exposure per day of nest site to direct sun, temperature of nest substrate and other parameters necessary to determining the suitability of a nesting site.

2.2 Determine nesting requirements. Within the study areas selected in 2.1, determine dates of nesting, period of greatest nesting activity, extreme nesting dates, incubation period, clutch size, frequency of nesting, and description of eggs. Incubation period may be determined by artificial rearing but should be compared to natural incubation where possible. Clutch size can be determined by counting the number of eggs laid, X-ray of gravid females, and dissection of a small number of individuals. Determining frequency of nesting will require extensive mark-recapture and/or X-ray of females immediately after laying.

2.3 Determine effects of environmental changes and of predation on reproductive success. This task will determine the effects of high water on nesting and hatching. The length of time an egg or embryo can be

submerged before dying is crucial in predicting certain environmental impacts to population trends. This will be crucial in evaluating the potential impact of a dry dam such as is authorized for the upper Pearl River. Because nest predation appears to be a limiting factor in other species of Graptemys, we must know the impact of nest predation on the ringed sawback turtle. This can be accomplished by marking and monitoring nests to determine the percent that successfully hatch and identifying predators by the tracks around destroyed nests.

2.4 Determine where most of the successful reproduction occurs and the influencing factors. This task will seek to determine if nest temperature influences sex determination and, if so, could bank clearing have enough effect on nest temperature to result in a skewed sex ratio. The relationship between female size and clutch size will be determined to evaluate the contribution of large females to population trends. Larger turtles are more likely targets of wanton shooting and in Graptemys these often are females. Determining where successful reproduction occurs will permit an evaluation of the importance of habitat quality, predator density, and the interaction of these factors.

3. Determine food sources. This task will seek to determine preferred and available food sources for various life stages of the ringed sawback turtle.

3.1 Determine the food requirements at various life stages and seasons. Juvenile and small male Graptemys apparently utilize insects as a food source. Larger males and adult females may also consume mollusks as food. This task will seek to determine the groups or species utilized as food by examining fecal samples from captured turtles and from stomach content analysis of any turtles that may be sacrificed for other purposes or from stomach pumping of live turtles. Stomach contents of G. pulchra that occur in the same habitat will be examined to determine what a closely associated species consumes and if there is competition for the food source. Determination of diet will be accomplished for two seasons in the two study areas selected in 2.1 to evaluate seasonal variations and dietary variation between the study areas.

3.2 Determine physical requirements of the major prey species. Once the major prey species have been identified in 3.1, this task will seek to determine those factors that influence their abundance and availability. This will include correlating peak insect population levels with turtle hatchling emergence and the impact of habitat

modification on various life stages of the insect prey. The required substrate and reproductive requirements of mollusk prey species will be determined. This may include the determination of molluscan fish host to evaluate project impacts on the turtle's food supply.

3.3 Determine how distribution and abundance of the major prey species correlates with the vigorous turtle populations. Shealy (1976) found a direct correlation between the presence and abundance of mollusks and the presence and abundance of G. pulchra. This task will determine if the same is true for G. oculifera by examining reaches of the Pearl River for prey organisms relative to G. oculifera populations.

4. Determine population structure. This task will develop data to evaluate population trends and possibly identify limiting factors for this species in areas of low population levels.

4.1 Determine sex ratio, size and age at maturity, age structure. Nest temperatures influence sex determination in several other species of Graptemys and probably do in G. oculifera. If early nesting is lost due to flooding or some other factor, the increased temperatures of late nesting could skew the sex ratio. Determining and comparing all these factors for each of the study areas will provide a base

for determining population trends and possibly identify limiting factors for reaches of the Pearl River that have low population levels of this turtle.

4.2 Estimate number of ringed sawback turtles per mile in each of the study reaches. This task will provide baseline data to determine population trends. Basking ringed sawback turtles will be counted on at least three occasions at each sample station each year for three years. Turtles will be captured within selected reaches to provide hands-on verification of the basking counts. Captured turtles will be marked by notching or drilling certain carapace marginals for recapture studies to provide an additional estimate of population size and to provide data on survivorship and growth rates.

5. Determine activity periods and behavior. This task will seek to provide data on activity and behavior by age and sex classes, by seasons, and on daily activity.

5.1 Determine seasonal activity. Studies have shown that feeding activity ceases in the late fall with turtles entering a period of low activity. This task will seek to identify if and when this occurs in G. oculifera. Where the turtles go during this period of low activity will be compared by age and sex classes.

5.2 Determine daily activity. Daily activity will be determined by age and sex classes under varying environmental conditions. Shealy (1976) found juveniles of G. pulchra to have a strong basking drive and that they would bask under unfavorable environmental conditions. Does this happen with G. oculifera and, if so, what impact does it have on the population structure? Peak feeding hours will be determined for juveniles and adults.

5.3 Determine if the species moves any distance during its lifetime and barriers to such movement, if any. This task will determine if river reaches that support low population levels are dependent upon emigration from other river reaches and if there are barriers to such movement. Homing tendencies will be evaluated by relocating some turtles and determining if they return to the point of capture. This task will require considerable mark and recapture work.

6. From the information gathered, determine and protect at least two river reaches critical to maintaining a stable population. Baseline data from this plan will be used to identify two river reaches with a minimum of 30 miles in one reach and totalling at least 150 river miles in the two reaches. Necessary actions to protect and plans to monitor these areas will be developed and implemented. Immediate and interim protection will be provided by the authority of Section 7 of the Endangered Species Act.

6.1 Protect these two river reaches from activities that would cause a decline of this species' population. This task will develop the actions necessary to protect the identified habitat and seek to protect it by implementing those actions. These actions may include anything from regulations or legislation restricting habitat modification in the designated reaches to acquisition of key areas.

6.2 Develop and implement a monitoring plan to evaluate effectiveness of protective measures and to track population trends. Using the baseline data gathered in this plan, develop a monitoring plan to evaluate the protective measures, track population trends, and take corrective action as necessary. Population monitoring including age classes, sex ratio, nesting success, food availability, and number of turtles per mile will be conducted at three year intervals in the protected river reaches.

The same factors will be monitored in the river reaches selected in 1.2 at five year intervals to evaluate trends in the areas of low population.

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PART III

KEY TO IMPLEMENTATION SCHEDULE COLUMNS 1 & 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. Depredation control
6. Disease control
7. Other management

Priority (Column 4):

1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

3 - All other actions necessary to provide for full recovery of the species.

Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS						
					Region	Division	Other	FY 1	FY 2	FY 3	
I3	Characterize physical parameters of habitat	1	2	1 yr.	4	FWE	MSDWC COE	5,000			All funding estimates are for FWS funds only.
I3	Determine nesting locations and physical description of sites	2.1	2	2	4	FWE	MSDWC COE	5,000	5,000		
I3	Determine nesting requirements and parameters	2.2	2	1	4	FWE	MSDWC COE		5,000		
I3	Determine effects of environmental changes and of predation on reproductive success	2.3	2	3	4	FWE	MSDWC COE		5,000	5,000	
I3	Determine where most of the successful reproduction occurs and the influencing factors	2.4	2	1	4	FWE	MSDWC COE			5,000	
I3,5	Determine the food organisms at various life stages and seasons	3.1	2	2	4	FWE	MSDWC COE	5,000	5,000		
I3	Determine physical requirements of the major prey species	3.2	3	1	4	FWE	MSDWC COE		5,000		
I1	Determine how distribution and abundance of major prey species correlates with vigorous turtle populations	3.3	3	1	4	FWE	MSDWC COE			5,000	

Implementation Schedule

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS Region	Division	Other	FY 1	FY 2	FY 3	
I1,6	Determine sex ratio, size and age at maturity, age structure, survival rates by sex and age classes	4.1	2	3	4	FWE	MSDWC COE	8,000	8,000	8,000	
I1	Estimate number of ringed sawback turtles in each of study reaches	4.2	2	3	4	FWE	MSDWC COE	5,000	5,000	5,000	
I6,8 14	Determine activity periods and behavior	5	3	1	4	FWE	MSDWC COE			5,000	
A3,03	Protect two river reaches	6.1	3	continu-ous	4	FWE LE	MSDWC COE	1,000	1,000	1,000	
04	Develop and implement a monitoring plan	6.2	3	continu-ous	4	FWE	MSDWC COE	2,000	2,000	2,000	

FWE = Division of Endangered Species, Fish and Wildlife Enhancement
LE = Law Enforcement
MSDWC = Mississippi Dept. of Wildlife Conservation
COE = U.S. Army Corps of Engineers