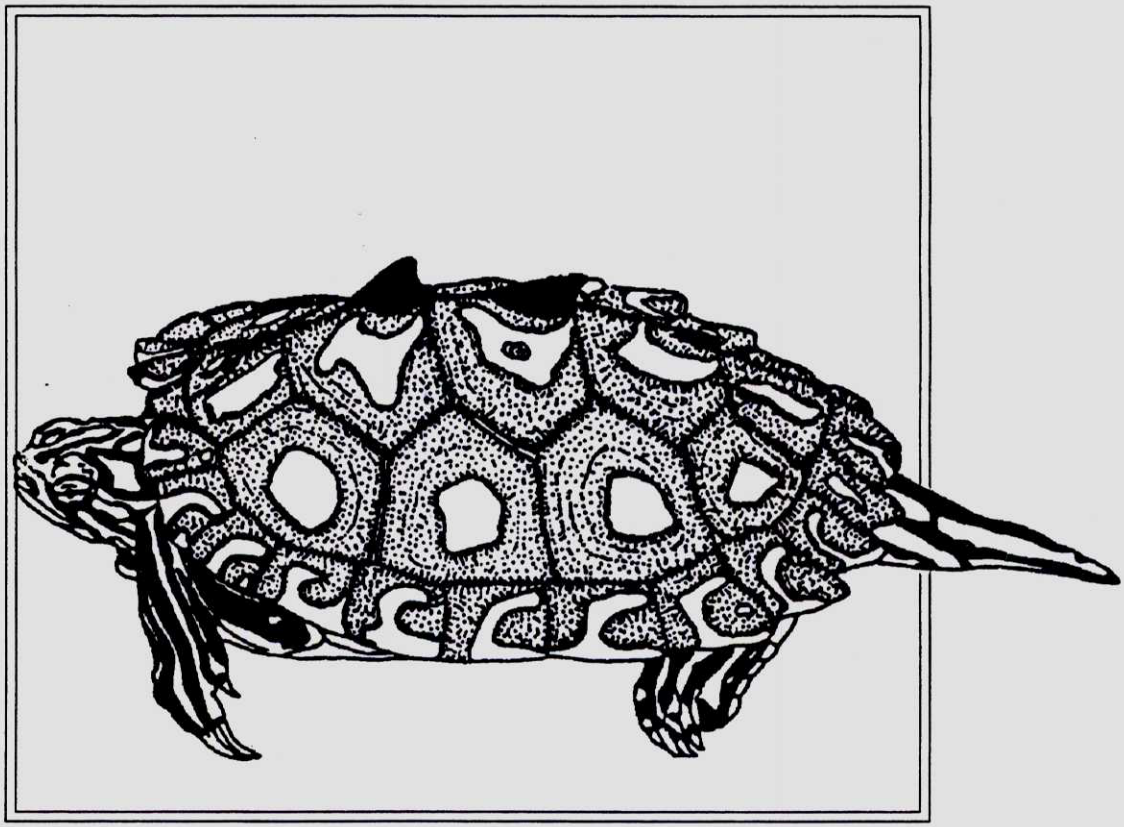
Recovery Plan

Yellow-blotched Map Turtle
(Graptemys flavimaculata)



U.S. Fish and Wildlife Service

Yellow-blotched Map Turtle

(*Graptemys flavimaculata*)

Recovery Plan

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for

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EXECUTIVE SUMMARY

Current Species Status: This riverine turtle is listed as threatened and is endemic to the Pascagoula River system of Mississippi.

Habitat Requirements and Limiting Factors: Major threats to its continued existence are habitat and water quality degradation. The preferred habitat is apparently river stretches with moderate currents, abundant basking sites, and sand bars. Its diet apparently consists largely of insects and snails. Very little is known of the life history.

Recovery Objective: Delisting.

Recovery Criteria: This species may be considered for delisting when there is evidence of a stable or increasing population in the Leaf, Chickasawhay, and Pascagoula Rivers for a period of at least 15 years. Minimum density estimates should average 44 yellow-blotched map turtles per river kilometer in the Pascagoula River and at least 22 per river kilometer in the Leaf and Chickasawhay Rivers over the 15-year period. Also, the habitat must be protected on the entire Pascagoula River and on the lower 129 kilometers of both the Leaf and the Chickasawhay Rivers.

Actions Needed:

1. Conduct population assessments throughout the range.
2. Conduct life history research on the species.
3. Investigate water quality and determine habitat suitability.
4. Formulate actions to protect the habitat.
5. Develop educational materials about the turtle, its habitat, and threats.
6. Develop plan to monitor populations.

Total Estimated Cost of Recovery: The cost of recovery is estimated at $845,000.

Date of Recovery: Recovery of this species is estimated to take at least 15 years after the population levels have attained target levels and the habitat has been protected. It is not possible to estimate the time necessary for the populations to attain this level or for the habitat to be protected.

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PART I: INTRODUCTION

Background

The U.S. Fish and Wildlife Service (1991) published a final rule on January 14, 1991, indicating its determination that the yellow-blotched map turtle (Graptemys flavimaculata) was a threatened species under the Endangered Species Act of 1973, as amended. The yellow-blotched map turtle is known only from the Pascagoula River system of southeastern Mississippi.

Cagle (1954) described Graptemys flavimaculata from a series of 83 specimens collected by a Tulane University field crew on the Pascagoula River 13 miles southwest of Lucedale, George County, Mississippi. Cliburn (1971) assumed that the actual type locality was in the vicinity of Old Benndale Crossing because no point on the Pascagoula River was precisely 13 miles southwest of Lucedale. Mertens and Wermuth (1955, cited in McCoy and Vogt 1987) relegated the yellow-blotched map turtle to a subspecies of Graptemys oculifera, but this arrangement has not been accepted (Ernst and Barbour 1989, Conant and Collins 1991).

Description

The yellow-blotched map turtle is a member of the "narrow-headed" Graptemys group (Cagle 1954). Sexual dimorphism in body size is pronounced. Carapace lengths of 88 males collected and released near Vancleave in Jackson County (Stewart 1989) ranged from 8.8 to 12.1 centimeters (cm) or 3.5 to 4.8 inches (in), and 13 females from the same locality ranged from 10.3 to 21.2 cm (4.1 to 8.5 in).

The ground color of the carapace is olive to light greenish-brown. Each costal scute (enlarged, lateral plate of the carapace) has a central yellow or orange blotch, although not uncommonly the blotches are replaced by bars, semicircles, or complete circles. The marginals (plates along edge of shell) have orange bars or semicircles opening posteriorly. The first four vertebral scutes (plates along the middle of the carapace) have black, spine-like projections flanked by irregular orange blotches. The spines are prominent in juveniles and in adult males but much reduced in adult females. The plastron is yellow to light beige with dark pigment, often fading with age, present along the seams of the plastron's plates. The soft parts are dark greenish-black. Yellow stripes are present on the tail, neck, legs and head, and a triangular or quadrangular yellow spot is present behind the eye.

The only other Graptemys known from the Pascagoula River is the Alabama map turtle, Graptemys pulchra. This species has a dull olive-green carapace marked with a network of pale yellow or orange circles or narrow lines that often fade with age. A large, yellow blotch extends backward and downward behind the eyes from between the eyes. The spines along the vertebral scutes are somewhat less prominent than in Graptemys flavimaculata of similar size.

Distribution

The yellow-blotched map turtle is known to occur in the Leaf River from the U.S. Highway 84 bridge in Covington County (Cliburn 1971) downstream to the confluence of the Leaf and the Chickasawhay Rivers (Figure 1). It occurs in the Chickasawhay River upstream to Enterprise in Clarke County (McCoy and Vogt 1987). Graptemys flavimaculata is present in the Pascagoula River from its point of origin near Merrill, George County, south to where the river forks into the East and West Pascagoula channels near Vancleave, Jackson County. It occurs in the West Pascagoula to just south of the I-10 bridge (Dobie 1991), and has been observed in the East Pascagoula River from the fork downstream to approximately 1 mile north of the I-10 bridge (T.C. Majure, Mississippi Dept. Wildlife, Fisheries and Parks, pers. comm. 1991). A small population also occurs in the lower Escatawpa River, Jackson County (T.C. Majure, pers. comm. 1991). Cliburn (1971) reported specimens from Tallahala Creek, Perry County (T4N, R11W, Sec. 9), approximately 13 river kilometers (8 river miles) above its confluence with the Leaf River, and from Red Creek at MS Hwy. 57, Jackson County (T4S, R8W, Section 12), approximately 18 river kilometers (11 river miles) above its confluence with the Pascagoula River.

Description of the Habitat

The yellow-blotched map turtle is a species of rivers and large creeks. It apparently avoids smaller streams where the surface of the water is shaded by bank vegetation for much of the day. Its preferred habitat has been described as river stretches with moderate currents, abundant basking sites, and sand bars (McCoy and Vogt 1987). The Pascagoula River near Vancleave has numerous accessory channels connecting oxbow lakes to the main river, and the yellow-blotched map turtle occurs in all of these habitats (R.L. Jones, pers. obs. 1991). It is more abundant, however, in the main channel.

Life History

Very little information is available on the life history of the yellow-blotched map turtle. Walquist (1970) and Cagle (1955) reported on several aspects of its courtship behavior. Cagle (1954) speculated that males mature during their second season of growth. Ernst and Barbour (1989) stated that the diet consisted largely of insects and snails, and that captives would eat fish. It is assumed that the life history of this species is similar to that of the closely-related ringed (Graptemys oculifera) and black-knobbed (Graptemys nigrinoda) sawbacks. Male yellow-blotched map turtles probably mature at 3 to 4 years of age, as do male G. oculifera (Jones 1991) and male G. nigrinoda (Lahanas 1982). Females probably mature at 8 to 10 years of age.

Related turtle species, such as female G. nigrinoda mature at 8 or 9 years (Lahanas 1982) and female G. oculifera appear to mature at 9 to 11 years (Jones 1991). Nesting probably occurs from mid-May to early August, and it

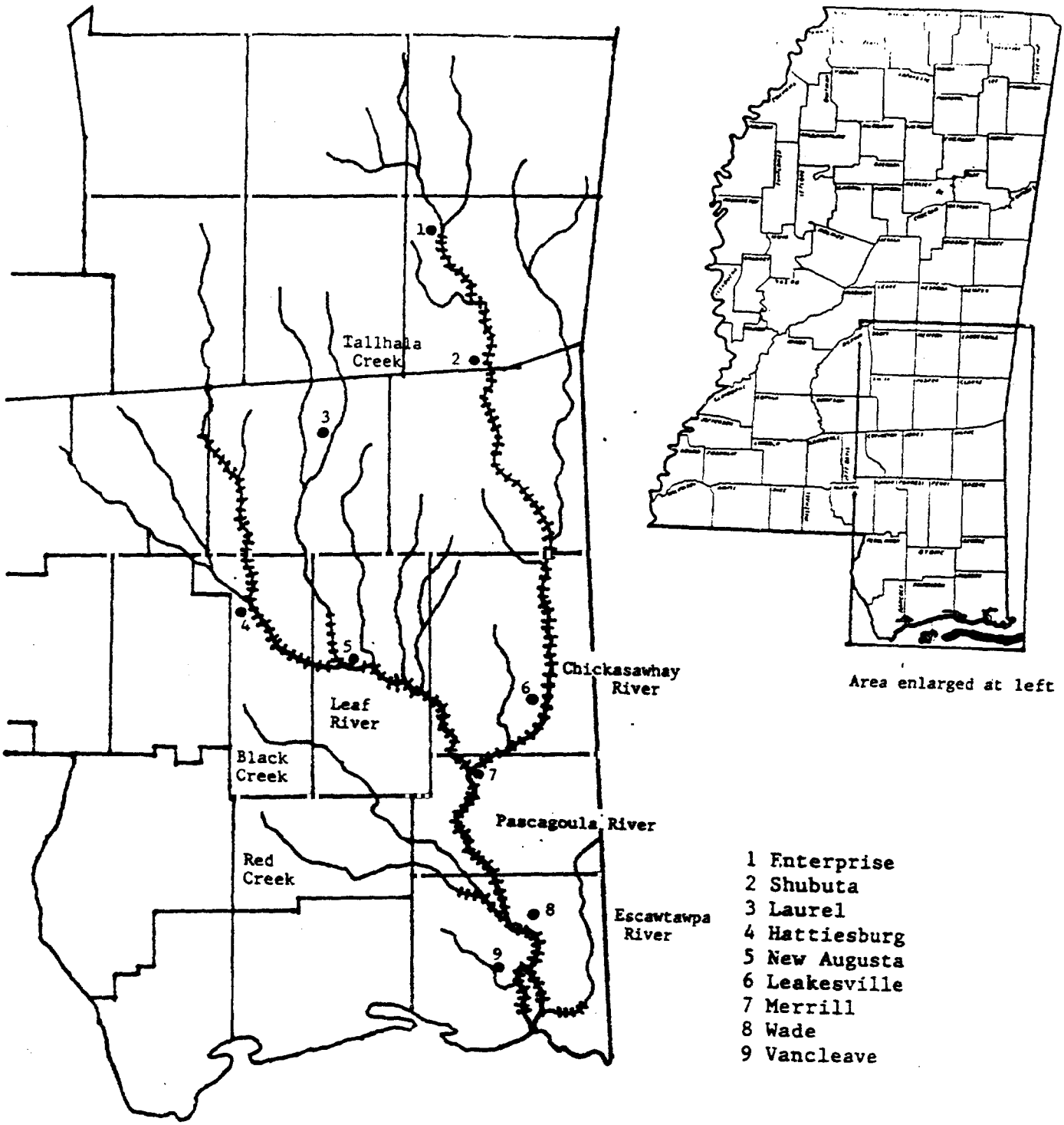

Figure 1. Distribution of ~~Graptemys~~ flavimaculata in the Pascagoula River system. Hatching represents presumed range.

is likely that more than one clutch may be deposited during the nesting season. Graptemys nigrinoda nests at night (Lahanas 1982), while G. oculifera has been observed nesting during the daylight hours (Jones 1991). A female G. flavimaculata was observed nesting at night (G. George, Tennessee Aquarium, pers. comm. 1991), although females assumed to be searching for nesting sites, have been seen on sandbar areas during the day (E. Keiser, University of Mississippi, pers. comm. 1991). Nests are probably constructed on sandbars. The diet may be composed of aquatic insects with some plant materials, as in G. oculifera (Kofron 1991), or algae, bryozoans, sponges, mollusks, and insects, as in G. nigrinoda (Lahanas 1982).

Current Status and Population Trends

The first comprehensive status survey of Graptemys flavimaculata was conducted by McCoy and Vogt (1980). They did not find this species in Red or Tallahala Creeks where Cliburn (1971) had reported them earlier. They concluded that these streams were too small, shaded, and slow-moving to provide other than marginal habitat, and that G. flavimaculata, if present, existed in very low numbers.

McCoy and Vogt (1980) also found that populations in the Chickasawhay River were declining and were much smaller than those in the Leaf and Pascagoula Rivers. They found what they considered to be good populations in the Pascagoula River from Vancleave and upstream in the Leaf River to Hattiesburg, and stated that the best population occurred in the Pascagoula River from Wade upstream to Merrill.

Biologists with the U.S. Fish and Wildlife Service conducted another status survey in 1989 on the Leaf, Pascagoula, and lower Chickasawhay Rivers (Stewart 1989). They found fewer than four yellow-blotched map turtles per mile of river between McLain and Wade, an area that includes that segment of the Pascagoula River that McCoy and Vogt (1980) described as having the best population of G. flavimaculata they found 10 years earlier. In contrast, populations were much larger downstream from that area. Stewart (1989) observed up to 70 G. flavimaculata per river mile on the Pascagoula near Vancleave. He concluded that the largest remaining population occurred from the vicinity of Wade to approximately 18 river miles downstream.

Anecdotal reports from wildlife management personnel familiar with the yellow-blotched map turtle also indicate a marked decline in the species in the upper part of the Pascagoula River. Herman Murrah (Mississippi Dept. of Wildlife, Fisheries and Parks, pers. comm. 1991) stated that the number of turtles on the Pascagoula Wildlife Management Area (between Wade and McLain) had steadily declined over the last 4 or 5 years.

Reasons for Decline and Continuing Threats

Stewart (1989) and U.S. Fish and Wildlife Service (1991) listed a variety of factors that may have contributed to the decline of the yellow-blotched map turtle:

Sedimentation and Stream Modification

Navigation and flood control projects usually call for removal of logs and snags used by Graptemys flavimaculata for basking. They may also result in the alteration or elimination of sand bars, which are important for nesting. Increased sedimentation and turbidity resulting from both flood control projects and gravel mining can also negatively impact the invertebrate species that are fed upon by the yellow-blotched map turtle.

Several channel modification projects in the Pascagoula watershed have been planned, authorized, or completed. A snagging project along almost 4.1 kilometers (2.5 miles) of the Leaf River at Hattiesburg has eliminated basking structure for map turtles and impacted invertebrate prey populations through increased sedimentation and the elimination of the snags and logs that provide habitat for the invertebrates. Seven additional projects on tributaries of the Leaf and Chickasawhay Rivers have either been completed, are being planned, or are under study. In addition, four reservoirs have been built in the Pascagoula watershed and two more are authorized. A gravel mining operation in the Bowie River at its confluence with the Leaf River has caused increased sedimentation downstream in the Leaf River.

Commercial Collecting, Wanton Shooting, and Trapping

Yellow-blotched map turtles were collected in the past for the commercial pet trade where they sold for as much as $65 per specimen (Stewart 1989). Illegal collecting for this market probably continues at a reduced level. Some individuals habitually use basking turtles for target practice. Slat baskets and wire traps used illegally to capture catfish have also caught and drowned Graptemys flavimaculata (G. George, pers. comm. 1991).

Diseases and Predation

No diseases are known to threaten the yellow-blotched map turtle, but numerous dead turtles of this and other species have been noted in the recent past on the Pascagoula Wildlife Management Area (M. Everett, Mississippi Dept. of Wildlife, Fisheries and Parks, pers. comm. 1991). It is not known whether these deaths were a result of disease or were caused by some toxic agent in the water. Nest predation is probably high and may average between 90 and 100 percent as it does in some other species of turtles (Shealy 1976, Vogt 1980). Much of this predation is probably attributable to fish crows, which are known to be significant egg predators for other species of Graptemys (Lahanas 1982; R.L. Jones, pers. obs. 1990).

Water Quality Degradation

Water pollution has been a serious problem in parts of the Pascagoula watershed for many years. Anderson (1950) commented on the high levels of industrial and municipal effluents in Sowashee and Tallahala Creeks. Grantham (1962) documented water quality degradation from industrial effluents and domestic sewage on the Leaf and Bowie Rivers near Hattiesburg and on Tallahala Creek below Laurel. He also found high levels of brine discharge from oil fields in the Chickasawhay River, adding to the effects

of industrial and municipal effluents (Grantham 1967). Grantham (1964) stated that the upper 60 miles of the Pascagoula River were not severely polluted, but that the lower portion of the Escatawpa River had been grossly impacted by industrial effluents.

Many of the same water quality problems are still present in the Pascagoula system (U.S. Fish and Wildlife Service 1991), including, in the Leaf River watershed, municipal run-off at Hattiesburg, dioxin contamination at New Augusta, and municipal run-off in Tallahala Creek at Laurel. The Mississippi Department of Wildlife, Fisheries and Parks banned commercial fishing in the Pascagoula River in 1990 because of high dioxin levels in some species of fish. Although the ban has since been lifted, advisories on the consumption of fish from the Pascagoula River are still in effect. Brine releases from oil fields are a recurring problem in the Chickasawhay River. Other effluents in the Pascagoula River system permitted by the Environmental Protection Agency include acetone, ammonia, chlorine, cyclohexane, sodium sulfate, and toluene (U.S. Fish and Wildlife Service 1991).

Water quality degradation from chemical pollution could result in the bioaccumulation of toxic compounds in yellow-blotched map turtles. Although the effects of water quality degradation on Graptemys flavimaculata are not known, moribund turtles, including some Graptemys, afflicted with a subcutaneous ulcerative disease, have been observed in highly polluted segments of the Flint River of Georgia (G. George, pers. comm. 1991). Dodd (1988) speculated that a disease of unknown origin affecting Sternotherus depressus could have involved either an environmental contaminant or a viral infection resulting from an impaired immune system. Stewart (1989) found few turtles less than 4 years old in the lower Pascagoula River near Vancleave. This may reflect limited nesting habitat, high levels of egg and hatchling predation, or the effects of some effluents on the hatchlings or reproductive physiology of the turtle.

Although the effects of industrial and municipal effluents (on the turtles of the Pascagoula watershed) are currently unknown, the effects on the invertebrates that most likely constitute the yellow-blotched map turtle's prey base are well known (Grantham 1962, 1964, 1967). Much of the upper Pascagoula, the Chickasawhay, and the Leaf Rivers have abundant basking sites and wide sandy nesting beaches. The absence or scarcity of Graptemys flavimaculata may indicate that effluents have severely impacted its food resources in these areas.

Conservation Measures

On-going studies by the Mississippi Department of Wildlife, Fisheries and Parks include a mark-and-recapture study in the lower Pascagoula River designed to estimate population numbers and a radio telemetry study in that same area to determine movement patterns and locate nesting beaches.

PART II: RECOVERY

A. Objective

The objective of this plan is to delist the yellow-blotched map turtle.

The criteria for delisting are:

(1) Evidence of a stable or increasing population in the Leaf, Chickasawhay, and Pascagoula Rivers for a period of at least 15 years. A stable population is defined as one having the reproductive capability to sustain itself without immigration of individuals from other populations. Minimum density estimates from basking counts should average at least 44 Graptemys flavimaculata per river kilometer in the Pascagoula River, and at least 22 yellow-blotched map turtles per kilometer in both the Leaf and Chickasawhay Rivers over the 15 year period. These figures are based on estimates from basking counts conducted by Stewart (1989) in the lower Pascagoula River.

(2) Protection of yellow-blotched map turtle habitat on the entire Pascagoula River and the lower 129 kilometers (80 miles) of both the Leaf and Chickasawhay Rivers. The areas to be protected begin, on the Leaf River, at the U.S. 84 bridge in Covington County, and on the Chickasawhay River, in the vicinity of Quitman, Clarke County. Protection is defined as having sufficient control over the watersheds that adverse environmental impacts are unlikely to occur.

It should be noted that the delisting criteria are preliminary and may be revised on the basis of new information.

B. Narrative Outline

1. Conduct assessment of yellow-blotched map turtle populations throughout the Pascagoula River system. An assessment of Graptemys flavimaculata should be made to determine the relative sizes and viabilities of populations throughout the Pascagoula River system. The information obtained will serve as a baseline to evaluate the efficacy of recovery efforts and will aid in detecting any sudden downward trends in G. flavimaculata numbers.

   1.1 Determine current status of yellow-blotched map turtle populations in the Leaf, Chickasawhay, and Pascagoula Rivers. Monitoring stations should be established at sites on the Leaf, Chickasawhay, and Pascagoula Rivers to provide baseline data on Graptemys flavimaculata densities. Stations should be located above and below Hattiesburg and New Augusta on the Leaf River (four stations), Shubuta, Waynesboro, and Leakesville on the Chickasawhay River (six stations), and Merrill, Benndale, Wade, and Vancleave on the Pascagoula River (eight stations). Long-term mark-recapture studies would provide the most precise estimates of Graptemys flavimaculata densities, but these

require large commitments of time and labor. Basking surveys, although less precise, appear to be an acceptable method of detecting substantial changes in population densities if the surveys are conducted under similar environmental conditions during times of maximum basking. Basking counts should be conducted over 5-kilometer stretches within the designated monitoring areas. At least three counts per monitoring session should be conducted from mid-morning to mid-afternoon on bright sunny days in mid- to late spring when water temperatures are still relatively cool. Basking in Graptemys nigrinoda becomes somewhat more sporadic later in the summer (Waters 1974), and the same phenomenon appears to occur in Graptemys oculifera (Jones 1991). Turtle populations should be monitored at least three times each year for 3 years. Monitoring should continue on a biennial basis until the conservation areas (4.1) and monitoring programs (4.2) are established.

1.2 Determine status of yellow-blotched map turtle populations in the upper Leaf, upper Chickasawhay, and lower Escatawpa Rivers. Yellow-blotched map turtles were known or have been reported to occur in the upper Leaf, upper Chickasawhay, and lower Escatawpa Rivers, but no information is available on the current status of populations in those areas. Surveys should be conducted on the Leaf River upstream from Hattiesburg on the Chickasawhay River upstream from Shubuta, and on the Escatawpa River from its mouth to Goodes Mill Lake in Jackson County to determine if Graptemys flavimaculata still occurs in those areas.

2. Investigate life history of the yellow-blotched map turtle. Little is known of the life history of Graptemys flavimaculata. Determining the factors responsible for its apparent decline and monitoring the effectiveness of recovery efforts will require information on its population structure, relative abundance, reproductive biology, habitat preferences, diet, and movements. Populations appear to be small throughout most of the range except in the Pascagoula River near Vancleave. This apparently healthy population should provide adequate baseline information on the biology of the species and should serve as the focus for the life history study.

2.1 Determine sex ratios of adults, sizes and ages at maturity, age structure, and growth rates. These data will provide information that can be used to evaluate long-term trends in G. flavimaculata populations and to identify current management needs. Turtles should be trapped and permanently marked for future identification. Captured individuals should be sexed and the dimensions of the plastron and carapace should be recorded. Specimens should be aged, if possible, by counting annuli (growth rings) on plastral scutes. Growth rates may be determined for the first few years of life using Sergeev's

formula or a modified version thereof (Moll and Legler 1971), and by measurements of recaptured individuals.

2.2 Investigate reproductive biology by determining clutch size, clutch frequency, nest site selection, time of nesting, incubation period, and clutch survival rate. Data on clutch size and frequency are necessary to determine the reproductive potential of the species. Discovering when and where eggs are laid will allow an evaluation of potential disruptions to nesting habitat. Information on clutch survival rate is needed to evaluate average reproductive success and the importance of nest predation. Clutch size can be determined by examining gravid females using radiography, by counting eggs deposited in natural nests, and by dissecting available museum specimens. Clutch frequency can be determined by intensive mark-recapture studies coupled with radiography or radio-telemetry studies of females during the nesting season. Determining nest site selection and time of nesting might require both intensive observational studies and radio-telemetry. The incubation period of G. flavimaculata can be determined through observations of natural nests and by hatching clutches artificially. Natural nests could be marked and then followed throughout the season to determine clutch survival rate.

2.3 Investigate daily and seasonal movements. Data on daily activity patterns can be obtained using radio-telemetry. This should enable determination of home range sizes, important feeding areas, and frequency and duration of basking. Data on seasonal movement patterns should enable a determination of winter habitat and recolonization potential of the yellow-blotched map turtle.

2.4 Determine diet by sex and maturity class. The decline of G. flavimaculata in many parts of the Pascagoula River system might be attributable to a reduction of its prey base. An investigation of the diet of the yellow-blotched map turtle is necessary to evaluate this hypothesis. Data can be obtained from existing museum specimens, examination of fecal remains, and from stomach flushing (Legler 1977). Sexual, seasonal, and age (maturity) class differences in diet should also be determined.

3. Investigate water quality and determine habitat suitability for the yellow-blotched map turtle in the Pascagoula River system. Water pollution may have affected the yellow-blotched map turtle directly or may have acted indirectly by impacting its prey base. The habitat requirements for this turtle are poorly known, and degradation of its habitat in the upper parts of the Pascagoula River system may be responsible for its decline in those areas. Water quality should be assessed at sites in the Leaf, Chickasawhay, and upper Pascagoula Rivers and compared to those in the lower Pascagoula River near Vancleave. Assessment of the physical

character of the habitat should be conducted in the same areas. The distribution and abundance of those species that make up the bulk of the yellow-blotched map turtle's diet should also be determined.

3.1 Examine water quality at selected sample points on the Leaf, Chickasawhay, and Pascagoula Rivers. Water quality sampling stations should be established at the localities identified in Task 1.1. Additional sample stations should be established on the Escatawpa River when the distribution and abundance of Graptemys flavimaculata in that system are more completely known. Water quality parameters that should be monitored include turbidity, dissolved oxygen, CO_2, conductivity, total dissolved and suspended solids, total and fecal bacteria, metals, and pesticides. Most of these parameters should be monitored monthly for at least 1 year to establish baseline conditions, and then resampled every 2 years to establish trends. Resampling should continue until the conservation areas (4.1) and the monitoring programs (4.2) have been established.

3.2 Characterize habitat conditions in the Chickasawhay, Leaf, and Pascagoula Rivers. Habitat conditions should be documented in the Vancleave area, where the largest population of Graptemys flavimaculata occurs, and compared to conditions in the rest of the watershed. Sample stations should be located in the areas identified in 1.1. Two sample stations of 100 meters length should be randomly selected per kilometer over a 5 kilometer stretch of river (10 stations per site at 18 sites). Features to be measured should provide a detailed description of the site, and include river width, water depth, current speed, bottom composition, number of snags suitable for baskings, distance of snags from the bank, bank height, sandbar area, and characteristics of bank and sandbar vegetation, among others. These sites can then be compared using multivariate statistical procedures to determine which characteristic or combination of characteristics differs among them. Sampling should be conducted under normal flow conditions during the summer months.

3.3 Investigate distribution and abundance of major prey species. Once the dietary habits of the yellow-blotched map turtle are known (2.4), sampling should be conducted to determine the distribution and abundance of its major prey species. Sample stations should be established in the areas identified in 1.1, and sampling should be conducted at least once a month for a period of 2 years. Data can then be compared between the Vancleave area and those areas with few or no turtles to determine if differences in prey availability occur.

4. Formulate actions to protect the lower 129 kilometers of the Leaf and Chickasawhay Rivers and the entire Pascagoula River for the yellow-blotched map turtle. The lower 129 kilometers (80 miles) of

the Leaf and Chickasawhay Rivers, and the entire Pascagoula River and their watersheds should receive special attention relative to actions that may adversely affect the yellow-blotched map turtle. These segments should be protected and a program to monitor Graptemys flavimaculata populations and habitat should be initiated. This program may include the development of voluntary conservation easements.

4.1 Protect habitat through appropriate conservation measures. Measures to establish conservation easements could include cooperative agreements with landowners and identification of important habitat areas for protection emphasis or for fee title acquisition from willing sellers. If water quality degradation is found to be a problem in these areas, the Environmental Protection Agency and the Mississippi Department of Environmental Quality should be encouraged to ensure that existing water quality regulations are met and to raise water quality standards if necessary.

4.2 Develop a monitoring plan to evaluate yellow-blotched map turtle populations and habitat quality in the conservation areas. Counts of basking yellow-blotched map turtles like those in 1.1 should be conducted in the areas identified for special attention every 3 years. These counts should cover at least 20 kilometers (12 miles) in both the Leaf and Chickasawhay areas, and at least 40 kilometers (24 miles) in the Pascagoula River. Sex ratios, age structure, nesting success, prey availability, and water quality should be investigated in these river stretches every 5 years.

5. Develop educational materials about the yellow-blotched map turtle. Public support may be necessary to accomplish the recovery actions of this plan. Educational materials explaining the uniqueness of Graptemys flavimaculata, its biology and habitat requirements, and the factors responsible for its being listed as a threatened species can assist in gaining this support. These materials should also be useful to law enforcement personnel who may not be familiar with the species, and should be helpful to them in apprehending people who shoot the turtles and collect them for the pet trade. A poster with a color illustration of the species should be produced, along with a brochure containing information on the life history. These materials should be distributed primarily within the counties drained by the Pascagoula River and its tributaries.

6. Develop plan for monitoring populations for at least 5 years after delisting. This plan will provide specific guidance and time frames for monitoring population trends for this species for at least 5 years after delisting to ensure protection is not required.

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PART III: IMPLEMENTATION SCHEDULE

Priorities in column one of the following Implementation Schedule are assigned as follows:

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

2. Priority 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. Priority 3 - All other actions necessary to meet the recovery objective.

Key to acronyms used in Implementation Schedule

ES - Ecological Services, U.S. Fish and Wildlife Service
RES - Division of Research, U.S. Fish and Wildlife Service
EPA - Environmental Protection Agency
DEQ - Mississippi Department of Environmental Quality
COE - U.S. Army Corp of Engineers
MDWFP - Mississippi Department of Wildlife, Fisheries and Parks

IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION	RESPONSIBLE PARTY			COST ESTIMATES ($K)			COMMENTS/NOTES
				USFWS						
				Region	Division	Other	FY 1	FY 2	FY 3	
2	1	Assess turtle populations	10 years	4	ES	MDWFP	10	10	10	
2	2	Investigate life history	5 years	4	ES, RES	MDWFP	40	40	40	
2	3	Determine water quality and habitat suitability	10 years	4	ES, RES	EPA,DEQ, MDWFP	50	50	50	
2	4	Protect habitat	Ongoing	4	ES	EPA,DEQ, MDWFP, COE	10	10	10	
3	5	Develop educational materials	1 year	4	ES	MDWFP	10			
3	6	Develop monitoring plan	1 year	4	ES	MDWPF			5	
				4	ES					

Part IV: APPENDIX

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