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Submitted via Regulations.gov and email

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Re: **12-Month Finding for Pascagoula Map Turtle; Threatened Species Status with Section 4(d) Rule for Pearl River Map Turtle; and Threatened Species Status for Alabama Map Turtle, Barbour's Map Turtle, Escambia Map Turtle, and Pascagoula Map Turtle Due to Similarity of Appearance with a Section 4(d) Rule (FWS-R4-ES-2021-0097)**

Dear Principal Deputy Director Williams and Acting Field Supervisor Austin:

The National Wildlife Federation and the Louisiana Wildlife Federation appreciate the opportunity to comment on the U.S. Fish and Wildlife Service's (Service) proposal to list the Pearl River map turtle as threatened under the Endangered Species Act (ESA), proposed Section 4(d) rule, and finding regarding designation of critical habitat.¹ Our organizations support the Service's decisions to list the Pearl River map turtle as threatened and to list the Alabama map turtle, Barbour's map turtle, Escambia map turtle, and Pascagoula map turtle due to similarity of appearance. However, we urge the Service to adopt a fundamentally revised Section 4(d) rule that will protect and conserve Pearl River map turtles as required by the ESA, and designate critical habitat for the Pearl River map turtle to support the species' conservation.

¹ 68 Fed. Reg. 66624-66659 (November 23, 2021).

The National Wildlife Federation is the nation's largest conservation advocacy organization with more than 6.8 million members and supporters and affiliate conservation organizations in 53 states and territories. Our members represent the full spectrum of people who care deeply about wildlife: they are bird and wildlife watchers, hikers, gardeners, anglers, hunters, forest stewards, and farmers. Conserving the nation's rich array of natural resources and the fish and wildlife that depend on those resources are at the core of our mission.

The Louisiana Wildlife Federation is a statewide, nonprofit organization that represents 18 affiliate organizations and more than 6,800 members who are outdoor enthusiasts dedicated to the conservation of Louisiana's wildlife and natural resources.

A. The Decision to List the Map Turtles As Threatened Is Fully Supported by the Science and the Wide Range of Threats to These Species

Our organizations support the Service's decision to list the Pearl River map turtle as threatened and the Service's decision to list the Alabama map turtle, Barbour's map turtle, Escambia map turtle, and Pascagoula map turtle due to similarity of appearance. These map turtles face a wide range of threats and require protection under the ESA as documented in the proposed rule.

Among other findings, the Service concludes that listing the Pearl River map turtle as threatened under the ESA is warranted due to the threats of "habitat degradation and loss due to alterations in the aquatic and terrestrial environments that affect water quality through sedimentation, impoundment, and gravel mining."² The Service also recognizes that a major pollution event could have significant consequences as most of the population primarily uses the main stem river, which is subject to more catastrophic events, and pollutants would flow downstream throughout the turtles' range below the point of contamination.³ These risks are amplified because there are limited refugia from future catastrophic effects since the species has limited occurrence in tributaries in its range.⁴ The Service also anticipates the species' resilience "to drop significantly in several units across many scenarios"¹⁷ with "the overall future condition of the species...expected to continue a declining trajectory resulting in compromised viability as described in the future scenarios out to year 2070."¹⁸

Further support for this listing decision is provided by the IUCN Red list of species, which lists the Pearl River map turtle as endangered.⁵ A copy of this [assessment](#), which was not referenced in the documents supporting this listing, is provided at Attachment A to these comments.

B. The Section 4(d) Rule Should Be Fundamentally Revised

The proposed Section 4(d) rule is not supported by the record or the threats facing the map turtles, and must be fundamentally revised.⁶ The proposed Section 4(d) rule allows numerous forms of

² 86 Fed. Reg. at 66647.

³ 86 Fed. Reg. at 66647.

⁴ 86 Fed. Reg. at 66648.

⁵ van Dijk, P.P. 2011. *Gratemys pearlensis*. The IUCN Red List of Threatened Species 2011: e.T184437A97423604. <http://dx.doi.org/10.2305/IUCN.UK.2011-1.RLTS.T184437A8276246.en>.

⁶ We also note that for decades, the Service implemented a "blanket 4(d) rule" that extended all of the ESA Section 9 take prohibitions to threatened species by default upon listing. 50 C.F.R. § 17.31(a) (2018). But in 2019, the Trump Administration finalized new rules that rolled back the blanket 4(d) rule for newly listed or

take that are widely recognized to actively contribute to the species' decline, and as a result fails to conserve the species and fails to comply with the affirmative conservation mandate in Section 7 of the ESA.

Under Section 4(d) of the ESA, the Service is required to establish regulations that are necessary and advisable for the "conservation" of the Pearl River map turtle.⁷ The ESA defines conservation as "the use of *all* methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are no longer necessary."⁸ In other words, the Service is required to establish regulations that are necessary and advisable to ensure the recovery of the Pearl River map turtle such that the population is robust enough to be delisted. The Service also has an independent, substantive conservation duty under Section 7(a)(1) of the ESA.⁹

The proposed 4(d) rule prohibits various forms of take relating to the importation, exportation, possession, delivery, transport, and sale of turtles.¹⁰ While the rule also prohibits unpermitted or unauthorized take (harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting, or to attempting to engage in any such conduct), it does so **with exceptions that do not ensure recovery**. Indeed, these exceptions cover the precise activities that the Service acknowledges are the primary causes of the losses to the Pearl River map turtle and the resulting need to list the species under the ESA.

These exceptions include take incidental to any otherwise lawful activity caused by:

- (1) Construction, operation, and maintenance activities that occur near and in-stream;
- (2) Maintenance dredging activities that remain in the previously disturbed portion of the maintained channel; and
- (3) A blanket exception for pesticide (insecticide or herbicide) application that follows approved label instructions and appropriate application rates.¹¹

These broad exceptions are arbitrary and contrary to the ESA's conservation mandate. These exceptions are also contrary to the Service's stated intent "to address the Pearl River map turtle's conservation needs"¹² because they will allow continued threats that are projected to cause ongoing species declines.

reclassified threatened species, meaning they only receive protective regulations when the Service promulgates a species-specific 4(d) rule. 84 Fed. Reg. 44,753 (Aug. 27, 2019); 50 C.F.R. § 17.31 (2021). In 2021, following President Biden's January 20 executive order 13990, the Service announced its plans to initiate rulemaking to reinstate the blanket 4(d) rule. See U.S. Fish and Wildlife Serv., U.S. Fish and Wildlife Service and NOAA Fisheries to Propose Regulatory Revisions to Endangered Species Act, Press Release, <https://www.fws.gov/news/ShowNews.cfm?ref=u.s.-fish-and-wildlife-service-and-noaa-fisheries-to-propose-regulatory-& ID=36925>.

⁷ 16 U.S.C. § 1553(d).

⁸ 16 U.S.C. § 1532(3).

⁹ 16 U.S.C. § 1536(a)(1).

¹⁰ 86 Fed. Reg. at 66659.

¹¹ 86 Fed. Reg. at 66659.

¹² 86 Fed. Reg. at 66650.

For example, while the proposed 4(d) rule exempts construction and similar activities near and in-stream, the Service is explicitly proposing to list the Pearl River map turtle as threatened in large part because of the current threats of “habitat degradation and loss due to alterations in the aquatic and terrestrial environments that affect water quality through sedimentation, impoundment, and gravel mining.”¹³ Construction related impacts can also include, or lead to, major pollution events which could cause significant impacts to the map turtles, as the Service acknowledges.¹⁴ The main stem of the river, which is the primary habitat for most of the population, is recognized as being subject to more catastrophic pollution events that would then flow downstream throughout the turtles’ range below the point of contamination.¹⁵ Because the species has limited occurrence in tributaries in its range, there are limited refugia from future catastrophic effects.¹⁶

The proposed rule concludes that the risks posed by construction and development is “substantial” in the Middle Pearl-Strong unit and “particularly around Jackson, Mississippi.”¹⁷ The proposed rule further notes that the “Middle Pearl—Strong unit is perhaps the most vulnerable unit, as development, agriculture, and water engineering projects are all potential stressors in this unit.”¹⁸ According to the proposed rule:

The threat of habitat loss and degradation is concentrated on the Middle Pearl–Strong and Upper Pearl units due to an existing reservoir and a planned project that disjoins the connectivity of turtles above and below the reservoir. The impacts due to habitat degradation and loss are acting on the species’ current condition and possibly future condition if the One Lake project is constructed as planned. Future reduction in habitat in the Middle Pearl–Strong and Upper Pearl units will occur, and increased isolation of the Upper Pearl unit will further reduce connectivity if the additional One Lake project is completed. Researchers have estimated that up to 170 individual Pearl River map turtles could be directly impacted by the One Lake Project (Selman 2020b, pp. 192–193).¹⁹

Our organizations urge the Service to carefully assess the full scope of the impacts of the proposed Pearl River One Lake project, which is both authorized for construction and currently under active study. This project, which could receive final approval as early as this year, would cause massive and irreparable harm to the Pearl River ecosystem, expose people and wildlife—including the Pearl River map turtle—to significant amounts of toxic pollution, reduce vital freshwater flows and water quality all the way to the Gulf of Mexico, and encourage a significant amount of additional development in the Middle Pearl-Strong unit. Among other adverse impacts, the One Lake project would:

- *Fundamentally and irreparable alter the Pearl River ecosystem.* The tentatively selected plan will construct a new low-head dam on the Pearl River and dredge 25 million cubic yards of sediment—enough to fill 7,500 Olympic size swimming pools. These combined actions will transform a 10 mile stretch of riverine ecosystem into a 1,900-acre impoundment. The dredged

¹³ 86 Fed. Reg. at 66647.

¹⁴ 86 Fed. Reg. at 66647.

¹⁵ 86 Fed. Reg. at 66647.

¹⁶ 86 Fed. Reg. at 66648.

¹⁷ 86 Fed. Reg. at 66642.

¹⁸ 86 Fed. Reg. at 66642.

¹⁹ 86 Fed. Reg. at 66648-49.

sediment will then be used to raise and build a number of large levees and bury floodplain habitat to create new land for development purposes.

- *Destroy vital wildlife habitat, including wetlands, small streams, sloughs, and diverse instream habitats that also provide critical ecosystem services, including natural flood protection.* The draft environmental impact statement (DEIS)²⁰ for the project acknowledges that more than 2,500 acres of wildlife habitat, including at least 1,500 acres of vital bottomland hardwood wetlands, will be destroyed. An additional 1,900 acres of diverse in-stream riverine habitat and ecologically vital small streams will be destroyed and turned into an impoundment. Though not acknowledged by the DEIS even more habitat will be lost as the fundamental changes to the form and function of the Pearl River system play out over time, including reduction and elimination of natural floodplain inundation.
- *Adversely affect hundreds of species of fish and wildlife, including numerous species listed under the Federal Endangered Species Act or otherwise federally designated as at-risk, due to the habitat losses and fundamental transformation of the Pearl River ecosystem.* As the U.S. Department of the Interior has advised, “[w]ildlife resources within the Pearl River Basin are dependent upon the diverse floral composition of associated forested wetlands” and “a higher percentage” of vertebrate wildlife species in the Basin “use bottomland hardwoods as primary habitat (habitat a species depends upon for reproduction and/or feeding during all or a portion of the year) than any other habitat type.”²¹
- *Threaten the health and productivity of vital downstream habitats, including the Mississippi Sound, Lake Borgne, and the Gulf of Mexico, including by reducing freshwater flows below the new dam, particularly during traditional low flow periods.* The Pearl River is a major source of freshwater to the Gulf of Mexico and such reductions in flow could alter water quality and coastal salinities, affect sediment transport, and increase saltwater intrusion upriver. This would threaten the health and productivity of many downstream habitats including more than 125,000 acres of existing—and mostly public—conservation lands such as Bogue Chitto National Wildlife Refuge, Pearl River Wildlife Management Area, and Hancock County Coastal Preserve. Altered flows could also affect the already struggling oyster sector that relies on a well-balanced mix of fresh and salt water to ensure oyster survival and harvest.
- *Expose people and fish and wildlife—including the Pearl River map turtle—to high levels of toxic pollution.* The tentatively selected plan’s extensive dredging will re-suspend contaminated sediments, and will impact at least three highly contaminated sites—a former creosote wood treatment facility and two unpermitted landfills. At least five additional contaminated sites, including one identified for federal Superfund cleanup, could also be affected.
- *Impair water quality.* The project’s large-scale dredging operations, major construction, impoundment of a once free-flowing stretch of river, and large-scale destruction of wetlands that help filter pollutants will all adversely affect water quality and could facilitate harmful algal

²⁰ Integrated Draft Feasibility Study & Environmental Impact Statement Pearl River Basin, Mississippi Federal Flood Risk Management Project Hinds & Rankin Counties, MS (June 13, 2018).

²¹ U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 1 (August 16, 2018) (providing official comments on the Integrated Draft Feasibility Study & Environmental Impact Statement Pearl River Basin, Mississippi Federal Flood Risk Management Project Hinds & Rankin Counties, MS (June 13, 2018)).

blooms. Project-induced changes in flow will also make it harder for downstream industrial and municipal facilities to meet their environmental permit discharge limits without installing costly new water treatment technologies, threatening water quality all the way to the Gulf of Mexico. More than one hundred downstream industrial users and municipalities in Mississippi and eight in Louisiana—including the sewage treatment plants for Jackson, Bogalusa and Pearl River as well as Georgia-Pacific and International Paper—depend on a reliable flow of freshwater from the Pearl River to meet their environmental permit discharge limits. The project-induced future development will increase runoff and cause other adverse impacts that will harm water quality.

- *Induce development in areas that will remain at high risk of flooding, putting more people, homes, businesses, and properties at risk, and adding to future degradation of the Pearl River.* The DEIS acknowledges that additional future development is both a goal and likely outcome of the tentatively selected plan. This new development will occur in areas that will continue to have a high risk of flooding, including potentially catastrophic flooding when the project and/or existing levees overtop or fail. Under the best possible scenario, the tentatively selected plan would only provide protection for the 100 year flood event, and larger flood events will happen.

As noted by Selman and Smith 2017:

If the One Lake project is implemented, it will dramatically alter the hydrology of this stretch of the Pearl River. It will convert from a lotic, river setting (i.e., moderate to high flow) to a more lentic, lake setting (i.e., low to no flow setting; for review see Bunn and Arthington 2002). Furthermore, it seems likely that if the One Lake Project was implemented, the conditions that result would benefit common, generalist species that thrive in low flow settings (e.g., Red-eared Slider, Common Musk Turtle, Common Snapping Turtle, Spiny Softshell) at the expense of threatened riverine specialist species (e.g., Ringed Sawback, Pearl Map Turtle, Razorbacked Musk Turtle, Alligator Snapping Turtle, Smooth Softshell). Indeed, reservoirs are a leading contributor to species endangerment in the southeastern United States (Czech et al. 2000), **and a project such as this could lead to localized extirpations of flow-dependent species.**²²

Selman 2020 further concludes:

In summary, based on the abundance data presented here, it is anticipated the impacts of the One Lake Project to these *Graptemys* populations will be significant in intensity and long-term in duration. Our survey data indicate *G. oculifera* occurs in greater abundance throughout the One Lake Project area, and recruitment/ reproduction are better in this segment than what has been observed in other *G. oculifera* populations. **Thus, if completed, the One Lake Project will be a major setback to both *Graptemys* species and negatively impact their recovery potential.**²³

²² Will Selman, Ph.D. and Haley Smith, *Diamonds in the Rough: Status of Two Imperiled *Graptemys* Species (*Graptemys oculifera* and *G. pearlensis*) in the Pearl River of Jackson, MS (Year 1)*, prepared for the Mississippi Department of Wildlife, Fisheries, and Parks and the U.S. Fish and Wildlife Service (November 13, 2017)(emphasis added) at 11. A copy of this study is provided at Attachment B to these comments.

²³ Selman, Will, 2020, *River Turtles and One Dam Lake: Two Imperiled *Graptemys* Species in the Pearl River and Potential Impacts of the Proposed One Lake Project*, *Chelonian Conservation and Biology*, 2020, 19(2): 186–196 at 195-196 (emphasis added), doi:10.2744/CCB-1400.1 This study is included in the record for the proposed rule.

As the proposed rule acknowledges, the One Lake project is just one of a number of plans for projects that would impound free-flowing reaches of the Pearl River both upstream and downstream of Jackson.²⁴ Given these significant risks, exempting incidental take related to any otherwise lawful activity caused by construction, operation, and maintenance activities that occur near and in-stream cannot be supported by the record, and is contrary to the goals and mandates established by the ESA.

Other incidental take exemptions set forth in the proposed rule are equally arbitrary. For example, the Service has exempted incidental take related to maintenance dredging activities that remain in the previously disturbed portion of the maintained channel despite clearly identifying dredging, and the related removal of underwater structure and woody debris used by map turtles, as an activity that negatively affects the species' conservation²⁵:

Dredging and channelization have led to loss of aquatic habitat in the Southeast. Dredging and channelization projects are extensive throughout the region for flood control, navigation, sand and gravel mining, and conversion of wetlands into croplands. Many rivers are continually dredged to maintain a channel for shipping traffic. Dredging and channelization modify and destroy habitat for aquatic species by destabilizing the substrate, increasing erosion and siltation, removing woody debris, decreasing habitat heterogeneity, and stirring up contaminants, which settle onto the substrate. Channelization can also lead to headcutting, which causes further erosion and sedimentation. Dredging removes woody debris, which provides cover and nest locations for many aquatic species.²⁶

The removal of deadwood, mainly through dredging, has been noted as a reason for the decline in the ringed map turtle, a species that occurs within in the same geographic region as the Pearl River map turtle.⁴³

Moreover, the Service does not provide any evidence to support its contention that maintenance dredging activities “generally disturb the same area of the waterbody in each cycle” and present “less likelihood that suitable turtle habitat . . . occurs in the maintained portion of the channel.”²⁷ Indeed, given the dynamic nature of the Pearl River, including periodic flooding, and the often infrequent cycles of maintenance dredging, viable turtle habitat is likely to develop in or near previously dredged channels. Moreover, even if these assertions are correct, the Service has no way of monitoring these dredging activities to ensure they occur in the maintained portion of the channel and do not stray into undisturbed habitat.

Given the threats posed by construction, operation, and maintenance activities that occur near and in-stream, and the threats posed by dredging suitable or occupied habitat, the Service should remove these exceptions from the Section 4(d) rule and address these activities on a case-by-

²⁴ 68 Fed. Reg. at 66633 (“Additionally, plans for new reservoirs on the Pearl River both upstream and downstream of Jackson have been or are being considered (Lindeman 2013, pp. 202–203). Up to 170 individual Pearl River map turtles could be impacted by the construction of the One Lake Project, one of several proposed impoundments (Selman 2020b, entire).”)

²⁵ 86 Fed. Reg. at 66632.

²⁶ 86 Fed. Reg. at 66632 (internal citations omitted).

²⁷ 86 Fed. Reg. at 66652. The Service also does not explain how maintenance dredging does not have any indirect impacts, such as introducing sediments downstream or outside the main channel.

case basis through ESA Section 10 incidental take permitting or Section 7 consultation. These provisions would provide the Service with some oversight, and monitoring requirements could be included in the terms and conditions of permits issued under the ESA.

The blanket pesticide and herbicide exemption is also not supported by the Service's own findings or the best available science regarding the turtle's conservation. To the contrary, the Service's species status assessment lists pesticides and herbicides as "contaminants" that negatively impact water quality and wildlife, including turtles,²⁸ and that nonpoint sources contribute pollution to streams "via sediments, heavy metals, fertilizers, **herbicides, pesticides**, animal wastes, septic tank and gray water leakage, and oils and greases."²⁹ The Species Status Assessment Report for the Pearl River Map Turtle (*Graptemys pearlensis*) Version 1.1 (SSA) specifically identifies glyphosate as a widely used herbicide that has been found in many waterways from agricultural run-off and exposure that "has been associated with endocrine and reproductive disorders in animals."³⁰ Moreover, given the diverse uses for, and effects of, different pesticides and herbicides, the Service cannot reasonably conclude that *all* pesticide and herbicide use presents low risk and high benefit (for eradicating invasive species) for the turtle.³¹

Because different pesticides and herbicides present diverse potential impacts on the Pearl River map turtle, the Service should narrowly tailor the exception in the Section 4(d) rule to specific applications consistent with the recovery of the species, or that are proven to support the species' conservation (e.g., removal of invasive species in critical locations).

Allowing existing threats to continue through the broad take exceptions for activities that contribute to sedimentation and water pollution, will likely compound ongoing species declines and run counter to the Service's conservation duty under the ESA. Our organizations urge the Service to remove these exceptions, or at the absolute minimum, significantly narrow the exceptions.

C. The Service Should Designate Critical Habitat

The ESA requires the Service to designate critical habitat concurrently with listing a species as endangered or threatened "to the maximum extent prudent and determinable."³² Critical habitat includes "the specific areas within the geographical area occupied by the species" that have physical and biological features essential to the species' conservation and which may require special management or protection, as well as unoccupied habitat that the Service determines is "essential for the conservation of the species."³³ Critical habitat must be designated on the basis of

²⁸ SSA at 25-26, 29-30, 33.

²⁹ SSA at 25 (emphasis added).

³⁰ SSA at 25-26.

³¹ Moreover, the proposed Section 4(d) rule's reliance on current regulations and pesticide labels to protect the turtle is arbitrary and does not justify allowing their use. Most pesticide labels approved by the Environmental Protection Agency contain restrictions that apply on a nationwide basis, and do not account for the geographic and temporal factors specific to an application site that are necessary to avoid harm to listed species. Angelo, M.J., *Discordant Environmental Laws: Using Statutory Flexibility and Multi-Objective Optimization to Reconcile Conflicting Laws*, 38 Stan. Envtl. L.J. 165, 182 (2019).

³² 16 U.S.C. § 1533(a)(3).

³³ *Id.* § 1532(5).

the best scientific data available.³⁴

Our organizations urge the Service to withdraw its determination that it is “not prudent” to designate critical habitat because it cannot be supported in the face of the major threats to the Pearl River map turtle, and is not supported by the record. We also urge the Service to designate critical habitat for the Pearl River map turtle to help address primary threats to the turtle and support its conservation.

Critically, designating critical habitat would benefit the Pearl River map turtle because habitat destruction and degradation is a recognized major threat to the species. Specifically, the Service finds that habitat alteration from anthropogenic disturbances such as dredging, de-snagging, removal of riparian cover, channelization, in-stream activities that result in stream bank erosion and siltation (e.g., stream crossings, bridge replacements, flood control structures, impoundments, etc.), improper pesticide use, and changes in land use within the riparian zone of water bodies all have the potential of negatively affecting the species.³⁵ Indeed, the Service concludes that the Pearl River map turtle should be listed as threatened under the ESA precisely because of the threats of “habitat degradation and loss due to alterations in the aquatic and terrestrial environments that affect water quality through sedimentation, impoundment, and gravel mining.”³⁶

Furthermore, it is inappropriate to adopt the “imprudence exception” to the designation of critical habitat for the Pearl River map turtle because the rare and extraordinary circumstances needed to justify such an exception are not present. As made clear in the legislative history:

The committee intends that in most situations the Secretary will . . . designate critical habitat at the same time that a species is listed as either endangered or threatened. It is only in rare circumstances where the specification of critical habitat concurrently with the listing would not be beneficial to the species.³⁷

The proposed rule determines that designating critical habitat for the Pearl River map turtle “would not be prudent . . . because the species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of such threat to the species.”³⁸ The Service states that “there is currently an imminent threat of collection” and “identification and mapping of critical habitat is expected to facilitate any such threat”³⁹ because such designation “requires the publication of maps and a narrative description of specific critical habitat areas in the Federal Register” which “would more widely announce the exact locations of

³⁴ Id. § 1533(b)(2). Following President Biden’s January 20 executive order 13990, the Service stated its intent to rescind and revise several regulations pertaining to the designation of critical habitat, including rescinding regulations setting forth processes for excluding areas from critical habitat and rescinding the regulatory definition.

³⁵ 86 Fed. Reg. 66631; See also SSA at iv, 27-31.

³⁶ 86 Fed. Reg. at 66647.

³⁷ H.R. Rep. No. 95-1625 at 17 (1978), reprinted in 1978 U.S.C.C.A.N. 9453, 9467 (emphasis added); see also *Enos v. Marsh*, 769 F.2d 1363, 1371 (9th Cir. 1985) (holding that the Secretary “may only fail to designate a critical habitat under rare circumstances”); *Northern Spotted Owl v. Lujan*, 758 F. Supp. 621, 626 (W.D. Wash. 1991) (“This legislative history leaves little room for doubt regarding the intent of Congress: The designation of critical habitat is to coincide with the final listing decision absent extraordinary circumstances.”).

³⁸ 86 Fed. Reg. at 66654.

³⁹ 86 Fed. Reg. at 66654.

Pearl River map turtles and their suitable habitat that may facilitate unauthorized collection/poaching and contribute to further declines of the species' viability."⁴⁰

While we agree that poaching is a major threat to the Pearl River map turtle, we disagree that the species falls into one of the rare circumstances where designation of critical habitat is not prudent. The suggestion that the designation of critical habitat would have to be so granular that it would reveal the specific locations of these turtles is unreasonable and unsupported. A critical habitat designation that includes all rivers and tributaries where the Pearl River map turtle has been known to exist would provide protection for habitat used in all life stages without revealing known locations of adult turtles, which are the individuals most susceptible to collection.

Moreover, contrary to the Service's assertion, nothing in the ESA or its implementing regulations requires the Service to "widely announce the exact locations" of turtles.⁴¹ The ESA does not discuss what level of specificity is required, and the Service's implementing regulations provide only that:

Each critical habitat area will be shown on a map, with more-detailed information discussed in the preamble of the rulemaking documents published in the FEDERAL REGISTER...Textual information may be included for purposes of clarifying or refining the location and boundaries of each area or to explain the exclusion of sites (e.g., paved roads, buildings) within the mapped area. Each area will be referenced to the State(s), county(ies), or other local government units within which all or part of the critical habitat is located. Unless otherwise indicated within the critical habitat descriptions, the names of the State(s) and county(ies) are provided for informational purposes only and do not constitute the boundaries of the area. Ephemeral reference points (e.g., trees, sand bars) shall not be used in any textual description used to clarify or refine the boundaries of critical habitat.⁴²

In other words, the level of detail required would not direct people to individual animals. The Service would not have to disclose the exact known locations where the turtles occur. To the contrary, the scale of mapping and narrative description would only need to define the outer boundary of the designation. Accordingly, there is no reason to believe that publication of such information would increase the threat of unauthorized collection.

As importantly, the Service has already published the range of this rare turtle in the SSA, which lists and maps bodies of water currently occupied by the Pearl River map turtle.⁴³ No additional detail would need to be published to designate critical habitat. Accordingly, designating critical habitat would not lead to the release of new information that would increase the threats from poaching.⁴⁴ Further, given all of the information already available to the Service on the habitat of the Pearl River map turtle, the Service does not appear to have financial, staffing, or other resource constraints that have delayed the concurrent designation of critical habitat for other species.

⁴⁰ 86 Fed. Reg. at 66654.

⁴¹ 86 Fed. Reg. 666354 (emphasis added).

⁴² 50 C.F.R. § 424.12(c).

⁴³ See SSA at 10, 47.

⁴⁴ See *Conservation Council v. Babbitt*, 2 F. Supp. 2d 1280, 1284 (D. Haw. 1998) (explaining that FWS must "consider, in each case, the degree to which information about the location of the [species] already exists and is readily available").

Conclusion

The National Wildlife Federation and the Louisiana Wildlife Federation agree with the Service's decision to list the Pearl River map turtle as threatened and the Service's decision to list the Alabama map turtle, Barbour's map turtle, Escambia map turtle, and Pascagoula map turtle due to similarity of appearance. However, we believe that the agency's decision to broadly exempt take in the Section 4(d) rule and to decline to designate critical habitat will harm the species' conservation. For these reasons, we urge the Service to reexamine and revise its Section 4(d) rule and to designate critical habitat for the Pearl River map turtle to ensure the conservation of the species.

Sincerely,

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Attachment A:

van Dijk, P.P. 2011. *Graptemys pearlensis*. The IUCN Red List of Threatened Species 2011: e.T184437A97423604. <http://dx.doi.org/10.2305/IUCN.UK.2011-1.RLTS.T184437A8276246.en>

Attachment B:

Will Selman, Ph.D. and Haley Smith, Diamonds in the Rough: Status of Two Imperiled *Graptemys* Species (*Graptemys oculifera* and *G. pearlensis*) in the Pearl River of Jackson, MS (Year 1), prepared for the Mississippi Department of Wildlife, Fisheries, and Parks and the U.S. Fish and Wildlife Service (November 13, 2017)

Attachment A

National Wildlife Federation and Louisiana Wildlife Federation Comments on

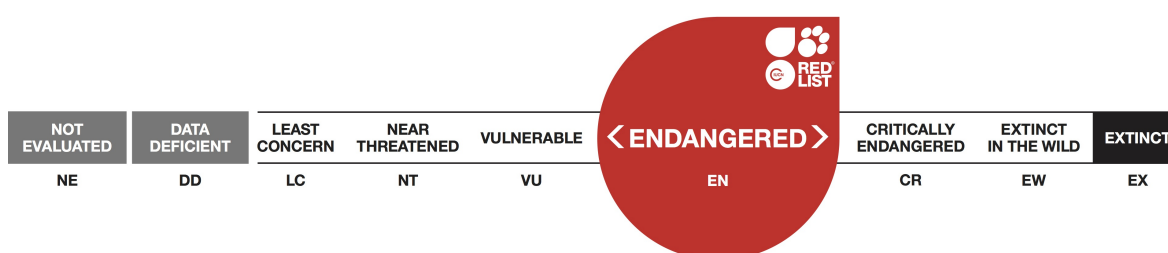
FWS–R4–ES–2021–0097

12-Month Finding for Pascagoula Map Turtle; Threatened Species Status with Section 4(d) Rule for Pearl River Map Turtle; and Threatened Species Status for Alabama Map Turtle, Barbour’s Map Turtle, Escambia Map Turtle, and Pascagoula Map Turtle Due to Similarity of Appearance with a Section 4(d) Rule

Graptemys pearlensis, Pearl River Map Turtle

Errata version

Assessment by: van Dijk, P.P.



View on www.iucnredlist.org

Citation: van Dijk, P.P. 2011. *Graptemys pearlensis*. The IUCN Red List of Threatened Species 2011: e.T184437A97423604. <http://dx.doi.org/10.2305/IUCN.UK.2011-1.RLTS.T184437A8276246.en>

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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Reptilia	Testudines	Emydidae

Taxon Name: *Graptemys pearlensis* Ennen, Lovich, Kreiser, Selman & Qualls, 2010

Common Name(s):

- English: Pearl River Map Turtle

Taxonomic Notes:

Previously this species was considered the Pearl River population of *Graptemys gibbonsi*, until *G. pearlensis* was described by Ennen *et al.* (2010) as a full separate species.

Assessment Information

Red List Category & Criteria: Endangered A1bcde+4bcde [ver 3.1](#)

Year Published: 2011

Date Assessed: August 1, 2010

Justification:

While hard quantitative data are absent, available information indicates that populations of *Graptemys pearlensis* have declined by 80–98% since 1950, a time period probably representing 2–3 generation lengths. While the worst impacts from pollution and habitat destruction may have been ameliorated, habitat quality has not been restored to optimal conditions while impacts from commercial collection, wanton destruction, and hurricane aftermath continue to be of concern. Thus *Graptemys pearlensis* qualifies as Endangered A1bcde+4bcde, and potentially qualifies as Critically Endangered by the same criteria.

Geographic Range

Range Description:

Graptemys pearlensis is restricted to the main stems and major tributaries of the Pearl and Bogue Chitto rivers of Louisiana and Mississippi, USA (Ennen *et al.* 2010). The occupied section of suitable habitat in the Pearl is about 800 km and the occupied section of the Bogue Chitto about 140 km, for a total estimated length of 940 km of occupied river length.

Country Occurrence:

Native: United States (Louisiana, Mississippi)

Population

Graptemys pearlensis, as part of *G. gibbonsi*, was considered the second rarest *Graptemys* species by Lindeman (pers. comm 6 Aug 2009) based on extensive basking surveys. *Graptemys pearlensis* used to be observed/captured in the 1950s–1960s in almost double numbers than sympatric *G. oculifera* (review by Lovich *et al.* 2009), whereas it had declined severely by the 1990s and it is now being observed in, at best, a one to five ratio (Lindeman 1998, 1999, pers. comm 6 Aug 2009); in context, *G. oculifera* populations have held stable or locally declined during the same time (Jones and Selman 2009). This steep decline was attributed to water pollution impacting mollusc populations on which *pearlensis* feed.

Current Population Trend: Decreasing

Habitat and Ecology (see Appendix for additional information)

Very limited ecological data are available for *Graptemys pearlensis*; in most aspects it is probably similar to those reported for *G. gibbonsi* in the Leaf-Pascagoula systems.

Females reach up to 29.5 cm carapace length (CL), males to 12.1 cm CL. Average clutch size has been reported as 6.4 eggs, and multiple nesting is likely (McCoy and Vogt in Lovich *et al.* 2009). Hatchlings measure about 23 mm plastron length (PL) (CL apparently not reported). Females of the analogous and closely-related *G. gibbonsi* were estimated to mature at an age of 15–20 years (Selman in Lovich *et al.* 2009). Generation length has not been determined but is unlikely to be shorter than 25 years.

Systems: Terrestrial, Freshwater

Use and Trade

Map turtles identified as *Graptemys gibbonsi* have been extensively traded in the global pet trade; collecting efforts for the species have included the Pearl River basin (Selman and Qualls in Lovich *et al.* 2009), meaning that an unknown but certain proportion of the animals traded as *gibbonsi* were actually *pearlensis*.

Threats (see Appendix for additional information)

Recorded declines in Pearl River broadheaded *Graptemys*, i.e. *G. pearlensis*, has been attributed to water pollution impacting mollusc populations on which *pearlensis* feed, snag and log removal, channelization and impoundment, as well as collection for the pet trade, wanton destruction by fishermen and plinking rednecks, and potentially by subsidized predators (i.e., unnaturally large populations of predators subsidized by easily available resources near human settlements) increasing nest predation rates.

Over 21% of the range of the species had already been channelized by 1986, and plans for channelization of an additional 28% of the Pearl River and over 160 km of the Bogue Chitto river, while not executed, have not been entirely rescinded and remain as a significant potential threat to the species' future (Jones and Selman 2009).

Riverine pollution has been particularly significant in the Pearl River system as a result of riverside paper industries, and riverine gravel mining (review in Lovich *et al.* 2009). In addition, the river has suffered significant impact from hurricanes in recent years. Because of the connectivity of river mainstem

habitat, a catastrophe somewhere in the river basin will affect the entire turtle population (and/or its prey base) in the downstream parts of that river, increasing the species' vulnerability to impacts elsewhere in the basin.

Conservation Actions (see Appendix for additional information)

Graptemys pearlensis, as former part of *G. gibbonsi*, is protected from commercial exploitation in Mississippi and possession is limited to 4 individuals. Its Louisiana populations are considered an Animal of Conservation Concern. The genus *Graptemys* is included in CITES Appendix III (United States) since 14 June 2006. *Graptemys gibbonsi* has been suggested to qualify for inclusion as threatened under the Endangered Species Act (ESA) (Lindeman 1999, Selman and Qualls 2007), and the taxonomic and conservation status of the split-out taxon *pearlensis* reinforces this further. *Graptemys pearlensis* is likely to benefit from conservation measures in place for sympatric *G. oculifera*, including turtle-sensitive channel management practices in the 19 km section of the Pearl River designated as ringed map turtle sanctuary (Jones and Selman 2009). Lovich *et al.* (2009) stated that appropriate conservation measures for the species include:

- Protecting and improving the water quality of the rivers and streams it inhabits;
- Discouraging channelization and removal of snags;
- Promoting streamside management zones and proper forest management practices within riparian zones;
- Prohibiting or further regulating commercial collecting;
- Further population surveys and systematic monitoring densities of known populations
- Further research on natural history, ecology, and the effects of recovery measures.

Conservation actions for this species should occur in synergy with efforts already underway for the conservation of sympatric *Graptemys oculifera*.

Credits

Assessor(s): van Dijk, P.P.

Reviewer(s): Horne, B.D., Mittermeier, R.A., Philippen, H.-D., Quinn, H.R., Rhodin, A.G.J. & Shaffer, H.B.

Contributor(s): Selman, W.

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Citation

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External Resources

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Appendix

Habitats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Habitat	Season	Suitability	Major Importance?
5. Wetlands (inland) -> 5.1. Wetlands (inland) - Permanent Rivers/Streams/Creeks (includes waterfalls)	-	Suitable	-

Threats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Threat	Timing	Scope	Severity	Impact Score
11. Climate change & severe weather -> 11.4. Storms & flooding	Future	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
3. Energy production & mining -> 3.2. Mining & quarrying	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
4. Transportation & service corridors -> 4.3. Shipping lanes	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale) [harvest]	Ongoing	-	-	-
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.3. Unintentional effects: (subsistence/small scale) [harvest]	Ongoing	-	-	-
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
6. Human intrusions & disturbance -> 6.1. Recreational activities	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.10. Large dams	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.9. Small dams	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.1. Unspecified species	Ongoing	-	-	-

	Stresses:	2. Species Stresses -> 2.1. Species mortality		
8. Invasive and other problematic species, genes & diseases -> 8.2. Problematic native species/diseases -> 8.2.1. Unspecified species	Ongoing	-	-	-
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
9. Pollution -> 9.1. Domestic & urban waste water -> 9.1.2. Run-off	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
9. Pollution -> 9.2. Industrial & military effluents -> 9.2.1. Oil spills	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
9. Pollution -> 9.2. Industrial & military effluents -> 9.2.3. Type Unknown/Unrecorded	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.2. Soil erosion, sedimentation	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.3. Herbicides and pesticides	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Actions in Place
In-Place Land/Water Protection and Management
Conservation sites identified: Yes, over entire range
In-Place Species Management
Successfully reintroduced or introduced benignly: No
Subject to ex-situ conservation: No
In-Place Education
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Conservation Actions Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection

Conservation Actions Needed
2. Land/water management -> 2.1. Site/area management
2. Land/water management -> 2.2. Invasive/problematic species control
2. Land/water management -> 2.3. Habitat & natural process restoration
3. Species management -> 3.2. Species recovery
4. Education & awareness -> 4.3. Awareness & communications
5. Law & policy -> 5.2. Policies and regulations
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.3. Sub-national level

Research Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.3. Life history & ecology
1. Research -> 1.5. Threats
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
2. Conservation Planning -> 2.2. Area-based Management Plan
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km ²): 940
Habitats and Ecology
Generation Length (years): 25

Errata

Errata reason: An errata assessment is required to generate a revised PDF without the range map which had been included in error; no range map was available when this assessment was originally published.

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Attachment B

National Wildlife Federation and Louisiana Wildlife Federation Comments on

FWS–R4–ES–2021–0097

12-Month Finding for Pascagoula Map Turtle; Threatened Species Status with Section 4(d) Rule for Pearl River Map Turtle; and Threatened Species Status for Alabama Map Turtle, Barbour’s Map Turtle, Escambia Map Turtle, and Pascagoula Map Turtle Due to Similarity of Appearance with a Section 4(d) Rule

**Diamonds in the Rough: Status of Two Imperiled *Graptemys* Species
(*Graptemys oculifera* and *G. pearlensis*) in the Pearl River of Jackson, MS**

Year 1



G. oculifera female, Stretch 2



G. pearlensis female, Stretch 1

Prepared for:
the Mississippi Department of Wildlife, Fisheries, and Parks
and the U.S. Fish and Wildlife Service

Will Selman, Ph.D. and Haley Smith
Millsaps College
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13 November 2017

ABSTRACT

Two *Graptemys* species (Map Turtles and Sawbacks) are endemic to the Pearl River system of Mississippi and Louisiana: *Graptemys oculifera* (Ringed Sawback) and *Graptemys pearlensis* (Pearl Map Turtle). *Graptemys oculifera* was designated as federally threatened in 1986, while *G. pearlensis* was recently petitioned in 2011 to be listed under the Endangered Species Act. Relatively little is known about either species in the Pearl River system surrounding Jackson, Mississippi, even though Jackson is the most populated city along the river's entire length. We surveyed for both *Graptemys* species and other river turtle species during June and July 2017 using spotting scopes and binoculars. Surveys occurred along five equidistant stretches (5.3 rkm; S1-S5) from south of the Ross Barnett Reservoir (east of Westbrook Road) to south of Interstate 20 (near Savanna Street Exit). We documented *G. oculifera* in all surveyed reaches of the Pearl, and all stretches had reproducing populations as evidenced by the presence of juveniles. Densities of *G. oculifera* were higher (30 – 44/rkm) in stretches upstream of Lefleur's Bluff State Park (S1, S2) and downstream of Interstate 20 (S5) compared to middle stretches (10 – 14/rkm). This is likely associated with human modifications to the middle stretches of river including altered riverine hydrology and a lack of riparian forest that borders the river. Even though densities of *G. oculifera* were lower in these stretches, we found reproducing populations in degraded habitat and sometimes moderate densities where pockets of suitable habitat occur. We found *Graptemys pearlensis* in all river stretches surveyed, but densities were lower than *G. oculifera* in all surveys (0.7 – 3.2/rkm). Stretches 2 – 4 are inclusive of a portion of the Pearl River that is proposed to be impounded for flood control and economic development via the One Lake Project. This project would certainly alter existing riverine hydrology to favor turtles that prefer non-flowing, lake settings at the expense of turtles like *G. oculifera* and *G. pearlensis* that are riverine specialists. We estimate that along the ~15.9 km that would be impounded, this would impact 1033 to 1895 *G. oculifera* and ~65 to 150 *G. pearlensis*.

INTRODUCTION

Two endemic *Graptemys* species occur sympatrically in the Pearl River system of central Mississippi: *G. oculifera* (Ringed Sawback; Baur 1890) and *G. pearlensis* (Pearl Map Turtle; Ennen et al. 2010). Much research has been conducted on *G. oculifera* including population densities (Jones and Hartfield 1995, Dickerson and Reine 1996, Lindeman 1998, Shively 1999), population structure (Jones and Hartfield 1995), reproductive ecology (Jones 2006), and population genetics (Gaillard et al. 2015). Most of this information was collected because the species was listed as federally threatened in 1986 (USFWS 1986) and subsequently, the *G. oculifera* recovery plan outlined many studies to be undertaken (Stewart 1988). However, there is very little data available for *G. pearlensis*, with most being coincidental to *G. oculifera* visual population density surveys (Dickerson and Reine, 1996; Lindeman, 1998; Shively, 1999). Almost all of the data reported occurred prior to its recognition as a separate *Graptemys* taxon (Ennen et al., 2010), and only recently has long-term and short-term population status data become available (Selman and Jones 2017). Selman and Jones (2017) and all previous data point to *G. pearlensis* being rarer and in steeper decline relative to *G. oculifera*. In turn, *G. pearlensis* was recently petitioned by the Center for Biological Diversity to be considered a candidate for federal protection status (vis-à-vis *G. gibbonsi*; U.S. Fish and Wildlife Service 2011).

The objective of this study was to determine if both species occurred in 5 river stretches of the Pearl River that flow through the Jackson Metropolitan area (Hinds/Rankin counties). We also wanted to determine the abundance of each species via basking density surveys. Because data has only been collected for *Graptemys oculifera* north Lakeland Drive (see Jones and Hartfield 1995), our data for downstream sites are novel and will be informative for state and federal entities tasked with managing both species in this urban river stretch. Furthermore, this stretch is also inclusive of a segment of the Pearl River that would be impacted by the proposed

One Lake Project. Therefore, our data may also serve as pre-construction data for post-construction comparisons.

MATERIALS AND METHODS

Study Site.—Five equidistant and consecutive river segments (5.3 rkm each; total 26.5 rkm) of the Pearl River were selected to survey for river turtles in Jackson, Mississippi (Hinds and Rankin counties; Fig. 1). Two of these stretches (S1, S2) occur upstream of a lowhead dam on the Pearl River that pools water for intake by the J.H. Fewell Water Treatment Plant. Three survey stretches occur downstream of the lowhead dam (S3-S5). S1 and S5 are similar because they have alternating sandbar and cutbank sections with high levels of submergent and emergent deadwood. They also have an intact riparian forest buffer (i.e., forest up to the river's edge) and the primary trees species include Water Oak (*Quercus nigra*), Bald Cypress (*Taxodium distichum*), Overcup Oak (*Quercus lyrata*), and Black Willow (*Salix nigra*). Stretch 2 is a relatively straight portion of the Pearl River with fewer sandbar and cutbank sections, but similar to S1 and S5, S2 maintains moderate-high amounts of deadwood and a mostly intact riparian forest buffer. Lakeland Drive also crosses the Pearl River in S2. Stretch 3 and 4 encompass a highly modified stretch of the Pearl River, with human modifications including channelization, mowing, and desnagging of riverine deadwood. The river lacks a riparian forest buffer along most of S3 and S4, and instead, it is bordered by a grassy/shrubby margin. In stream differences include few deadwood snags and a shallow bottom with few deep sections. Also, Interstate 59, Old Brandon Road, and a railroad crossing occur within S3, while Interstate 20, U.S. Highway 80, and another railroad crossing occur along S4. Three of these river stretches occur within the

planned zone of the One Lake Project (S2-4), while two stretches (S1, S5) occur upstream and downstream of the proposed impacted segment.

Methods.—All river survey stretches were floated by boat during the months of June and July 2017. We completed 4 replicate surveys for S1 and 3 replicate surveys for S2-5 (total of ~84.8 rkm surveyed); for the latter, flooding during June prevented us completing a fourth round a surveys for S2-5. When sandbars were present, we moored the boat on the upstream end of the sandbar and viewed/counted basking turtles via spotting scope while we walked down the sandbar (similar to Selman and Qualls 2009); turtles were typically counted on emergent deadwood snags, but we also observed them on river banks and other manmade structures present in the river (e.g., rock rip rap). In the absence of sandbars, visual surveys consisted of floating downstream in an outboard motorboat with two observers that were equipped with binoculars; each observer counted opposite banks of the river and another person served as data recorder. A Nikon Coolpix p900 digital camera with 83× optical zoom was also used to take photographs of large basking aggregations of turtles that were difficult to identify from a distance with binoculars. All surveys were completed between the mid-morning to mid-afternoon hours (~0900 – 1530 hrs), when environmental conditions are conducive for basking. We avoided days when mostly cloudy conditions or precipitation occurred to minimize differences of environmental conditions during our observations.

We used a one-factor ANOVA to determine if *G. oculifera* densities were equal across the five stretches surveyed. If differences were observed, we used a Tukey-Kramer post hoc analysis to determine differences among sites. Because *G. pearlensis* data were non-normally distributed, we used a nonparametric Wilcoxon Rank Sums test to determine if densities were equal among the sites.

RESULTS

***Graptemys oculifera* Status.**—The mean number of *G. oculifera* observed per survey for all stretches surveyed was 158.4 turtles (99.1 ♂, 43.4 ♀, 9.9 Juveniles) with densities averaging 29.8 per rkm. Adults of both sexes and juveniles were observed within all stretches surveyed. However, there was considerable variability in densities among the stretches (Table 1).

Graptemys oculifera densities were statistically different among the 5 stretches surveyed ($F_{4,16} = 7.78, p = 0.0031$). Results from the Tukey-Kramer post hoc analysis indicated that S1 (44.0/rkm) and S5 (41.8/rkm) had higher densities than S3 (10.0/rkm) and S4 (14.8/rkm), but S1 and S5 densities were not higher than those observed in S2 (33.5/rkm); S2 did not have higher densities than S3 and S4 (Table 1). *Graptemys oculifera* were observed in higher densities than *G. pearlensis* during all surveys at all sites (Fig. 2). For all surveys combined, *G. oculifera* was observed at 23× higher densities in comparison to *G. pearlensis*. Within site comparisons of *G. oculifera* and *G. pearlensis* ranged from a low of 13× higher in S5 to a high of 48× higher in S2.

***Graptemys pearlensis* Status.**—The mean number of *G. pearlensis* observed for all stretches surveyed was 7.1 turtles (4.7 ♂, 1.4 ♀, 0.6 Juveniles) per survey with densities averaging 1.3/rkm. Adults of both sexes were observed in all stretches, but juveniles were not observed in S3. Contrary to *G. oculifera*, *Graptemys pearlensis* densities were low in all river stretches surveyed (range: 0.25 – 3.2/rkm; Table 1), but densities were statistically different across sites ($\chi^2 = 12.1, df = 4, p = 0.016$). S5 had higher densities than S1-S4.

Other Turtle Species Observed and Miscellaneous Observations.—Along with *G. oculifera* and *G. pearlensis*, we also observed *Pseudemys concinna* (River Cooter; 93 observed, 1.1/rkm), *Sternotherus carinatus* (Razorback Musk Turtle; 35, 0.41/rkm), *Trachemys scripta* (Red-eared Slider; 41, 0.48/rkm), *Apalone mutica* (Smooth Softshell; 7, 0.08/rkm), *Apalone*

spinifera (Spiny Softshell; 1, 0.01/rkm), and *Graptemys pseudogeographica* (False Map Turtle; 16, 0.19/rkm).

For *G. pseudogeographica*, 16 individuals were observed in S2 (11 individuals), S3 (1), S4 (1), and S5 (3) including both mature males and females. No juveniles were observed, but hatchling and juvenile age classes of turtles can be relatively difficult to detect. Photographs were taken of individuals, and there seems to be subspecific variability with some individuals expressing *kohnii* subspecies characters (Fig. 3A, 3B) and other expressing *pseudogeographica* subspecies characters (Fig. 3C). *Graptemys pseudogeographica* was observed basking with other native turtle species including *P. concinna*, *G. oculifera*, and *G. pearlensis*; in one observation, all three *Graptemys* species were observed basking in the same tree crown (Fig. 3D). Thus, it seems likely that this species is established (likely via the pet trade and introductions) and occurs primarily downstream of Lakeland Drive.

While conducting surveys, we made many observations of *G. oculifera* basking on “non-traditional”, manmade basking platforms. This includes individuals basking on rock rip rap (Fig. 4A), concrete culverts (Fig. 4B), exposed pipes (Fig. 4C), and discarded metal (Fig. 4D). Many of these “non-traditional” basking platforms were located in S3 and S4 (discussed below). We also observed *G. oculifera* basking on a log under Lakeland Drive even though the log was fully shaded by the bridge (Fig. 4E).

Within S3 and S4, the Pearl River has been highly modified throughout much of this 10.6 rkm stretch by channelization (i.e., straightening), desnagging, and removal of riparian trees/vegetation. Because of these actions, there are few deadwood basking structures for turtles in this stretch compared to S1, S2, and S5, and this likely contributes to turtles basking on manmade structures as mentioned above. Along with fewer deadwood basking structures, the

river channel has also filled substantially by sand/sediment, and this has left long river sections with a shallow river bottom and few deep refuges preferred by *Graptemys* species. Nonetheless, both *Graptemys* species persist in this setting – albeit at lower densities. Juveniles are also present in these stretches, an indication of a breeding population. Within S3/S4, there were short river sections where moderate to high amounts of deadwood and an intact riparian zone could be found (e.g., at the end of S3 [near E. Silas Brown Road/Old Brandon Road], in the middle of S4 [east of East McDowell Road and downstream of I-20]). In these stretches, densities of *G. oculifera* were concentrated around areas that maintained a riparian forest buffer even though few individuals occurred upstream and downstream of these locations.

DISCUSSION

***G. oculifera* Status.**—The Pearl River around Jackson has been historically altered by humans in many ways, particularly to limit flooding in the city of Jackson via channelization, desnagging, and riparian zone clearing (especially in S3 and S4). Many riverine modifications were made before and following the historic Easter Flood of 1979, and all of these modifications were implemented in an attempt to move river water faster through a segment of the Pearl River that was historically sinuous. It has also been hydrologically altered since 1963 via the Ross Barnett Reservoir that controls river flows via a dam and spillway system (~17.4 km upstream of lowhead dam in Jackson). Last, along with these modifications, this entire stretch of the Pearl River has also been historically subjected to degraded water quality via industrial, municipal, and residential sources (McCoy and Vogt 1979). However, water quality throughout this section of the Pearl River has improved following infrastructure enhancements (Mississippi Department of

Environmental Quality 1998), but litter is still present in copious amounts (WS and HS, personal observation).

Therefore, our observations that *G. oculifera* persists throughout this section of river – sometimes in relatively high densities – is surprising, encouraging, and indicative of the recovery potential of the species. Even in the most degraded habitat of S3 and S4, *G. oculifera* were still present and reproducing, and they were observed in moderately high densities where a riparian buffer was present (e.g., near Silas Brown Street). Thus, it is not surprising that densities in S1 and S5 were highest given their “more natural” river setting with sandbars, cutbanks, intact riparian buffer, and copious amounts of riverine deadwood for basking. Stretch 1 has also been the focus of long-term study by R.L. Jones (site name Lakeland), and this population of *G. oculifera* is one of the most stable populations of the 5 populations surveyed since the 1980s (Selman and Jones 2017).

Mean densities of *G. oculifera* in S1 (44.0/rkm), S2 (33.5/rkm), and S5 (41.8/rkm) exceeded the densities observed by prior researchers throughout the Pearl River system except at two study sites: Ratliff Ferry and Columbia (see Selman and Jones 2017). However, even though mean densities of *G. oculifera* in S3 (10.0/rkm) and S4 (14.8/rkm) are 2-3× less than the other river stretches we surveyed, these densities are not insignificant. Densities in S3 and S4 are similar to densities observed by Shively (1999) in the Bogue Chitto River (4 – 17/rkm), and they exceed or are similar to densities in the lower Pearl River (0 – 15.7/rkm; Dickerson and Reine 1996).

***G. pearlensis* Status.**—*Graptemys pearlensis* densities were lower during all surveys and in all stretches in comparison to *G. oculifera*. Most studies to date have found similar observations for the species comparison (see summary table Selman and Jones 2017). Our observed densities

fall within most previously reported basking densities for *G. pearlensis* (range: 0 – 7 per rkm), with only a few sites having densities exceeding our observations (range: 10 – 15/rkm; Pearl River at Columbia, Selman and Jones 2017; portions of the Bogue Chitto River, Shively 1999). Based on *G. pearlensis* capture data for the Lakeland population (i.e., S1, north of Lakeland Drive), this population has undergone a significant population decline since the 1980s (Selman and Jones 2017). For example, in the 1980s and 1990s, 20-40 individuals were regularly captured per trapping effort, while by 2013, only a single individual was captured with similar effort (Selman and Jones 2017). It is unknown why the population has declined in this stretch, but water quality and riverine regulation at the reservoir have likely impacted prey item presence and availability (Selman and Jones 2017). Ultimately, the chances of localized extirpations is higher in species with small populations like *G. pearlensis* (in comparison to *G. oculifera*) due to environmental and demographic stochastic events.

Implications of the One Lake Project on Riverine Turtles.—Proposed riverine impoundment projects on this section of the Pearl River, particularly the One Lake project, have the potential to impact populations of both *G. oculifera* and *G. pearlensis* along with other riverine turtle species we observed. The One Lake project currently proposes to impound ~15.9 rkm of the Pearl River, and that river stretch encompasses surveyed stretches S2 – S4.

Based on our surveys, the minimum number of *G. oculifera* impacted along this stretch (S2 – S4) of river would be 379 individuals (Max and Mean Counts: S2 – 211 [\bar{x} = 177.5]; S3 – 58 [\bar{x} = 53]; S4 – 110 [\bar{x} = 78.4]). However, when factoring in basking frequency information for a similar species from the Pascagoula River (*G. flavimaculata*; Selman and Qualls 2011), it is likely that we only observed 20 – 30% of the population basking during our surveys (i.e., during the summer, thermoregulatory needs are much less for individuals, and therefore, fewer

individuals in the population are observed basking at any particular time compared to spring or fall). Therefore, if we only observed 20 – 30% of the population, the population in this stretch impacted would likely approach 1033 to 1895 *G. oculifera* individuals. This is inclusive of males and females that represent a viable and reproducing population given the presence of juveniles along all stretches.

In contrast to *G. oculifera*, a much smaller minimum number of *G. pearlensis* would be impacted along this stretch of river (S2 – S4): 15 individuals (Max and Mean Counts: S2 – 4 [\bar{x} = 3.7]; S3 – 3 [\bar{x} = 1.3]; S4 – 8 [\bar{x} = 4.8]). However, factoring in basking frequency information for a similar species from the Pascagoula River system (*G. gibbonsi*; Selman and Lindeman 2015), it is likely that we only observed 10 – 15% of the population basking during our surveys for similar reasons as cited above for *G. oculifera*. Therefore, given that we only observed 10 – 15% of the population, the population in this stretch impacted would be ~65 to 150 *G. pearlensis* individuals.

If the One Lake project is implemented, it will dramatically alter the hydrology of this stretch of the Pearl River. It will convert from a lotic, river setting (i.e., moderate to high flow) to a more lentic, lake setting (i.e., low to no flow setting; for review see Bunn and Arthington 2002). Furthermore, it seems likely that if the One Lake Project was implemented, the conditions that result would benefit common, generalist species that thrive in low flow settings (e.g., Red-eared Slider, Common Musk Turtle, Common Snapping Turtle, Spiny Softshell) at the expense of threatened riverine specialist species (e.g., Ringed Sawback, Pearl Map Turtle, Razorbacked Musk Turtle, Alligator Snapping Turtle, Smooth Softshell). Indeed, reservoirs are a leading contributor to species endangerment in the southeastern United States (Czech et al. 2000), and a project such as this could lead to localized extirpations of flow-dependent species.

The data contained herein provide baseline basking densities for comparison if the project occurs in order to test this likely scenario. We intend to collect additional data during the summer 2018 using similar methods along the same stretches outlined.

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Stretch	Mean (SD) <i>G.o.</i> ♂	Mean (SD) <i>G.o.</i> ♀	Mean (SD) <i>G.o.</i> Juv	Mean (SD) <i>G.o.</i> Total	Mean <i>G.o.</i> /rkm	Mean (SD) <i>G.p.</i> ♂	Mean (SD) <i>G.p.</i> ♀	Mean (SD) <i>G.p.</i> Juv	Mean (SD) <i>G.p.</i> Total	Mean <i>G.p.</i> /rkm
1	137.5 (63.7)	72.8 (26.0)	15.5 (6.2)	234.3 (86.8)	44.0 ^a (16.3)	5.5 (3.1)	1.0 (0.82)	1.5 (1.3)	8 (2.2)	1.5 ^a (0.4)
2	109.3 (11.0)	40.7 (13.3)	23 (10.8)	178.0 (31.2)	33.5 ^{ab} (5.9)	2.3 (1.5)	1.3 (1.2)	0	3.7 (0.6)	0.7 ^a (0.1)
3	28.3 (2.5)	21.7 (8.4)	2.0 (1.2)	53.0 (9.5)	10.0 ^b (1.8)	1.0 (1.0)	0.3 (0.56)	0	1.3 (1.5)	0.25 ^a (0.28)
4	47 (19.7)	21.7 (3.8)	3.7 (2.5)	79 (27.2)	14.8 ^b (5.1)	2.3 (2.5)	2.3 (1.2)	0.3 (0.6)	5.0 (3.6)	0.9 ^a (0.7)
5	160.7 (54.6)	50.7 (28.0)	3.3 (1.2)	222.3 (50.6)	41.8 ^a (9.5)	12.0 (6.1)	2.3 (0.58)	1 (n/a)	17.0 (7.0)	3.2 ^b (1.3)
Total	99.1 (63.0)	43.4 (26.6)	9.9 (9.8)	158.4 (89.5)	29.8 (16.8)	4.7 (4.9)	1.4 (1.1)	0.6 (0.9)	7.1 (6.3)	1.3 (1.2)

Table 1. Mean counts and densities of *Gratemys* species within the Pearl River near Jackson, MS. Different superscript letters are indicative of significantly different densities among river stretches. *G.o.* = *G. oculifera*, *G.p.* = *G. pearlensis*, SD = Standard Deviation, rkm = river km.

Figure 1. River turtle survey segments along the Pearl River near Jackson, Mississippi (Hinds and Rankin counties). Numbered markers note the beginning of each of the 5.3 river km stretches surveyed.

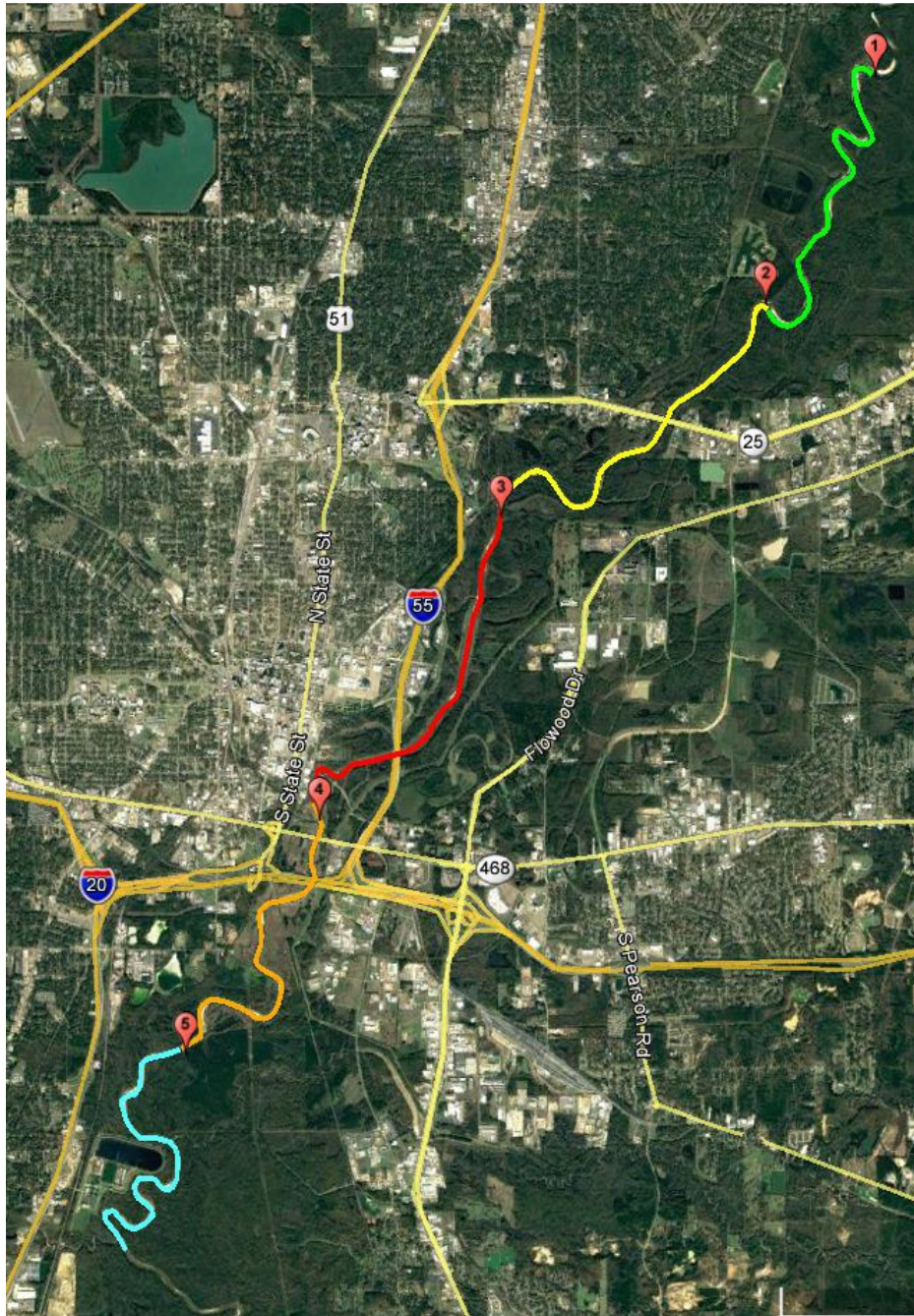


Figure 2. Variability in *Graptemys* densities among five stretches surveyed of the Pearl River. *Graptemys oculifera* is in blue and *G. pearlensis* is in red.

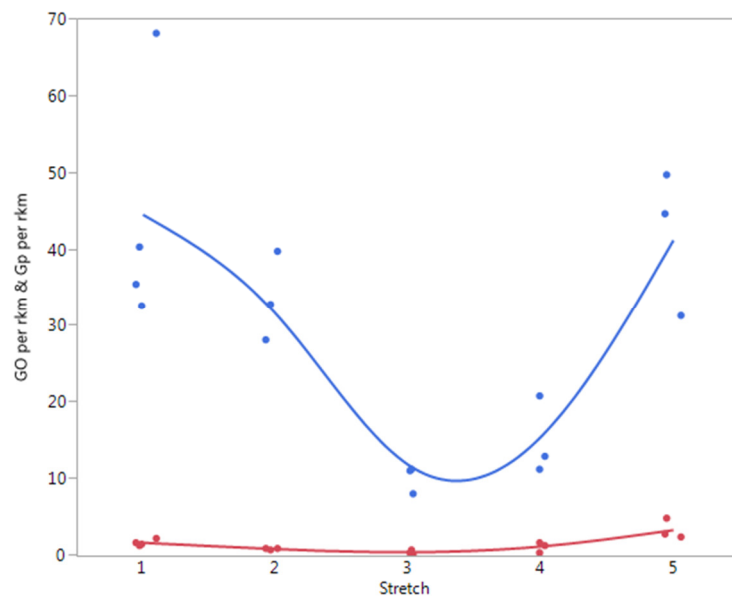


Figure 3. Observations of *G. pseudogeographica* in the Pearl River including *kohnii* subspecies forms (A, B) and *pseudogeographica* subspecies forms (C). *Graptemys pseudogeographica* was also observed basking with other native *Graptemys* (D). The white iris is characteristic for the species and can be seen here in all photographs.

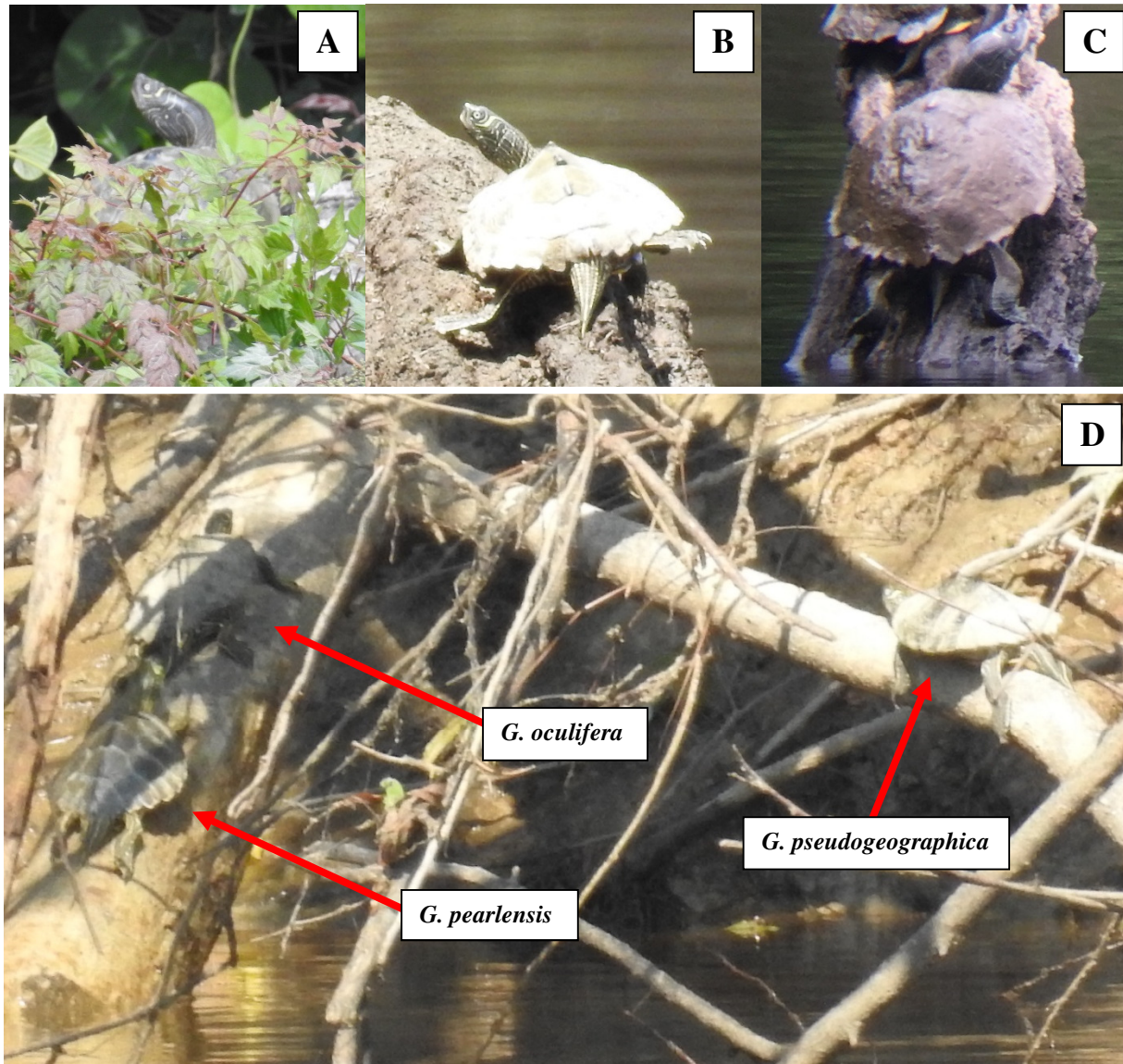


Figure 4. Observations of *G. oculifera* basking on manmade structures in the Pearl River near Jackson, Mississippi. This includes rock rip rap (A), discarded concrete culverts (B), exposed pipes (C), and discarded metal (Fig. D). We also commonly made observations of turtles basking under bridge overpasses like Lakeland Drive (E).

