

**Assessment of Ringed Map Turtle (*Graptemys oculifera*)
and Pearl Map Turtle (*Graptemys pearlensis*)
Abundance and Habitat
on the U.S. Navy's Stennis Western Maneuver Area (WMA)
East Pearl and Mike's Rivers, Mississippi**

With Recommendations for Habitat Enhancement

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Purpose

The purpose of this project was to identify for the U.S. Navy, where rare turtles, notably federally-listed Ringed Map Turtles (*Graptemys oculifera*), but also including Pearl Map Turtles (*Graptemys pearlensis*) exist within the boundaries of the Stennis Western Maneuver Area (WMA). We worked specifically within the East Pearl and Mike's River system. We sought to identify areas of turtle abundance and to identify specific habitats of importance to them, such as sandbars for nesting and the presence of aquatic habitat structure, such as deadwood for basking. Our results are intended to identify opportunities for natural resource management and enhancement of riparian habitats for these rare turtles.

The Pearl River System, including the Bogue Chitto River comprises the entire global range of the Ringed Map Turtle (*Graptemys oculifera*). This highly aquatic, basking turtle is also Federally Threatened (U.S. Fish and Wildlife Service, 1988) and ranked globally as G2 by the Natural Heritage network. The Ringed Map Turtle is considered a species in need of recovery by the Partners in Amphibian and Reptile Conservation (PARC), of which the DOD is a partner agency. The Ringed Map Turtle requires clean water, abundant log snags, on which they frequently bask, and healthy mollusk and aquatic invertebrate populations upon which these carnivorous turtles feed (Jones and Hartfield 1995). Nesting habitat for Ringed Map Turtles includes sandbars and shoreline sand beaches that are above the usual flood line. Declines of Ringed Map Turtle populations have been largely attributed to habitat modifications (river channel and flow), water quality degradation (McCoy and Vogt 1980; Dickerson 1995), and freshwater mollusk declines.

The Pearl Map Turtle (*Graptemys pearlensis*) also an endemic to the Pearl River System, and was recently identified as distinct through genetic and morphological characters (Ennen et al 2010) from the Gibbons Map Turtle (*Graptemys gibbonsi*) which is now restricted only to the Pascagoula River System in eastern Mississippi (Lovich 1992). The Pearl Map Turtle is also a basking turtle, relying on the availability of log snags and deadwood on which to exit the water and raise body temperature. The Pearl Map Turtle is ranked globally rare (G3) in both Louisiana and Mississippi. Pearl Map Turtles are a larger species than Ringed Map Turtles and feed on bottom-dwelling freshwater mussels and snails; the females of this species large heads, with wide, strong jaws for crushing freshwater mussels and snails.

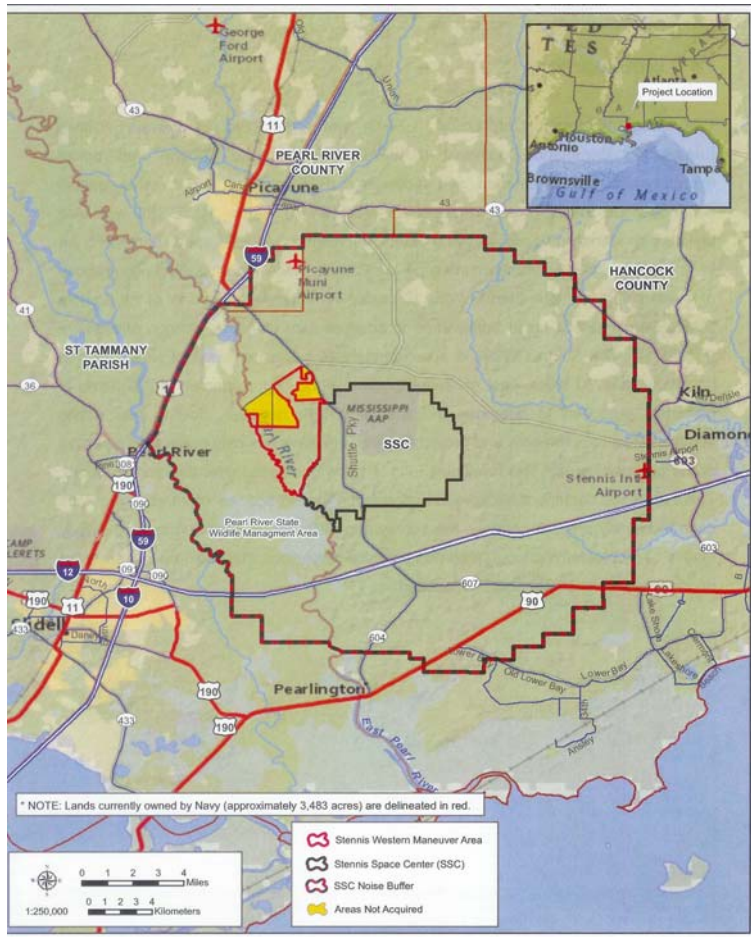
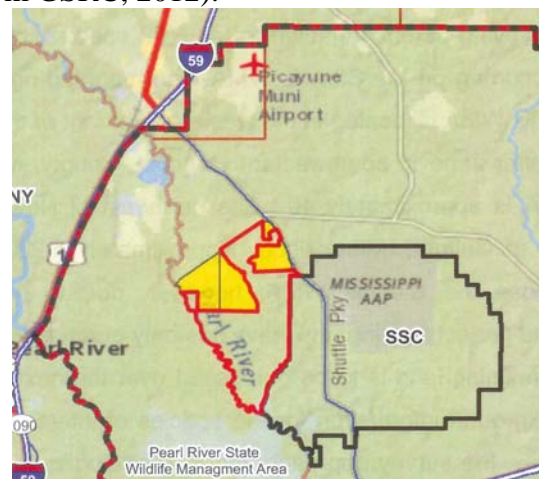


Figure 1. Vicinity Map

GSRC
February 2012

The U.S. Navy operates the Stennis Western Maneuver Area which is located on the western edge of the NASA Stennis Space Center and is incorporated into the Stennis Space Center Buffer Zone. (Map obtained from GSRC, 2012).



The Stennis WMA is bounded by the East Pearl River on the west and Mike's River on the east, as indicated in red above. Yellow areas indicate areas to be incorporated into the WMA.

The Stennis Space Center and its Buffer Zone (NASA) occupy a footprint that is approximately 20 miles east to west from the towns of Pearl River to Kiln and approximately 18 miles north to south from near Picayune Airport to Hwy 90 in Hancock and Pearl River Counties, Mississippi. Within the Buffer Zone, the Stennis Western Manuever Area (WMA) is located immediately west of and adjacent to the core Stennis Space Center (SSC) research and development facility. The Stennis WMA is operated by the U.S. Navy and encompasses a 4-mile reach of the East Pearl River and a smaller eastern tributary named Mikes River. These river reaches are used by the Navy's Construction Battalion Center (NCBC) for riverboat warfare training. The western bank of the East Pearl River denotes the boundary of the Navy property and is managed as the Pearl River State Wildlife Management Area. Unused stretches of the East Pearl extend upstream (and outside the Navy boundaries), but within the Stennis (NASA) Buffer Zone beyond the Old Rt. 11 Bridge.

Goals of Field Visits 2012-2013

Part 1: Initial Habitat Assessment

The purpose of our trip in October 2012 was to familiarize ourselves with the riverine and riparian habitats along both the East Pearl and Mike's Rivers within the Stennis Western Manuever Area. River levels were unusually high; however this provided an opportunity to assess the locations of the highest quality nesting areas, which need to remain above high water while turtle eggs are incubating in the sandbanks. High water reduced the ability to conduct basking surveys, as many favorite deadwood basking sites were submerged. However, some snags attached banks were available for basking and several turtles were observed, including Ringed Map, Pearl Map, and River Cooters (*Pseudemys concinna*).



Initial views of the East Pearl River near the lower boat launch and just downstream of the confluence with Mike's River. The lower stretches of East Pearl and Mike's River are bordered by Cypress-Tupelo Forest whereas the middle and upper reaches of the East Pearl River within the boundaries of the Stennis WMA are characterized as Bottomland Hardwood Forest (GSRC, 2012).



Mike's River is characteristic of a bayou. This tributary has low banks and the flow is less than the East Pearl. There are no sandbar deposits. There are numerous snags and woody debris which can provide basking habitat for map turtles.



Mike's Dredge Spoil Target Beach (GPS UTM: 245679 3362123).

One of the very first habitat structures that we noticed was man-made dredge spoil sand pile on the western bank of the lower Mike's River. This site is significant and will be referred to throughout this report as "Mike's Dredge Spoil Target Beach."



Mike's Dredge Spoil Target Beach was completely above the high water encountered on 4 October 2012. This site would remain above high water for any flood level that might occur on the East Pearl system. Thus, is a significant potential resource for rare turtles and will be discussed further in Parts 2 and 3 of this report. We found evidence of use of this site by nesting turtles in October 2012. We also note that the use of this site by the Navy Boat Training helps maintain the open character of the canopy as this site and thus is beneficial as a turtle nesting area. We note that dredge spoil islands were used extensively in the lower Appalachicola River by Barbour's Map Turtles (*Graptemys barbouri*), but the islands were undergoing vegetative succession that will eventually make them unsuitable for nesting (Ewert and Jackson, 1994; Lindeman, 2003, pg 275).



Navy Boat Training access to further upstream reaches of Mike's River ends at the wooden bridge (above left). At this point on Mike's River map turtle habitat seems limited, however, the road that crosses Mike's at the wooden bridge could provide nesting sites. Future research involving use of wildlife cameras might help assess use of this area.



During the October 2012 visit, we toured terrestrial habitats within the Stennis WMA and a series of borrow pits. The Hunt Camp and its associated borrow pits are located just east of the wooden plank bridge on Mike's River. Borrow pits with connections to riverine habitat occasionally contain map turtles, although these are usually transient males or juveniles. Hurricane Issac apparently put one foot of water inside the Hunting Camp building. We observed one Ringed Map Turtle basking in the Hunt Camp borrow pit on 4 October 2012. (photo by Marion Fannaly)



A view of Mike's River from the road (GPS UTM 245173 3366104) and upstream of the wooden plank bridge and beyond Navy Boat Training use. The slough-like condition of Mike's River from this point upstream is more suitable for slider turtles (*Trachemys scripta*), and not representative of map turtle habitat.



The East Pearl is a typical of a Gulf Coastal Plain River with alternating sandbar and cutbank sections (Selman and Qualls, 2011). The cutbank sections have a preponderance of deadwood snags, whereas sandbar sections easily identified by sand willow.



Deadwood on the undercut bank sides provides necessary basking structure for map turtles, whereas sandbars (although underwater, are indicated by willow) provide nesting habitat.



The Old Rt. 11 Bridge during 4OCT12 survey and high water. The bridge marks the upper boundary of the Stennis WMA. Sandbar habitat does become more abundant upstream of the Rt. 11 bridge. However, there are several sandbars that may represent quality nesting habitat within the WMA.



Target 117



Target 75

Initial views of the some to Navy Boat Training target areas may already offer opportunities for turtle nesting because of their elevation and open canopy conditions. We will be seeking opportunities for enhancement of these sites in a manner that does not interfere with Navy training (see Part 3). The open canopy needed as nesting area is actually enhanced by the weapons firing from Navy Boat training.

Part 2: Map Turtle Distribution and Abundance via Basking Survey

There are two map turtle species endemic to the Pearl River System.

The Ringed Map Turtle (*Graptemys oculifera*) is the focal species of this project. It is listed as Federally Threatened (USFWS, 1986). Moore and Seigel (2006) found that the close cousin of the Ringed Maps, the Yellow-blotched Map Turtles (*G. flavimaculata*) were easily disturbed by boating and recreational activity. Females map turtles appear to be more easily disturbed than males, as they are more likely to abandon a basking site when human observers are at greater distances away. Part of this may be because the smaller males often bask cryptically while hidden within smaller branches, whereas the larger females are already more exposed on larger log snags.



The Ringed Map Turtle (*Graptemys oculifera*) is endemic to the Pearl River System in Louisiana and Mississippi. Declines in native freshwater mussels and snails, and loss of nesting beach habitat are contributing to its endangerment.

The Pearl Map Turtle (*Graptemys pearlensis*) is the big-headed species. Originally part of the species complex known as the Alabama map turtle (*Graptemys pulchra*) that had a poorly defined range that included the Escambia, Mobile Bay, Pearl, and Pascagoula drainages (Cagle 1952). Subsequently, the populations in the Pearl and Pascagoula were split (Lovich and McCoy 1992) and re-named as Gibbon's or Pascagoula Map Turtle (*Graptemys gibbonsi*). Ennen et al (2010) recognized the Pearl River populations as further distinct and named the new species Pearl Map Turtle (*Graptemys pearlensis*). The Pearl Map Turtle is restricted to the Pearl Drainage in southern Mississippi and two parishes in southeastern Louisiana. Greatest observed densities are near the accumulations of deadwood and sandbars, as with the Ringed Map Turtle, with which it co-occurs. As is typical of other members of the big-headed (megacephalic clade), it feeds predominately on the larger native mussels, although smaller snails are part of the diet. Average clutch size is 6.4 eggs (Lovich et al 2009). Basking surveys over several decades indicate a decline in Pearl Map Turtles (no protective status) relative to congener Ringed Map Turtles (Lindeman, 2013). Basking surveys conducted by Cagle (1953) found Pearl Map Turtles to make up 67% of the map turtle observations between the two species; Tinkle (1958) reported ratios of 1.9:1 (Pearl:Ringed). Lindeman (1998) reported that Pearl Maps were 8 % of the overall turtles seen and at a rate of 4.8/river km. More recent surveys on the Pearl River found Ringed Maps outnumbering Pearl Maps (Jones and Hartfield, 1995), as well as on the Bogue Chitto River where Ringed Maps outnumbered Pearl Maps 1.4:1 (Shively, 1999). Therefore, from the literature, it does appear that Pearl Maps are in decline relative to their co-occurring relative.



The Pearl Map Turtle (*Graptemys pearlensis*) is also endemic to the Pearl River system. Like the Ringed Map Turtle, this map turtle is also threatened by degradation of habitat but primarily by the loss of the freshwater mussel fauna, a chief food resource.

We conducted a basking survey in April, as female map turtle are more likely to be observed basking at this time of year (Moore and Seigel, 2006). We also were particularly interested in documenting the presence of females to confirm that the Stennis WMA represented habitat for a “population” of map turtles, not simply habitat used by males displaced or washed downstream from more prime habitats. Data from Selman and Quall (2011) seems to suggest that females may not be less likely to bask in summer months, but that they may bask for shorter durations in summer, hence floating surveys conducted by canoe may spot fewer females in summer.

During 24 and 25 April 2013, float trips were made to count basking turtles on both Mike’s River and the East Pearl River. The stated goals of the basking surveys were to assess the distribution of ringed map turtles, as well as Pearl Map turtles within the sections of the rivers that were part of the Stennis WMA. We wanted to assess areas where concentrations of turtles might occur. We also sought to document the presence of adult female turtles of both species within these river stretches. The presence of the larger females, which are easy to identify via basking surveys, would indicate that nesting is likely to take place within this section of the river. Prior basking surveys for other map turtle species on different rivers have documented mostly males in degraded sections or in reservoirs (Lindeman, 2013; Buhlmann and Gibbons 2006). These results have been presumed to be the results of a paucity of larger freshwater mollusks (i.e., unionid mussels) and snails, which the sexually dimorphic and larger females require. This is certainly true in the reservoir impoundments along stretches of Gulf Coast-draining rivers. The smaller males tend to be less affected by loss of mollusks, as they alternatively feed on smaller aquatic invertebrates, such as caddisflies and mayflies.

Mikes River 24 April 2013 Basking Survey

We launched a canoe at the wooden plank bridge (see page 6) and floated this river stretch to the junction with the East Pearl River. We observed no map turtles in the upper reaches and only observed 2 *Graptemys pearlensis* once we had floated downstream of the Mike's Dredge Spoil Target Beach (see pages 5, 14). The shaded canopy conditions of Mike's River likely reduce the favorability of this stretch for map turtles; however, the sheltered conditions could provide some nursery habitat for hatchlings and juveniles that might result from successful nesting on Mike's Dredge Spoil Target Beach.

We detected several floating jugs that indicated trotlines, but we note that we never encountered any other boaters during this float nor the recon trip of 4 October 2013, or later on 26 June 2013. Because of its potential low fishing pressure and recreational use, Mike's River may provide suitable habitat for Alligator Snapping Turtles (*Macrolemys temminckii*). Although not a target of this study, Alligator Snapping Turtles have been heavily persecuted throughout their range and were actively harvested (that continues in some areas) for the turtle meat and soup trade. Mike's River has the characteristics (shaded, slow flow, undercut banks with large cypress stumps), that tend to be frequented by alligator snappers.



Canoeing Mike's River 24 April 2013.



Perhaps the floats at the mouth of Mike's River are a slight deterrent to fishermen, and perhaps turtle trappers, thus benefitting Alligator Snapping Turtles. Although some fishing jugs (above) were found on Mike's.



The location of a new landing area with rip-rap on Mike's River for the Navy Boat Training. However, the launch ramp provides access to the upland habitat by nesting turtles should map turtles use Mike's River in any large numbers. It is not certain that *Graptemys oculifera* are abundant in Mike's. They have not been observed during this study, but they must occasionally traverse this section, as they have been observed infrequently in the adjacent borrow pits at the Hunt Camp (see Part 1). A more efficient action would be to improve nesting conditions at "Mike's Dredge Spoil Target Beach (see below).



Some low, small nesting areas exist along Mikes River. These are vulnerable to flooding and seem more likely to be used by alligator snappers (if they are present) and perhaps razor-backed musk turtles (*Sternotherus carinatus*). This site is directly across Mike's River from the Dredge Spoil Target Beach.



Although we were unable to capture it, we observed a musk turtle, likely a Razor-backed Musk Turtle (*Sternotherus carinatus*) within this log jam on Mike's River, 24 April 2013. (Photo above by J. Iverson). We also saw one Diamondback Watersnake (*Nerodia rhombifer*) and heard Bird-voiced Treefrogs (*Hyla avivoca*) calling. We previously observed a softshell turtle (*Apalone* sp.) in October 2012, GPS UTM: 246333 3363000).



The most promising map turtle habitat on Mike's River is the Dredge Spoil Target Beach which is used as a Navy Boat training Target area on the lower portion of Mike's River. We visited this site on 24 April during the basking surveys and measured the area that could be cleared of brush, which amounted to an area 85 feet long by 40 feet wide. We also discovered additional turtle egg shell fragments from prior nesting.



A low-cost enhancement project could involve clearing some of the shrub cover from the backsides of this dredge spoil target. The site is certainly used by turtles and the site is tall enough to survive most, if not all, flood events. It is used by softshell turtles and hard-shelled turtles, as we found both round and elliptical egg shells. The front-facing part of the site might incur some nest mortality due to plastic bullets and boots on the ground, but there is additional habitat behind the big old plastic-bullet riddled pine tree that would be protected from target practice.

East Pearl River 25 April 2013 Basking Surveys

The basking surveys conducted on the East Pearl River on 25 April 2013 are reported in the attached Excel spreadsheet ("Stennis_all_GPS_points_Compiled_20FEB2014.xls) and occurred in three stages:

1. We drove the Powerboat and towed the canoe upstream from Stennis WMA Launch upstream to above the Old Rt. 11 Bridge; Points #9 - #43 are all collected from the Rt. 11 Bridge and upstream. Points #42 and #43 on the Google Earth image are located at the Old Rt. 11 Bridge crossing. Although some of this river region was outside the study area, we wished to make observations of map turtle abundance upstream of the Stennis WMA.





The abundance of sandbars increases upstream of the Old Rt. 11 bridge.
 The powerboat part of the survey—Points #9- #43: 1115 AM-1305 PM

Total turtles seen: 114

Total Species:	4
Ringed Maps:	11 (1 was a known large female)
Pearl Maps	9 (3 were known large females)
Unidentified Maps	35
River Cooters	1
Softshell sp.	1
Unknown Turtles	57

We note that quite a few turtles were unable to be identified as we were traveling fast in the powerboat. Of interest, few River Cooters were seen upstream of Old Rt. 11 Bridge relative to the downstream stretch.

2. On the powerboat ride back downstream (Old Rt. 11 back to the WMA Launch), two Navy wildlife biologists each counted the number of turtles they saw. Each counted separately, and the powerboat certainly was likely to disturb turtles

Two separate counts:
45 and 61 turtles seen, respectively

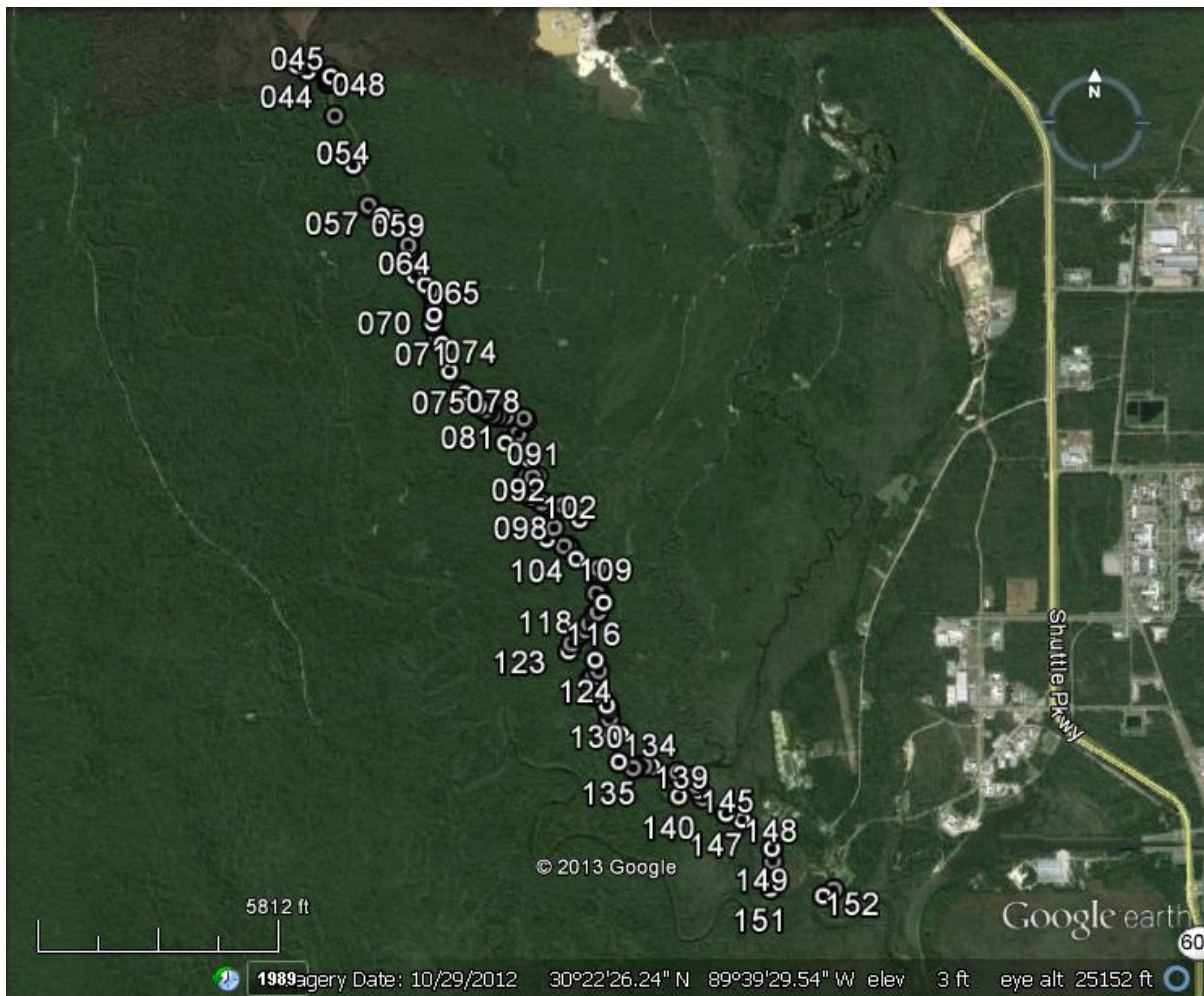
3. Canoe downstream from Old Rt. 11 Bridge back to the WMA Launch, 2 UGA biologists in the canoe, floating and counting turtles (1330-1530 PM)
No other boats were seen on the East Pearl River during our survey float.

The canoe part of the survey was conducted from Points #44 to #153:

Total turtles seen: 137

Total Species:	4
Ringed Maps:	43 (7 known large females)
Pearl Maps	25 (13 known females)
Unidentified Maps	25
River Cooters	16
Softshell sp.	5
Unknown Turtles	23

All turtle location points are assigned a GPS (UTM) on the attached Excel file).



Although the Google Earth map above is rather general, turtles are distributed along the entire stretch of the East Pearl within the boundaries of the Stennis WMA. Point #44 is upstream at the Old Rt. 11 Bridge and Point #153 is at the mouth of the lower WMA Boat Launch. Both species of map turtles were observed, and more importantly both sexes of map turtles were observed. River Cooters and Softshells became more abundant in the downstream survey reaches.

Part 3: Turtle Nesting use of Navy Target Beaches and Natural Sandbars

The goal of nesting surveys in June 2013 was to determine use of open canopy Target sites along the riparian border of the East Pearl and Mike's Rivers. We traveled upstream by powerboat and stopped at all the Target Sites and sandbars that had been previously noted in October 2012 and April 2013. These Target Sites had been previously assigned a number that matches the GPS identifier in the accompanying Excel file. Thus, Target Site 117, for example is GPS Point 117 in the Excel file.

Specific goals were:

1. Determine if Target Sites are being used by turtles for nesting
2. Assess whether these target area might benefit from some habitat management, including the addition of sandy dredge spoil to enhance nesting habitat.
3. Identify particular Target Sites that are more easily accessible than others by trails and dirt roads.
4. Assess the feasibility of conducting habitat improvement options on natural sandbars, including the use of mechanical removal and herbicide to remove invasive and/or encroaching woody vegetation.

East Pearl River Target Sites



Target Site 117. This site had two large metal boxes on the top of the steep riparian bank. It is a well-drained site above the water level on 26 June 2013. The bank seems steep and difficult to access, yet we found predated turtle nests on the top of the bank. The canopy was not that open. This Target Site is not easily accessible by any roads.





Target Site 110 contained four metal target boxes and the riverbank was a steep incline. However, we found three depredated (presumably by raccoons) turtle nests on the flat topped, open canopy area. This target site has an open canopy, including the 4 metal target boxes. The nests were near to the top of the bank. This site would be a high priority for adding dredge spoil sand to improve the nesting site characteristics. This site would benefit from re-sloping the access from the river. However, road access is a limiting factor at this site.



GPS Point 94 is a low, natural, tallow-dominated sandbar. It was noticed on multiple trips (named "Raise1" in June 2013) and referred to as Points 93 and 94 in April 2013. This site could be targeted for tallow tree removal.



Targets 85 and 87 are small target sites. The sites are flat and have grasses, vines, and poison ivy. They are not used very often for target practice.



Target Site 88: This site has a gentle slope to the water's edge which would facilitate access for nesting. A potential enhancement could be to increase the open area of the canopy to perhaps triple its current size. Addition of sand would provide a better nesting substrate. Marion Fannaly suggested the creation of a "coffer" dam at this site. This would be at the base of the slope to the water and would keep the bank sediment from washing away. The coffer dam would act as a bulwark and create a sloping beach. It seems unlikely that this site floods, except in a 100 yr flood. The lip of the bank edge is two feet higher than the dirt access road behind. The Navy might be willing to enhance this site, and we could study it to see if it really resulted in an increase in turtle nesting use.



Target Site 85: This site had a nice open canopy with a sand substrate. There was evidence of at six nests at this site. At least three nests on the lip of the bank and three other nests beyond the dirt access road. Hogs had dug up quite a few nests. Some additional sand could be added with relative ease at this site, due to the proximity of the dirt road. The turtle basking survey data from April 2013 documented quite a few turtles between Targets 88 and 85 (see Google Earth map above).



Target Site 80 is a shady site with an eroded bank. It has the metal Jeep as one of the targets. We did not observe any turtle nests here.



Target Site 75 was identified as the metal boat target beach. A large basking softshell turtle dove from the top of the bank as we approached. Inspection revealed that she had been digging a nest. This is a nice open area. The addition of sand would enhance this site. A coffer dam could help minimize the erosion here.



Target Site 73 is illustrated with the metal helicopter. It has a nice gentle slope to the water. Some recently downed trees have opened the canopy. The ground is primarily hard packed clay; it would benefit from the addition of sand. A few nest attempts seemed abandoned, not predated. There were numerous rubber bullets in the pine trees at this site. These trees will soon fall and aid in opening the canopy.

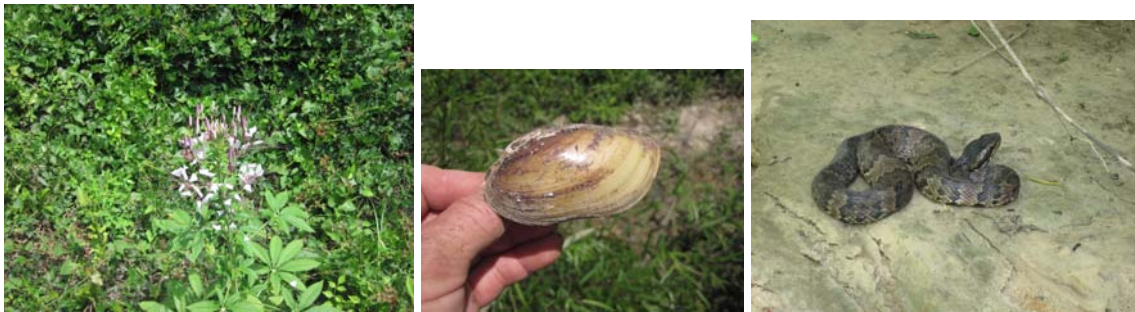


Target Site 70 (GPS: 243314 3364631) was identified with a metal sign. It was a very steep access from the water to the top of the riparian flat. No nests were found. It may be too steep for a turtle to access. Target Site 70 is only a few hundred meters downstream of the Fish Camp. Marion Fannaly (pers comm.) has noted quite a few Ringed Map Turtles on the deadwood between Target Site 70 and the Fish Camp, however.

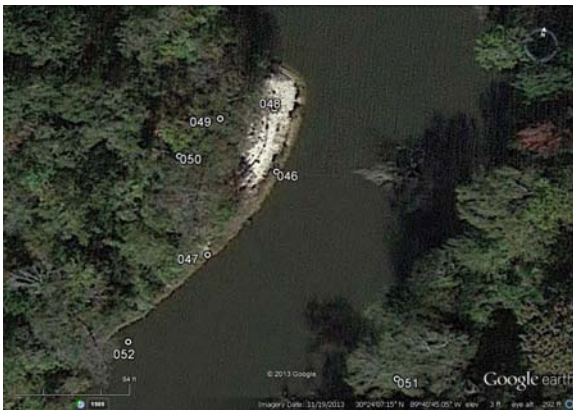


The Fish Camp Site (GPS Point #65). There is an opportunity to add sand and open some canopy at the Fish Camp site. A new boat ramp access point was being constructed during the June 2013 period. We observed several predated turtle nests on the slope leading up from the river to the chain link fence. One of those nests was clearly made by

a River Cooter, as it contained a main nest chamber flanked to the left and right by single egg satellite nests (see photo directly above). Three other nests along the chain link fence were observed. The Fish Camp (GPS Point #65) could make for a nice nesting site, but has big trees that the Navy might not want to cut down; it is somewhat shady. But turtles do nest along the fence and possibly inside the compound. If the dismantling of the Fish Camp is planned, then there would be a very nice open area on that site.



Spiny Coneflower Sandbar Site. (GPS point: “hih bar”) We named this site for the attractive, although non-native purple-flowered plant that was abundant there. We also found live mussels, as well as observed a Cottonmouth (*Agkistrodon piscivorus*). There is a large old sandbar on the east side of the river just north of the Fish Camp. We discussed clearing the encroaching vegetation. Although it is rather low in elevation near the river, it has silty, sandy soils. In addition to the spiny coneflower, trumpetvine and blackberry was present. It might be possible to spray herbicide (Roundup) in the early Spring, and perhaps burn. There appears to be access from the Fish Camp. We suggest keeping the willow trees at the rivers edge, but then clear all the invasive plants back to the riparian forest tree line.



Pearl River Wildlife Management Area Sandbar Site (GPS Point #52). The natural sandbar found at this location is the most frequently used turtle nesting site within the boundaries of the Stennis WMA. The site currently has an abandoned bed cot on it. Although located on the west side of the East Pearl River, and thus not on Navy property, this site could be jointly managed. Many turtles are nesting in the small open sunny area. It would be possible to remove some of the river birch trees to increase the open canopy. Currently, there is a minimal amount of invasive vegetation. This site could be a focal point of continuing research to monitor use of the site by nesting turtles, including protection of nests from predators, if appropriate. We suspect that this sandbar (Point #52) is an important resource for the map turtles using the Stennis WMA.



Raccoon tracks flanking turtle tracks from water's edge to nest site and back. This photograph was not taken on Stennis WMA, but on another Gulf Coast River and illustrates the effectiveness with which raccoon's locate map turtle nests.

At least 30 nest depressions were found in the open sandy beach section (Sandbar #52) on 26 June 2013. That portion of the sandbar had been underwater 4 weeks previous to that site visit (M. Fannaly, pers comm.), so the peak turtle nesting occurred in early June. We could install wildlife cameras on this site to monitor turtle nesting use and potential predation. There is also a large collection of deadwood snags directly across the river from this nesting site.



The Old Rt. 11 bridge demarcates the upper limit of the Navy's Western Maneuver Area (WMA). There is a potential old sandbar immediately downstream of the bridge on the east side bank. The Navy may acquire this property within the next year or so.



North of Old Rt. 11. Identified as GPS: 4Softsh7NST. We stopped our nesting site survey at this site north of the Rt. 11 bridge. We found 7 predated nests with elliptical eggs, likely map turtles. We also saw 4 basking softshell turtles here.



Mikes River: Dredge Spoil Target Site



Mike's River Dredge Spoil Target Area, 26 June 2013. This site, although previously man-made, was visited on each trip to the Stennis WMA. It is clearly used for turtle nesting. It likely attracts female turtles from the lower portion of the East Pearl as it is close to the confluence of the two rivers, and it is the only large nesting area available on Mike's River.



Mike's River Dredge Spoil Target Area. See additional management recommendations in Part 2.



Mike's River Dredge Spoil Target Area. This man-made site likely remains open because of human foot traffic resulting from Navy training. The spoil pile was created by dredging of the adjacent logging boat slip around 1900.



Pearl Map turtle basking on log at entrance to Mike' River, 26 June 2013, and within sight of Mike's River Dredge Spoil Target Area

General Conclusions

Occurrence

Ringed Map Turtles occupy the WMA section of the East Pearl River. A population demography that includes male, females, and juveniles exists there. Ringed Map Turtles are more abundant in the upper stretches where sandbar habitat becomes more abundant; however, the deadwood used as basking habitat exist throughout the WMA stretch, and eroding banks, both from natural processes, as well as that contributed by Naval Boat training, help add this component to the river's aquatic structure.

Mike's River may function as secluded nursery habitat for juvenile ringed map turtles, and some turtles likely use this small bayou-like tributary of the East Pearl. However, the shaded, deeply wooded characteristics of the riparian habitat, as well as the disturbance (overwash) from Navy Boats in this small confined tributary, mean that Mike's River is not ideal habitat.

Pearl Map Turtles also occupy the East Pearl River, and males, females, and juveniles were observed along its length within the WMA.

Habitat

Two important habitat features are required by map turtles along Gulf Coast Rivers. These included an abundance of deadwood for use as basking structure. These features exist as the natural flow of the river undercuts river banks in the outside curves, and riparian trees fall into the river. This is a natural process that map turtle exploit. Deadwood in the river also provides the substrate for mayflies, caddisflies, and other aquatic invertebrates, which are preferred food items for juvenile and the smaller male map turtles. Deadwood habitat exists in the Stennis WMA.

Sandbars are used as the primary nesting habitat by map turtles. These habitat features form on the insides curves of the river where the slowing current deposits sediment, rather than undercutting and eroding the banks. The river current slows and the East Pearl widens in the lower reaches of the East Pearl WMA, and sandbars are less abundant here than upstream of the WMA. However, natural sandbar nesting habitat does exist, on the Stenis WMA although the best sites are on the western banks of the east Pearl where the property us owned by the Mississippi Department of Wildlife.

Nesting

There was abundant evidence of nesting by map turtle along the WMA stretch of the East Pearl River. The most abundantly used sites were found, as expected on the sandbar exposures on the inside curves of the river (see Sandbar #52). As mentioned above, natural sandbar habitats within the WMA are somewhat limited, particularly in the lower reaches. However, open canopy area in the riparian forest created by Naval Target practice, even when on the outer curves of the river, resulted in habitat that showed evidence of use by nesting turtles (specifically, Targets 117, 110, 88, 85, 80, 75, 73, and the Fish Camp). The open canopy areas are likely attractive to map turtles, and offer opportunities for enhancement as nesting sites.

Along the lower stretch of Mike's River, the man-made spoil pile shows clear evidence of use by nesting female turtles. This site, which mimics a natural sandbar, presents a significant opportunity for management and enhancement of nesting habitat along the lower portion of Mike's River and its location near the junction with the East Pearl at the lower portion of the WMA presents a real opportunity for turtle habitat enhancement.

Literature Cited

Buhlmann, K.A. and J.W. Gibbons. 2006. Habitat management recommendations for turtles of conservation concern on National Wildlife Refuges. Unpublished Report to the National Fish and Wildlife Foundation, Washington, D.C.

Cagle, F.R. 1952. The status of the turtles *Graptemys pulchra* and *Graptemys barbouri*, with notes on their natural history. *Copeia* 1952: 223-234.

Ennen, J.R., J.E. Lovich, B.R. Kreiser, W. Selman, and C.P. Qualls. 2010. Genetic and morphological variation between populations of the Pascagoula map turtle (*Graptemys gibbonsi*) in the Pearl and Pascagoula Rivers with description of a new species. *Chelonian Conservation and Biology* 9: 98-113.

GSRC. 2012. Field Summary Report: Inventory of Rare, Threatened, Endangered, and Invasive Species. Naval Construction Battalion Center (NCBC) Gulfport, Stennis Western Maneuver Area, Stennis Space Center, Mississippi (Revised Final). Gulf South Research Corporation, Baton Rouge, LA. Contract No. N62467-04-D-0167. April 2012.

Jones, R.L. and P.D. Hartfield. 1995. Population size and growth in the turtle *Graptemys oculifera*. *Journal of Herpetology* 29: 426-436.

Lindeman, P.V. 1998. Of deadwood and map turtles (*Graptemys*: An analysis of species status for five species in three river drainages using replicated spotting scope counts of basking turtles). *Chelonian Conservation and Biology* 3: 137-141.

Lindeman, P.V. 2013. The Map Turtle and Sawback Atlas: Ecology, Evolution, Distribution, and Conservation. University of Oklahoma Press, Norman, OK. 460 p.

Lovich, J.E. and C.J. McCoy 1992. Review of the *Graptemys pulchra* group, with descriptions of two new species. *Annals of the Carnegie Museum* 61: 293-315.

Moore, M.J.C. and Seigel, R.A. 2006. No place to nest or bask: effects of human disturbance on the nesting and basking habits of the yellow-blotched map turtles (*Graptemys flavimaculata*). *Biological Conservation* 130: 386-393.

Selman, W. and C.P. Qualls. 2011. Basking ecology of the yellow-blotched sawback (*Graptemys flavimaculata*), an imperiled turtle species of the Pascagoula River System, Mississippi, United States. *Chelonian Conservation and Biology* 10 (2): 188-197.

Shively, S.H. 1999. Survey for the Ringed Map Turtle (*Graptemys oculifera*) in the Bogue Chitto River, Louisiana. Unpublished report to the Louisiana Natural Heritage Program, Baton Rouge.