NM WRRI Student Water Research Grant Final Report

1. Student Researcher: Francisco Rodriguez
   Faculty Advisor: Dr. Ivana Mali

2. Project title:

Nesting ecology of the Rio Grande Cooter (Pseudemys gorzugi) on the Black River, New Mexico

3. Description of research problem and research objectives.

Most aspects on the nesting ecology of the Rio Grande cooter *(Pseudemys gorzugi)* are unknown at this time. With the lack of understanding of crucial components of nesting behavior (i.e., seasonality, nesting habitat, nest structure, hatching success, etc.) it is impossible to implement any protection and management practices of the river and the nesting grounds. This freshwater turtle is already negatively impacted by the river flow alterations such as dam construction and channelization, which can affect resource availability. The objectives of this study are to address the missing components of species life history and provide recommendations for proper riparian habitat management.

Currently, the Black River, an ~87km tributary of the Pecos River in Eddy County, New Mexico, is the only known system where *P. gorzugi* juveniles are captured and observed annually. Although knowledge on *P. gorzugi* ecology has increased in the past five years, information on some aspects of its natural history, such as reproductive ecology, are still lacking. The objectives of this project are to: (1) gather information on the nesting ecology of *P. gorzug*i, (2) locate and monitor nests to reveal predation levels and hatching success, and (3) assess any interactions between abiotic factors and nest dynamics of *P. gorzugi* on the Black River, New Mexico.

To achieve these objectives, we will conduct pedestrian surveys in search for nesting *P. gorzugi* females and fresh nests on the Black River where small juveniles have been readily captured via hoop-net traps. The purpose of this will be to observe and locate female nesting site selection with the aid of Global Positioning System (GPS) technology. This will help us understand and differentiate between suitable and unsuitable nesting sites. This study will also assess the impacts that natural disturbances (e.g., wildfire, flood, etc.) have on female nest site selection. In addition, it will also reveal important behavioral aspects that the females may exhibit during gestation and nesting.

Nests will be monitored using game cameras to assess successful hatching rates and possible predation levels. The game cameras will help determine how many days after oviposition these nests are being visited by predators. This will help determine at what stage in incubation the nests require protection and to what degree. In addition, game cameras will also simultaneously reveal specifically what predators are primarily feeding on *P. gorzugi* nests. Predator exclusion devices will be installed to prevent predation of nests. The game cameras will be significant because they will determine the type of exclusion device that will be used and for what predator. Furthermore, the game cameras will also record the hatching success of each nest that is found. Understanding hatching success of each nest can help determine the average input per nest into the local population. It will also help determine hatchling mortality in accordance with predation, abiotic factors, nest site selection, etc.

4. Description of methodology employed.

Turtle Capture and Survey

Research was conducted in collaboration with the Bureau of Land Management and private landowners who have previously granted permission to river access. The New Mexico Department of Game and Fish research permit has been obtained (authorization #3621) as well as Eastern New Mexico University IACUC permit (2019-0226-01A2). To capture gravid females, fifty hoop-net traps were set approximately 5-10 meters apart and stretched open using homemade wooden poles that have been modified to fit the traps with applied tension. Floating devices were placed inside the open trap to prevent any turtles from drowning or injuring themselves. The hoop net traps are made of fiberglass, have a diameter of 50.8 cm, are single throated, and have a wide mouth. Hoop-net traps consist of four hoops that will open the trap from 122-137 cm depending on the trap. Traps were baited using canned sardines and romaine lettuce. Sardines were placed into a small non-consumable plastic container that is drilled with holes to allow for scent dispersal and prevent turtles from consuming the sardines. The lettuce was placed in every third trap and will be free-floating inside the trap. Traps were tied to live vegetation to hold them to their spots and GPS location will be recorded using a handheld device. The work was done from May to August 2021, with most pedestrian surveys conducted in May and June based on previous research. Simultaneously with pedestrian surveys, additional hoop-net trap surveys were conducted to assess reproductive status of adult females (by palpation). Similar trapping efforts were replicated in an effort to retrieve GPS telemetry units from females after nesting has occurred and can be confirmed.

GPS Attachment and Operation

Any female turtles with a minimum straight-line carapace of 185 mm were inspected using an E.I. Medical Imaging portable ultrasound to determine if the female is gravid. The diameter of the follicles was measured to determine if the female will develop shelled eggs further into the breeding season based on previous assessments of *P. concinna* (>10 mm and >15 mm). Females with shelled eggs were taken into our facilities and a GPS telemetry unit (Q4000ER V.130; Advanced Telemetry Solutions Inc.) was attached to the carapace using PC-11 Epoxy. This GPS telemetry unit recorded the turtle's location every 40 minutes until the batteries are completely drained (approximately 2-3 months). The turtle must be above water for the GPS location to be recorded; VHF will work underwater (to certain depths). The GPS telemetry unit will emit both GPS location points and very high frequencies (VHF) for tracking. The GPS points were collected remotely using a small handheld base station, which will transfer GPS data remotely into and out of the GPS telemetry unit attached to the female turtle. Stations downloaded GPS data from any telemetry recognized GPS device within range. It contains two antennas, one for short-ranged transceiver and another for long-ranged transceiver. Battery life is limited on GPS telemetry units so a continuous battery life calendar was uploaded to ensure optimal data collection pre- and post-oviposition. Base stations were placed in high elevation areas to ensure that GPS data transfers are maximized.

Raw GPS data was uploaded to the manufacturer’s software (Collar SW 2.92 software) and later analyzed using Google Earth to map out GPS coordinates. When a 3-D GPS location has been recorded using ≥ 6 satellites in the field then its position was considered accurate with a

location error (LE) of 4 – 17 m. All GPS point locations with ≥ 6 satellites were surveyed the following day after data are downloaded from base stations. Base stations were left out in the field all day and recovered in the late evenings for battery recharge and data download. The GPS location points with higher satellite count will reflect more accurate positioning. Anything below 6 satellites was considered arbitrary and ignored during data collection. Then, GPS points were surveyed the following day to ensure location success and avoid any disruption and/or predation. After females were assumed to have undergone oviposition, an effort was made to recover GPS telemetry units using hoop net traps and basking traps (where applicable).

Nest Location and Exclusion Devices

When nests were located, game cameras were installed (Campark Trail Camera T70) by attaching them to 6-foot t-posts and positioning the cameras at a 45-degree angle facing the nest. A predator exclusion device was placed on the nest for the duration of the incubation period to deter predation and record predator visits/predation. The predator exclusion device included 17-25 dowels that were pushed vertically into the ground and through a 50 sq cm metal mesh in a birdcage design. This design allowed for no temperature fluctuations between the inside of the nests and exterior conditions. Game cameras were placed approximately 1-2 m from the nest and were examined every 3-4 days for proper function. After nest visits from predators subsided (based on game camera data), cages were removed, and eggs were allowed to successfully hatch with game cameras still in place. During this time, nests were visited weekly until successful hatching occurred. After successful hatching, nests were excavated to determine hatching success and mortality rates.

5. Description of results; include findings, conclusions, and recommendations for further research.

Nests

Ten gravid females were used for GPS tracking. A total of 5 nests were located and PEDs were installed. Females constructed nests 1-5m away from the water. Game cameras revealed raccoons as primary predators. On August 1st, 2021, PEDs were removed from all nests following heavy rainfall and flooding on the Black River. On September 10th, 2021, nests were excavated to check the status of the eggs. Three nests were found to have suffered egg mortality. It is speculated that these nests were directly impacted by the flooding conditions in late June. The fourth nest that was excavated contained 5 live hatchlings, 1 dead hatchling (closest to the surface), and 1 egg mortality. Given heavy rainfall events in the days prior and uniform size of 6 hatchling turtles, we suspect that one hatchling died while trying to emerge from the nest (the mouth of the hatchling was full of dirt). The fifth nest contained intact eggs; this nest was covered, and the game camera adjusted in order to record the hatching event. On September 16th, 2021, the final nest hatched with a 100% hatch rate. We found five intact nests and 14 predated nests. *Pseudemys gorzugi* females were found nesting from Mid to late June, between 07:00 am and 02:00 pm. Nests were constructed close to the water (mean = 3.8 m; SD = 2.5 m) than expected. Two out of five non-predated nests successfully hatched. Eggs had an incubation period (IP) of 78 and 91 days. Both intact nests hatched in September. Mean hatchling size was 31.6 ± 0.5 mm plastron length. Nests were only found on the bank of the river that suffered from a

wildfire in March 2021. Egg mortality in the other nests can be attributed to flooding events endured in late June.

Predation

Nests were visited primarily by racoons (*Procyon lotor*). Predator (i.e., raccoon) nest visits were the highest immediately after oviposition, declined in late July and were no longer reported after July 23rd (~38 days after oviposition). Although none of the protected nests suffered predation, 14 nests were reported throughout our surveying which suffered predation. Nests that were protected using PED were visited most frequently in the early hours of the evening (between 8:00pm and 10:00pm). No other predators were observed throughout incubation of the nests.

6. Provide a paragraph on who will benefit from your research results. Include any water agency that could use your results.

This study is the first to report nesting habitat and hatching success for the Rio Grande cooter in the wild. The results of this research will provide insights into the nesting habitat, site selection and hatching success of Rio Grande cooter, that will interest natural resource agencies and research institutes such as New Mexico Department of Game and Fish, Bureau of Land Management, US Fish and Wildlife Service, and Carlsbad Soil and Water Conservation District. This research will direct riparian habitat conservation and management as well as provide important insights into the effects of water quality and river flow on survivorship of the earliest and most vulnerable stages of the species life cycle. Our results indicate that occasional flooding of the river may have negative consequences on egg survivorship and warrants further investigation. These conclusions can likely be extrapolated to other river systems where *P. gorzugi* occurs. Overall, this research integrates riparian habitat investigations with river flow monitoring to understand species success.

7. Describe how you have spent your grant funds. Also provide your budget balance and how you will use any remaining funds. If you anticipate any funds remaining after May 19, 2022, please contact Carolina Mijares immediately. (575-646-7991; mijares@nmsu.edu)

Thus far, funds have been used to cover tuition for the Fall 2021 and Spring 2022. The remainder will cover Spring 2022 travel expenses. (Approx. $1,800.00 remaining balance)

8. List presentations you have made related to the project.

Joint Annual Meeting of New Mexico and Arizona Wildlife Society Annual (2022), New Mexico Water Resource Conference (66th Annual) (2021).

9. List publications or reports, if any, that you are preparing. For all publications/reports and posters resulting from this award, please attribute the funding to NM WRRI and the New Mexico State Legislature by including the account number: NMWRRI-SG-2021.

10. List any other students or faculty members who have assisted you with your project.

Laramie Mahan (Graduate Student), Sierra Shoemaker (Undergraduate), Jodie Montgomery (Undergraduate), James Alles (Undergraduate), Li Zheng (Undergraduate) Jaecy Banther-McConnell (Graduate Student).

11. Provide special recognition awards or notable achievements as a result of the research including any publicity such as newspaper articles, or similar.

No special recognition or achievements have been awarded thus far.

12. Provide information on degree completion and future career plans. Funding for student grants comes from the New Mexico Legislature and legislators are interested in whether recipients of these grants go on to complete academic degrees and work in a water-related field in New Mexico or elsewhere.

Degree competition is anticipated in May 2023 followed by the pursuing of a Doctoral Program in the Fall of 2023 in area(s) Wildlife Biology, Landscape Ecology.

You are encouraged to include graphics and/or photos in your draft and final report.

Figure 1. A picture of a gravid female *P. gorzugi* caught on the Black River in May 2021, with attached GPS transmitter to study nesting timing and nest site selection. The GPS transmitter is attached to the lower scutes (using Epoxy-11) of the carapace and the two antennas (GPS and VHF) are wrapped around the carapace towards marginal scutes.

Figure 2. A picture of several eggs of *P. gorzugi* inside of the nest chamber along the Black River. The nest was purposely excavated in September 2021 in order to check on the condition of the nest after the flooding events in late June. This is one of the two of five monitored nests that survived.

Figure 3. A picture of a Predator Exclusion Device (PED) installed on top of a *P. gorzugi* nest on the Black River. PED was installed in June 2021 shortly after oviposition to protect the eggs from predation.

Figure 4. A picture of two hatchling *P. gorzugi* found inside the nest in Mid-September 2021 on the Black River. These were the last two hatchlings found inside of the nest chamber in addition to shell fragments. The rest of the eggs hatched one day earlier, which was recorded by the game camera.