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Monitoring and Detection of Gulf Sturgeon During a Bridge Deconstruction Project in Pensacola Bay, Gulf Breeze Florida

by
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for
Tetra Tech Inc. and the City of Gulf Breeze

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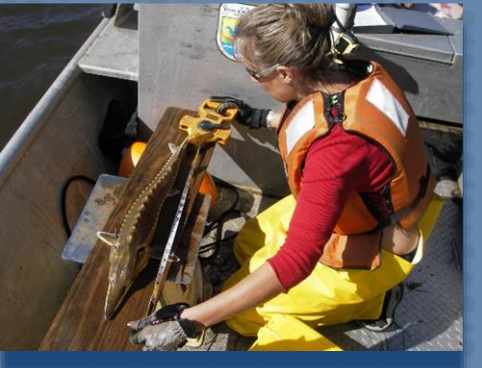

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Executive Summary

This report was created for the Tetra Tech Inc. and the City of Gulf Breeze, to monitor the presence of the sturgeon during the deconstruction the Pensacola Bay Bridge. The deconstruction site is the old fishing pier and once the old three-mile bridge of Highway 98 and connected Gulf Breeze in Santa Rosa County with the City of Pensacola in Escambia County. When Highway 98 was reconstructed on a more modern bridge in 1960, several sections in the center of the original bridge were removed from the navigation channel of Pensacola Bay. Removal of these sections resulted in the splitting of the bridge into two sections, each of which assumed the role of a fishing pier within their respective communities. The 1.5-mile fishing pier (7,350 feet) was damaged during Hurricane Ivan by high winds and storm surges and was determined to be irreparable (FEMA 2009). The bridge was the responsibility of the City of Gulf Breeze. All work was done in accordance with all local, state, and federal regulations.

Introduction

Monitoring activities of the Gulf sturgeon, *Acipenser oxyrinchus desotoi*, were conducted using Vemco receivers designed to detect the telemetry transmitter tags were surgically implanted in the body cavity or abdomen of the Gulf sturgeon. The tags are used to monitor the migration of the Gulf sturgeon from September to May of each year.

In Florida, environmental regulators have restricted projects from September to May because of the protected Gulf sturgeon. The Gulf sturgeon were designated as threatened species since 1991. This restriction is for marine waters and marine construction projects. During this period construction may disrupt migratory patterns when the fish leave the freshwater systems to overwinter in the marine systems where feeding occurs. The sturgeon has a life span of 20-25 years, can grow up to 200 pounds with a length of 4 to 8 feet long. Not all Gulf sturgeon will enter the Gulf to overwinter, but some adults and most sub-adults and juveniles will remain in the bays to overwinter and feed (Paruka pers comm.). Some these areas frequented by the Gulf sturgeon could be impacted by constrcution. The Pensacola Bay Bridge area is believed to contain a rich foraging ground similar to other coastal locations for the sturgeon. Previous studies have shown sturgeon prefer deep water holes near the pass and but prefer shallow shoals. 1.5-2.1 m deep (Craft Et al 2001). A deep-water navigational channel is under the Pensacola Bay bridge, and it has been speculated the sturgeon travel within the deeper channels (Slack et al. 1998).

Environmental regulators in US Fish and Wildlife and National Marine Fisheries of NOAA allowed The City of Gulf Breeze a waiver of consent to perform the deconstruction of a fishing bridge during the Gulf sturgeon migration in agreement to monitor the sturgeon activity using receivers to detect any tagged sturgeon. It was essential to begin construction promptly. The City of Gulf Breeze fishing bridge was destroyed by storms. Hurricane Ivan in 2004, rendered the remaining standing structures unsafe for the health, safety, and welfare of the general public. The sections of the bridge removed would be used as an artificial reef in the Gulf of Mexico within the Escambia County jurisdiction.

The US Fish and Wildlife Service biologists surgically implanted 140 Gulf sturgeons with acoustic transmitters during the late fall of 2009 and 2010 within the Escambia, Blackwater, Yellow River, and Choctawhatchee System. Delaware State University researchers equipped 95 Gulf Sturgeon with internal acoustic transmitters collected during the same period in the Choctawhatchee River. The tags were detected during various times of the day. The detection times were cross-referenced with the construction hours to determine whether the sturgeon were present in the area of deconstruction. Quality control data from the deconstruction project were cross-referenced to verify the construction activity times. Benthic surveys, March 2008, in the nearby areas, such as Deadman's Island in Gulf Breeze, Florida, have shown some sites in Pensacola Bay contains an excellent foraging food supply within the sediment, so it was very likely sturgeon would be detected in the area (ECS 2008, Edwards 2003).

Objective

The primary purpose of the monitoring was to determine whether the deconstruction project had an adverse impact on the migration patterns of the Gulf sturgeon. Additional objectives were to

determine if the sturgeon will avoid the area of construction during the time of operation, and to quantify the number of tags detected within a triangulation pattern surrounding the deconstruction equipment.

Project site

The project site is located at the Pensacola Bay bridge between Pensacola and Gulf Breeze, based in Pensacola Bay within Escambia and Santa Rosa County, Florida. Pensacola Bay system has five watersheds draining into four rivers, Blackwater, East, Escambia, and Yellow River, which provide freshwater to the bay's system. These freshwater systems are where the sturgeon originates the seasonal migration to the marine waters and returns to the freshwater systems when the water temperatures increase (Heise et al. 2005). The Pensacola Pass, six miles away is the closest outlets to the saline waters of the Gulf of Mexico.

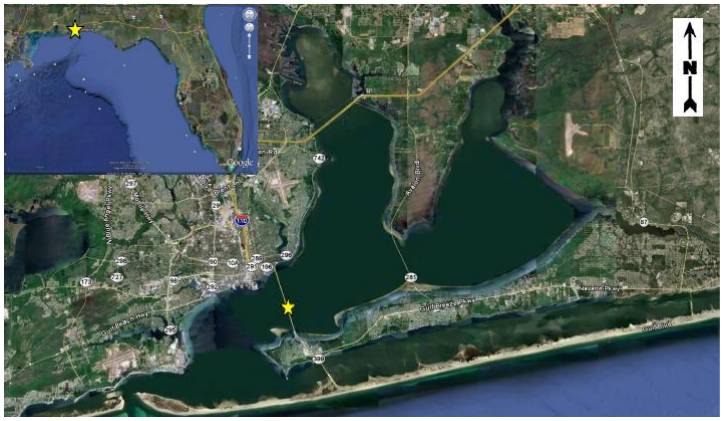

Fig. 1 Project site

Deconstruction Project

The deconstruction of the bridge consisted of removing the rebar, cutting the concrete pilings and connected slabs. The project was performed in sections and phases by removing the pier decking concrete slabs on top of the bridge first, along with the deteriorating metal frame work and then cutting the piling at the base of the sediment line. The cutting consisted of sliding a cutter down the support column for each section and cutting the column at the base of the bay's floor bottom. Each piece was removed by crane and placed on a barge and transported to either an upland site of offshore in the Escambia County jurisdiction by Escambia County Marine Resources to create and artificial reef system.

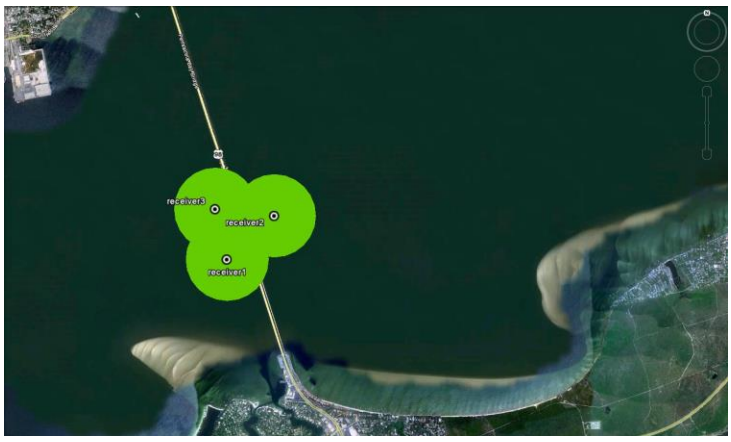

Fig 2. Receiver stations surrounding the deconstruction site

Materials and Methods

Three receiver stations located off the Pensacola Bay Bridge, in Gulf Breeze, Florida in Pensacola Bay, (Fig. 1) were monitored for the presence of the tagged acoustic telemetry transmitters found on sturgeon migrating from the Yellow River, Blackwater River, and Escambia Rivers into Pensacola Bay.

Receivers to detect the transmitters were placed, in a triangular shaped pattern, to surround the deconstruction area and

equipment. Range tests were performed to determine the appropriate spacing distance to allow an overlap in the triangular pattern of the receiver locations. The design had 100-meter radius overlap of all three buoys to assure the detection of the presence of the sturgeon within the deconstruction area. Periodically, the receivers were retrieved to download the data to the computer, mapped, and analyzed. The receivers were attached to solar powered lighted buoys which were maintained as needed. The receiver sensors were also maintained and cleaned periodically to prevent fouling and cause transmitters interference.

Buoy Receiver Station

Three buoy receiver stations were positioned to surround the deconstruction site at all times to set up a triangulation pattern and positioned to overlap detection ranges. As the deconstruction barge and equipment moved north or south alongside the bridge, the buoys would be relocated to maintain a triangulation around the deconstruction site. The buoy system contained a weighted, lighted buoy, a trawl float, receiver anchor, and buoy anchor. The buoy anchor secured the entire setup. The large trawling buoys were daytime, visual navigational aids. The solar powered flashing lighted buoy provided navigational visual aids at night. Instead of pulling the entire anchor systems, the receiver was attached to a separate line to allow easy access and retrieval. The receiver line is pulled onto the boat and wrapped around one of the side cleats of the vessel, and the receiver is activated for data retrieval onto a laptop. The entire anchor system was pulled out of the water only for relocation.

Depth

The depth range of the stations was 10 to 23ft from the water's surface to the bottom of the Bay. The average depth was 21ft. The northern deployment station was a constant 23ft. The deploying unit moved south, towards the mainland of Wayside Park, the depth decreased to 10ft.

Receivers

The receivers used were the VEMCO VR2W, with a memory available of 8 MB 69 kHz, capable of detecting over 1,000,000 detections, real-time clock, Bluetooth compatible communication, and battery life of fifteen months. Three receivers were used for this assessment. The receiver was set at a distance of ¾ of the current depth between the surface and bottom. The VR2W records the code from the transmitter's tag number, the date/time of valid detections, and sensor data. The information is stored in memory until downloaded from the receiver using Bluetooth wireless communication and a laptop PC running the VUE software provided by VEMCO (VEMCO 2011). A range test was conducted using an untagged transmitter on a tow line. Once the distance range was determined, the over lapping range was then tested for the best location with the triangulation pattern.

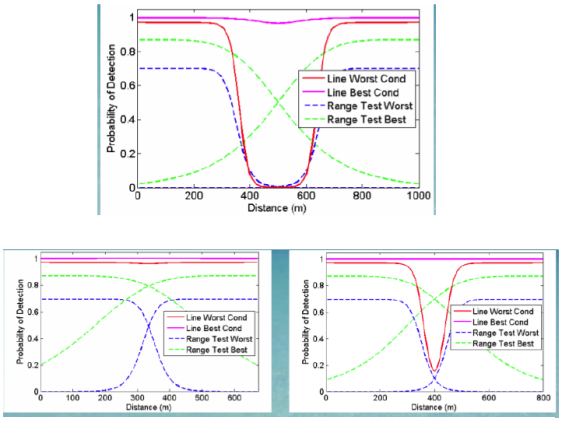

Fig 3. Range test comparison. Vemco receivers

Receiver Deployment Method
The buoy system was set up with an anchor on one line and receiver attached another line. Both lines were secured to an anchor. The receiver was placed at a distance of ¾ of the current depth between the surface and bottom within the water column.

Transmitters
The transmitter identification and sturgeon specifications information were provided by many agencies, which are currently, tagging the sturgeon in the Florida Panhandle area. The sturgeon are caught in the rivers and tagged with a transmitter, to monitor migration patterns. During this process, specifications such as size, age, sex, location, weight, and date of catch are recorded. When in range and depending on any interference, the transmitter data only pings the tag number to the receiver.

Results

General.
From the 144 transmitters detected during the project, a total of 82 transmitters were found within the triangulation pattern in the deconstruction site during deconstruction hours. The total number of pings were 130078 pings and 7096 detections at Station 1, 155465 pings and 7309 detections at Station 2, and Station 3 showed 46994 pings and 2181 detections.
The beginning months of the migration season showed the highest detections. October to December were 77 transmitter identifications, December to January (16), February (5), March to May (16). Only two transmitter Identification numbers were detected long-term in the area. Forty-six of the seventy-seven found from October to December did not return through deconstruction site area. It is not known if the sturgeon did not return to the rivers or returned to the rivers using another route. November showed the most number of transmitters detected fifty-eight and followed by March with forty-five transmitters. The average depth of the buoy stations was 19.4ft.

Normally oil exposure would not be addressed, however, due to the British Petroleum Deepwater Horizon Oil spill in 2010, it has been documented submerged and buried oil, currently with a petroleum organic hydrocarbon range greater than 400,000 (ppm), is present at the mouth of the Pensacola Pass and within Pensacola Bay (ECS 2010). It is unknown if this buried oil has an impact on the benthic foraging grounds of the sturgeon within the Gulf of Mexico or Panhandle Bay systems where the sturgeon are present.

Stations
Stations at the area varied in depth from 10ft- 22ft. Station 1 was the northwest buoy and range from 23ft- 19ft. Station 2 was the southwest buoy and ranged from 22ft to 10ft. Station 3 was the west buoy and ranged from 22ft-10ft over the seven months. The salinity and temperature were relatively constant among stations but varied throughout the months ranging from 28.3-13.2 ‰ and water temperature 75 F to 45F respectively.

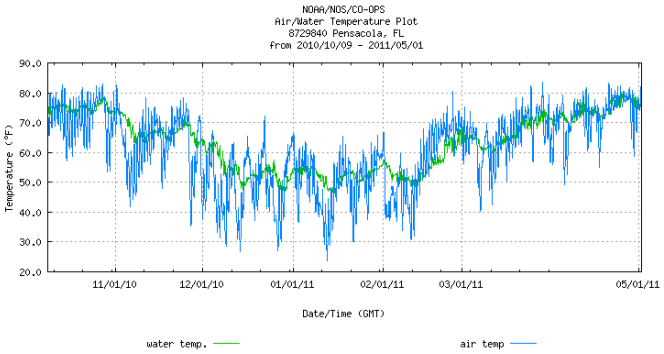

Fig 4. Air and water temperature from October 2010 to May 1, 2011

Station 1 were the deepest end of construction site along the northwest end of the bridge. Station 2 were the most shallow and station three was subjected to all depth ranges. Total numbers of transmitters increased at the deeper sites and were less at shallow sites. Station 1 showed a general trend of higher values at the deeper sites except for when relocated south as the deconstruction site moved south.

Area Comparison.

In comparing the transmitter detections surrounding the deconstruction site and the transmitter detections without the deconstruction site equipment being centrally located between the buoys, it was found there were more transmitter detections when the deconstruction barge was in the middle of the buoys than when it was absent. The detection of the transmitters varied during the months of the sturgeon migration season. October was the highest number of detections, and the transmitter detections did not increase again until March 2011.

Discussion

Detections

This study shows this project being a minor impact project, meaning minimal construction in the water was performed; this project showed no adverse impact on the Gulf Sturgeon migration for the season of 2010-2011. However, because there was a significant number of sturgeon present within the range area of each station, larger scale marine projects may conduct more in water disturbance in the deeper water. This observation shows construction time periods may have to be limited to avoid the months of late October to Early December when the sturgeon are leaving the rivers and March and April when the sturgeon are returning to the rivers.

Out of 144 transmitters, only four sturgeons stayed present in the site location within the bay. Two sturgeons stayed over a month, in the area. Transmitter tag number 61036 (January 22-March 13) and 61027 (Jan 19 –Feb 26) showed the highest number of pings at all three stations. Sturgeon tag #61036 showed 3568 pings, and # 61027 showed 1292 pings. These detections were within the range of the buoys but not always in the center of the triangulation pattern. This long-term presence could be speculated as, sense of safety of the barge, preferred food source around the barge or another unknown parameter. Temperature could be another factor.

Sturgeon migration patterns are triggered according to temperature (Heise et al. 2005). The temperature of the entire season ranged from 32 F to 79 F. The period from December 31st ,2010 to January 4, 2011, showed no transmitters were detected. During the Holidays, the barge was present

in the water. The air temperature, during this study, was 47 F, and the water temperature was 55 F.

The number of transmitters entering the triangulation pattern showed the sturgeon were passing through and continued their migration through Pensacola Bay. There was a significant amount of activity of true detections at night than during the day. After reviewing the number of actual detections occurring at night, it was first thought the sturgeon were more active at night than during the day. However, after analyzing the false detections during the day, there were an increased number of true detections at night, could be due to reducing anthropogenic noise levels, which can cause false detections. Anthropogenic noise levels such as cars from the bridge, boat and barge noises from recreational and commercial entities, caused interference from the echoing of the large concrete piling from the bridge and barge can also cause false detections and show the appearance of increased presence of the sturgeon. However, due to cross-referencing three receivers, the detections around the barge would most represent true detections of the presence of the sturgeon.

The number of transmitter detection pings did not correlate with the number of sturgeon transmitter identification detections. Interference such as boat engine noise, the concrete bridge, and pilings, car noise most likely created false detections. It was hypothesized the noise from the deconstruction equipment would deter the sturgeon. Since the deconstruction project mostly entailed above water on the bridge cutting and crane operation removal, there was no documentation given on actual dates of bridge work being conducted versus offshore bridge concrete debris placement or steel debris transport. The number of pings and detections were highest on the weekends; however, there was still receiver activity throughout the week and during construction. This could be noise pings from the increased traffic on the nearby bridge. Cross referencing the quality assurance data from the construction company of the days of actual work there was an increased number of detections on the days the construction was not being performed.

There was a period where the buoys could not be moved for two weeks due to rough weather. During this time, the equipment barge was out of the triangulation pattern. There were no detections during this time. This incident could be considered a minor control when setting up future projects. When the buoys were finally moved and triangulated around the barge, the number of pings from the transmitters of all stations were detected again. This time frame was around the highest return from migration timeframes. Therefore, the absence of transmitters outside the vicinity of the barge may show the sturgeon prefers the location of the large barge. This preference could be due to shadowing of the barge over the water, which could provide protection from predators or attract food sources.

The transmitter ID tags detected in 2010 for the migrating sturgeon coming from the rivers into Pensacola Bay were not the same ID tags detected in 2011 for the sturgeon returning to the rivers. As the tags were identified, the appropriate agency and owner of the tags were notified. A group of sturgeon tagged from Choctawhatchee was detected on the return migration to Yellow River, Black Water River and Escambia River (Fox et al. 1998). The group of sturgeon detected leaving from the three rivers were not detected in the early spring season. Due to the Natural Resource Damage Assessment (NRDA) processes regarding the 2010 Deep Water Horizon oil spill,

the identification and whereabouts of these tags were not allowed to be discussed at this moment.

Recommendations from lessons learned

Construction of marine projects during the sturgeon migration season

To be able to maintain the mission of the National Marine Fisheries Service and continue light construction projects during the sturgeon migration, the construction companies, consultants and other agencies should modify their construction plan to perform the "in water" tasks, such as piling placement, concrete pouring etc., outside of the sturgeon migration time frame and conduct "out of the water" tasks such as bridge placement over pilings, welding, setting frames, etc., during the migration period. This planning will help National Marine Fisheries evaluate the current rules and any adversely affected impacts during their project review process.

Project Techniques Improvement recommendations

Control

Transmitters were not present during the time frame the barge was not centrally located in the triangulation pattern. To effectively, attempt to ascertain the barge did or did not have an effect on the lack of detections during, this time, it would be recommended to place an identification transmitter on the barge as a control transmitter. Although construction noise and engine noise may interfere and cause false detections, the transmitter can be cross-referenced by the barge GPS location on the quality assurance data sheets.

Maintenance

Maintenance was an ongoing problem. In Pensacola Bay, as lines fouled with barnacle, hydroids, etc., the attached ropes became weaker as time progressed and could have led to lost receivers. It is recommended to change out the lines of the entire setup every four months to ensure the security of equipment.

Fouling of the receivers would also increase weight and weaken the secured lines. It is recommended after the final rope is attached to the receiver to use heavy duty duct tape and cover the entire receiver, accept the sensor glass and keyhole. Fouling can be reduced in these areas using nylon material secured by the duct tape. When the receiver units become fouled, the nylon, the tape (and fouling organisms) can be removed and disposed of and re-applied. This small amount of pre-maintenance will reduce the fouling maintenance to only the sensor eye and key holes of the receiver unit.

Receiver Deployment Method

Weather and waves can cause an inconvenience when using laptops on an open field boat, the laptop screen, and hinges and become damaged and when closed, can hibernate the program, causing a substantial delay in data retrieval, which can cause a trip to be unsuccessful in bad weather. It is recommended open faced covered waterproof PC notepads with Bluetooth capability being used for

retrieval and deployments in case of rough weather and waves.

Continued collaboration with other Agencies
Continued communication with regulatory, educational and field agencies can reduce duplication of efforts, increase productivity and provide sturgeon information and additional insight to an area of concern.

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