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Job No. TGL15223

ENVIRONMENTAL SENSITIVITY ATLAS STATUS REPORT
GLO CONTRACT NO. 15-181-000-8931

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Acronyms and Abbreviations

CBBEP	Coastal Bend Bay and Estuary Program
ESI	Environmental Sensitivity Index Atlas
FNI	Freese and Nichols, Inc.
NOAA	National Oceanic and Atmospheric Administration
PPA	priority protection area
RARNUM	Resources-at-Risk
SABF	San Antonio Bay Foundation
TCWS	Texas Colonial Waterbird Society
TGLO	Texas General Land Office
TNRIS	Texas Natural Resources Information System
TPWD	Texas Parks and Wildlife Department
USFWS	U.S. Fish and Wildlife Service

1.0 INTRODUCTION, PURPOSE, AND NEED

1.1 PROJECT PURPOSE

The Texas General Land Office (TGLO) contracted with Freese and Nichols, Inc. (FNI) to perform environmental sensitivity mapping services including updating the biological data layer for the lower Texas coast from the Colorado River tidal south to the Rio Grande and creating a priority protection area (PPA) layer for the entire Texas coast. TGLO also requested that data be collected and Resources-at-Risk (RARNUM) and PPA polygons be created for four new quad maps (Manson, LaSalle, Rincon Bend, and Willamar) not included in the most recent version of the Environmental Sensitivity Index Atlas (ESI). The work was conducted under TGLO environmental services contract, GLO Contract No. 15-181-000-8931. This project was necessary because much of the information in the ESI had not been updated since originally generated 12 to 20 years earlier.

This report describes sources of information used and decisions made to update the biological data layer and create the PPA layer for the ESI. In addition to this report, the following items are included in this product and it was sent electronically to Steve Buschang and Jeff Perkins, TGLO, on September 30, 2015:

- Geodatabase with updated PPA (with attribute table) and RARNUM shape files (generated by FNI),
- Microsoft® Excel spreadsheet containing updated biological data organized following National Oceanic and Atmospheric Administration (NOAA) schema for the lower Texas coast from the mouth of the Colorado River south to the Rio Grande,
- KMZ (geospatial) file of Texas diamondback terrapin distribution along the Texas coast, and
- Texas Colonial Water Bird Microsoft® Excel database.

1.2 TASK 1

- Review and draft revised PPAs for the Texas coast.
- Coordinate three information gathering meetings along the coast to obtain expert review and comment on draft revised PPAs.

Information gathered from the meetings and other information sources was used to modify boundaries of existing PPAs, delete PPAs, add new PPAs, and update attribute data for PPAs for the Texas coast. The geodatabase product generated includes:

- Revised PPA polygons,
- Revised attribute table, and
- PPAs for three of the four added quad maps (Manson, LaSalle and Rincon Bend). Experts recommended that PPAs not be created in the Willamar quad map.

There were several instances when two or more PPAs were merged into a new PPA. In all these instances, the highest priority designation of the merged PPAs was assigned to the new PPA.

- PPAs were renumbered in consecutive order from north to south and east to west

1.3 TASK 2

- Collect data to update biological information for the RARNUM polygons on the lower Texas coast from the Colorado River tidal south to the Rio Grande.
- Coordinate three information gathering meetings along the lower coast to obtain expert input on current biological conditions.

Information gathered from the meetings and other information sources was used to populate a Microsoft® Excel spreadsheet, referred to in the remainder of this report as the "biofile," with biological data for RARNUM polygons from the mouth of the Colorado River south to the Rio Grande. Although not part of this project, an attempt was made to update the biological data for the upper coast throughout the course of this project. This attempt was made to enhance comparability between the biological data for the upper and lower coasts. Data were compiled in a format intended to facilitate converting the data to the NOAA schema when the ESI is revised again.

Results from Task 2 include:

- Microsoft® Excel workbook with three spreadsheets:
    - Quality-assured version of the biological data for the lower coast.
    - Biological data for the upper coast which has not been completely quality-assured.
    - Spreadsheet with biological data combined for the upper coast (not completely quality-assured) and the lower (quality-assured) coast.
- RARNUMs were created for the Manson, LaSalle and Rincon Bend maps as requested. Based on expert recommendations, there were no RARNUMs created for the Willamar map.

2.0 BIOLOGICAL DATA UPDATE

Information was collected from a variety of sources to update the biological data associated with RARNUM polygons in the ESI.

2.1 MEETINGS

Meetings were held on May 12, 13, and 14, 2015 (Brownsville, Port Lavaca, and Corpus Christi, respectively) to update biological data in the ESI. Thirty-one people attended the meetings representing TGLO, FNI, TPWD, U.S. Fish and Wildlife Service (USFWS), Texas Department of State Health Services, San Antonio Bay Foundation (SABF), Mission-Aransas National Estuarine Reserve, and Coastal Bend Bay and Estuary Program (CBBEP) (Table 1). Participants provided verbal comments, which were recorded, and some hand written comments on copies of the ESI maps for the lower coast.

Three meetings were held on September 1, 2, and 3, 2015 (Corpus Christi, Dickinson, and Port Arthur, respectively) to get comments on the draft PPAs from the 30 experts in attendance (Table 1). Comments were also received on biological data at these meetings.

Table 1
List of Participants in Biological and PPA Update Meetings

Name	Organization	Email	Phone	Date*
Alonso, Dan	SABF	dalonso@sabay.org	830-660-4429	5/13/2015
Balboa, Bill	Sea Grant	bill.balboa@ag.tamu.edu	979-245-4100	9/2/2015
Barron, Robert	TGLO	robert.barron@glo.texas.gov	512-463-5305	5/12/15, 9/1/2015, 9/2/15, 9/3/15
Biggs, Heather	TPWD	heather.biggs@tpwd.texas.gov	281-534-0133	9/2/2015
Boyd, Norman	TPWD	norman.boyd@tpwd.texas.gov	361-553-9808	5/13/2015
Brown, Harmon	USFWS	harmon_brown@fws.gov	N/A	9/2/2015
Buschang, Steve	TGLO	steve.buschang@glo.texas.gov	512-431-2232	9/1/15, 9/2/15, 9/3/15
Buzan, David	FNI	david.buzan@freese.com	512-617-3164	5/12/15, 5/13/15, 5/14/15, 9/1/15, 9/2/15, 9/3/15
Clements, Pat	USFWS	pat_clements@fws.gov	361-994-9005 (x 225)	5/14/2015
Clevenger, Ryan	TGLO	ryan.clevenger@glo.texas.gov	361-552-8081	5/13/15, 9/1/2015, 9/2/15
Cupit, Willy	TPWD	willy.cupit@tpwd.texas.gov	956-465-9287	5/12/2015
Darcey, Johnny	TGLO	johnny.darcey@glo.texas.gov	409-727-7481	9/3/2015
Denton, Winston	TPWD	winston.denton@tpwd.texas.gov	N/A	9/2/2015

Name	Organization	Email	Phone	Date*
Dixon, Tom	FNI	tom.dixon@freese.com	512-617-3140	5/12/15, 5/13/2015, 5/14/15
Dulany, Austin	TGLO	austin.dulany@glo.texas.gov	361-438-4914	9/1/2015
Ewing, JT	TGLO	jt.ewing@glo.texas.gov	409-727-7481	9/3/2015
Ferguson, Jason	TPWD	jason.ferguson@tpwd.texas.gov	956-350-4490	5/12/15, 9/1/2015
Fitzsimmons, Owen	CBBEP	owen@cbbep.org	361-885-6247	5/14/15, 9/1/2015
Gonzalez, Michael	TPWD	michael.gonzalez@tpwd.texas.gov	956-350-4491	5/12/15, 9/1/2015
Grubbs, Faye	TPWD	faye.grubbs@tpwd.texas.gov	361-825-3281	5/14/15, 9/1/2015
Guillen, Zeke	TGLO	ezequiel.guillen@glo.texas.gov	512-936-4104	5/12/15, 5/13/2015, 5/14/15
Hackney, Amanda	Audubon Texas	ahackney@audubon.org	936-554-9033	9/2/2015
Harper, Josh	TPWD	joshua.harper@tpwd.texas.gov	361-972-6253	5/13/15, 9/1/2015
Harrell, Wade	FWS	wade_harrell@fws.gov	361-676-9953	5/13/2015
Hartman, Leslie	TPWD	leslie.hartman@tpwd.texas.gov	361-972-6253	5/13/15, 9/2/2015
King, Brian	FNI	brian.king@freese.com	512-617-3175	5/12/15, 5/13/2015, 5/14/15
Koza, Brent	TGLO	brent.koza@glo.texas.gov	361-438-4928	9/1/2015
Koza, Leslie	TPWD	leslie.koza@tpwd.texas.gov	361-825-2329	5/14/2015
Leiva, Adriana	TPWD	adriana.leiva@tpwd.texas.gov	N/A	5/13/15, 5/14/15, 9/1/2015
Lerma, Liana	TPWD	liana.lerma@tpwd.texas.gov	956-650-4491	5/12/2015
Mace, Christopher	TPWD	christopher.mace@tpwd.texas.gov	361-729-5429	5/14/15, 9/1/2015
Mitchell, Steven	TPWD	steven.mitchell@tpwd.texas.gov	281-534-0107	9/2/2015, 9/3/15
Nuñez, Alex	TPWD	alex.nunez@twpd.texas.gov	361-825-3246	5/13/15, 5/14/15, 9/1/2015
Ortego, Brent	TPWD	brent.ortego@tpwd.state.tx.us	N/A	9/2/2015
Peña, Gonzo	TGLO	gonzalo.pena@glo.texas.gov	956-459-3178	5/12/15, 9/1/2015
Prieto, Felipe	USFWS	felipe_prieto@fws.gov	361-286-3559	5/13/15, 9/1/2015
Robbins, Alec	TPWD	alec.robbins@tpwd.texas.gov	281-534-0135	9/2/2015
Robinson, Jackie	TPWD	jackie.robinson@tpwd.texas.gov	361-825-3241	5/14/2015
Roco, Colleen	TPWD	colleen.roco@tpwd.texas.gov	281-534-0139	9/2/2015
Shelly, RJ	DSHS	rj.shelly@dshs.state.tx.w	361-552-1798	5/13/2015
Silva, Paul	TPWD	paul.silva@tpwd.texas.gov	361-825-3204	5/13/15, 5/14/15,9/1/2015
Stelly, Terry	TPWD	terry.stelly@tpwd.texas.gov	409-983-1104 (x 224)	9/3/2015

Name	Organization	Email	Phone	Date*
Tunnell, Jace	Mission-Aransas Reserve	jace.tunnell@austin.utexas.edu	361--749-3046	5/14/15, 9/1/2015
Tirpak, Andy	TPWD	andy.tirpak@tpwd.texas.gov	381-534-0317	9/2/2015
Wagner, Tom	TPWD	tom.wagner@tpwd.texas.gov	361-729-2328	5/14/15, 9/1/2015
Weaver, Frank	USFWS	frank_weaver@fws.gov	361-994-9005	5/13/2015, 5/14/15
Westlake, Keith	USFWS	Donald_Westlake@fws.gov	361-286-3559	5/13/15, 9/1/2015
Woodrow, Woody	USFWS	woody_woodrow@fws.gov	281-286-8282 (x 235)	9/2/2015

* Biological update meetings: 5/12 (Brownsville), 5/13 (Port Lavaca), and 5/14 (Corpus Christi),
PPA review meetings: 9/1 (Corpus Christi), 9/2 (Dickinson), and 9/3 (Port Arthur)
N/A = Not Available

2.2 TEXAS COLONIAL WATERBIRD ROOKERY DATABASE

Experts attending the May 2015 meetings suggested all active colonial water bird rookeries be included in the PPAs and they should receive a high priority designation. A Microsoft® Excel version of the Texas Colonial Waterbird Society's (TCWS) colonial waterbird rookery database was provided to David Buzan (FNI) on June 5, 2015 by Amanda Hackney, Audubon Texas Coastal Conservation Program Manager. This version included data from 2003 through 2013 with some data from 2014. When TCWS colonial waterbird rookery data are requested, a request form must be completed which states these requirements regarding use of the data.

- "It's important to recognize caveats in the data, like incomplete coverage, observer bias, annual shifts in breeding seasonality, etc.
- Any user needs to realize that data is not an absolute count, but rather an estimation of breeding bird use over time.
- If TCWS data is used in any written work (including but not limited to calculations, reports, presentations, projects, proposals, etc.) TCWS must be identified and cited as the source of data."

The following steps were taken to use the colonial waterbird rookery data for rookeries considered active:

- Geographic coordinates in the TCWS database were placed in a geodatabase with RARNUMs and PPAs. The coordinates for each rookery were surrounded by a 1,000 foot radius circular buffer.
- Species listed in the TCWS database were added to the biofile for the RARNUM in which they occurred. The TCWS database lists species and number of breeding pairs for each year. For each species added to the biofile, the number of birds (number of breeding pairs reported in the TCWS database multiplied by 2) for the most recent year of data was added.
- Locations were visually compared to boundaries of nearby PPAs.

- If a rookery appeared in an existing PPA, the size and shape of the rookery was evaluated in comparison to the entire PPA.
    - If the PPA was not substantially larger than the rookery, the PPA description was updated with the most abundant species most recently using the rookery and the PPA was generally given a high priority.
    - If the PPA was substantially larger than the rookery, a new PPA was created surrounding the rookery and it was assigned a high priority
- If the rookery was not in an existing PPA, a new PPA was created surrounding the rookery and it was assigned a high priority.

- If a rookery was located inland with no obvious connection to tidal waters and did not appear near probable spill response activities (i.e. equipment staging locations, roads likely to be used to move response equipment), the rookery was not placed in a PPA.

2.3 TEXAS DIAMONDBACK TERRAPIN DISTRIBUTION

Texas diamondback terrapin is considered a species of concern by Texas. Relatively little is known about the distribution of this cryptic turtle which occurs in nearshore zones likely to be impacted by oil spills. Experts at the May 2015 meetings recommended we contact Aaron Baxter, Texas A&M University-Corpus Christi and Dr. George Guillen, University of Houston Clear Lake for Texas diamondback terrapin distribution data.

The following summarizes comments from Aaron Baxter regarding terrapin distribution:

- Frequent rookery islands (Nueces Bay bird islands, North and South Deer islands in Galveston Bay).
- Found in tidal streams several miles upstream from the open bay.
- Use tidal rivers, marshes, bird islands, and bay side of barrier islands. Appears to be found in more habitat types than terrapins on the east coast of the U.S.
- May be present in suitable habitats from Oso Bay east to Sabine Lake. Not expected south of Oso Bay.
- Rarely leaves the water.
- Relatively little is known about nesting: may nest in shell hash, have been observed nesting in St. Augustine grass lawns, and marsh near nesting sites is considered important.
- Newly-hatched turtles move into the marsh from the nest.

Dr. Guillen provided a KMZ file (TerrapinSpillPlanningOnly.kmz) file illustrating locations where terrapins had been observed along the Texas coast. Terrapins were added to the biofile wherever RARNUM polygon boundaries intersected locations in the TerrapinSpillPlanningOnly.kmz.

2.4 FISH DISTRIBUTION

TGLO allowed grouping some fish species in order to enhance consistency of fish distribution information in the RARNUMs and facilitate completion of the Incident Command System 232 "Resources at Risk" form. Dr. Jim Tolan (TPWD) analyzed TPWD Coastal Fisheries data and developed a list of the most abundant fish and shellfish collected in shoreline bag seines in each major bay system. Dr. Tolan's analysis was approved by TPWD Coastal Fisheries and is included as Appendix A. Fish identified in Dr. Tolan's analysis as the most abundant in a bay system (Table 2, Appendix A) are called the "Native fish community" in the biofile, while the shrimp and crabs found most abundantly in bag seines are called the "Native shrimp and crab community" in the biofile (Table 2). In addition to the list of abundant shoreline bag seine species compiled by TPWD, Hardhead Catfish is included in the Native fish community for each major bay system because of its wide distribution along the Texas coast. All other fish species identified by experts during meetings are listed separately in the biofile.

Table 2
Native Fish Community and Native Shrimp and
Crab Community Species Composition for Each Major Bay System in Texas

Species	Sabine-Neches	Trinity-San Jacinto	Lavaca-Colorado	Guada-lupe	Mission-Aransas	Nueces	Upper Laguna Madre	Lower Laguna Madre
Native Fish Community:								
Anchoa mitchilli (Bay Anchovy)	x	x	x	x	x	x	x	
Ariopsis felis (Hardhead Catfish)								
Brevoortia patronus (Gulf Menhaden)	x	x	x					
Cynoscion nebulosus (Spotted Seatrout)							x	
Cyprinodon variegatus (Sheepshead Minnow)			x	x	x	x	x	x
Fundulus grandis (Gulf Killifish)	x	x	x	x	x	x	x	x
Fundulus similis (Longnose Killifish)		x	x	x	x	x	x	x
Lagodon rhomboides (Pinfish)	x	x	x	x	x	x	x	x
Leiostomus xanthurus (Spot)	x	x	x	x	x	x	x	x
Lucania parva (Rainwater Killifish)							x	
Menidia sp. (Silversides)	x	x	x	x	x	x	x	x
Micropogonias undulatus (Atlantic Croaker)	x	x	x	x	x			x
Mugil cephalus (Striped Mullet)	x	x	x	x	x	x	x	x
Mugil curema (White Mullet)				x	x	x	x	x
Paralichthys lethostigma (Southern Flounder)	x							
Sciaenops ocellatus (Red Drum)	x	x		x	x		x	
Native Shellfish and Crab Community:								
Callinectes sapidus (Blue crab)	x	x	x	x	x	x	x	x
Callinectes similis (Lesser blue crab)						x		x
Crassostrea virginica (American oyster)	x	x	x				x	
Farfantepenaeus aztecus (Brown shrimp)	x	x	x	x	x	x	x	x
Farfantepenaeus duorarum (Pink shrimp)						x		x
Litopenaeus setiferus (White shrimp)	x	x	x	x	x	x		x
Palaemonetes spp. (Grass shrimp)	x	x	x	x	x	x	x	x

In addition to grouping abundant species of fish, Alex Nuñez (TPWD) expressed interest in identifying when larval fish may be present in the bays. Dr. Tolan responded there are larval fish and shellfish of present throughout the year.

2.5 BIRD GROUPING

There was considerable discussion with experts and response personnel regarding grouping bird species into (shorebirds, wading birds, waterfowl, and marsh birds groups. Three species, Great blue herons, Snowy egrets, and Great egrets were grouped into the wading bird group because of their ubiquitous distributions along the coast. This was the only grouping of birds made.

It may be appropriate to group species into broad categories in future updates of the biological data however there are substantial questions to resolve before meaningful groups can be established with the support of experts. Examples of those questions include:

- Cattle egrets and Sandhill cranes may be considered for inclusion in the wading bird group however they are not typically as frequently found along the shore as other wading birds like Reddish egrets.
- Should Black-crowned and Yellow-crowned night herons and Green herons be included in the wading birds group although they tend to be ambush predators from the shore and are not commonly observed in the water?
- Although geese are usually considered waterfowl, they are not usually observed floating in open coastal waters like many ducks and teal.
- Should we also group gulls, terns, and raptors?
- When we group bird species, we may make information about seasonality of different species more difficult to access.

2.6 PIPING PLOVERS AND RED KNOTS

Red knots were added to all RARNUMs and PPAs that included Piping plovers. Populations of Red knots have declined since collection of data for the first ESI and subsequently have been federally listed as a threatened species. Experts on the lower coast recommended that Red knots be included in all RARNUM polygons and PPAs which included Piping plovers. Although experts on the upper coast expressed the opinion that Red knots are typically found on the Gulf beach and not in all the same habitats as Piping plovers, additional discussion with experts supported the conclusion of adding Red knots to all polygons with Piping plovers.

2.7 MARINE MAMMALS

West Indian manatees and bottlenose dolphins are the two species of marine mammals included in the biofile. Neither species is regularly monitored in Texas. Bottlenose dolphins are widely distributed, occur throughout the year, and are commonly observed along the Texas coast. Conversely, West Indian

manatees occur in very low numbers during warmer months and are rarely seen. Anecdotal information received at the expert meetings suggests there may be one to three manatees along the lower Texas coast (west of the Colorado River) each year. Manatees have been observed in the Sabine Lake area at an approximate frequency of one individual about every five years. There is not a breeding population of manatees in Texas.

Although bottlenose dolphins are not considered a species of concern for conservation, the public has a relatively high level of interest in their protection. Likewise, even though manatees are rarely observed, their conservation status (State and federally listed as endangered) and the high public interest when one is observed make it important for responders to be aware of their potential presence. Both species are charismatic megafauna. Because of the high public interest in these species and the conservation status of manatees, these species were added to all estuarine RARNUMs where the water level may exceed one meter. Manatees do not typically occur in the Gulf of Mexico or along the Gulf shore and therefore were not included in any RARNUMs in the Gulf or along the Gulf beach. The bathymetry used for the one meter bathymetric contour was the "Bathymetry TX Coast v0.1" file (http://tnris.org/data-catalog/bathymetry/bathymetry-tx-coast-v0-1/) downloaded from Texas Natural Resources Information System (TNRIS).

2.8 SEAGRASS PRIORITIZATION

During the expert meetings, experts discussed prioritization of PPAs containing seagrasses. Seagrasses are very important habitats along the Texas coast because they shelter larval and juvenile forms of many fish and shellfish, contribute to estuarine primary productivity, and help reduce turbidity. They enhance recreational fishing. Significant resources have been expended to increase public awareness of seagrasses, their importance, and the need to protect them.

Expert discussion focused on the potential susceptibility of seagrass to exposure during a spill because seagrass is usually completely submerged and may have limited exposure to spilled product. Experts agreed that PPAs containing seagrasses and located where the water is less than one meter deep should be assigned a high ranking. PPAs located where the water is greater than one meter deep could be assigned a medium ranking. The bathymetry used for the one meter bathymetric contour was the "Bathymetry TX Coast v0.1" file (http://tnris.org/data-catalog/bathymetry/bathymetry-tx-coast-v0-1/) downloaded from TNRIS.

Other species and factors were considered when prioritizing PPAs with seagrass (ex. density of seagrass). As a result some PPAs with seagrass deeper than one meter were prioritized high and some PPAs with seagrass shallower than one meter were prioritized medium.

2.9 SPECIES CONSERVATION STATUS

The biofile includes information about each species' legal conservation status, whether it is considered threatened or endangered by the state or federal government or whether it is considered a species of

concern by Texas. Information about each species' conservation status was obtained from TPWD's listing of species conservation status (Nongame and Rare Species Program: Federal and State Listed Species, http://tpwd.texas.gov/huntwild/wild/wildlife_diversity/nongame/listed-species/, effective August 24, 2015).

3.0 OIL SPILL RESPONSE SUGGESTIONS

During the course of meetings along the coast and through conversations by telephone and email, a variety of comments were received regarding oil spill response considerations.

Those comments are listed below:

- When responding to oil spills threatening the island in Lavaca Bay just south of State Highway (SH) 35 and west of the Point Comfort Alcoa facility, care should be taken not to breach the island levees. Breaching the levees may cause release of mercury-contaminated sediments to Lavaca Bay.
- Identify water control structures, particularly on the upper coast, to help understand where spilled oil may travel through these structures. Knowledge of these structures and who is responsible for operating them may facilitate closing these structures during spills and restricting the movement of spilled material.
- High tides along the McFaddin National Wildlife Refuge Gulf beach may wash oil from the Gulf in the refuge marshes (from High Island east to near Texas Point).
- When *Sargassum* is abundant in the Gulf, it can complicate recovery of oil on open water and on the Gulf beach.
- Marsh and seagrass adjacent to passes should be a higher priority for protection because these areas are most likely to experience higher rates of larval fish and invertebrate settlement.

4.0 FUTURE UPDATES OF BIOLOGICAL DATA AND PRIORITY PROTECTION AREAS

In the course of conducting this project, potential enhancements of the ESI were identified. Suggestions to make those enhancements include:

- Do not stop RARNUM polygons at quad (USGS topographic map) map boundaries. There are about 1,600 RARNUM polygons and allowing RARNUM polygons to cross map boundaries would reduce the number of polygons and proportionally simplify future updates and data management.
- Publish an ArcGIS Online web mapping application of the ESI which is accessible using mobile devices and Windows-based platforms. This should facilitate access to information in the ESI and decisions made using the data. It is believed open access to an online version will also facilitate future revisions of the biological information and PPAs.
- Conduct a regular update of biological data and PPAs every 5 years.
- Redraw RARNUM and PPA polygon boundaries to conform to current shorelines and coastal features. This will be a very time consuming process but valuable as reliance shifts to use of aerial imagery as the background for maps.
- The TGLO has a process for updating colonial water bird rookery locations. From our observations, it appeared the TGLO locations may be more accurately placed than the locations we derived from the TCWS database. There may be some advantage to the TGLO to be able to use the TCWS database for each update. However if the TGLO takes that approach, care must be taken to ensure rookeries are accurately located.
- Create an ESRI Data Collector Application for real-time field data collection using Android and iPhone devices. The creation of a single data collection system will reduce errors and streamline data integration into the existing ESI database. The use of a real-time data collection system will also facilitate future revisions of the biological information and PPAs.
- As discussed multiple times, the upper coast and lower coast maps should not duplicate numbers and RARNUMs should be numbered consecutively along the entire coast, not separately for the upper and lower coast.

5.0 RESPONSE TO TGLO COMMENTS ON DRAFT REPORT

Steve Buschang reviewed the draft of this report. His comments and response to those comments are presented in Table 3.

Table 3
Response to Draft Report Comments

Comment	Response
Can our GIS specialists discuss the database information with us so they have a better idea of what the delivered data will look like and how we think it will be included?	Jeff Perkins and Brian King discussed the data deliverables in one conversation and Steve Buschang and Jeff Perkins discussed the data deliverables in another conversation. Both conversations were on September 30, 2015. We expect there to be questions about the final product and we will be glad to respond to those questions.
Is the TerrapinSpillPlanningOnly.kmz in a GIS spatial file?	Yes. This KMZ was provided electronically to the TGLO with the final product and Section 1.1 was modified to reflect it is a geospatial database.
I think the rookeries by definition have the same high status of a PPA. I do like the idea of extracting the colony information in a query for high codes. Can we somehow do both, i.e. leave designation as a TCWS rookery and as a status of HIGH?	The majority of rookeries were assigned a high priority and every attempt was made to include colony information in the description for each PPA containing a rookery. However there is not a quick, easy way to extract only information for rookeries.
Did you create some new TCWS rookery polygons to now more accurately depict the colonies? Are these part of the coverages you are providing?	Yes. We have included very specific PPA polygons around several rookeries in order to help response personnel understand more precisely where they are located.
If a TCWS rookery polygon is within an existing PPA the information about that rookery would incorporate into the PPA? I think we need to be able to extract, update and use just the TCWS data as stand alone.	If a rookery is located in a PPA, there should be information in that PPA's attributes about the rookery (colony name and code, species counted in the most recent year of data, and in some cases, the number of breeding pairs). We recommend requesting a copy of the TCWS colonial water bird database each year for your use and maintaining an archive of those databases.
Did the experts recommend what that wanted TGLO to do with the oil spill response suggestion included in Section 3.0? Did you add it to any of the data layers in some way?	The oil spill response suggestions listed in Section 3.0 of this report are not included in any of the materials we have provided. We listed them in the report because their inclusion in the PPA attributes did not seem appropriate.
Do the current RARNUM and PPA polygon boundaries conform to current shorelines and coastal features?	The shoreline data provided by Dr. Jim Gibeaut, Harte Research Institute, accurately follows the shoreline represented in current aerial photography. However the RARNUM and PPA polygons were created in some cases before aerial photography was readily available for this purpose. There were not enough resources in this project to redraw all the polygon boundaries.

Appendix A

TPWD Analysis of Shoreline Bag Seine Data

TPWD Analysis of Shoreline Bag Seine Data

The rationale for the following Table was to define the 15 most numerically abundant organisms encountered with shoreline bag seine collections, in each of the major estuaries along the Texas coast. Starting with Sabine, the rank order lists the top 15 taxa, and then moving down the coast, each estuary is listed according to its community structure. The original taxa ordering are maintained, and as new abundant taxa are encountered, they were added to the list.

Table 1. Rank order of the 15 most abundant species contributing to the observed community structure of each estuary. Species identified by an asterisk (*) represent recreationally or commercially important species currently used in Regional Water Planning efforts. *Crassostrea virginica* are not found in the Upper Laguna Madre, therefore their rank is signified with not available (N/A). Blank entries represent species present within every estuary on the Texas coast, but their overall contribution to that community is relatively small.

Species	Sabine-Neches	Trinity-San Jacinto	Lavaca-Colorado	Guadalupe	Mission-Aransas	Nueces	Upper Laguna Madre	Lower Laguna Madre
Micropogonias undulatus	1	2	4	12	13			14
*Callinectes sapidus**	2	1	2	5	3	2	7	5
Anchoa mitchilli	3	5	10	11	11	13	8	
Brevoortia patronus	4	3	11					
Menidia sp.	5	4	3	2	2	5	2	8
Mugil cephalus	6	6	12	8	10	10	10	9
*Litopenaeus setiferus**	7	10	6	15	12	14		13
Palaemonetes spp.	8	7	1	1	1	6	3	12
Leiostomus xanthurus	9	8	9	9	8	7	11	6
*Farfantepenaeus aztecus**	10	9	5	6	7	8	9	3
Lagodon rhomboides	11	11	8	3	4	3	6	1
*Sciaenops ocellatus**	12	15		14	14		15	
*Crassostrea virginica**	13	14	15				N/A	
*Paralichthys lethostigma**	14							
Fundulus grandis	15	13	14	10	9	9	5	15
*Cynoscion nebulosus**							13	
Cyprinodon variegatus			13	4	5	1	1	2
Mugil curema				13	15	15	14	11
Callinectes similis						12		10
Lucania parva							12	
Fundulus similis		12	7	7	6	4	4	4
Farfantepenaeus duorarum						11		7
Percent Total Abundance	96	92	91	83	85	86	93	89

The following table represents the temporal component of species recruitment into Texas estuaries. The taxa are listed as the rows, and each month is listed as a column (1-12, beginning with December as the meteorological year, instead of January as the calendar year). The “X” represents abundance values above

the median for each taxa, and taxa are grouped according to similar recruitment patterns. The abundance values are coast-wide, and not separated by estuary system.

Species	12	1	2	3	4	5	6	7	8	9	10	11
Atlantic Croaker	X	X	X	X	X							
Blue crab	X	X	X	X	X							
Striped Mullet	X	X	X	X	X							
Grass shrimp spp.	X	X	X	X	X							
Gulf Killifish	X	X	X	X	X							
Sheepshead Minnow	X	X	X	X	X							
Gulf Menhaden			X	X	X	X	X					
Spot			X	X	X	X	X					
Pinfish			X	X	X	X	X					
Southern Flounder			X	X	X	X	X					
Lesser blue crab			X	X	X	X	X					
Rainwater Killifish			X	X	X	X	X					
Brown shrimp				X	X	X	X	X				
Naked Goby				X	X	X	X	X				
Bay Whiff				X	X	X	X	X				
Sand Trout					X	X	X	X	X			
White Mullet					X	X	X	X				
Gulf Pipefish						X	X	X	X			
Mojarra spp.							X	X	X	X	X	
Bay Anchovy							X	X	X	X	X	
Silversides spp.							X	X	X	X	X	
Longnose Killifish							X	X	X	X	X	
Spotted Seatrout							X	X	X	X	X	
Southern Kingfish							X	X	X	X	X	
Hardhead Catfish							X	X	X	X	X	
White shrimp								X	X	X	X	X
Pink shrimp									X	X	X	X
Red Drum	X	X								X	X	X

The following table represents the contribution of each taxa to the total collections, as recorded by bag seines, from each of the major estuaries in Texas. The 90th percentile is listed first, then adding in the next 5%, and then the 99th percentile of the total collections (N = 7,345,156 individuals). The time frame for collections is between 1982 and 2013. While all individuals are counted in the field, some taxa which do not represent target organisms are removed from this list (Common begula - *Bugula neritina*; Class Jellyfish – Class Scyphozoa; sea squirt - *Molgula manhattensis*; Variable cerith - *Cerithium lutosum*).

Common_Name	Scientific_Name	Catch	% Total	Cumulative
Gulf Menhaden	*Brevoortia patronus*	1530371	20.98	20.98
Brown shrimp	*Farfantepenaeus aztecus*	869539	11.92	32.89
White shrimp	*Litopenaeus setiferus*	801764	10.99	43.88
Grass shrimp – unident	*Genus Palaemonetes*	605931	8.30	52.19
Pinfish	*Lagodon rhomboides*	560660	7.68	59.87
Sheepshead Minnow	*Cyprinodon variegatus*	521194	7.14	67.02
Spot	*Leiostomus xanthurus*	448030	6.14	73.16
Atlantic Croaker	*Micropogonias undulatus*	255016	3.50	76.65
Bay Anchovy	*Anchoa mitchilli*	198192	2.72	79.37
Inland Silverside	*Menidia beryllina*	174393	2.39	81.76
White Mullet	*Mugil curema*	171977	2.36	84.11
Striped Mullet	*Mugil cephalus*	159537	2.19	86.30
Blue crab	*Callinectes sapidus*	127755	1.75	88.05
Tidewater Silverside	*Menidia peninsulae*	121486	1.67	89.72
Longnose Killifish	*Fundulus similis*	105582	1.45	91.16

Adding in the next 5 % of the total catch:

Common_name	Scientific_name	Catch	% Total	Cumulative
Gulf killifish	*Fundulus grandis*	69012	0.95	92.11
Pink shrimp	*Farfantepenaeus duorarum*	53803	0.74	92.85
Spotfin mojarra	*Eucinostomus argenteus*	48802	0.67	93.52
Lesser blue crab	*Callinectes similis*	31932	0.44	93.95
Red drum	*Sciaenops ocellatus*	29444	0.40	94.36
Thinstripe hermit	*Clibanarius vittatus*	29308	0.40	94.76
Hardhead catfish	*Ariopsis felis*	24572	0.34	95.10

Remaining taxa to reach 99% of the total catch.

Common_name	Scientific_name	Catch	% Total	Cumulative
Black Drum	*Pogonias cromis*	23862	0.33	95.42
Daggerblade grass shrimp	*Palaemonetes pugio*	23177	0.32	95.74
Spotted Sseatrout	*Cynoscion nebulosus*	19441	0.27	96.01
Eastern oyster	*Crassostrea virginica*	19322	0.26	96.27
Sand Seatrout	*Cynoscion arenarius*	16390	0.22	96.50
Rainwater Killifish	*Lucania parva*	15192	0.21	96.71
Bay Whiff	*Citharichthys spilopterus*	14195	0.19	96.90
Silver perch	*Bairdiella chrysoura*	14004	0.19	97.09
Rough Silverside	*Membras martinica*	10082	0.14	97.23
Cannonball jelly	*Stomolophus meleagris*	8424	0.12	97.35
Silver Jenny	*Eucinostomus gula*	8342	0.11	97.46
Scaled Sardine	*Harengula jaguana*	7510	0.10	97.56

Common_name	Scientific_name	Catch	% Total	Cumulative
Finescale Menhaden	*Brevoortia gunteri*	7488	0.10	97.67
Naked Goby	*Gobiosoma bosc*	7429	0.10	97.77
Southern Flounder	*Paralichthys lethostigma*	7428	0.10	97.87
Least Puffer	*Sphoeroides parvus*	7249	0.10	97.97
Pigfish	*Orthopristis chrysoptera*	6731	0.09	98.06
Southern Kingfish	*Menticirrhus americanus*	6557	0.09	98.15
Atlantic Threadfin	*Polydactylus octonemus*	6525	0.09	98.24
Gulf Pipefish	*Syngnathus scovelli*	5605	0.08	98.32
Darter Goby	*Ctenogobius boleosoma*	5409	0.07	98.39
Family mullets	*Family Mugilidae*	4385	0.06	98.45
Diamond Killifish	*Adinia xenica*	4316	0.06	98.51
Flagfin Mojarra	*Eucinostomus melanopterus*	4256	0.06	98.57
Dwarf surf clam	*Mulinia lateralis*	4077	0.06	98.62
Leatherjacket	*Oligoplites saurus*	3878	0.05	98.68
Gulf grassflat crab	*Dyspanopeus texanus*	3827	0.05	98.73
Seabob	*Xiphopenaeus kroyeri*	3805	0.05	98.78
Ladyfish	*Elops saurus*	3723	0.05	98.83
Arrow shrimp	*Tozeuma carolinense*	3400	0.05	98.88
Florida Pompano	*Trachinotus carolinus*	3375	0.05	98.93
Crevalle Jack	*Caranx hippos*	2975	0.04	98.97
Blackcheek Tonguefish	*Symphurus plagiusa*	2807	0.04	99.01