Abandoned Crab Trap Removal Program Interim Report No. 1 -- Reduction of Ghost Fishing from Derelict Blue Crab Traps on the Mid-Texas Coast: February 22-28 Crab Trap Closure Period Trap Removal Results for the Texas Mid-Coast Area

Acknowledgments: We thank the National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program and the Coastal Bend Bays & Estuaries Program (CBBEP) for funding this study. We would also like to thank our project partners: the University of Texas Marine Science Institute/Mission-Aransas National Estuarine Research Reserve, and the Harte Research Institute at Texas A&M University – Corpus Christi. In addition to these entities, project participants include Federal, state, and local resource agencies/programs, non-profit organizations, and the dedicated volunteers who spent hours of their time out on the bays of the Mid-Texas Coast, removing derelict crab traps and gathering data.

Photo 1. Results of "Ghost Fishing"

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Executive Summary:

The "***Reduction of Ghost Fishing from Derelict Blue Crab Traps on the Mid-Texas Coast***" project was initiated to develop an expanded and more strategic effort to locate and remove derelict blue crab traps in the bays along the Texas Mid-Coast, and to gather standardized data that can be used to better assess ecological and economic impacts of these "abandoned" crab traps, which are known to be a significant source of mortality for a variety of marine organisms, many of which are recreationally or commercially important and are considered NOAA Trust Resources. Many abandoned traps are continuing to catch/trap/kill a variety of estuarine organisms as they remain unattended in local bays – a concept known as "ghost fishing."

In addition to the ecological impacts caused by derelict traps, there are also economic impacts. By continuing to capture estuarine organisms that would have contributed to commercial or recreational harvests, derelict traps can cause economic losses for commercial and recreational fishing sectors.

2021 Crab Trap Pickup Program: The crab trap removal efforts being funded and implemented under this project take place in the Aransas Bay, San Antonio Bay, and Matagorda/Lavaca Bay estuarine systems located along the Texas Mid-Coast. Stakeholder groups involved in the project include: The Coastal Bend Bays and Estuaries Program, the San Antonio Bay Partnership, the Matagorda Bay Foundation, the Lavaca Bay Foundation, The Aransas Project, The International Crane Foundation, and local Coastal Conservation Association (CCA) chapters. Additionally, large numbers of individuals volunteered their time, boats, and efforts to remove the abandoned crab traps.

Participants in the 2021 crab trap pickup program for the Mid-Texas Coast utilized a smart phone-based application (ESRI Collector App) to collect, record and report data about the location and contents of abandoned crab traps as they are being removed from the bays. The goal of the study is to use the information derived from the analysis of the data collected and compiled during the crab trap pickups to involve stakeholders in discussing the problem and developing potential solutions.

Project participants and volunteers drew on their experiences in previous years' crab trap removal programs to develop the procedures and protocols to be followed during the event so as to "make the cleanup as comprehensive and systematic as practical." One of the hallmarks of the program was the use of the ESRI Collector App, which is free for download to all smart phones. While piloted during the previous year's program, it was used more extensively this year to geo-locate the abandoned crab traps and to capture map-based data for later download to geographic databases/mapping programs – Collector App data was obtained on 87% of the traps removed. Data entered into the Collector App during the 2021 Crab Trap Pickup event was compiled into an Excel spreadsheet and then exported as a .kmz file for use with Google Earth Pro, a mapping program.

Results and Analysis:

In this year's abbreviated 7-day crab trap "closure period" (February 22-28, 2021), volunteers removed 1,207 abandoned crab traps from the Texas Mid-Coast project area (*1,045 (87%) with Collector App locations and data entered).* The effort involved 60 boats and 148 volunteers.

- **Crab Trap Contents – Crabs/Fish Released in 2021**
  - 26 percent of traps had blue crabs entrapped; 23 percent of traps had stone crabs entrapped; Removed dead or released alive: 567 blue crabs, 707 stone crabs, and 328 fish.

- **Of the 1,207 crab traps retrieved from bays along the Texas Mid-Coast in 2021:**
  - Over half appear to have been windblown to shore.
  - Over a quarter left in open bay -- down significantly from last year despite weather issues.
  - Nearly a quarter left in shallow marshes with problematic access during winter low tides.
  - One percent of the traps appear to have been "dumped" at certain locations.

Figure ES-1: Map of Locations Where Abandoned Traps Were Removed in 2021:

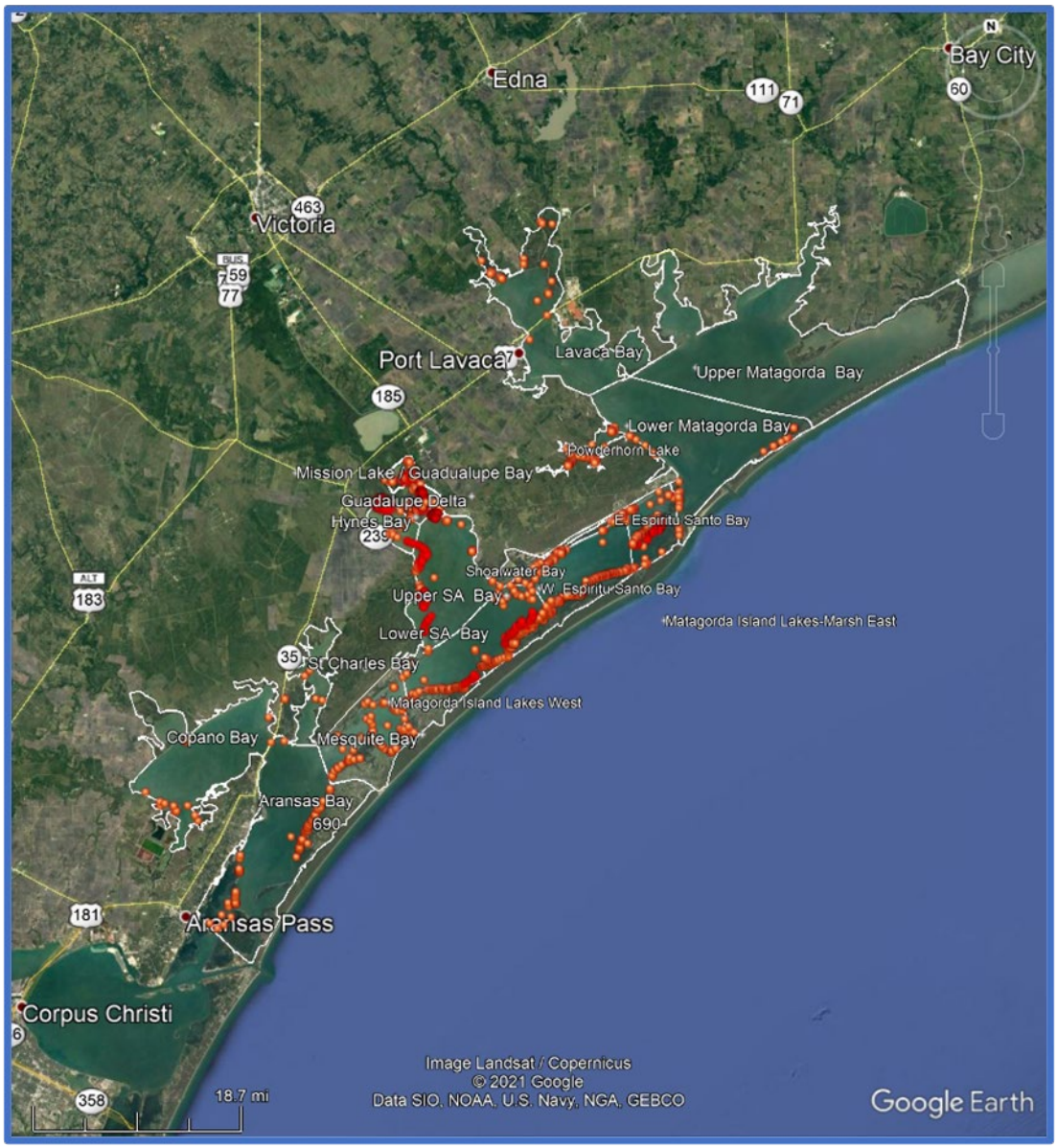


Table ES-1: Number of Traps Removed by Bay System/Area and Type of Environment

Trap Count by Area	Environment					
Area Name	**Bay**	**Shore**	**Marsh**	**"Dump"**	**Total**	***Figure #:***
Copano Bay	8	9	1		18	***4***
Aransas Bay	2	63	10		75	***4***
St. Charles Bay	1	5			6	***4***
Mesquite Bay	17	56			73	***4***
Lower S.A. Bay	74	139			213	***5***
Upper S.A. Bay	69	3	3		75	***5***
Hynes Bay	10	1		8	19	***5***
Guadalupe Delta			64		64	***5***
Mission Lake/ Guadalupe Bay	23	39		4	66	***5***
Matagorda Island Lakes E & W		1	85		86	***6***
Shoalwater Bay			45		45	***7***
West Espiritu Santo Bay	8	112	3		123	***7***
East Espiritu Santo Bay	19	56	17		92	***7***
Lower Matagorda Bay	2	22			24	***7***
Powderhorn Lake	2	33	11		46	***7***
Lavaca Bay	5	10	5		20	***7***
TOTAL	**240**	**549**	**244**	**12**	**1045**	
Percent (%)	23	*53*	*23*	*1*	*100*	

Discussion:

- **The location data for many traps removed during the February 2021 Crab Trap Removal program seems to indicate that the traps were simply, and purposely, abandoned in place.**
  - This finding stems from both from the "linearity" of the point locations of multiple traps (which indicates a "trap line" left in place) and the ownership information on the trap tags (same owner for all the traps in a trap line). Some traps (1%) appear to have been "dumped" as a means of disposal.
- **Strong wind events in the bays blow traps out of place and they wind up on bay shorelines**
  - As shown in the table above, the largest number of abandoned traps (53%) were removed from the shorelines within the bay systems. Texas' bays are a dynamic environment, especially when it comes to high winds and the resulting wave energy, which can lift traps off the bottom and then blow them long distances until they reach shallow water along the shorelines.

- **There appears to be problems with the placement of crab traps in shallow marsh areas**
    - Bays along the Texas Mid-Coast are fringed by tidal marsh complexes characterized by areas of vegetation surrounding shallow, typically muddy-bottomed, open-water features. Crab traps placed in these marshes during higher water conditions may not be accessible during regularly occurring lower tides, or for extended periods during the winter when the passage of frontal systems and accompanying strong N/NW winds push water out of the bays and drop water levels in the marshes to the extent that access via boat is sometimes impossible for days. This limits crabbers' ability to regularly check traps in these locations, or to remove them during the closure period, resulting in by program volunteers removing large numbers of traps (23%) from marsh areas.

Outreach, Communications and Stakeholder Engagement Program

Information generated from the data compiled during the 2021 Crab Trap Removal Program is being used to develop an outreach, communications and stakeholder engagement program aimed at involving crabbers and key partners in fostering changes which reduce crab trap dereliction and are supported by the local commercial crabbing community.

The 2021 data from within the San Antonio Bay portion of the study area has already been used to inform the development of a one-page flyer designed to communicate to the crabbing community and the general public some of the results of this year's efforts. The analysis of the 2021 project data generated several "Key Messages." In addition, "Key Audiences" for these messages have been identified.

For example, Key Messages to crabbers, one of the Key Audiences, might include something like:

- ***"Remember to Pack your traps!" Derelict traps cost you money and reduce your catch.***
- ***Let's save costs and reduce the number of derelict traps in our bays!***
- ***Let's work together to keep our Bays healthy!***

A list of "Key Partners" has also been compiled. Communication through Key Partners' websites and social media outposts will act as a community outreach tool during the implementation of the program and be used to create and add onto the project's volunteer base

Abandoned Crab Trap Removal Program Interim Report No. 1: Reduction of Ghost Fishing from Derelict Blue Crab Traps on the Texas Mid-Coast

I. Introduction

A. Project Need/Purpose/Methods

The crab traps used by commercial crabbers along the Texas Coast are designed (***see Appendix I – Crab Trap Design and Function***) to capture and hold blue crabs until they can be retrieved and taken to market. However, crab traps which have been abandoned, for various reasons, continue to catch/trap/kill crabs, fish, and other estuarine organisms as they remain unattended in local bays – a concept known as "ghost fishing." Abandoned crab traps are known to be a significant source of mortality for a variety of marine organisms, many of which are recreationally or commercially important and are considered NOAA Trust Resources (e.g., blue crabs, Gulf stone crabs, sheepshead, spotted seatrout, hardhead catfish, black drum, Atlantic croaker, and Texas diamondback terrapins). Abandoned crab traps can also have negative effects on sensitive habitats like submerged seagrass and salt marsh vegetation, and animal species that depend on them (i.e., endangered Whooping Crane). In addition to the ecological impacts caused by derelict traps, there are also economic impacts. By continuing to capture estuarine organisms that would have contributed to commercial or recreational harvests, derelict traps can cause economic losses for commercial and recreational fishing sectors. Other economic costs imposed by derelict traps include damage to sensitive habitats and a subsequent reduction in the ecosystem services they provide, and the replacement cost of the derelict traps. Finally, lost traps can lead to user conflicts when the motors of boaters/fishermen run into them, and shrimpers nets become entangled with them.

To help address the problems associated with abandoned crab traps, the State of Texas closes every bay system in the State to crabbing for a 10-day period each February, and declares any traps left in the water during the closure period to be "derelict" or "abandoned" and subject to removal and disposal. Every year, during the closure period, the Texas Parks and Wildlife Department (TPWD) leads a volunteer-based, statewide effort to remove derelict traps. The statewide closure has been in place for 18 consecutive years, and although the number of abandoned traps has decreased over time, there are still significant numbers of derelict traps collected each year. Many of them are continuing to catch/trap/kill a variety of estuarine organisms as they remain unattended in local bays – a concept known as "ghost fishing."

The "Reduction of Ghost Fishing from Derelict Blue Crab Traps on the Texas Mid-Coast" project was initiated to develop an expanded and more strategic effort to locate and remove derelict blue crab traps and gather standardized data that can be used to better assess ecological and economic impacts. In addition, efforts are being undertaken to identify and address the root causes of trap abandonment to ultimately lessen ghost fishing and its impacts.

The NOAA grant supports the local project team, which organizes and works with volunteers to locate and remove derelict crab traps in coastal waters from Matagorda Bay to Aransas Bay during the Texas Parks and Wildlife Department's 10-day closure period in February 2021 and February 2022. In addition to trap removal, volunteers are also responsible for collecting specific data parameters about each derelict trap. Data parameters will be designed to assist in both the assessment of impacts (e.g., number of individuals, by species, entrapped, habitat where the traps are found, habitat impacts and a determination of the reason for abandonment (e.g., abandoned in place or blown to shore, signs of entanglement with other fishing gear, buoy line cut, owner information, etc.).

Participants in the 2021 crab trap pickup program for the Texas Mid-Coast utilized a smart phone-based application (ESRI Collector App) to collect, record and report data about the location and contents of abandoned

crab traps as they are being removed from the bays. The data gathered during the February 2021 crab trap cleanup has been analyzed to better understand both the ecological and economic impacts of abandoned crab traps on the mid-Texas coast and to identify potential root causes of the dereliction.

The results of this analysis are to be utilized to engage commercial crabbers in in the Matagorda Bay, San Antonio Bay, and Aransas Bay systems in constructive, two-way conversations that seek to identify root causes of dereliction and develop alternatives for reducing the number of lost traps, ultimately reducing the amount of ghost fishing and potential economic losses.

B. Audience

The information gathered, analyzed, and reported about the nature and location of the abandoned crab traps being removed from Texas Mid-Coast bays (from Matagorda Bay to Aransas Bay) during the 2021 and 2022 closure periods will be of value to coastal resource agencies, marine extension agents, game wardens, academic researchers, participants in future removal efforts, members of the crabbing industry, and recreational boaters and crabbers in the area. The goal of the study is to use the information derived from the analysis of the data collected and compiled during the crab trap pickups to involve these groups in discussing the problem and developing potential solutions.

II. 2021 Crab Trap Removal Study Area

A. Study Area Description

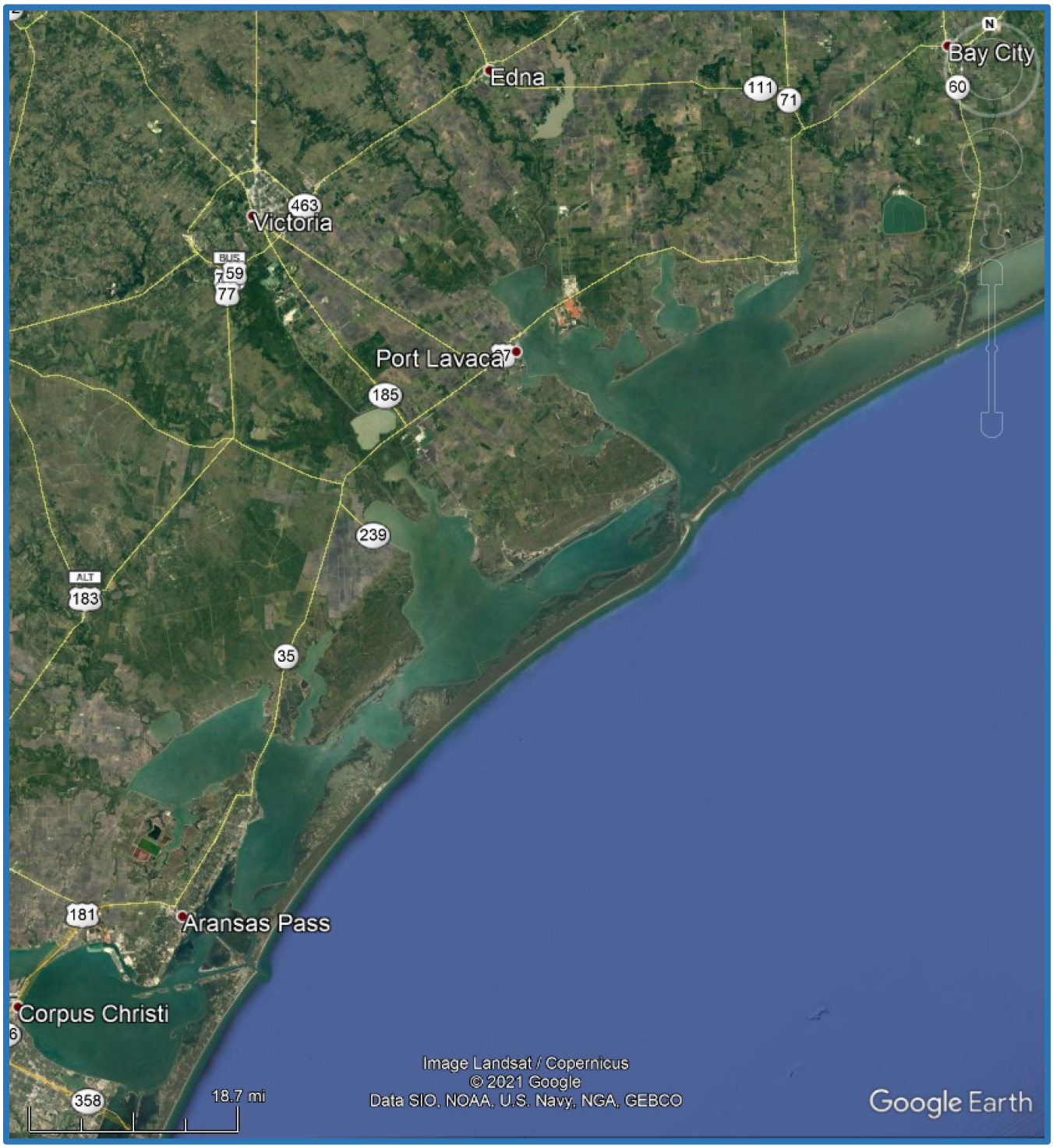
The crab trap removal efforts being funded and implemented under this project take place in the Aransas Bay, San Antonio Bay, and Matagorda/Lavaca Bay estuarine systems located along the Mid-Texas Coast (see Figure 1: "Map of Texas Mid-Coast Crab Trap Removal Study Area" in Section II B., next page). A portion of the project area (the Aransas Bay System) falls within the boundaries of both the Mission-Aransas National Estuarine Research Reserve (MANERR) and the Coastal Bend Bays and Estuaries Program (CBBEP -- an EPA National Estuary Program). In addition, several non-profit environmental organizations are involved in efforts to protect the natural resources of the project area, including: The Coastal Bend Bays and Estuaries Program, the San Antonio Bay Partnership, the Matagorda Bay Foundation, the Lavaca Bay Foundation, The Aransas Project, The International Crane Foundation, and local Coastal Conservation Association (CCA) chapters. and.

Significantly, this area of the Mid-Texas Coast also encompasses the Aransas National Wildlife Refuge (ANWR), which, along with other properties in State, local, non-profit, and private ownership, serves as the wintering grounds for the only naturally migrating flock of endangered Whooping Cranes (*Grus Americana*). Blue crabs are one of the primary food sources utilized by these Whooping Cranes during their time on the Mid-Texas Coast. The Aransas National Wildlife Refuge (ANWR) and the International Crane Foundation (ICF) have been active participants in the Abandoned Crab Trap Removal Program activities in the Texas Mid-Coast region.

The Texas Mid-Coast is also a focal point for a large commercial blue crab fishery, and data from this study suggests "ghost fishing" by abandoned traps reduces commercial blue crab landings within the Mid-Texas Coast area by about 27% annually, which would result in a loss of revenue of $170,000 per year for the region's commercial blue crab fishery.

B: Study Area Map

Figure 1: Map of Texas Mid-Coast Crab Trap Removal Study Area



III. Data Collection Procedures

A. Collector App Info

The ESRI Collector App is a free app available for download to all smart phones. It is used in the field to geo-locate the abandoned crab traps and to capture map-based data for later download to geographic databases/mapping programs. The app also allows users to take and store photos in association with the data collection location. In this application for the Abandoned Crab Trap Removal Program, the Collector App allowed users to identify and record the latitude/longitude of the location where a trap found and removed, and to input and record descriptive information (data) about the trap and its contents (if any) -- see details below. The Collector App then sends the collected data to a US Fish and Wildlife Service (USFWS) database for storage and later analysis. The use of the Collector App was piloted during the 2019 Abandoned Crab Trap Removal Program, and lessons learned during that pilot program helped in the design of the Collector App data collection protocols for the 2021 Abandoned Crab Trap Removal Program.

B. Protocol for Data Collection

Per the Scope of Work for the project, SABP produced a "Texas Mid-Coast Abandoned Crab Trap Removal Program 2021 Operational Procedures" document to inform project participants and crab trap pickup volunteers about the procedures to be followed during the event so as to "make the cleanup as comprehensive and systematic as practical." This document included the following section on Data Collection procedures and protocols **(*see* Figure 2., *next two pages*)**:

Figure 2, pg. 1: Data Collection Procedures and Protocols

3. Data Collection

a. TPWD requires reporting of the number of traps removed and the effort expended. The Basic Data sheet used to capture this information is shown below (next page). The Team Captain is responsible for ensuring the info is reported to Bay Leaders. Because most of the funding for the 2021 program is from a NOAA Marine Debris Removal Program grant, documentation of the volunteer effort is essential. The grant has local match requirements that are met by volunteer boats and volunteer hours.

b. Using the Collector App to collect trap data is an obligation of the NOAA grant and will help identify root causes. Teams are expected to mark the specific location of each collected trap, collect info on trap/license owner, and record entrapment data using the Collector App.

c. The Collector App is a free download to all smart phones. The app sends data to a USFW database. It was used last year and found to be user friendly. We ask that a crew member be assigned as "Data Deckhand" (to keep their hands clean for phone use) and complete the Collector App training.

d. We ask that the Data Deckhand signup early so that USFW can create the personal sign-on needed for the Collector App to send the collected data to the database. Instructions for downloading and using the Collector app are provided on the SABP website. Training sessions will also be provided (TBD).

e. Derelict traps spotted during the aerial surveys on Friday, Feb 19 in the SA Bay and Aransas Bay Systems, Lavaca Bay & Powderhorn Lake and Matagorda Bay will be viewable in the Collector App and used by boat teams to find & remove the traps.

f. Data to be collected by Boat Teams via the Collector App.

- **Location per Collector App GPS**
- **Trap owner (from Tag) / Float #**
- **Trap Contents – Number of:**
  - **Blue crab (BC)**
  - **Stone crabs (SC)**
  - **Fish (F)**
  - **Turtle Diamondback terrapin**
  - **Sea turtles • Float present? (yes or no)**
- **Other/Comments**
- **Attach photo - optional**

g. If you have a boat or hand-held GPS, it would be very helpful if you could also provide your actual search route in a kmz format. This insight reduces duplicative searches later in closure period.

Figure 2, pg. 2: Data Collection Procedures and Protocols

Volunteer's Crab Trap Removal Report, Feb 2021

Route: _____ Captain:_____ email:_____ Phone:_____ Data Collector:_____ email:_____ Phone:_____ Date: _____ Areas missed: _____ Affiliation:_____ eg CCA, TMN, Paddling Club, GBRA , SABP	Crew and email addresses: 1._____ email_____ 2._____ email_____ 3._____ email_____ 4._____ email_____
# Traps picked up _____ Deposited at _____ Counted by TPWD staff ? Yes or No?	Includes: ____ from Matagorda Bay ____ from Aransas Bay(Mesquite Bay south) ____ from Lavaca Bay
Hours on the water working Traps, including boat transportation: ___	
ARC- GIS App used to mark collected traps. Yes or No Route KMZ file: can you send Allan your approx. route?	
Most interesting observation of the Day:	
Suggestions for improvement next year:	

Documenting Signature: _____

Printed:_____

C. Data Reporting

Data entered into the Collector App by the various boat crews during the 2021 Crab Trap Pickup event was compiled into an Excel spreadsheet by the U.S. Fish and Wildlife Service's Aransas National Wildlife Refuge program staff. A copy of this spreadsheet was provided to San Antonio Bay Partnership for use in preparing this report. In a few instances, participants retrieved traps, but did not use the Collector App. In this case, handwritten records were obtained and entered into the Excel spreadsheet used to tabulate data on traps removed during the 2021 Abandoned Crab Trap Program for the Texas Mid-Coast.

D. Problems/Limitations

While the use of the Collector App makes the process of collecting and reporting information on the number and nature of the crab traps removed during the crab trap closure period more uniform and streamlined, experience in the field indicates that it is sometimes difficult for the crab trap pickup boat crews, particularly crews of less than three persons, to capture all of the information needed to complete the Collector App data entry form while also engaging in the process of getting the traps out of the water and into the boat, the contents/tag information noted properly, and the traps safely stowed on the boat for later disposal. This issue resulted in some data not being captured and reported, but out of the total of 1,207 traps reported as having been picked up in the Texas Mid-Coast project area during the slightly abbreviated 2021 Crab Trap Closure Period and Pickup event, 1,121 Collector App records were acquired and compiled for analysis.

IV. 2021 Abandoned Crab Trap Removal Program Operational Highlights

- **Over 1,200 derelict traps were removed from five bays systems (Lavaca, Matagorda, San Antonio, Aransas and Copano).**

  2021: 1,207 (*1,045 with Collector App locations and data entered (87%))*

  Previous Years:
  2020: 1,632 (1,202 with Collector App locations and data entered (74%))
  2019: 838
  2018: 996

- **Effort involved:**

  2021: 60 boats/148 volunteers (*Note: Winter storm "Uri" reduced boats and volunteers available)*

  2020: 68 boats/160 volunteers

  - Locations of removed traps successfully captured on 87% of traps with Collector, vs 74% in 2020.
  - Other trap data is less thorough, reducing the comprehensiveness of study.
  - Conducted recycling pilots in Port O' Connor TPWD Dock and at Austwell. The recycled traps would all be from San Antonio Bay.
  - Areas less comprehensively searched or under recorded: Matagorda Island Lakes/Marsh, St. Joe Island south shore/Mud Island, Matagorda Peninsula shore, East and West Matagorda Bays

- Pilot program for crab trap recycling effort: 217 traps recycled.
  - Port O'Connor TPWD Dock – 188 out of 397 (47%) ***Note:*** *this dock was fully staffed during the Saturday of the event*
  - Austwell/USFW -- 29 out of 329 (9%) ***Note:*** *many traps were from marshes and fouled with mudLei*

- **Crab Trap Contents – Crabs/Fish Released in 2021**
  - Percent of traps with blue crabs entrapped = 26%
  - Percent of traps with stone crabs entrapped = 23%
  - Released alive: 567 blue crabs, 707 stone crabs, and 328 fish
- ***Data suggests 'ghost fishing' reduces commercial blue crab landings by 27% annually, or $170,000/yr.***
- **What happened to the 1,207 crab traps retrieved from bays along the Mid-Texas Coasts:**
  - Nearly half appear to have been windblown to shore.
  - Over a quarter left in open bay -- down significantly from last year despite weather issues.
  - Nearly a quarter left in shallow marshes with problematic access during winter low tides.
- **Weather/scheduling issues prohibited aerial reconnaissance of the program area in advance of removal efforts –** Due to the onset of severe cold weather just prior to the 2021 crab trap closure period, Texas Parks and Wildlife Department moved the closure period start date back from Friday, February 19th to Monday, February 22nd. This impacted the availability of the aircraft and pilot for the scheduled pre-pickup aerial reconnaissance. Attempts to re-schedule the flights just prior to the new start date of crab trap closure period were affected by the same pilot availability issues and inclement weather. *The result was that no aerial reconnaissance was accomplished before or during the closure period.*

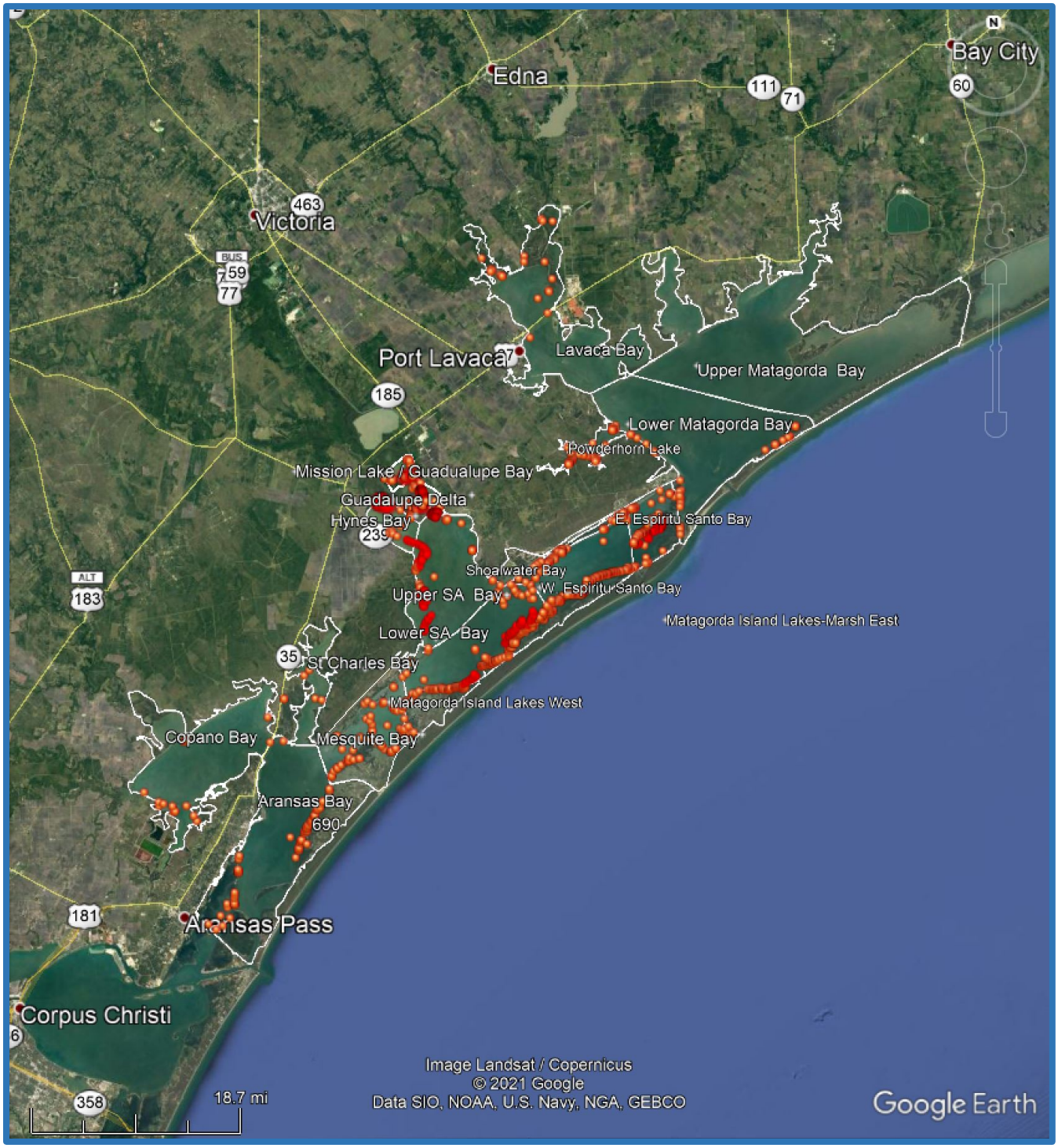
V. 2021 Abandoned Crab Trap Removal Program Results: Mapping Data

A. Generating Google Earth Maps from Collector App Data

The Collector App allows volunteers aboard the boats used in the crab trap removal program to capture and automatically record accurate location data on each trap, and to manually enter data on that trap's contents, tags, etc. Because the app is used on a smart phone, photographs of the trap can also be taken and stored with data record. Then, at the end of each day, the data was uploaded to a data file. At the end of the crab trap removal period, all the records in the data file were exported to an Excel spreadsheet file and a Google Earth Pro data file (.kmz) for further analysis.

During the 2021 abandoned crab trap pickup, the Collector App was used to capture data on 1,045 of the 1,207 of the traps removed (almost 87%). Figure 3., next page, illustrates the location of each abandoned crab trap removed from bays along the Texas Mid-Coast during the April 19 – 25, 2021 revised closure period.

Figure 3: Map of Traps Removed in the Texas Mid-Coast Crab Trap Removal Study Area, by Bay System Areas



As a result of this high level of data collection, it is possible to use this data for geographic and statistical analysis which can address questions such as:

- Where were abandoned traps found?

- Are there spatial patterns in the locations of the abandoned traps?
- What kind and number of estuarine organisms were found in the abandoned traps?

B. What the Maps Reveal: Discussion on Mapping Results

While a picture may say "a thousand words," a good map speaks volumes. Mapping of the location data obtained by the Collector App was done in Google Earth Pro, (GE Pro). Google Earth Pro allows users to create maps which can display georeferenced "categorical" information. After the Collector App location data was downloaded into a ".kmz" data file format used by GE Pro, that data was used to display locations where crab traps were removed. In addition to "point data" like crab trap locations, GE Pro can work with polygon data to define search areas – in this analysis, the Texas Mid-Coast study area was divided into sixteen (16) "Bay System Areas" where traps were found and removed (see Figure 3., previous page).

From these maps, certain patterns can be visually discerned in the locations of traps removed – and categories of traps assigned based on the locations – i.e., trap locations were identified as being located in one of the following: open bay, shore, marsh – and in a few locations: "dump." (A dump is a site with several traps in close proximity and apparently used to dispose of old traps instead of hauling them back to shore.) Combining that information with "Area" information (a label used to designate the discrete portions of the broader study area) a "cross-tabulation table," or "pivot table," can be created to display the number of traps found in each category of trap locations in each Area (see Tables 1. and 2., next page).

Photo 2: Airboat used to Access Traps in Marsh Areas (Photo: Victoria Advocate)

Tables 1. and 2., below, list the number of traps found by type of environment (Bay, "Dump," Marsh, or Shore) within each Area, and then the Total number of traps found in that Area.

Table 1. Number of Traps Removed by Bay System/Area and Type of Environment

Trap Count by Area	Environment					
Area Name	**Bay**	**Shore**	**Marsh**	**"Dump"**	**Total**	***Figure #:***
Copano Bay	8	9	1		18	***4***
Aransas Bay	2	63	10		75	***4***
St. Charles Bay	1	5			6	***4***
Mesquite Bay	17	56			73	***4***
Lower S.A. Bay	74	139			213	***5***
Upper S.A. Bay	69	3	3		75	***5***
Hynes Bay	10	1		8	19	***5***
Guadalupe Delta			64		64	***5***
Mission Lake/ Guadalupe Bay	23	39		4	66	***5***
Matagorda Island Lakes E & W		1	85		86	***6***
Shoalwater Bay			45		45	***7***
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Powderhorn Lake	2	33	11		46	***7***
Lavaca Bay	5	10	5		20	***7***
TOTAL	**240**	**549**	**244**	**12**	**1045**	
Percent (%)	*23*	*53*	*23*	*1*	*100*	

Table 2. Ranking of Bay Systems by Number of Traps Removed

Ranking by Number of Traps Removed					
Trap Count by Area	**Environment**				
Area Name	**Bay**	**Shore**	**Marsh**	**"Dump"**	**Total**
Lower S.A. Bay	74	139			213
West Espiritu Santo Bay	8	112	3		123
East Espiritu Santo Bay	19	56	17		92
Matagorda Island Lakes E & W		1	85		86
Aransas Bay	2	63	10		75
Upper S.A. Bay	69	3	3		75
Mesquite Bay	17	56			73
Mission Lake/ Guadalupe Bay	23	39		4	66
Guadalupe Delta			64		64
Powderhorn Lake	2	33	11		46
Shoalwater Bay			45		45
Lower Matagorda Bay	2	22			24
Lavaca Bay	5	10	5		20
Hynes Bay	10	1		8	19
Copano Bay	8	9	1		18
St. Charles Bay	1	5			6
TOTAL	**240**	**549**	**244**	**12**	**1045**
Percent (%)	*23*	*53*	*23*	*1*	*100*

C. Crab Traps Removed by Area – Maps

Figures 4. through 7. illustrate a closer look at locations within the study area where abandoned/derelict crab traps were found and removed. These maps reveal the spatial distribution/clustering which is summarized and categorized in Tables 1 and 2.

Figure 4. -- Aransas-Copano, St. Charles and Mesquite Bays: red dots indicate locations of the 172 traps removed from these four (4) bays.

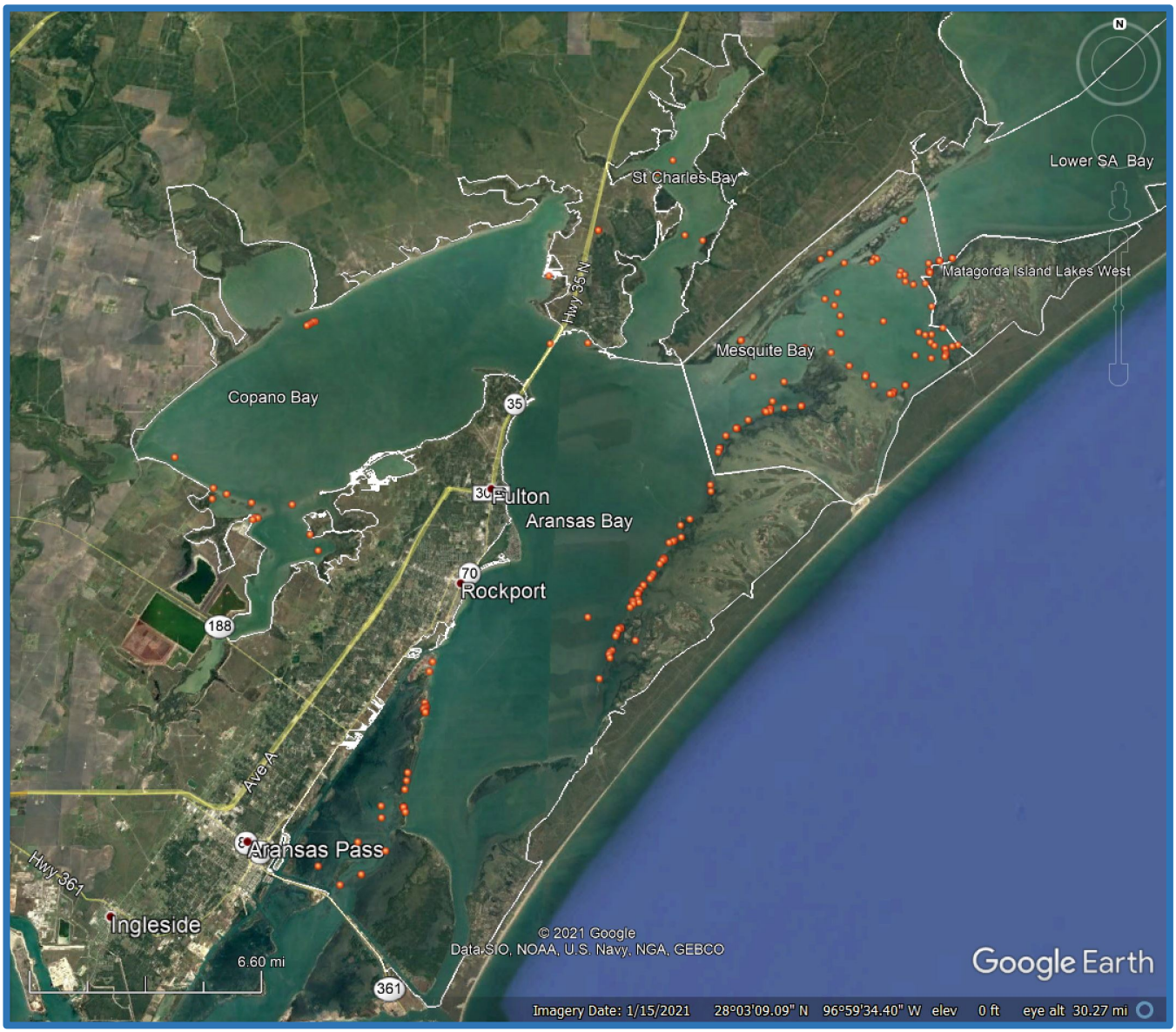


Figure 5. – San Antonio, Hynes, Guadalupe Delta, and Mission Lake/Guadalupe Bay: red dots indicate locations of the 437 traps removed from these four bays/areas.

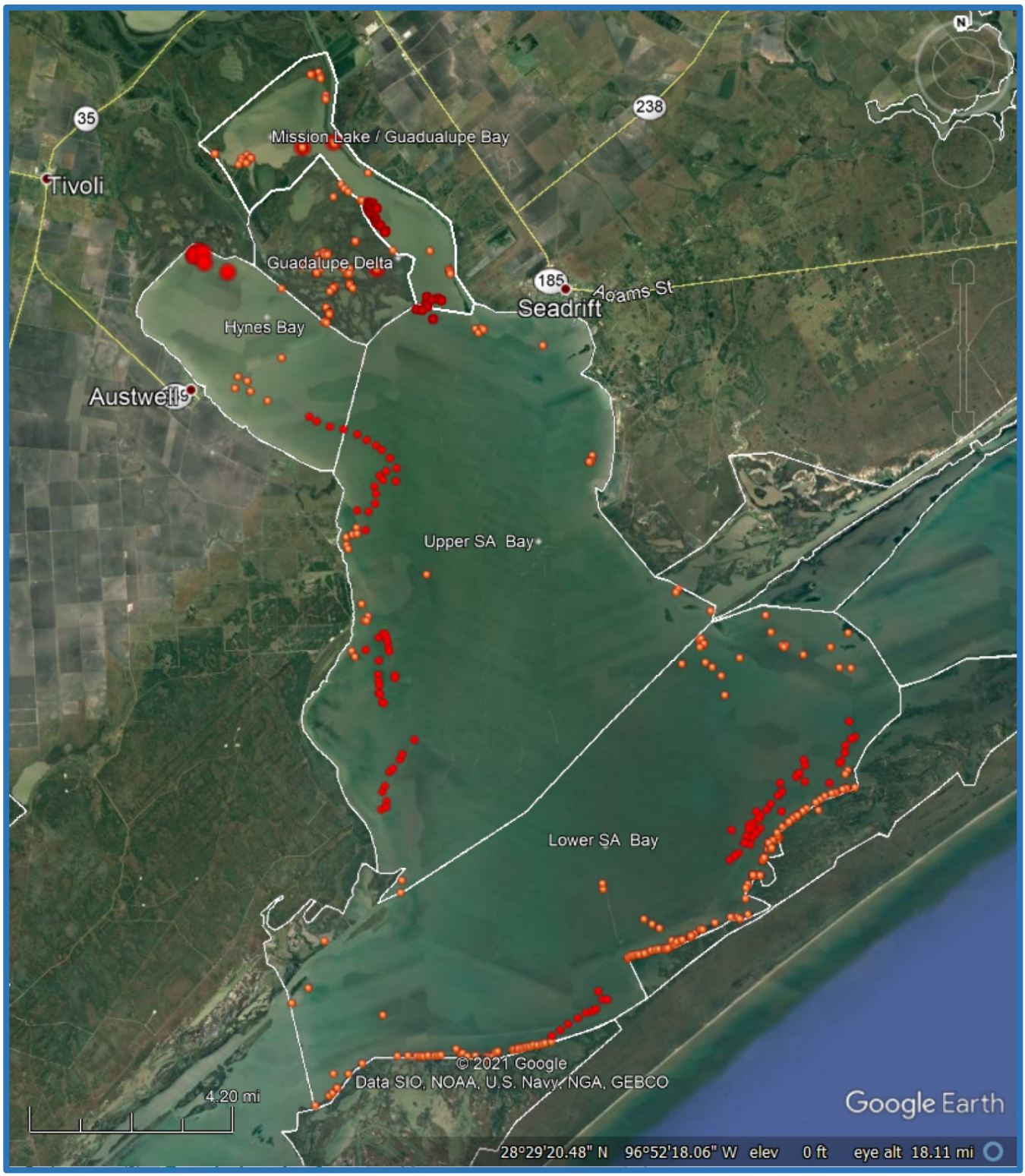
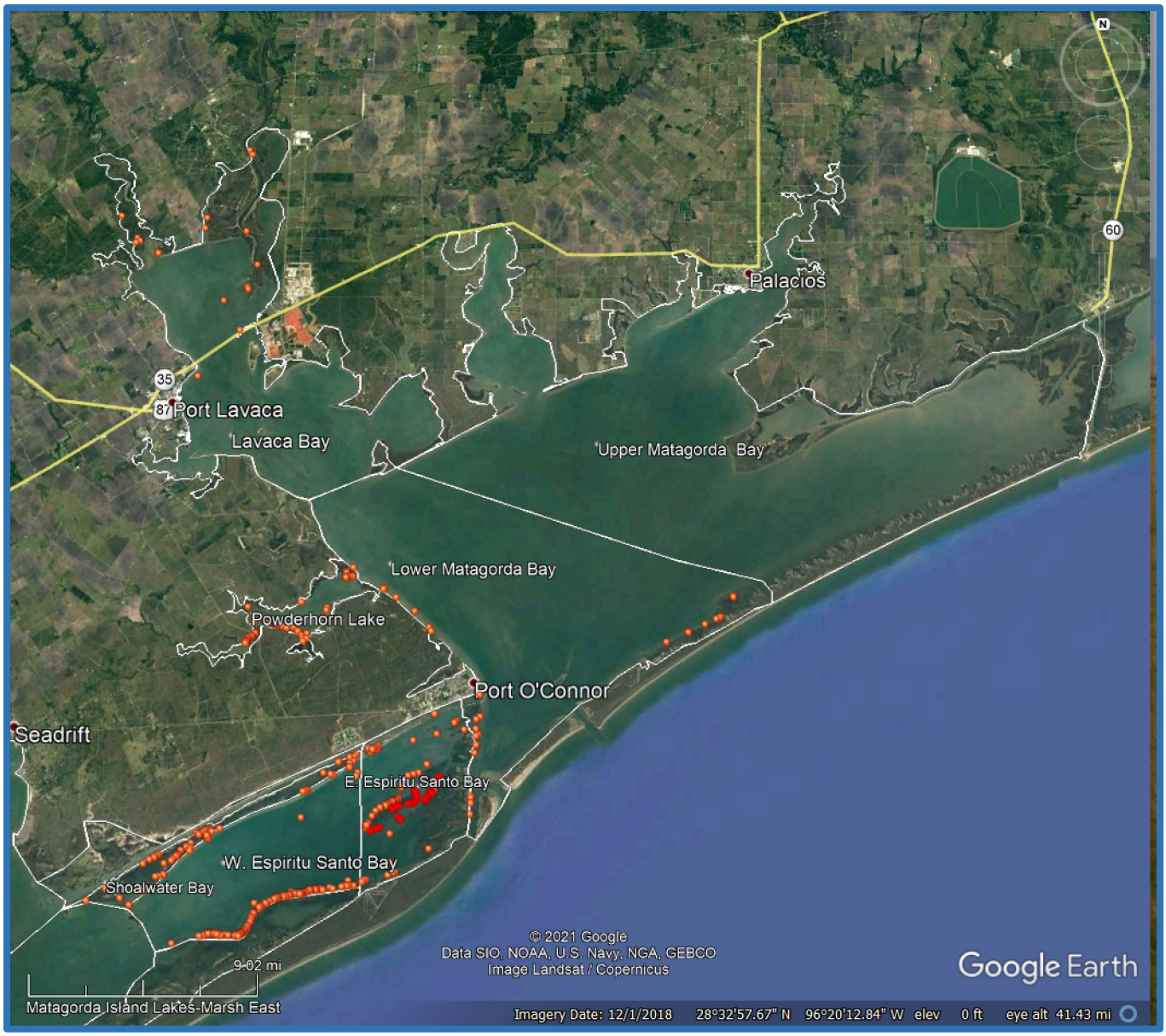


Figure 6. – East and West Matagorda Island Lakes: red dots indicate locations of the 86 traps removed from these two areas.

Figure 7. – Shoalwater Bay, West and East Espiritu Santo Bays, Lower Matagorda Bay, Powderhorn Lake, and Lavaca Bay: red dots indicate locations of the <u>350</u> traps removed from these six bays.



VI. Results/Discussion

A. Trap Contents

The commercial crabbing industry on the Texas Mid-Coast targets the harvest and sale of blue crabs (*Callinectes sapidus*), but the standard crab trap design (*see Appendix I*) also allows entry into the trap of other crab species, primarily stone crabs (*Menippe mercenaria*), as well as a variety of fish species and, occasionally, turtles (including a species of special concern, the Texas Diamond Back Terrapin (*Malaclemys terrapin littoralis*). Commercial crabbers who check and empty their traps regularly will generally return this "bycatch" to the water in good condition. Unfortunately, both the blue crabs and the bycatch in traps which are not checked regularly, or are abandoned, tend to die in the trap. These dead blue crabs and other species which remain in the trap then act as "bait," attracting and entrapping more blue crabs and bycatch. This "vicious cycle" of death and continued capture is commonly referred to as "ghost fishing," which can account for significant mortality numbers for blue crabs and other species which get caught in the traps.

One of the primary data collection goals for this project was to document the number of crabs, fish, and other marine life found in the traps removed during the 2021 closure period – and to tie that information to the location where the trap was found and removed. **Overall, 34% of the traps removed (354 out of 1045 traps) contained one or more species of crab or fish – note: no turtles were found this year**. Volunteers documented that the traps had captured 567 blue crabs, 707 stone crabs and 328 fish – and then removed the trap contents, both living and dead.

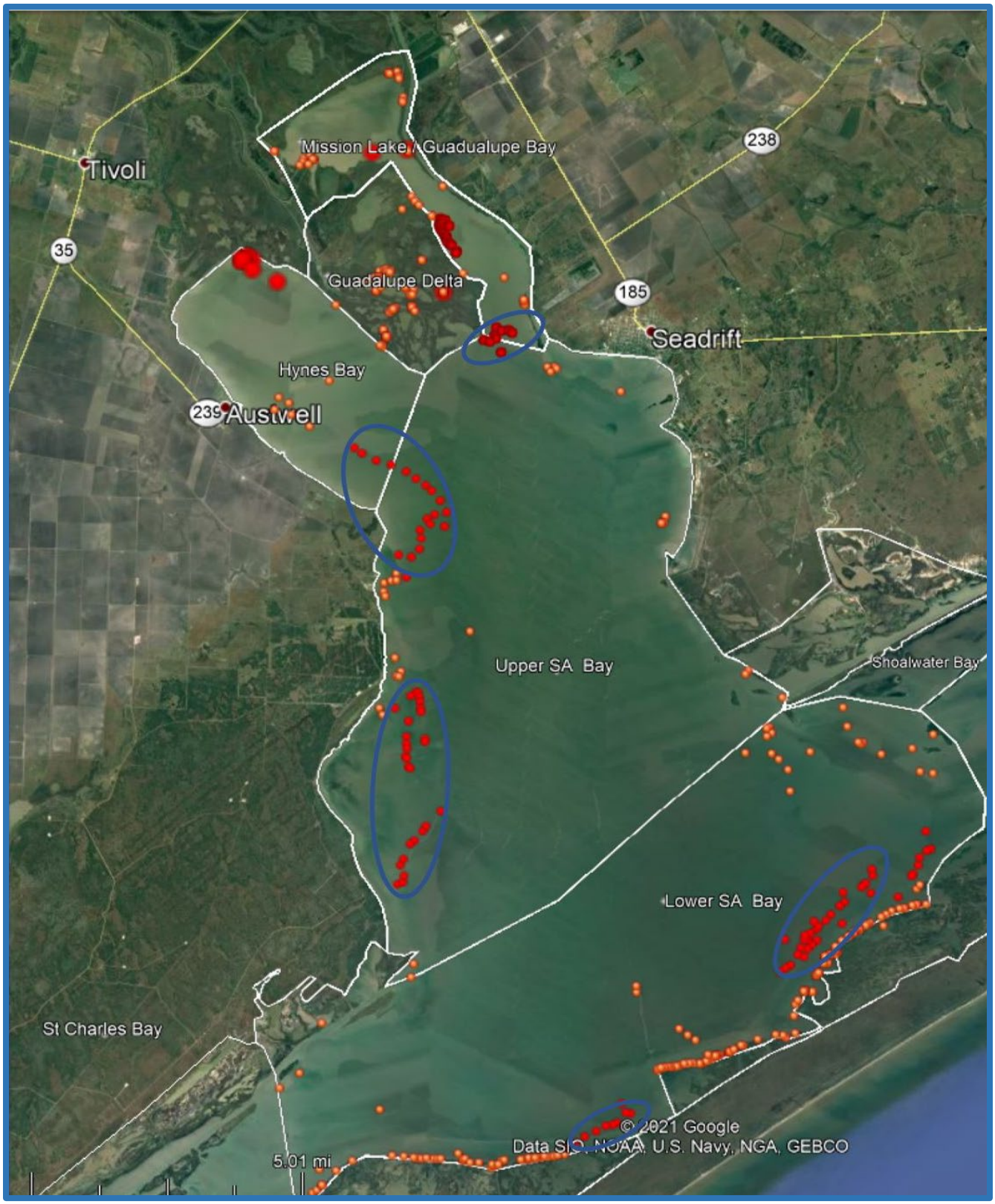
B. Abandoned Traps vs. "Lost Traps"

While many, if not most, abandoned crab traps result from some unintentional cause (i.e., traps are "lost" -- blown by wind or moved by currents to locations where they cannot be located or accessed by the owner), the location data for many traps removed during the February 2021 Crab Trap Removal program seems to indicate that the traps were simply, and purposely, abandoned in place. This finding stems from both from the "linearity" of the point locations of multiple traps (which indicates a "trap line" left in place) and the ownership information on the trap tags (same owner for all the traps in a trap line). Figure 8., on the following page (Pg. 17), illustrates this pattern in traps removed in the larger San Antonio Bay area bay complex. Similar patterns of purposely abandoned traps appeared in several other bay systems.

Another category of what appears to be purposely abandoned crab traps is the "dumped" traps which were observed at several locations within the San Antonio/Hynes/Guadalupe Bay area. In this case, groups of anywhere from 3 to 6 traps, usually unmarked, were found in immediate proximity to each other. See photos below.

Photos 3 & 4: Traps "Dumped" in Hynes Bay (Photo: James Dodson, SABP)

Figure 8. – San Antonio, Hynes, Guadalupe Delta, and Mission Lake/Guadalupe Bay: Spatial Distribution of Trap Locations Appears to Indicate "Abandonement in Place" of Traps – see areas outlined in blue



C. Problems with the Placement of Crab Traps in Shallow Marsh Areas

Bays along the Texas Mid-Coast are fringed by tidal marsh complexes characterized by areas of vegetation surrounding shallow, typically muddy-bottomed, open-water features. Many of these marshes connect to the open bay via shallow channels which are navigable during normal to high water conditions. Crab traps placed in these marshes during higher water conditions may not be accessible during regularly occurring lower tides, or for extended periods during the winter when the passage of frontal systems and accompanying strong N/NW winds push water out of the bays and drop water levels in the marshes to the extent that access via boat is sometimes impossible for days. This limits crabbers' ability to regularly check traps in these locations, or to remove them during the closure period.

This was exactly what happened just prior to the 2021 Crab Trap Closure period. A cold front of historic strength pushed across the Texas Coast on Saturday, February 13th (6 days before the Friday, February 19th beginning of the 2021 Crab Trap Closure period) dropping both water temperatures and water levels to extreme lows. These conditions lasted an entire week. Because of the freezing conditions, Texas Parks and Wildlife Department (TPWD) issued an emergency order delaying the start of the 2021 Crab Trap Closure period until Monday, February 22nd to provide additional time for crabbers to remove their traps. The impact of this cold weather event on the crabbers' ability to access and remove traps placed in the marsh areas may have increased the number of traps found left in place during the abbreviated closure period, even with the time extension provided by TPWD.

VII. Outreach, Communications and Stakeholder Engagement Program

The time and effort spent during the annual Texas Mid-Coast Crab Trap Removal event is only part of the picture – in order to reduce the number of abandoned crab traps that have to be removed from Texas' Mid-Coast bays, this project involves much more time and effort in identifying and addressing the root causes that result in large numbers of traps being found and removed, year after year. The goal is to rectify that problem by systematically gathering and analyzing data on the location and contents of the abandoned traps to look for patterns, impacts and potential root causes, and then using that information to develop a plan which informs a public outreach, communications, and stakeholder engagement process.

This effort, which began in the early stages of the project, is being led by a team of social scientists at the Harte Research Institute at Texas A&M University, Corpus Christi. It involves close engagement and collaboration with decision-makers, key partners, and stakeholder groups. This communication plan also targets federal and state agencies, and non-profit and private sector organizations.

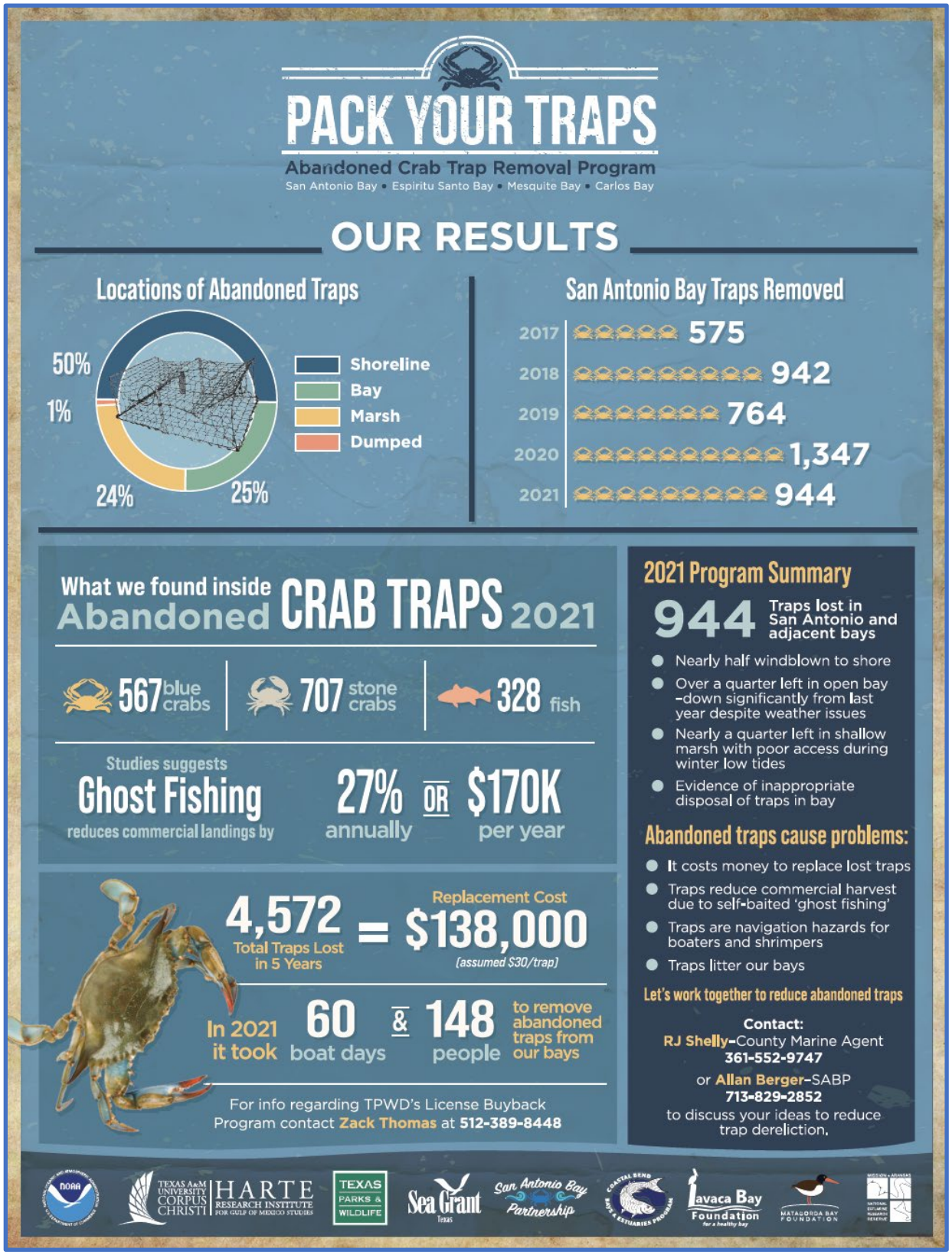
This plan is organized as follows:

I. Communications Mission, Goals, & Strategies
II. Key Audiences and Messages
III. Key Partners and Vehicles

Details of the plan can be found in the Appendix.

Information generated from the data compiled during the 2021 Crab Trap Removal Program has already been used to inform the development of a one-page flyer (*see Figure 9., next page*) designed to communicate to the crabbing community and the general public both the results of this year's efforts and the "take-away" messages the analysis of the data generated.

Figure 9. – 2021 Crab Trap Removal Program Flyer (focused on results in San Antonio Bay system)



VIII. Conclusions/Recommendations

Despite the challenges presented by a near-record-setting cold spell immediately preceding the 2021 Texas Mid-Coast Crab Trap Closure and Removal event, which resulted in an abbreviated closure period (7 days instead of the usual 10 days), this year's efforts resulted in the removal of 1,207 abandoned crab traps containing over 1,200 crabs (567 blue crabs and 707 stone crabs) and 328 fish. Of these 1,207 traps removed, exact locations and information on the contents of the trap were logged, via a cell-phone base "Collector App," on 1,045 traps (87%).

Mapping and analysis of the location data recorded for these 1,045 traps reveals several patterns in terms of spatial distribution – i.e., the locations of the traps could be categorized as: open bay, shoreline, marsh, and "dump." The causal factors for trap abandonment can be inferred from these location groups and categorized as: abandonment (largely open bay), dispersal/inaccessibility (shoreline/marsh), and "dumping" (groups of traps found in one location).

Shoreline/marsh locations account for the largest number of traps removed (544out of 1,045 (~52%)), and this large number could indicate that traps found in these environments are there because they are difficult for crabbers to locate, identify and retrieve – i.e., retrieving them is either physically or economically unproductive. However, crab trap pickup volunteers' experience in removing traps along shorelines and in marshes indicates it is possible to remove traps in these environments – sandy shorelines being the easier to access and marsh areas the more difficult, often requiring an airboat capable of reaching traps found in shallow, muddy areas.

The next largest category of abandoned traps retrieved is the traps found in open bay areas, which account for 23% of the traps removed. Mapping of the data on the location and ownership of these "open bay traps" reveals patterns (in "trap lines") which seem to indicate that many of these traps were simply abandoned in place. In this case, further interaction with the crabbing community could reveal why/how that is occurring and how to prevent it in the future.

A smaller, but significant, number of traps (12 in total) appear to have been purposely "dumped." Categorizing these traps as such is based on the fact that there are several traps, often with no identification, found in close proximity to each other. While some of these traps appeared to be in good condition, which begs the question as to why they were abandoned, others were fouled and in poor condition, which means thy were left in the water as an alternative to transporting them back to the docks for proper disposal.

While these categorizations are based largely on observations – both in the field and in the mapped data – they may offer the best available explanation of the causal mechanisms for trap abandonment

Based on this generalized analysis, outreach to, and communication with, the crabbing community would appear to be critical in validating these assumptions and working together to develop ways to address the problems giving rise to these high numbers of abandoned crab traps being found in the Texas Mid-Coast estuaries each and every year.

IX. Tools/References

A. Collector App (ESRI)

ArcGIS Collector, a mobile phone-based data collection app, was used to capture data on crab trap location and contents. Retrieved from: https://www.esri.com/en-us/arcgis/products/arcgis-collector/overview

B. Excel (Microsoft)

Microsoft Corporation. (2018). *Microsoft Excel*. Retrieved from: https://office.microsoft.com/excel

C. Google Earth Pro (Google LLC)

Release 7.3.3.7786

Appendix I:

Crab Trap Design and Function

A good explanation of crab trap design and function can be found on the website "Crabbing Hub."

Photo 5: Typical Trap for Blue Crabs

Website Address and Photo Credit: https://crabbinghub.com/how-crab-pots-work-with-pictures/

Appendix II:

Texas Mid-Coast Abandoned Crab Trap Removal Program (ACTRP)

Communications and Engagement Strategy for the 2021 Crab Trap Closure Program

Overview: Abandoned crab traps are known to be a significant source of mortality for a variety of organisms, many of which are recreationally or commercially important and are considered NOAA Trust Resources. To help address this issue, the State of Texas closes every bay system in the State to crabbing for a 10-day period each February to allow for derelict traps to be removed. The Abandoned Crab Trap Removal Program (ACTRP) for the Texas Mid-Coast Reis a joint project between San Antonio Bay Partnership, Mission-Aransas, Harte Research Institute, Matagorda and Lavaca Bay Foundations, Aransas National Wildlife Refuge, and the International Crane Foundation. The program organizes volunteers to locate and remove derelict crab traps in coastal waters from Matagorda Bay to Aransas Bay during the TPWD's 10-day closure period in February 2021 and February 2022. Volunteers will also collect standardized data to be used to understand the impacts and identify root causes of the dereliction. Successful implementation of the project will require close engagement and collaboration with decision-makers and key stakeholder groups. Along with key partners, this communication plan also primarily targets federal and state agencies, and non-profit and private sector organizations.

This plan is organized as follows:

I. Communications Mission, Goals, & Strategies
II. Key Audiences and Messages
III. Key Partners and Vehicles

I. Communications Mission, Goals, and Strategies

Mission: To reduce the number of derelict traps in the Bay and reduce new derelict traps escaping.

Goals:

1) Develop and implement recommendations and changes that reduce crab trap dereliction and are supported by the local commercial crabbing community
2) Create an active and involved volunteer group dedicated to continuing to remove derelict traps and other marine trash that are in the bays of the Texas Mid-Coast
    a. Leverage this project to build a broader volunteer base for general bay cleanup, especially with the Matagorda volunteer base
    b. Include use of the app. (but must be trained as part of the volunteer group)
    c. SABP has information and contacts on their website to sign up
    d. Real limitation is boats – not walk on volunteers – need to recruit more boaters
3) Encourage positive social media interest and engage in community outreach through social media outposts and partner websites

II. Strategies:

1) Strong internal coordination with key partners

2) Potential Strategy to engage Commercial Crabbers
    a. Focus on dock-based outreach in fishing communities, which in Seadrift are Vietnamese and Hispanic
    b. Prior to Closure - enhance reminders of upcoming closure (posters, dockside visits, mailouts)
    c. Also look to bring a crabber to local media TV interviews or, if looking for boats, bring a boat owner that is supportive and have been involved
    d. After Closure – share results of cleanup effort (#, location, content, analysis) – pamphlet in layman's terms
        i. With Sea Grant, develop a plan for how to package and effectively communicate data collected from the February 2021 event back to the crabbing community over the summer
            1. What is the current priority need?
            2. What messages should be targeted to individual crabbers, key leaders?
            3. How should data be packaged to help motivate crabbing community, e.g., in terms of costs or crabs unavailable for harvest during the pickup event?
            4. How to best reach the 30 license holders, as some of the addresses are old (e.g., engage Catholic Church or Vietnamese Community Center)?
    e. Develop Educational Material regarding consequences of derelict traps—in layman's terms
        i. Develop Best Practices training materials
    f. Identifying and developing improvements and buy-in
        i. Continue building relationship with Community leaders
        ii. identify individual crabbers willing to share perspectives.
        iii. Identify incentives that might change current practices / incentives, e.g.
            1. buyback program for old traps
            2. storm recovery program
            3. promote license buy-back programs
    g. Determine appropriate stance for enforcement that encourages improvements without heavy-handed actions
3) Develop media strategy for 2022 season. Target local media:
    a. Victoria Advocate
    b. Port O'Connor/Sea Drift – Dolphin Talk
    c. Rockport Pilot
    d. Palacios / Bay City papers
    e. Parks & Wildlife Press Release
    f. TV stations in the Corpus or Victoria area
4) Engage broader stakeholders through social media with content and flyers
5) As allowed as COVID-19 restrictions ease, engage commercial crabbers in this region for a discussion over root causes and develop alternative solutions.

III. Key Audiences & Messages

Key Audiences:

- Recreational crab fisherman and commercial crab fisheries
- The general public and active volunteers
- Local community stakeholders – universities (TAMUCC, UTMSI), businesses (crab processors and wholesalers, crab trap manufacturing), and industry (several local industries are sponsors of crab trap removal as good corporate citizens)

- Non-governmental organizations & environmental groups (private or non-profit), e.g., SABP, CBBEP, MBF, LBF, ICF, CCA
- Local, regional, state, and federal government agencies involved with implementation, e.g., TPWD Coastal Fisheries, USFWS, TXSG, County Government, enforcement (TPWD, USFWS)

Social Media Key Draft Messages for Crabbers, General Public & Volunteers:

Key message to Commercial crabbers: ***derelict traps cost you money and reduce your catch*** *—(need catchier version of this theme.)*

Bays along the Texas Mid-Coast are closed to crabbing from February 19-28 – ***remember to Pack Your Traps!***

All crabbers are required to pack up traps before February 19th – ***let's work together to save costs and reduce the number of derelict traps in our bays!***

Pack Your Traps!!! *Remember to remove all crab traps before February 19th – any traps left in the water will be collected and destroyed.* ***Let's work together to keep our Bays healthy!***

Looking for volunteers*, February XX! The Abandoned Crab Trap Removal Program will remove derelict crab traps from our Bays,* ***come enjoy the outdoors and help keep our coasts healthy!***

IV. Key Partners and Vehicles

Communication through key partners' websites and social media outposts will act as a community outreach tool during the implementation of the program and be used to create and add onto the project's volunteer base (though boats are currently more limiting).

Partner		Website & Social Media Outposts
San Antonio Bay Partnership (SABP)	Allan R. Berger	• Website: https://www.sabaypartnership.org • Facebook: @SanAntonioBayPartnership • https://www.facebook.com/SanAntonioBayPartnership/ • email distribution capabilities, e.g. Vertical Response
Coastal Bend Bays & Estuaries Program (CBBEP)	Leigh Perry	• Website: https://www.cbbep.org • Facebook & Instagram: @cbbep • https://www.facebook.com/CBBEP
Texas Sea Grant (TSG)	R.J. Shelly	• Website: https://texasseagrant.org • Facebook & Instagram: @texasseagrant • https://www.facebook.com/texasseagrant • Twitter: @TXSeaGrant
Matagorda Bay Foundation (MBF)	Bill Balboa	• Website: https://matbay.org • Facebook: @matbay.org • https://www.facebook.com/matbay.org/
Lavaca Bay Foundation LBF)	Raymond Butler	• Website: https://lavacabay.org • Facebook: @lavacabay • https://www.facebook.com/lavacabay/
International Crane Foundation (ICF)	Liz Smith Terry Turney	• Website: https://www.savingcranes.org/ • Facebook: https://www.facebook.com/savingcranes • Twitter: https://twitter.com/savingcranes
National Ocean & Atmospheric Administration (NOAA)		• Website: https://www.noaa.gov
TAMU-CC, Harte Research Institute (HRI)	Katya Wowk	• Website: https://www.harte.org • Facebook, Twitter & Instagram: @harteresearch • https://www.facebook.com/harteresearch • Twitter: @HarteResearch
Texas Parks & Wildlife Department (TPWD)	Holly Grand	• Website: https://tpwd.texas.gov • Facebook & Instagram: @texasparksandwildlife • https://www.facebook.com/texasparksandwildlife/ • Twitter: @TPWDnews
Mission Aransas National Estuarine Research Reserve (MANERR)	Katie Swanson	• Website: https://missionaransas.org • Facebook & Instagram: @manerr, @missionaransas • https://www.facebook.com/manerr/ • Twitter: @MissionAransas
US Fish & Wildlife Service Aransas National Wildlife Refuge	Laura Bonneau	• Website: https://www.fws.gov/refuge/aransas/ • Facebook: @AransasNWR • https://www.facebook.com/AransasNWR • Twitter: @USFWSRefuges