Chemical Contaminant Sediment Study for St. Andrew Bay, Florida

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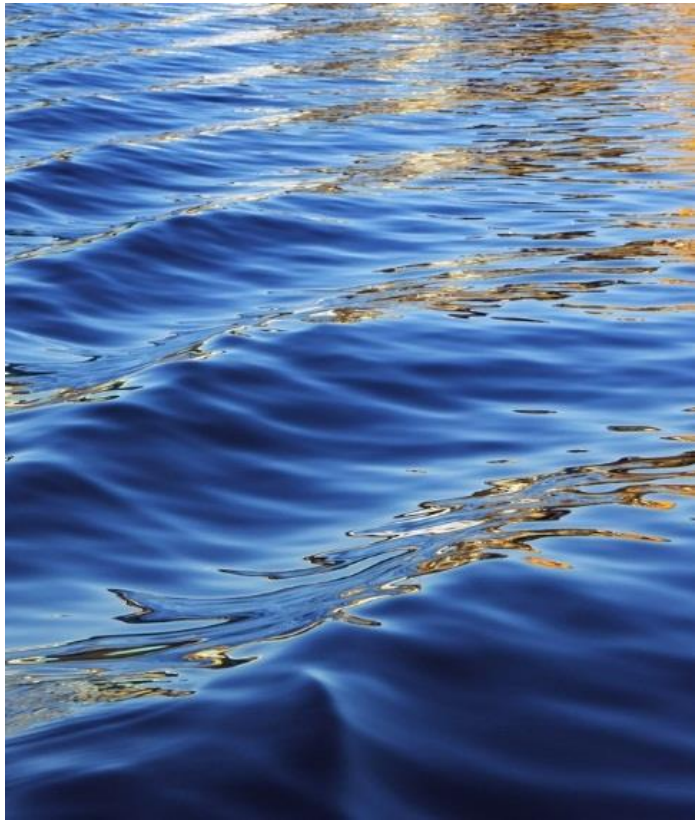


Unique Features of St Andrew Bay Complex

- Inflow of freshwater is minimal and originates primarily from the spring-fed flow of Econfina Creek
- The presence of river sediments typical of most estuaries is practicality non-existent in St. Andrew Bay
- Without these deposits, the bay remains deeper than most north Florida bays, lacks river-carried turbidity, and has minimal flushing from freshwater land drainage
- Because of its location on the Gulf of Mexico, the Bay has minimal tidal exchange.
  - The vertical difference of the maximum tidal range (spring tides) is just over two feet (0.7m)
- Lack of a river-driven impact and minimal tides results in water that is generally saltier than most estuaries and has unusually good clarity allowing maximum light penetration and marine plant photosynthesis.
  - These conditions allow exceptional growth of seagrass beds and a high diversity of marine animals.

Study Objectives

- Determine the health of St. Andrew Bay by analyzing the chemical and organic composition of sediment found in various locations of the estuary.
- Study analyzed for the presence of the following:
  - Semi Volatile Compounds
  - Metals
  - Organochlorine Pesticides
  - Polycyclic Aromatic Hydrocarbons
  - Organotins
  - Polychlorinated Biphenyls (PCBs)
  - Dioxans and Furans
- 33 locations within the St. Andrews Bay complex were analyzed
- Samples were collected by ponar grabs

Standard Ponar Grab

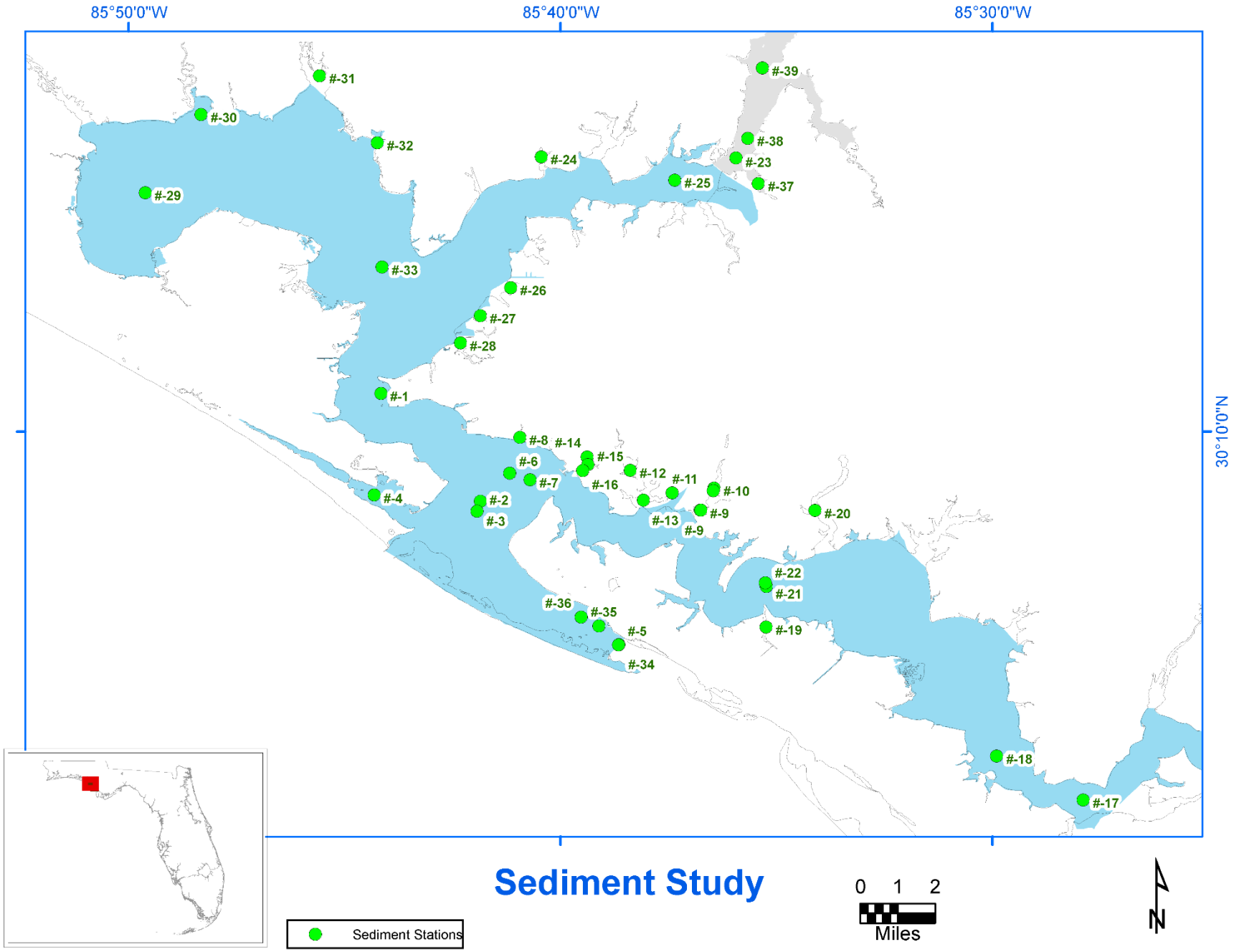
Contaminants Included in Study

- **Semi Volatile Compounds**
  - Petroleum hydrocarbons contain SVOCs and can be found in stormwater runoff.
- **Metals**
  - The presence of metals such as Chromium, Copper, Lead, Nickel, Vandium, Mercury, Cadmium and Zinc can adversely impact aquatic health
- **Organochlorine Pesticides**
  - Very toxic and resistant to degradation. An example is DDT. While they are currently banned in the U.S., their use still occurs globally in some countries.
- **Polycyclic Aromatic Hydrocarbons**
  - These can naturally occur in oil and natural gas regions but can be harmful in high concentration due to human activity (e.g. industrial operations). Napthalene, used in moth balls, is an example of a PAH.

Contaminants Included in Study

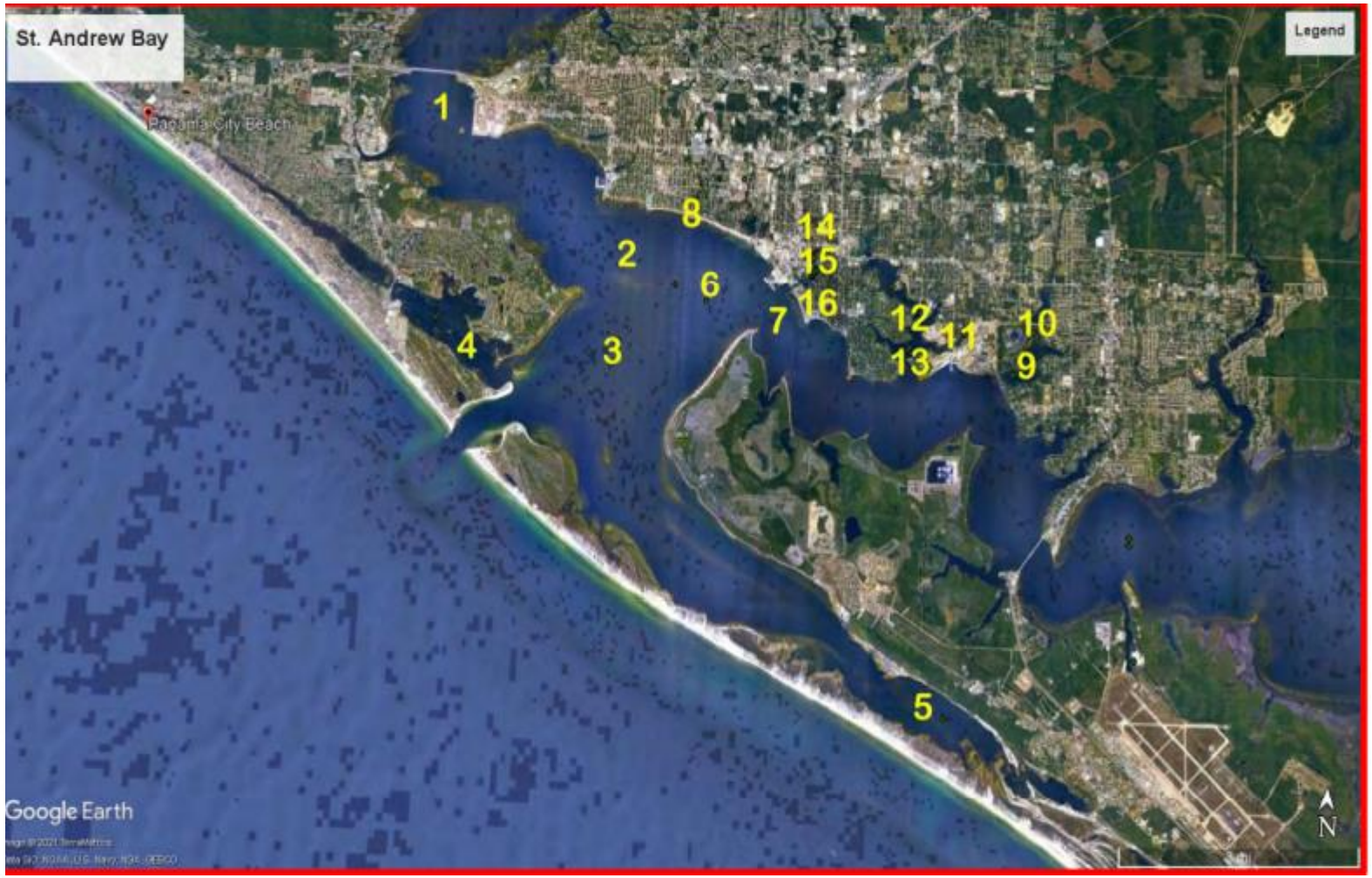
- **Organotins**
  - Most commonly known as "antifouling" agents used on ship hulls. These compounds "leach" into the aquatic environment and are highly toxic to marine life. These have been highly restricted since the 1980s
- **Polychlorinated Biphenyls (PCBs)**
  - PCBs are manmade and are used in a variety of industrial application. Local sources are likely from previous industrial operations and old machinery. These substances are banned but do not easily degrade and are persistent unless remediated.
- **Dioxans and Furans**
  - These compounds are highly toxic and are formed when other compounds react with each other. 2,3,7,8-TCDD (2,3,7,8-tetrachlorodibenzo-para-dioxin) is an example of this class of chemicals

Sample Locations



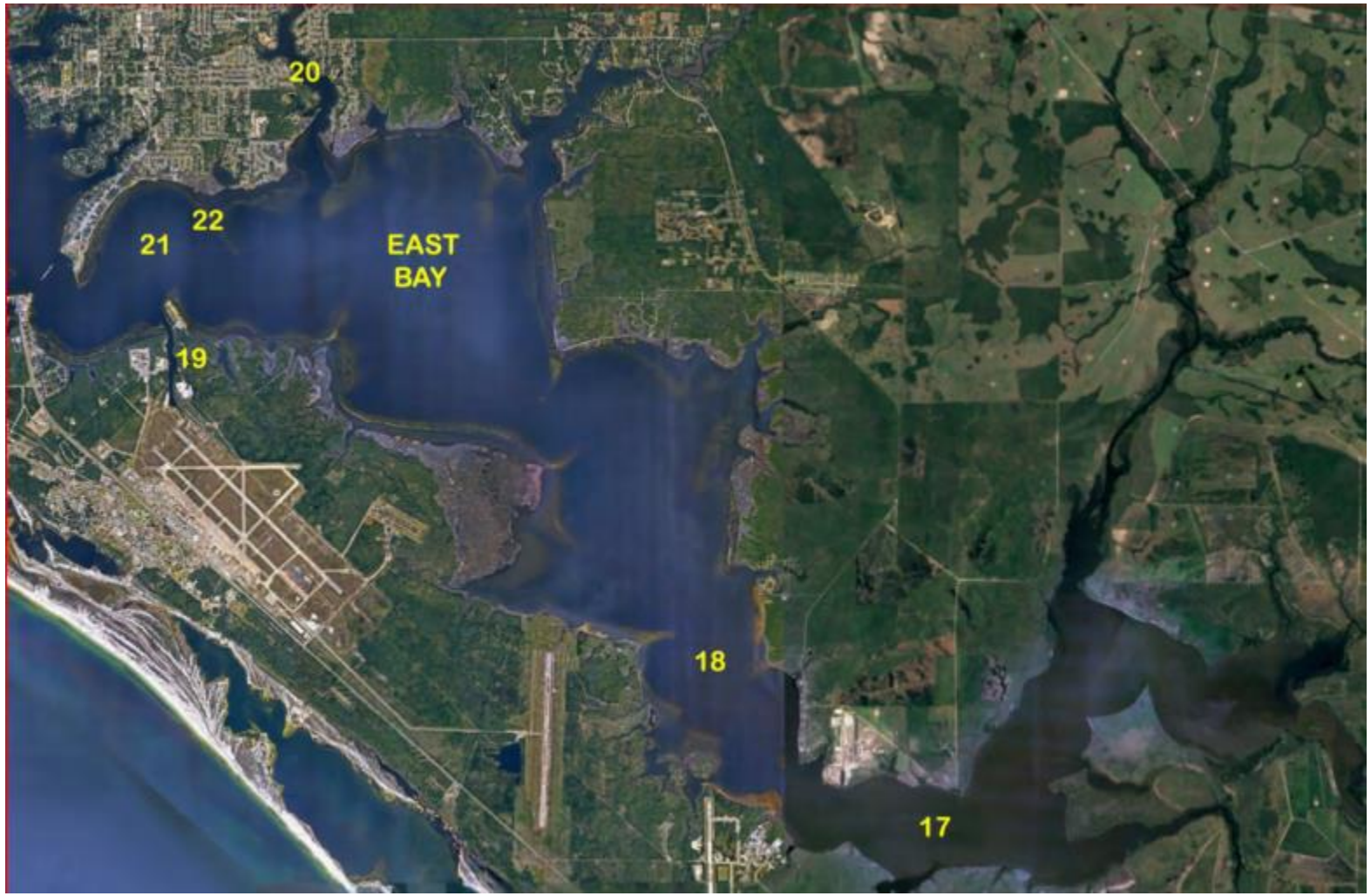
Lower St. Andrew Bay Stations

Station #	Local Name
1	Port Panama City
2	SC, B CN #5
3	lower St. Andrew Bay
4	lower Grand Lagoon
5	SE Tyndall Yacht Club
6	SC, E of QF G 17' 3
7	SC off Redfish Point
8*	lower Lake Caroline
9**	lower Martin Lake
10	S Cherry St, Martin Lk
11	SE arm, Watson Bayou
12	Just N, Eastern Marine
13	Just N, of bayou mouth
14	Up, Massalina Bayou
15	Mid, Massalina Bayou
16	Low, Massalina Bayou



East Bay Sample Stations

Station #	Local Name
17	Eastern Marine - east
18	Eastern Marine – west
19	Shoal Pt Bayou, TAFB
20	Callaway Bayou
21	N of QF G 17' "45"
22	E of Long Point

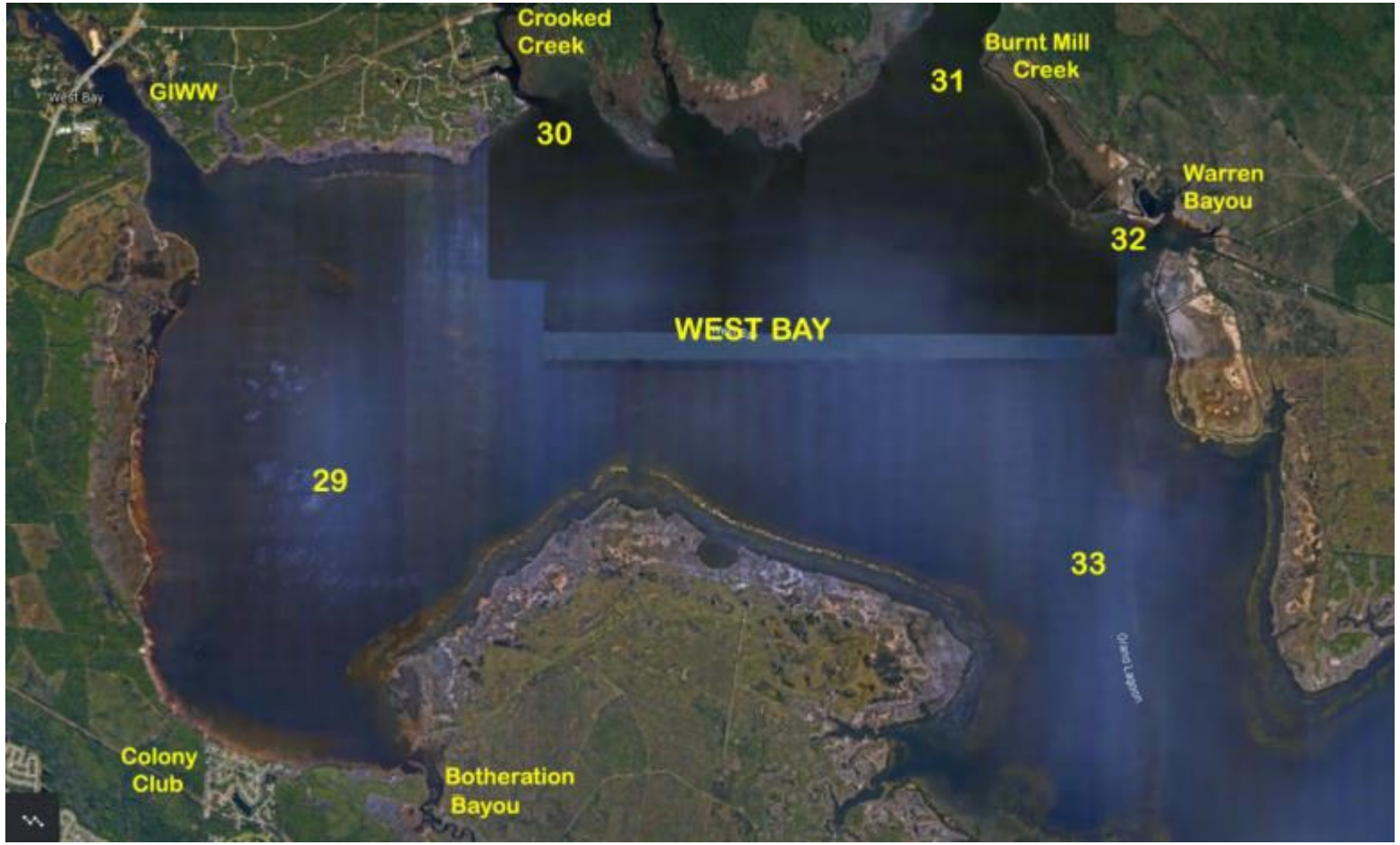


North Bay Sample Sites

Station #	Local Name
23***	Deer Point Lake
24	Newman Bayou
25	"5 Bayous" and dam
26	Goose Bayou E of A.P.
27	Robinson Bayou
28	Pretty Bayou

West Bay Sample Sites

Station #	Local Name
29	N of Colony Club
30	Crooked Creek
31	Burnt Mill Creek
32	Warren Bayou
33	E of "Long Point"



Study Findings

- Semi-volatile organic compounds pose no significant risk at the locations analyzed.
- Metal contamination is minimal overall, but poses some risk in three bayous:
  - Massalina
  - Watson
  - Martin Lake
- Organochlorine pesticides no longer present an ecological risk within the bay.
- Polycyclic aromatic hydrocarbons were not found at levels to pose any significant ecological risk within the bay system.
- Organotin compounds are present and pose an undefined risk in Watson Bayou.
- PCBs were present at every location sampled. At many stations, PCBs in all molecular weight groups were present, often at concentrations high enough to merit thoughtful consideration.
- Dioxins and furans are present and problematic in Watson Bayou and Martin Lake but were no longer found to pose a concern at the open-bay stations sampled in East Bay.

Conclusions and Recommendations

While most of the open-bay sediment stations were free of contaminants, there is still a need to identify and locate chemical sources in specific areas. Additionally, there are management actions recommended to create a comprehensive understanding of the bay's health.

1. St. Andrew Bay has not been surveyed for the presence of its marine species or the abundance of their populations in a very long time. It
   - **Repeat and compare the 1970s National Marine Fisheries Service surveys**
     - **There were three 3 types of surveys done in the past: trawling; gill netting; and haul seining. Each survey was reported as a separate publication.**
2. Develop a more intensive storm water treatment program for urban and suburban areas around St. Andrew Bay.
   - **Several areas of identified contaminant concentrations should be further evaluated and a remediation plan developed for each**
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Conclusions and Recommendations (Cont.)

4. Study the presence and impact of Chemicals of Emerging Concern (CECs), including Endocrine Disruptors (EDs)
   - This study should have as one of its focuses, threatened species, such as the bay scallop or other species revealed in jeopardy by recommendation #1
5. Study the impact of chemical mixtures and impact on marine life.
   - This study focused on discrete chemical families, but more should be known about chemical interactions and the marine environment.
6. Evaluate ecosystem stressors including atmospheric deposition, climate change, global warming and sea level rise.
   - It is relatively apparent that St. Andrew Bay is subject to chemical impacts by direct contact (e.g. runoff, contamination) and those that may be transported in the atmosphere from distant sources.
   - The presence of PCBs in the study supports this recommendation