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Bottlenose dolphin activity in a highly industrialized region of Galveston Bay, Texas

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Abstract

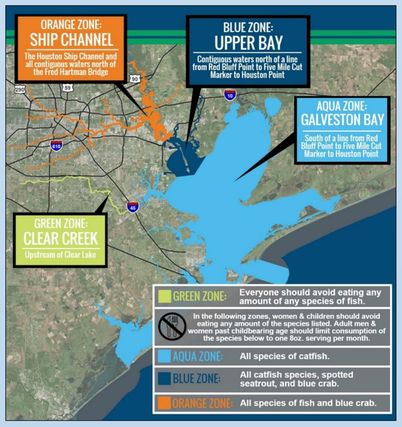
Critical data gaps exist for all Texas bay, sound and estuary bottlenose dolphin (*Tursiops truncatus*) stocks and managers consider Galveston Bay a high priority for research. Surveys conducted in 2013-2015 suggest that a bottlenose dolphin population regularly utilizes upper Galveston Bay (UGB) and the Houston Ship Channel (HSC). This highly industrialized region was previously thought to have very little dolphin activity. Elevated exposure to contaminants in UGB, combined with additional stressors such as habitat loss, harmful algal blooms, noise pollution and human and fisheries interactions, place dolphins at high risk. The Galveston Bay Foundation has partnered with the Environmental Institute of Houston to conduct research on this understudied population. Through long-term photo-id monitoring, mark-recapture techniques and remote biopsy darting, the Galveston Bay Dolphin Research and Conservation Program (GDRCP) aims to study the population's ecology, health and behavior. Additionally, GDRCP is examining historical data and distributing a questionnaire to long term UGB users to provide context to current trends. As of March 2015, we have conducted 16 boat-based surveys, resulting in the observation of 364 dolphins in 56 groups. A total of 196 dolphins have been uniquely identified. Dolphins were sighted year-round and of the marked dolphins, 30% were sighted more than once, suggesting the possibility of a resident population. Observations indicate an increase in abundance during the summer and fall months, which supports previous data suggestive of a seasonal coastal migration between Texas bays. Findings also indicate high levels of association with shrimp trawlers (30% of groups) and vessels traversing the HSC (bow-riding observed in 23% of groups). Considering the exceptionally high levels of human activity in UGB, it is imperative to continue monitoring this population, with focus on understanding residency and habitat use patterns, as well as the impact of anthropogenic threats.

Introduction

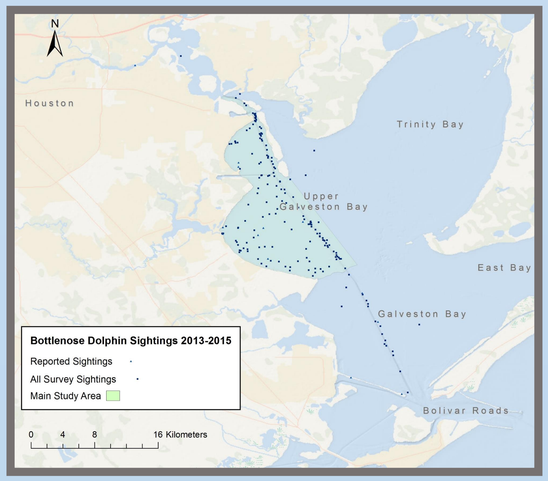
Galveston Bay (GB) is a 1600km^2 anthropogenically altered shallow bay system and an Estuary of National Significance. Growth and industrialization from the 1950's – 70's contributed to massive fish kills, a 95% decline in submerged aquatic vegetation and an EPA listing on the 10 most polluted waterways. Management activities have improved water quality and health; however, concerns over pathogenic bacteria and chlorinated organic compounds persist[1].

From the 1980's to early 2000's, studies of bottlenose dolphins (*Tursiops truncatus*) in Texas (largely conducted by Texas A&M University MMBL) found:

- High concentrations of dolphins near the entrance to GB and lower concentrations in GB and East Bay
- A decrease in abundance moving north from Bolivar roads in the Houston Ship Channel (HSC)[2] and little or no activity in upper GB and Trinity Bay regions[3,4]



Map of the current consumption advisories in Galveston Bay for high levels of PCBs and Dioxins. Figure modified from GBF (2015)[5]



Study area map with bottlenose dolphin sightings 2013-2015.

Association with a vessel was observed in over 60% of sightings during Photo-Id surveys

Conclusions

Preliminary results of this ongoing project show that bottlenose dolphins utilize upper GB, a region previously thought to have little or no dolphin activity, with an apparent increase in abundance in this region over the last 20 years. There is an increase in relative abundance during warm months. Dolphins often associate with shrimp trawlers and vessels in the HSC. More investigation is needed due to the high risk environment. Bottlenose dolphins are a good candidate to be a flagship species for Galveston Bay.

Part of the Texas Bottlenose Dolphin Research Collaborative

What is the perception of dolphin activity in upper GB among long-term bay users?

Objectives

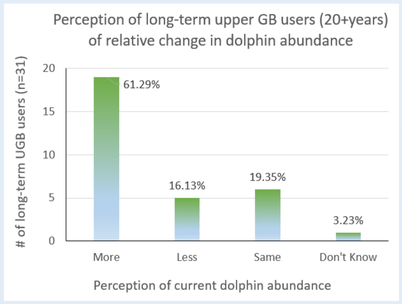
Explore long-term bay user perceptions regarding dolphin activity in upper GB, including those related to abundance trends, seasonal use, and human-dolphin interactions.

Methods

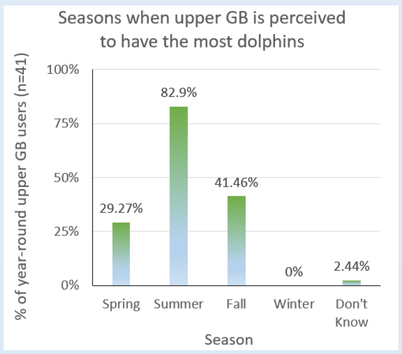
- Conducted a 34-question online survey (closed and open-ended) to be completed by users of upper GB (fishers, boaters, etc.).
- Recruitment efforts targeted long-term users of upper GB (defined as conducting 20+years of activity in upper GB).

Preliminary Results

- 83 bay users completed the online survey.
- More than 60% (n=19) of long-term users (20+ years) indicated there are now more dolphins in upper GB than when they first started using the bay. Most stated (63.16%, n=12) that the improved health of Galveston Bay (i.e., better water quality, less pollution) and/or increase in food sources explains the increase.



- A Fisher's Exact Test identified a significant difference in responses between upper GB users of 10+ years and those having used upper GB only 5-9 years (p value = 0.0215), with the latter group having more difficulty in identifying a trend. This could suggest that dolphin numbers may have changed more noticeably up until the early 2000s.



- 63.08% (n=41) of year-round current users of upper GB indicated there are observed changes in number of dolphins with time of year.
- Over 80% (n=34) of these users indicated "Summer" as a season with high dolphin numbers.
- Nearly 90% (n=65) of participants indicated that they believe dolphins are an important animal in upper GB. Nearly half (47.37%, n=27) stated that dolphins play an important role in the ecosystem and 36.84% (n=21) believe dolphins are good indicators of the health of upper GB.

Where and when are dolphins found in upper GB and how are they interacting with humans?

Objectives

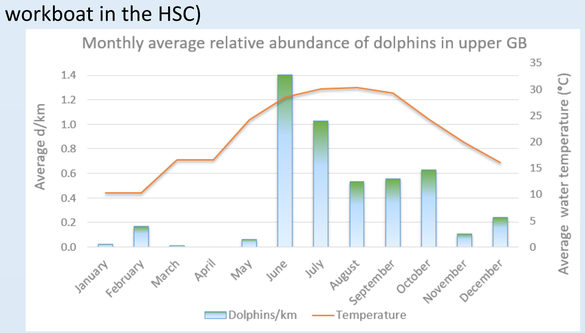
- Examine distribution, relative abundance, site fidelity and human interactions in upper GB.
- Establish a long-term monitoring plan for the region.

Methods

- Standard survey and photo-identification protocols
- FinBase Photo-Identification Database System
- Two seasons defined:
  Warm = May – October
  Cool = November – April
- Relative abundance: # dolphins sighted (d) per kilometer (km) surveyed
- Standard non-parametric tests to explore differences between seasons
- Record instances of human-dolphin interactions

Preliminary Results

- 28 photo-identification surveys conducted in UGB from August 2013 to November 2015: 109 group sightings, 670 dolphins
- Identified 304 distinct individuals (total catalog marked proportion = 0.689): 5% of dolphins were sighted 5 or more times; 38% sighted 2-4 times; 57% sighted only once
- Dolphins sighted year round
  - Significant difference in relative abundance (d/km) between seasons
  - Higher concentrations sighted in warmer months (Md= 0.326) compared to the cool months (Md = 0.015) (Mann-Whitney U = 33, nW=19, nC=9, P=.005, one-tailed)
- 22% of groups sighted patrolling around shrimp boats
- 38% of group sighted bow-riding on a vessel (typically a cargo ship, barge or workboat in the HSC)



Future Investigations and Goals

of the Galveston Bay Dolphin Research and Conservation Program (GDRCP)

- Compare the upper GB catalog to others along the coast and submit to the Gulf of Mexico Dolphin Identification System
- Continue current remote biopsy efforts to collect tissues for examination of persistent organic pollutants, stable isotopes and genetic markers
- Expand the study area and investigate seasonal movements
- Continue recruitment of participants for the online survey
- Conduct structured mark-recapture surveys to estimate abundance
- Investigate human interactions using an interdisciplinary perspective
- Develop education and outreach programs to increase public awareness and promote dolphins as sentinels for Galveston Bay ecosystem health

All work conducted under NMFS Permit# 18881

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