A Stomach Content Analysis of the Most Endangered Marine Mammal

Vaquita (*Phocoena sinus*) Diet and Foraging Behaviors

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What's The Porpoise?

- The most critically endangered marine mammal cetacean in the world (estimated 12-15 individuals remaining in the population)
- Majority of documented vaquita deaths are a result of commercial fishing activities, specifically gillnets that are illegally set to catch an endangered species of sea bass called the totoaba (*Totoaba macdonald*i),
- Low fecundity, late maturity (gestation time period is still unknown), and high mortality in gillnets all put the species at risk
- Vaquita may also fall prey to sharks and killer whales
- There is a paucity of data on the ecology of the species-with no studies indicating diet in vaquitas
- A stomach content analysis is a means of determining prey species through the examination of stomach contents, and is the basis to understanding its life history and biology, its physiological, ecological, and behavioral adaptations, and where it falls in the food web in relation to its prey
- Small porpoise, most closely related to the harbor porpoise, that is native to the northern Gulf of California in Baja, Mexico.
- Here we present on the feeding ecology of the vaquita based on stomach contents

Methods and Materials

- Stomachs came from stranded or captured vaquitas and were provided by the Southwest Fisheries Science Center in California
- Four stomachs (PS-1, PS-2, PS-3, PS-4) were rough sorted by the SWFSC and the contents were shipped to the Duke University Marine Laboratory
- Three stomachs (PS-8, PS-9, VO2F) were dissected at the Duke University Marine Laboratory and the contents found were rough sorted
- Stomachs dethawed 24 hours before dissection
- Before dissection, stomachs were weighed ("full stomach weight")
- A pipet was inserted into the fore and main stomach , through the esophagus to collect any present fluid
- Each stomach compartment was dissected separately
- Once cut open, any whole fish were removed, weighed, photographed, labeled, and frozen
- Stomach was then placed into a bucket and rinsed thoroughly with water to remove any remaining contents
- The bucket of water and stomach contents were poured over three sieves of sizes 12.5 mm, 1.4 mm, and 500µm
- Each sieve was sorted through for otoliths, squid beaks, isopods, fish bones, ocular lenses, and miscellaneous items
- Otoliths were sorted, counted, photographed, and placed in plastic, snap-lid vials labeled accordingly
- Once the stomach was completely emptied, it was re-weighed ("empty stomach weight")
- All otoliths were photographed under an Olympus SZX7 microscope using an Olympus DP71 microscope camera.

Literature Cited

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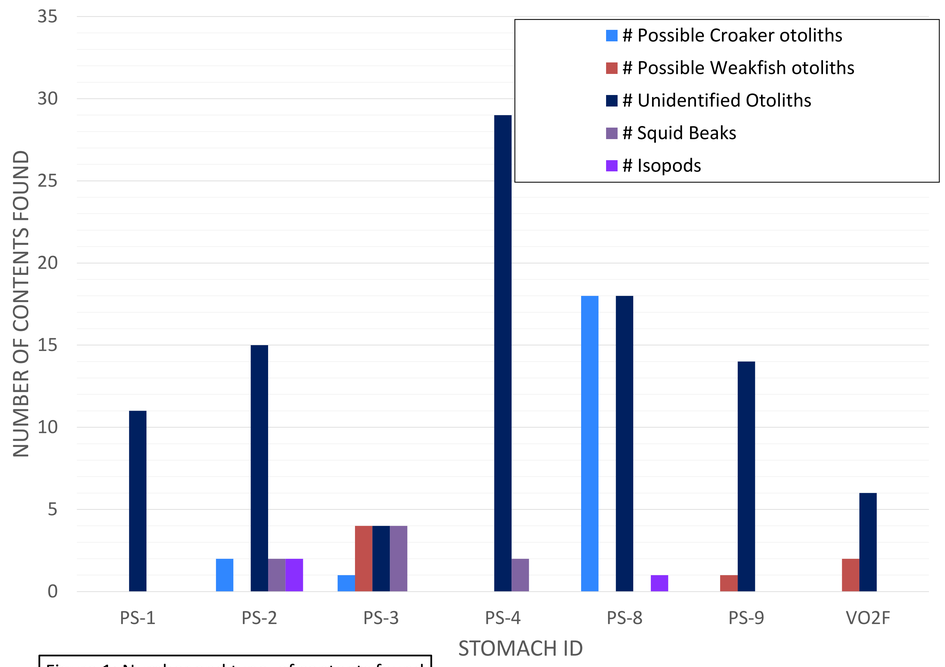


Figure 1: Number and type of contents found per stomach

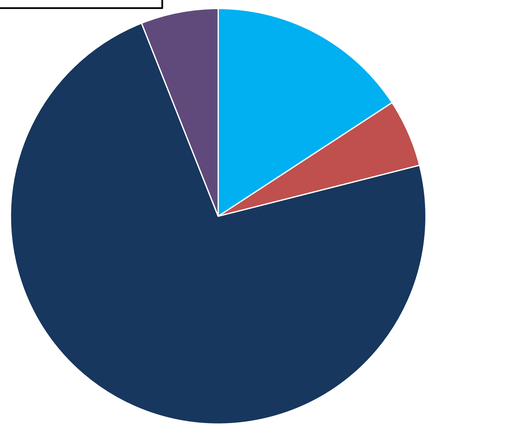
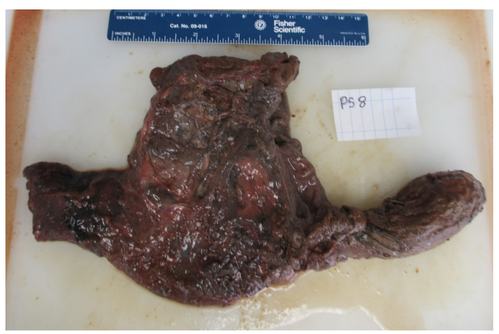


Figure 2: Proportion of prey contents found in dissected stomachs



Vaquita (*Phocoena Sinus*) Stomach (above) & Dissected/Labeled Dolphin (*Delphinus Delphis*) Stomach (right)

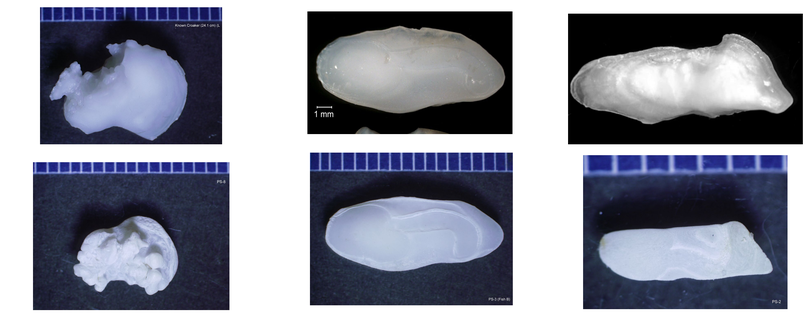
Results

- Stomach contents consisted of fish otoliths and other hard parts, squid beaks, parasitic isopods, crab legs, shells, and plastic (figures 1 &2)
- Croaker, Weakfish, and Kingfish otoliths are unique and easily distinguishable, and though we can not be 100% sure, we attempted to identify possible croaker, weakfish, and kingfish otoliths in each of our stomachs (images below)
- Specifically interested in the prey species ecology, distribution, sound emitting capabilities, and schooling behavior

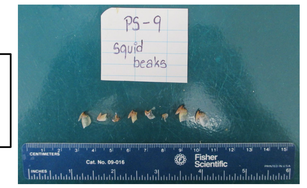
Known Croaker (top) & Potential Croaker (bottom)

Known Weakfish (top) & Potential Weakfish (bottom)

Known Kingfish (top) & Potential Kingfish (bottom)



Isopod (left) & Squid Beaks (right)



Discussion

- With the help of the curator and otolith expert from the Los Angeles County Natural History Museum, we hope to identify each otolith/otolith pair found in all seven stomachs
- After identification, we plan to look into/research the ecology of these prey species to infer potential foraging behavior of the vaquita
- Plan to calculate the minimum number of prey species in each stomach, the frequency of occurrence of prey species, the relative abundance of prey species, and the index of relative importance of prey species
- Create a more extensive otolith reference collection for the Sea of Cortez (will assist and make other marine mammal stomach content analyses from this area more accurate)
- With the Vaquita on the brink of extinction and the population continuing to decline despite conservation efforts, it is important to gather as much information and data on the vaquita
- The stomach content analysis will provide anther puzzle piece into the life, history, and biology of the vaquita

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