Name: _____ Date: _____ Period: _____

The response of gastric pH to fasting and feeding in blacktip reef sharks

Read, annotate, and complete each section.

Gastric digestion in carnivorous vertebrates is responsible for the breakdown of ingested prey. The role of the stomach is particularly important to vertebrates such as fish and reptiles, many of which ingest their prey whole, without chewing. Two components to gastric digestion occur: chemical digestion accomplished by the secretion of hydrochloric acid (HCl) and digestive enzymes, and mechanical digestion accomplished by the muscular contraction of the stomach wall. Sharks are capable of secreting highly acidic gastric fluids measuring as low as 0.4 on the pH scale. Distention of the stomach wall as food enters is the initial stimulus for increased acid secretion.

1. (RST.9-10.4.) Explain the meaning of these words using context clues and prefixes/suffixes.

Carnivorous: _____

Ingested: _____

Secretion: _____

Contraction: _____

Distention: _____

Stimulus: _____

2. (RST.9-10.2.) Sharks and other fish require both chemical and mechanical digestion because-

a. they eat a large quantity of prey
b. they secrete highly acidic gastric fluid
c. they ingest their prey whole
d. they experience distention of the stomach

An experiment was conducted with three adult blacktip reef sharks, *Carcharhinus melanopterus*. Data recorders were inserted into the stomach of each shark to quantify gastric pH, motility, and temperature during fasting and following ingestion of food. Figure 1 below summarizes the physical characteristics of each captive shark.

Shark	Total Length (in cm)	Mass (in kg)	Sex	Minimum pH	Maximum pH	Mean pH
1	139	19	F	1.2	3.6	1.7
2	144	21	F	0.8	3.4	2.0
3	150	24	F	1.2	4.0	1.9

Figure 1

3. (IOD 402) Which shark was recorded as having the greatest range in gastric pH values?

a. Shark 1
b. Shark 2
c. Shark 3

Name: _____ Date: _____ Period: _____

Figure 2 illustrates the continuous measurements of gastric pH in the blacktip reef sharks. The lower line is gastric pH; the upper line is gastric temperature. Arrows indicate the time of feeding, and the number above each arrow represents meal size expressed as %BW (body weight). Meal codes are "M" for mackerel fish, "RF" for reef fish, and "S" for squid.

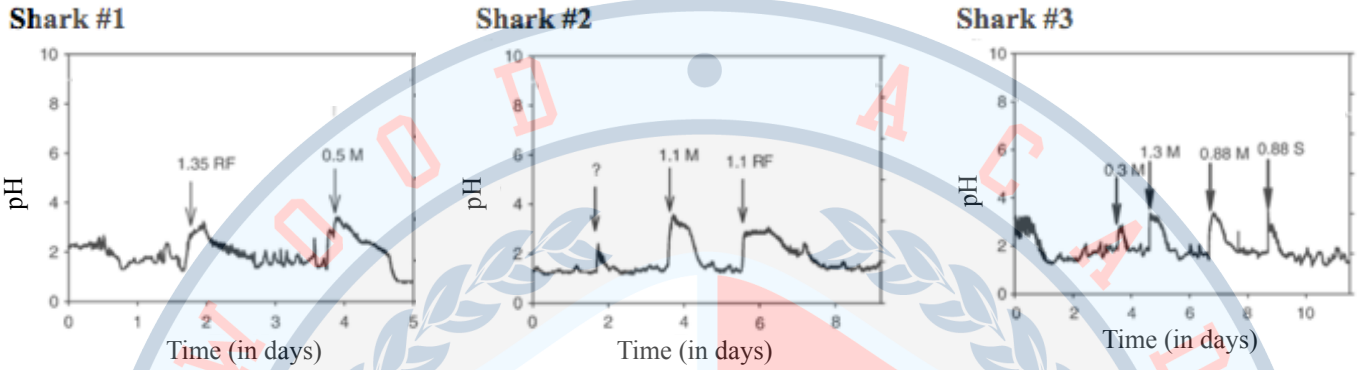

Figure 2

4. (IOD 402) According to Figure 2, which shark consumed the most prey during the experiment?
   a. Shark 1 b. Shark 2 c. Shark 3

5. (IOD 402) Which of the following statements is supported by the data in Figure 2?
   a. The smaller the prey, the greater the change in gastric pH.
   b. Consuming prey results in a temporary increase in gastric pH.
   c. Consuming prey results in a temporary decrease in gastric pH.
   d. The larger the prey, the greater the change in gastric pH.

When prey are consumed, the distention of the stomach stimulates the release of Hydrochloric acid, HCl. This results in a decrease in gastric pH.

6. (EMI 401) Which conclusion can be made about changes to gastric pH during consumption of prey?
   a. The gastric pH between meals is lower than during meals because there is less HCl in the stomach in between meals.
   b. The gastric pH between meals is higher than during meals because there is less HCl in the stomach in between meals.
   c. The gastric pH between meals is higher than during meals because there is the same amount of HCl in the stomach at all times.
   d. The gastric pH between meals is lower than during meals because there is more HCl in the stomach in between meals.

7. (RST.9-10.2.) Summarize the changes in gastric pH as related to consuming prey. In your summary, include changes in H+ and OH- ions.

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Data Representations and Research Summary adapted from:
Papastamatiou, Yannis. (2007). The response of gastric pH and motility to fasting and feeding in free swimming blacktip reef sharks, *Carcharhinus melanopterus*. *Journal of Experimental Marine Biology and Ecology,* 129-140.