Coates Coastal Marine Environments & Geology

(note that Jackson and D’ Croz are the authors of this chapter while Coates is the editor)

Question page

The authors open up with the statement that closure of the Central American isthmus has been the most pivotal event in the last 10 million years of Earth history. This is quite a statement! List five key things that happened, one leading to the next, that they cite.

Another result of the closure of the isthmus is that the Pacific and Caribbean coasts became distinct from each other in various ways. As you read the chapter, take notes of how they differ in the following respects (note that this material is not just on the first page but scattered throughout the chapter).

-seasonality of water temperature, rainfall, biological productivity

-prevalence/significance of coral reefs

-tidal range

-nutrient richness overall and its seasonality

Why are the differences of the two coasts of such importance in the economic, social, and political characteristics of the Central American countries? (more so than most other nations with ocean coasts) While there are many aspects to this answer, for this particular question I am only looking for the simple, overarching structural one on page 38.

What is the name of the basic wind system that persists of much of the region for much of the year, and what direction do these winds come from?

What broad zone of pressure moves up from the south during May – December, interrupting the Trade winds in the southern part of the isthmus especially? What else does this zone do of note to the climate that time of year?

Which side (east or west) of the isthmus receives the most rainfall? (note that these differences are the most pronounced in the December-April period, when the west side almost never experiences rain)

Why do the trade winds drive coastal upwelling on the Pacific side but not the Caribbean? (note that the Caribbean actually experiences downwelling most of the time) See diagram 2-5 to understand this.

Why is coastally upwelled water so nutrient rich? What economically important activity does this support?

Coastally upwelled water is also what in terms of temperature (cold or hot)? To what temperature extreme is this, in degrees F? (10⁰C = 50⁰F; 15⁰C = 59⁰F; 20⁰C = 68⁰F; 30⁰C = 86⁰F; 35⁰C = 95⁰F)

What are El Nino events, and what coast do they affect the most? In what specific ways to they affect the region?

Define biological production. Note that the diagram on page 44 is largely an example of it.

Define biological construction. List three key types from page 46.

Biological production is driven by photosynthesis, and phytoplankton are key producers. Consumers include zooplankton, which are eaten by anchovies and other higher order predators such as seabirds and tuna.
What key component controls the “bottom up” seasonal productivity of this *pelagic* system? (hint: starts with an “n”)

Benthic productivity is controlled from the top down, meaning by what key 3 factors?

Which of the coasts, Caribbean or Pacific, has all three major types of bioconstructed features often seen together? Examine Figures 2-6 and 2-7. Know which structure is found seaward, which one is found closest to land, and which one in the middle.

To understand the geography of what you just wrote, (where coral reefs, sea grass beds, and mangroves are found relative to each other, one must understand how the complement each other, how they are interdependent.

Coral reefs do what for sea grass beds and mangroves?

Mangroves and sea grass beds do what for coral reefs?

In a coastal area where there are no coral reefs but there are mangroves and perhaps sea grass beds, in what kind of areas would you find the latter? Explain why.

It may help your understanding of the above to remember that:

-corals are highly vulnerable to nutrient rich sediments and runoff from land

-mangroves and sea grass beds are highly vulnerable to extreme wave pounding

-from the reading and above material, why are sea grass beds absent from the coastal Pacific?

What is the name of the largest reef tract in the Caribbean?

At its peak rates, how fast did sea level rise per century during the major deglaciation that happened between 12,500 and 7000 years ago?

(note that the global climate is probably warming more rapidly now than during those times…)

Why did this rapid rise in sea level “drown” coral reefs up through 7000 years ago?

How then do we know that Caribbean coral reefs of today are less than 7000 years old? (ok, maybe I led you too much to the answer here!)

\_\_\_\_\_\_\_\_ nutrient content appears to be critical for coral reef growth.

Which bioconstructed feature is often growing with high nutrient input status?

The first full paragraph on page 50, especially its third and fourth sentence, summarize nicely why the Caribbean side has more coral reef development. Know this.

What was it about the 1983 El Nino that caused all baby pelicans to die in the Pacific coastal area? (what do they eat, and what do their prey eat, and so on…)

Why are pelagic fish and seabirds rarer in the Caribbean than the Pacific coastal areas?

Why are shellfish more abundant on the Pacific side rather than the Caribbean side?

Why are there few coral reefs in Costa Rica, the Mosquitia of Nicaragua and Honduras, and the Mosquito Gulf of Panama? (all on the Caribbean side, which otherwise has abundant coral reefs)

Which of the three bioconstructed environments are the most efficient at utilizing relatively scarce nutrients?

Many fishes like snappers and shrimps live the early parts of their lives in what habitat, only later to migrate to \_\_\_\_\_\_\_\_\_ habitat?

What are the key symbiotic photosynthesizers of coral reefs?

Parrot fish and other grazing fish, and later, sea urchins when the parrot fish declined, grazed on algae in the Caribbean – and thus keeping the algae from overgrowing the coral reefs (pages 55-56). What happened in 1983, and then what other factors later have led to the catastrophic decline of coral reefs in much of the Caribbean Coast of Central America?

What amazed Columbus and other early European explorers?

Just over a century ago, what were the three most important grazer types in sea grass beds? How about now?

Why is it that mangrove communities extend farther inland in bays on the Pacific side that the Caribbean side?

Why does the volume of fisheries increase with the size of local mangrove forests, aside from the protective nursery function of mangroves for some species? (page 59)

In Western Panama, Chiriqui Province, Caribbean side peoples derived most of their sustenance from the sea. Peoples of the Pacific side fed themselves more with a maize-based diet and terrestrial prey. What is the irony of all of this, today:

1. if you are a tourist eating marine life in a Caribbean resort?
2. If you are a coral reef diver on a Caribbean reef?

The authors speculate that what economic loss may exceed the economic gain of mangrove removal for mariculture (particularly shrimp), on the Pacific Coast?

The authors state that almost everything that people do on the Caribbean coast is harmful for bioconstruction. List 5 or 6 key factors.

List two key factors that explain why recovery is so slow in bioconstructed environments. (pages 67-8)

What biological risks are related to canal passage?