Julia Winberg

Week Twelve Oceanography Notes
(Week Eleven was week of Thanksgiving!)
November 26-30

Class: November 26, 2018
Marine Mammals

- Mammals
    - Warm-blooded
    - hair/fur at some stage in their life
    - Live birth
    - Make milk/ females have mammary gland
    - lungs/breathe air (not water, like other marine species)
- 116 species of marine mammals
    - Carnivora: Pinnipeds
    - Sirenia: Manatee/Dugong
    - Cetacea: Odontoceti and Mysticeti
- Pinnipedia
    - Seals, sea lions, walruses
    - Pinnipedia
    - Nearly exclusively Marine
    - Fin-footed: evolved from terrestrial carnivore
    - Predators: eat mostly fish, squid
    - Streamlined bodies to ease swimming
    - Thick layer of fat/blubber: food reserves, insulation, buoyancy
- Seals
    - **Earless Pinniped**
    - No outside ear lobe/flap
    - Phocidae: 19 species
    - Rear flippers cannot be moved forward
    - claws /fur on flippers
    - Short, robust neck
- Sea Lions and Fur Seals (otariidae) vs. Seals (phocidae)
    - Sea Lions
        - External ear
        - Long neck
        - Posterior flippers move forwards
        - Anterior flipper rotation
    - Seals
        - No external ear
        - Short neck
        - Posterior flippers cannot move forward

        - No anterior flipper rotation
- Seals: ear holes, flipper attached at wrist, longer claws
- California Sea Lion (W. Pacific)
    - Opportunistic feeders
    - CA to Galapagos
    - Common
    - Territorial while breeding
- Harbor Seal (Locals!)
    - Shy, quiet
    - Only social during mating and resting
    - Found in large groups when together
    - Mainly fish
    - Global distribution
- Local Seals (MA, RI, ME)
    - Harbor Seal
    - Harp Seal
    - Hooded Seal
    - Gray Seal
    - Ringed Seal
- Sea Lions: Not native to Atlantic
- Elephant Seal
    - Northern Elephant Seal (smaller)
    - Southern Elephant Seal (bigger)
        - Bulls (males) can be up to 16ft, 6k lb. and Cows (females) can be 10 ft, 2k lb.
    - Largest Elephant Seal ever is 11,000lb and 22.5ft
    - Largest member of carnivora
    - Big, deep divers, extremely aggressive
    - Fast movers even though they are enormous and don't look like they could move quickly
    - Eats: skates, rays, squid, octopus, eels, small sharks, fish
    - Will actually eat pebbles to help with digestion or buoyancy
    - Many of them are scarred due to territorial fights
- Leopard Seals
    - 2nd largest species in Antarctica
    - Keystone predator
    - Insane maneuverability
    - Highly movable mandible/jaw, can open really wide (think like a cobra's jaw), can open to a 160 degree angle, super sharp teeth
    - Deep divers
    - Aggressive
    - Well-evolved anterior flippers
    - Will eat humans

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- Northern Fur Seal
    - North Pacific
    - External ear flaps
    - Solitary except when mating or nursing young
    - Eats fish
    - Extra long flippers
    - Only 15 of them in captivity
- Walrus
    - Odobenidae
    - Tusks: males and females
    - Tusks can be used for defense, anchoring to ice, digging into benthos
    - Strictly arctic animals
    - Feeds primarily on clams
    - Neither a seal nor a sea lion
    - Hangs out on shallow-water ice flows
    - Will also eat echinoderms/things in the sediment
    - Reddish to pale grey in color
- Sirenia
    - Manatees, Dugongs, Stellar Sea Cow (Extinct)
    - Only vegetarian marine mammal
    - Shallow-water grasses
    - Close contact with humans, impacts them greatly
    - curious/friendly/ social
    - In the US, you are not allowed to touch them
    - They are often hit by boats, hurt by human presence
    - Manatee: spoon tail, Dugong: heart-shaped tail
    - Only herbivorous marine mammal, feed on algaes, grasses
    - Some live in fresh or brackish water
    - Thrive in temperate/subtropical environments
    - Human effects on them are huge. The Stellar Sea Cow, another member of Sirenia, was hunted to extinction within 27 years of discovery
- Carnivora
    - Prominent canine teeth
    - Skin-covered flippers
    - Sea otters, polar bears
- Sea Otters
    - Smallest Marine Mammal
    - Almost went extinct before we stopped hunting them
    - Pacific
    - Super dense fur (reason why we hunted them)
    - Foragers
    - Aggressive eaters: will eat up to 30% of body weight in a day
    - Eats mollusks, echinoderms, crustaceans

    - territorial/aggressive but cute
    - KEYSTONE SPECIES, meaning they hold the ecosystem together. If the sea otter is taken away from a kelp forest, the kelp will die, over-grazed by sea urchins
    - Very intelligent: will wrap kelp around themselves while eating to stabilize them in the water
- Polar Bears
    - Youngest of bear species
    - Semi-aquatic mammals
    - Good deal of life lived on land, sea ice
    - Eat seals by stalking them at breathing holes
    - World's largest land carnivore
    - Thick blubber for insulation
    - Translucent fur with hollow strands of fur, like an open tube-- sometimes bacteria will live in these tubes and make the bears bioluminescent
    - Algae grows inside fur as well
    - Black skin (underneath all the white fur)
    - Threatened by sea ice loss
    - Range: throughout Arctic, but only throughout the Northern Hemisphere (no polar bears in antarctic!!)
    - US, Canada, Russia, Greenland, Norway
    - World's largest non-aquatic predators
    - Well-adapted to life in the far North
    - Superb sense of smell, hearing, eyesight
    - We think there are around 22-31k polar bears worldwide, with 19 distinct subpopulations, around 60-80% of which live in Canada, however these are **estimates**
    - There is a lot about the polar bear population that is unknown (think of how hard/ expensive it is to get to them)
    - **Very** aggressive animals
    - For the record: penguins and polar bears are **never** found together.

Class November 28, 2018
Whales

- Cetacea
    - Range in size
    - Elongated, telescopic shell
    - Elongated body shape
    - Very few hairs
    - Blowholes on top of their skull
    - Horizontal tail fin
    - Streamlined, fast swimmers, smooth skin, deep divers
- Odontoceti (Toothed)

    - Smaller
    - Social
    - Most are not migratory
    - Hunters
    - Use echolocation for communication, hunting
    - Communicate using sound
- Mysticeti (Baleen)
    - Have baleen, made of **keratin**
    - Larger
    - Often solitary
    - Long, annual migration
    - Eat krill, copepods, small fish: very big bodies but eat low on food chain
    - Use sound only to communicate, not to hunt
    - Spend much of their time feeding
- Deep Diving
    - Sperm whales: super deep diving, as we learned a bit in the giant squid lecture
    - Mammals are not ideal diving machines because of the fat we store.
    - Humans have a lot of trouble with it and when we dive to super far depths it can take hours to resurface, because you have to let your body decompress, so the gases don't expand inside your blood vessels.
    - Humans can get nitrogen narcosis (too much N2 in blood), among other issues from diving to super deep depths and then resurfacing
- Sperm Whales
    - Deepest divers of marine mammals
    - Can descend for over 90 minutes (think of how long you can hold your breath as a human. Not for 90 minutes)
    - Can dive nearly 10k feet, or 3,048m
    - Looking for giant squid to feed on
- Pressure
    - Many marine mammals have evolved past exterior ears and sinuses. Humans have a lot of space for air to get trapped in their face when they dive, marine mammals don't.
    - Some species like seals will fill their ear canals with blood when they dive to push air out that could have gotten trapped.
    - Many will take a big exhale before diving, releasing 90% of air in lungs.
- Oxygen Storage
    - Marine mammals will store more O2 in blood and muscles
    - High amounts of hemoglobin and myoglobin
    - Mammalian diving reflex: slowed heart rate
    - Decompression sickness not an issue in marine mammals because of the exhale they take before they dive
- Easier for cetacea to withstand cold temperatures because of their body shape and their surface-to-volume ratio (also helps make them more buoyant)

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- Dolphins and Porpoises: Odontoceti - Telling the difference
    - Porpoise: spade-shaped teeth
    - Dolphin: pointed teeth
    - Mouth and tail different from the other
    - Dolphins have a curved dorsal
- Narwhals
    - Polar regions
    - 3.5-4m long
    - Eats halibut, cod, cuttlefish
    - Pretty big
    - The horn growing out of their head is actually a tooth. Mostly males have them, but about 15% of females have them too
    - Horn has pulpy, soft outer layer
    - Always “spins” counter-clockwise
    - Using the horn: possibly to stun food? Sense water and environment condition, scent
- Killer Whales/ Orcas
    - Very intelligent, creative
    - Mean and vicious predators
    - Males: 19 to 26 feet, weigh tons
    - Females: 16 to 23 feet, also weigh a lot, 4-5 tons
    - Eats: fish, mammals, birds, rays, sharks, sometimes other whales
    - 500lbs of food per day
    - About 60% of their time is spent looking for food
    - BIG range, all over the ocean
    - Subpopulations (which many understand to be genetically distinct)
        - Residents
            - Fish and squid
            - Most commonly sighted
            - N.E. Pacific
            - Visit the same areas repeatedly
            - Over 300
        - Transients
            - Travel in small groups, 2-6
            - Less strong family bonds
            - Diff. diet: mammals
            - Harder to dtudy
            - Roam widely
        - Offshore
            - Northeast Pacific
            - Open water
            - Eat: schooling fish, other mammals, sharks
            - Scarring on skin, possibly from battles

        - Also found in Canada
    - Orcas: big range in population
    - Working together to hunt food
    - Teach young how to hunt → social
    - Teamwork: will band together to make bow waves, wash seals off ice floats: coordinated camaraderie→ you have to know each other awhile to be able to orchestrate this behavior well
    - Will even play with caught prey instead of eating it for awhile, more teaching young
- Risk factors with Orcas
    - Vessel disturbance
    - Quality, quantity of prey (fishing pressure, salmon depletion)
    - Contaminants in prey (bigger animals are subject to bioaccumulation)
    - Water quality
    - Local populations affected -- close to the coast

Class Notes
November 30th, 2018

Whales Part II

- Mysticeti: Baleen Whales
    - No teeth
    - Keratin Baleen
    - Largest of whales
    - TWO blow holes
- Separated into three types, based on Feeding
    - GULPERS OR SWALLOWERS
    - SKIMMERS
    - BENTHIC (BOTTOM) FEEDERS
- We actually don't know that much about whale feeding
- Using drones to watch migration and feeding behavior has risen in popularity for research because you defeat the disturbance of a boat's engine
- Collecting whale spit to learn a little more about their diet
- **Skimmers: Right Whales, Bowhead, Sei**
    - Swim very slowly
    - Mouths agape
    - Constantly filtering food and water through their mouths and baleen until they have enough to swallow
- **Gulpers: Blues, Minke, Humpback**
    - Faster swimmers
    - Take huge gulp of water and fish and then squeeze out the water through their baleen and fish

- **Benthic (Bottom Feeders)**
    - Vacuum up sediment and keep the food
    - Example: Grey Whale
- Sei Whale
    - Skimmers
    - Eats: Copepods, Euphausids
    - Big distribution
    - 12-16m long as an adult
- Right Whale
    - Enormous
    - Different populations
    - 13-18m, 60 tons
    - Zooplankton, copepods
    - Friendly, social, called the “right” whale because they were the “right” whale to harpoon in the whaling era (ugh)
    - Skimmers
    - Victims of ship strikes very often: Slow Down for Right Whales Campaign
    - Dead skin exfoliating off of them is covered in parasitic crustaceans, each whale has unique patches, like a snowflake!
- Blue Whales
    - Eats: Zooplankton, Krill
    - 4 tons of food per day at peak summer feeding
    - Largest animal ever living
    - Baleen whale, Gulper
    - 100ft, Over 100 tons
    - More than 2x the size of a bus
    - Largest recorded was over 28m long
    - Great example of elongated, telescopic skull in whales
    - **Why are Blue Whales so big?**
        - Water lets animals grow to bigger sizes because there is less pressure from gravity: more room to grow, buoyant
    - Loudest call in the animal kingdom
        - Louder than a jet engine
        - Communicate over long distances
        - Low frequency: you almost can’t hear it
    - Oldest was about 110 years old
    - Used to be used a lot in clothing, we nearly hunted them to extinction
- Whales can be studied in their ear canals with an earwax plug, which produces new layers each year, like tree rings.
    - **The stress of the whaling era can actually be seen in earwax plug records: during the height of whale hunting, more cortisol (stress response) was produced by whales and is present in their plugs.**

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- Fin Whales
    - 17-24m
    - Eats small, schooling fish
    - Gulpers
    - Approx. 70 tons
    - 17-24 m long
- Gray Whales
    - Covered in barnacles, crustaceans
    - 36 tons, live 50-60 years
    - All of them live in the North or Northwest Pacific Ocean (hunted to extinction in North Atlantic)
    - Migration route: summers in Alaska, winters in California
    - Make a 12k mile round-trip journey annually. This is the longest migration of any known mammal
    - Used to charge whale ships in an effort to defend hunted whales, but they've shifted out of this behavior as we've stopped hunting them
    - Want to touch a whale? You can pet them in Baja, Mexico. They will swim right up to the boat :)
- Humpback Whales
    - 12-16m
    - 79k lb
    - Gulpers
    - Very Intelligent
        - Coordinated feeding behavior
        - Bubble net feeding: super special, rare
    - Stellwagen Humpback whales bottom-feed on sand lances
-