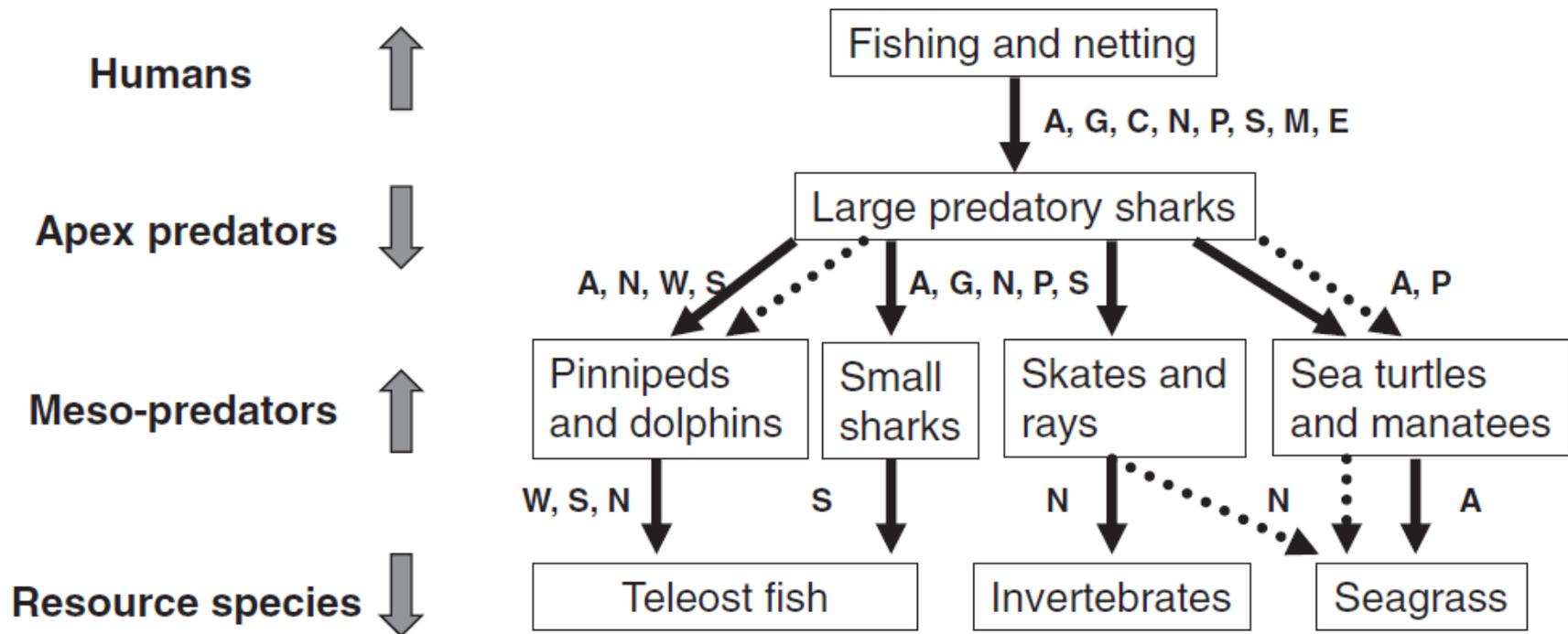
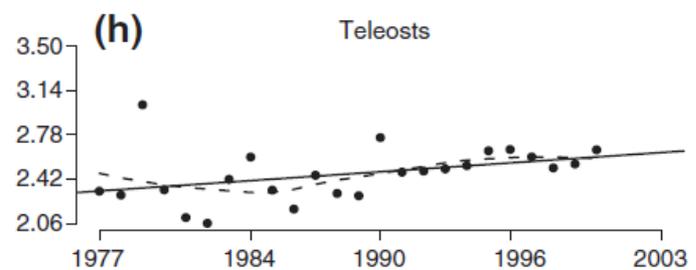
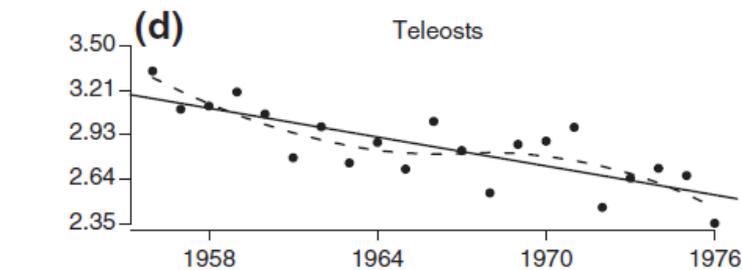
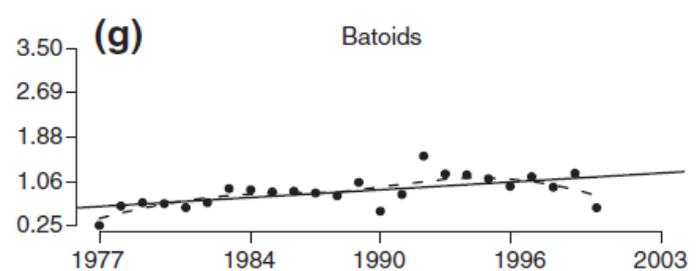
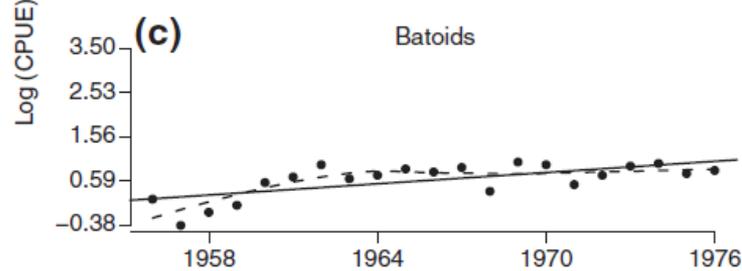
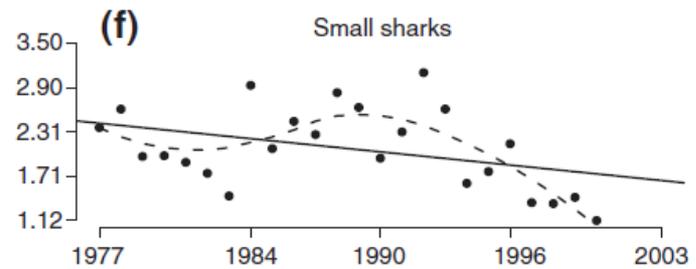
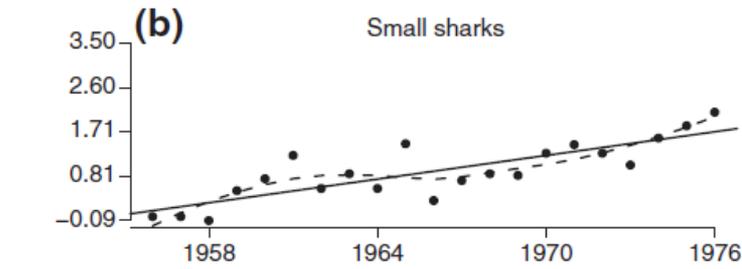
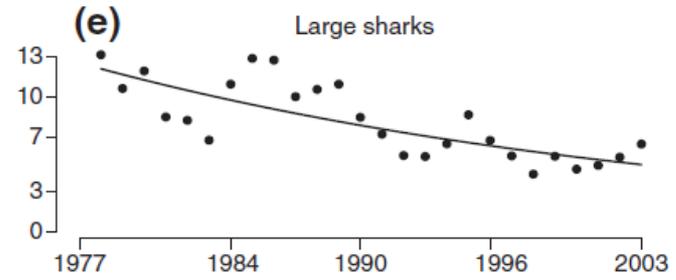
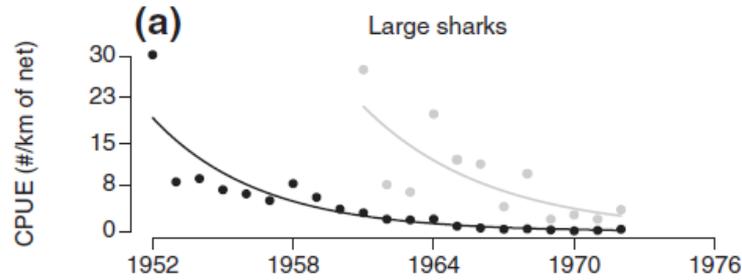


Ecological Role of Elasmobranchs

- ‘Top’ predators: regulate prey populations and community structure?
- More of an impact in coastal than pelagic ecosystems?
- More of an impact on larger, longer-lived prey species (mammals, turtles)



Trophic Cascades?



Year

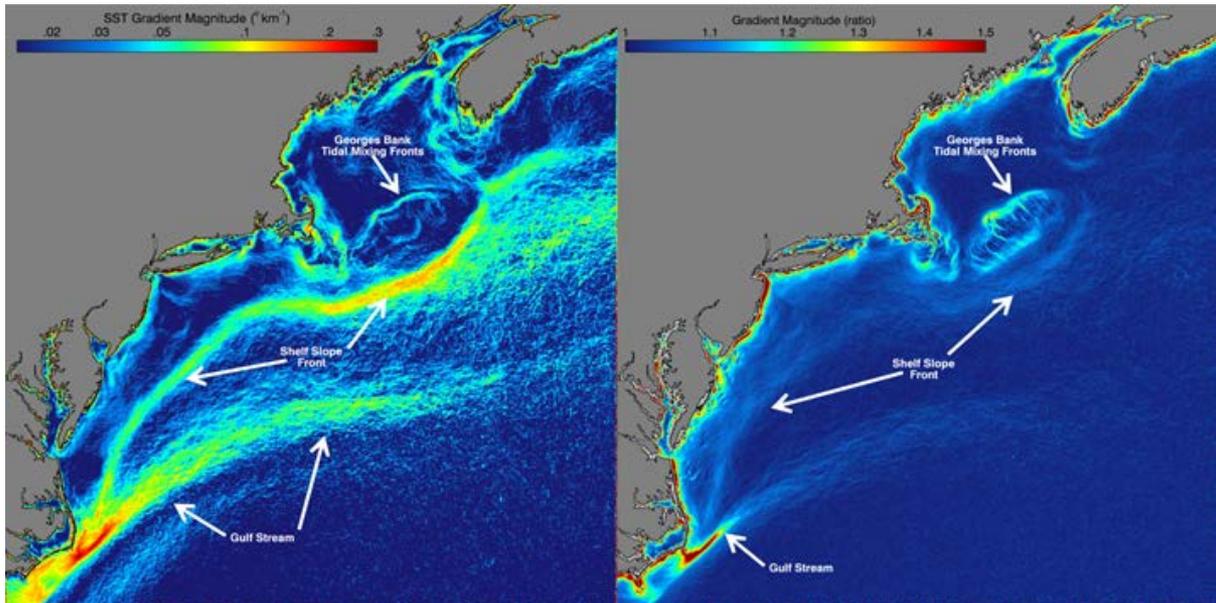
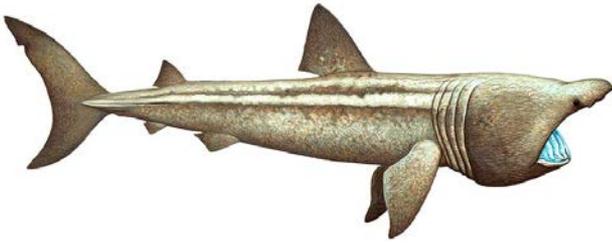
Elasmobranchs as Predators

- Optimal diet theory: preferentially target specific prey to maximize net energy
 - Balances costs of prey encounter rate, pursuit, capture, handling, consumption and energetic gain
 - Can lead to rejection of prey with 'low profitability'
 - Good condition (full bellies) = more selection for high-quality prey
 - Poor condition (hungry) = less selective
 - Varies by life stage, prey source, space, and time

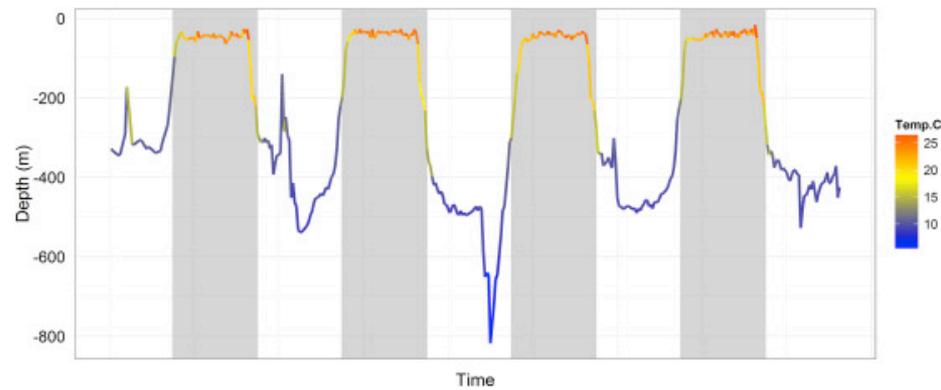
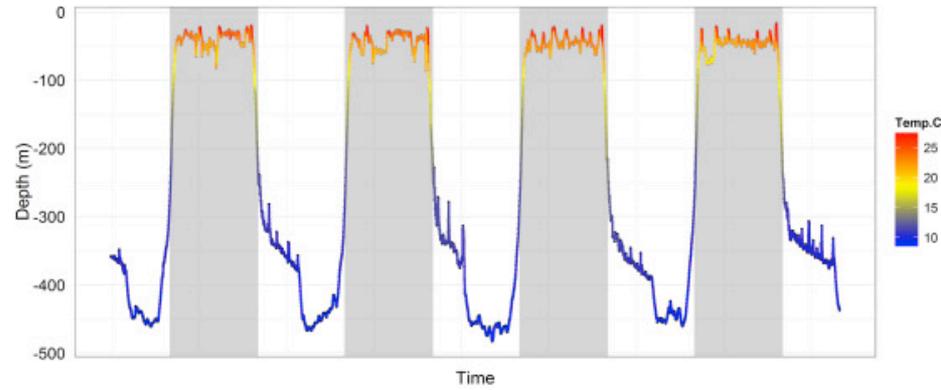
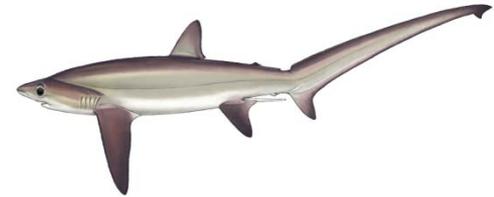
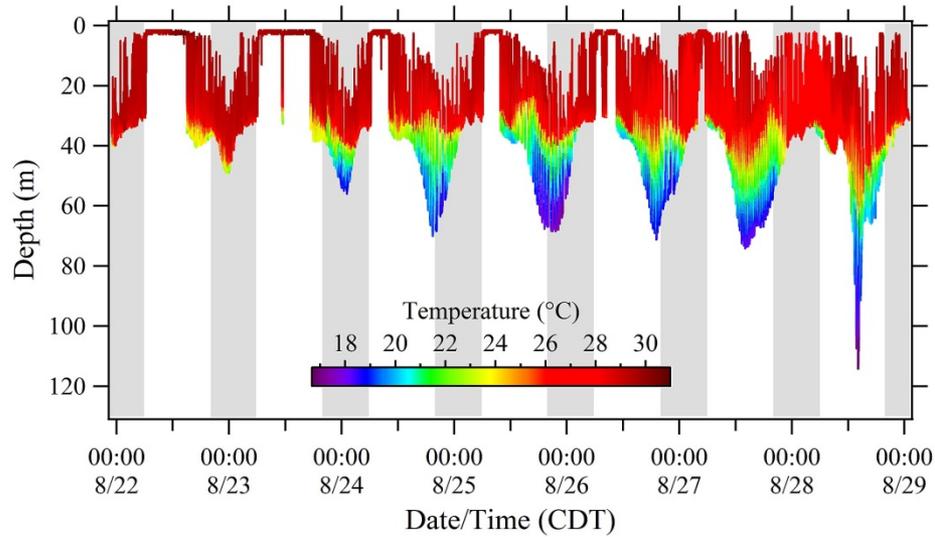
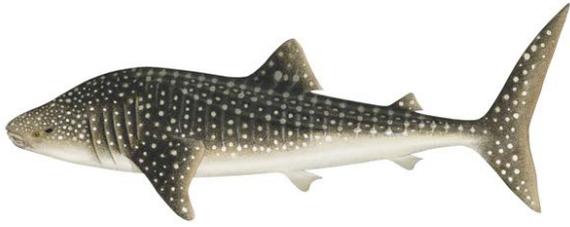


Role of Habitat in Feeding

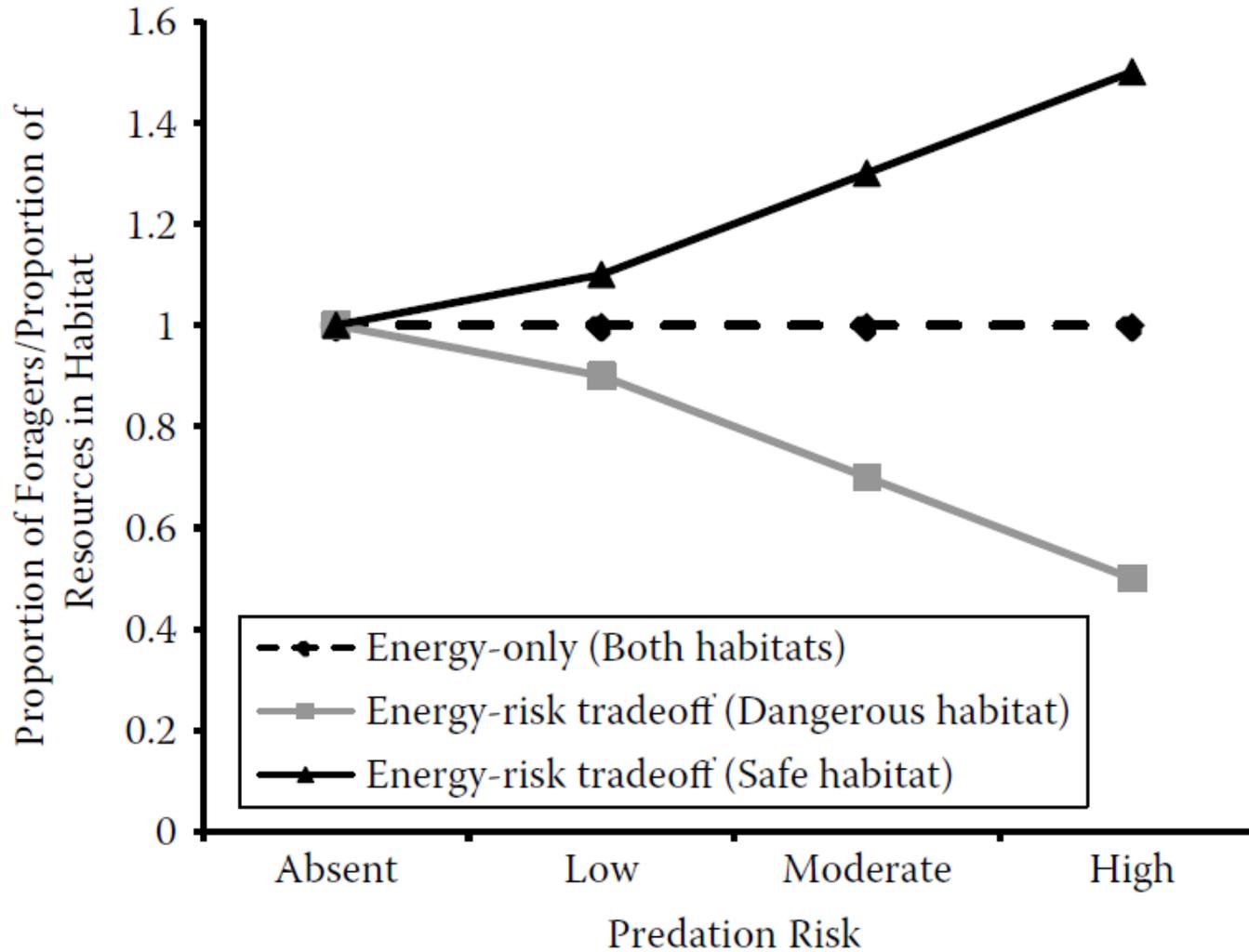
- Some species only forage when net energy gain is likely
- Select for areas with high probability of encountering prey
 - Not always where prey are most abundant
 - Often where prey are most vulnerable



Vertical Habitat Use and Foraging

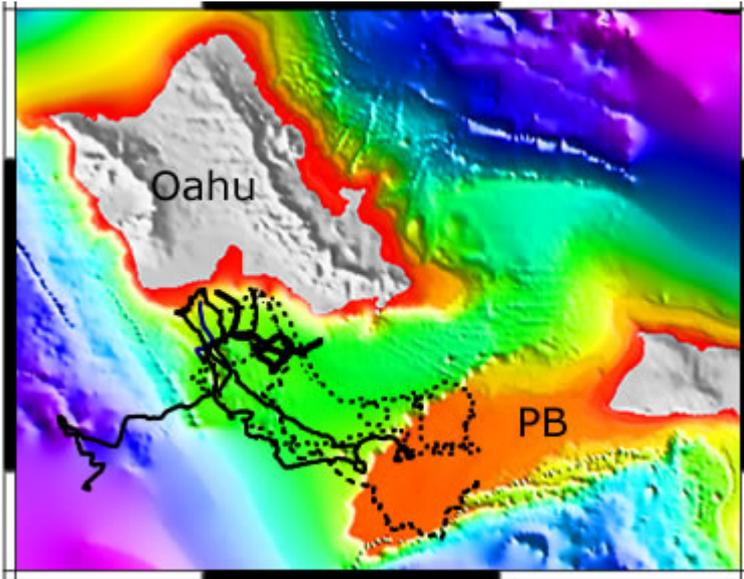
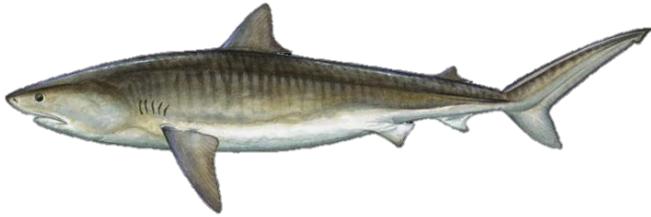


Foraging Trade-Offs: Predation Risk



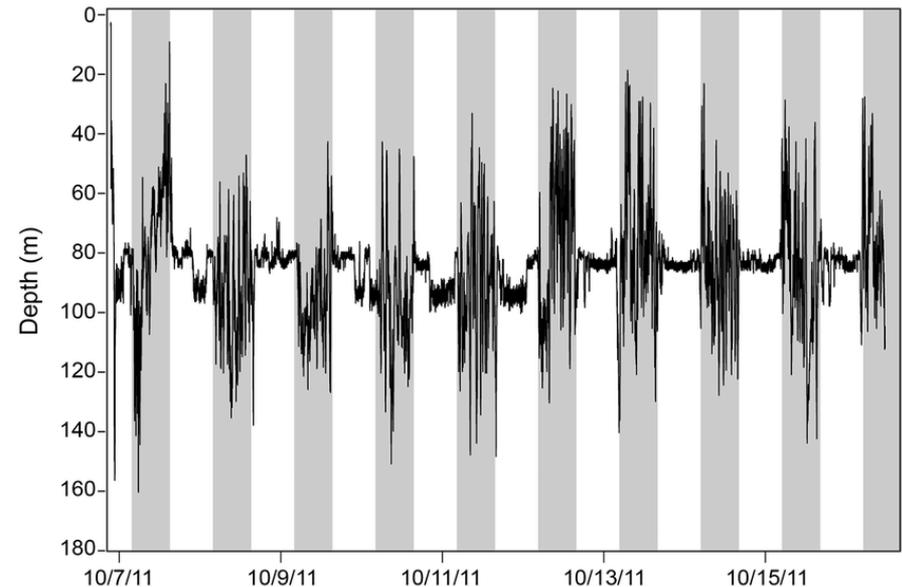
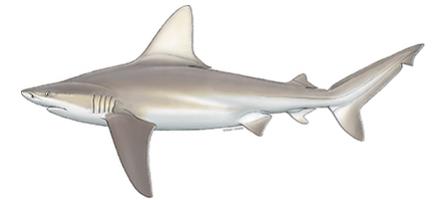
Keep them (your prey) on their fins

- Large home range = more habitats available for feeding
- Minimize time in foraging area
- Switch foraging areas/habitats regularly (daily, weekly)



Prey Searching

- Active and passive methods
 - Lie and wait
 - Active hunting
- Prey abundant = more random movements
- Prey scarce = many short movements, fewer longer movements
- Vertical oscillations (up/down) are foraging tactic

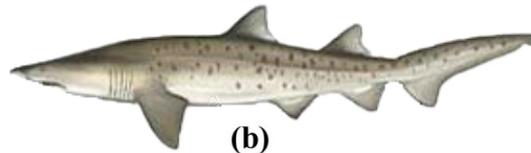


Group Foraging?

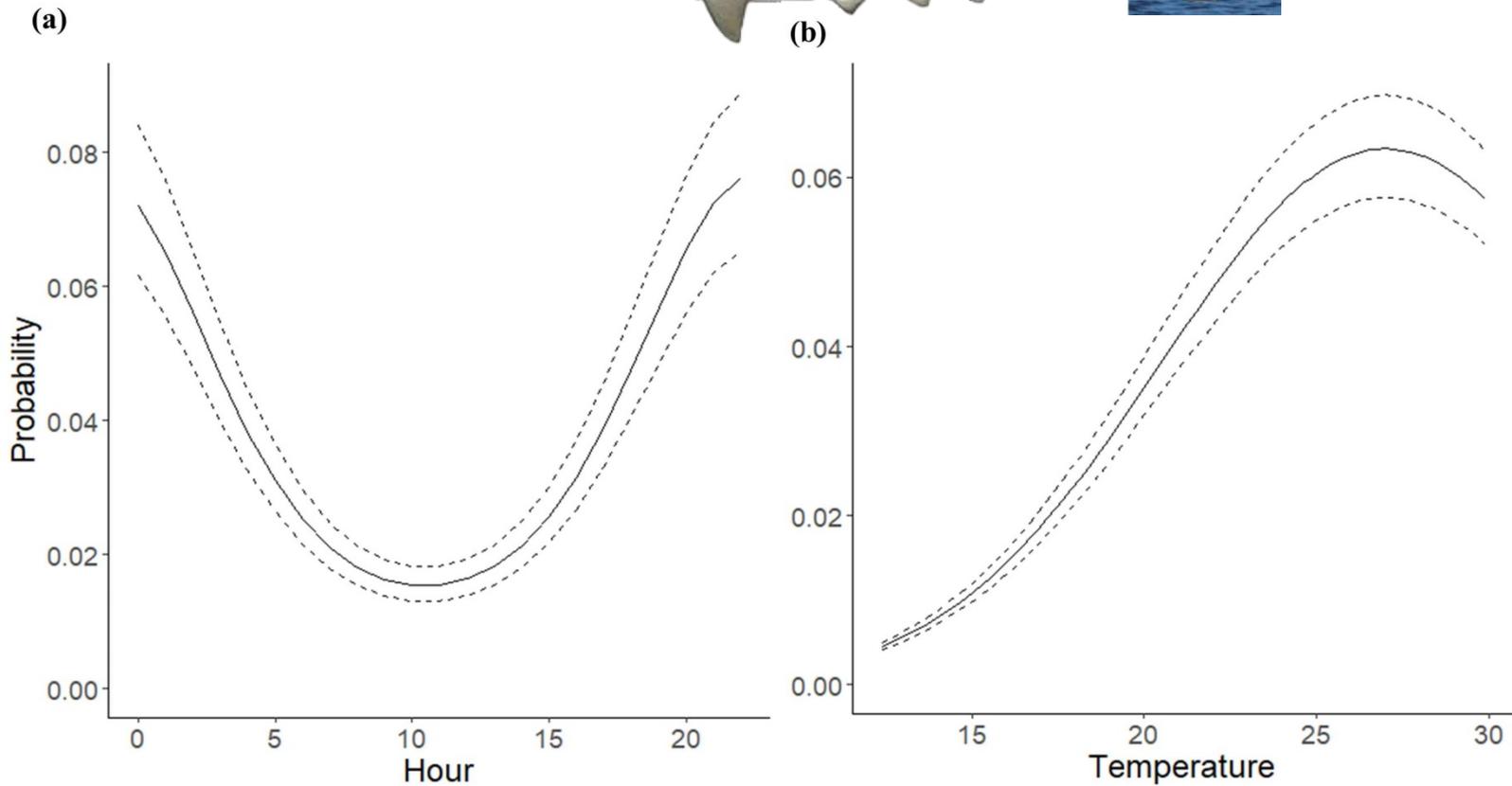


Activity Levels

- Regulate activity patterns based on
 - Temperature
 - Time of day
 - Tide



+



Competition?

- Intraspecific and interspecific
- Exploitative: consumption of prey item removes it from possible consumption
- Interference competition
 - individuals actively exclude others from prey resources (contest competition)
 - obstruct other foragers, reducing foraging efficiency
 - food stealing (kleptoparasitism)
 - killing of competitors (intraguild predation)???
- No evidence of territoriality
- Sized-based exclusion



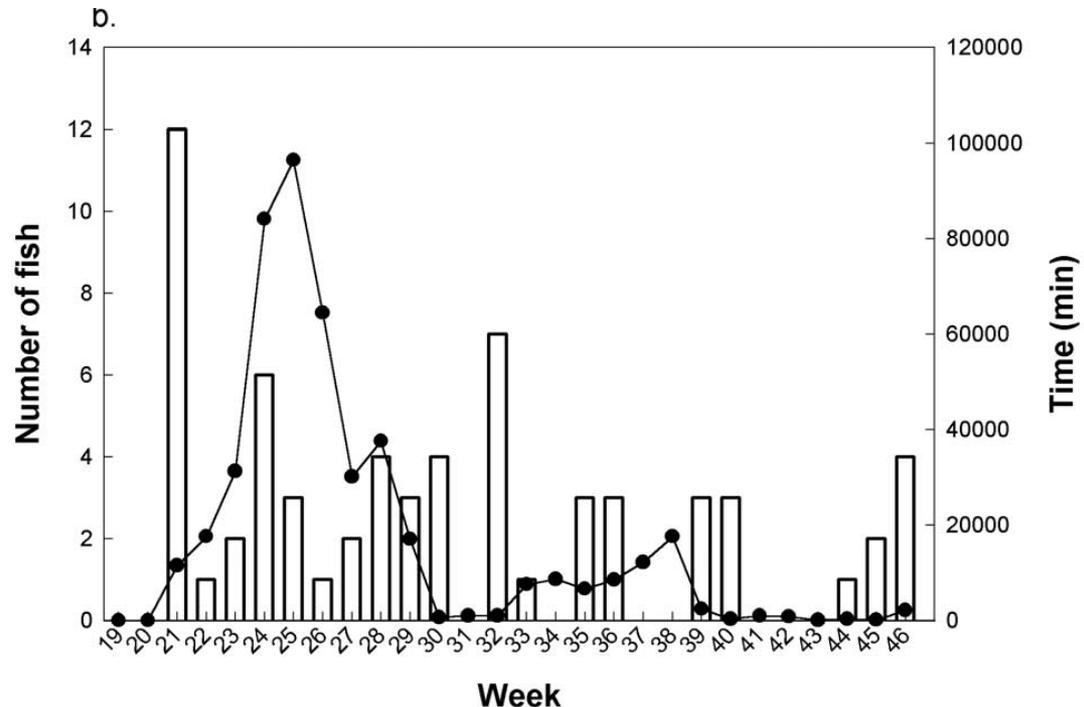
Elasmobranchs as Prey

- Preyed upon by several taxa
 - Cetaceans (Orcas)
 - Pinnipeds
 - Reptiles (crocodiles)
 - Large teleosts (bluefin tuna)
 - Other sharks (cannibalism too)
- Small sharks or batoids = more predation
- Large sharks are not exempt!
- Public enemy #1 – Other sharks
- Ontogenetic dietary shifts



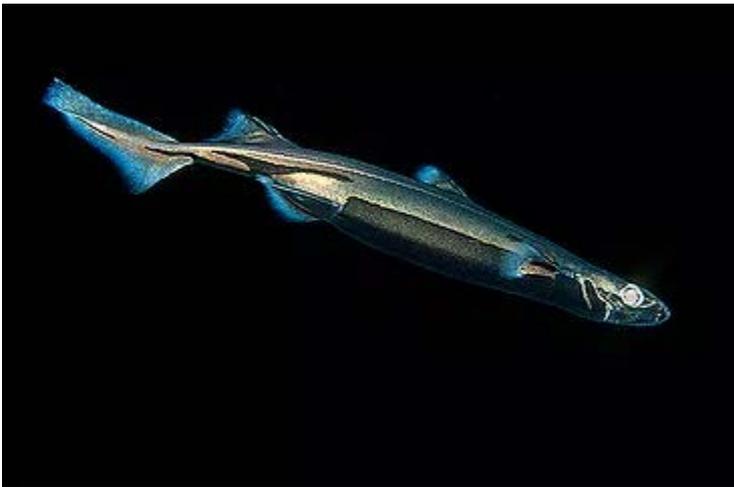
Avoiding Predators – Habitat Use

- Habitat selection (not just in nursery areas)
- Intrinsic habitat risk: Probability of encountering a predator vs. probability of being eaten
 - Affected by environment (water turbidity, substrate color, light levels, water depth)
 - Affected by condition (hungry = more likely to take risks)
- Juveniles occupy specific areas within a nursery to avoid predators
 - Use other areas in the nursery to feed
- Adult rays rest in extremely shallow water to avoid hammerheads



Avoiding Predators – Adaptations and Behavior

- Change activity patterns
 - Reduce movement (speed or duration)
 - Active only certain times of day or periods
- Hiding/crypsis (skates and rays)
 - Coloration for blending in with substrate
 - Coloration can change ontogenetically
 - Bioluminescence as camouflage
- Flight (fleeing!)



Schooling/Group Formation

- Increase probability of predator detection
 - Can be environmentally driven (low light = more grouping)
 - Sometimes group with other species
- Confuse predators with chaotic dispersal
- Dilution (more individuals = less chance YOU are the victim)
- Vigilance?



Deterrence and Defense

- Physical features (dorsal spines and 'sting's aka stingray spines)
- Changing body shape (swell sharks)
- Electric organs (Torpedo rays)
- Behavioral threat displays evident in some species
- Gray reef sharks exhibit defense behavior when pursued with a submersible
 - Exhibited by solitary and grouped sharks
 - Sharks attacked when pursued/provoked
 - Sharks fled after attacking predator
 - No threat displays evident towards conspecifics

