Physiological Ecology of Marine Vertebrates

What is "physiological ecology"?!!

Physiological ecologists strive to integrate data collected on different levels of biological organization to understand how animals function, survive, and thrive in their environment.

**Primary Research Interests**

- I use a combination of field and laboratory techniques to study the metabolic biochemistry, cardio-respiratory physiology, and diving patterns of sea turtles, with a focus on thermal effects.
- I am committed to applying knowledge gained through objective scientific research to further the cause of marine conservation and foster responsible stewardship of oceans.

**Seasonal energetics of sea turtles**

Energetics is the study of how organisms acquire and allocate energy.

The rate at which energy is expended, or the metabolic rate, is often measured to evaluate energetic requirements and the impact that an organism may have on its environment.

- **Mean TW**
  - **SUMMER**: 26.2°C
  - **WINTER**: 21.4°C

Green turtles (*Chelonia mydas*) at Heron Island, Australia experience a decrease in field metabolic rate (FMR) during winter compared with summer.

Seasonal shifts in FMR are accompanied by shifts in dive patterns (longer dives and more time in shallow habitats during winter compared with summer).

An understanding of sea turtle energetics is important for assessing growth and reproduction, population recovery trends, and management strategies for these endangered animals.

**Thermal biology of leatherback sea turtles**

The leatherback turtle (*Dermochelys coriacea*) is the largest extant species of sea turtle (c1000 kg).

Leatherbacks are oceanic wanderers, migrating from tropical breeding areas to foraging grounds at high latitude.

Models predict that leatherbacks could maintain elevated body temperatures (TB) while migrating through cold water due to their large body size and the use of peripheral tissues as insulation.

My colleagues and I found that leatherbacks in tropical seas maintain TB 1-4°C higher than ambient water temperatures, however food ingestion activity level affected TB.

I would like to expand these studies to include biochemical, physiological, and behavioral measurements for leatherback turtles migrating through temperate water so that we may explore the extent of this reptile’s thermoregulatory capabilities.

**Marine Conservation**

Bycatch of non-target species, such as sea turtles and sharks, in commercial fishing operations is a topic of great concern.

Basic science research coordinated and funded by the NOAA Fisheries has been directed at identifying gear and bait modifications that may reduce bycatch.

As part of this NOAA initiative, I conducted trials with captive loggerhead turtles to investigate the importance of chemoreception in food-finding abilities and to assess the feasibility of using chemically-modified baits to prevent fisheries interactions.

I also coordinated trials onboard the NOAA vessel Oscar Elton Sette to test the efficacy of recently developed chemical shark deterrents in reducing bycatch of non-target shark species in longline fishing gear. This research is on-going.

Future research efforts will be directed towards determining the physiological and behavioral consequences for sea turtles captured in fishing gear, with the ultimate goal of refining mortality estimates used in current fisheries management practice.