



**NOAA Teacher at Sea
Methea Sapp-Cassanego
Onboard NOAA Ship DELAWARE II
July 19 – August 8, 2007**

NOAA Teacher at Sea: Methea Sapp-Cassanego

NOAA Ship: DELAWARE II

Mission: Marine Mammal Survey

Day 6: Tuesday, July 24th

Weather Data from Bridge

Visibility: less than ½ nm

Wind Direction: Easterly

Wind Speed: 5-10 mph increasing to 20

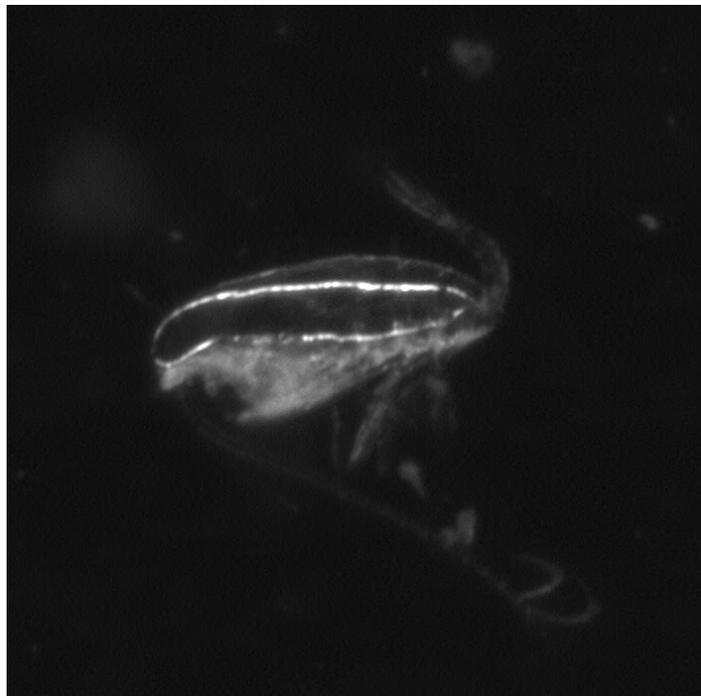
Swell height: 3 to 5 feet

Science and Technology Log

Dense fog has given us little to see or do but listen to the fog horn for the past two days. Therefore today's entry will be less of an activities report and more of an informative piece that will hopefully elucidate just one of the many ecological relationships which we aim to study...once the fog lifts of course.

Got Copepods?

Mammalian foraging strategies are as diverse as mammal themselves, from coordinated packs of prowling wolves to a solitary grazing rhinoceros. Yet regardless of the critter, the energy (or calories) spent pursuing a meal must be less than the energy gained from eating the meal. This simple equation of energy expenditures to energy gains must be kept in the positive for proper growth, development, and reproduction. All of this may seem fairly intuitive and straight forward until you stop to consider the right whale *Eubalaena glacialis*. This whale is one of the largest predatory animals on the planet measuring up to 17 meters and weighing 40-50 tons, yet feeds



A photograph of a *C. finmarchicus* C5 with a large oil sac, taken with a VPR (Video Plankton Recorder). Mark Baumgartner, Woods Hole Oceanographic Institution.

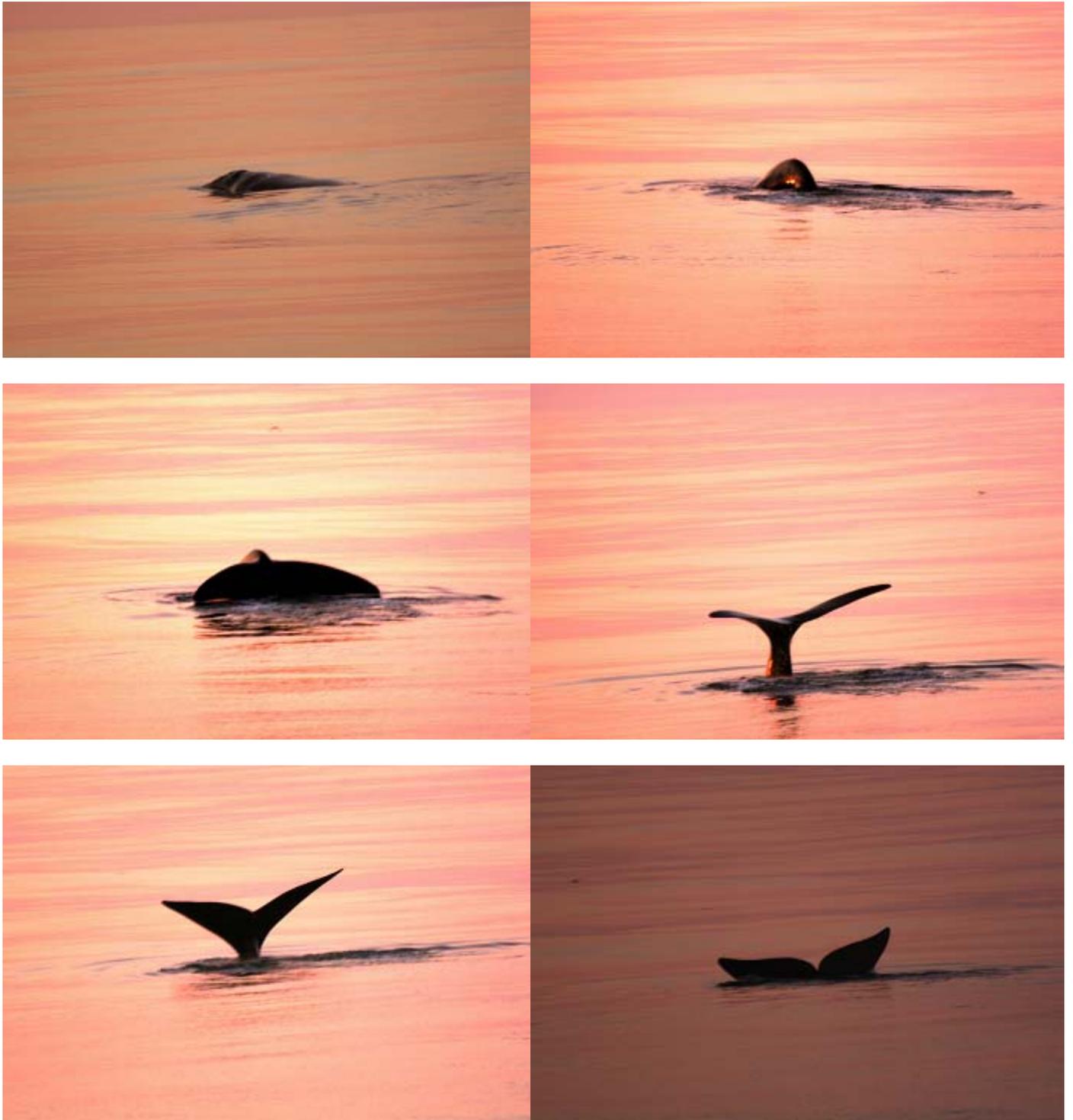
almost exclusively on a small ephemeral looking copepod which measures 1-2 mm long.

The copepod preferred by right whales is called *Calanus finmarchicus* but is often referred to simply as *Calanus*. *Calanus*, like most copepods feed on phytoplankton, transition through a number of growth stages, and aggregate in large concentrations of up to ~ 4,000 copepods per cubic liter of water. As far as right whale feeding goes the copepod of choice is most calorically valuable during stage 5 of its life cycle. By this stage (C5) the copepod has sequestered a significant amount of lipid (specifically wax esters) in a part of its body called an oil sack.

Right whales feed on copepods by either skimming the waters surface or diving; sometimes reaching feeding depths of 175 meters. Regardless of depth, the whale pushes its open mouth through the water and then shuts it while forcing the big gulp through its baleen plates which boarder the upper mandible. All filter feeding whales possess baleen, although the baleen of right whales is very fine and hair-like in texture, therefore enabling it to filter out the miniscule copepods. In contrast, a humpback's baleen is thick and bristle-like and more adept to filtering larger krill and small fish.

In order to maintain proper growth a right whale must consume copious amounts of copepods. Melissa Patrician, an Oceanographic Technician for Woods Hole Oceanographic Institute, reports that scientists estimate that a right whale consumes on average of 2-4,000 pounds (wet weight) of copepods per day. This is the equivalent weight of 1 Volkswagen beetle and calorically equal to 3,000 Big Macs. In general right whales can be found feeding in four main locations within the North Atlantic. These feeding grounds are centered around the Bay of Fundy, Roseway Basin, Cap Cod Bay, and the Great South Channel which runs E. of Nantucket.

Understanding the intricacies of copepod life and right whale feeding are just part of a greater body of knowledge which is aimed at saving the right whale from extinction. Researchers estimate that only 390 right whales are left following the extensive whaling practices of the 19th century. Scientists from multiple disciplines including but not limited to, pathologists, reproductive endocrinologists, geneticists, veterinarians, behavioral ecologists, and toxicologists are all working to protect the species from disease, entanglement, ship-strike and to better understand recent declines in reproductive success.



This diving sequence depicts right whale (*Eubalaena glacialis*) foraging for nutrient rich *Calanus finmarchicus*.