

Field metabolic rates - Andreas Fahlman

CWE Inc. are excited to work with field biologist in studies trying to define the physiological requirements in bottlenose dolphins. In a recent paper published in the scientific journal Royal Society Open Science a collaboration between researchers from the Oceanographic Foundation, Woods Hole Oceanographic Institution, Dolphin Quest, NOAA, and Sarasota Dolphin Research Program used equipment made by CWE Inc. to estimate metabolic rate in dolphins. For ecophysiologicals, it is important to understand how energy flows among and between different species. For an animal like the dolphin, scientists need to understand the amount of energy that is required to maintain the basic functions of being alive. For example, the brain requires a certain amount of energy to function, the heart needs energy to continue pumping blood, and even staying warm requires energy. The amount of energy required depends on many variables, such as activity level (is the dolphin resting, sleeping, diving or is it swimming), and water temperature. In order to better understand how much energy is required for survival, physiologists separate energy requirements into different categories, such as the resting metabolic rate (the costs to stay warm, for the heart to pump blood, for the brain to function, when the animal is resting quietly), foraging costs (the additional energy required to capture food), reproduction and nursing (the metabolic cost of raising a calf), predator avoidance, and migration, etc. If we know the overall metabolic cost for an individual it is then possible to determine the amount of food that dolphin will need to survive. We know from past studies in numerous species that the daily metabolic rate is about 2 to 3 times higher than the resting metabolic rate. By measuring the resting metabolic rate of dolphins in Sarasota Bay, we should have a good estimate of their daily metabolic requirements, allowing us to determine the amount of food (calories) a dolphin needs to find each day.

Respirometry is the gold standard used to estimate metabolic rate by measuring the O₂ consumption (VO₂) and CO₂ (VCO₂) production rates. The research team recently developed a device that can be used to estimate the metabolic rate in dolphins in the field (such as from a boat). The device consists of a flow-meter that measures the amount of air they inhale and exhale, and also measures the concentration of oxygen when they exhale using a gas analyzer from CWE Inc. Together, the flow and gas concentration are used to determine the metabolic rate. Our custom-made, non-invasive respirometer allows measurement of the O₂ taken up and the CO₂ produced on a breath-by-breath basis. Collection of that data over several minutes makes it possible to estimate the metabolic rate. Dolphins, like all mammals, have lungs and breathe air by counting how many molecules of oxygen are consumed over a given period of time. The researchers from Oceanographic Foundation are also using this equipment to study how dolphins and whales dive to extreme depths and hold their breath for such a long time. For example, the dolphins in Sarasota generally dive to depths around 6 meters, while the same species of dolphins in Bermuda dive to depths over 800 meters. Working with the companies like CWE Inc., has allowed the research team to collect respiratory data from free ranging dolphins in order to learn more about their incredible physiology and diving ability, their health, and the ecosystem we all share with these amazing animals.