

## **BLAINVILLE'S BEAKED WHALES & NORTHERN ELEPHANT SEALS Two Solutions to Deep Sea Foraging**



Figures 1 and 2. Blainville's beaked whales

Deep sea predators hunt in a three-dimensional world that is dark and has few landmarks. Large marine mammals have senses and strategies that allow them to hunt successfully and share the deep ocean. Food isn't evenly spread around, but is concentrated in predictable ways. The deep scattering layer, the benthic boundary layer, and the oxygen minimum layer – these terms will be defined below - all describe zones that attract or aggregate various organisms. Those organisms attract predators that feed on them, and on up the food chain to the top predators.

Down 1,000 feet and deeper, northern elephant seals are only one of the 20 or so mammals feeding in a dark, cold world. Blainville's beaked whales are one of the others that dive deep to hunt. As cetaceans, they are very different from seals, but the deep ocean is one of the largest ecosystems on earth and offers many ecological niches. Different diving and foraging strategies allow them to exploit various prey.

Although you are familiar with the northern elephant seal, Blainville's beaked whale is less well known. This paper will introduce you to Blainville's beaked whale and compare the foraging behaviors of these two deep diving mammals.

**Blainville's beaked whale:** These small whales are 15 to 20 feet long, weigh 1,800 to 2,300 lbs., and are dark gray or brownish blue, with a small dorsal fin. The males grow tusk-like teeth that point forward. Not much research has been done on these whales, as their small population ranges across oceans where they are hidden from human view. They live in small social groups, three to seven or perhaps as many as twelve individuals. Cookie-cutter sharks often scar adults. Males often have long scratch scars, suggesting violent competitive courtship, but no one knows for sure. They are usually sighted in waters 1,600 to 3,300 feet deep near deeper chasms. They use echolocation to find their prey.

Beaked whales, although considered toothed whales in contrast to baleen whales, have hardly any teeth. Little is known about them. Most research is based on rare examples of carcasses that wash up on beaches.

All deep divers have to balance the amount of energy it takes to dive down and find prey against the amount of nourishment they get from the dive. Prey species in shallow water have a good oxygen supply, move fast and can escape. Species that live deep, in the dark, with less oxygen, move more slowly and are easier to catch.

Blainville's beaked whales forage on tropical and sub-tropical continental slopes associated with oceanic islands, submarine canyons and seamounts. They are one of 22 species of beaked whales, several of which reside or migrate along our central California coastline. For this paper,<sup>1</sup> the researchers looked at the resident population of whales living around El Hierro in the Canary Islands off Africa.

Whales use echolocation to find their prey in the dark, different from elephant seals that rely on seeing bioluminescent prey or detecting prey movements in the water with their whiskers (vibrissae). Blainville's beaked whales have two distinctive kinds of clicks to help them succeed: search clicks while they are foraging and buzz clicks in the final stage of capturing the deep-water squid, crustaceans and fish that are their prey.<sup>2</sup>

To gather information about how the whales hunt, the researchers used tags that recorded the sounds the whales made as they hunted, as well as the time and depth of the dives.

Blainville's beaked whales' dives can be understood in three phases: transport, as the whale dives down to or returns from its hunting depth; search, when it's actually hunting; and "recovery", the time it spends back at the surface or diving shallowly, between foraging dives. While this approximately 90-minute period is called "recovery", scientists haven't yet studied the physiology of the whale during this time. (Figures 3 and 4.)

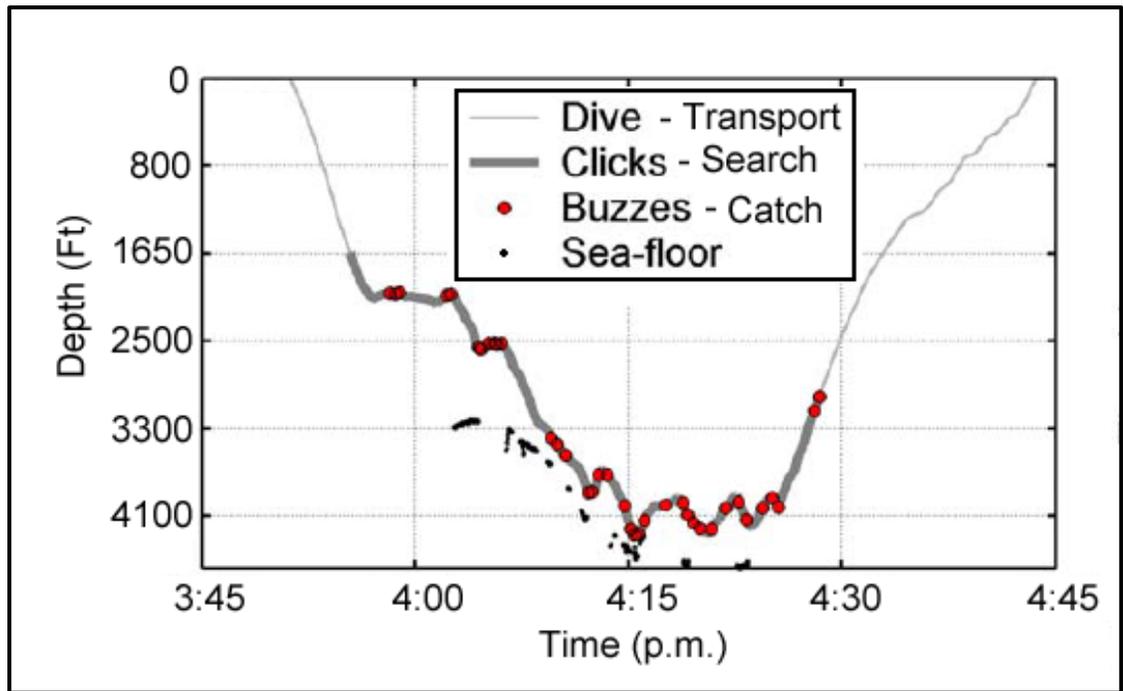


Figure 3. Blainville's foraging dive.

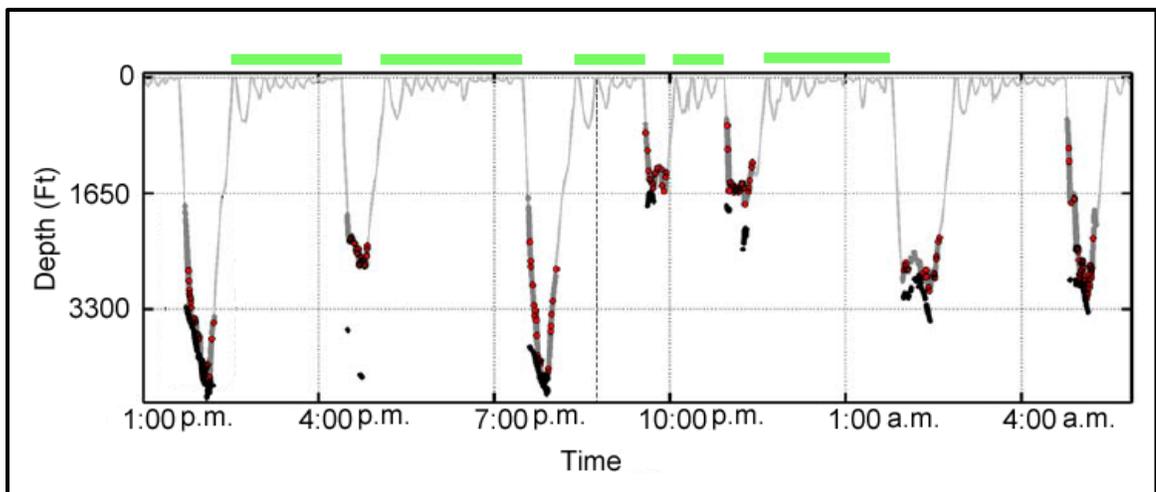


Figure 4 Several hours of typical activity for Blainville's beaked whale. Green bars mark time spent in shallow "recovery" dives.

Foraging dives for these whales are as deep as 1,600 to 4,400 feet (mean 2,700 feet), and as long as 23 to 65 minutes (mean 48 minutes). They produce distinct clicks while searching for prey, and change to buzzing as they attempt to capture prey and eat. They dive silently down about 1 to 11 minutes (mean 4 minutes), reaching a depth of 550 to 2,900 feet (mean 1,400 feet) before they start clicking to look for prey. They spend 9 to 38 minutes hunting (mean 24 minutes), buzzing to catch prey 4 to 53 (mean 27) times and then silently swim back to the surface, taking 9 to 35 minutes to get there (mean 19 minutes).

If the observed dives are typical, these whales are able to catch a days' worth of food in eight hours of foraging. They spend a third of their lives performing foraging dives, and only half of that time is spent actually hunting and catching prey. While the hunting phase of the whale's dive is distinctly marked by its clicks, for the elephant seal it is the horizontal motion, or rapid up and down motion, after a long descent that separates the transit phase of a dive from the hunting phase.

Northern elephant seals range farther and dive deeper in different habitat. They are not considered resident in any part of their range across the northeast Pacific Ocean. Their dives are separated into four types (Figure 5): active-bottom, especially around the deep scattering layer; flat-bottom (ocean floor foraging); drift dives (food-processing/rest), and v-shaped (transit) dives. Transit dives are used to get the seal to and from foraging areas, or between those areas. Elephant seal dives typically last 20-30 minutes. Dives up to 2 hours have been recorded. <sup>3</sup> See figure 6.

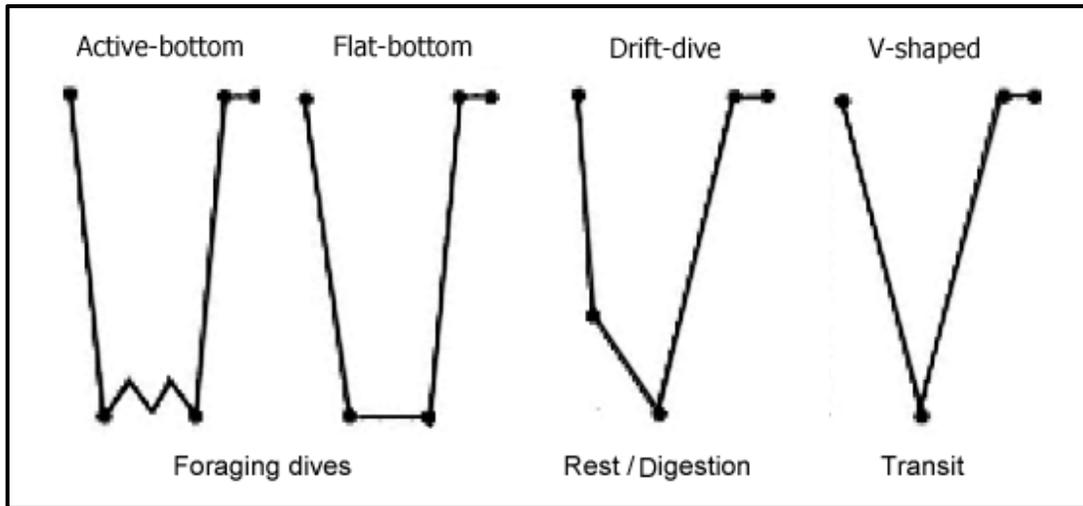


Figure 5. Common elephant seal dive types

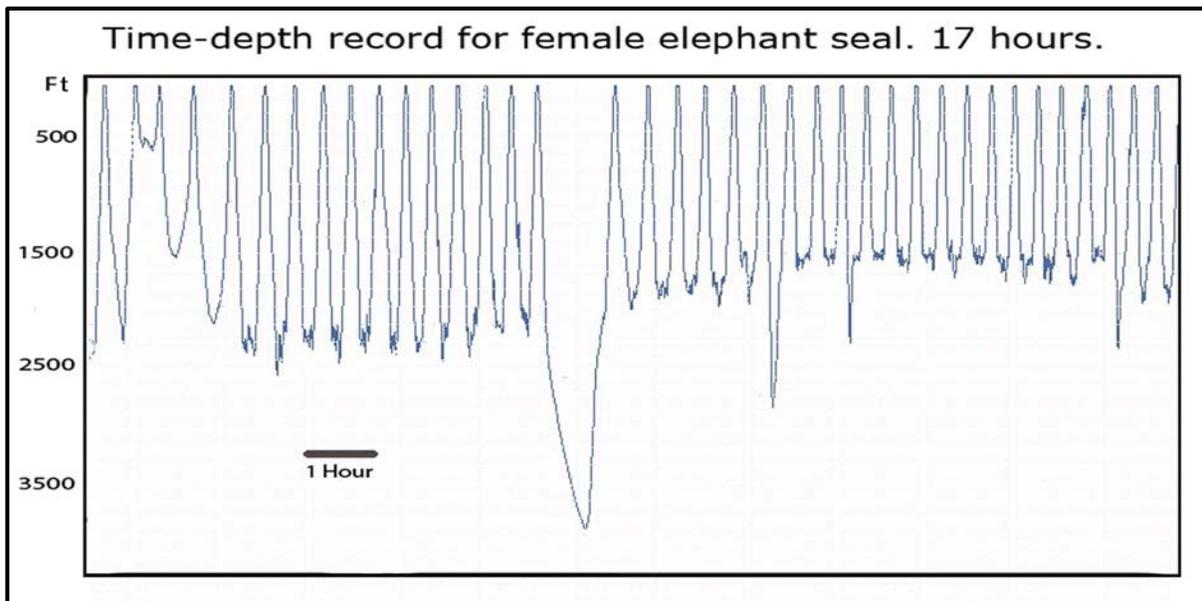


Figure 6. Several hours of typical activity for a female northern elephant seal

There are three major ocean zones that are of interest when studying Blainville's beaked whale. 1.) The Deep Scattering Layer (DSL) is a layer of living organisms, fish and zooplankton so dense that it scatters sound waves used to detect the ocean bottom. These organisms migrate vertically up toward the surface at night and sink down during the day, creating a shifting

depth of what early researchers thought was the ocean bottom. During the day the DSL is a discrete and dense layer, consisting mostly of small (1-6 inches long) organisms, located at depths between 1,300 and 2,600 ft., while at night the more active species in the DSL disperse upwards to forage. The dives of female elephant seals are observed to follow the elevation of the DSL. 2.) The Benthic Boundary Layer (BBL) extends from the sea floor to some 600 ft. above it. It holds most of the biomass in abyssal waters (3,300–11,000 ft. depth) and typically comprises species with low locomotor capacity. Male elephant seals appear to forage the BBL very near the ocean floor. 3.) The Oxygen Minimum Layer (OML) is the zone of lowest oxygen, a limiting factor for aerobic life. The OML is a region usually dominated by organisms with low metabolic rates as an adaptation to the low oxygen concentration in the water.

Deducing from the angle they descend and the depths they hunt, scientists conclude the whales are hunting in two of these major biological areas: the lower part of the DSL, and the BBL. The whales are able to find prey in both locations, even on a single dive. They are probably hunting for slow species associated with the deeper part of the DSL and along the sea floor. They don't chase their prey far, and are able to catch about 30 per dive. They dive past the fast-moving prey close to the surface and pick up the slower ones deeper down.

The echoes of the sounds they made allowed the researchers to figure out how far from the bottom the whales were hunting. They begin their echolocation clicking above the DSL and sometimes continue foraging at moderate depths before heading down the continental slope around the island. This kind of steep slope is habitat to rich concentrations of sea floor and open ocean fish and cephalopods. These resident whales have found a stable and abundant resource that gives them a secure ecological niche.

Northern Elephant Seals and Blainville's Beaked Whales are very different critters that inhabit the depths. Whales hunt with echolocation, seals by sight and motion. They forage in different parts of the ocean, but both dive deep to hunt, in a dark, cold environment that is as strange as another planet. Seals spend much more of their time at sea hunting than do the whales, but it would be interesting to see how the two would compare if an "hours hunting per year" calculation were made.

Recent studies of Cuvier's beaked whales give one of them the record for longest (2 hours 17 minutes) and deepest (almost two miles) mammalian dives. A record depth chart now looks like Figure 7. *See following page.*

Although little is known about species such as the Cuvier's beaked whale, initial research finds them in every ocean except the polar ones. Perrin's beaked whale was identified in 2002, and thus far found only along the California coast between San Diego and Monterey.

NES are better researched than any of the rare and elusive beaked whales. The limited research on these whales tends to be in coastal areas, simply because it's more accessible; research could be biased toward coastal populations. Exactly where beaked whales live and how they use their range for feeding, mating and other life cycle activities is largely unknown. Because they depend on echolocation for social communication as well as foraging, any interference with their ability to echolocate has the potential to disrupt their lives. Increased seismic blasts and sonar use have been associated with beaked whale stranding. Tagging to learn more about whale and seal lives can help find ways to protect them.

Elephant seal docents are experienced ocean and coastal observers. If you find a beaked whale washed up on the beach, report it to The Marine Mammal Center and file a report with the Beaked Whale Resource: <http://www.beakedwhaleresource.com/getinvolved.htm>

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References:

1. Arranz P, de Soto NA, Madsen PT, Brito A, Bordes F, et al. (2011) Following a Foraging Fish-Finder: Diel Habitat Use of Blainville's Beaked Whales Revealed by Echolocation. PLoS ONE 6(12): e28353. doi:10.1371/journal.pone.0028353, <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0028353>
2. Foraging Blainville's beaked whales (*Mesoplodon densirostris*) produce distinct click types matched to different phases of echolocation  
M. Johnson, P. T. Madsen, W. M. X. Zimmer, N. Aguilar de Soto and P. L. Tyack  
<http://jeb.biologists.org/content/209/24/5038.long>
3. Condition and mass impact oxygen stores and dive duration in adult female northern elephant seals, J. L. Hassrick, D. E. Crocker, N. M. Teutschel, B. I. McDonald, P. W. Robinson, S. E. Simmons and D. P. Costa, <http://jeb.biologists.org/content/213/4/585.full>

Cuvier's beaked whales hold their breath longer, news story, <http://www.bbc.com/news/science-environment-26743090>

First Long-Term Behavioral Records from Cuvier's Beaked Whales (*Ziphius cavirostris*) Reveal Record-Breaking

Dives <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0092633>

New Species of Deep-diving Beaked Whale Identified, <http://ens-newswire.com/2014/02/06/new-species-of-deep-diving-beaked-whale-identified/>