An Introduction to the World's Premier Predator

An excited Bigg's ("transient") killer whale eyes the photographer as it searches for a northern fur seal by the side of our research vessel near the Pribilof Islands, Alaska. Photo by R. Pitman, NOAA Alaska Fisheries Science Center, NMFS Permit No. 782-1719

by Robert Pitman

Thirty-five years ago, when I first started going to sea, a quite different killer whale roamed the world's oceans. It was a single, worldwide species and the ultimate omnivore, capable of preying upon any large vertebrate that swam into its purview, including fish, birds, mammals or reptiles. Social behavior revolved around dominant adult males, which used their much larger size and aggressive behavior to take command of harems of females and young - rather like a lion with his pride. Since that time, armadas of dedicated researchers working from small boats have spent countless thousands of hours following killer whales, studying their behavior and learning their ways. Their diligence, aided by burgeoning technologies – satellite tagging, digital photography, and genetic analyses, to name a few – has radically altered our understanding of this animal, and what has emerged is a completely different killer whale – in fact, several.

Killer whales are also called orcas. Many of us who have seen this animal relentlessly battering their prey for hours at a time, sometimes stripping flesh and limbs off live animals, prefer to call them killer whales. Others, perhaps choosing to emphasize the maternalistic social organization of killer whales, and people maybe more familiar with the relatively benign feeding habits of the fish-eating forms, prefer to call them orcas, as in their Latin name – *Orcinus orca*. Historically, these two names have been used interchangeably and the animals that they referred to were generally considered to be just two sides of the same coin. Recent research, however, suggests that these

naming preferences and the different perceptions that they represent, may be because these are in fact different coins.

What is an Ecotype?

As detailed in the articles that follow, killer whale communities are often comprised of groups of recognizably different types or forms – forms that, for example, look different and have different prey preferences, feeding habits, and acoustic behaviors. In the northeast Pacific, for example, there are fish-eating "residents," mammal-eating "transients" and the less-commonly encountered "offshores." Although the geographic ranges of these "ecotypes" often overlap at sea, they rarely interact and apparently avoid interbreeding entirely. For most animals, this would be convincing evidence that they are in fact separate species. Killer whales, however, are intelligent, highly social creatures that transmit cultural heritages within family groups that can be stable over decades, and it is possible that they merely choose not to breed with other forms of killer whales. This makes it difficult to determine whether these forms are different species or subspecies, or simply variants within a species. The term "ecotype," then, merely recognizes scientific uncertainty with regard to killer whale diversity, and until we know more about killer whale speciation, the term ecotype will remain a placeholder for a work in progress.

If Looks Could Kill.

Undoubtedly the most striking feature of killer whales is their designer paint job: a boldly contrasting, swirling pattern of black and white seemingly configured to make them as conspicuous in the water as possible. For the supreme hunter of the seas, this seems inexplicably maladaptive - most predators have color patterns that blend in with their surroundings to conceal them from their prey, but killer whale evolution has apparently run off in the opposite direction. This is the kind of counterintuitive observation that sets off alarm bells for biologists: Something interesting is going on here.

Killer whales are cooperative pack hunters – much like wolves – and they need to communicate in order to coordinate their hunting activities, whether they are pursuing prey that is small and fast, or large and powerful (read dangerous). Over longer distances, they resort to vocalizations – their sounds carry for miles underwater even when visibility is reduced to just a few feet. But in the heat of pursuit, at close quarters, in often murky waters, having a conspicuous color pattern with clear landmarks may be an important asset for cooperative prey capture.

For killer whales to conduct a coordinated attack on a prey animal, they need constantly updated information on the orientation, speed and direction of travel of other members of the group, and the color patterning of killer whales seems specifically designed to provide that at a glance. When viewed from the side, the large white flank patch on the tail stock of the killer whale telegraphs changes of speed and direction as the tail oscillates up and down. The tail (or "flukes") itself is black above and white below – an animal behind is also going to immediately detect any changes in speed and direction of an animal in front. When a killer whale turns away sharply, it exposes a flash of white belly; when it angles towards

Bob Pitman is a NOAA Fisheries marine ecologist at the Southwest Fisheries Science Center, La Jolla. When not out studying killer whales, he likes to consort with the prey, such as these Adélie penguins at a colony on the Western Antarctic Peninsula. Photo by Lisa Ballance

the viewing animal, it becomes darker as the white belly and sides are obscured. Although these features would also be conspicuous to prey animals, by the time killer whales are close enough for the prey to see them, it is probably already too late for the prey to avoid attack.

In addition to coordinating hunting activities, body coloration in killer whales is probably also useful for social signaling. For example, killer whales often leave tooth rake marks on each other's bodies and appendages. These undoubtedly occur during bouts of play, but sometimes exposed red flesh is visible when the wounds are fresh, a sign of more serious interactions - establishing social order, for example. Not surprisingly, an open mouth is a threat display among dolphins, exposing as it does the aggressor's teeth and perhaps intention. If, as seems likely, killer whales also have an open mouth threat display, then their black upper jaw and a white lower jaw will go a long way to making this signal clear and unambiguous.

Although these thoughts on coloration are mostly speculation, they do suggest that the conspicuous color patterning of killer whales maybe wasn't such a bad idea after all.

Why are Killer Whales Important?

Killer whales are important for several completely different reasons with one of the most obvious being that they are immensely popular with the public. In fact, they have become icons of marine biodiversity – pelagic pandas. With their enormous size and stunning black and white color patterning, they are probably the most universally recognizable animals that live in the sea, or perhaps anywhere on the planet. Add to that, they are predators nonpareil – the largest top carnivores on the earth today, with killing power that probably hasn't been rivaled since dinosaurs quit the earth 65 million years ago. Although these out-sized physical attributes make killer whales arguably the most spectacular animals anywhere in the world today, it is perhaps their more subtle traits that make them so compelling: they are intelligent, long-lived, cooperatively-hunting, intensely social animals – they are enough like humans that we are fascinated by them. People want to know more about them and they also want to know that they aren't being harmed.

Killer whales are also exemplars of how little we know about the ocean environment that largely envelops our planet. Not only are they the most widespread large animals on the planet, but as air-breathers they are conspicuous and eminently identifiable. Consequently, they have been studied by numerous people around the globe, for decades in some cases. And yet scientists cannot say with any certainty even how many species of killer whales there are – there could be one, or five, or maybe more. And, if so little is known about perhaps the most charismatic, widespread, easily recognized and well-studied species of animal that lives in the seas, then what do we really know about those millions of other, less-heralded species?

The question of how many species of animals we can identify in the ocean clearly has important conservation implications. If, for example, there is only one species of killer whale and it ranges around the world and has a varied and changeable diet, then local extinctions due to the combined effects of, say, fishery impacts (e.g, through bycatch or prey reduction), marine pollution, climate change, ship collisions, etc., are probably not going to critically impact this species. But, if

A BBC film crew with an underwater "polecam" is dwarfed by a passing adult male type B killer whale in Antarctica. The series producer has covered her head to watch on the monitor. Photo by Bob Pitman

there are multiple species, with smaller population sizes, more limited ranges and specialized feeding habits, then localized extinctions could result in the elimination of entire species. Such "cryptic" species can blink out without us even knowing they ever existed.

Killer whales are also important because of their role in marine ecosystems. As large, warm-blooded, apex predators, they necessarily have voracious appetites, making them potentially important in regulating their prey populations, including commercial fish species (e.g., salmon, bluefin tuna) and protected – and sometimes endangered – marine mammal populations (seals, sea lions, sea otters, whales, etc.). The potential for conflict with human interests is, of course, high and the more we know about ecology, taxonomy, distribution and abundance of killer whales, the more we can do to head off these conflicts.

To Have and to Hold

Not all killer whales live in the ocean and keeping them in captivity has always been a contentious issue. The first (and too often, only) exposure many people get to killer whales are with captives serving life sentences in aquaria, for crimes they did not commit. For an animal that can travel 200 or more miles a day in the wild and that would normally spend 50 years or more in a stable family group, hunting cooperatively and engaging in complex social interactions with others of its own kind, a solitary life cooped up in a chlorinated cubbyhole, performing the same tricks day after day for a bucket of dead fish, must be a life unfulfilled. On the other hand, for the majority of the land-locked public, a captive killer whale may be the only opportunity many of them will ever have to experience this magnificent animal. And just as we willingly cut down trees to produce books (and this issue of *Whalewatcher*), a few killer whales sacrificed to educate, perhaps enlighten (and, yes, entertain) the public, may serve to inspire the next generation of marine mammal advocates. It is a necessary evil that we should all grudgingly embrace.

The Known and the Unknown

As is often the case in research, we find that the more we know about killer whales, the less we know about them; every answer asks more questions. In the following pages, we summarize the history of modern killer whale research, describe some of the most significant findings unearthed along the way, and provide recent updates on what it is we know and don't know about these fascinating animals. Most of what we have learned about killer whales has come to light only in the last 20-30 years, and many of the people behind that research are still active in the field today. We

A calf Ross Sea killer whale (Antarctic type C) takes a long look at whale researcher, and Bob's wife, Lisa Ballance, in a fast ice lead in McMurdo Sound. Photo by Bob Pitman

are fortunate that several of them have offered to share their insights and experiences in these pages.

We are also very fortunate that Uko Gorter has once again offered up his time and artistic talent to illustrate this special issue. The centerfold he has produced represents not only an up-to-date sampler of killer whale diversity as currently understood, but it shows the various types, for the first time, drawn to scale.

I think I speak on behalf of all the contributors to this issue when I say that killer whales are the most amazing animals that currently live on this planet, and if you haven't already, you owe it to yourself to see this animal in the wild. You won't be disappointed.

ACS sends very special thanks to Bob Pitman and all of the contributing authors for this one-of-a-kind Whalewatcher issue. Photo by Bob Pitman

JOURNAL OF THE AMERICAN CETACEAN SOCIETY
Spring 2011 Volume 40, Number 1

Whalewatcher

Killer Whale:

The Top, Top Predator

Special Guest Editor
Robert L. Pitman

American Cetacean Society