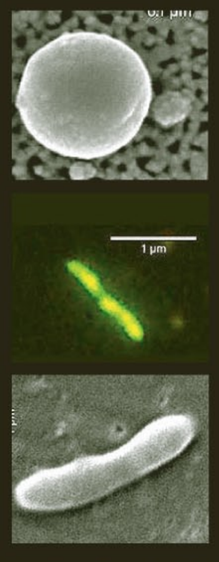
International Polar Year *Life in the Cold and Dark* National Science Foundation

Sunset at Cape Hallett, Antarctica; Credit: Ken Ryan, National Science Foundation

Trying to understand life at the very limits of existence...



Images from left to right: Amy Chiuchiolo, a research assistant with biologist John Priscu's research team, processes samples in a laboratory located at the National Science Foundation's Lake Bonney field camp in Antarctica's McMurdo Dry Valleys. Credit: Peter West, National Science Foundation. 3 microscopic images of bacteria found in melt samples taken from ice thought to be refrozen from the waters of Lake Vostok of Antarctica. Credit: David M. Karl et al., University of Hawaii. Ship in Arctic waters. Credit: Peter West, National Science Foundation.

Life forms in polar environments—from microbes to emperor penguins—exhibit unique strategies and adaptations to survive frigid temperatures and prolonged darkness or daylight. Recent climate changes may alter the effectiveness of these adaptations. Little is known about the cellular and genetic mechanisms that underlie how an organism adapts—or doesn't—to environmental change. Therefore, understanding responses to the rapidly changing polar environment is an important scientific challenge. New technologies offer better opportunities to study such mechanisms and expand our knowledge of how ecosystems in Antarctica and in the Arctic respond to variable climate.

Understanding more about the basic processes that allow organisms to conduct "Life in the Cold and Dark" is one of three National Science Foundation research themes for the International Polar Year, 2007-2008.

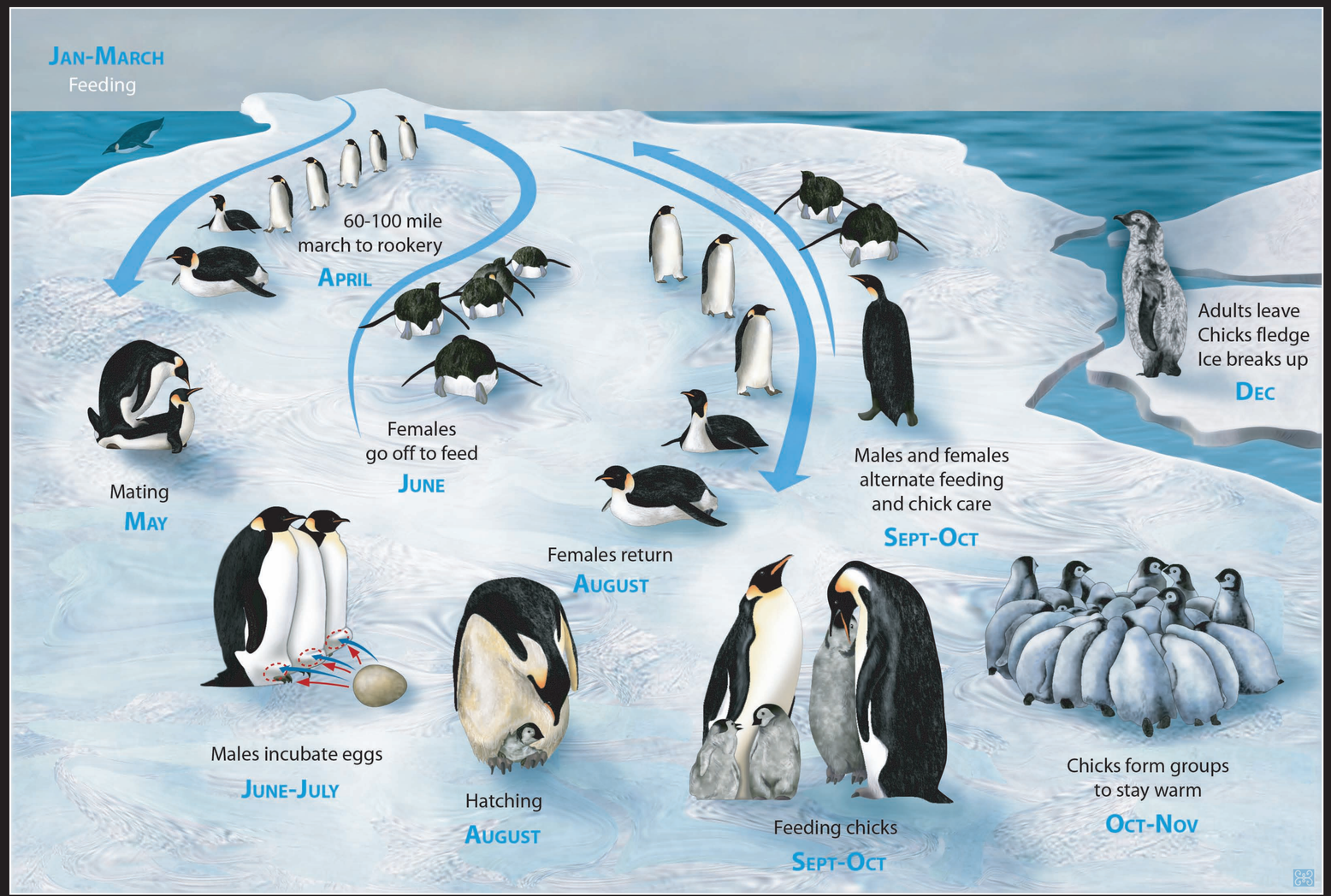
Earth's polar regions, located some 12,000 miles apart, are vast, icy and inhospitable landscapes. Yet, they offer unique opportunities to answer some of life's most perplexing questions. International Polar Year (IPY) 2007-2008 follows in the footsteps of historic past campaigns which led to discoveries that fundamentally changed how we view the polar regions and their links to the rest of the globe. Research and education projects carried out during the International Polar Year will explore new frontiers in polar science, discover the underlying mechanisms that allow polar life forms to thrive in seemingly "unearthly" habitats, better define the critical role the polar regions play in global environmental and ecological processes, and educate students, teachers and the public about the importance of polar regions to the planet.

All U.S. federal agencies engaged in research and education will participate actively in IPY. The National Science Foundation is the lead agency for coordinating US IPY activities. Dozens of foreign countries will also participate in IPY research efforts.

This poster is one in a series that depict NSF's science themes and observatories that are key to fulfilling NSF's role as the designated lead federal agency for the International Polar Year 2007-2008.

for more information visit http://us-ipy.gov and http://nsf.gov

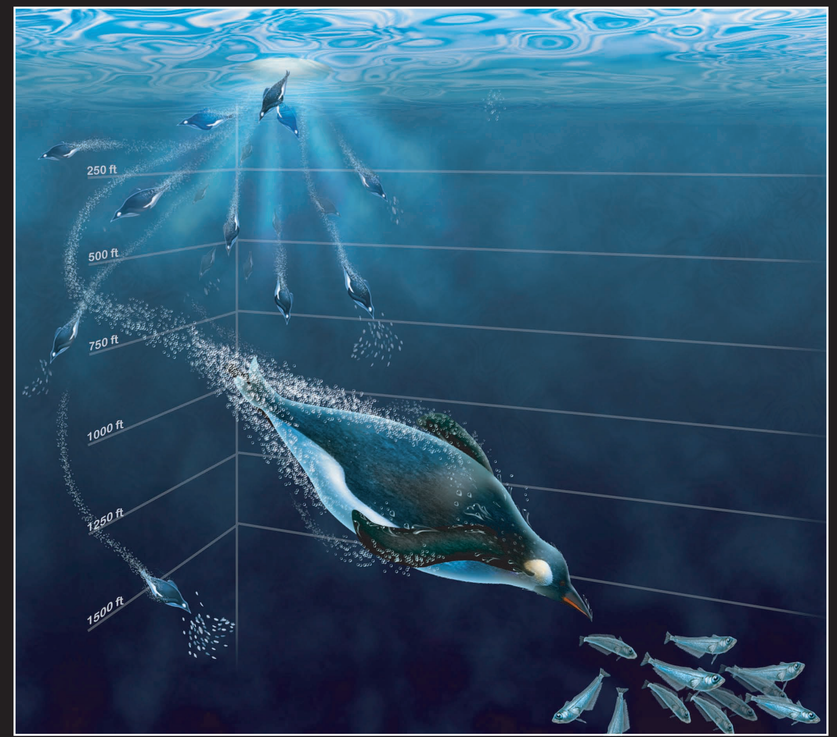
International Polar Year *Life in the Cold and Dark* National Science Foundation



Zina Deretsky, National Science Foundation

The Emperor Penguin, which can measure nearly four feet tall and weigh as much as 90 pounds, is the largest of all penguin species. The animals have fascinated explorers and the public alike for more than a century, and were once wrongly thought to be the "missing link" between reptiles and birds. Emperors can live—and incubate eggs—without shelter at temperatures as low as -70 F, and travel up to 15 miles per day by "tobogganing"—that is, by sliding on their bellies across the ice.

Moreover, they can easily sustain the crushing pressure of dives as deep as 1,500 feet (below). Scientists are studying this and other remarkable abilities, and may be able to use their findings in applications such as surgery and anesthesia.



Nicolle Rager Fuller, National Science Foundation

The annual reproductive cycle of the Emperor Penguin, shown above, provides a striking example of adaptation to extreme cold.

During the peak daylight months of austral summer (January to March), the animals gorge on fish, squid and krill. By the end of April, they have traveled over the ice to their breeding grounds, or rookeries, where mating occurs. After laying a single egg, females then return to the ocean to feed. Meanwhile, in the 24-hour darkness of winter, males keep the eggs warm and elevated above the ice until they hatch in August. Females return to tend the chicks—which sit on their parents' feet—and males head for the sea to feed.

The two sexes alternate chick care and feeding through the austral spring. Gradually, the chicks are released onto the ice, where they cluster for warmth. Finally, at the beginning of the Antarctic summer in December, when the chicks are five months old and getting their permanent feathers, the adults leave their offspring to fend for themselves.

for more information
visit http://us-ipy.gov
and http://nsf.gov