Ripple Marks

The Story Behind the Story

BY CHERYL LYN DYBAS

They Met on the Silk Road—Tigers of the Riparian Tugai, Coniferous Taiga Once Mingled on Fabled Highway

I imagine a tiger.
He'll move through the forest and his days
Leaving his traces on the mud banks
Of a river whose name he doesn't know.
In his world there are no names or past
Or future, only the certainty of now.
– Jorge Luis Borges, "The Other Tiger"

In reeds tinged red in the Central Asian sun, a tiger roamed. There, in riparian forests that line rivers like the Vakhsh on the border of Tajikistan, the Caspian tiger (*Panthera tigris virgata*) prowled.

Until its extinction in the mid-1900s, the tiger stalked Bukhara deer along *tugai*, thicketed watercourses that flow through Central Asia's otherwise vast, arid deserts.

In the early twentieth century, the Russian government instructed its Army to exterminate all tigers as part of an agricultural conversion project across Central Asia. Once Caspian tigers were almost gone, farmers moved in, clearing *tugai* and planting crops like cotton. The tigers retreated, first from lowland streams to marshes around larger rivers. Finally, they crept into forested mountain ranges.

In 1947, the Soviet Union banned hunting of the Caspian tiger's close relative, the Siberian, or more properly, Amur, tiger (*Panthera tigris altaica*), still found today in the *taiga*, or coniferous forests, near the Amur River in the Russian Far East. But the edict came too late for the Caspian tiger, says Carlos Driscoll, a biologist at the US National Cancer Institute's Laboratory of Genomic Diversity in Frederick, Maryland.

The Caspian tiger's last stronghold was a reserve in Tajikistan: *Tigrovaya Balka*, "tiger former river channel."

No tigers were glimpsed there after 1958. Although still a matter of debate, the legendary final wild Caspian tiger may have been killed in February 1970, in Hakkari Province, Turkey.

New DNA evidence, however, reveals that we may not have seen the last of this tiger-of-the-riverbanks.

In 2010, the Chinese Year of the Tiger, Driscoll and other scientists are working to bring back the Caspian tiger. They analyzed mitochondrial DNA in samples from Caspian tigers preserved in museums in Russia, Kazakhstan, and Azerbaijan, and compared them with those of Amur tigers. The two tigers, it turned out, have almost identical genetic sequences, differing by only a single nucleotide.

Pronouncing the Caspian tiger extinct, Driscoll believes, may have been premature.

Some 10,000 years ago, Caspian tigers used a narrow trail to migrate from eastern China to the region around the Caspian Sea. The corridor they used—a funnel not much wider than the dusty, caravan-traveled Silk Road itself—was bordered on one side by mountains, on the other by desert. From there, the tigers colonized Central Asia. Eventually, some returned eastward across southern Siberia, establishing the Russian Far East's Amur tiger population.

Tigers likely stopped meeting at this ecological crossroads within the last 200 years, a result of increasing human presence in the region.

The discovery raises the possibility of repopulating a now tigerless Central Asia with Amur tigers, according to Ron Tilson, director of conservation at the Minnesota Zoo in Minneapolis, if it's attempted in the right habitat.

That habitat is *tugai*.

Stretching through Central Asia in long green strands, *tugai* was once widespread. Now it remains only as fragments along rivers such as the Ili in Kazakhstan and Amu-Darya in Uzbekistan. Other extensive *tugai* still exists in and around Tigrovaya Balka, and along Kazakhstan's Syr-Darya River, says Olga Pereladova, director of the World Wildlife Fund (WWF)'s Central Asia Program.

WWF-Russia and WWF-Netherlands recently undertook a feasibility study for Caspian (Amur) tiger reintroduction in Central Asia. The results identified at least two likely habitats: the Amu-Darya Delta and the Ili River Delta. The Ili River looks especially promising. The 894-mile-long Ili runs through northwestern China to Kazakhstan, finally flowing into Lake Balkhash. There it forms a large delta with vast *tugai* wetlands. "This delta still has enough healthy *tugai* to offer cover to good numbers of tiger prey," says Pereladova. "Without prey, there can be no tigers."

What are the prospects for the "Caspian" tiger? Will it return to Central Asia by the next Year of the Tiger in 2022?

The way ahead will not be easy. The Amur tiger itself hovers on the brink, according to biologist Dale Miquelle, Director of the Wildlife Conservation Society (WCS)-Russia, which oversees the long-running Siberian Tiger Project in the Sikhole-Alin *zapovednik* of the Russian Far East. "Poaching, prey depletion, habitat loss from logging of pines in the *taiga*, and now infectious diseases

Tiger photos courtesy of Ilya Raskin. Tugai photos courtesy of Olga Pereladova, WWF-Central Asia.

have taken down the tigers. Our last Russia-wide census found fewer than 500 tigers even in remote forests."

A newly designated preserve along the Koppi River should help. In late September, the Khabarovsk Krai Administration in the Russian Far East passed a resolution to protect 94,000 acres of the Koppi River watershed. The river basin provides a home or migration corridor for many large mammals, including Manchurian deer, moose, brown bears—and Amur tigers. "The most valuable section of the Koppi River has been granted protection in perpetuity," says Yuri Kolpak, director of the regional arm for Wildlife Conservation and Protected Areas in Khabarovsk Krai.

A Koppi River Watershed Council will act as a governing body to coordinate sustainable watershed management, anti-poaching efforts, and regional development opportunities such as ecotourism and catch-and-release sport fishing. The council is an outgrowth of more than a decade of efforts by international and regional non-governmental organizations like the Wild Salmon Center in the United States, regional government, and local district administration and communities.

Cooperation that extends from local to international levels, says Miquelle, is at the heart of Amur tigers' future.

There's also hope on the horizon for the former Caspian tiger, believes Eric Dinerstein, vice president for conservation science at WWF.

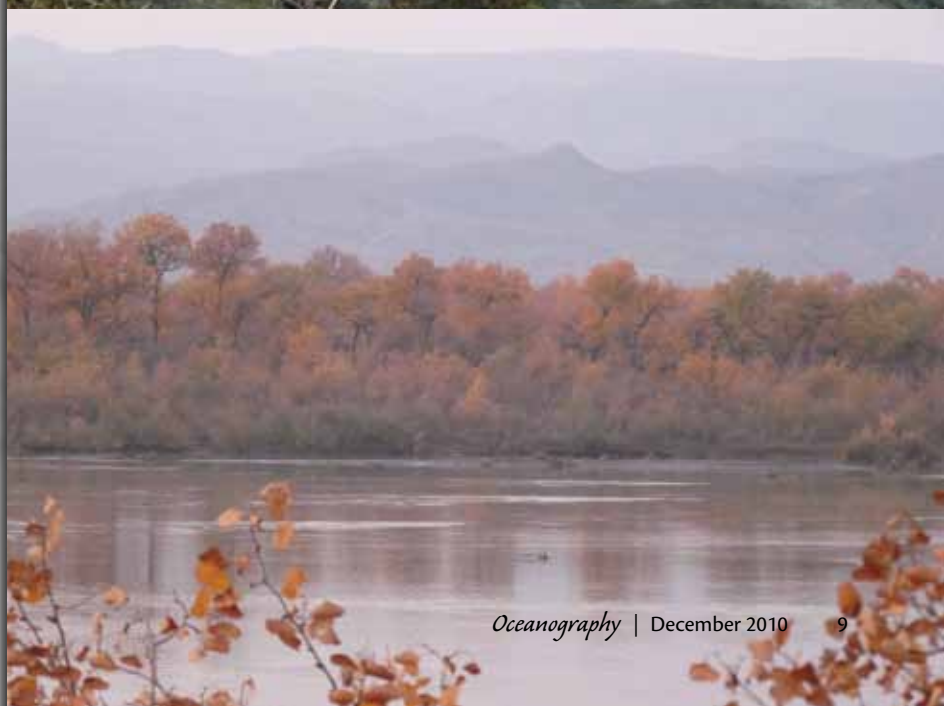
"With the Caspian tiger, we might be able to do what was once thought impossible," he says, "'reincarnate' an animal gone forever."

When a tiger vanishes into the forest, legend says, last to fade from view are its eyes.

The eyes of the Caspian tiger may be forever closed. But a relative close enough to be its shadow might again rustle through reedy *tugai.*

Then *Tigrovaya Balka* may reclaim its rightful name: a former river channel where tigers indeed dwell.

Adapted from an article by C.L. Dybas in BioScience *(December 2010).*



Thysanoessa raschii. Krill are much less prominent in the Arctic than the Antarctic. Among them, this species is the most common. It only reaches 25 mm in length. *Courtesy of Hopcroft/UAF/NOAA/CoML*

Mirror Images—Identical Species Thrive in Antarctic, Arctic Seas

Polar bears live on northern ice, penguins on southern, with an 11,000-km distance between them. Life on the North and South Poles couldn't be more different.

Or could it?

The forbidding oceans of the Arctic and Antarctic have revealed a treasure trove of secrets to Census of Marine Life (CoML) scientists. They were stunned to find more than 235 species common to the seas around both poles.

Begun in 2000, CoML is an international research program uniting thousands of scientists worldwide. The goal: to assess and explain the diversity, distribution, and abundance of marine life—past, present, and future—by 2010. In October of this year, CoML researchers presented the results of their decade-long endeavors.

Among initial findings were species both poles share, including blue, humpback, and fin whales, and many seabirds, as well as worms, crustaceans, and butterfly-like planktonic pteropods. The discoveries open a host of questions about where these animals originated, and how they ended up at both ends of the Earth.

The biologists also documented evidence of cold-water-loving species shifting toward both poles to escape rising ocean temperatures.

The results were hard-won. A series of polar expeditions took scientists through 16-m-high waves near Antarctica. Their Arctic colleagues worked under the watchful eyes of armed lookouts to protect them from polar bears. What they found, the oceanographers say, was worth the risk.

"Polar seas, far from being biological deserts, teem with an amazing quantity and variety of life," says Ian Poiner, chair of the CoML Steering Committee and chief executive officer of the Australian Institute of Marine Science. "Only through the cooperation of 500 scientists from more than 25 countries could such daunting environmental challenges [as those of the poles] be overcome to produce this unprecedented research."

Surprisingly, the Antarctic seafloor is a single bioregion, the scientists found, and a cold incubator for new species.

Research conducted in the 1970s suggested separate bioregions around Antarctica. CoML efforts, however, reveal that life on the seafloor around the continent of ice forms a single biological province—in spite of 8,500 km of ocean separating Antarctica's opposite sides. Scientists are analyzing hundreds of open-ocean samples from all compass points to find out whether marine life distribution has been evened out by the flow of the Antarctic Circumpolar Current. The swift-flowing current circles the polar continent twice as fast as the Gulf Stream flows from the Gulf of Mexico to Europe.

Glacial cycles taking place over millions of years have made the Antarctic an incubator of many species that today live in northern waters, molecular techniques show.

Antarctica regularly refreshes the world's ocean with new species of sea spiders, isopods, and other creatures. The species evolve, it's believed, when glacial expansions around the continent later melt. As the ice vanishes, new species radiate northward. For example, over 30 million years, several Antarctic octopi have colonized the deep sea, each "migration" coinciding with retreating ice.

"One hundred years ago, explorers like Robert Scott and Ernest Shackleton saw mostly ice in Antarctica," says Victoria Wadley of the Australian Antarctic Division. "Now we see life here—everywhere."

The findings in the Arctic are no less far-reaching. As ice melt there continues, sea ice ridges may play a role as important refuges for marine species.

The effects of global warming on marine life distribution, abundance, and diversity are appearing in unexpected Arctic places. Cold-water amphipods in Hornsund Fjord near Spitsbergen, Norway, are vanishing in the fjord's warming waters. Halfway around the pole in the Chukchi Sea off Alaska, several animals, including snow crabs, have extended their ranges northward—by more than 500 km.

Smaller marine species are replacing larger ones. The implications for the Arctic food web, say scientists like Russ Hopcroft of the University of Alaska, may be profound.

Clues lie in a CoML database called OBIS (Ocean Biogeographic Information System). OBIS has logged one million observations of 5,500 taxa in Arctic waters, with more being added. "We've filled in major blank spots on the Arctic map," says Hopcroft, "though big unobserved areas remain."

Waiting for their day in the sun, he says, could be creatures like the tiny, bright orange crustacean *Gaetanus brevispinus*, among the 235-and-counting species living in two worlds, the Antarctic and Arctic.

The revelation that the same species dwell at both the north and south poles tells us that despite an 11,000-km-separation, they—and we—are all citizens of one Earth.

Limacina retroversa. Sea-butterflies, or pteropods, are pelagic snails that swim through the water and catch food on sticky mucus webs and parachutes. This species is most abundant in the subarctic Atlantic, and adjoining parts of the Arctic proper. *Courtesy of Hopcroft/UAF/NOAA/CoML*

Fueled by Sugar Rush and Remodeled Legs—Christmas Island Red Crabs Run for the Money

Santa and his globe-trotting reindeer have nothing on the red crabs (*Gecarcoidea natalis*) of Christmas Island in the Indian Ocean.

In one of the most spectacular migrations on Earth, with the arrival of the monsoon rains each November or December, millions of red crabs set out on an arduous journey from an inland rainforest plateau to the ocean to reproduce.

Christmas Island becomes a carpet of red as the crabs flow across roadways, scuttle through shops and homes, and turn the island's golf course greens bright crimson. Some 120 million red crabs live on Christmas Island. They migrate so females can release their eggs into the sea at the turn of high tide during the last-quarter moon.

"This trip takes them across several kilometers of land," says Lucy Turner, a researcher at the University of Bristol in the UK who has studied the crabs, "a long way when you're a small land crab less than 20 cm long."

Scientists have wondered about the mechanisms that let the crabs make a dramatic switch from sedentary lifestyle to 5-km marathon—overnight.

A project led by the late Steve Morris of the University of Bristol led to the discovery that hormonal changes play a pivotal role in enabling the crabs to walk—if not run—for several days without stopping. Crustacean Hyperglycemic Hormone (CHH) allows them to make super-efficient use of stored energy in the form of glycogen in their muscles, spurring its rapid conversion to glucose to fuel the migration.

Their walk to the sea is "extremely energetically demanding," says Simon Webster, an endocrinologist at the University of Bristol and member of the research team. "During the nonmigratory period, the crabs are inactive and stay in burrows on the rainforest floor, emerging only for a brief period at dawn to feed. Their migration behavior reflects a fundamental alteration in metabolic status."

CHH is but one part of that change.

To switch from muscles suited to short-term inland burrow-sprinting to a high-endurance march to the coast, genes that code for proteins involved in muscle reconstruction are activated in the crabs' legs. In essence, the crabs remodel their leg muscles for the wet-season migration.

Tragically, Morris did not live to see his work come to fruition. He was knocked off his bike on the way into work on August 11, 2009, and later died of his injuries.

His colleagues published the results of the group's study in the *Journal of Experimental Biology*, April 30, 2010, online edition. "It is now crucial," they wrote in the paper's last paragraph, "to compare not just quiescent dry season crabs with those undergoing the annual migration, but crabs throughout their seasonal cycle."

The crabs may not have much time left. Monsoons have arrived later and later in recent years, causing the crabs to die of dehydration and exhaustion when they ultimately migrate in the absence of heavy rains. In the monsoonal delay, numbers of an ant called the yellow crazy ant are exploding. The ants spray the crabs with poison, then eat them.

Life on Christmas Island is clearly not a holiday. In the face of droughts and yellow crazy ants, icy North Pole lands suddenly look very inviting.

Photos are from http://www.environment.gov.au/parks/mediacentre and are copyright of the Australia Director of National Parks

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