Six-Legged Tigers

David L. Pearson

Tiger beetles are justifiably one of the most popular and most studied beetle groups in the world. With about twenty-seven hundred species described so far, there could be as many as another two hundred species awaiting discovery. Tiger beetles occur in a wide variety of biomes, from high-elevation alpine forests and high-latitude taiga (boreal) forests to tropical rain forests, from desert washes to ocean beaches. They are found in almost every part of the world except Antarctica, Tasmania, and smaller oceanic islands and atolls.

No matter where they reside, however, each species tends to occupy a narrow or highly specialized habitat. For example, in the Gran Chaco region of Brazil, Paraguay, Bolivia, and Argentina, the bicolored mound-dwelling tiger beetle (*Cheilonycha auripennis*) occurs only on tall termite mounds, where the beetles feast on larval glow worms that live in tunnels on the outside of the mounds. (At night, the glow worms cause the mounds to glow eerily in the darkness.) Even adults of the most widespread species, such as the North American bronzed tiger beetle (*Cicindela repanda*), occupy relatively restricted habitats—in this case, sandy margins of rivers, lakes, and ponds.

Larvae of each species are even more restricted to microhabitats than are their adult stages. The larvae are also predatory, but they hunt using sit-and-wait techniques from the mouths of vertical tunnels in the soil. Some of these tunnels reach more than six feet (two meters) in depth, but most are only six to twelve inches (fifteen to thirty centimeters) deep. The larvae of some

Tiger beetles are alert, fast-running hunters. Big sand tiger beetle (*Cicindela formosa*), photographed by Bryan E. Reynolds.

tropical arboreal species construct their tunnels in decaying wood.

Although adults of many species are plain in appearance, with browns and blacks predominating, many are as colorful as spectacular jewels—emerald green, purple, orange, and eye-popping crimson. Upon closer inspection, even the apparently plainly colored ones are pointilistically covered with brightly reflecting microscopic pits. The various colored reflections from these pits blend through the physics of interference to produce the subdued but still attractive hues that are seen with the naked eye.

Adult tiger beetles can fly short distances to escape danger. They spend most of their time on the ground and among rocks, although a few tropical species patrol tree trunks and leaves. The beetles run rapidly on their long, thin legs and use their large, sickle-shaped mandibles to capture and dismember small, fleeing arthropods. Hudson's saline tiger beetle (*Rivacindela hudsoni*), a flightless species found only on huge saline lake beds in interior Australia, has been clocked running at 2.49 meters per second (5.57 miles per hour), so fast that collectors can rarely get close to them.

Largely because of the cooperative efforts between passionate amateurs and a few dedicated professionals over the past two centuries, the taxonomy of tiger beetles is relatively stable, even for species in such remote parts of the world as Sulawesi, Brazil, and the Sudan. These days, it is easier and faster for inexperienced helpers and students to learn to reliably census tiger beetles than it is for them to learn to census other taxa.

And the work itself is faster: students of tiger beetles can quite easily census an area during the season of adult activity and reliably find most of the species within a short time, even in such complex and species-rich habitats as tropical forests. At one site at Tambopata in southeastern Peru, ornithologists took almost five years of intensive work to document 90 percent of the bird species occurring there, while in the same area butterfly and dragonfly workers took two or three years to arrive at this level of knowledge for their respective taxa; those of us looking for tiger beetles found 90 percent of the fauna within the first fifty-five hours of searching.

Field identification guides for tiger beetles have been published for many countries, including Bolivia, Venezuela, Colombia, Thailand, and Madagascar, and these publications have encouraged amateurs in many countries to adopt tiger beetles as hobby organisms. The work of these enthusiasts quickly adds to the growing body of information on tiger beetle distribution and natural history in a cost-effective way.

It is no wonder, then, that tiger beetles lend themselves well to conservation efforts. Around the world they are among the few insect groups for which endangered species can be declared with certainty and placed on national red lists. In the United States, four species have been officially declared threatened or endangered by the U. S. Fish and Wildlife Service, and some experts claim that as many as 15 percent of the 225 named species and subspecies in the United States and Canada have fallen to such low levels that they should be considered for protection efforts. The Sacramento Valley tiger beetle (*Cicindela hirticollis abrupta*), for instance, evidently has gone extinct in the last thirty years, a victim of flood

The splendid tiger beetle (*Cicindela splendida*) displays spectacular iridescent colors. Photograph by Bryan E. Reynolds.

control and habitat destruction. In Bolivia, the beautiful Bolivian ornate tiger beetle (*Pometon bolivianus*) was first discovered and named in the early 1990s; although such a large and obvious species should be easy to find, it has not been seen since, even with extensive searching in the same areas in which it was originally found (most of which are now coffee plantations), and this species has been placed high on Bolivia's red list of endangered insect species. In Spain, the highly endemic Murcia tiger beetle (*Cephalota deserticoloides*) has been declared endangered. In Sweden, the most northern populations of the wide-ranging Eurasian tiger beetle (*Cicindela maritima*) have been declared threatened due to habitat destruction.

Those of us working in conservation cannot afford having to defend false claims of rarity, and the reliability of accurately censusing tiger beetles minimizes questions of detectability that haunt conservationists who study the many other taxa that are harder to observe and easier to miss. By protecting threatened populations of tiger beetles we also secure habitat for many other species that also need protection—an umbrella effect.

We have strong evidence that, across the world, the species richness of tiger beetles is a good predictor of the species richness of other, harder-to-census taxa, such as butterflies and birds. And, because the number of species in a given locale can be so quickly determined, we can census hundreds of acres for tiger beetles in the time it would take to census one acre for birds or butterflies.

Tiger beetles thus make excellent bioindicators, and they have been used to monitor diversity in Amazonia and other less-well-studied areas of the world. With the aid of mathematical modeling we can examine a wide swath of habitat and generate broad estimates

Many tiger beetles have obvious markings, easing their identification. Oblique-lined tiger beetle (*Cicindela tranquebarica*), photographed by Bryan E. Reynolds.

of the quantitative patterns of tiger beetle species across vast areas such as the Indian subcontinent or South America. These patterns reveal areas of high and low species richness, which in turn can help determine priorities and boundaries for protected areas, as, for instance, in the case of Madagascar's recently declared Masoala National Park.

Bioindicators also have a role to play in the early detection of habitat degradation. Because tiger beetle adults and larvae are so specialized in habitat use, they tend to be highly sensitive to minor changes, functioning as barometers of degradation that might imperil them and their habitats. Collections made long ago are valuable aids in comparing the historic distributions of tiger beetle species with their current geographic ranges; tiger beetle records accumulated over the last century and a half in Europe have already documented habitat changes there that would not otherwise have been obvious.

Tiger beetles, employed as bioindicators to monitor habitat condition, can even help to guide management decisions. In Venezuela, for example, conservation advocates have joined with lumber companies to maintain forest biodiversity while increasing profits, applying their knowledge of the habitat specialization of the local tiger beetles in planning a long-term rotation for harvesting smaller plots within a large forest concession. Although timing logging to maintain the forest for sustainable use is made difficult by local variations in drainage, soil fertility, and a host of other factors that render dependence on a rigid timetable impossible, the presence of particular species of tiger beetles provides a relatively accurate measure of when the forest is sufficiently mature for harvest. Succeeding patches of regenerated forest, from cleared to mature, have different tiger beetle species present, each adapted to differences in shade tolerance, temperature, and vegetation density. Now the companies monitor the presence of tiger beetles, and reharvest particular sections only when the complement of species is that known to

be typical of the mature forest community, thus maximizing the continuing complex diversity of the forest.

When Barry Knisley, Chuck Kazilek, and I first published our *Field Guide to the Tiger Beetles of the United States and Canada* in 2006, there were likely only a hundred or so tiger beetle aficionados in North America, most of them amateurs. Now, just a few years later, we can hardly keep up with the flood of new distribution records, natural-history observations, and innovative insights into the study and uses of tiger beetles that we receive from thousands of enthusiasts. With growing economies in China, India, and much of South America, the field guides and web sites that focus on tiger beetles attract a growing number of hobbyists who have the time and money to support their avocation.

The future of insect conservation is more and more in the hands of these professional amateurs, whose contributions should help guide future policy decisions and budget planning by professional biologists, politicians, legislators, and policy makers. This passion for tiger beetles illuminates the ways in which insects and their admirers can advance conservation policy everywhere in our threatened world.

David L. Pearson, a research professor in the School of Life Sciences at Arizona State University, has worked with birds and tiger beetles since he was a teenager in Minnesota. His research has spanned habitats from desert grasslands to tropical rain forests, and he has co-authored eight books ranging from insect field guides to wildlife guides for ecotourists.

For further information about tiger beetles, see Tiger Beetles: the Evolution, Ecology, and Diversity of the Cicindelids, *by David L. Pearson and Alfried P. Vogler (Cornell University Press, 2001), and Arizona State University's "Ask A Biologist" web site.*

Publication of excellent field guides has boosted interest in tiger beetles. Six-spotted tiger beetle (*Cicindela sexguttata*), photographed by Bryan E. Reynolds.

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