Final Report on Miller Island Surveys for the Columbia River Tiger Beetle (*Cicindela columbica*) and the Hairy-necked Tiger Beetle (*Cicindela hirticollis couleensis*)

Submitted to the Interagency Special Status / Sensitive Species Program
Modification 2 to Assistance Agreement L08AC13768 (HAA081034)

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August 16, 2010

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Introduction

The Columbia River tiger beetle (*Cicindela columbica*) was historically known from the sandy banks of the Columbia, Snake and Salmon Rivers in Oregon, Washington and Idaho, yet it is thought to have been extirpated from both the Columbia and Snake Rivers when dams were constructed in the mid 20th Century, and currently can only be found along the Salmon River in Idaho. The Hairy-necked tiger beetle (*Cicindela hirticollis couleensis*) is distributed along most of the Columbia and Snake Rivers in Oregon and Washington, and adjacent Idaho, and is presumably extant, although few recent records exist of this species from the Columbia River. While numerous historical records exist for both species from the banks of the Columbia River near Miller Island in the Columbia Gorge National Scenic Area, to the best of our knowledge, Miller Island had never been systematically surveyed for these two species. On May 6, 2010, Sarina Jepsen of The Xerces Society joined a team of U.S. Forest Service botanists and biologists who chartered a boat to visit Miller Island. Jepsen conducted surveys for adult *C. columbica* and *C. h. couleensis* in all suitable habitat on Miller Island, while Forest Service botanists studied a rare plant. Neither *C. columbica* nor *C. h. couleensis* were observed during the surveys, although numerous *C. oregona oregona* were observed and a single additional species – probably *C. repanda repanda* – was observed and vouchered.

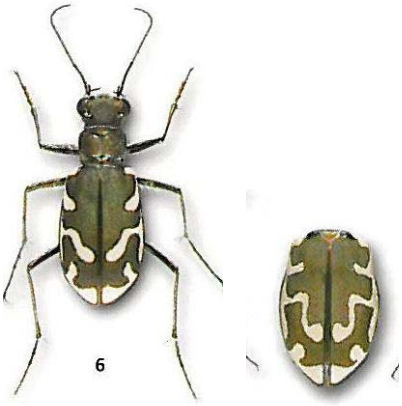

Figure 1. *C. columbica* (left) and abdomen of *C. h. couleensis* (right) reproduced from Pearson *et al.* 2006.

Methods

Historic records, ISSSSP fact sheets, survey protocols, relevant scientific literature, and aerial photos were reviewed for the two target species to ensure that Miller Island was within the range of these species and that it contained suitable habitat. Indeed, records for *C. columbica* exist prior to 1976 from Sherman, Wasco, Gilliam, and Hood River Counties in Oregon and Skamania County in Washington. Records for *C. h. couleensis* exist prior to 1988 from Gilliam,

Sherman and Wasco Counties in Oregon. A single *C. h. couleensis* record exists as recently as 2002 from an unspecified location on the Columbia River.

Appropriate habitat for *C. columbica* is described as "well-established riverine sandbars and dunes along the Snake, Columbia, and Salmon Rivers that are not completely flooded by normal spring run-off and extending 100 m back from the water" (Brenner 2005). Appropriate habitat for *C. h. couleensis* is described as "sandy beaches of the Columbia and Snake Rivers in eastern Washington and Oregon and adjacent Idaho" (Mazzacano and Foltz 2009). Prior to conducting the surveys, Xerces staff consulted with Robin Dobson, a USFS biologist who is familiar with Miller Island, to find out more about the potential tiger beetle habitat there. While Miller Island does not have well-established riverine sandbars, there is a large sand dune in the middle of the island that touches the edge of the Columbia River on the southeastern side of the island. In preparation for the surveys Xerces staff examined photographs in Pearson *et al.* (2006) of other tiger beetle species whose ranges cover, or are near, Miller Island, and thus may be encountered in the surveys. Those species include: *C. columbica, C. h. couleensis, C. oregona oregona, C. repanda repanda, C. depressula depressula, C. hemorrhagica hemorrhagica, C. tranquebarica vibex, C. tranquebarica borealis, C. longilabris perviridis, C. purpurea lauta, C. purpurea audubonii, C. nebraskana, C. pugetana,* and *C. terricola imperfecta*.

After arriving at Miller Island, the boat captain dropped off the team of botanists and Xerces staff took a boat tour around the perimeter of the island to determine which parts of the island had sandy shores. Sandy shores were only present on the northeastern and southeastern part of the island (see Appendix I: Map of habitat surveyed on Miller Island). Three transects along the sandy shores of the island were surveyed for *C. columbica* and *C. h. couleensis* adults following the ISSSSP survey protocol in Appendix II. An aerial sweep net and Garmin Dakota 10 GPS unit were used. Tiger beetles were netted and identified on site, then released; a single voucher specimen was collected for each species observed. Voucher specimens were pinned, spread, labeled, photographed, and stored at the Xerces Society. See Appendix III for a table of transects walked and tiger beetles observed.

After all areas of sandy shore habitat were surveyed, Xerces staff walked through the sand dune to the center of the island. Prior to visiting Miller Island, Robin Dobson had indicated that there was a small pond in the middle of the sand dune, and it seemed possible that the wet sand within the dune may provide suitable habitat for *C. columbica* or *C. h. couleensis*. However, the small amount of water present within the sand dune was overgrown with large trees and did not present suitable habitat for tiger beetles. Therefore, a survey was not conducted within this area.

Results

Surveys were conducted along the sandy shores of the Columbia River on the southeast and northeast edge of Miller Island. Three transects were walked through wet, damp and dry sand and tiger beetles within approximately a 10 foot swath were observed (5 feet on either side of the observer). Transects were named: Miller 2, Miller 5 and Miller 7.

Miller 2

This survey began at 10:01 a.m. and ended at 11:07 a.m. on May 6, 2010. The survey transect began at N 45° 39.510' W 120° 52.795' and ended at N 45° 39.413' W 120° 52.993' (see Figure 2). The air temperature was 61° F and the soil temperature was 67° F. The sky was relatively clear above and there was only a light breeze. Two adult tiger beetles were observed. One was netted, identified as *Cicindela oregona oregona*, and taken as a voucher specimen (see Figure 3). The voucher specimen was taken at N 45°39.425' W 120°52.975'. The other tiger beetle observed flew away before it could be identified.

Figure 2. Photo of Miller 2 survey transect, taken from beginning of transect, facing west.

Figure 3. Photos of dorsal view (left) and lateral view (right) voucher specimen of *C. oregona oregona*.

Miller 5

This survey began at 11:25 a.m. and ended at 12:07 p.m. on May 6, 2010. The survey transect began at N 45° 39.470' W 120° 53.182' and ended at N 45° 39.533' W 120° 53.001' (see Figure 4). The air temperature was 77° F and the soil temperature was 83° F. The sky was clear and it was not windy. Eight adult tiger beetles were observed. One larva and ten larval burrows were observed. Four of the adult tiger beetles observed were identified as *Cicindela oregona oregona*. Three additional tiger beetles were spotted, but escaped capture and were not able to be identified. A fourth tiger beetle was netted, examined, and taken as a voucher specimen (see Figure 5). The voucher specimen is not one of the target species of this survey. It is likely *Cicindela repanda repanda*. The voucher specimen was taken at N 45° 39.502' W 120° 53.024'.

Figure 4. Photo of Miller 5 survey transect, taken from beginning of transect, facing east.

Figure 5. Photos of dorsal view (left) and lateral view (right) voucher specimen – likely *C. repanda repanda*.

Miller 7

This survey began at 13:47 p.m. and ended at 13:55 p.m. on May 6, 2010. The survey transect began at N 45° 39.645’ W 120° 52.798’ and ended at N 45° 39.655’ W 120° 52.876’ (see Figure 6). The air temperature was 78° F and the soil temperature was 89° F. The sky was clear. One unidentified adult tiger beetle was observed.

Figure 6. Photo of Miller 7 survey transect, facing west.

Discussion

Additional surveys for these two species are not recommended on Miller Island at this time. Miller Island has very little sandy shore habitat; all habitat that is potentially suitable to support *C. columbica* or *C. h. couleensis* was surveyed during the appropriate adult flight period for both species. While numerous tiger beetles flew away before they could be identified, Xerces staff spent additional time netting tiger beetles within the survey transect after the surveys were completed, and all individuals netted were identified as *C. oregona oregona*. Thus, it appears highly unlikely that any of the beetles that escaped identification during the transect surveys were either of the two target tiger beetle species.

Historic sites along the sandy banks of the Columbia and Snake Rivers should be revisited and surveyed for *C. h. couleensis* to determine its current distribution and status, since the current status of this species is unknown. Several other subspecies of *Cicindela hirticollis* have declined in recent years and this species appears to be highly sensitive to human disturbance (see Nagano 1980, Shook 1981, Knisley and Schultz 1997, Larochelle and Lariviere 2001, Cornelisse & Hafernik 2009, Mazzacano *et al*. 2009).

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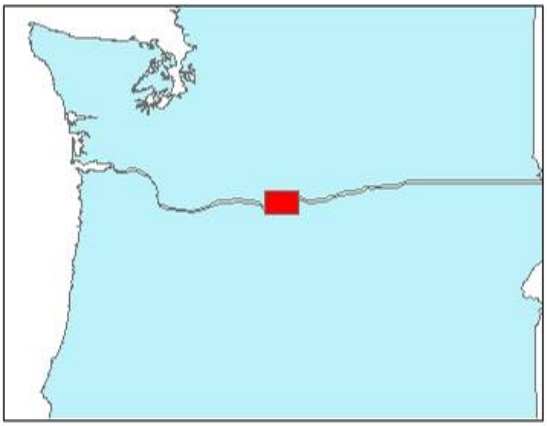
Appendix I: Map of habitat surveyed on Miller Island

Only the eastern edge of the island had suitable habitat
Target species C. columbica & C. hirticollis couleensis were not present in any transects



Appendix II. ISSSSP Survey Protocol for *Cicindela columbica*, *Cicindela hirticollis couleensis* and *Cicindela tranquebarica vibex.*

Survey Protocol

Taxonomic group:
Coleoptera: *Cicindela*

Species:
Cicindela columbica
Cicindela hirticollis couleensis
Cicindela tranquebarica vibex

Adapted from Pearson *et al.* (2006), Pearson & Vogler (2001) and Larochelle (1978).

Adults:

When:

Members of the genus *Cicindela* are diurnal and are best collected on warm (70°F) and sunny days, as they are sensitive to changes in light intensity and are much less active when it is cloudy, often retreating into burrows dug in the sand. Some species, however, do not hide in cloudy or rainy weather, but remain on the surface of the soil where they are generally motionless and easily collected.

Most species in this genus display one of two distinct life-cycle patterns, summer-active or spring-fall-active. Species in the latter category have an activity period which peaks twice: in the spring and again in the fall.

Where:

Most species of tiger beetle are restricted to a single habitat type, such as sand dunes, river banks, or ocean beaches. Sand is a critical aspect of tiger beetle habitat, since the larval stage creates burrows in the sand which they use as a retreat, and for capturing and consuming prey. Many *Cicindela* species have highly specific preferences with regard to soil composition, moisture, temperature, and chemistry, vegetation cover, and degree of flooding.

How:

When looking for adult activity, scan the ground or substrate about 5-20 m ahead. Adult tiger beetles tend to become habituated to the presence of an observer who remains motionless or makes very slow, careful movements. It may be difficult to approach some species whose habitat is muddy, slippery, or otherwise inaccessible, but even after being disturbed, adult beetles will resume their normal behaviors within a few minutes. The rapid movement of adult beetles can make them difficult to catch.

The most common technique for capturing adult tiger beetles involves using a sweep or aerial net. Collectors must be careful to avoid rapid, sudden movements that can alarm the beetles into flight. Since the shadow of the collector's body or net moving across the beetle's field of vision can elicit escape behavior, the collector should face the sun, and also hunt against the wind. If using a short-handled (<50 cm/20 in.) net with a smaller diameter ring (20 cm/8 in.), the specimen must be approached slowly until the collector is close enough to flip the net ring over the insect. A long-handled net (1-1.5 m/3.2-5 ft.) with a larger diameter ring (30-45 cm/ 12-18 in.) allows adult beetles to be trapped at a greater distance from the collector, especially over level terrain. A net with a more open weave is recommended, such that beetles trapped beneath are visible through the mesh without having to lift up the net rim. Some tiger beetle adults will remain immobile once the net falls over them, but escape quickly if the net rim is lifted so the collector can look underneath.

After the adult beetle is approached closely enough for capture, the net can be swung downwards so that the ring is slammed down firmly onto the substrate, trapping the beetle beneath. In soft substrate such as sand, a firm swing can bury the net rim a few cm into the substrate, decreasing the likelihood of gaps between the ring and substrate through which the beetle could escape. Holding the net rim as nearly parallel with the substrate as possible during the downward swing can also reduce gaps through which the beetle can flee. However, shadows from the approaching net being swung down may startle the beetle into escaping. Adults that are startled into flight may be caught on the wing.

The beetle may also be approached with the net held close to the ground, and the net mouth facing upwards. Once the net rim is next to the beetle, the net can be quickly flipped over sideways onto the insect. This approach reduces the risk of shadows falling across the beetle from above, but makes it more difficult to swing the net strongly enough to drive the rim into the substrate and trap the beetle securely beneath.

Adults should be removed carefully from the net, as they may cling with their mandibles and could be decapitated if pulled away abruptly. Locate the beetle under the net and grasp it gently but firmly. Lift the net up, still holding the beetle, and push your hand through the ring so the net is inside-out. Gently grasp the body and pull it free of the net, or guide it directly from the net into a sample vial.

Because of the unknown status of most *Cicindela* populations, it is desirable to identify specimens and release them alive as often as possible. Sample vials containing adult beetles can be placed in a portable cooler for several minutes to chill them and slow their movement. Once cooled, the beetles can be gently shaken from the vial onto the substrate and detailed photographs taken to provide a visual record. At sites where voucher specimens are needed, a limited number should be taken to avoid impacting the population. Adult

beetles can be killed and preserved in the field in 70% ethanol in lidded vials. For long-term preservation, specimens may be placed in hexane for several days to remove interior fat deposits that can otherwise leach out and discolor the exterior cuticle and make delineation of setal patterns difficult. Specimens can then be pinned through the anterior portion of the right-hand elytron using no. 1 or no. 2 insect pins, or stored in 70% ethanol in leak-proof, neoprene-lidded or stoppered glass vials.

Adults in the genus *Cicindela* can be distinguished from the other three genera of tiger beetle in North America by the absence of a forward projecting lobe on the front corners of the pronotum.

Larvae:

Cicindela larvae inhabit small, vertical burrows constructed in sandy or clay soil. Like adults, tiger beetle larvae can also become habituated to an observer's presence, and are difficult to capture. Predator avoidance behavior includes dropping to the base of the burrow; they can also anchor themselves within the burrow using the sharp hooks on their 5th abdominal segment. Collectors should examine the ground at close range to detect the small round openings of larval burrows. Larvae may be found and captured as they crawl across the substrate to relocate their burrow in response to changing moisture levels. Extracting a larva from its burrow may be accomplished by sliding a blade of grass down into the burrow; the larva may close its mandibles over the grass and can then be pulled out of the burrow. Otherwise, the blade of grass can be used as a guide for the location of the burrow; the observer can dig down alongside the grass, scooping substrate aside to create small pit that larva will tumble out into.

Not only is it difficult to collect larvae from their burrows, but larval identification to species is challenging. The characters used in larval identification are more difficult to discern than adult characters, change at each instar, and the larval differences between subspecies are not well known. In addition, there are no larval descriptions for about 40% of the known species in the U.S. and Canada, and a comprehensive key to described larvae is lacking. Larvae in the genus *Cicindela* have two pairs of hooks (as opposed to three pairs) on the hump on the 5th abdominal segment. The pairs differ in shape, with the median pair long, curved, and sickle-shaped, and the inner pair short, cylindrical, and usually possessing a short sharp spine. The 1st and 2nd pair of simple eyes differ only slightly in size.

Species-Specific Survey Details, including Updated Distributions:

Cicindela columbica

This species is known from sandy beaches and sand bars along the Salmon River in Idaho and the Snake and Columbia rivers of eastern Washington, Oregon, and adjacent Idaho. Most of the habitat of this species has been

destroyed by damming and flooding of the Columbia and Snake Rivers for irrigation and hydroelectric purposes. Populations are now known from only a few sites along the Salmon River in Idaho (Pearson *et al.* 2006, Beer 1971, Shook 1981). The apparent dependence of *C. columbica* on large well-established sandbars suggests that re-colonization of flooded habitats is unlikely or will be slow to occur. Additionally, large numbers of dams along the historic range of this species have fragmented the remaining areas of suitable potential habitat, further limiting dispersal and colonization. However, the small possibility that this species has been able to re-establish itself in its historic habitat on the Snake and Columbia Rivers since the time of the Shook (1981) report is worth investigating (ask Barry about this). New surveys along suitable areas of the Columbia River in Oregon and Washington would be valuable in determining if habitat recovery has occurred since the species was extirpated from the area after the damming in the 1970's.

The habitat for this species is well-established riverine sandbars and dunes that are not completely flooded by normal spring run-off and extending back from the river sufficiently (~100 m) to generally not be inundated by spring runoff waters (Shook 1981). The amount of vegetation cover that this species will tolerate in its habitat is unknown, but the documented vegetation of inhabited sandbars include sparse cover of willows (*Salix sp.*), cocklebur (*Xanthium*), and Licorice-root (*Glycyrrhisa*) (Bartels 1995). Larvae are found in the sandy soil of riparian sand bars, moistened from the nearby stream or river (Leffler 1979).

The activity of *Cicindela columbica* peaks in the spring and fall. Adults can be found from mid April to late June, and again from early August to late September (Pearson *et al.* 2006).

Adults of this species are 12 to 13 mm (0.47 to 0.51 in.) in length, with dark brown elytra and three bold, well-separated maculations which are not connected along the outer edge of the elytra. The front maculation is shaped like an open C, and the middle line has a steep curve backward with only the hint of a sharp "elbow." This species is most easily confused with *C. oregona*, *C. repanda*, and *C. hirticollis*, all of which occur in the same habitat. *Cicindela columbica* is distinguished from these species by the lack of a sharp, 90-degree "elbow" on the middle maculation, thicker maculations in general, and the dark brown elytra. It is further distinguished from *C. hirticollis* by the lack of thick, hairlike setae on the sides of the thorax. The larval stage of this species is undescribed, and no geographical variants of the adults are known (Pearson *et al.* 2006).

Cicindela hirticollis couleensis:

C. h. couleensis is known from sandy beaches of the Columbia and Snake rivers in eastern Washington and Oregon and adjacent Idaho. Its distribution

extends as far west as Cowlitz County, Washington, where individuals exhibit some intergrade characters with *C. h. siuslawensis*. However, there are no populations of *C. h. couleensis* within 100 km of the nearest *C. h. siuslawensis* populations (Pearson, *et al.* 2006).

Like other *C. hirticollis* subspecies, the activity period of *C. h. couleensis* peaks in spring (April to late June) and again in fall (early August to September) in northern latitudes. Both adults and larvae overwinter. Most eggs laid in the spring emerge as adults by August or September, one of the fastest development times known for any species of tiger beetle (Pearson *et al.* 2006). Occasionally, individuals in this species are found at lights at night.

C. hirticollis larvae burrow in sandy soil near surface water or where the subsurface soil is constantly moist. The burrows are typically shallow, ~8-20 cm (3-8 in.) deep, and may occur at high density along flood plains, overwash areas, and other low-lying water edges. The larvae are regularly found crawling across the sand to relocate their burrow in response to changes in soil moisture.

Adults of this species are 10 to 15 mm (0.39 to 0.59 in.) in length, and are characterized by the large tuft of long white hairs on the sides of the thorax and the front maculation shaped roughly in the form of a G, with a forward hook on its bottom end. The mandibles are longer and thinner than those of the similar *Cicindela repanda,* which is best distinguished from *C. hirticollis* by the front maculation in the form of a C, and the absence of large tufts of white hairs on the thorax (although white thoracic hairs may be present). Individuals of this subspecies are intermediate in size with dark brown to purple elytra and relatively heavy maculations (Pearson et al 2006).

Cicindela tranquebarica vibex

This subspecies is known from western British Columbia south to California, occurring on both the eastern and western sides of the Cascades. It is much rarer west of the Cascades where it inhabits sea beaches, irrigation ditches, and mud flats along lakes, ponds, and streams. It is more common east of the Cascades where it is found on salt flats, open dry ground, roads, and forest openings (Pearson *et al.* 2006).

This species is a strong flier with a wobbly (side-to-side) escape flight. The species can be solitary or gregarious, and individuals are occasionally attracted to lights. In most areas, both the adults and larvae overwinter (Pearson *et al.* 2006).

This species is most active between April and May and again between September and October (Pearson *et al.* 2006).

Adults of this species are 11 to 15 mm (0.43 to 0.59 in.) in length. The *vibex* subspecies has brown, green, or dull coppery green elytra with thin maculations in which the first one is often released to a short line. The ventral coloration is metallic purple to green. In general, species occurring west of the Cascades are green, and those occurring east of the Cascades are brown to dark green. Mixed populations, however, are common throughout the area, and eastern populations may be intergrading with *C. t. borealis* (Pearson et al 2006).

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Date: February 2009

Appendix III: Summary of data collected in surveys for *C. hirticollis couleensis* and *C. columbica* on Miller Island.

Transect Name	State	County	Observer	Date (dd/mo/yr)	Latitude (begin)	Longitude (begin)	Latitude (end)	Longitude (end)	*C. hirticollis couleensis*	*C. columbica*	*C. oregona oregona*	Unidentified adult tiger beetles	*Cicindela* larvae	larval burrows	Voucher	Voucher ID
Miller 2	WA	Klickitat	Jepsen	06/05/2010	45° 39.510′	120° 52.795′	45° 39.413′	120° 52.993′			1	1			1	*C. oregona oregona*
Miller 5	WA	Klickitat	Jepsen	06/05/2010	45° 39.470′	120° 53.182′	45° 39.533′	120° 53.001′			4	4	1	10	1	unidentified; likely *C. repanda repanda*
Miller 7	WA	Klickitat	Jepsen	06/05/2010	45° 39.645′	120° 52.798′	45° 39.655′	120° 52.876′				1				