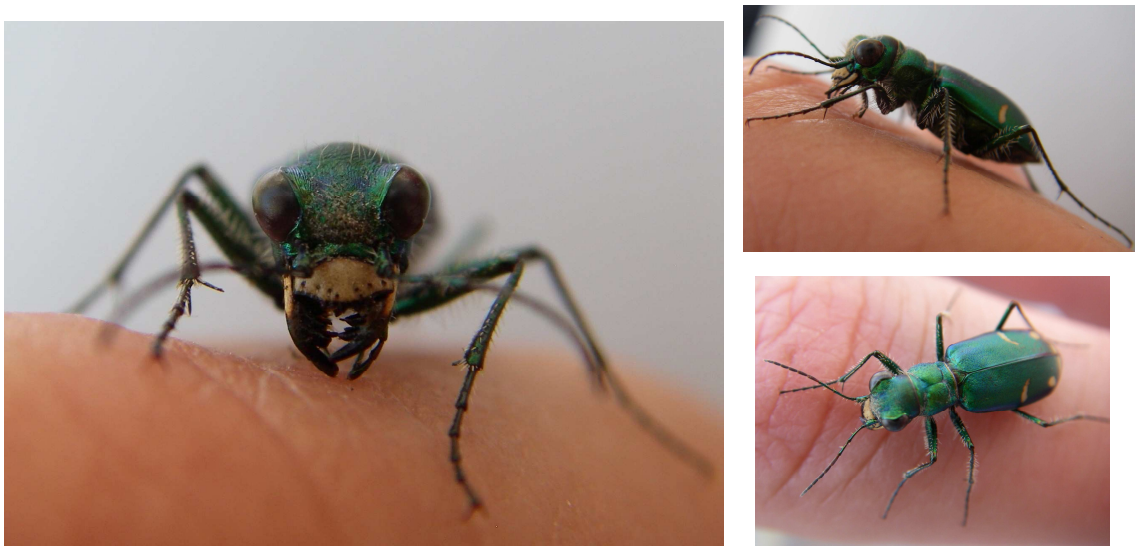
TIGER BEETLE (*CICINDELA SPP.*) INVENTORY IN THE SOUTH OKANAGAN, BRITISH COLUMBIA, 2009



Cicindela pugetana photographed at East Skaha Lake TNT property; courtesy of Dawn Marks BCCC.

By

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BC Ministry of Environment

Internal Working Report

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EXECUTIVE SUMMARY

The Okanagan valley is home to a diverse array of rare or endangered insects, including grassland associated tiger beetles. Three of these, Dark Saltflat Tiger Beetle (*Cicindela parowana*), Badlands Tiger Beetle (*Cicindela decemnotata*) and Sagebrush Tiger Beetle (*Cicindela pugetana*) have been found in the Okanagan area. These tiger beetles are Red-listed (S1), Red-listed (S1S3) and Blue-listed (S3) respectively by the BC Conservation Data Centre and thought to occupy similar habitats (open soils in low elevation grasslands and forest). Under the BC Conservation Framework additional inventory is listed as an action for these three species. In 2009, the BC Conservation Corps crew, with guidance and support from the BC Ministry of Environment, conducted multi-species surveys in the Okanagan grasslands. These three species of tiger beetles were included in the surveys. Surveyors conducted tiger beetle inventories in May and again in September during the adult tiger beetle activity periods. Tiger beetles were also searched for, casually, during the multi-species surveys throughout the field season. The September surveys proved most effective and over 50 tiger beetles were observed at nine sites in the south Okanagan. Surveyors covered 84.2km while targeting tiger beetles in September. No Dark Saltflat Tiger Beetles were encountered. One Badlands Tiger Beetle and twenty-one Sagebrush Tiger Beetles were recorded.

ACKNOWLEDGMENTS

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INTRODUCTION

In 2009, the BC Ministry of Environment, in cooperation with the BC Conservation Corps (BCCC) and the BC Conservation Foundation, began a multi-species inventory initiative. This project was designed to provide inventory data for several grassland species including tiger beetles, several butterflies, Nuttall's Cottontail (*Sylvilagus nuttallii*), *Efferia* n. sp. Robber Flies, Lark Sparrow (*Chondestes grammacus*), and Grasshopper Sparrow (*Ammodramus savannarum*). The multi-species inventories were conducted in the Okanagan valley, Boundary region and Similkameen region, on selected provincial crown lands including parks, ecological reserves and protected areas, as well as on privately protected properties owned by the Nature Trust of BC (TNT) (Figure 1).

The objective for the majority of these species, including tiger beetles, was: conduct presence/not detected surveys within potentially suitable habitats, including those not previously surveyed, and note coarse habitat descriptions where target species were found and areas surveyed. This was done using a multi-species approach when possible which allowed surveyors to detect the presence of more than one target species while in the field. Tiger beetles were surveyed for in the south Okanagan valley.

This inventory targeted three tiger beetle species: *Cicindela parowana* (Dark Saltflat Tiger Beetle), *Cicindela decemnotata* (Badlands Tiger Beetle), and *Cicindela pugetana* (Sagebrush Tiger Beetle). These tiger beetles use similar habitats (grassland, shrub-steppe and open ponderosa pine) and/or have overlapping distributions in the Okanagan Region.

The primary target tiger beetle was *Cicindela parowana* (Dark Saltflat Tiger Beetle). This species is Red-listed (S1) by the BC Conservation Data Centre (2008). The BC Conservation Framework (2009) ranks the Dark Saltflat Tiger Beetle Priority 1 for Goal 3 (Maintain the diversity of native species and ecosystems); inventory is one of the actions suggested for this species. A COSEWIC status report is in preparation for this species. Historically the Dark Saltflat Tiger Beetle ranged within Canada from Osoyoos to Vernon along the Okanagan Valley. It was thought to be extirpated until 2008, when a specimen collected in the south Okanagan Valley in the 1990s was identified as *Cicindela parowana*. Its habitat is not well known in BC but may include the Bunchgrass (BG), Ponderosa Pine (PP) and Interior Douglas fir (IDF) biogeoclimatic zones where alkaline soil occurs, but not usually in association with alkaline wetlands (R.A. Cannings, pers. comm.). Specific habitats may include sagebrush flats, wild rye patches, but not areas that are wet or associated with rivers. It is solitary and flies from April to June and July to September (Pearson et al. 2006).

The Badlands Tiger Beetle (*Cicindela decemnotata*) is Red-listed (S1S3) by the BC Conservation Data Centre (2008). A rank of S1S3 indicates a lack of information about the species, making a discrete rank impossible to determine. The BC Conservation Framework (2009) ranks the Badlands Tiger Beetle Priority 2 under Goal 3 (Maintain the diversity of native species and ecosystems); inventory is one of the actions suggested for this species. This species is found in grassland, sagebrush, sparsely vegetated areas with clay or gravely soil. They are generally solitary and widely spaced but may be in patchy colonies. They fly from mid March to late June and again in September to mid-October

(Pearson et al. 2006). Syd Cannings (pers. comm. to Orville Dyer) recommends searching silt bluffs as well. Concerted survey efforts will likely help narrow the uncertainty of the status of this species as reflected in the Conservation Status Rank of S1S3.

The Sagebrush Tiger Beetle (*Cicindela pugetana*) is Blue-listed (S3) by the BC Conservation Data Centre (2008). The BC Conservation Framework (2009) ranks it as Priority 2 for Goal 2 (Prevent species and ecosystems from becoming at risk); inventory is suggested as an action for this species. This beetle occupies sagebrush habitat with bare soil patches and road cuts. It is not gregarious but may forage together in patches. Its occurrence seems localized, being found at one site but not in apparently similar habitat nearby (Pearson et al. 2006). Sagebrush Tiger Beetles fly from March to mid-June and again from September to late October. RBCM records include Vernon, Penticton, West Bench, Osoyoos, Haynes Lease, Okanagan Falls, White Lake and Kelowna. A concerted survey effort for this species may find it to be less at risk than originally thought.

STUDY AREA

Tiger beetle search effort in 2009 focused on grassland habitat in the Okanagan valley south of Penticton (Figure 1). Selected protected and crown lands around Vaseux Lake, Osoyoos and South Okanagan Grasslands Protected Area received the most focus.

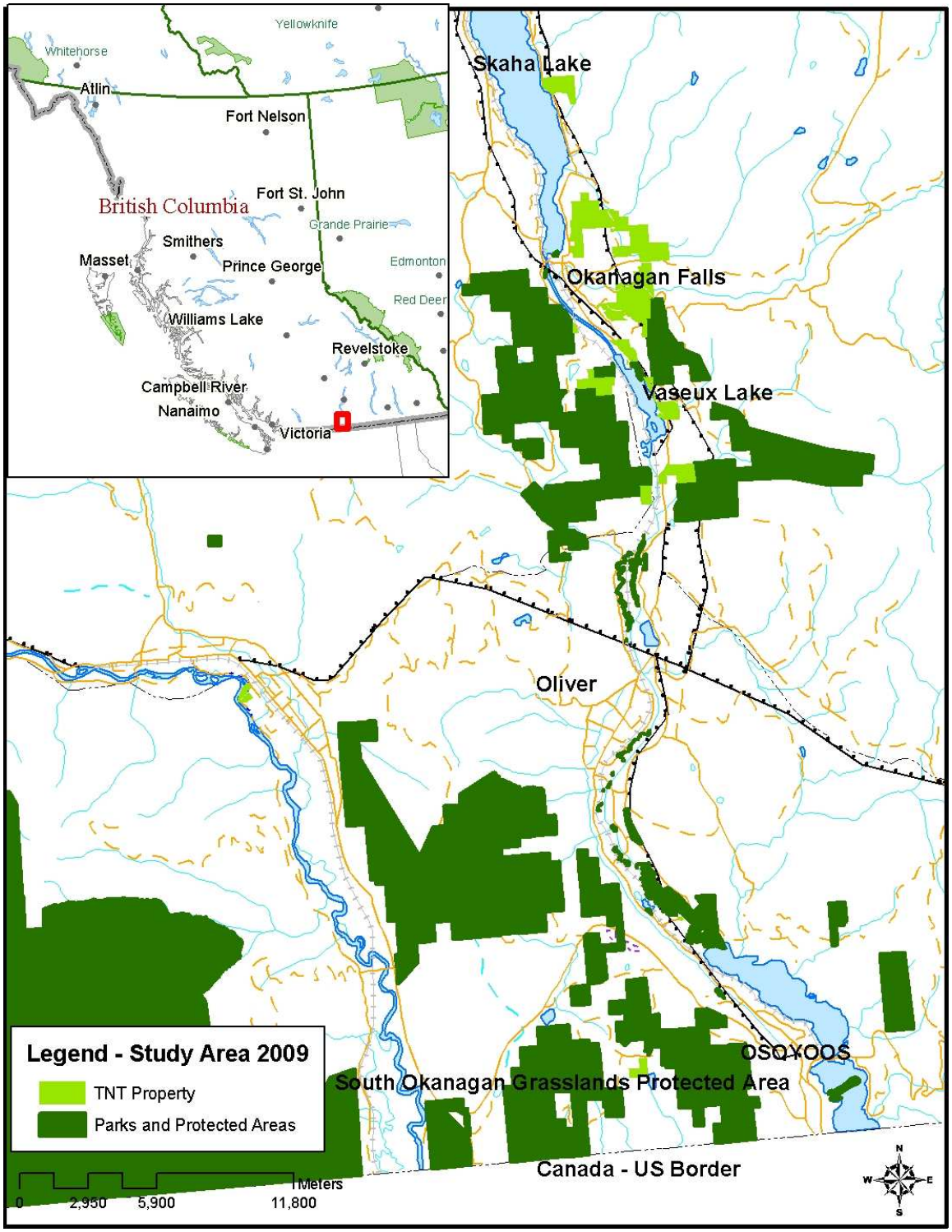

Figure 1. Study area for tiger beetle searches conducted by BCCC crew, 2009.

METHODS

BC Conservation Corps crew members were provided training in insect diversity and inventory methods, voucher collection and pinning, and tiger beetle identification and catching.

Wandering transects were used to conduct a presence/not detected inventory of potential habitat for tiger beetles and other species. Wandering transects have no fixed direction, distance or speed, and allow surveyors to change course to target potentially suitable habitat that occurs sporadically across the landscape. Surveys targeting tiger beetles focused on dirt roads and patches of bare soil through grassland habitat, as well as alkaline soils such as those surrounding alkaline lakes.

Focused tiger beetles searches were conducted in May and September when Tiger beetles are most active. Known tiger beetle sites were visited at the beginning of the surveys to determine and confirm tiger beetle activity. During all other multi-species inventories, surveyors were prepared to note any species of tiger beetle encountered. Surveyors attempted to catch all tiger beetles detected in the field to confirm identification. When a tiger beetle was caught the following information was recorded: species (or voucher label), date, time, location (UTM NAD 83), and photograph number (if applicable). Weather information (temperature, wind, cloud cover and precipitation) and coarse scale habitat notes were also recorded for the survey site. Surveys were not conducted under inclement weather.

Initial training included a period where surveyors practiced catching tiger beetles with butterfly nets and identifying them. Tiger beetles had to be caught in order to identify them accurately. Surveyors only counted tiger beetles that were caught and identified, photographed or collected.

Identification of caught beetles was conducted in the field based on Pearson et al. (2006) and notes provided during training. If identification was not possible, surveyors collected a specimen or took photographs for confirmation of identification by an expert at a later date. This approach was especially necessary for the Sagebrush Tiger Beetle (*Cicindela pugetana*) and its close relative the Cow-path Tiger Beetle (*Cicindela purpurea*). These two beetles occupy similar habitats; have a bright green/purple iridescent elytron and very similar and variable maculations. Because these two specimens could not always be identified with confidence in the field, surveyors took many pictures or collected specimens of green *Cicindela* beetles encountered in an area.

At alkaline lakes where there were many tiger beetles and they were difficult to catch (i.e. Blue Lake), surveyors used visual scanning and binoculars to view them. This was possible because the two species of tiger beetle found in this type of habitat, the Dark Saltflat Tiger Beetle and Western Tiger Beetle (*Cicindela oregona*), could be differentiated by the obvious maculations on their elytra. Large and thick maculations would have indicated a Dark Saltflat Tiger Beetle (Pearson et al. 2006).

Surveyors used handheld Garmin GPS units (GPSmap 60Cx and GPSmap76Cx) to

record their detections and wandering transects track logs. Track logs were recorded by each surveyor and consisted of a UTM point automatically placed every 10 metres. All UTM locations were downloaded using Garmin MapSource version 6.15, saved as .txt files and imported into a Microsoft Excel 2003 spreadsheet. Data was then uploaded into ESRI ArcMap 9.2 and saved as shapefiles. In ArcMap, the track points were then joined into a polyline for presentation in maps within this report.

All results, including spreadsheets and reports, were uploaded onto the Ministry of Environment's Wildlife Species Inventory database.

RESULTS

Surveyors visited the beach at Vaseux Lake Provincial Park with Orville Dyer and Rob Cannings during training on May 11, 2009. There, eight *Cicindela oregona* were observed. On May 15 surveyors visited the East Skaha Lake TNT property (north) for further tiger beetle training (air temperature ranged from 23-29^{o}C). This parcel contains bluebunch-wheatgrass/ponderosa pine habitat. Surveyors followed a dirt trail and searched the bare soil for tiger beetles to improve their beetle catching techniques. On this date surveyors successfully caught 14 tiger beetles. Voucher specimens were collected and photographs taken to help confirm species identification. Eight were confirmed by voucher specimen or photographs to be *C. pugetana*; five additional beetles were identified in the field by novice surveyors to be *C. pugetana*, but were not photographed or collected. The remaining tiger beetle was identified by novice surveyors as *C. purpurea* because of the noticeable purple tinge to the body, head and pronotum. Unfortunately this specimen escaped before it could be photographed. Surveyors returned to the East Skaha Lake TNT property (south) on May 25 to check tiger beetle activity and found a single tiger beetle (*C. pugetana*) (air temperature 27^{o}C). Approximately four hours were spent in the field for catching technique training and the activity check in May.

During additional multi-species surveys, between May and August, surveyors were at times in potential suitable tiger beetle habitat but no beetles were observed (Table 1). Multi-species surveys for the following species occurred within sagebrush and antelope-brush grasslands habitats: Nuttall's Cottontail (*Sylvilagus nuttallii*) pellets, Immaculate Green Hairstreak (*Callophrys affinis*), Lark Sparrow (*Chondestes grammacus*), Grand Coulee Owl-clover (*Orthocarpus barbatus*) and Half-moon Hairstreak (*Satyrium semiluna*). Surveys in July and early-mid August were outside of the suitable habitat for targeted tiger beetle species. Surveys at the end of August were primarily within antelope-brush habitats to survey for Nuttall's Buckmoth (*Hemileuca nuttalli*), Ground Mantid (*Litaneutria minor*) and Nuttall's Cottontail pellets.

Table 1. Surveys within sagebrush and/or antelope-brush grasslands as part of the multi-species approach which were not focused exclusively on tiger beetles.

Survey Site Name	Date	Habitat Description
Schneider TNT Property	20-May-09	Antelope brush, sparse Ponderosa pine, bluebunch wheatgrass, rock outcrops
White Lake Basin	21-May-09	Habitat included hilltops and ridges, sage – bluebunch wheatgrass.
McIntyre Bluff	27-May-09	Sage, antelope brush, bluebunch wheatgrass, ponderosa pine. Note: Surveyors were accompanied by an expert focused on searching for tiger beetles.
Blue Mountain TNT Property	29-May-09	Antelope brush, sage, ponderosa pine, bluebunch wheatgrass. Note: Surveyors were accompanied by an expert focused on searching for tiger beetles. (Temp 24-30^{o}C).
South Okanagan Grasslands Protected Area (SOGPA) - North Kilpoola	01-Jun-09	Sage, with bluebunch wheatgrass and needle-and-thread grass. Some ponderosa pine. Some cheatgrass.
Oliver Wastewater Treatments Lagoon Area	02-Jun-09	Antelope brush (very large in some areas), sage, rock outcrops, hills and ridges, buckwheat species are present at this site. Some ponderosa pine is present.
Gilpin Provincial Park	03-Jun-09	South facing slope with many rocky outcrops, some bluebunch wheatgrass and needle-and-thread grass, but lots of weedy plant species are present. Ponderosa pine is present, becoming more forested with climbing elevation.
Relkov TNT Property	04-Jun-09	South facing slopes with hills, rock outcrops and small ridges. bluebunch wheatgrass and arrow-leaved balsamroot are plentiful. Buckwheat and fine-leaved daisy are present and were targeted during searches. Ponderosa pines are present to the north and on the western portion of the property (beyond the gully). Note: big sage, and antelope brush are NOT present.
SOGPA - East Chopaka	10-Jun-09	Sage, bluebunch wheatgrass
Osoyoos West Bench	11-Jun-09	Sage, bluebunch wheatgrass
White Lake Basin	12-Jun-09	Sage, bluebunch wheatgrass
SOGPA - North Kilpoola	16-Jun-09	Sage, with bluebunch wheatgrass and needle-and-thread grass. Some ponderosa pine. Some cheatgrass.
White Lake Basin	17-Jun-09	Sage, bluebunch wheatgrass
Inkaneep Provincial Park	18-Jun-09	Antelope brush (very large in some areas), bluebunch wheatgrass, Dalmatian toadflax. Plentiful cheatgrass and some yarrow also present. Some ponderosa pine is present.
Haynes Lease	24-Jun-09	Antelope brush, big sage, common rabbitbrush, cactus. Open, bare, sandy soil. Some ponderosa pine is present.
Kennedy Property TNT	24-Jun-09	A large bench above a large lower elevation area. Rock outcrops, antelope brush (very large in some areas), bluebunch wheatgrass, needle-and-thread grass, cactus, cheatgrass, yarrow, and buckwheat species are present at this site. Ponderosa pine is present. Vaseux creek passes through this property (large gully/small canyon). A dirt

		road parallels the benches on the lower portion of the property.
SOGPA - East Chopaka – A	26-Jun-09	Sage, bluebunch wheatgrass
SOGPA - East Chopaka – B	26-Jun-09	Sage, bluebunch wheatgrass
SOGPA - East Chopaka – C	29-Jun-09	Sage, bluebunch wheatgrass
SOGPA - East Chopaka – D	29-Jun-09	Sage, bluebunch wheatgrass
Kilpoola Lake TNT Property	29-Jun-09	Thick sage, patches of Eriogonum (buckwheat), grass
Fairview Townsite	24-Aug-09	Antelope brush, grasses, including bluebunch wheatgrass; mustard, cheatgrass, Dalmatian toadflax, some sage, ponderosa pine, cactus.
Kennedy Property TNT	24-Aug-09	Antelope brush with bluebunch wheatgrass and needle-and-thread grass. Ponderosa pine and cactus also present. Snow buckwheat blooming.
Blue Mountain TNT property	28-Aug-09	Antelope brush, bluebunch wheatgrass, with rocky outcrops and depressions throughout. Ponderosa pine and interior Douglas-fir present.
Haynes' Lease	31-Aug-09	Antelope brush, bluebunch wheatgrass, cheatgrass, bare sandy soil, cactus, Dalmatian toadflax.
South Okanagan Management Area	01-Sep-09	Antelope brush, sand dropseed grass, cheatgrass, cactus, some snow buckwheat, bare sandy soil.
Wildlife Management Area (Black Sage Rd.)	01-Sep-09	Thick antelope brush, toadflax, cheatgrass, bare sandy soil, sand dropseed grass, snow buckwheat.
SOGPA - North Kilpoola	02-Sep-09	Sage, with bluebunch wheatgrass and needle-and-thread grass. Some ponderosa pine. Some cheatgrass. Common rabbitbrush and snowbuckwheat.
White Lake Basin	04-Sep-09	Sage, bluebunch wheatgrass, common rabbitbrush, snow buckwheat.

In September, after confirming the activity of tiger beetles at both Mahoney Lake (air temperature 23^{o}C) and East Skaha Lake TNT property (north) (air temperature 24^{o}C) (04-Sep-09), surveyors began to target tiger beetles more intensely. Thirteen sites were visited in September to search for tiger beetles and a total of 84.2 km were covered during fall searches (Tables 2-3).

Figures 2-5 show all locations inventoried specifically for tiger beetles during the 2009 field season and Table 4 presents a summary of detections per species.

Surveyors encountered several *C. oregona*, but only at beach habitats, both sandy around Vaseux Lake, and muddy alkaline soil around Mahoney Lake and Blue Lake. *C. tranquebarica* was encountered at two sites, both of which were near forested areas with Ponderosa pine (*C. nebraskana* was also observed at one of these sites). All *C. pugetana* and *C. purpurea* were observed in sagebrush grassland habitats with little to no large trees. *C. decemnotata* was also observed in this type of habitat at a site where both *C. pugetana* and *C. purpurea* were also identified.

Table 2. Survey conditions at sites visited in September to survey for targeted tiger beetles (after reconfirming tiger beetle activity). Tiger beetle detections at these sites and associated habitat notes are presented in Table 3.

Site Name	Date	Start Time	End Time	Search time	Track length	Temperature °C	Wind*	Cloud Cover**
Mahoney Lake	04-Sep-09	11:10	13:30	1hr 50min	4.7 km	23	1	2
Vaseux Creek	08-Sep-09	11:45	14:00	1hr 45min	3.5 km	20; 22	3; 4	2
	11-Sep-09	10:50	12:10	1hr 20min	1.3 km	20; 24	2	2
West Chopaka – Nighthawk Border	10-Sep-09	10:10	13:00	2hr 20min	1.4 km	21; 25	2	2
West Chopaka – North of Highway 3	10-Sep-09	13:05	14:15	1hr 10min	1.7 km	25	2	1; 2
TNT Kennedy Property	11-Sep-09	13:10	13:45	35min	1.3 km	24	2; 3	1
Osoyoos West Bench	14-Sep-09	10:15	14:30	3hr 45min	5.7 km	24; 27; 32	2; 3	1; 2
	15-Sep-09	10:00	14:50	4hr 20min	8.7 km	23; 28	2; 6	2; 3
SOGPA – Blue Lake	16-Sep-09	10:15	13:50	3hr 5min	2.1 km	22; 25	2	2
Kilpoola Lake	16-Sep-09	14:15	15:00	45min	1.1 km	28	4	2
SOGPA – East Chopaka A	17-Sep-09	10:40	12:30	1hr 50min	4 km	20	5; 3	1
SOGPA – East Chopaka B	17-Sep-09	13:20	14:00	40min	1.5 km	27	5	2
SOGPA – East Chopaka C	17-Sep-09	14:10	15:00	50min	2.1 km		2; 1	1
TNT Kilpoola Lake	17-Sep-09	15:10	15:45	35min	2.1 km	25	4; 2	1
McIntyre Bluff	18-Sep-09	9:30	14:00	4hr 15min	11.5 km	21; 28	2; 5	1
TOTAL				29hr 5min	84.2 km			

*Wind codes: 1 = light air; 2 = light breeze, leaves rustle; 3 = gentle breeze, leaves and twigs constantly move; 4 = moderate breeze, small branches move, dust rise; 5 = fresh breeze, small trees sway; 6 = strong breeze, large branches moving, wind whistling.
**Cloud codes: 1 = clear; 2 = scattered clouds (<50%); 3 = scattered clouds (>50%); 4 = unbroken clouds.

Table 3. Sites visited in September to survey for targeted tiger beetles (after reconfirming tiger beetle activity) – Tiger beetle species detected and general habitat notes

Site Name	Date	Species* observed	#	Habitat notes	Additional comments
Mahoney Lake	04-Sep-09	IC-CICORE	1	Beetle observed on the alkaline soil at the edge of Mahoney Lake. Search described in Table 2 represents the surveys around dried ponds, and along dirt roads and bare soil patches in Ponderosa pine, antelope brush habitat within the park. Elevation of detection (as measured by GPS): 480m.	The lake site was visited to confirm the fall activity of tiger beetle s in the south Okanagan. Searches then continued primarily along dirt roads within the park (not around Mahoney Lake proper in the Ecological Reserve).
Vaseux Creek	08-Sep-09 11-Sep-09	IC-CICTRA IC-CICTRA IC-CICNEB	3 5 1	Forested ponderosa pine, and rock outcrops over to the Fortis powerline and the dirt access road. The road was walked to search for tiger beetles up to the Park Boundary. Elevation of detections: 552m.	This site was accessed through the TNT Kennedy property. The Vaseux Creek site is along a valley north of Manuel's Draw where the last record of *C. parowana* was collected in 1996.
West Chopaka – Nighthawk Border	10-Sep-09	IC-CICDEC IC-CICPUG IC-CICPUR	1 7 1	Dirt road running up a slope of sage, bluebunch wheatgrass, needle-and-thread grass, bare soil patches, common rabbitbrush, snow buckwheat. Elevation of detections: 491m – 565m.	Search was conducted up the road. On the return trip surveyors walked in the sage, and were able to visually detect two green tiger beetles, but were unable to catch them.
West Chopaka – North of Highway 3	10-Sep-09	None		Sage, bare soil, sand dropseed grass, needle-and-thread grass, timothy, ponderosa pine, purple pea sp., cactus	Search was conducted along a dirt trail. (Elevation range 469m – 514m).
TNT Kennedy Property	11-Sep-09	None		Dirt/gravel roads through ponderosa pine and antelope brush habitat.	Search was conducted along dirt/gravel roads. (Elevation range 330m – 367m).
Osoyoos West Bench	14-Sep-09	IC-CICPUG IC-CICPUR	3 2	Dirt road through sage, bare soil, open weedy areas, common rabbitbrush, bluebunch	Two additional beetles could not be caught. Search was conducted along dirt roads.

	15-Sep-09	IC-CICPUG IC-CICPUR IC-CICTRA	1 7 1	wheatgrass,unknown grass sp. Elevation range of detections: 388m – 551m.	Two to three additional green beetles could not be caught. Search was conducted along dirt roads.
SOGPA* – Blue Lake	16-Sep-09	IC-CICORE	Many (see comments)	Dried soil/beach shoreline around Blue lake and northern pond in interior Douglas-fir and ponderosa pine forest. Elevation range: 831m - 857m.	Search was conducted by walking around lake, visually scanning with binoculars and capture by net. A complete count was not conducted but many *C. oregona* were observed.
Kilpoola Lake	16-Sep-09	None		soil/beach shoreline around Kilpoola Lake. Surrounded by sage grassland and trembling aspen, interior Douglas-fir and ponderosa pine on the hills above.	Search was conducted by walking around lake. Elevation range: 809m – 822m
SOGPA – East Chopaka A	17-Sep-09	IC-CICPUR	5	Dirt road through sage, bare soil, common rabbitbrush, bluebunch wheatgrass. Elevation range of	Four additional green beetles could not be caught. Search was conducted by walking along dirt road/trail.
SOGPA – East Chopaka B	17-Sep-09	None		detections: 746m – 913m.	Search was conducted by walking along dirt road.
SOGPA – East Chopaka C	17-Sep-09	IC-CICPUR	2		Search was conducted by walking along dirt road.
TNT Kilpoola Lake	17-Sep-09	IC-CICPUR	1	Dirt road through sage, bare soil, common rabbitbrush, bluebunch wheatgrass. Elevation of detection: 828m.	Two additional green beetles could not be caught. Search was conducted by walking along dirt road.
McIntyre Bluff	18-Sep-09	IC-CICPUG IC-CICPUR	1 2	Sage, antelope brush, common rabbitbrush, sand-dropseed grass, bluebunch wheatgrass, cheatgrass, ponderosa pine. Elevation range of detections: 495m – 500m	Three to four additional green beetles could not be caught. (elevation approx. 590m). Search was conducted by walking along hiking trail and around Rattlesnake Lake.

*Species codes: IC-CICORE = *Cicindela oregona*; IC-CICPUG = *C. pugetana*; IC-CICPUR = *C. purpurea*; IC-CICTRA = *C. tranquebarica*; IC-CICNEB = *C. nebraskana*; IC-CICDEC = *C. decemnotata*

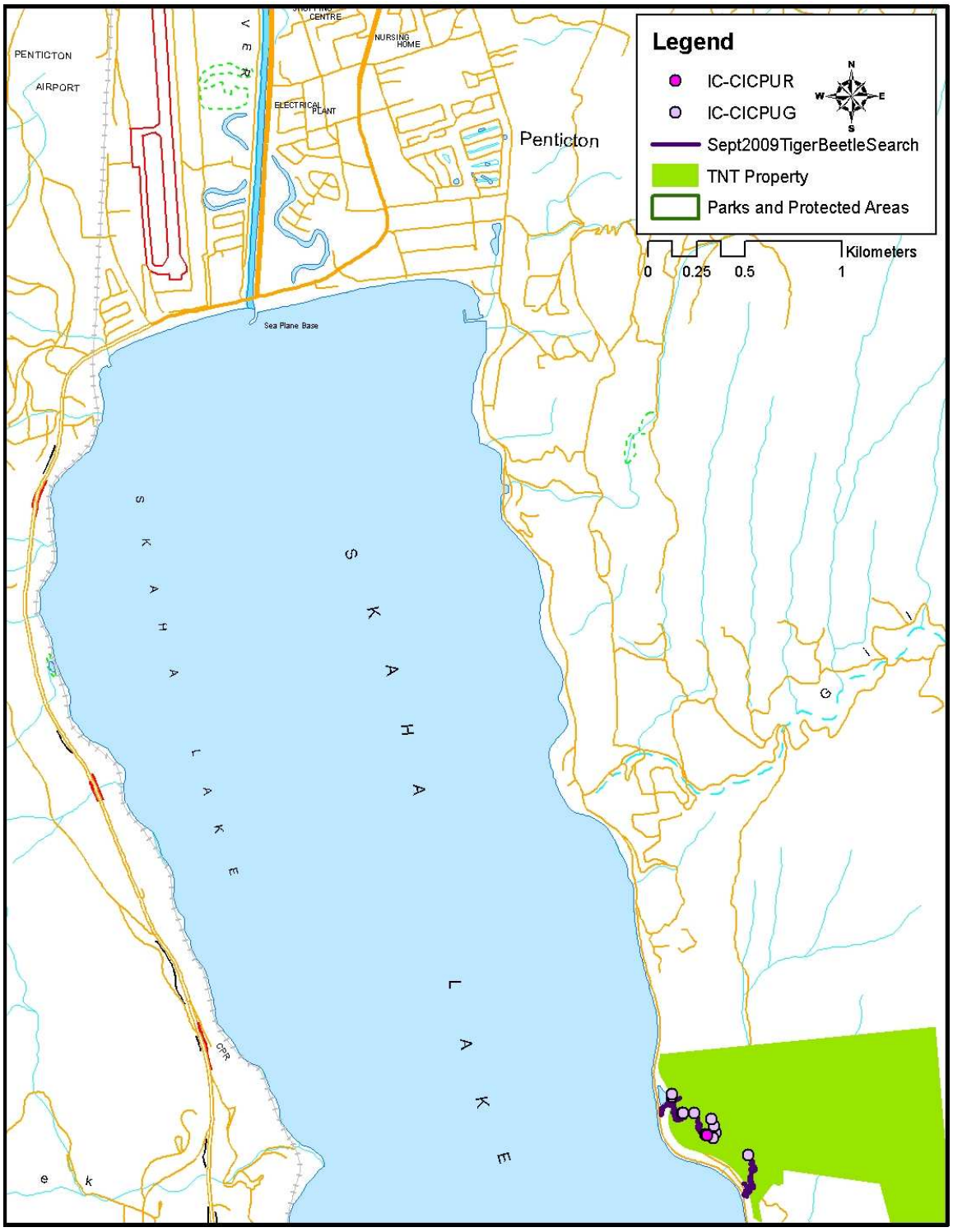

Figure 2. Tiger beetle survey tracks and detections from TNT East Skaha Lake site, May 2009.

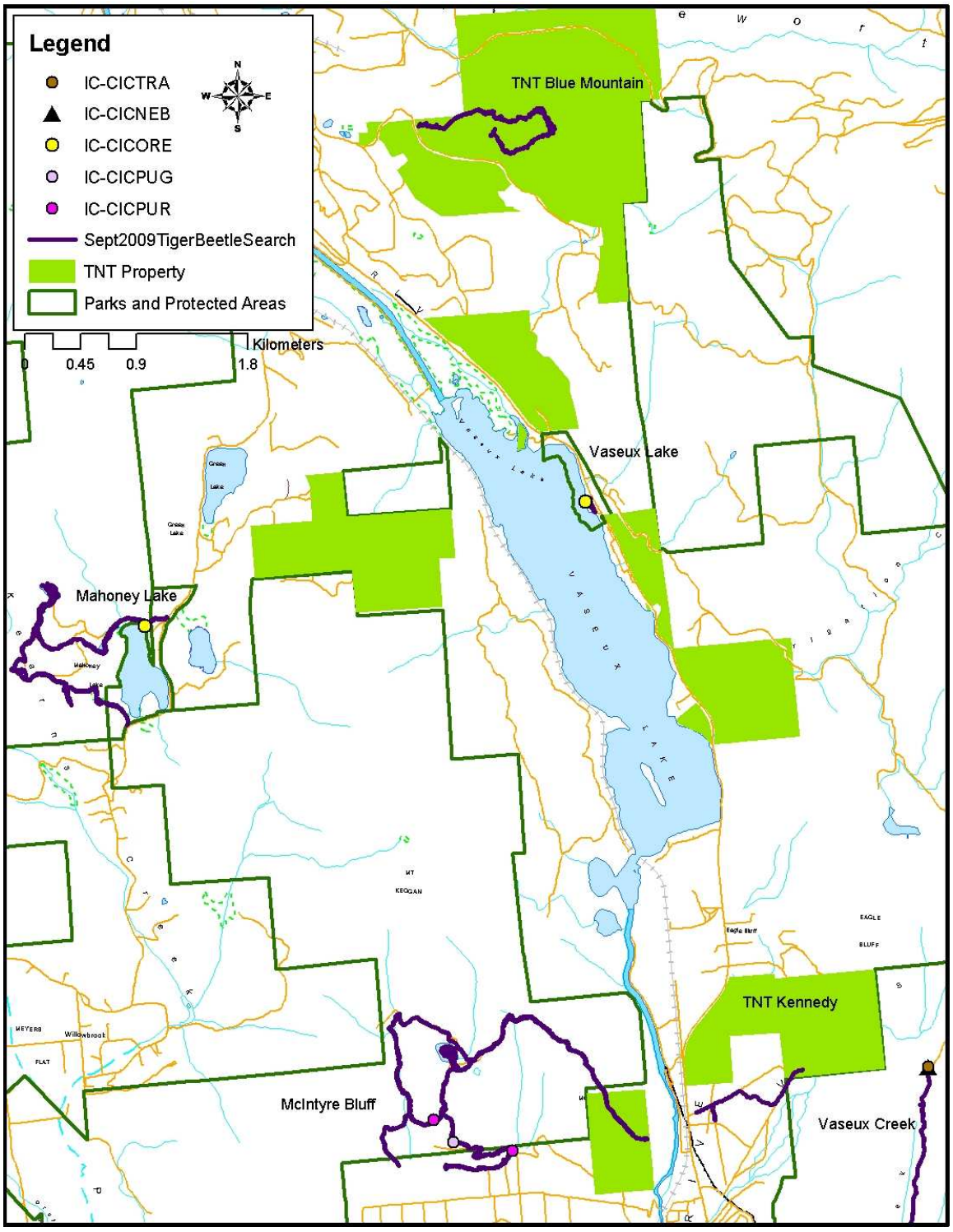

Figure 3. Tiger beetle survey tracks and detections from sites around Vaseux Lake, 2009.

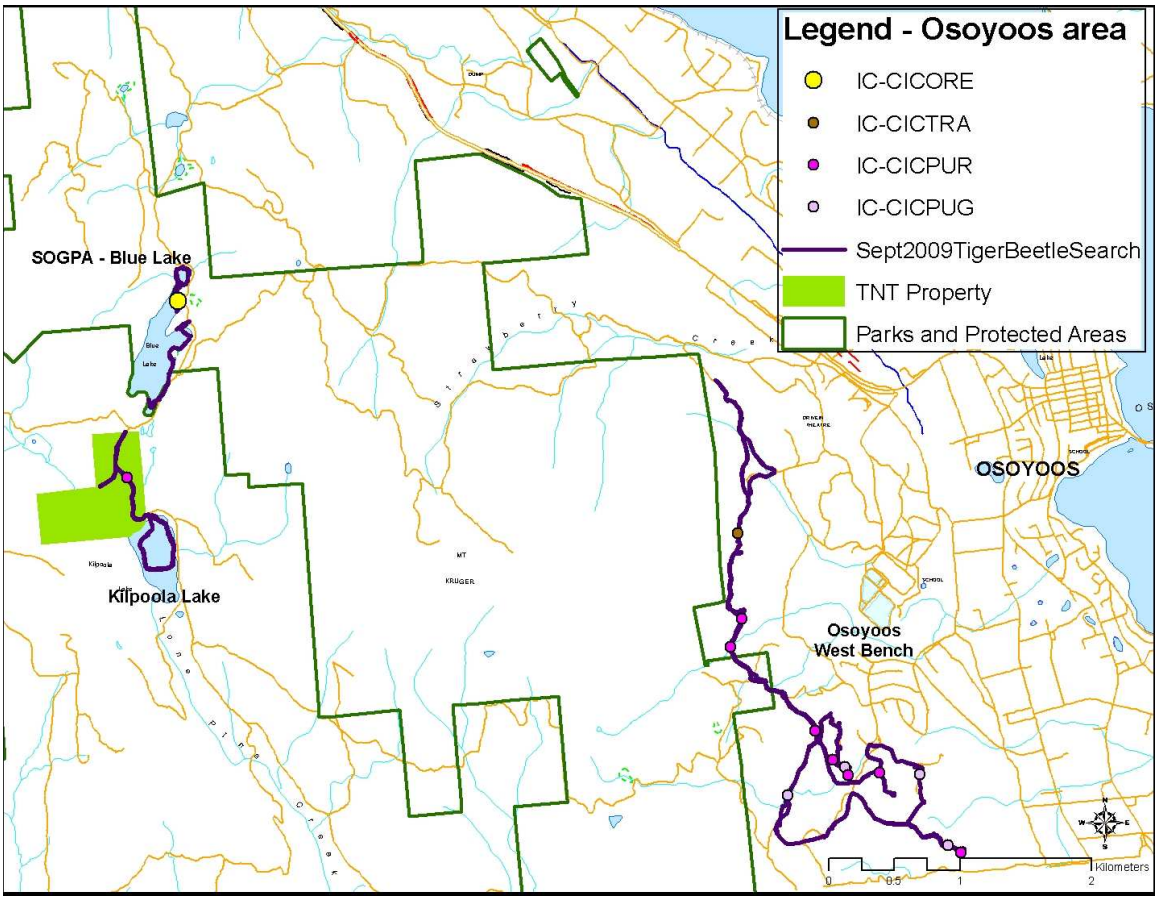

Figure 4. Tiger beetle survey tracks and detections from sites around Osoyoos and the South Okanagan Grasslands Protected Area, 2009.

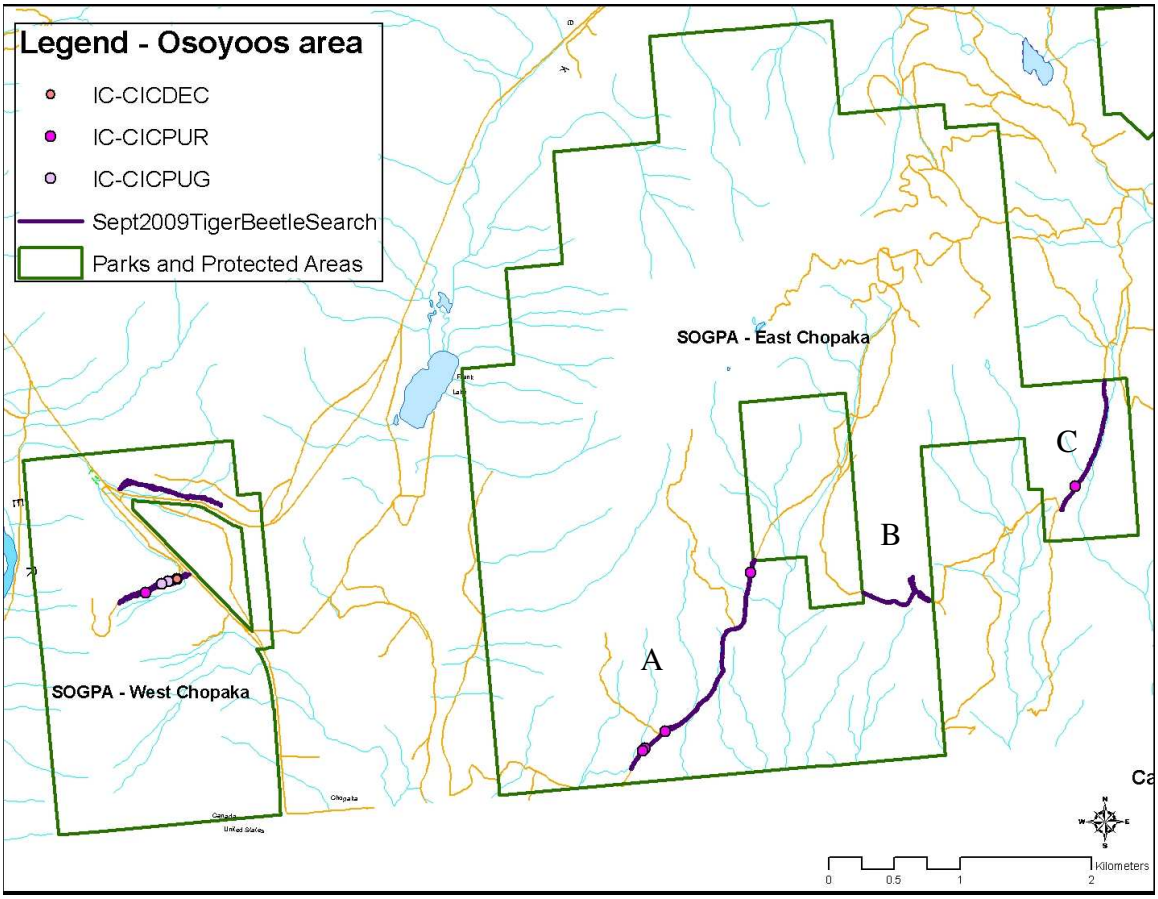

Figure 5. Tiger beetle survey tracks and detections from sites around the South Okanagan Grasslands Protected Area, 2009.

Table 4. List of species observed in 2009 and numbers of detections.

Species	Total number of detections during 2009 surveys	CDC Rank
C. parowana	0	Red (S1)
C. decemnotata	1	Red (S1S3)
C. pugetana	21	Blue (S3)
C. purpurea	20	Yellow (S4)
C. tranquebarica	6	Yellow (S5)
C. nebraskana	1	Yellow (S5)
C. oregona	Many	Yellow (S5)

DISCUSSION

In May, the BC Conservation Corps crew visited suitable tiger beetle habitats in the south Okanagan, at times accompanied by experienced tiger beetle surveyors. Tiger beetles were observed at two sites: Vaseux Lake Provincial Park (one date) and East Skaha Lake TNT property (two separate dates) which were visited as part of the initial training and to check tiger beetle activity. These were not included in our final search effort calculations because surveyors were still improving their capture techniques and identification skills (the detections, however, have been included in the results). These visits were the only times in May when surveyors were focused exclusively on searching for tiger beetles. During two multi-species survey days, May 27 at McIntyre Bluff and May 29, at Blue Mountain TNT property, surveyors were accompanied by Leah Ramsay, Program Zoologist, BC Conservation Data Centre. Her search efforts were focused on tiger beetles. Although the relative effort allotted to tiger beetles on those dates was greater than other days in May, no tiger beetles were observed.

It is unclear why no tiger beetles were observed at the end of May, 2009. Tiger beetles have specific phenology patterns; factors such as seasonal variation may have affected the adult tiger beetle activity period for the spring of 2009. Temperature conditions during the May surveys were similar, with ranges of 23-29^{o}C on the 15th and 25th, and 24-30^{o}C on the last surveys. Fall temperature conditions were also similar ranging from 20-32^{o}C during surveys. Many more tiger beetles were observed in September and our results suggest that September is a suitable time to conduct tiger beetle inventories in the south Okanagan.

As our results show, most of the surveys were conducted in sagebrush/grassland type habitats. The predominant species detected there were *C. pugetana* and *C. purpurea*. *C. decemnotata* was also detected within this habitat type. Many *C. oregona* were observed along beaches and edges of ponds but surveyors did not visit these habitats as often. *C. tranquebarica* was found in more forested areas but these were also not visited often.

The number of detections provided in the results should be considered a minimum count only. Surveyors only counted tiger beetles that were identified, either in the field or later by an expert. Due to the difficulty in capturing tiger beetles, surveyors were not able to always successfully capture or accurately identify all tiger beetles in an area. In areas with many beetles present, tiger beetles were captured and then released. Surveyors did

not attempt to separate new and previously caught tiger beetles. As a result, a complete count of all tiger beetles present at a site was not possible.

Surveyors most frequently detected *C. pugetana*, and *C. purpurea*; *C. pugetana* was found at sites where *C. purpurea* also occurred. From the East Skaha TNT and SOGPA West Chopaka – Nighthawk border sites, the number of *C. pugetana* observed was greater than the number of *C. purpurea* (8:1 and 7:1 respectively). Surveys of SOGPA East Chopaka and Kilpoola Lake TNT properties yielded only *C. purpurea*. The Osoyoos West Bench site was visited twice and a different ratio of *C. pugetana*: *C. purpurea* was found on each day (3:2 and 1:7 respectively). At McIntyre Bluff one *C. pugetana* and two *C. purpurea* were detected. A total of 21 *C. pugetana* and 20 *C. purpurea* were captured, making their overall ratio essentially 1:1. Caution should be taken when interpreting these relationships as these surveys were intended to be presence/not detected only. There were specimens that escaped without being caught which may have altered the numbers of detections of one species or another. Future studies may wish to examine abundance in more detail.

Since the objective of these surveys was presence/not detected, only coarse habitat characteristics were noted at survey sites and detection sites. Surveyors concentrated their searches on dirt roads and paths within grassland habitats. They also targeted the edges of alkaline ponds for *C. parowana* due to their association with alkaline soils. This strategy was adopted because tiger beetles were easier to detect and catch in these open areas. It also allowed surveyors to focus their search effort within a very large area of searchable habitat. This method was acceptable for the level of inventory intensity required for these surveys (presence/not detected). It also proved effective for novice tiger beetle surveyors to observe and catch the targeted species. This did, however, introduce a bias in habitat types searched. It is not possible therefore to determine availability or amount of suitable tiger beetle habitat within the landscape based on our results.

C. parowana is thought to be associated with alkaline soils in the Bunchgrass (BG), Ponderosa Pine (PP) and Interior Douglas fir (IDF) biogeoclimatic zones. Surveyors targeted alkaline ponds to readily locate these types of soils but were unable to locate, with certainty, significant patches of alkaline soils within the broader grassland areas. This was due to the inexperience of surveyors with identifying these types of soils and does not reflect the distribution or abundance of these micro habitats.

Once a tiger beetle search image was in place, surveyors were able to spot tiger beetles along the path ahead, or in patches of open soil. This was especially true of the brightly coloured *C. pugetana* and *C. purpurea*. This suggests that the duller tiger beetles and tiger beetles within denser grassland areas may have been more easily missed during surveys. Even after sighting, tiger beetles were difficult to catch particularly those that flew into more densely vegetated areas once detected. Although surveyor technique improved with practice, this challenge and influence cannot be ignored.

Tiger beetle species identification also posed a challenge. There are subtle differences between some species and extensive variability in colour and maculations (Appendix 1). This was true for the *Cicindela pupurea* and *Cicindela pugetana* species complex; *C. pugetana* was once considered to be a subspecies of *C. pupurea* (Wallis 1961). Voucher specimens and photographs were taken of many individuals detected to allow for expert species identification confirmation.

Although the multi-species surveys conducted from June to August brought surveyors within described suitable tiger beetle habitat no tiger beetles were observed. The paucity of tiger beetle detections during this time does not imply a lack of tiger beetles in those areas. This is due to a number of factors, including that the timing of these surveys was not during the optimal adult tiger beetle activity period. Additionally, although surveyors were aware of potential tiger beetles in the area, these were not the primary target species. Surveyors were most often scanning above the ground for other target species and may have easily missed tiger beetles. Also, during this time surveyors were searching within grassland habitats but not primarily along roads or paths where tiger beetles can be easily observed. For these reasons and to avoid overrepresentation of search effort for these species, the search efforts recorded during the multi-species surveys are not included in these results.

During September surveys, search effort was quantified by both time spent in the field, and by track length searched. This is due to the fact that surveyors were focused entirely on tiger beetles and because searches were conducted along dirt roads and trails within the grassland habitats. Two surveyors each covered 84.2 km of dirt roads and trails in twenty nine hours of surveying. It should be noted that the time spent in the field includes time spent walking, searching the habitat as well as time spent catching, photographing and recording data. The photographing and collection of specimens was time consuming in the field but was necessary because of the surveyors' level of expertise. Surveyors also did not separate search effort by species because all three were targeted during searches. Search effort is valuable information used by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) for species status assessments. Future such initiatives should consider a strategy to accurately record search effort. Separating search effort for each species within a multi-species project such as this one will demand additional data management and time.

This project succeeded in recording one *C. decemnotata* record and 21 *C. pugetana* records. A lack of tiger beetle sightings does not conclusively reflect an absence from the area. Weather, species habits, seasonal timing and variability, and surveyor focus, may all have influenced the results of 2009 surveys.

RECOMMENDATIONS

- Ensure surveyors receive expert training in species and habitat recognition.
- Ensure that surveyors have continued access to expert advice to facilitate correct species identifications.
- Surveyors should be provided with as many pictures and specimens of targeted tiger beetles prior to surveys to practice identification of similar species.
- Due to the great variation in markings and colouration of tiger beetles more novice surveyors should collect as many specimens and photographs as possible during surveys.
- Ensure that surveyors and project managers are prepared to survey large areas with the potential of not encountering the target species.
- Conduct surveys for multiple years and multiple times within the year to account for variation in yearly weather patterns and species phenology and behaviour.
- If additional population or habitat information is required ensure that surveys are designed to collect this data while in the field.
- Establish and field test an efficient method to track search effort accurately (as desired by COSEWIC).

REFERENCES

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Pearson, D. L., C. B. Knisley, and C. J. Kazilek. 2006. A Field Guide to the Tiger Beetles of the United States and Canada. Oxford University Press. Oxford, New York. 227pp.

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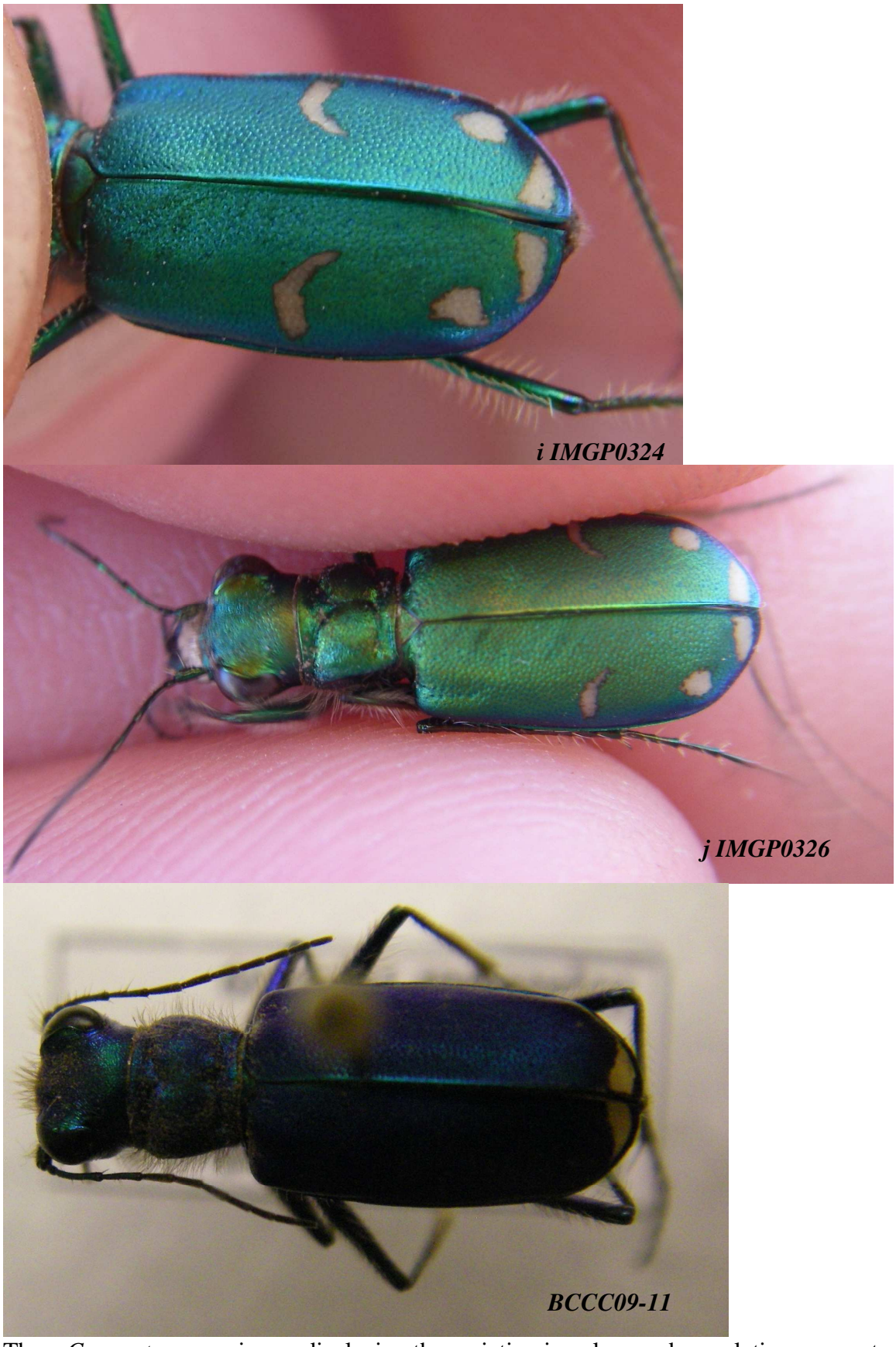
Appendix A. Selected photographs of tiger beetles encountered in 2009.

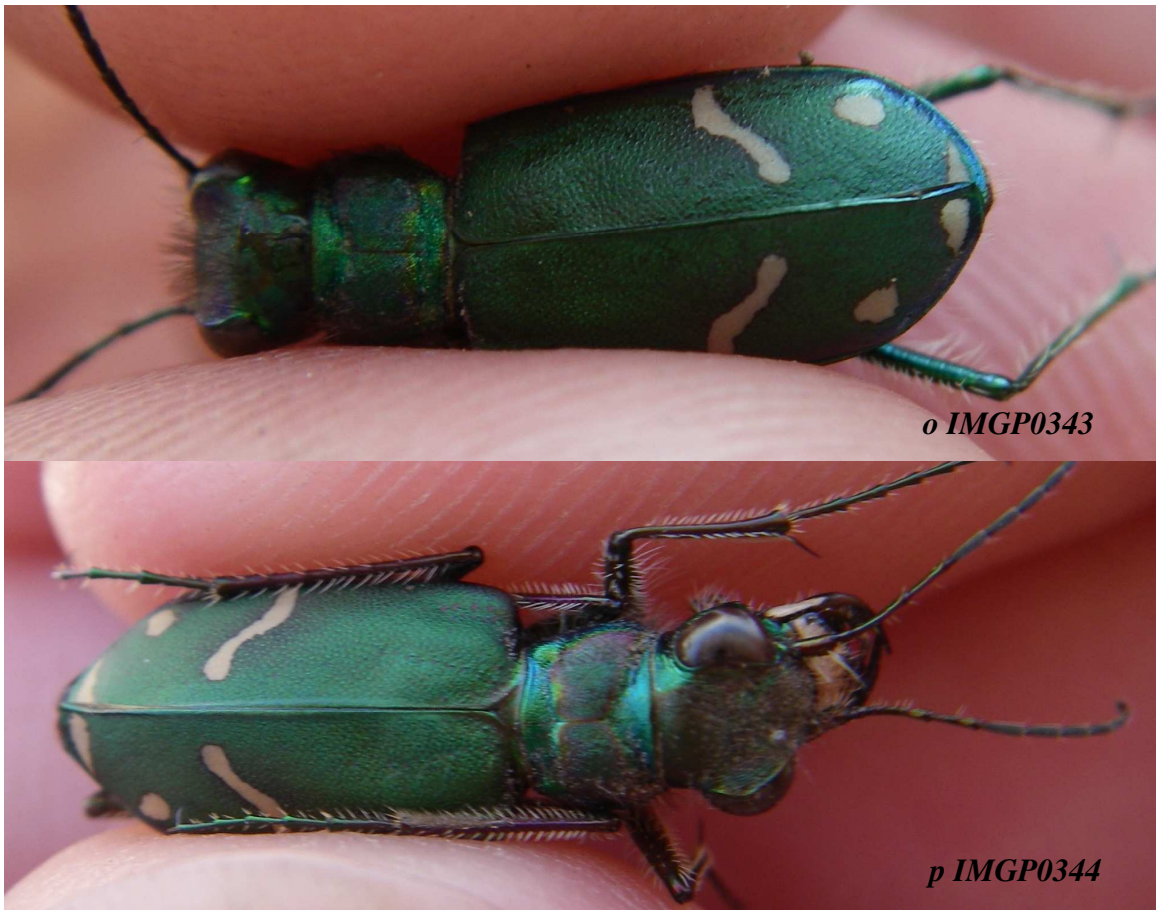
C. decemnotata photographed at SOGPA – West Chopaka, Nighthawk border, September 10, 2009.

Three *C. pugetana* specimens displaying variation in colouration of this species photographed at East Skaha Lake TNT property, May 2009.

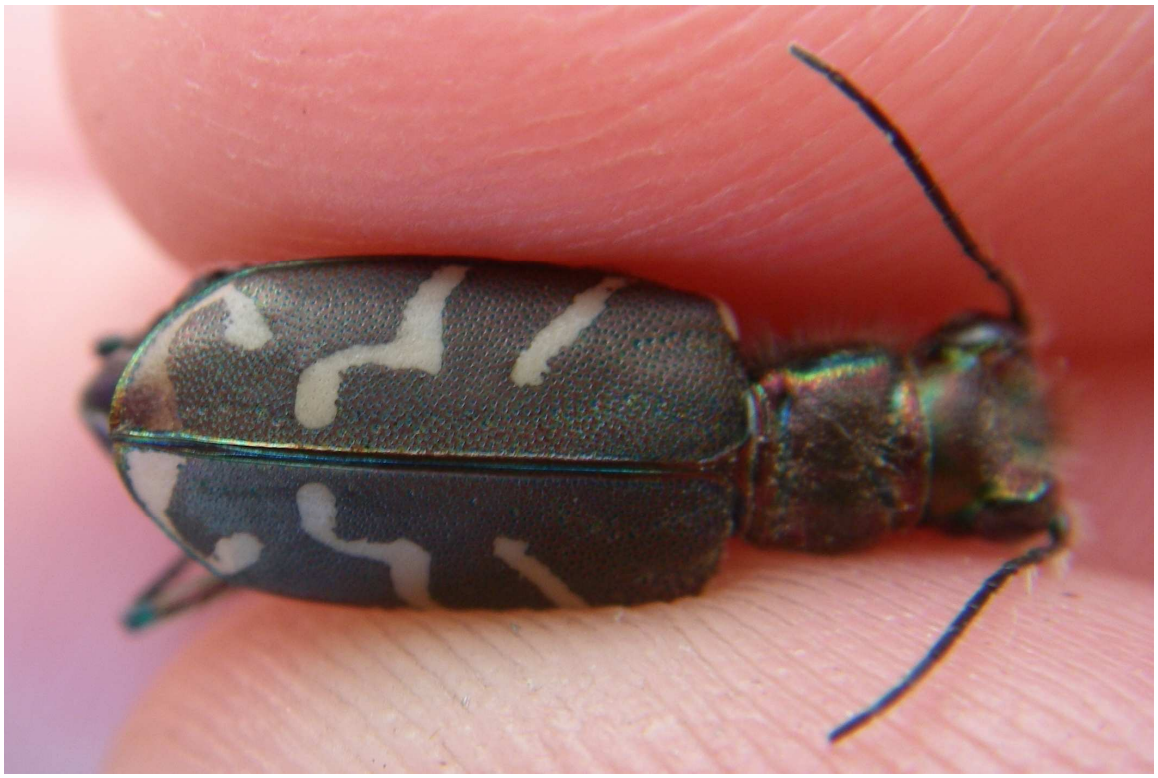


Three *C. pugetana* specimens displaying the variation in colour and maculations present in this species. The top two photos (***i*** and ***j***) were photographed at SOGPA – West Chopaka. The bottom specimen was collected from Osoyoos West Bench.

Three *C. purpurea* displaying a range of colour and maculation present in this species. Note the overall purplish tinge, especially on the margins of the elytra, pronotum and head. The top photo was taken at SOGPA – West Chopaka, Nighthawk border. The bottom two photos were taken at Osoyoos West Bench.



Two *C. purpurea*, the top photo was taken at Osoyoos West Bench. The bottom photo was taken at SOGPA – East Chopaka.



C. tranquebarica photographed at Vaseux Creek, September 8, 2009. Note the oblique line of the shoulder maculation.

C. nebraskana photographed at Vaseux Creek, September 11, 2009. Note the black body and the long labrum.