Redescription of *Haliplus dorsomaculatus* (Coleoptera: Haliplidae) with a New Synonymy and Comments on Habitat and Distribution

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ABSTRACT

Adults of *Haliplus dorsomaculatus* Zimmermann are redescribed including a discussion of male and female morphological characters. The species ranges from southern British Columbia east to western Montana and south to northeastern Utah and northern California; there is little geographic variation. Its preferred habitat appears to be emergent vegetation near the margins of slowly flowing water. *Haliplus allisonae* Brigham is a junior synonym of *H. dorsomaculatus*.

Key Words: *Haliplus allisonae*, Nearctic, wing venation, mandible, female genital sclerites

INTRODUCTION

Haliplidae is a small family of aquatic adephagan beetles most obviously characterized by the greatly expanded metacoxal plates. There are about 65 species in North America; these are placed in four genera, the largest of which is *Haliplus* Latreille. Wallis (1933) revised the Nearctic *Haliplus* species; six species have subsequently been described (Mank 1940; Leech 1948; Brigham & Sanderson 1972, 1973; Brigham 1977; Wells 1989). The Nearctic members of *Haliplus* have been assigned to three subgenera, *Haliplus sensu stricto*, *Liaphlus* Guignot and *Paraliaphlus* Wallis.

Haliplus dorsomaculatus Zimmermann (1924) was described from a single male specimen from "Boreal America". It belongs to the nominotypical subgenus (Guignot 1928, see discussion in Holmen 1987, p. 90), characterized by the presence of pronotal plicae and penultimate segments of the labial palps produced on the medioapical angle. Wallis (1933) did not examine the type specimen for this species and uncertainly referred to a male from CA and a female from CO as "? *dorsomaculatus*". Based on these specimens and his interpretation of Zimmermann's description, Wallis provided a new description and included *H. dorsomaculatus* in his key to species. Certain characters in his key do not apply to the *H. dorsomaculatus* holotype and his illustration of the male genitalia is incorrect for that species. These errors have long been suspected; a specimen correctly identified by H.B. Leech in 1946 has a note attached: "Can this be the true *H. dorsomaculatus* Zimm?"

More recently, Brigham (1977) described a new species, *Haliplus allisonae*, based on a series of specimens from BC similar to those he previously correctly identified as *H. dorsomaculatus*. Brigham discussed separating his new species from *H. distinctus* Wallis but mentioned *H. dorsomaculatus* only in his amended version of Wallis's key. Here it is shown that *H. allisonae* is a junior synonym of *H. dorsomaculatus*.

Apart from Zimmermann's brief description, little has been published about *H. dorsomaculatus*. No habitat information is available and, due to the high level of misidentifications, all published distribution information should be considered suspect. Here, the habitat preference for *H. dor-*

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somaculatus is described and its currently known distribution, based on examined specimens, is mapped.

In water beetles, as with most organisms with male intromittent organs (Eberhard 1985), male genitalia frequently provide unequivocal characters for the identification of species. Female characters are often overlooked and in many cases only males can be identified with certainty. Galewski (1972a, 1972b) showed that European haliplid females can be identified by mandibular and external genital characters and more recent guides to these species have included illustrations of the latter (Franciscolo 1979, Holmen 1987). Here, these characters and the metathoracic wing are illustrated for *H. dorsomaculatus* and a brief description of the internal structures of the female reproductive system is given.

MATERIALS AND METHODS

In addition to the type specimens of *H. dorsomaculatus* and *H. allisonae*, 718 *H. dorsomaculatus* from the museums and private collections listed in Table 1 were examined. Collection information for all *H. dorsomaculatus* specimens examined is listed in the text (type specimens) or Appendix 1. Standard postal abbreviations for states and provinces are used throughout.

Using a calibrated ocular micrometer on a Wild M5 stereomicroscope with 10x eyepieces, the following measurements were taken: L, distance from the front of the head to the apices of the elytra in lateral view; W, maximum width across the elytra in dorsal view; IO, minimum distance between the eyes in dorsal view; and H, maximum width of the head measured across the eyes in dorsal view. Five to eight specimens of each sex were measured for a given locality; means and standard errors are reported. Where insufficient numbers of specimens from a single locality were available, those from localities in the same county were combined. The normalized interocular distance, Rel. IO, was calculated using Rel. IO = IO / H.

Many male specimens were dissected in order to examine the genitalia. For freshly collected specimens, the genitalia were simply extended, spread and allowed to dry in place. Older specimens were relaxed in hot water and the genital capsule removed using fine forceps. The capsule was cleared of non-sclerotized tissue in hot 10% aqueous KOH and the genitalia were teased out of the capsule. After examination, the genitalia and capsule were stored in glycerin in genitalia vials on the same pin as the specimen. Some females were dissected in a similar manner to characterize the external genitalia. Other females were dissected following a procedure similar to Mazzoldi (1996) and Miller (2001a), using 0.2% aqueous Toluidine Blue to stain the preparation before microscopic examination. Mandibles or metathoracic wings were removed from several specimens and examined in temporary mounts on microscope slides. Nomenclature for wing venation follows Ward (1979). Drawings were made using a drawing tube on a Wild M5 stereomicroscope.

RESULTS

Haliplus dorsomaculatus Zimmermann 1924.

Holotype: ♂, “Amer. bor.”, no date, no collector, ZSMC.

Haliplus allisonae Brigham 1977. Holotype: ♂, CANADA, BC, Creston, King Cr., 22 Sept 1955, G. Stace-Smith, INHS; Allotype: ♀, same data, INHS; Paratypes: 4 ♂, 4 ♀, same data; INHS; 1 ♂, 1 ♀, same data, CAS. NEW SYNONYMY.

For habitus drawings, see Brigham (1977, Fig. 1) and Hatch (1953, Plate XXXIII Fig. 3 - note the figure is incorrectly labeled as *H. longulus* LeConte and is broader (L/W = 1.75), has a larger Rel. IO (=0.63) and shorter pronotal plicae than

Table 1.
Sources of Specimens examined in this study with abbreviations and contact person.

Abbr.	Source	Contact
AMNH	American Museum of Natural History, New York, New York	L. H. Herman
BCPM	Royal British Columbia Museum, Victoria, BC	R. A. Cannings
BYU	Monte L. Bean Life Science Museum, Brigham Young University, Provo, UT	R. W. Baumann
CAS	California Academy of Sciences, San Francisco, CA	D.H. Kavanaugh
CBBC	Cheryl Barr Collection, c/o Essig Museum, University of California, Berkeley, CA	C. B. Barr
CNC	Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Ottawa, Ontario	Y. Bousquet
EMEC	Essig Museum of Entomology, University of California, Berkeley, CA	C. B. Barr
INHS	Illinois Natural History Survey, Champaign, Illinois	C. Favret
JBWM	J.B. Wallis Museum, University of Manitoba, Winnipeg, Manitoba	R. E. Roughley
MTEC	Montana Entomological Collection, Montana State University, Bozeman, MT	M. A. Ivie
NSNH	Nova Scotia Museum of Natural History, Halifax, Nova Scotia	C. Majka
OSAC	Oregon State Arthropod Collection, Oregon State University, Corvallis, OR	D. Judd
RDKC	Rex D. Kenner Collection, Vancouver, BC	R.D. Kenner
ROME	Royal Ontario Museum, Toronto, Ontario	D. Currie
UASM	Strickland Museum, University of Alberta, Edmonton, AB	D. Shpeley
UBCZ	Spencer Entomological Museum, University of British Columbia, Vancouver, BC	K. M. Needham
WSU	Maurice T. James Entomological Collection, Washington State University, Pullman, WA	R. S. Zack
ZSMC	Zoologische Staatssammlung München, München, Germany	M. Baehr

normal for *H. dorsomaculatus*).

Holotype. Male on point with labels: white rectangular “Amer. bor.”; circular white “Typop” handwritten; red rectangular “Typus” printed; white rectangular “Samml. A. Zimmermann”; red rectangular “Holotype ♂ Haliplus dorsomaculatus Zimmermann 1924”, species handwritten; blue rectangular “Zool. Staatsslg. München”. Genitalia on point on separate pin with labels: white rectangular “penis H. dorsomaculatus” handwritten; white rectangular “Samml. A. Zimmermann”; red rectangular “Holotype Haliplus dorsomaculatus Zimmermann 1924”, species handwritten; blue rectangular “Zool. Staatsslg. München”.

L = 3.32 mm, W = 1.62 mm, L/W = 2.05, Rel. IO = 0.51. Elongate oval, fairly pointed posteriorly; not very convex, maximum near midpoint. Head amber with darker post-ocular band extending to middle of compound eyes; labrum medially emarginate with dense fringe of setae, medial dark mark extending to clypeus, micropunctation sparser medially and anteriorly; clypeus coarsely punctured, narrow impunctate area extending onto frons; interocular area coarsely punctured with inverted U-shaped impunctate area; dense punctures along ocular margin; palpi same colour as head, not infuscate apically, labial palpi with penultimate segment produced medially; vertical carina behind eye on side of head. Pronotum yellow, paler than head; narrow medial impunctate area extending approximately 2/3 along midline from posterior margin, ovate impunctate area medially each side of the midline, puncturing less dense anterior to these impunctate areas; plicae deeply impressed with brown lateral edges, impression steep on lateral side, sloping more gradually medially; plicae approximately 1/3 length of pronotum measured along plical line; pronotal lateral bead ends just anterior to posterolateral corner; pronotum wider than elytral base by width of lateral bead; hind margin sinuate with point of inflection slightly medial to midpoint of each side; anterior part of hypomeron visible in lateral view; lateral margin of pronotum evenly curved ventrally from posterior to anterior; anterolateral corner about midpoint of eye. Elytra same colour as pronotum with brown maculation as follows: sutural blotch extending to stria 3 anteriorly, stria 4 posteriorly; medial discal blotch between striae 3 and 4 with posteromedial corner connected to sutural blotch; postmedial discal blotch between striae 5 and 7; weak indications of premedial discal blotch between striae 5 and 6, most obvious along stria 6 where 4 or 5 punctures have merging "brown halos". Punctures of striae 1-4 large and blackened, basal punctures of striae 2 and/or 3 enlarged; punctures of striae 5-10 decreasing in size laterally, those of stria 9 similar in size to interstrial punctures, stria 10 with even smaller, barely blackened punctures. Sutural interstrial row with punctures nearly linear and single with occasional doubled or misplaced punctures; subsequent interstrial rows with punctures more widely spread, especially apically where some rows obsolete; no micropunctures visible at 50x between larger punctures; elytral apical margin very weakly sinuate. Prosternal process with sides converging to minimum of constriction, which occurs at about anterior margin of procoxae, subsequently widening posteriorly to just short of apex, then nearly parallel to apex; not channeled anteriorly, very shallowly channeled from anterior end of constriction to apex, flat between margins; coarsely punctured with dense micropuncturing from near bottom of declivity to posterior margin;. Metasternum mostly impunctate, a few larger punctures laterally; in ventral view, weakly depressed behind mesocoxae. Ventral surface similar in colour to dorsal surface, legs somewhat redder; micropuncturing as described in Brigham (1977). Genitalia as in Brigham (1977, Figs. 2–4) except aedeagus with distal end of "dorsal hump" somewhat farther from apex (fragments of tissue on dorsal edge suggest "hump" originally in exact agreement). Protarsi only slightly produced, with specialized setae; protarsal claws about equal in length but anterior claw more sharply bent near base and somewhat broader and thicker than posterior claw. Mesotarsi slightly produced, with specialized setae; mesotarsal claws equal, longer and more gently curved than protarsal claws.

Males. L = 3.16 ± 0.02 mm, W = 1.65 ± 0.01 mm, L/W = 1.92 ± 0.01, Rel. IO = 0.53 ± 0.002 (n=50; no significant geographical variation observed in these characters, see Table 2); as in holotype except as follows: medial discal blotch usually merged with sutural blotch to give triangular sutural blotch with apex pointed posteriorly; one to three lateral blotches on each elytron (no geographic pattern to variation in maculation); in a minority of specimens, apex of aedeagus slightly more tapered to form a narrower tip (no geographic pattern except tapered condition more prevalent in CA specimens). Mandibles and metathoracic wing as in females (see below).

Females. L = 3.13 ± 0.02 mm, W = 1.65 ± 0.01 mm, L/W = 1.89 ± 0.01, Rel. IO = 0.54 ± 0.003 (n=49; no significant geographical variation observed in these characters, see Table 2); similar to males except as follows: protarsal claws slender, evenly curved, equal; pro- and mesotarsi not produced and without specialized setae. External genital sclerites, mandibles and metathoracic wing as shown in Figs. 1–3. Internal structures of female reproductive system weakly sclerotized, spermathecal duct short, such that spermatheca ventral to

Table 2.
Length, width and relative interocular distance for *H. dorsomaculatus* as a function of geographic location.

Locality	L(mm) males	W(mm) males	L/W males	Rel. IO males	L(mm) females	W(mm) females	L/W females	Rel. IO females
CA, Lassen Co.	3.21 ± 0.05	1.62 ± 0.03	1.98 ± 0.01	0.53 ± 0.004	3.17 ± 0.05	1.66 ± 0.03	1.91 ± 0.01	0.56 ± 0.007
OR, Multnomah Co.	3.25 ± 0.06	1.74 ± 0.02	1.87 ± 0.04	0.51 ± 0.007	3.27 ± 0.03	1.75 ± 0.02	1.87 ± 0.03	0.53 ± 0.007
WA, Pierce Co.	3.09 ± 0.02	1.61 ± 0.02	1.92 ± 0.02	0.53 ± 0.002	2.98 ± 0.06	1.55 ± 0.03	1.92 ± 0.01	0.53 ± 0.006
WA, King Co.	3.06 ± 0.05	1.56 ± 0.03	1.96 ± 0.01	0.53 ± 0.009	3.07 ± 0.03	1.62 ± 0.01	1.90 ± 0.02	0.53 ± 0.005
BC, Surrey	3.11 ± 0.03	1.62 ± 0.02	1.92 ± 0.02	0.51 ± 0.006	3.10 ± 0.02	1.64 ± 0.01	1.89 ± 0.01	0.54 ± 0.006
BC, Wynndel	3.27 ± 0.05	1.68 ± 0.01	1.95 ± 0.02	0.54 ± 0.004	3.17 ± 0.05	1.67 ± 0.03	1.90 ± 0.01	0.55 ± 0.010
ID, Clearwater Co.	3.12 ± 0.05	1.75 ± 0.03	1.79 ± 0.02	0.53 ± 0.008	3.10 ± 0.03	1.71 ± 0.01	1.81 ± 0.02	0.55 ± 0.006
MT, Gallatin Co.	3.16 ± 0.03	1.63 ± 0.01	1.94 ± 0.01	0.54 ± 0.005	3.13 ± 0.04	1.63 ± 0.02	1.92 ± 0.01	0.56 ± 0.005
UT, Cache Co.	3.15 ± 0.04	1.67 ± 0.02	1.89 ± 0.02	0.52 ± 0.008	3.19 ± 0.02	1.68 ± 0.01	1.90 ± 0.005	0.53 ± 0.006
All specimens	3.16 ± 0.02	1.65 ± 0.01	1.92 ± 0.01	0.53 ± 0.002	3.13 ± 0.02	1.65 ± 0.01	1.89 ± 0.01	0.54 ± 0.003

apex of vagina; bursa copulatrix connected ventrally to vagina between spermatheca and apex of vagina.

Diagnosis. Among the Nearctic members of *Haliplus s. str.*, the adults of *H. dorsomaculatus* are most similar to those of *H. longulus*; these two species share a similar elongate shape and size. They may most easily be separated by the characters of the prosternal process. In *H. dorsomaculatus*, the prosternal process is essentially flat in cross-section between the margins with dense micropuncturing between the abundant larger punctures. In *H. longulus*, the cross-section is convex with sparse coarse punctures and no micropunctures.

Other external characters that help to separate the adults of these species are the pronotal plicae and the elytral maculation. In *H. dorsomaculatus*, each plica is asym-

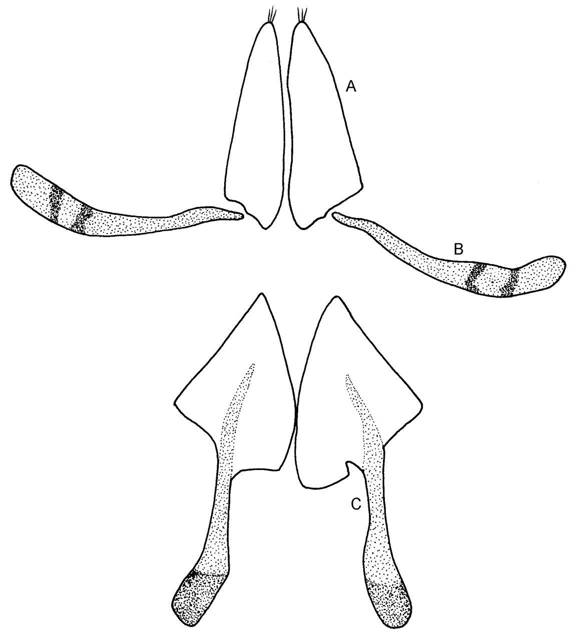

Figure 1. Female genital sclerites of *Haliplus dorsomaculatus*, posterior up; (A) gonocoxae, (B) tergal halves IX, (C) gonocoxosternites. USA, ID, Benewah Co., E Fork of Charles Creek, 27 July 1987, R.S. Zack, WSU.

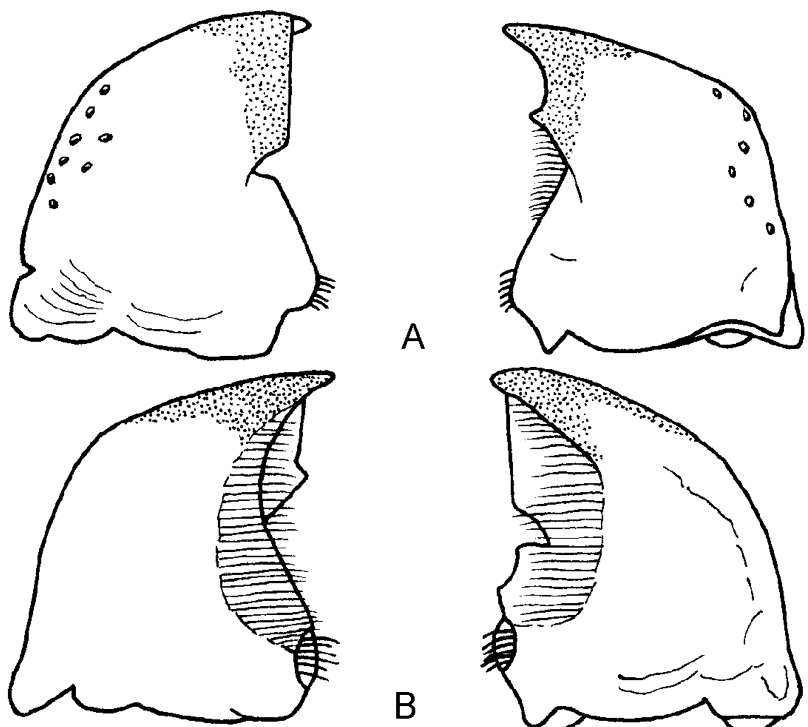

Figure 2. Mandibles of *Haliplus dorsomaculatus*, female, anterior up; (A) dorsal view, (B) ventral view. Canada, BC, Wynndel, Head of Lizard Creek, 07 April 1946, G. Stace-Smith, SEM #3142.

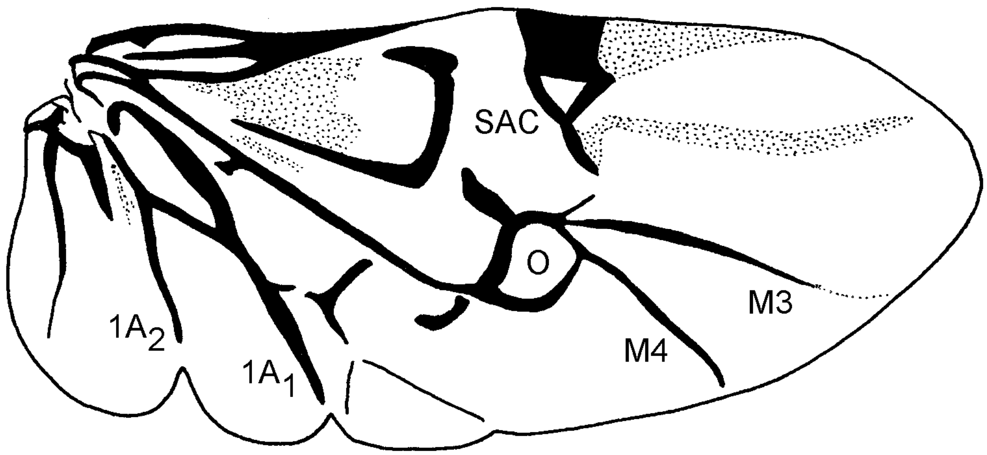

Figure 3. Right metathoracic wing of *Haliplus dorsomaculatus*, ventral view, female, O: oblongum cell; SAC: anterior sector cell, M: medial veins, A: anal veins, nomenclature according to Ward (1979). Canada, BC, Surrey, 110 Ave. right-of-way N of 168 St., 03 September 2004, R.D. Kenner, RDKC.

metrically impressed, usually with an infuscate lateral margin. In *H. longulus*, each pronotal plica is symmetrically impressed and is not infuscate. In *H. dorsomaculatus*, the sutural blotch is roughly triangular with the apex pointed posteriorly and there are one to three lateral blotches on each elytron. In *H. longulus*, the sutural blotch is not roughly triangular and may be almost obsolete; there are zero to one lateral blotches on each elytron.

Males of *H. dorsomaculatus* and *H. longulus* can also be separated by differences in their aedeagi. In *H. dorsomaculatus*, the aedeagus is shaped like "an inverted boot" (Zimmermann 1924), see Brigham (1977, Fig. 3). In *H. longulus*, the main axis of the aedeagus is gently curved and the apical quarter is narrowed, see Wallis (1933, Fig. 9d), Hilsenhoff & Brigham (1978, Fig. 5T), Gundersen & Otremba (1988, Fig. 66), Durfee, Jasper & Kondratieff (2005, Fig. 3).

Distribution. *Haliplus dorsomaculatus* ranges along the coastal mountains from northern CA to southern BC, east to western Montana and south along the Rocky Mountains to northeastern UT (Fig. 4). No records are known from south or east of the Great Divide Basin in WY. This may be an artifact as relatively little material from either WY or CO was available for this study. Durfee, Jasper & Kondratieff (2005) list *H. dorsomaculatus* as "unconfirmed" in CO. All examined specimens from CO and CA previously determined as *H. dorsomaculatus* were misidentified. A long series of *H. dorsomaculatus* from Lassen Co., CA was found in the unidentified material from the CAS. This series is the only valid record for CA known to the author.

Habitat. Many of the collection locations for *H. dorsomaculatus* imply lotic habitats although some specimens appear to have been collected in lentic habitats. Descriptions of habitats at some collection sites have been provided by R. S. Zack (pers. comm.), and R. W. Baumann (pers. comm.). Zack reported taking haliplids by digging or kicking into emergent vegetation along the margins of generally slowly flowing water. Baumann reported that all of his sites were associated with spring-fed creeks.

In 2004, *H. dorsomaculatus* was collected from three locations in the Lower Fraser Valley, BC: an apparently permanently flooded drainage ditch beside a highway, a very shallow, apparently spring-fed pool beside an industrial parking lot and a small creek draining an apparently spring-fed swamp at the base of bluffs on the edge of the Fraser River flood plain. Only two and three specimens, respectively, were

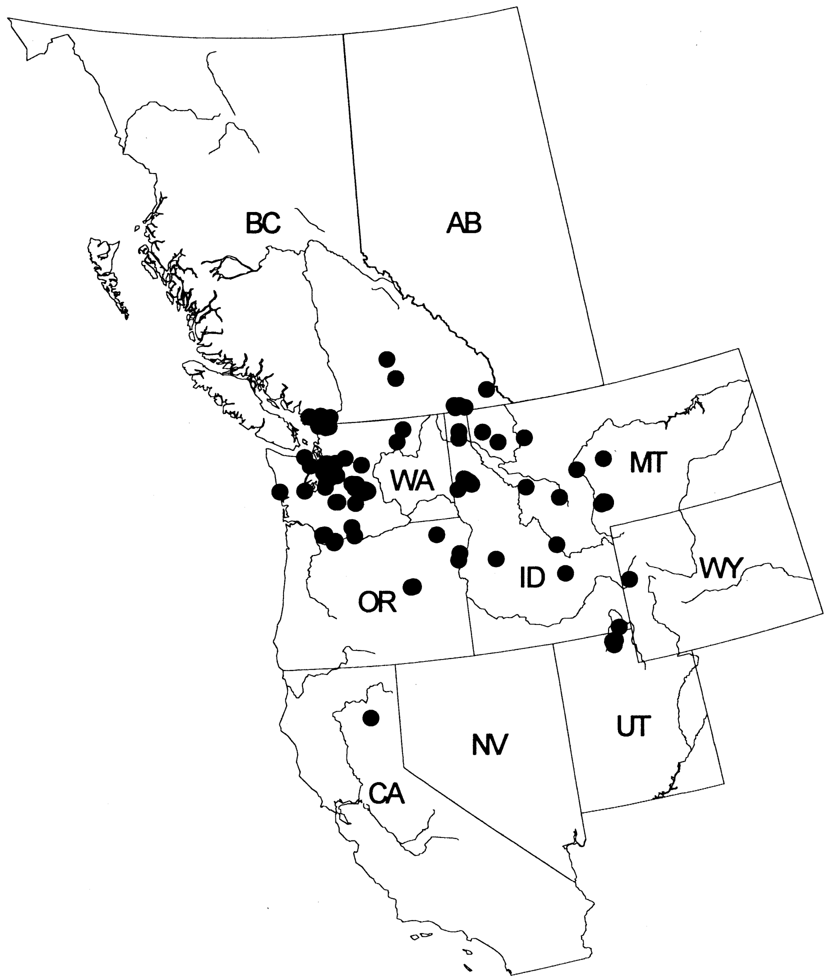

Figure 4. Distribution of *Haliplus dorsomaculatus* based on specimens examined by the author. Collection data given in Appendix 1.

collected from the first two sites. The creek site yielded a good series, including probable teneral specimens, all from dense emergent vegetation near the creek margin; no *H. dorsomaculatus* were found in other microhabitats in the creek.

DISCUSSION

The confusion surrounding the identification of *H. dorsomaculatus* stems chiefly from errors in Wallis (1933). It is likely that Wallis had no *H. dorsomaculatus* specimens in the material he examined. The apparent CA specimen is possibly *H. robertsi* Zimmermann although the species limits and status of that taxon are not clear. The CO specimen has not been found.

Two couplets in Wallis's key can give problems in determining *H. dorsomaculatus*: those concerning: (i) channeling of the prosternal process and (ii) the characters of the mid-metasternum and male protarsal claws. The first couplet requires a subjective choice between "evidently" and "very feebly or not" channeled. The prosternal process of *H. dorsomaculatus* can easily be described as "very feebly channeled". That choice leads to *H. longulus* and many previous determinations have reached that conclusion. The second couplet requires a mid-metasternum with lateral longitudinal impressions and male protarsal claws equal.

The mid-metasternum of *H. dorsomaculatus* has coarse punctures laterally and, in some specimens, these overlap to produce what could be described as a longitudinal impression. However, the male protarsal claws are never equal. The other half of this couplet leads to *H. distinctus* Wallis. See Brigham (1977) for a discussion of the differences between *H. dorsomaculatus* (as *H. allisonae*) and *H. distinctus*.

Comparison of the holotypes of *H. dorsomaculatus* and *H. allisonae* makes it clear that these are the same species. The only significant difference between the two specimens is in the base colour: yellow for *H. dorsomaculatus* and reddish brown for *H. allisonae*. The colour of the *H. allisonae* type series is likely an artifact of specimen preparation or storage because other specimens collected by Stace-Smith at the *H. allisonae* type locality over a two-week period (which includes the collection of the type series) are the "normal" yellow colour and similar darker specimens occasionally occur in preserved specimens of other species.

Female reproductive characters. Galewski (1972a) showed that, although interspecific differences among the characters of the external female genitalia can be subtle, there are larger differences at higher taxonomic levels. Drawings of these sclerites showing greater detail have subsequently been published for the European species (Franciscolo 1979; Holmen 1987). The external genitalia of *H. dorsomaculatus* (Fig. 1) are, most similar to those of *H. wehnckei* Gerhardt (=*H. sibiricus* Motschulsky, see Lundmark, Drotz & Nilsson (2001)) illustrated in Holmen (1987, Fig. 251). Characters of the gonocoxae should be used with caution, since these structures tend to collapse or distort upon drying and are difficult to characterize in drawings. Further study of the external female genital sclerites will need to be done before their diagnostic utility for the North American species can be determined.

Characters of the internal female reproductive system, especially the spermatheca, have proven useful both in the determination of phylogenetic relationships and in species determinations (Burmeister 1976, Ordish 1985, Mazzoldi 1996, Miller 2001a, 2001b). It is anticipated that these characters may be similarly useful in haliplids (Holmen 1987). Burmeister (1976) investigated the internal parts of the female reproductive system in *Haliplus (Neohaliplus) lineatocollis* (Marsham) although he did not investigate the spermatheca in detail. His findings differ from what was observed here for *H. dorsomaculatus*; they are, however quite similar to what was found for *Haliplus (Liaphlus) gracilis* Roberts (RDK, unpublished data). In *H. lineatocollis*, the spermathecal duct is relatively long and the bursa copulatrix is connected to the anterior end of the vagina (Burmeister 1976, Fig. 44b) whereas in *H. dorsomaculatus*, the spermathecal duct is short and the bursa copulatrix is connected ventrally to the vagina. With no other species for comparison, it is hard to draw conclusions at this point but these results do suggest that these characters deserve further investigation.

Mandibular and metathoracic wing characters. Galewski (1972b) suggested the use of mandibular characters for the identification of haliplid females. However, in this work no difference in mandibular characters was found between conspecific males and females suggesting that these characters may also be useful for the identification of males. Although the differences in these characters between species can be subtle, they are potentially useful at the species and higher taxonomic levels (Galewski 1972b, RDK, unpublished data). Within the *Haliplus s. str.* species shown by Galewski, the relative size of the apical tooth of the right mandible appears to be a useful character. Comparing the mandibles of *H. dorsomaculatus* (Fig. 2) with those shown in Galewski (1972b, Figs. 1–5, 7–10), *H. dorsomaculatus* is, as above, most similar to *H. wehnckei*. Until information is available for more Nearctic species, it is hard to determine how useful mandibular characters will be for species identification in North America.

Characters of the metathoracic wings

are little used in the identification of beetles, in part, because venation shows little variation between species in many groups of beetles. Ward (1979) discussed three wing venation characters that appeared to be useful in adephagan beetles: (i) the shape of the oblongum cell, (ii) the position of the distal segment of M_4 relative to M_3 and Cu_1 and (iii) the position of the SA vein which separates the SA cell from the 3R cell.

There appear to be few published examples of haliplid metathoracic wing venation comparable to that shown in Fig. 3. Balfour-Browne (1943) examined 13 species of Haliplidae but illustrated only the area around the oblongum cell for *Peltodytes caesus* (Duftschmidt) (Balfour-Browne 1943, Fig. 18). He discussed general trends in the venational characters of adephagan beetles, including haliplids, but it is difficult to make detailed comparisons in the absence of drawings. Illustrations of the wings of three haliplid species have been published: *Haliplus (Haliplus) ruficollis* De Geer (Franciscolo 1979), *Peltodytes muticus* (LeConte) (Wallace & Fox 1980) and *Haliplus (Liaphlus) fulvus* (Fabricius) (Holmen 1987). In addition, a Master's thesis (Mousseau 2004) includes drawings for the three Nearctic *Brychius* species.

Even within a single genus, the overall shape of the metathoracic wing can vary (Mousseau 2004). In the *Haliplus* figures referenced above, the posterior margin of the wing is smooth and continuous, or nearly so. In *H. dorsomaculatus* the posterior margin is relatively deeply emarginate at the position of the anal fold (approximately aligned with the distal end of the $1A_2$ vein) and, to a lesser extent, at the end of the $1A_1$ vein (Fig. 3).

The wing venation is identifiably different in the figures for each of the seven species listed above. The three *Haliplus* species differ in the shape of the oblongum cell and the relative position of the distal portions of M_3 and M_4. The position of the SA vein appears to be similar in all three species. These results suggest that in Haliplidae, wing venation may provide diagnostic characters at the species level, although more work is needed to determine the limits of intraspecific variation.

Distribution and habitat. *Haliplus dorsomaculatus* appears to be a strictly western Nearctic species (Fig. 4). A record from NF (Larson 1987, Roughley 1991) is almost certainly an error. No voucher specimen has been found to support that record and the original source is unknown. *Haliplus dorsomaculatus* should be removed from the NF list until a verifiable voucher specimen has been found.

In western North America, the distribution for *H. dorsomaculatus* corresponds to the mountainous areas. This correlation is particularly apparent in WA where, in eight decades of collecting, there are there are records from the Olympic Mountains and almost every county overlapping the Cascade Mountains but none from eastern WA . *Haliplus dorsomaculatus* may eventually be found in extreme southeastern WA as there are records from the neighbouring Blue Mountains in northeastern OR. The correlation with mountainous terrain fits well with a preferred habitat associated with relatively permanent flowing water, as springs or creeks need sources of water at higher elevations.

Further collecting is needed to clarify the distribution in several areas. Given the known distribution in southern BC and western MT, it seems likely that *H. dorsomaculatus* will be collected in southwestern AB. More collecting is needed in OR to determine if the apparent gap in the distribution between northern CA and northern OR is real. The southern limits, both in CA and the Rocky Mountains, need further investigation. In UT, *H. dorsomaculatus* appears limited to the northeastern corner; its status in the Uinta Mountains is uncertain. With the habitat information given here, it should be possible to conduct directed searches to clarify the status of this species in all of these areas.

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APPENDIX 1

Material examined. The number preceding the repository is the number of specimens; the following abbreviations are used for names of some of the collectors: DLG (D. L. Gustafson), GSS (G. Stace-Smith), HBL (Hugh B. Leech), MHH (Melvin H. Hatch), nc (no collector), RDK (Rex D. Kenner), and RSZ (Richard S. Zack).

CANADA.

BC: Abbotsford, roadside ditch, 14-ix-45, HBL, 3 CAS, 1 CNC; Chilliwack, 23, 27, 28-v-63, D.J. Farish, 5 UBCZ; Coquitlam, ditch behind warehouses at W end of Rocket Way, 27-ix-2004, RDK, 2 RDKC; Creston, Goat Mt. Lake, 5000 ft, 2-vii-33, GSS, 1 UBCZ; Creston, Goat River, 25-viii-46, GSS, 1 UBCZ; Creston, King Creek, 27-vii-48, GSS, 1 UBCZ; same loc., 8-ix-48, GSS, 2 UBCZ; same loc., 7, 15-vii-49, GSS, 3 UBCZ; same loc., 18-ix-55, GSS, 2 UBCZ; same loc., 19-ix-55, GSS, 1 INHS, 1 UBCZ; same loc., 21-ix-55, GSS, 1 UBCZ; same loc., 2-x-55, GSS, 1 UBCZ; Creston, 24-ix-55, GSS, 1 CAS, 1 CNC; Fernie, 31-viii-35, HBL, 3 CAS; Kitchener, roadside pond, 1-x-55, GSS, 1 UBCZ; Mission City, 18, 20-vi-53, G.J. Spencer, 2 CNC; Salmon Arm, 2-ix-29, HBL, 1 CAS; Surrey, shallow pond at 116 Avenue x 136 Street, 2-vi-2004, RDK, 3 RDKC; Surrey, extension of 110 Avenue N of 168 Street, 2-vi-2004, RDK, 2 RDKC; same loc., 3-ix-2004, RDK, 24 RDKC; Wynndel, head of Lizard Creek, 7-x-45, GSS, 3 UBCZ; same loc., 7-iv-46, GSS, 1 OSAC, 8 UBCZ; same loc., 23-vi-46, GSS, 1 UBCZ; same loc., 4-v-47, 1 UBCZ; same loc., 11-v-47, GSS, 14 CAS, 1 CNC, 8 UBCZ; same loc., 28-viii-47, GSS, 1 CNC, 2 UBCZ.

USA.

CA: LASSEN Co.: Norval Flats, 5500 ft, 15-ix-20, J.O. Martin, 90 CAS.

ID: BEAR LAKE Co.: Little Spring, below Davis Canyon campground, 18-viii-2004, S.M. Clark & R.W. Baumann, 5 BYU. BENEWAH Co.: Charlies Creek, 4-5 mi SE of Emida, 2-ix-86, RSZ, 1 WSU; E Fork of Charlies Creek, ca. 6 mi SE of Emida, 29-vii-87, RSZ, 51 WSU. BONNER Co.: Pack River, 8 mi N of Sandpoint, 22-ix-69, J. Schuh, 2 AMNH; Sagle, 4-vii-49, N.M. Downie, 1 OSAC. BUTTE Co.: Little Lost River, 10.6 mi N of Howe, 25-ix-91, RSZ, 1 WSU. CLEARWATER Co.: Badger Meadows ca. 7 mi E of Bovill, 28-viii-87, RSZ & V.L. Zack, 45 WSU. LATAH Co.: Big Meadow Creek Recreation Area, 5 mi. NW of Troy, 9-iv-87, RSZ, 1 WSU; E Fork Emerald Creek, ca 20 mi E of Harvard on Rt 447, 6-ix-90, RSZ, 1 WSU; N Fork of Palause River ca 11 mi NE of Harvard, 19-v-87, 2 WSU; pond by Rte 3, 7 mi SSW of Clarkia, 28-ix-90. LEMHI Co.: Canyon Creek, Railroad Canyon, 2.5 mi on Rte 29 below top of Bannock Pass, 7075 ft, 24-viii-69, HBL, 5 CAS. VAL-

LEY Co.: Trail Creek, FS Rte 22, 22.4 mi NNE of Cascade, 22-ix-91, RSZ, 3 WSU.

MT: DEER LODGE Co.: Jct Hwy 10A & Hwy 10, 7-viii-63, R.D. Anderson, 1 BYU. FLATHEAD Co.: Thompson R., Rte 56 ca 6.6 mi S of Rte 2, 25-ix-90, 1 WSU. GALLATIN Co.: no locality, 21-iv-24, nc, 3 MTEC; pond 2 mi from Bozeman, 17-v-55, nc, 2 MTEC; side ponds of Bridger Creek, 4800 ft, 28-vii-87, DLG, 3 MTEC; pond by Bridger Creek, 19-ix-87, DLG, 5 MTEC; Bridger Creek, 4800 ft, 26-iii-87, DLG, 3 MTEC; same loc., 18-v-87, DLG, 1 MTEC; same loc., 20-vi-87, DLG, 2 MTEC; Bridger Cr. 2 mi NE of Bozeman, 4800 ft, 18-v-86, DLG, 1 MTEC; Bridger Warm Springs, 3 mi NE of Bozeman on Hwy 86, 23-vii-89, C.B. Barr, 1 CBBC; E Gallatin River, 4600 ft, 22-vi-87, DLG, 1 MTEC; Gallatin River, 8 mi W of Bozeman, 23-viii-86, DLG, 3 MTEC; same loc., 1-ix-86, DLG, 3 MTEC; same loc., 13-x-86, DLG, 1 MTEC; Gallatin River, Bozeman, v–ix-88, DLG, pitfall trap, 2 MTEC; Gallatin River, weedy side pond, 4700 ft, 6-ix-87, DLG, 2 MTEC; same loc., 20-x-87, DLG, 1 MTEC; same loc. 10-xi-87, DLG, 4 MTEC; Gallatin R., 4700 ft, 12-iii-87, DLG, 7 MTEC; same loc., 25-v-87, DLG, 2 MTEC; same loc., 15-vii-87, DLG, 2 MTEC; same loc., viii-87, DLG, pitfall trap, 1 MTEC; same loc., 10-xi-87, DLG, 3 MTEC; same loc., 30-ix-88–12-iv-1989, DLG, pitfall trap, 3 MTEC; same loc., 12-iv–18-vii-89, DLG, pitfall trap, 2 MTEC. LAKE Co.: wet area just E of Swan River, ca 3 mi S of Swan L. at N.F. Road 129, 4-viii-89, C.B. Barr, 2 CBBC. LEWIS & CLARK Co.: Beaver Creek, 3-x-86, DLG, 1 MTEC; Beaver Creek near mouth, 3-x-86, DLG, 1 MTEC. LINCOLN Co.: Libby Fish Hatchery, 19-ix-86, DLG, 4 MTEC; same loc., 20-iii-87, DLG, 2 MTEC; same loc., 7-iv-88, DLG, 4 MTEC. MEAGHER Co.: *Sphagnum* bog & beaver pond with ice, 26.8 mi N of White Sulphur, 27-x-73, R.E. Roughley & M.L. Roughley, 1 JBWM. RAVALLI Co.: Lee Metcalf N.W.R., Pond 2, 9-viii-94, DLG, USFWS bottle trap, 1 MTEC; same loc., Pond 3, 9-viii-94, DLG, USFWS bottle trap, 3 MTEC; same loc., 8-ix-94, DLG, USFWS bottle trap, 2 MTEC; same loc., 30-ix-94, DLG, USFWS bottle trap, 2 MTEC.

OR: BAKER Co.: Beecher Creek, 7 mi N of Halfway, 4250 ft, 14-x-69, D. Gray, K. Gray, R. Rosenstiel, J. Schuh & D. Johnson, 1 AMNH; Richland "Env.", 2000 ft, 1-viii-45, H.P. Chandler, 4 EMEC. GRANT Co.: pond 9 mi W of Seneca, 15-x-71, J. Schuh, 1 AMNH; Rte 395 ca 9 mi N of Mt. Vernon, beaver pond, 17-vii-90, RSZ, 4 WSU; spring at SE Corner, 14-x-67, J. Schuh, 1 AMNH. MULTNOMAH Co.: marsh near Ainsworth State Park, 10-x-88, RSZ & R.D. Akre, 13 WSU. UNION Co.: Elgin, 29-viii-32, MHH, 1 OSAC.

UT: CACHE Co., A.J. Park, Blacksmith Fork Canyon, 14-vi-2003, M.J. Peterson, 3 BYU; Logan, 27-iv-63, E. Drake, 1 BYU; Spring Hollow, Logan Canyon, 16-iv-82, E. Coombs, 3 BYU; Spring Hollow pond, Logan Canyon, 5-v-89, nc, 6 BYU.

WA: CHELAN Co.: Rte 207 ca 3 mi N of Coles Corner, 13-ix-90, RSZ, 1 WSU. CLALLAM Co.: Matriotti Creek, Rte 101, 2.5 mi W of Sequim, 24-vi-92, RSZ, 2 WSU. CLARK Co.: E Fork of Lewis River ca 6 mi E of Heisson, 13-viii-89, J. Back, 1 WSU; Heisson ca 5 mi NE of Battle Ground, pools, 18-xi-88, J. Back, 5 WSU. GRAYS HARBOR Co.: Copalis Lagoon, 20-vii-33, T. Kincaid, 1 OSAC. JEFFERSON Co.: Quilcene, 26-vii-36, nc, 6 OSAC. KING Co.: Canyon Park, Bothell, 17-v-28, T. Kincaid, 2 OASC; pool ca 1.5 mi E of Redmond, 24-viii-89, RSZ, 1 WSU; Cedar Mt., 18-v-37, nc, 1 OSAC; same loc., 12-v-39, MHH, 4 OSAC; same loc., 6-vii-39, I.M., 2 OSAC; same loc., 9-v-40, MHH, 3 OSAC; same loc. & date, R.H. Foster, 2 OSAC; same loc., 10-vi-40, R.H. Foster, 2 OSAC; same loc., 22-v-41, MHH, 2 OSAC; same loc. & date, Thomas, 3 OSAC; same loc. & date, D.R. Orcutt, 3 OSAC; same loc., 26-iii-44, nc, 2 OSAC; same loc., 29-v-45, MHH, 2 OSAC; same loc., 16-v-46, MHH, 3 OSAC; same loc., 15-v-47, MHH, 3 OSAC, nc, 2 OSAC; Evans Creek, 30-viii-29, MHH, 1 OSAC; Malony's Grove, 20-iv-32, nc, 2 OSAC; North Bend, Malony's Grove, 20-ix-29, MHH, 14 OSAC; same loc., 10-v-30, MHH, 3 OSAC; same loc., 16-v-30, P. Ludy, 1 OSAC; same loc., 16-v-31, MHH, 3 OSAC; Redmond, 4-vi-67, D. Frechin, 1 WSU; Renton, 22-v-41, Campell, 1 OSAC; Renton, Cedar River, 22-v-41, Campell, 1 OSAC; same loc., 29-x-45, H.J. Jensen, 5 EMEC; pond in Forsgren Park, Seattle, 23-iv-92, K.A. Rosema, 4 WSU; Seattle, viii-28, nc, 1 OSAC; Snoqualmie Falls, 10-v-30, nc, 1 OSAC; Snoqualmie R., Malony's Grove, 13-v-28, MHH, 48

OSAC; Stillwater, 11-ii-34, nc, 1 OSAC. KITTITAS Co.: Rte US 10, 2.9 mi NW of Ellensburg, 8-x-77, R. Thorne, 1 WSU; Easton, 28-iv-39, MHH, 1 OSAC; Ellensburg, 19-vii-32, MHH, 2 OSAC; Jungle Cr., FS Rte 19 ca 11 mi N of Cliffdell, 31-viii-90, RSZ, 1 WSU; Manastash Canyon, ca 10 mi WSW of Ellensburg, beaver pond, 3-xi-88, RSZ, 1 WSU; Roslyn Ponds, 7-v-2000, E. Sugden, 1 BYU. KLICKITAT Co.: pool by Klickitat River ca 5.5 mi N of Lyle, 17-viii-89, RSZ, 1 WSU; Outlet Creek ca 1.5 mi S of Glenwood, 17-viii-89, RSZ, 2 WSU. MASON Co.: irrigation ditch 3.5 mi SW of Kamilche on Rte 108, 19-i-94, RSZ, 1 WSU. OKANOGAN Co.: Granite Creek ca 6 mi W of Republic on Rte 20, 11-ix-90, RSZ, 1 WSU; small pool 12 mi N of Nespelem on RTE 155, 30-ix-87, R.D. Akre, 23 WSU. PIERCE Co.: Mt. Rainier National Park, Longmire, Fish Creek Valley, spring-fed pond, 3000 ft, 15-vi-69, I. Smith, 36 ROME; Mt. Rainier National Park, Longmire, Fish Creek Valley, shallow pond in flood plain, 3000 ft, 15-vi-69, I. Smith, 10 ROME; Mt. Rainier National Park, Tahoma Creek, 2300 ft, 12-viii-73, A. Smetana, Z. Smetana & D. Smetana, 2 CNC; WSU Res & Ext. Center, Puyallup, pond, 24-ix-92, RSZ, 2 WSU. SKAMANIA Co.: Moffett Creek ca 2 mi W of North Bonneville, 12-x-88, RSZ & R.D. Akre, 16 WSU. SNOHOMISH Co.: Canyon Park, 15-x-28, nc, 2 OSAC; same loc., 6-v-30, nc, 2 OSAC; same loc., 8-vii-32, nc, 1 OSAC; Martha Lake, 5-v-31, nc, 1 OSAC; Monte Cristo, in stomach of rainbow trout, 987 m, 9-vii-38, Kiser, 1 OSAC; Sultan, 1-vi-53, B. Malkin, 1 OSAC; Thomas Lake, 5-vii-32, nc, 1 OSAC; same loc., 31-v-34, nc, 1 OSAC; same loc., 10-vii-34, nc, 3 OSAC. WHATCOM Co.: Kendall Creek, 14-viii-32, nc, 1 OSAC; Lynden, 6-vii-64, nc, 3 OSAC; same loc., 7-viii-64, nc, 3 OSAC; same loc., 2-vii-65, L. Russell, 4 OSAC; N Fork Nooksack River, 17-vii-32, nc, 1 OSAC; Silver Lake, 14-viii-32, nc, 1 OSAC. YAKIMA Co.: Milk Creek, FS Rte 12, 1-viii-90, RSZ, 2 WSU.

WY: TETON Co.: Snake River, 15.8 mi S of Jackson on Rte 26/89, 24-ix-91, RSZ, 1 WSU.