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Leech Collections from Washington State, with the Description of Two New Species of *Placobdella* (Annelida: Glossiphoniidae)

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ABSTRACT

An assessment of the hirudinifauna of Washington State is presented. In total, 11 distinct leech species were found representing two new records for the state and two new species of the genus *Placobdella*, both described herein. *Placobdella kwetlumye,* n. sp., and *Placobdella sophieae,* n. sp., both collected in Squires Lake, Whatcom County, are morphologically similar to *P. burresonae* and *P. pediculata* respectively, but exhibit morphological features that readily separate them from congeners. In addition to the descriptions of the new species, here we provide a brief summary of the morphological traits possessed by each species found.

INTRODUCTION

Washington State displays a wide variety of climates, environments, and ecological niches (e.g., Kruckeberg, 1991; Peterson et al., 1997). The Cascade Mountain Range divides the state from north to south and the climate varies greatly from one side of the range to the other: West of the Cascades is a marine west coast climate with substantial parts covered by conifer forests and temperate rainforests. East of the range is warmer and more arid with steppe as well as

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true desert. The Cascades themselves are a series of dormant and active volcanoes, which, coupled with Pleistocene glaciations, have given rise to an almost unique geomorphological complexity of the landscape (e.g., Armstrong et al., 1965; Crandell, 1971). This complexity, in turn, provides the fauna with several microhabitats such as isolated ponds, small rock formations, and patches of bushy growth (e.g., McCune et al., 2000; Peterson et al., 1997).

Accounts of the leech fauna of the Pacific Northwest are scarce, especially when compared to the numerous accounts of the fauna east of the Rocky Mountains (e.g., Moser et al., 2008; Phillips and Siddall, 2005; Sawyer, 1967; Sawyer et al., 1975). Klemm (1982) produced what is probably the most comprehensive list of morphological attributes and species distributions of North American leeches, which he based on published literature and collection records of the time. Therein, *Actinobdella inequiannulata* Moore, 1901, *Glossiphonia elegans* (Verrill, 1872), *Helobdella elongata* (Castle, 1900), *Helobdella modesta* (Verrill, 1872), *Placobdella montifera* Moore, 1906, *Myzobdella lugubris* Leidy, 1851, *Erpobdella punctata* (Leidy, 1870), *Erpobdella obscura* (Verrill, 1872) and the marine leech *Piscicola salmositica* Meyer, 1946, are all reported as present in Washington State (Klemm, 1982). Pursuant to our recent collection efforts across Washington, we here present an assessment of the distribution of 11 species of leeches and, furthermore, describe two new species of the genus *Placobdella*, both collected in the state.

MATERIALS AND METHODS

Leeches were collected from 13 localities in 10 counties in Washington state (fig. 1; table 1) in September 2008 and October–November 2009. Leeches were found on the undersides of rocks, wood, and debris in freshwater environments. Alternatively, blood-feeding leeches were

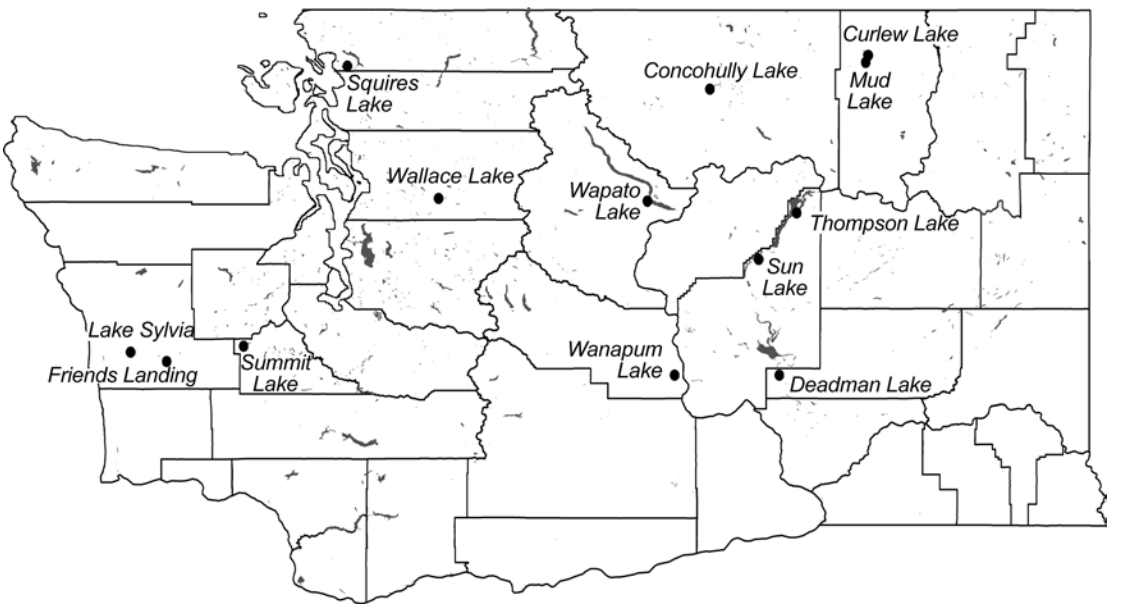


FIGURE 1. Map of Washington showing the 13 collection sites in solid circles. Grey areas indicate bodies of water.

TABLE 1. Species and collection locality information for for leech specimens encountered in this study

Site	Taxa	County	Georeference	Date	AMNH catalog no.
Conconully	*Helobdella modesta* (G) *n* = 19	Okanogan	48°33′52.72″N 119°43′45.12″W	26 Sept 2009	5513
Curlew Lake	*Erpobdella obscura* (E) *n* = 11 *Erpobdella punctata* (E) *n* = 3 *Glossiphonia elegans* (G) *n* = 17 *Helobdella modesta* (G) *n* = 1	Ferry	48°43′37.57″N 118°39′32.38″W	25 Sept 2009	5514 5515 5516 5517
Friends Landing	*Placobdella montifera* (G) *n* = 1	Grays Harbor	46°56′52.21″N 123°38′19.54″W	3 Sept 2008	5518
Mud Lake	*Helobdella modesta* (G) *n* = 24 *Glossiphonia elegans* (G) *n* = 3 *Theromyzon* cf. *rude* (G) *n* = 1	Ferry	48°40′16.35″N 118°45′59.54″W	25 Sept 2009	5519 5520 5521
Summit Lake	*Erpobdella annulata* (E) *n* = 8 *Placobdella montifera* (G) *n* = 1 *Helobdella modesta* (G) *n* = 21 *Helobdella elongata* (G) *n* = 1	Thurston	47°02′56.84″N 123°06′58.42″W	29 Sept 2009	5522 5523 5524 5525
Sun Lake	*Erpobdella punctata* (E) *n* = 8	Grant	47°36′20.20″N 119°21′17.35″W	26 Sept 2009	5526
Squires Lake	*Placobdella kwetlumye,* n. sp. (G) *n* = 2 *Placobdella sophieae,* n. sp. (G) *n* = 8 *Theromyzon* cf. *rude* (G) *n* = 5 *Helobdella modesta* (G) *n* = 63 *Helobdella elongata* (G) *n* = 1 *Erpobdella annulata* (E) *n* = 5	Whatcom	48°39′36.98″N 122°20′02.76″W	30 Sept 2009	5527, 5528 5529, 5530 5531 5532 5533 5534
Lake Sylvia	*Erpobdella annulata* (E) *n* = 2 *Helobdella modesta* (G) *n* = 48	Grays Harbor	46°59′38.68″N 123°38′36.92″W	29 Sept 2009	5535 5536
Thompson Lake	*Helobdella modesta* (G) *n* = 5 *Helobdella papillata* (G) *n* = 39	Grant	47°50′59.07″N 119°08′09.81″W	26 Sept 2009	5537 5538
Wallace Lake	*Helobdella modesta* (G) *n* = 23	Snohomish	47°54′06.87″N 121°40′30.55″W	28 Sept 2009	5539
Wanapum Lake	*Helobdella modesta* (G) *n* = 2 *Erpobdella punctata* (E) *n* = 5	Kittitas	46°53′58.48″N 119°59′10.08″W	27 Sept 2009	5540 5541
Wapato Lake	*Helobdella modesta* (G) *n* = 32 *Erpobdella punctata* (E) *n* = 1	Chelan	47°55′11.12″N 120°09′43.49″W	26 Sept 2009	5542 5543
Deadman Lake	*Helobdella modesta* (G) *n* = 18	Adams	46°53′02.69″N 119°14′35.54″W	27 Sept 2009	5544

collected by immersing legs into the water at the edges of the lakes, waiting for approximately 1 min, and then examining for leeches attached to skin. Specimens were relaxed with gradual addition of ethanol and fixed with 96% ethanol. The posterior sucker of representative specimens was fixed in 100% ethanol. Dissections of leeches were accomplished using stereoscopic microscopy. Photographs of whole specimens were taken using either a Nikon Coolpix P5000

or a P5100 digital camera attached to a microscope. Drawings were made by superposition of vector art on placed images in Adobe Illustrator (Adobe Systems, San Jose, California). All measurements mentioned herein are in millimeters. The type series and voucher specimens were deposited in the American Museum of Natural History (AMNH), New York.

SYSTEMATICS

Rhynchobdellida Blanchard, 1894
Glossiphoniidae Vaillant, 1890

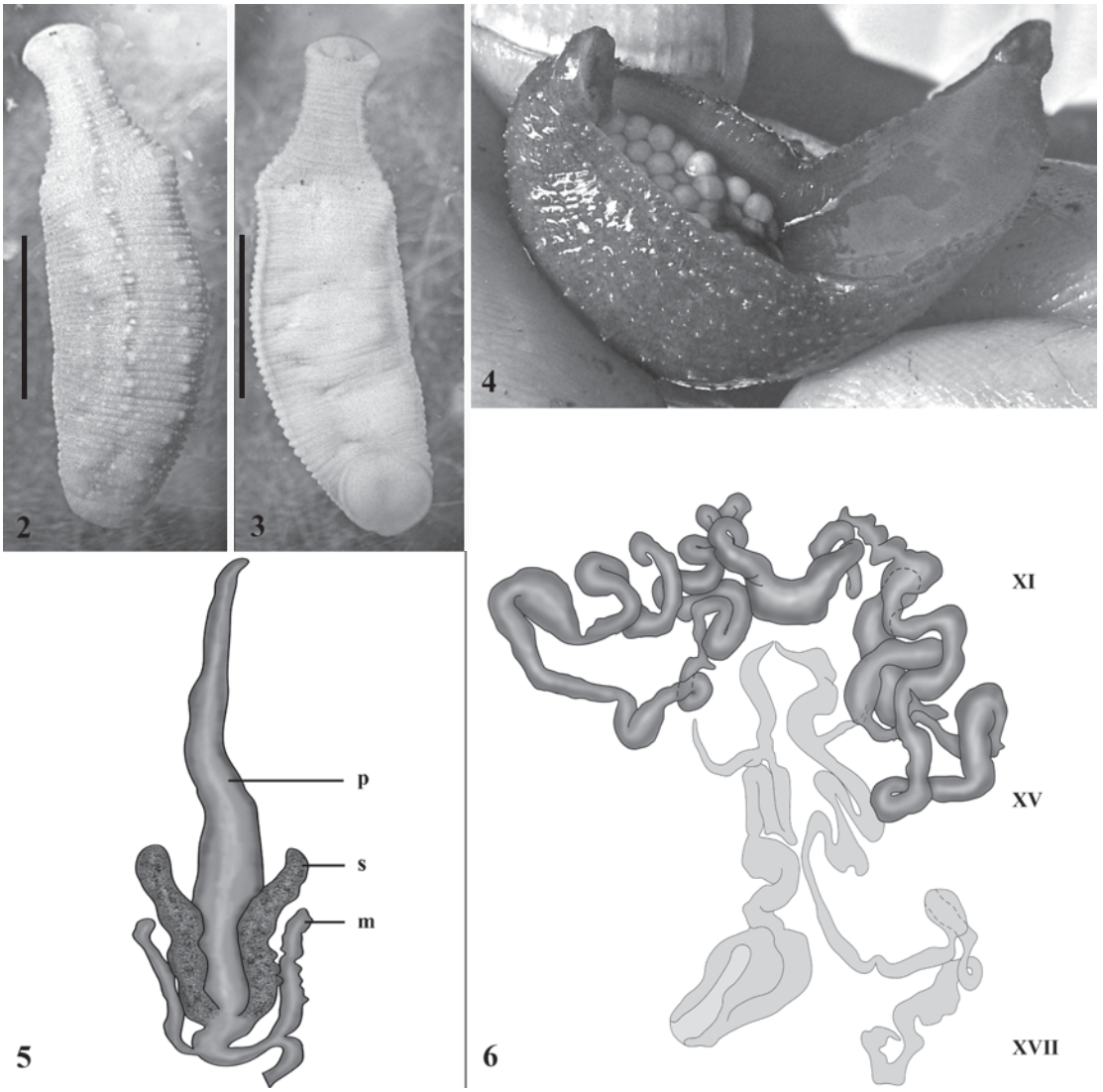
Placobdella kwetlumye, new species

Figures 2–6

Material Examined: Two specimens collected in Squires Lake, Washington on September 30, 2009, by Alejandro Oceguera-Figueroa and Sebastian Kvist. Collected from the legs of AOF and on the underside of submerged rocks and wood.

Description: External morphology based on two specimens. Body dorsoventrally flattened, lanceolate, brownish tegument. Average body length 17.75 (14.60–20.90), average body width 4.70 (4.60–4.80). Complete somite triannulate, partially subdivided in somites at middle of body. Somites I and II uniannulate; III–IV biannulate; V–XXIV triannulate; XXV–XXVI biannulate; XXVII uniannulate. Two pair eyespots on III in "placobdellid" arrangement (i.e., in which the anterior most eyespots are coalesced medially to each other and posteriorly to the second pair). Oral sucker small, mouth pore on anterior border. Posterior sucker circular with papillae on dorsal surface. Anus located on dorsal surface of XXVII. Solid longitudinal stripe in midline of dorsal surface from V to XXIV, partially interrupted by large papillae and replaced by unpigmented medial stripe in most anterior somites. Dorsum with seven rows of papillae. Large papillae forming five longitudinal rows, prominent papillae on a2. Medial and lateral rows more conspicuous than marginal rows. Minor paramedial rows formed of medium-sized papillae bilaterally in the area between medial and lateral rows. From XXV–XXVII minor paramedial rows only are prominent. Dorsal surface not occupied by large and medium papillae, covered with punctiform, evenly distributed papillae (fig. 2). Ventral surface smooth and brownish, without metameric stripes, papillae or spots (figs. 3–4). Male gonopore between XI and XII. Female gonopore at XII a2/a3; two annuli between gonopores.

Internal morphology based on one dissected specimen. Proboscis large, in membranous sheath extending posteriorly to XI when retracted, unlooped. One pair well-developed anteromedial compact salivary glands extending from IXa3 to XI, discharging into base of proboscis. Posterolateral salivary glands absent. Esophagus short, folded, with one pair elongated mycetomes extending anteriorly from XI/XII to X a2 (fig. 5). Crop with seven pairs foliaceous caeca, last pair forming well-developed postcaeca (diverticula) extending posteriorly to XXV. Intestine with four pairs simple caeca in XX–XXIII. Male reproductive system with well-developed atrial cornua and highly coiled ejaculatory ducts. Six pairs intersegmen-



FIGURES 2–6. *Placobdella kwetlumye,* n. sp. **2.** Paratype, dorsal view. **3.** Paratype, ventral view. **4.** Eggs attached to the venter, ventral view. **5.** Illustration of the proboscis (p), compact salivary glands (s), and mycetomes (m), in dorsal view. **6.** Illustration of the male and female reproductive systems, dorsal view; testisacs not shown. Scale bars = 5 mm.

tal testisacs from XIII/XIV to XVIII/XIX. Ovisacs without common oviduct, anteriorly bilobed, extending posteriorly to XVII, anterior ovisac bifurcation at XIII/XIV. Anterior lobe extending anteriorly to XIII (fig. 6).

Holotype: Dissected, fixed in ethanol. 20.9 length, 5.0 maximum width. Collected by Alejandro Oceguera-Figueroa on September 30, 2009 (AMNH 5527).

Type Locality: Squires Lake, Whatcom County, Washington, 48°39′36.98″N; 122°20′02.76″W.

Paratype: One undissected specimen fixed in ethanol, collected by Sebastian Kvist, Squires Lake, Whatcom County, Washington, 48°39′36.98″N; 122°20′02.76″W, on September 30, 2009 (AMNH 5528).

Additional Material: Thirteen specimens fixed in ethanol collected by Robin M. Overstreet. Some specimens found free living, some feeding from the cloaca of a gadwall (*Anas strepera*) in Summer Lake Wildlife Area, Lake County, Oregon, on August 14, 2002.

Remarks: This species stands apart from all other species of *Placobdella* by its possessing a single pair of compact salivary glands. Siddall et al. (2005) and Siddall and Bowerman (2006) redefined the genus *Placobdella* to include species provided with two pairs of eyespots (with the anterior pair smaller and coalesced), with one pair of cecate mycetomes connected to the esophagus and with bilobate ovaries. The morphological characteristics found in *P. kwetlumye,* n. sp., are consistent with that definition. *Placobdella kwetlumye,* n. sp., resembles other papillated members of the genus described for North America: *Placobdella burresonae* Siddall and Bowerman, 2006*, Placobdella multilineata* Moore, 1953*, Placobdella ali* Hughes and Siddall, 2007*, Placobdella ornata* (Verrill, 1872), and *Placobdella papillifera* (Verrill, 1872). However, the new species is easily distinguished from the last three of these owing, among other things, to the pattern of papillation. *Placobdella ali, P. ornata,* and *P. papillifera* present highly papillated dorsal surfaces, not forming well-structured rows like those present in *P. burresonae*, *P. multilineata,* and *P. kwetlumye,* n. sp. In addition, those highly papillated species exhibit two pairs of well-developed compact salivary glands connecting to the base of the proboscis; *P. kwetlumye,* n. sp., is the only species of the genus lacking the posterior pair. Furthermore, *P. ali* and *P. papillifera* present ventral pigmentation patterns, completely absent in *P. kwetlumye,* n. sp.

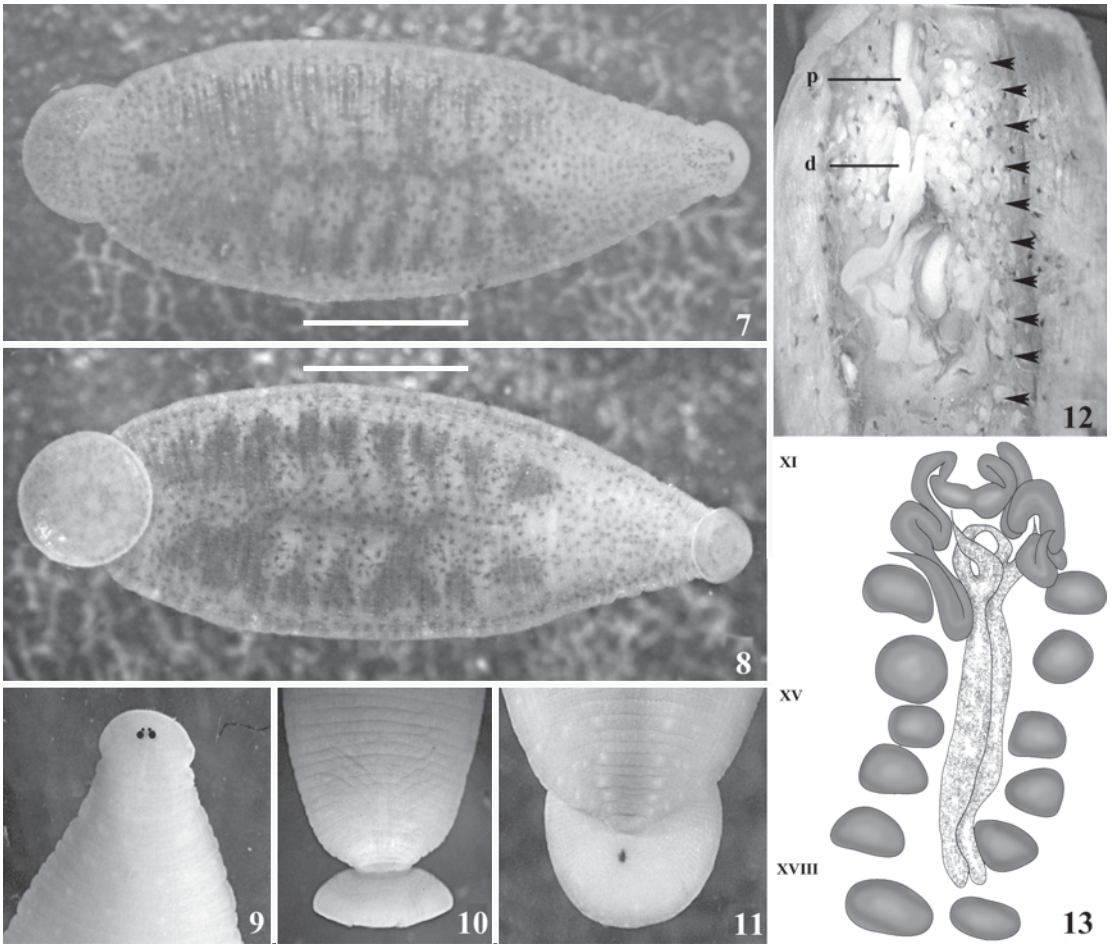
Placobdella burresonae and *P. multilineata* are superficially the most morphologically similar species to *P. kwetlumye,* n. sp. However, some differences in the external as well as in the internal morphology can be recognized. Medial and paramedial dorsal rows in *P. burresonae* and *P. multilineata* are formed by papillae of different size in every single annulus (see fig. 1 in Siddall and Bowerman, 2006), whereas in *P. kwetlumye,* n. sp., rows are formed by prominent papillae only on a2. Moreover, no marginal furrows are present in *P. burresonae* in contrast with *P. kwetlumye,* n. sp. (which has marginal papillae instead).

Etymology: The specific epithet is based on the Nlaka'pamux (an Interior Salish "Thompson group" language) word for "leech" or "bloodsucker," k'ʷétl'um'ye. The species name should be pronounced "kwaitle-oom-yay." The type locality of *P. kwetlumye,* n. sp., corresponds to a region inhabited by the Coast Salish, but because no word for "leech" could be found in the Coast Salish lexicon, we opted for the lexicon of the geographically closest group.

Placobdella sophieae, new species

Figures 7–13

Material Examined: Eight specimens collected in Squires Lake, Washington, September 30, 2009, by Alejandro Oceguera-Figueroa and Sebastian Kvist. Collected from the legs of A.O.-F. and from the underside of submerged rocks and wood.



FIGURES 7–13. *Placobdella sophieae,* n. sp. **7.** Holotype, dorsal view. **8.** Holotype, ventral view. **9.** Eyespots showing characteristic "placobdellid" arrangement. **10.** Posterior sucker showing the pedicel (peduncle). **11.** Posterior sucker showing dorsal papilla. **12.** Proboscis (p) and bundle of ductules (d), dorsal view; mycetomes not shown. Diffuse salivary glands indicated by arrows. **13.** Dorsal view of the male and female reproductive systems. Scale bars = 3 mm.

Description: External morphology based on eight specimens. Body dorsoventrally flattened, ovate-lanceolate, semitransparent tegument when alive, with three pairs of dorsal rows of brownish-pigmented spots on a2 of each somite, otherwise chromatophores randomly arranged on ventral and dorsal surfaces (figs. 7–8). Body brownish when fixed. Average body length 12.6 (11.0–14.1), average body width 4.8 (4.0–6.4). Complete somite triannulate. Somites I and II uniannulate; III–V biannulate; VI–XXIII triannulate; XXIV biannulate; XXV–XXVII uniannulate. Two pair eyespots on III in "placobdellid" arrangement (fig. 9). Oral sucker small, mouth pore on anterior border. Posterior sucker circular, separated from body by obvious constriction or pedicel (fig. 10). Anus on dorsal surface of XXVII (fig. 11). Male gonopore between XI and XII. Female gonopore at XII a2/a3; 2 annuli between gonopores.

Internal morphology based on three dissected specimens. Proboscis short, in membranous sheath extending posteriorly to IX, unlooped when retracted. Diffuse salivary glands dispersed dorsolaterally from VII to XIII, connecting to base of proboscis through well-developed bundles of ductules (fig. 12). Esophagus large, folded, with one pair cecate mycetomes at X. Crop with seven pairs foliaceous caeca, last pair forming well-developed postcaeca (diverticula) extending posteriorly to XXV. Intestine with four pairs simple caeca in XX–XXIII. Male reproductive system with well-developed atria and highly coiled ejaculatory ducts. Six pair intersegmental testisacs from XIII/XIV to XVIII/XIX. Ovisacs without common oviduct, anteriorly bilobed, extending posteriorly to XVIII, ovisac bifurcation at XIII. Anterior lobe very short extending only to XII (fig. 13).

Holotype: Undissected, fixed in ethanol. 15.0 length, 5.8 maximum width. Collected by Alejandro Oceguera-Figueroa on September 30, 2009 (AMNH 5529).

Type Locality: Squires Lake, Whatcom County, Washington, 48°39′36.98″N; 122°20′02.76″W.

Paratypes: Seven specimens (3 dissected and 4 undissected), fixed in ethanol. Collected by Alejandro Oceguera-Figueroa and Sebastian Kvist, Squires Lake, Whatcom County, Washington, on September 30, 2009 (AMNH 5530).

Etymology: The species is named after Sophie Alice Burgess in honor of her birth.

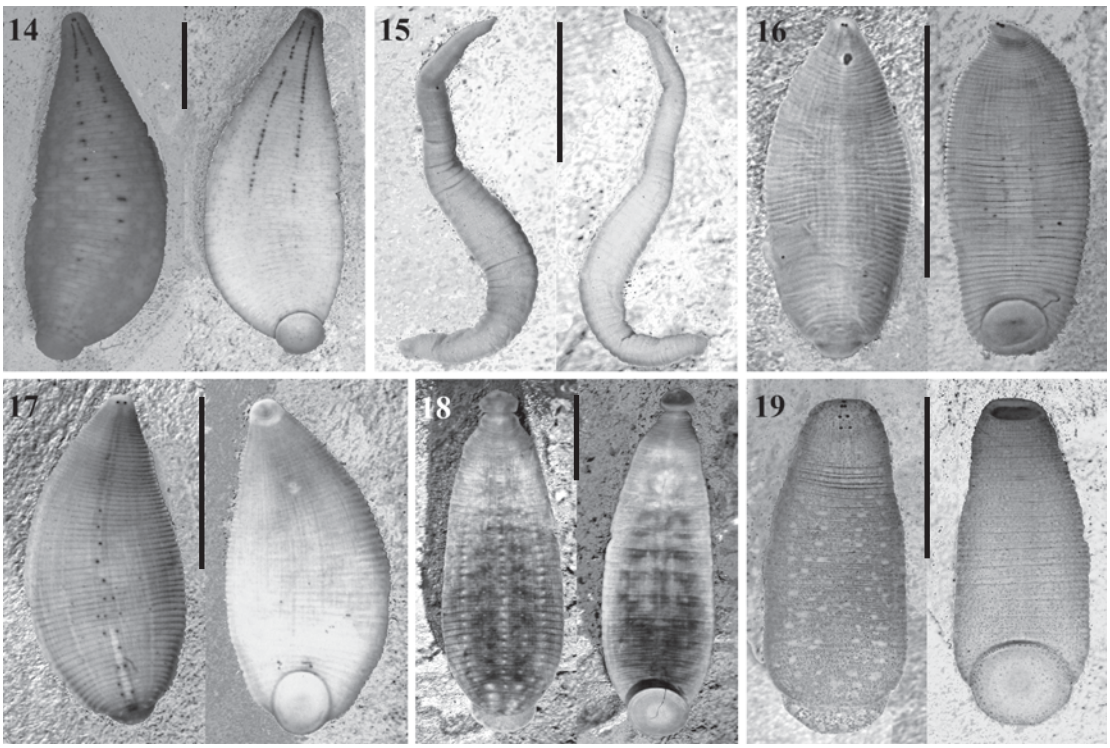
Remarks: The morphological characteristics found in *P. sophieae,* n. sp., are consistent with synapomorphies of the genus (Siddall et al., 2005; Siddall and Bowerman, 2006). The presence of a small pedicel (peduncle) separating the posterior sucker from the rest of the body, present in *P. sophieae,* n. sp., has been recorded in at least two other *Placobdella* species, *Placobdella pediculata* Hemingway, 1908, and *Placobdella cryptobranchii* (Johnson and Klemm, 1977), as well as in *Actinobdella inequiannulata* Moore, 1901, and *Actinobdella annectens* Moore, 1906. *Placobdella sophieae,* n. sp., is distinguished from species of *Actinobdella,* in that the latter have several retractile digitate processes on the rim of the caudal sucker; absent in the new species. In addition to the presence of a small pedicel, *P. pediculata* and *P. cryptobranchii* also have diffuse salivary glands like those of *P. sophieae,* n. sp. However, *P. sophieae,* n. sp., is distinguished principally by its external morphology, which contrasts with the absence of prominent papillae, white patches or colored dots in *P. pediculata* and *P. cryptobranchii.* Moser et al. (2008) described two paramarginal rows of metameric spots on the dorsal surface as well as white patches (typically 3) between white cephalic and caudal somites for *P. cryptobranchii*, in any case, the pattern corresponds with that of *P. sophieae,* n. sp. Furthermore, Hemingway (1908) recorded the anus at XXIII/XXIV in *P. pediculata,* whereas in *P. sophieae,* n. sp., the same structure is situated in XXVII. The diffuse salivary glands of *Placobdella sophieae,* n. sp., connect to the base of the proboscis through well-developed common bundles. These structures were not recorded by Johnson and Klemm (1977) for *P. cryptobranchii*. *Placobdella pediculata* and *P. cryptobranchii* were described as permanent parasites of the fresh-water sheepshead (*Aplodinotus grunniens*) and the Ozark hellbender (*Cryptobranchus alleganiensis*) respectively. Hemingway (1908) and Johnson and Klemm (1977) reported that the leeches were always found attached to their host, never free living, which contrasts with our findings of *Placobdella sophieae,* n. sp. In addition to *P. pediculata* and *P. cryptobranchii*, discussed above, *Placobdella phalera* (Graff, 1899), *Placob-*

della michiganensis (Sawyer, 1972), and *Placobdella picta* (Verrill, 1872) also possess diffuse salivary glands, yet are easily distinguished from *P. sophieae,* n. sp., based on external pigmentation. *Placobdella phalera* and *P. michiganensis* have white patches together with a white nuchal ring on the dorsal surface. *Placobdella picta* has a dark greenish-brown dorsum and a thin median line. These characters contrast with the semitransparent tegument of *P. sophieae,* n. sp.

Glossiphonia elegans (Verrill, 1872) Castle, 1900

Figure 14

The presence of three pairs of eyespots, dorsal papillation and pigmentation pattern, two paramedial longitudinal stripes in the ventral surface, two annuli between gonopores, and a relatively large size correspond with the description of *Glossiphonia elegans*. North American and European forms have very similar morphological traits, to the extent that previous taxonomists (i.e., Klemm, 1982; Sawyer, 1986) considered them to be the same species: *Glossiphonia complanata* (Linnaeus, 1758). However, Siddall et al. (2005), using phylogenetic criteria, found that they represent different evolutionary lineages and resurrected Verrill's 1872 name *Glossiphonia elegans* for the North American species (see also Madill and Hovingh, 2007). Found on the underside of submerged rocks and wood.



FIGURES 14–19. Glossiphoniids found in Washington in this study; dorsal and ventral views, left and right respectively. **14.** *Glossiphonia elegans*. **15.** *Helobdella elongata*. **16.** *H. modesta*. **17.** *Helobdella papillata*. **18.** *Placobdella montifera*. **19.** *Theromyzon* cf. *rude*. Scale bars = 5 mm.

Helobdella elongata (Castle, 1900)

Figure 15

The absence of a chitinous nuchal scute as well as the presence of an unpigmented, nonpapillated, and subcylindrical body all correspond to the description of *H. elongata*. Washington specimens lacked obvious eyespots, a characteristic noticed for some individuals of this species elsewhere (Klemm, 1982). Found on the underside of submerged rocks and wood.

Helobdella modesta (Verrill, 1872) Siddall et al., 2005

Figure 16

Specimens all correspond to the description of *H. modesta* due to the presence of an obvious chitinous nuchal scute on the dorsal surface of VIII, one pair of eyespots, and the absence of dorsal or ventral papillation or pigmentation. The presence of a nuchal scute had led previous taxonomists to synonymize almost every previously described species exhibiting this characteristic under the name *Helobdella stagnalis* Linnaeus, 1758. Siddall et al. (2005), using a phylogenetic perspective, resurrected *Helobdella modesta* (Verrill, 1872) for the North American species. Found on the underside of submerged rocks and wood.

Helobdella papillata (Verrill, 1872) Siddall and Borda, 2003

Figure 17

The presence of one pair of eyespots, longitudinal dorsal pigmented stripes, and rows of black-tipped papillae as well as one annulus between gonopores and diffuse salivary glands match the description of *Helobdella papillata*. This species belongs to the "*triserialis*" complex of species defined by Sawyer, 1986. *Helobdella triserialis* (Blanchard, 1894) was originally described based on specimens collected in Chile. However, because of the high degree of variation in the various forms in the New World, Ringuelet (1943) lumped them all under "*H. triserialis.*" Siddall and Borda (2003) found that at least North and South American forms each constitute distinct evolutionary lineages and resurrected Verrill's name, *Helobdella papillata,* for North American forms, all of which are genetically similar regardless of pigmentation. Specimens were found on the underside of submerged rocks and wood.

Placobdella montifera (Moore, 1906)

Figure 18

The presence of three longitudinal ridges on the dorsal surface (one median and two lateral) and the distinctively narrow neck constriction, together with the "placobdellid" eyespot arrangement are in agreement with the description of *P. montifera* (see Klemm, 1982). Found on the undersides of submerged rocks and wood.

Theromyzon, cf. *rude* (Baird, 1869)

Figure 19

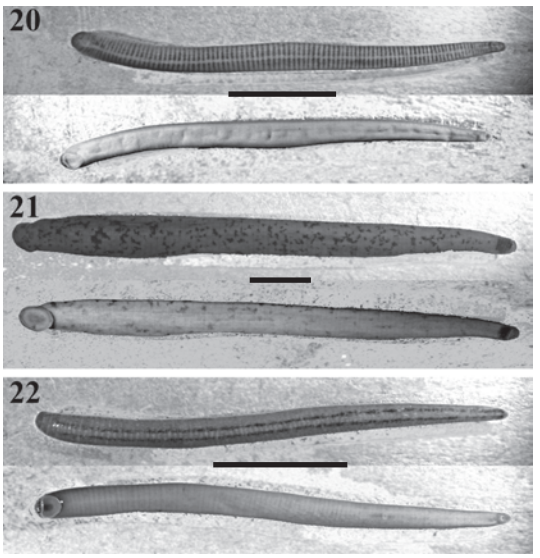
The presence of four pairs of eyespots arranged in parallel, two annuli between gonopores, cylindrical male atrium and weakly developed atrial cornua agree with the description of *Theromyzon rude* (see Oosthuizen and Davies, 1993). The type locality of *T. rude* is in the Northwest at Great Bear Lake, Canada. Sawyer (1986) considered this species common in the western United States and Canada. A major revision of the genus, including their phylogenetic relationships has yet to be attempted. Found on the underside of submerged rocks and wood.

Arhynchobdellida Blanchard, 1894
Erpobdellidae Blanchard, 1894

Erpobdella annulata (Moore, 1922) Oceguera-Figueroa et al. (in press)

Figure 20

Moore (1922) described *Erpobdella punctata annulata* from the vicinity of Vancouver, Canada, and noticed that in the humid Pacific regions of Washington, Oregon, and British Columbia this subspecies replaces the more common *E. punctata punctata*. The main morphological characteristic that distinguishes *E. annulata* from *E. punctata* is that the former has strongly pigmented dorsal transverse stripes (one on each annulus), unlike the longitudinal pigmentation of *E. punctata* sensu stricto or any of its variants (see Madill and Hovingh, 2007). Oceguera-Figueroa et al. (in review) suggested that the name *E. annulata* should be used for the transversally striped form from the Pacific Northwest. All other morphological characters, including three pairs of eyespots, two annuli between gonopores, and ejaculatory ducts not forming preatrial loops, are consistent with those of *E. annulata.* Found on the underside of submerged rocks and wood.



FIGURES 20–22. Erpobdellids found in Washington in this study; dorsal and ventral views, top and bottom respectively. **20.** *Erpobdella annulata*. **21.** *E. obscura*. **22.** *Erpobdella punctata*. Scale bars = 5 mm.

Erpobdella obscura (Verrill, 1872) Siddall, 2002

Figure 21

The presence of four pairs of eyespots, colored patches dispersed on the dorsal and ventral surface, two annuli between gonopores, spirally coiled atrial cornua, ejaculatory ducts forming preatrial loops, and a relatively large size correspond to the description of *Erpobdella obscura* (see Klemm, 1982). Found on the underside of submerged rocks and wood.

Erpobdella punctata (Leidy, 1870)

Figure 22

Erpobdella punctata is widely distributed in North America with highly variable pigmentation patterns (see diagrams in Klemm, 1982; Madill and Hovingh, 2007). The presence of two longitudinal paramedial stripes on the dorsal surface, as well as three pairs of eyespots, two annuli between gonopores and ejaculatory ducts not forming preatrial loops are consistent with the characteristics of *E. punctata.* Found on the underside of submerged rocks and wood.

CONCLUSIONS

This paper represents a first broad attempt to investigate the hirudinifauna from Washington. We found a relatively rich diversity of leeches with 11 species of two families (Glossiphoniidae and Erpobdellidae) including two new glossiphoniids: *Placobdella kwetlumye,* n. sp., and *Placobdella sophieae,* n. sp. Altogether, 14 species are now known for the state of Washington, including those identified by Klemm (1982). Our discovery of heretofore undescribed species of *Placobdella* continues a recent pattern of increasing clarity regarding the diversity of this principally North American genus of blood-feeding leeches (Hughes and Siddall, 2007; López-Jiménez and Oceguera-Figueroa, 2009; Oceguera-Figueroa and Siddall, 2008; Siddall and Bowerman, 2006). Additional faunistic surveys of neighboring freshwater habitats in Idaho, Wyoming, northern California, and southwestern Canada may yet reveal species in addition to those already found in Oregon and Washington.

Previously, glossiphoniid leeches known to feed on birds were exclusively in the genus *Theromyzon*. *Placobdella kwetlumye,* n. sp., is the first species of the genus found feeding from waterfowl, though not from their narines, as is typical for species of *Theromyzon*. Whether this represents a specificity for waterfowl by *P. kwetlumye,* n. sp., or is merely reflective of very general tastes is not yet clear.

Morphology of the salivary complex has long been used in the taxonomy of the genus and some species formerly considered as belonging to *Placobdella* were transferred to the genus *Desserobdella* Barta and Sawyer, 1990, because of their possession of diffuse salivary glands (Barta and Sawyer, 1990; Jones and Woo, 1990). However, Siddall et al. (2005) recovered *Desserobdella* as polyphyletic showing the poor phylogenetic value of this character and considered *Desserobdella* a junior synonym of *Placobdella*. Regardless of this, the character is useful in

distinguishing between species since no evidence of intraspecific (within a particular species) variation of the salivary glands in *Placobdella* species is known to occur. *Placobdella kwetlumye,* n. sp., is unique among the species of *Placobdella* insofar as it possesses a single pair of compact salivary glands; its inclusion in the genus *Placobdella* is guaranteed by its possession of diagnostic characters but provide evidence for the extremely variable condition of the salivary cells. Similar levels of salivary gland variation occur in the genus *Helobdella*, which includes non–blood-feeding leeches with compact, partially compact and diffuse salivary glands (Siddall and Borda, 2003) but in sharp contrast with the unique salivary gland morphology present in all the species of *Haementeria* (e.g., Oceguera-Figueroa, 2008).

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