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The Gerridae or
Water Striders of
Oregon and Washington
(Hemiptera:Heteroptera)



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The Gerridae or Water Striders of Oregon and Washington (Hemiptera:Heteroptera)

Gary M. Stonedahl and John D. Lattin

ABSTRACT

Seven species of Gerridae are known to occur in Oregon and Washington. These are *Gerris (Aquarius) remigis* Say, *Gerris (Gerris) buenoi* Kirkaldy, *Gerris (Gerris) gillettei* Lethierry and Severin, *Gerris (Gerris) incognitus* Drake and Hottes, *Gerris (Gerris) incurvatus* Drake and Hottes, *Limnoporus notabilis* (Drake and Hottes), and *Metrobates trux infuscatus* Usinger. The literature dealing with the family is reviewed. A diagnostic key for species identification is given. Species diagnoses, geographical and seasonal distributions, habitat preferences, and illustrations of abdominal regions also are provided.

Biology and Distribution

Water striders or "water skippers" are familiar insects on most bodies of fresh water. They live on the surface of small streams to large rivers, ponds, and lakes, and even on the surface of the ocean. Their long legs distribute the body weight, enabling them to "walk" or "skate" on the surface film. Gerrids are predators which use their front legs to grasp prey caught in the surface film. Water striders are very conspicuous and may occur in large groups, but they are rarely eaten by other aquatic animals such as fish. Scent gland secretions are believed to be responsible for this apparent immunity. These insects are common and widely distributed, but detailed biological studies of many North American species are lacking.

Gerrids are small to moderate-sized insects with long, narrow legs. The head is horizontal and bears a pair of large, rounded eyes at its posterolateral margins. The antennae are long, four-segmented, and inserted in front of the eyes. Ocelli are absent. The rostrum is short, stout, and four-segmented. The structure of the thorax varies with the degree of wing development. In apterous individuals, the pronotum is short, but in winged forms this body region is extended caudad of the wing bases. The long, slender middle and hind legs are widely separated from the shortened, raptorial front legs. The tarsi are two-segmented and have a single preapical claw arising from a cleft on the last segment. Most adult gerrids have a median scent gland opening, the omphalium, on the metasternum, but this structure is absent in the

Rhagadotarsinae and many of the Trepobatinae. Wing polymorphism is widespread in the Gerridae, and many species are represented by two and sometimes three different wing morphs. The body is covered with a fine, hydrofuge hair-pile, velvety in appearance and gray to dark brown in color.

There are 56 genera and approximately 450 species of Gerridae in the world. Eight subfamilies are recognized (Andersen, 1975), but only the Gerrinae and Trepobatinae are represented in the Pacific Northwest. Hungerford and Matsuda (1960), Matsuda (1960), and Andersen (1975) have conducted studies on the higher classification of this family. Phylogenetic relationships between the Gerridae and other semiaquatic bugs are discussed by Andersen (1979).

Small gerrids are frequently confused with another family of semiaquatic bugs, the Veliidae. Although numerous external characters are used to separate these two families, the only consistent characters on a worldwide basis are various structures of the internal genitalia. In the Gerridae, the vesica of the aedeagus is sclerotized, while veliids have a membranous vesica (China, 1957). The second gonocoxites are absent in female gerrids but are well developed in veliids (Scudder, 1959). In the Pacific Northwest, gerrids can be separated from veliids by the absence of metathoracic scent gland canals and the long hind femora which greatly exceed the end of the abdomen. The hind femora of veliids rarely exceed the end of the abdomen. West coast species of Gerridae also lack a median longitudinal groove on the frons, a feature which is well developed in most veliids (Polhemus and Chapman, 1979).

Gerrids are among the most frequently encountered insects of surface waters. Habitats range from ponds to lakes, streams to large, slow-moving rivers, and brackish coastal waters to the open ocean. A few species inhabit a variety of aquatic environments (e.g., *Gerris remigis* Say), but most gerrids typically display a degree of habitat preference (Vepsäläinen, 1973a; Calabrese, 1977; Spence and Scudder, 1980). For example, *Gerris buenoi* Kirkaldy is usually associated with thick vegetation around the margins of ponds and small lakes. *Metrobates trux infuscatus* Usinger prefers moderate to swift flowing waters of large streams and rivers. Spence and Scudder (1980) found that strict habitat association is the most important factor contributing to ecological separation and coexistence of gerrid species on the Fraser Plateau of British Columbia.

Although most Gerrids are restricted to freshwater habitats, a few species are known to extend their ranges into brackish waters (Vepsäläinen, 1973a; Andersen, 1975). Several species of *Gerris* have been taken on saline lakes in British Columbia, Canada (Scudder, 1969, 1971). The genus *Rheumatobates* contains both strictly freshwater and marine species, as well as several species that inhabit both brackish and freshwater situations (Andersen and Polhemus, 1976). *Halobates* species occur on the ocean, but the majority of them are restricted to coastal or nearshore habitats (Andersen and Polhemus, 1976). Of the 42 known species of *Halobates*, five are truly pelagic and have been found hundreds of miles from the nearest land (Cheng, 1974).

All known water striders are predaceous. They feed on terrestrial insects that fall on the water and on aquatic invertebrates that maintain some degree of contact with the surface. Gerrids appear to be indiscriminate feeders, with a preference for living prey (Riley, 1922a). Lists of food items are available for several North American species of *Gerris* (Riley, 1922a, 1925). Coastal water striders probably feed on land insects carried out to sea by wind currents (Andersen and Polhemus, 1976), but this food source is less available to open ocean species of *Halobates*. These insects have been observed feeding on dead pelagic coelenterates (Savilov, 1967) and have been maintained in captivity on chopped pieces of sea anemones, planktonic crustaceans, and fish larvae (Herring, 1961; Cheng, 1974).

Cannibalism has been observed in nature for several species of Gerridae (Riley, 1922a, 1922b, 1925). This method of feeding is usually restricted to small, drying pools and is probably a response to crowding and extreme food shortage. Larvae and newly molted adults are often the first victims of cannibalism.

Gerrids are sensitive to disturbances of the water surface and use surface wave signals to locate prey and mates (Murphey, 1971a; Wilcox, 1972, 1979). Orientation to prey involves a series of slow and discrete turning movements, which are correlated with the angle between the waves produced by the prey and the longitudinal axis of the gerrid's body (Murphey, 1971b,c). Lawry (1973) suggests that tarsal mechanoreceptors mediate the orientation response to surface wave stimuli. Neuromuscular control of leg movements involved in orientation to prey is discussed by Murphey (1971b).

Surface locomotion in the Gerridae has been investigated by Brinkhurst (1960), Andersen (1976), and Caponigro and Eriksen

(1976). Water-repellent hairs on the tarsi and tibiae help to maintain the insect on the surface. The wettable claws are used to penetrate the surface film, thus gaining traction for forward thrust (Andersen, 1976). The claws can be folded against the tarsal surface to prevent drag while the insect is gliding. The gliding motion is accomplished by paddlelike movements of the middle legs. Unequal strokes of the midlegs provide direction control and the hind legs act as pivotal points (Caponigro and Eriksen, 1976). During the recovery stroke, the middle legs are lifted out of the water and brought forward over the head. The front legs support and stabilize the insect during the recovery stroke. Gerrids apparently create forward thrust by directing a force down and back against a compressed portion of the surface film (Caponigro and Eriksen, 1976). The build-up of surface pressure behind the middle tarsi imparts a thrust which causes the insect to move forward (Brinkhurst, 1960).

Water striders are covered with a velvety coat of hair which is resistant to wetting. Cheng (1973) found that in *Halobates* the hair coat is comprised of two kinds of hairs and a dense undergrowth of hooklike microtrichia. The macro-hair layers protect against wetting by rain, spray, and waves, and also may play a role in respiration during periods of submergence. The microtrichia hold a thin film of air at the body surface. This film probably aids in water protection but does not appear to be involved in underwater respiration. Most water striders have cuticular surface structures similar to those found in *Halobates* (Andersen and Polhemus, 1976).

Gerrids have typical hemipteran mouthparts (Cobben, 1978). The rostrum is four-segmented and encloses the paired mandibular and maxillary stylets. It is usually held against the ventral side of the head, but is swung forward during feeding. The tip of the rostrum is equipped with sensory papillae and hairs which aid the insect in locating a suitable spot to penetrate the prey (Cheng, 1974). The mandibular stylets are used to puncture the body wall but take no direct part in feeding (Cheng, 1966a). Recurved spines at the apices of the mandibles serve to anchor them in the integument of the prey. The maxillary stylets, which are held together by hairs, serve the function of tissue penetration and convection of food and salivary secretions (Cheng, 1966a). Food is taken in through the food canal after being liquefied by salivary enzymes injected into the prey via the salivary canal (Cheng, 1974).

Water striders have few natural enemies. Andersen and Polhemus (1976) suggest that unpleasant secretions produced by the metathoracic scent glands make gerrids distasteful to predators. Gerrids have been reported as prey for frogs (Drake, 1914; Torre-Bueno, 1917b; Riley, 1925; Callahan, 1974), fish (Riley, 1925; Callahan, 1974), ducks (McAtee, 1918; Mabbot, 1920; Anderson, 1932), shorebirds (Wetmore, 1925), and swallows (Beal, 1918). However, little evidence indicates that gerrids are an important food source for these predators. Andersen and Polhemus (1976) summarize some information concerning the consumption of *Halobates* by several species of seabirds.

A number of endoparasites have been found in gerrids, including trypanosomatid flagellates (Poisson, 1957; Wallace et al., 1960), nematodes (Poisson, 1957), and parasitic Hymenoptera (Usinger, 1956; Poisson, 1957). Water mite larvae are known ectoparasites of water striders (Torre-Bueno, 1917a; Polhemus and Chapman, 1979).

Water striders have a typical heteropteran life history which includes the egg, five larval instars, and the adult stage. Freshwater species usually lay their eggs just below the surface on sticks, vegetation, and other materials. One notable exception is the European species *Gerris najas* De Geer, which apparently oviposits on stones and other objects on lake bottoms (Brinkhurst, 1960). Eggs are laid singly or in groups and are attached to the substrate with a sticky, gelatinous material (Hungerford, 1920; Cobben, 1968; Andersen and Polhemus, 1976). Coastal species of *Halobates* probably lay their eggs on coral reefs and cliffs near the splash zone (Herring, 1961). Pelagic forms oviposit on a variety of floating objects, and the eggs are often deposited in dense masses (Andersen and Polhemus, 1976). The eggs of North American *Gerris* species range in size from 1.0 by 0.3 millimeters (*G. marginatus* Say) to 1.6 by 0.5 millimeters (*G. remigis*). The eggs of *Halobates* are 1.0 to 1.3 millimeters in length (Herring, 1961).

Incubation time has been reported for a number of gerrid species and varies from 6 to 14 days (Torre-Bueno, 1917a, 1917b; Hungerford, 1920; Hoffman, 1924; Bobb, 1951; Herring, 1961; Cheng, 1966b). At eclosion, the egg is split longitudinally with the aid of an egg burster (Hungerford, 1920; Cobben, 1968). The first instar larva frees itself from the embryonic cuticle and swims to the surface, where it may remain submerged for several hours before breaking through the surface film (Torre-Bueno, 1917a).

Larval developmental rates vary with climate. Penn and Goldsmith (1950) reported a 21-day developmental period for larvae of *Limnopus canaliculatus* (Say) in Louisiana. The same species in Virginia required 34 days to reach the adult stage (Bobb, 1951). Herring (1961) reported that 44 days were required for larval development in *Halobates hawaiiensis* Usinger. Additional records of larval development in American species of *Gerris* are given by Torre-Bueno (1917a, 1917b), Hungerford (1920), and Hoffman (1924). Developmental rates of some European *Gerris* species are reported by Vepsäläinen (1973b).

Water striders have five larval instars. Larvae appear similar to the adults except for size, proportions of body parts, and differentiation of the genitalia. Gerrid larvae also lack scent glands and have one-segmented tarsi. At ecdysis, the old cuticle splits open along a dorsal Y-shaped suture on the thorax (Cheng, 1966b). Newly molted larvae and adults are especially susceptible to predation and cannibalism, with mortality being highest in the early instars (Polhemus and Chapman, 1979). Adults remain teneral for several days before hardening and darkening of the cuticle is complete (Andersen, 1973).

During mating, the male rides on the back of the female, grasping her with his front legs only. The male genitalia are bent downward to engage the female. Copulation may last from a few minutes to several hours (Hungerford, 1920). In many American species of *Gerris*, mating begins after termination of diapause. Torre-Bueno (1917a) observed mating pairs of *Gerris remigis* as early as February in New York.

Water striders in tropical regions probably reproduce throughout the year. Cheng (1966b) found that *Metrocoris tenuicornis* Esaki produces as many as six generations annually in Malaya. In temperate regions, reproductive activity is confined to the spring and summer, and rarely are there more than two or three broods per year. In Ontario, Canada, all gerrid species appear to have a single generation (Cheng and Fernando, 1970). Spence and Scudder (1980) reported bivoltine life cycles for three species of *Gerris* in British Columbia, Canada. *Limnopus dissortis* (Drake and Harris) is reported (as *rufoscutellatus* Latreille) to be univoltine in Minnesota but bivoltine in New York (Hoffman, 1924). *Gerris remigis* in New York (Torre-Bueno, 1917a) and *Limnopus canaliculatus* in Virginia (Bobb, 1974) have been reported to have three generations per year. *Gerris gillettei*

Lethierry and Severin and *Gerris incognitus* Drake and Hottes are both bivoltine near San Francisco, California (Callahan, 1974). In Finland, *Gerris* species are either univoltine or bivoltine (Vepsäläinen, 1974b). Further south in Europe, all species are bivoltine and some display a partial third generation (Vepsäläinen, 1974c).

Gerrids overwinter in the adult stage. Hibernating water striders have been found in leaf litter, under logs and rocks, and in other sheltered sites near water (Riley, 1921, 1925). Winged gerrids have been found at overwintering sites far removed from the nearest water (Torre-Bueno, 1917a; Riley, 1925; Brinkhurst, 1959). Studies of *Gerris odontogaster* (Zetterstedt) in Finland have revealed that day length is an important factor in the determination of reproductive diapause. Diapause appears to be a result of shortening day lengths during larval development (Vepsäläinen, 1971b, 1974a, 1974d). Seasonal variation of lipid levels in *Gerris remigis* suggests that this species metabolizes triglycerides while in hibernation (Lee et al., 1975).

Wing polymorphism is widespread in the Gerridae. Most univoltine populations are either totally apterous or totally macropterous (Brinkhurst, 1959). Apterous populations are generally restricted to stable aquatic habitats (rivers, large lakes), while macropterous populations inhabit less dependable water supplies (seasonal streams, ponds, small lakes). Brinkhurst (1963) suggests that apterous populations produce occasional winged forms for dispersal purposes. Bivoltine *Gerris* populations are frequently dimorphic during the summer generation. Macropterous individuals are maintained because of their ability to survive drying conditions; competition between wing and ovarian development favors flightless forms. Only the flightless individuals of the summer generation are reproductively active. The macropters enter reproductive diapause and overwinter with the second generation (Andersen, 1973). The second (overwintering) generation is predominantly macropterous, the wings being used for dispersal to overwintering sites and to return to aquatic habitats in the spring. The occurrence of a few flightless individuals in the overwintering generation may function to maintain populations at permanent aquatic habitats from one season to the next (Brinkhurst, 1961). Flightless, overwintering individuals in bivoltine populations may also be the result of competition between development of the flight musculature and the fat body, which is necessary for winter survival (Andersen, 1973). The adaptive significance of wing polymorphism in *Gerris* is

discussed by Andersen (1973), Järvinen (1976), and Järvinen and Vepsäläinen (1976).

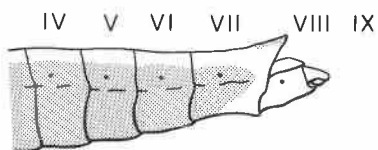
The control of wing polymorphism recently has been investigated for several species of *Gerris* in Europe (Vepsäläinen, 1971a, 1971b, 1974a, 1974b). According to Vepsäläinen, the seasonal dimorphism (summer generation only) observed in many bivoltine species is controlled by an environmental switch mechanism. In northern areas, absolute day length and illumination rhythm appear to be the only important factors acting on this switch mechanism. Further south, temperature plays an increasingly important role in adjusting this photoperiodic switch. There are no genetic differences between the wing morphs of seasonally dimorphic species (Vepsäläinen, 1971a, 1971b). In Finland, several species of *Gerris* are univoltine and also display permanent wing dimorphism. In these species, a genetic switch is responsible for the observed dimorphism. The switching mechanism is monogenic and involves a single pair of alleles or super-genes with the allele for short wings being dominant (Vepsäläinen, 1971a, 1974a). In areas south of Finland, the genetic switch is influenced by temperature and photoperiod.

Although gerrids are known to fly to overwintering sites and new habitats, flying individuals are rarely observed. Flight activity has been reported by Riley (1920), Leech (1970), Callahan (1974), Spence and Scudder (1980), and Polhemus (pers. comm., 1981). Lack of food, drought, and crowding are important factors influencing flight (Riley, 1925).

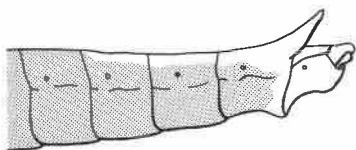
Four subfamilies of Gerridae occur in America north of Mexico, but only the Gerrinae and Trepobatinae are represented in the Pacific Northwest. Two of the four North American genera of Gerrinae (*Gerris*, *Limnoporus*) are found in Washington and Oregon. The Trepobatinae is represented by a single species of *Metrobates*.

Key to the Adult Gerridae of Oregon and Washington

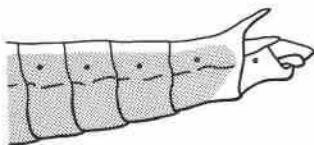
1. Body short and wide (length 4.0 to 4.6 millimeters); length of first antennal segment greater than combined length of remaining three (Figure 15) (Trepobatinae).....
Metrobates trux infuscatus Usinger
 Body elongate (length 6.0 millimeters or more); length of first antennal segment much shorter than combined length of remaining three (Figure 14) (Gerrinae)..... 2
2. Length of antennal segment I less than combined length of II and III; males without a posteromedian notch on sternum VII (Figure 13).....
Limnopus notabilis (Drake and Hottes)
 Length of antennal segment I equal to or greater than combined length of II and III; males with posteromedian notch on sternum VII (Figures 4 to 12) (genus *Gerris*)..... 3
3. Body length 12.5 to 16.6 millimeters.....
remigis Say
 Body length 11.5 millimeters or less..... 4
4. Pronotum without a pale, anterolateral stripe.....
incurvatus Drake and Hottes
 Pronotum with a pale, anterolateral stripe..... 5
5. Posteromedian notch of male sternum VII subrectangular; sternum VIII of male as broad as long (Figure 6); posterolateral angles of female tergum VII obliquely truncate, not prolonged into spinelike projections (Figure 1).....
buenoi Kirkaldy
 Posteromedian notch of male sternum VII rounded; sternum VIII of male longer than broad (Figures 7 to 10); posterolateral angles of female tergum VII spinelike (Figures 2, 3)..... 6
6. Dorsolateral margins of abdomen with silver spots at intersegmental sutures; males without lateral tufts of long hairs on sternum VIII (Figures 7,8); pale stripe on lateral margins of female abdominal sterna confined to segments V, VI, and VII (Figure 2).....
gillettei Lethierry and Severin
 Dorsolateral margins of abdomen without silver spots at intersegmental sutures; males with lateral tufts of long hairs on sternum VIII (Figures 9,10); pale stripe on lateral margins of female abdominal sterna extending the length of the abdomen (Figure 3).....
incognitus Drake and Hottes



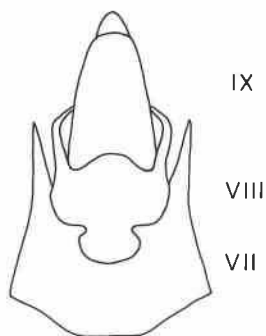
1 *G. buenoi*



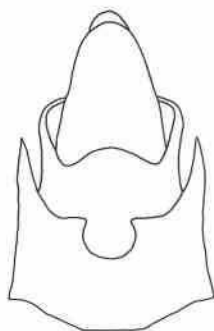
2 *G. gillettei*



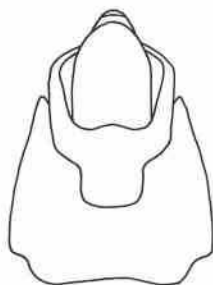
3 *G. incognitus*



4 *G. remigis* (m)



5 *G. remigis* (a)

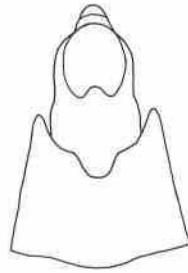


6 *G. buenoi* (m)

Figures 1-6. Abdominal segments of *Gerris*: 1-3, lateral view of female abdomen; 4-6, ventral view of male abdominal apex (a = apterous, m = macropterous).



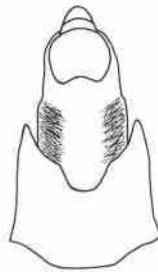
7 *G. gillettei* (m)



8 *G. gillettei* (a)



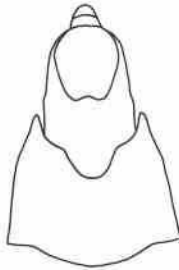
9 *G. incognitus* (m)



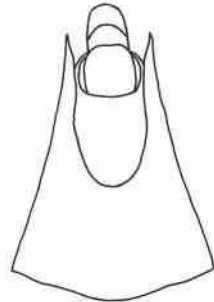
10 *G. incognitus* (a)



11 *G. incurvatus* (m)



12 *G. incurvatus* (b)



13 *L. notabilis* (m)

Figures 7-13. Abdominal segments of Gerridae males: 7-12, ventral view of abdominal apex in *Gerris*; 13, ventral view of abdominal apex of *Limnoporus notabilis* (a = apterous, b = brachypterous, m = macropterous).

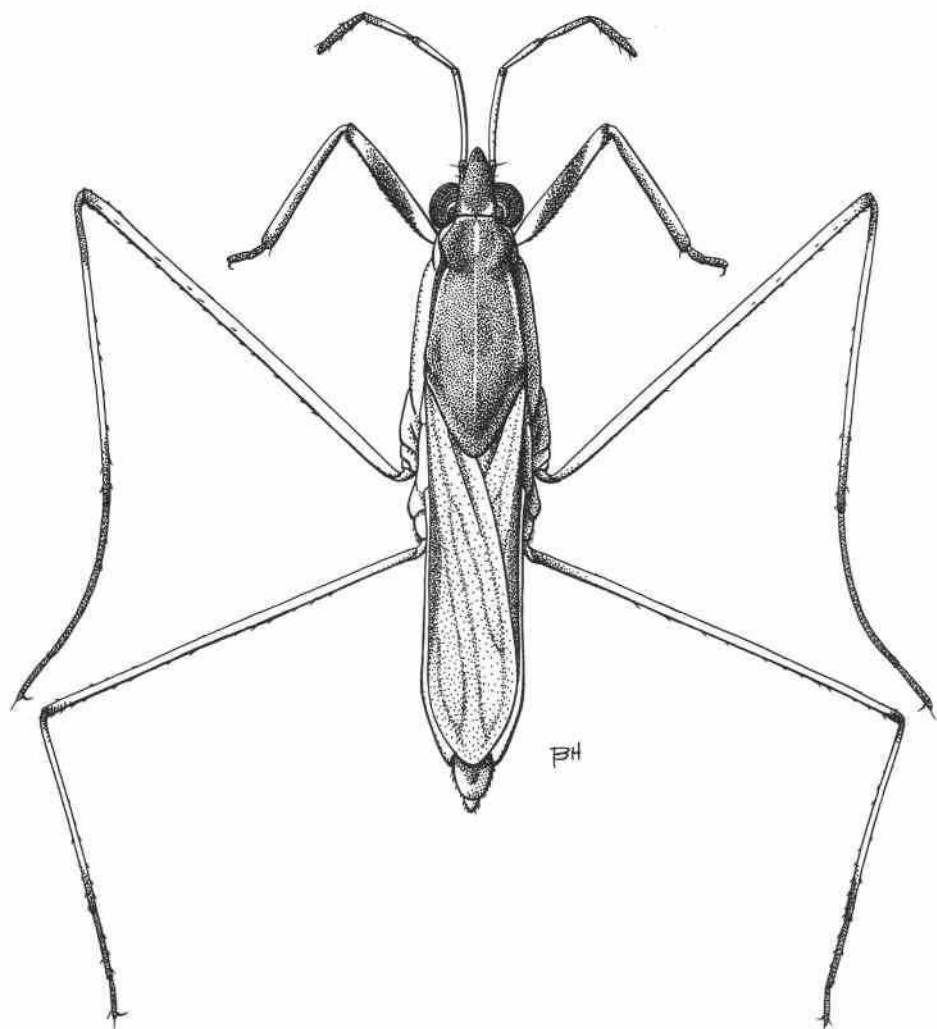


Figure 14. *Gerris incurvatus* Drake and Hottes, macropterous male.

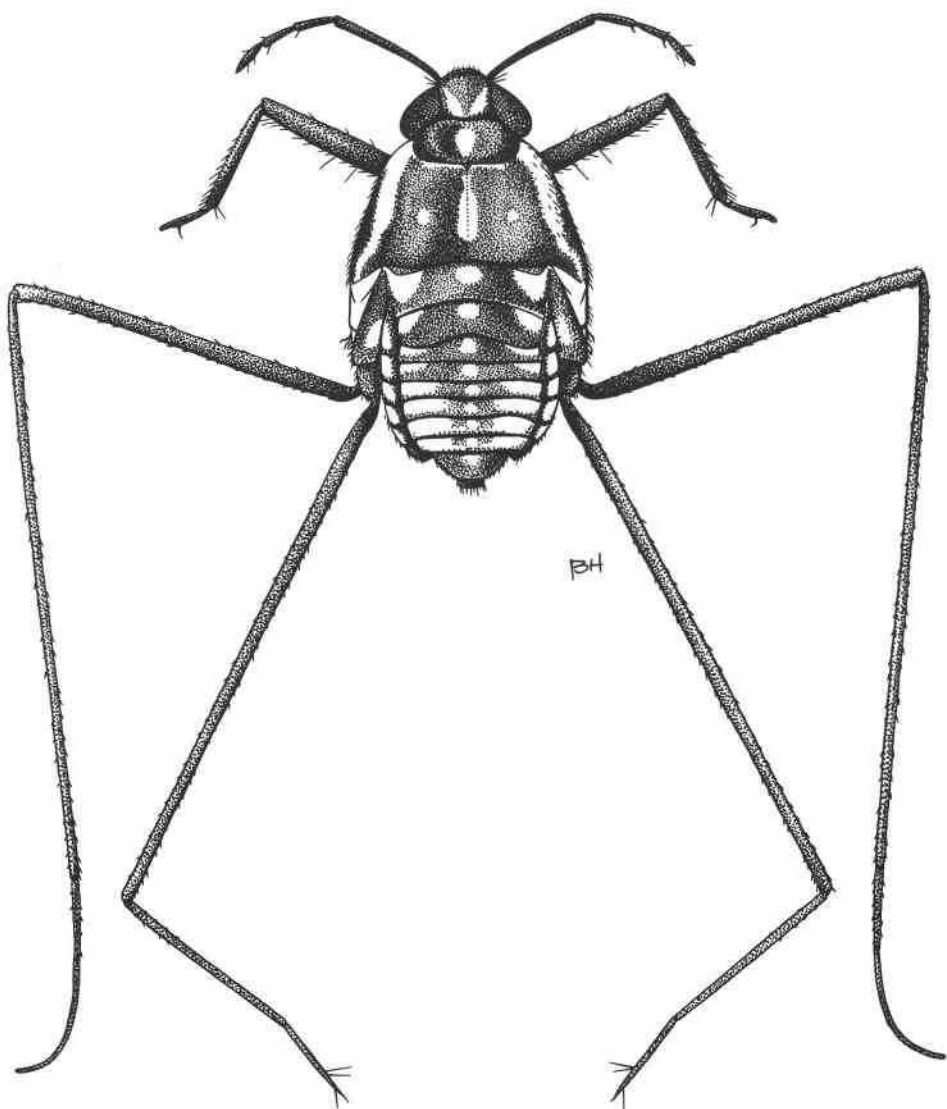


Figure 15. *Metrobates trux infuscatus* Usinger, apterous female.

SUBFAMILY GERRINAE

Genus *Gerris* Fabricius

***Gerris* Fabricius 1794:188.** Type species: *Cimex lacustris* Linnaeus 1758:450 (type designated by Latreille 1810:434).

Members of this genus are distributed throughout the world. Twenty-three species are known from the Americas; 15 are restricted to the Nearctic Region (Drake and Harris, 1934). Seven species have been reported from Washington and Oregon, but only five of these are confirmed in the present study. *Gerris marginatus* Say was reported from the Pacific Northwest by Drake and Harris (1934) and Kuitert (1942), but these records probably pertain to the closely related *G. incurvatus*, which replaces *G. marginatus* in western North America. The occurrence of *G. remigis* in our area is less clear, but it also appears to be replaced by a related western form.

The most recent revision of the genus for North America is by Drake and Harris (1934). Their species key and distribution records were updated by Kuitert (1942). Three subgenera are recognized (Andersen, 1975), two of which (*Gerris*, *Aquarius*) are represented in the Pacific Northwest. The larvae of most North American *Gerris* species have been described by Sprague (1967), Scudder and Jamieson (1972), and Calabrese (1974a).

***Gerris (Aquarius) remigis* Say**

(Figures 4,5,16)

***Gerris remigis* Say 1832:35.** Original description: "Inhabits United States" (types destroyed).

***Gerris orba* Stål 1859:264.** Original description: Near San Francisco, California (syntype in United States National Museum).

***Hygrotrechus robustus* Uhler 1871a:105-106.** Original description: Holotype female: Clear Lake, California (United States National Museum).

***Gerris remigis caloregon* Calabrese 1974b:27-28,30.** Original description: Holotype male: Hope Valley, California (University of California, Davis).

The true distribution of *G. remigis* in the United States is not known. Drake and Harris (1934) reported this species from the 48 contiguous states, Canada, Mexico, and Guatemala. In the western United States, *G. remigis* has been reported at various times under

four other names: *Gerris orba* Stål, *Hygrotrechus robustus* Uhler, *Gerris remigis caloregon* Calabrese, and *G. nyctalis* Drake and Hottes. With the exception of *G. nyctalis*, these nominal taxa are now considered synonyms of *G. remigis*. *Gerris nyctalis* was described from Colorado and subsequently reported from British Columbia, California, Idaho, Montana, Newfoundland, Washington (Drake and Harris, 1934), Massachusetts, Saskatchewan, Utah (Kuitert, 1942), and Alberta (Strickland, 1953). We have been unable to separate *G. nyctalis* and *G. remigis* on the basis of external morphology. Characters used by previous authors to separate these species (e.g., color, body size, length of antennae and legs) vary considerably and, therefore, are of little taxonomic value. External morphology of the terminal abdominal segments in males is extremely variable, especially the length of the lateral spines on tergum VII (Figures 4,5).

Michel (1962) investigated the internal genital structure of the *remigis-nyctalis* complex and found consistent differences between specimens from eastern states (Connecticut, Iowa, Michigan, Missouri, Ohio) and western states (California, Idaho, Oregon, Washington). The two forms were separated by Michel on the basis of structures found on the apical segment of the endosoma, and the shape of the basal plate of the phallus. Michel concluded that the eastern form was *G. remigis* and the western form, *G. nyctalis*, but he did not examine type material or specimens from the type locality of *G. nyctalis*. If Michel's western form is indeed conspecific with *G. nyctalis*, then the correct name by priority for this taxon would be *Gerris orba* Stål. The situation is further complicated by the occurrence of another *remigis*-like form in Arizona, Texas, and Virginia (Michel, 1962).

The solution to this complex problem will come from a detailed study of large samples from many geographical locations in North America. At least three taxa are involved in the United States and Canada, but the taxonomic status and distributions of these taxa are unclear at the present time. The relationship of *G. amplus* Drake and Harris to the *remigis* complex also should be investigated. This species is known only from Mexico, but a subspecies, *G. amplus arizonensis*, was described from Arizona by Kuitert (1942). Until such an analysis is completed, we will use the name, *Gerris remigis* for Oregon and Washington populations, recognizing that a name change may be needed in the future.

Gerris remigis is easily separated from other Pacific Northwest *Gerris* by its large size (males, 12.5 to 15.5 millimeters; females, 13.8 to 16.6 millimeters). The notch at the apex of male sternum VII and the long first antennal segment separate this species from *Limnoporus notabilis*. Macropterous, bachypterous, and apterous forms occur in the Pacific Northwest, but the brachypterous form is rarely encountered. Notes on the biology of *G. remigis* were given by Torre-Bueno (1917a), Hungerford (1920), and Riley (1922a). Riley (1920) studied the behavior of this species during periods of severe drought. Tropic responses to contact and light also were studied by Riley (1921). The larvae of *G. remigis* have been described by Torre-Bueno (1917a), Scudder and Jamieson (1972), and Calabrese (1974a).

Oregon and Washington records (Figure 16). *Gerris remigis* is the most frequently encountered gerrid in the Pacific Northwest. Specimens have been seen from 25 counties in Oregon and 32 counties in Washington. Collection dates range from January to November. This species inhabits a variety of aquatic habitats ranging from ditches, small streams, and ponds to large rivers and lakes.

Geographic range. The distribution of *G. remigis* is unclear because of confusion over the proper identity of this species. *Gerris remigis* has been reported from the 48 contiguous states, Canada, Mexico, and Guatemala. However, specimens from different geographical regions display noteworthy differences regarding color, phallic structure, and size (Michel, 1962). An extensive study of specimens from many geographical locations and a review of type material is needed to determine the true status and distribution of this species.

***Gerris (Gerris) buenoi* Kirkaldy**
(Figures 1,6,17)

***Gerris buenoi* Kirkaldy 1911:246.** Original description: No holotype designated.

***Gerris buenoi*, Menke and Polhemus 1973:257.** Lectotype female designated: Fort Collins, Colorado (California Academy of Sciences).

This species is easily distinguished by its small size (males, 6.6 to 7.5 millimeters; females, 7.6 to 8.1 millimeters) and the presence of a

pale stripe on the anterolateral margin of the pronotum. Sternum VIII of the male is as broad as long. The notch at the apex of male sternum VII is subrectangular (Figure 6). The posterolateral angles of female tergum VII are obliquely truncate, not prolonged into spinelike projections (Figure 1). Macropterous and brachypterous forms occur in the Pacific Northwest. Hoffman (1924) studied the life cycle, food habits, and habitats of *G. buenoi* in Minnesota. Spence and Scudder (1980) reported a bivoltine life cycle for this species in British Columbia, Canada. Larvae have been described and illustrated by Scudder and Jamieson (1972) and Calabrese (1974a).

Oregon and Washington records (Figure 17). *Gerris buenoi* is known from seven counties in Oregon and 16 counties in Washington. Specimens have been collected year round in Oregon. This species is an inhabitant of ponds and small lakes, and seems to prefer shallow shoreline waters with abundant, thin-stemmed, emergent vegetation (Spence and Scudder, 1980).

Geographic range. Transcontinental in northern United States and southern Canada. Specimens have been taken as far south as Colorado (Drake and Harris, 1928) and Macdoel, California (Polhemus and Chapman, 1979).

***Gerris (Gerris) gillettei* Lethierry and Severin**
(Figures 2,7,8,18)

***Limnotrechus productus* Uhler 1895:61.** Original description: Holotype female: Fort Collins, Colorado (Colorado State University). (Preoccupied).

***Gerris gillettei* Lethierry and Severin 1896:60.** (New name).

This species is similar to *G. incognitus* but can be distinguished from the latter by the presence of silver spots on the dorsolateral margins of the abdomen. Males lack lateral tufts of long hairs on sternum VIII. The pale, dorsolateral stripe on the abdomen of the female is confined to segments V, VI, and VII (Figure 2). Males and females are similar in body length (9.0 to 10.6 millimeters). Apterous and macropterous forms have been taken in the Pacific Northwest. The abdomens of apterous males are strongly tapered in comparison to those of macropterous males. Apterous males also have shorter lateral spines on tergum VII (Figures 7, 8). Notes on the biology of *G.*

gillettei were given by Callahan (1974). The larvae of this species have not been described.

Oregon and Washington records (Figure 18). This species is found east of the Cascade Range, predominantly in ponds and lakes. Specimens have been seen from six counties in Oregon and four counties in Washington. Collection dates range from April to October.

Geographic range. California, Colorado, Montana, Oregon, Texas, Utah, Washington (Drake and Harris, 1934), Wyoming (Kuitert, 1942), Nevada (Polhemus and Chapman, 1979).

***Gerris (Gerris) incognitus* Drake and Hottes**
(Figures 3,9,10,19)

***Gerris incognitus* Drake and Hottes 1925a:73.** Original description: Holotype male: Kaslo, British Columbia (United States National Museum).

Gerris incognitus is a moderate-sized species (males, 6.7 to 10.0 millimeters; females, 8.6 to 11.0 millimeters) with a pale, anterolateral stripe on the pronotum. Males have distinct, lateral tufts of long hairs on sternum VIII (Figures 9,10). The pale, dorsolateral stripe on the abdominal sterna of the female extends the length of the abdomen (Figure 3). Macropterous specimens outnumbered apterous individuals 2:1 in material examined from Oregon and Washington. Macropterous and apterous males differ with respect to the shape of the terminal abdominal segments (Figures 9,10). Callahan (1974) studied the biology of *G. incognitus* in the San Francisco Bay area of California. The larvae of this species have been described and illustrated by Scudder and Jamieson (1972) and Spence and Scudder (1978).

Oregon and Washington records (Figure 19). This species is known from 16 counties in Oregon and 17 counties in Washington. Specimens were captured from February to November. *Gerris incognitus* is primarily an inhabitant of ponds and lakes but also occurs on streams and rivers in the Pacific Northwest.

Geographic range. British Columbia, California, Idaho, Montana, Oregon, Washington (Drake and Harris, 1934), Colorado, Wyoming (Kuitert, 1942), Nevada (Polhemus and Chapman, 1979). This species was also reported from Quebec, Canada, by Drake and Harris (1934).

***Gerris (Gerris) incurvatus* Drake and Hottes**

(Figures 11,12,14,20)

***Gerris incurvatus* Drake and Hottes 1925a:72.** Original description: Holotype male: Bozeman, Montana (United States National Museum).

Body length (males, 8.7 to 9.6 millimeters; females, 9.0 to 10.7 millimeters), coupled with the absence of a pale stripe on the anterolateral margin of the pronotum, separate this species from other *Gerris* species in Oregon and Washington. Females have the lateral spines of tergum VII abruptly incurved. This species is usually macropterous but a few brachypterous forms have been examined from Oregon. Kuitert (1942) reported the occurrence of some apterous specimens in the University of Kansas collection. Macropterous and brachypterous males differ with respect to the shape of the terminal abdominal segments (Figures 11,12). No information is available on the biology of *G. incurvatus*, but the larvae have been described by Scudder and Jamieson (1972).

Oregon and Washington records (Figure 20). Specimens have been examined from 17 counties in Oregon and 24 counties in Washington. Collection dates range from March to October. This species is usually found around the margins of ponds and small lakes.

Geographic range. British Columbia, California, Idaho, Montana, Oregon, Washington (Drake and Harris, 1934), Texas, Wyoming (Kuitert, 1942), Nevada (Polhemus and Chapman, 1979). *Gerris incurvatus* also was recorded from Illinois by Drake and Harris (1934), but is not known to occur in Indiana (Deay and Gould, 1936) or Missouri (Froeschner, 1962).

Genus *Limnopus* Stål

***Limnopus* Stål 1868:396.** Type species: *Gerris rufoscutellatus* Latreille 1807:134.

Limnopus was a subgenus of *Gerris* until Andersen (1975) raised it to generic rank. There are four Nearctic species of *Limnopus* but only *L. notabilis* occurs in the Pacific Northwest. *Limnopus dissortis* (Drake and Harris) and *L. canaliculatus* (Say) are widely distributed east of the Rocky Mountains (Drake and Harris, 1934), and *L. nearcticus* (Kelton) is known only from Alaska and the Yukon Territory (Kelton, 1961).

***Limnopus notabilis* (Drake and Hottes)**

(Figures 13,21)

***Gerris notabilis* Drake and Hottes 1925b:46-47.** Original description: Holotype male: Pingree Park, Colorado (United States National Museum).

This slender species is easily recognized by its large size (14.4 to 19.7 millimeters), reddish-brown pronotum, and short first antennal segment. Sternum VII of the male is simply emarginate (Figure 13), not with a posteromedian notch as in *Gerris*. Only the macropterous form of *L. notabilis* is known. The life cycle of *L. notabilis* is univoltine in British Columbia, Canada (Spence and Scudder, 1980). The larvae of this species were described by Scudder and Jamieson (1972).

Oregon and Washington records (Figure 21). Specimens have been seen from 13 counties in Oregon and 19 counties in Washington. Collection dates range from March to September. *Limnopus notabilis* usually inhabits ponds and lakes, but also occurs in slow-moving stretches of moderate to large-sized rivers. On the Fraser Plateau of British Columbia, *L. notabilis* is most abundant in lakes with a surface area less than 2.5 hectares (Spence and Scudder, 1980). Shallow water with abundant, thin-stemmed, emergent vegetation is the preferred habitat.

Geographic range. British Columbia, California, Colorado, Idaho, Iowa, Montana, Oregon, Utah, Washington, Wyoming (Drake and Harris, 1934), Arizona, South Dakota (Kuitert, 1942), Alberta (Brooks and Kelton, 1967).

SUBFAMILY TREPOBATINAE

Genus *Metrobates* Uhler

***Metrobates* Uhler 1871b:108-109.** Type species: *Metrobates hesperius* Uhler 1871b:109.

Members of the genus *Metrobates* are distributed throughout the Western Hemisphere. Five species are represented in the Nearctic Region, but only *Metrobates trux infuscatus* occurs in the Pacific Northwest. The revisions of Anderson (1932) and Drake and Harris (1932) are outdated, and the genus is in need of further revisionary study.

Metrobates trux infuscatus Usinger
(Figures 15,22)

Metrobates trux infuscatus Usinger 1953:178-179. Original description: Holotype male: Putah Creek, Davis, California (California Academy of Sciences).

Metrobates can be distinguished from other gerrids in the Pacific Northwest by its small size (males, 4.0 to 4.3 millimeters; females, 4.3 to 4.6 millimeters), long first antennal segment, and short, flattened abdomen. Males have the second and third antennal segments swollen distally. Only apterous forms have been collected in Oregon, but macropterous individuals have been taken in California (Usinger, 1953). The biology and larvae of this species have not been described.

Oregon and Washington records (Figure 22). Although we have not seen this species from Washington, it probably occurs in some of the larger rivers in the southern portion of the state (e.g., Lewis, Klickitat, Yakima, Snake). *Metrobates trux infuscatus* has been reported from Washington by Polhemus and Chapman (1979) but without a specific locality. **Oregon records:** BENTON CO.: Corvallis, Willamette River, VIII-17-1960; Marys River, 8 miles west Corvallis, VIII and IX-1979. DOUGLAS CO.: South Umpqua River, VII-20-1980. POLK CO.: Luckiamute River, 15 miles north Corvallis, IX-24-1961. *Metrobates trux infuscatus* is probably much more widespread in Oregon than the records indicate. Because of its small size and preference for swift currents in large rivers, *Metrobates* is rarely taken by the casual collector. The Columbia, Deschutes, Grande Ronde, Illinois, John Day, Klamath, and Rogue rivers are likely habitats for this insect in Oregon.

Geographic range. California (Usinger, 1953), Idaho, Oregon, Washington, Wyoming (Polhemus and Chapman, 1979).

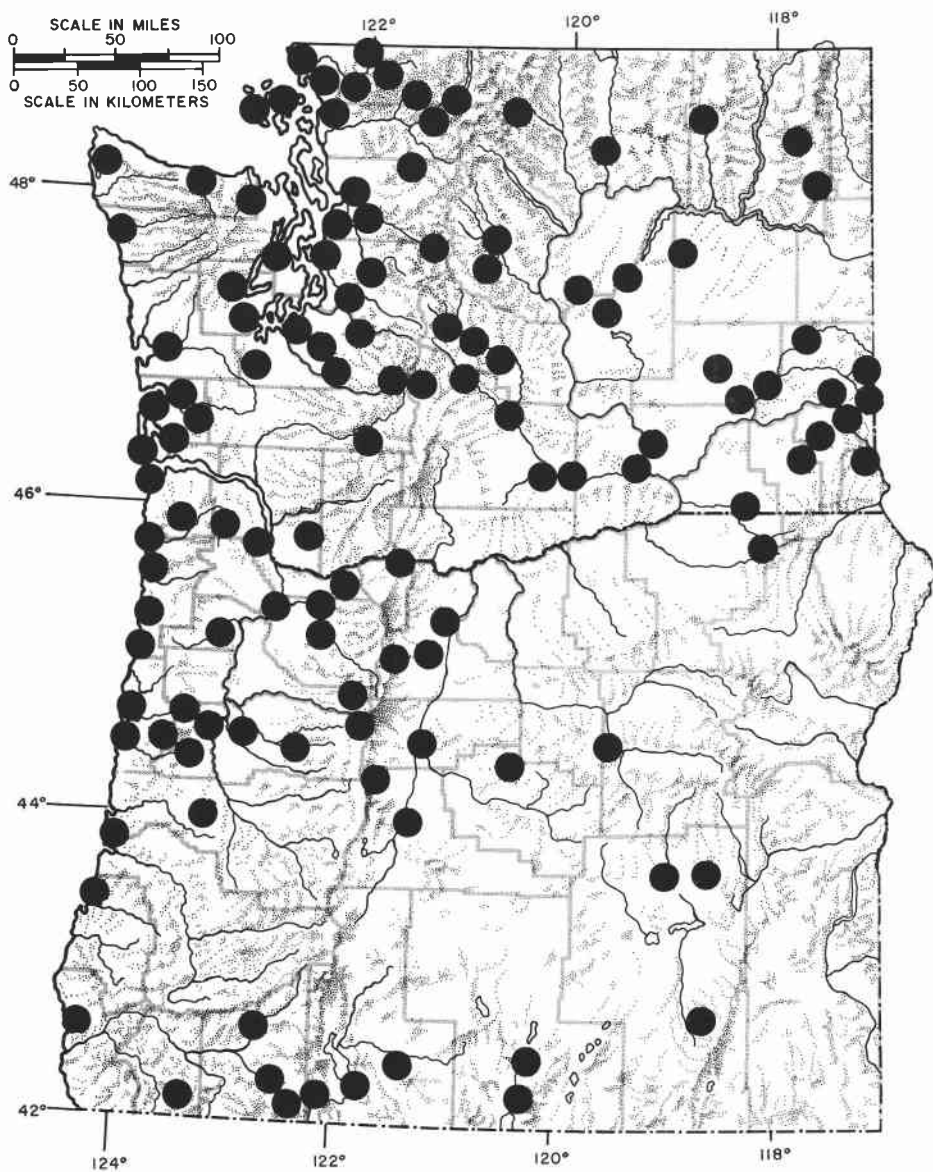


Figure 16. Distribution map of Oregon and Washington, *Gerris remigis*.

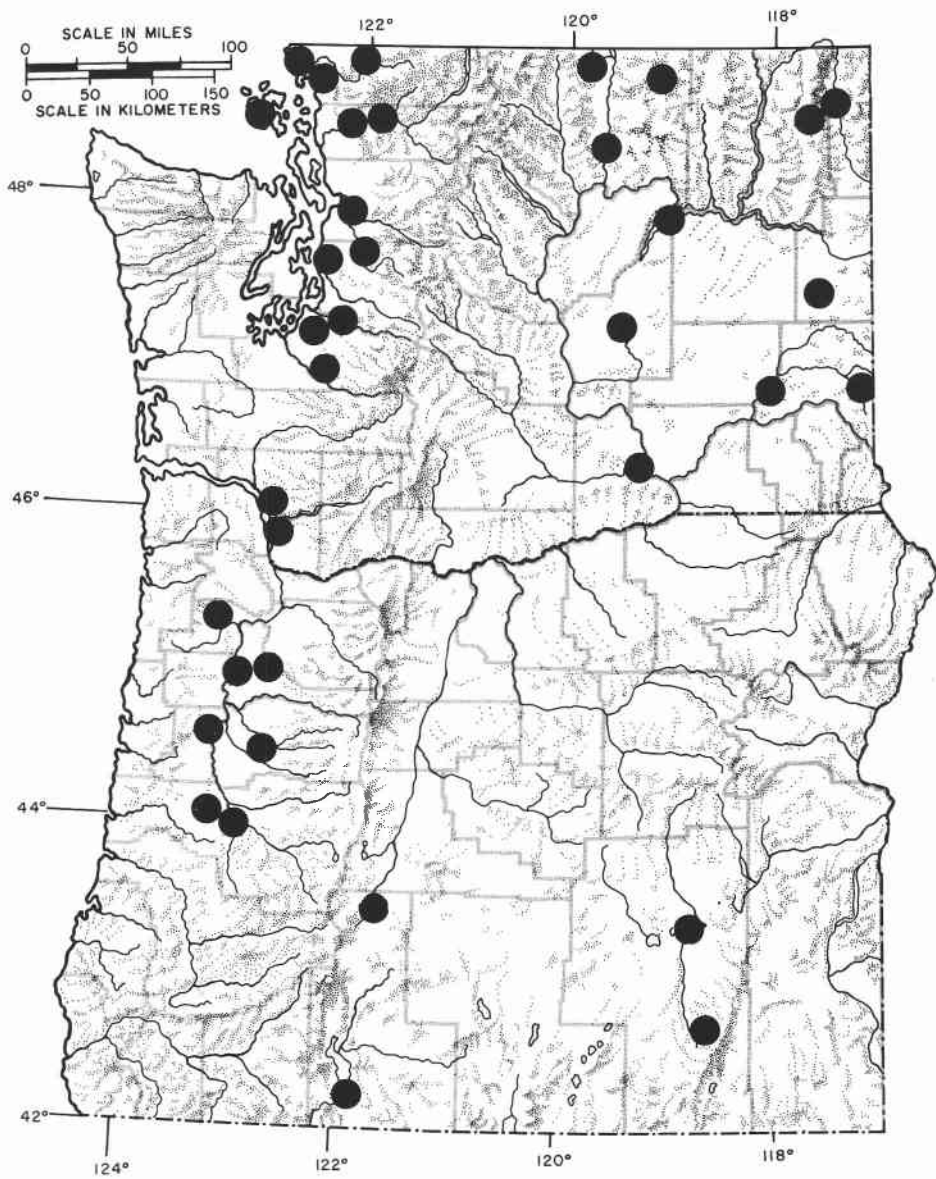


Figure 17. Distribution map of Oregon and Washington, *Gerris buenoi*.

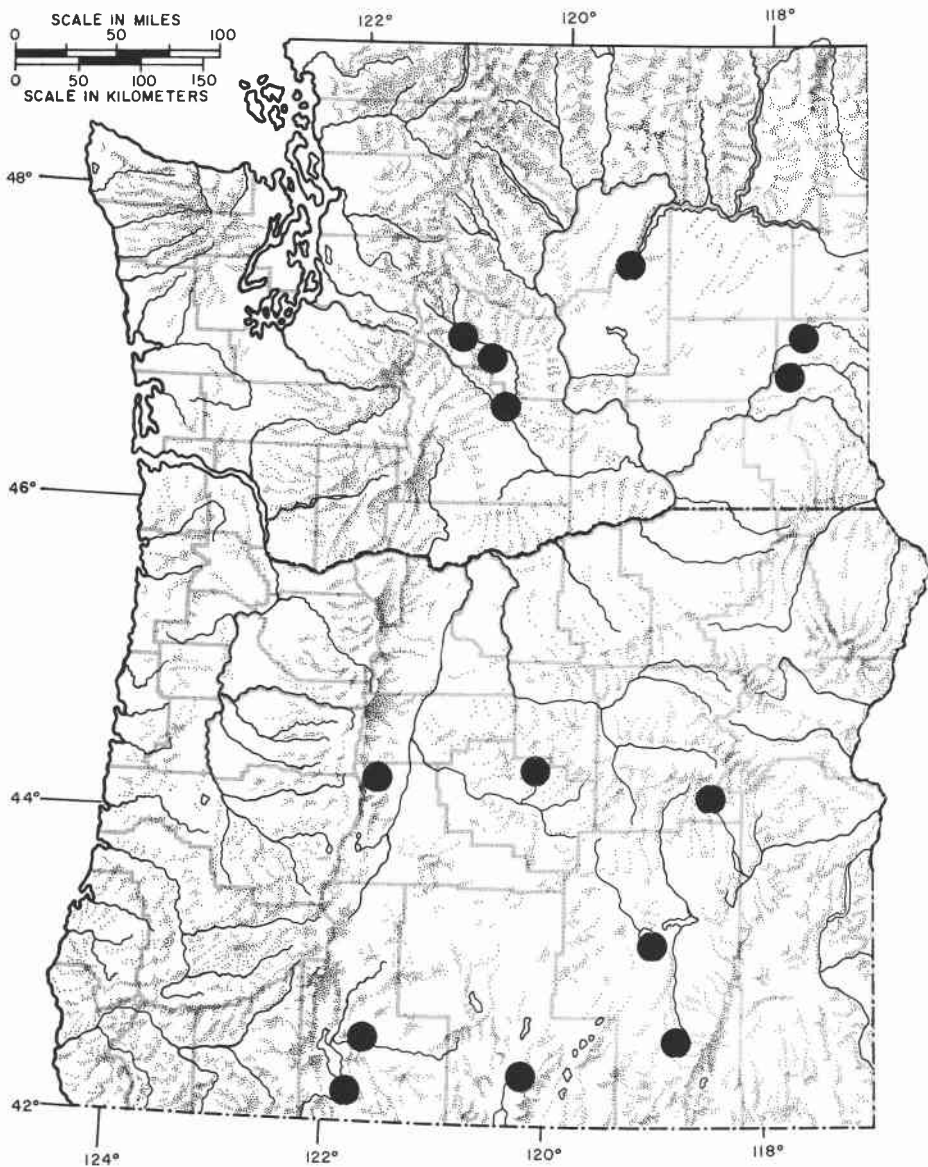


Figure 18. Distribution map of Oregon and Washington, *Gerris gillettei*.

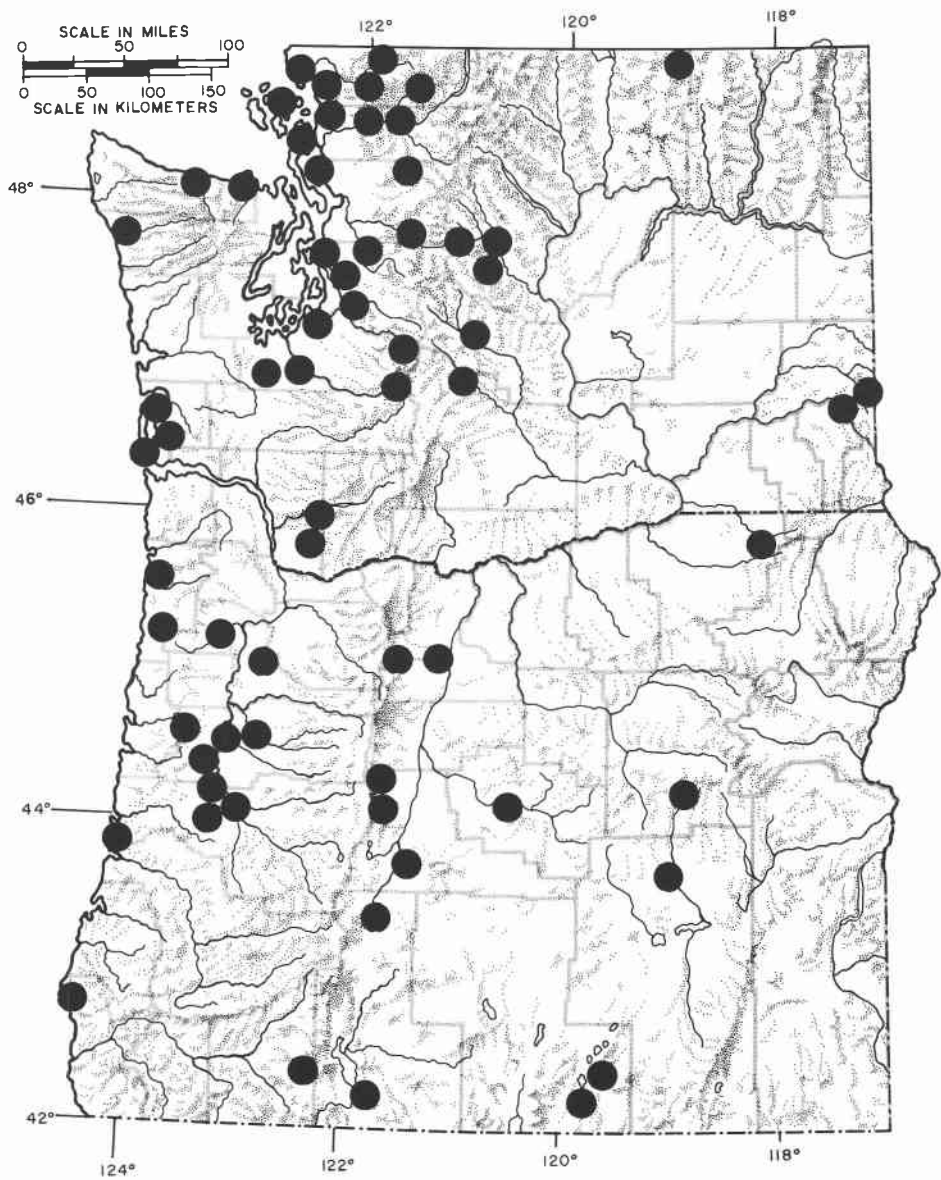


Figure 19. Distribution map of Oregon and Washington, *Gerris incognitus*.

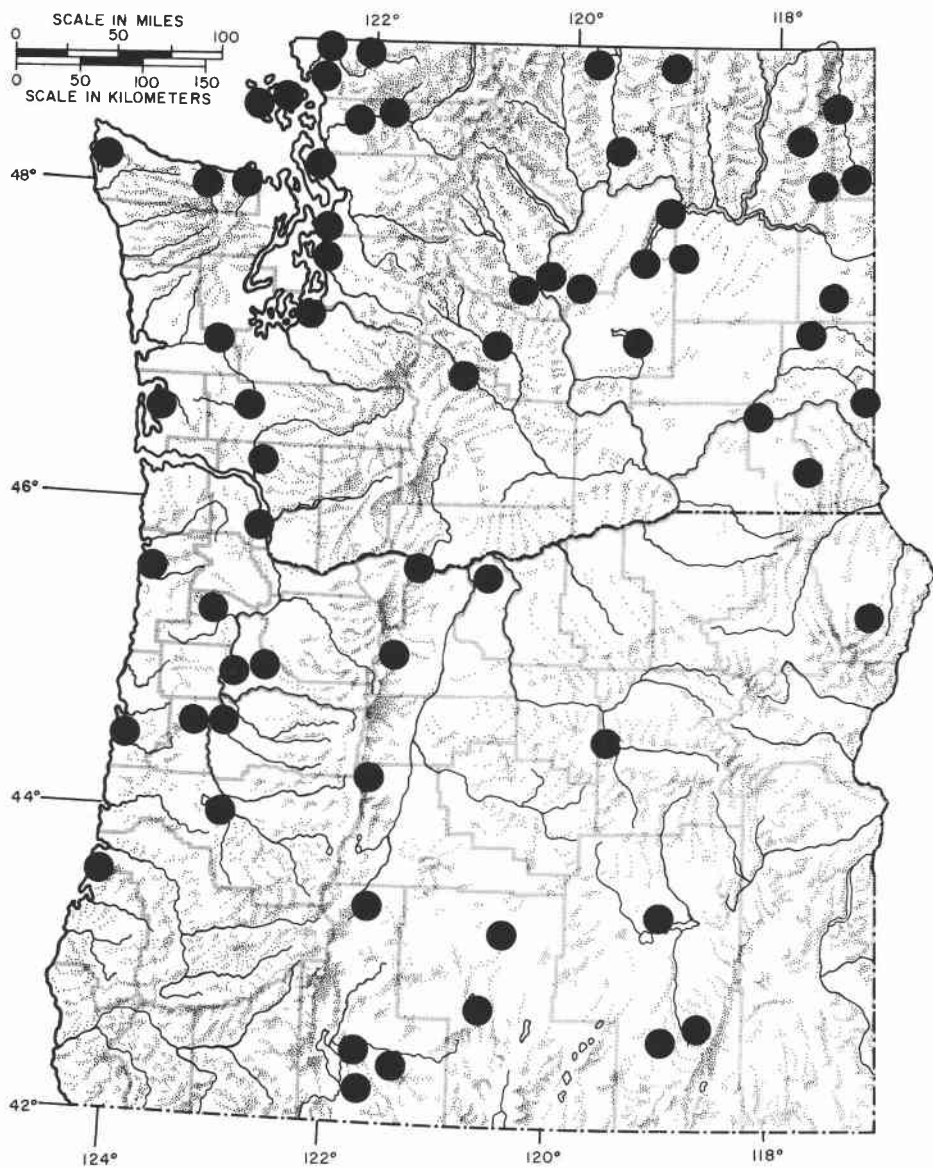


Figure 20. Distribution map of Oregon and Washington, *Gerris incurvatus*.

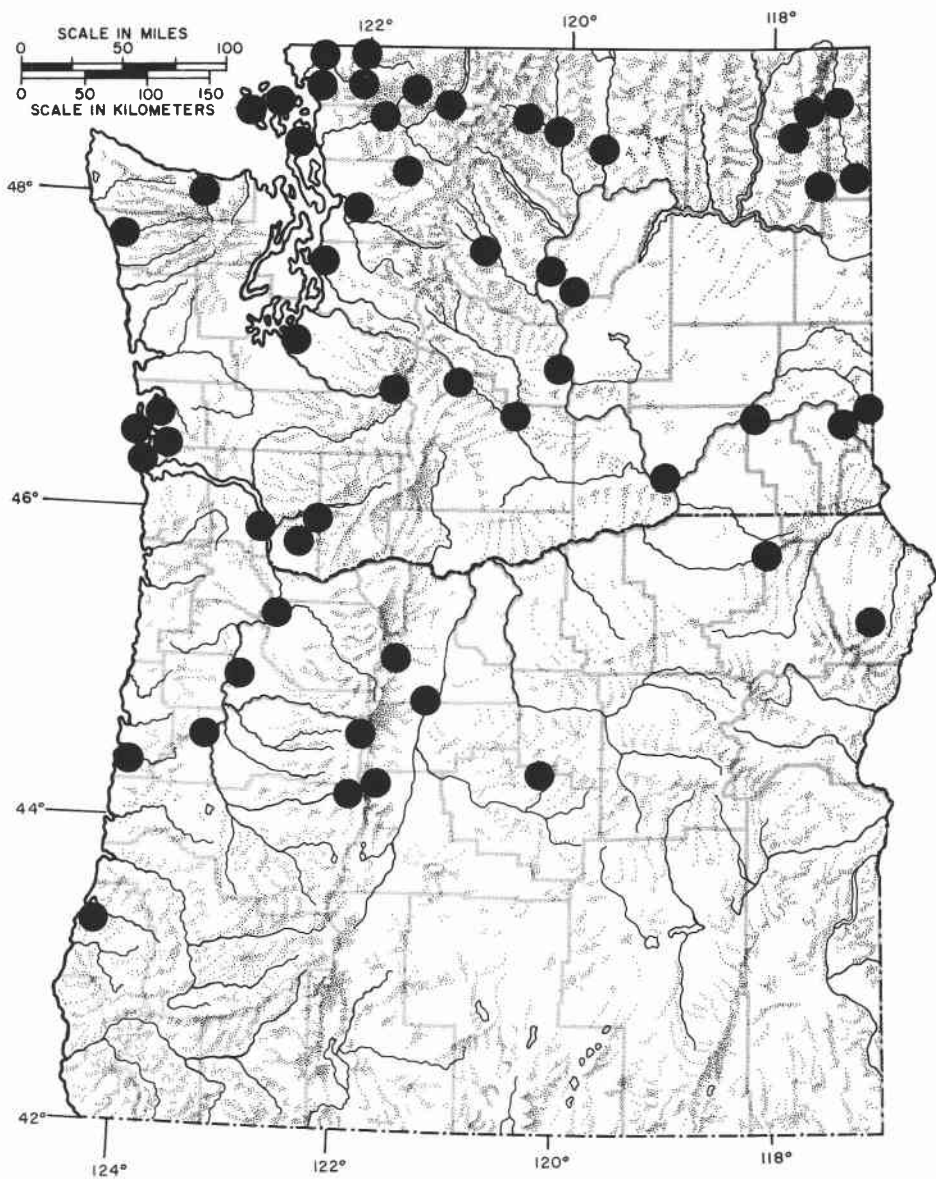


Figure 21. Distribution map of Oregon and Washington, *Limnopus notabilis*.

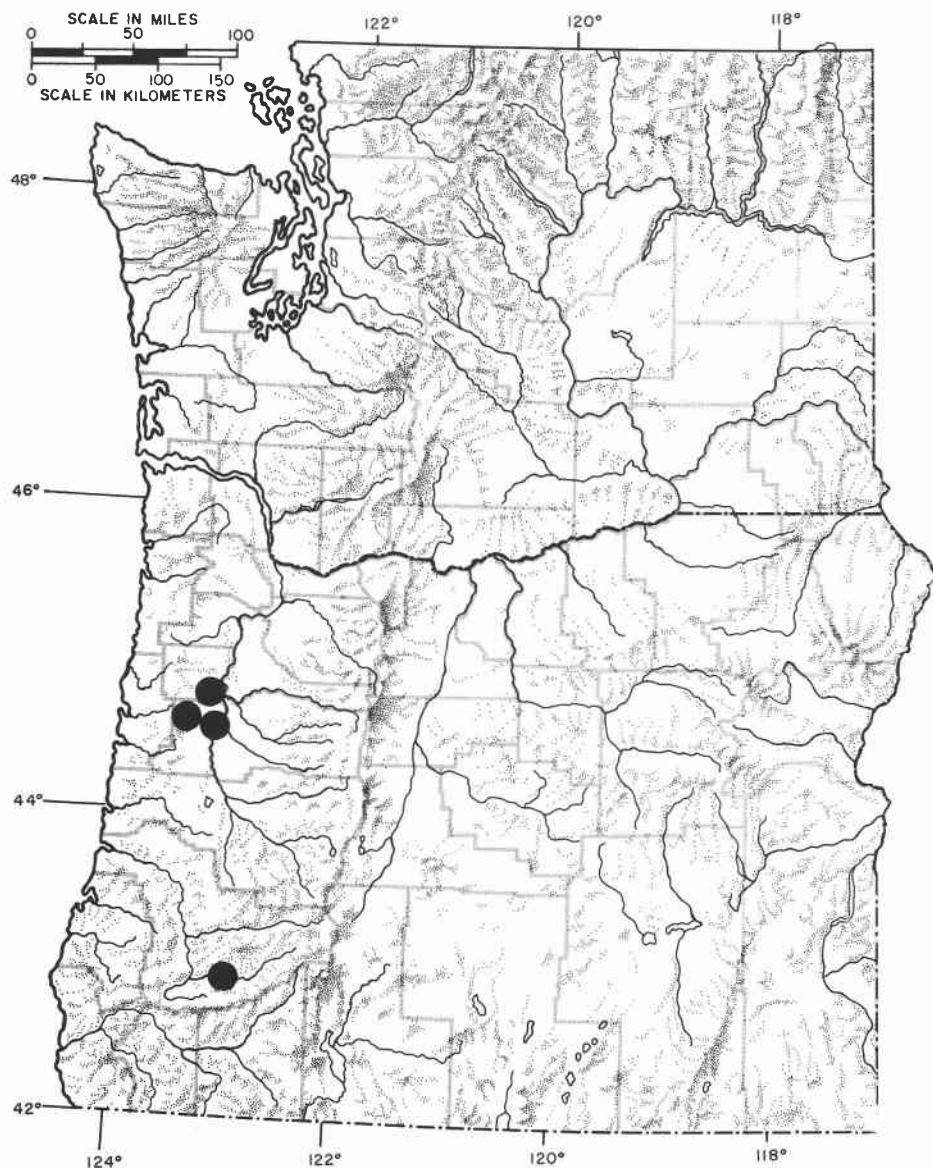


Figure 22. Distribution map of Oregon and Washington, *Metrobates trux infuscatus*.

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