Sampling Riparian Arthropods with Flight-Interception Bottle Traps

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SAMPLING RIPARIAN ARTHROPODS WITH FLIGHT-INTERCEPTION BOTTLE TRAPS

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Creating or restoring habitat for insectivorous birds requires producing an adequate food-supply of arthropods (Williams 1993). Employing traps to estimate arthropod abundances may be easier and less disturbing to wildlife than sampling (e.g., sweeping) vegetation. My objective is to develop an easy and repeatable method for sampling arthropods in habitat created for riparian wildlife, in particular the southwestern willow flycatcher *Empidonax traillii (*Audubon) ssp. *extimus* Phillips. This endangered bird eats a variety of insects and spiders (Wiesenborn & Heydon 2007). I compared relative numbers of arthropods in taxa captured by flight-interception bottle traps and collected from branches on narrow-leaved willows (*Salix exigua* Nutt.) and Fremont cottonwoods (*Populus fremontii* S. Watson) planted for wildlife.

The study site (33°41'N, 114°32'W; elevation 81 m) is a 21.4-ha farm field, planted with shrubs and trees during Mar 2007, near the Colorado River in Riverside County, California, 12 km northeast of Blythe. I sampled arthropods within two 1.0-ha plots of *S. exigua* shrubs, 2-3 m tall, and two 0.6-ha plots of *P. fremontii* trees, 4-5 m tall. Willows, but not cottonwoods, were flowering or seeding. Alfalfa (*Medicago sativa* L.) grows as an understory throughout the site. The site is surrounded by agriculture.

I trapped arthropods in each plot with an aerial-interception trap made of four 2-liter, clear-plastic, carbonated-beverage bottles (Carrel 2002). Bottles were placed together and hung by their caps from a plywood board held 1.5 m aboveground by 2 steel rods. Spiders and insects flew or walked through outward-facing, rectangular openings cut into the bottles and fell into soapy water. Traps were placed near the centers of plots and did not contact branches. Arthropods were trapped during 15-19 May, 4-9 Jun, 8-12 Jul, and 10-13 Aug 2008. Air temperatures measured at the start and end of each trapping period averaged 29°C during 0740-0845 PDT and 35°C during 1510-1821 PDT.

Insects and spiders were collected from plants concurrent with trapping. Sampled plants were randomly selected along rows extending 40 m north and south from each trap. I collected arthropods by sweeping a 1.4-m long, fine-mesh net (field insect-cage cover, Bioquip, Gardena, CA), held open with a 0.8-m diameter metal hoop, over a 1-m long, arbitrarily-selected branch. I constricted the net around the base of the branch and fumigated the enclosed arthropods with 43 g of aerosol insecticide (0.2% tetramethrin + 0.4% permethrin, Hot-Shot Fogger©, United Industries, St. Louis, MO). I shook the arthropods into a 40-dram plastic container, attached by a rubber band to a cut corner of the net, and cut and weighed (±2 g) the sampled branch with a 300-g capacity spring scale. Arthropods were collected from 1 branch each on a different shrub or tree in each plot on 8 dates (16 & 27 May, 9 & 10 Jun, 7 & 8 Jul, and 11 & 12 Aug 2008).

Spiders and insects were identified to order. Insects in Hemiptera and Diptera were identified to suborder, and bees (Apoidea) were distinguished from other Hymenoptera. Numbers of arthropods in traps were divided by numbers of days (n = 3-5) during each trapping period. Numbers of arthropods on branches in each plot were summed across dates in each month and divided by total masses of sampled branches. Adjusted numbers of arthropods from traps and branches were paired by month, producing 8 pairs (2 plots × 4 months) in each plant species. Associations between adjusted numbers of arthropods from traps and branches across taxa on each plant species and within taxa on both plant species were measured with Spearman rank correlation coefficients. I calculated coefficients with SYSTAT (version 10.2, Richmond, CA) and their test statistics (Neter et al. 1996). Coefficients within taxa were calculated only if arthropods were taken from traps and branches.

Flight-interception traps within willows captured 176 arthropods, and those within cottonwoods captured 221 arthropods. An average of 6.2 insects or spiders was captured per trap per day. Trapped arthropods (Fig. 1) were mostly Araneae (spiders) followed by Thysanoptera. I collected 155 arthropods from 16 willow branches totaling 4.7 kg and 205 arthropods from 16 cottonwood branches totaling 4.5 kg. Most arthropods collected from branches (Fig. 1) were Araneae followed by Homoptera and Heteroptera. Most homopterans on branches were Cicadellidae followed by Aphididae.

Relative numbers of arthropods in taxa captured by traps were similar to those collected on branches. Arthropod abundances across taxa (n = 15) from traps and branches were positively associated within plots of *S. exigua* ($r_s = 0.42$, $t^* = 5.07$, $P < 0.001$, $n = 120$) and *P. fremontii* ($r_s = 0.33$, $t^* = 3.82$, $P < 0.001$, $n = 120$). Within taxa, numbers of

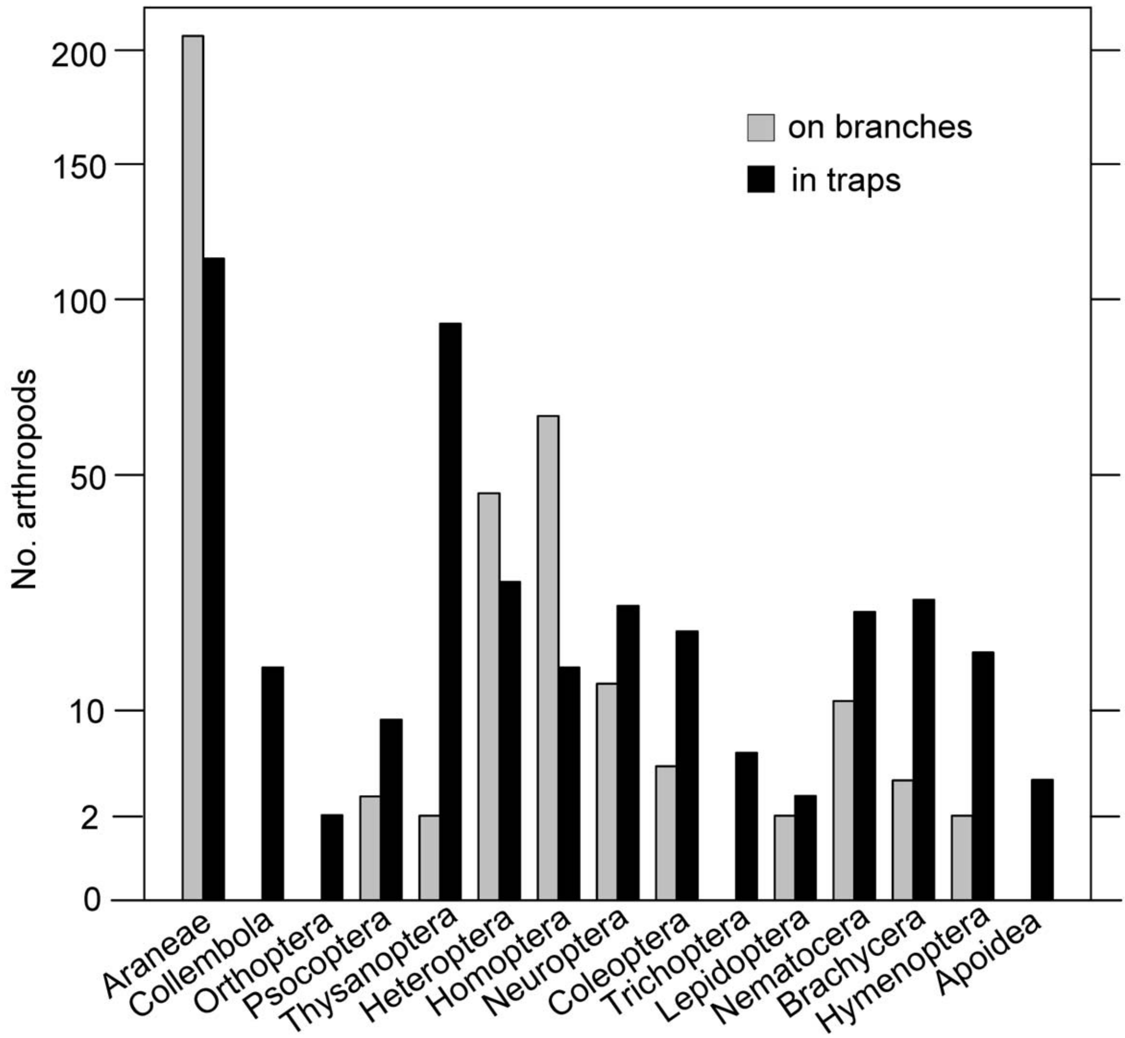

Fig. 1. Numbers of arthropods in taxa collected from branches on, and captured in flight-interception bottle traps among, planted *Salix exigua* shrubs and *Populus fremontii* trees during May-Aug 2008 near Blythe, California. *Y*-axis is square-root scale.

arthropods from traps and branches on both plant species were associated only in Homoptera (Fig. 2). Cicadellidae were the most abundant homopterans in traps, similar to branches, but Delphacidae, Membracidae, and Aphididae also were captured. A weak and nonsignificant association between traps and branches was detected in Nematocera (Fig. 2).

Flight-interception bottle traps were more effective in estimating relative abundances across, rather than within, taxa of arthropods collected on riparian plants. Abundances of Homoptera in traps generally paralleled those on branches, despite the low numbers of trapped homopterans compared with other taxa. Homoptera can be an important diet component of insectivorous birds. For example, leafhoppers were the most-frequent arthropods eaten by southwestern willow flycatchers in several plant communities (Wiesenborn & Heydon 2007). The only limitation of bottle traps encountered was the short trapping-periods required to avoid decomposition of specimens. High air temperatures contributed to this problem. Adding a nontoxic preservative, such as propylene glycol (Thomas 2008) to the water within traps should allow extended collecting without harming wildlife.

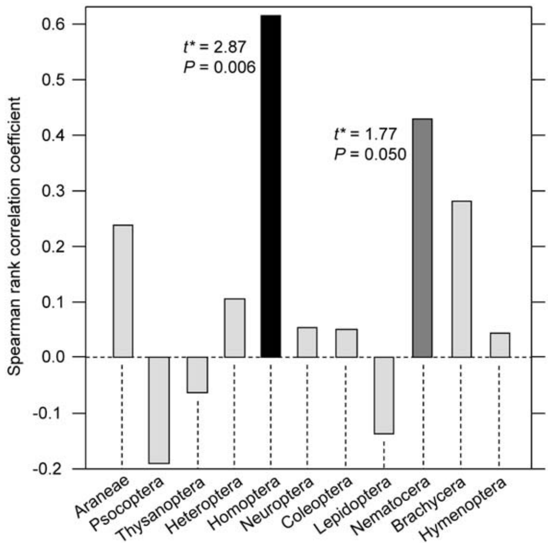

Fig. 2. Associations between numbers of arthropods in taxa collected from branches on, and captured in flight-interception bottle traps among, planted *Salix exigua* shrubs and *Populus fremontii* trees during May-Aug 2008 near Blythe, California. Labels are tests of association (n = 16). Probabilities of association in other taxa are > 0.1 (n = 16).

Summary

Abundances of arthropods captured in flight-interception bottle traps and on branches within plots of narrow-leaved willows and Fremont cottonwoods were associated across 15 taxa (mostly orders) collected. Abundances within taxa were associated only in Homoptera. These traps may provide a simple and economical method for sampling arthropods in created riparian habitat.

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