

Mammal Fleas (Siphonaptera: Ceratophyllidae) New for Alaska and the Southeastern Mainland Collected During Seven Years of a Field Survey of Small Mammals

GLENN E. HAAS¹, JAMES R. KUCERA², AMY M. RUNCK³,
STEPHEN O. MACDONALD⁴ and JOSEPH A. COOK⁴

ABSTRACT

Ten taxa of mammal fleas were among 124 collection records from 12 host species (one shrew, nine rodents and two carnivores), at 72 localities on the southeastern Alaska mainland in 1989 and during an extensive survey of mammals in 1992-1995 and 1997-1999. *Megabothris asio megacolpus* (Jordan) ex *Microtus pennsylvanicus* (Ord), *Malariaeus telchinus* (Rothschild) ex *Peromyscus keeni* (Rhoads) and *Clethrionomys gapperi* (Vigors) are new fleas for Alaska. *Orchopeas caedens* (Jordan) ex *Tamiasciurus hudsonicus* (Erxleben) is a new flea for southeastern Alaska. *Synaptomys borealis* (Richardson) is a new host record for *Opisodasys k. keeni* (Baker). The other six taxa of fleas collected were *Hystrihopsylla dippieii spinata* Holland, *H. o. occidentalis* Holland, *Catallagia charlottensis* (Baker), *Ceratophyllus ciliatus protinus* Jordan, *Megabothris abantis* (Rothschild) and *Opisodasys vespertalis* (Jordan). Of these, *H. o. occidentalis*, *C. charlottensis* and *M. abantis* have seven new host records for the southeastern Alaska mainland. Distribution patterns of the fleas and their host relationships in North America are discussed.

Key Words: fleas, Siphonaptera, mammals, Alaska

INTRODUCTION

The advancement in knowledge of the fleas of southeastern Alaskan mammals has lagged behind that of Alaska west of the Yukon Territory in part due to difficulties of travel in the fragmented, rugged coastal to montane topography. An extensive survey by the University of Alaska Museum, Fairbanks, of shrews, mice, voles, lemmings and some larger mammals, such as arboreal squirrels during 1992-1995 (MacDonald and Cook 1996) and 1997-

1999 included the collection of fleas. This survey produced 124 collection records (including three from an earlier study of marten) at 72, mostly new, localities. Two fleas of mice and voles new for Alaska, one squirrel flea new for southeastern Alaska, seven new host records for three other fleas for the southeastern Alaska mainland, and one new lemming host record for a mouse flea were added (Table 1).

MATERIALS AND METHODS

The fieldwork for the mammal survey was conducted as described by Murrell *et al.* (2003) on ticks collected from some of the same mammal specimens that produced

some of the fleas reported on here. Full data for the mammal specimens can be obtained at <http://arctos.database.museum> by tracking the University of Alaska Museum of the

¹ PO Box 60985, Boulder City, NV, United States 89006

² Associated Regional and University Pathologists, Inc., Salt Lake City, UT, United States

³ Biology Department, Idaho State University, Pocatello, ID, United States

⁴ Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM, United States

Table 1.

Mammalian hosts of the 10 taxa of fleas with present records for the southeastern Alaska mainland.

Mammal	Fleas
<i>Sorex cinereus</i> Kerr, masked shrew	<i>Hystrichopsylla o. occidentalis</i> Holland ¹
<i>Tamiasciurus hudsonicus</i> (Erxleben), red squirrel	<i>Ceratophyllus ciliatus protinus</i> Jordan <i>Orchopeas caedens</i> (Jordan) ²
<i>Glaucomys sabrinus</i> (Shaw), n. flying squirrel	<i>Opisodasys vespéralis</i> (Jordan)
<i>Peromyscus keeni</i> (Rhoads), Keen's mouse	<i>H. o. occidentalis</i> <i>Catallagia charlottensis</i> (Baker) <i>C. c. protinus</i> <i>Megabothris abantis</i> (Rothschild) <i>Opisodasys k. keeni</i> (Baker) <i>Malaraeus telchinus</i> (Rothschild) ³
<i>Clethrionomys rutilus</i> (Pallas), n. red-backed vole	<i>H. o. occidentalis</i> ¹ <i>C. c. protinus</i> <i>M. abantis</i>
<i>C. gapperi</i> (Vigors), s. red-backed vole	<i>H. o. occidentalis</i> ¹ <i>C. charlottensis</i> <i>M. abantis</i> ¹ <i>M. telchinus</i> ³
<i>Microtus pennsylvanicus</i> (Ord), meadow vole	<i>C. charlottensis</i> ¹ <i>M. abantis</i> ¹ <i>Megabothris asio megacolpus</i> (Jordan) ³
<i>M. longicaudus</i> (Merriam), long-tailed vole	<i>M. abantis</i>
<i>Synaptomys borealis</i> (Richardson), n. bog lemming	<i>M. abantis</i> ¹ <i>O. k. keeni</i> ⁴
<i>Zapus hudsonius</i> (Zimmerman), meadow jumping mouse	<i>M. abantis</i>
<i>Martes americana</i> (Turton), marten	<i>Hystrichopsylla dippei spinata</i> Holland
<i>Mustela vison</i> Schreber, mink	<i>H. d. spinata</i> ⁵

¹ New host record for southeastern Alaska.

² New for southeastern Alaska.

³ New for Alaska.

⁴ New host record.

⁵ Probably from marten.

North AF number listed under Material Examined.

In the laboratory the fleas were prepared for microscopic study by transferring them from the labeled field vials of 70% ethanol to a rinse in distilled water, then submerged in 10% KOH until sufficiently bleached (1 hr to 3 days), rinsed two or three times in distilled water, dehydrated in graduated ethanols (to 90%), degreased in oil of wintergreen, rinsed in xylene and mounted in Canada balsam on labeled microscope slides. Voucher specimens were deposited

in the United States National Museum (USNM) and the Canadian National Collection of Insects and Arachnids (CNC). Following is a list of collectors and their acronyms used in this paper: C. J. Conroy (CJC), J. A. Cook (JAC), J. Foreit (JF), R. Heinen (RH), S. O. MacDonald (SOM), S. R. Peterson (SRP), A. M. Runck (AMR), C. T. Seaton (CTS), K. D. Stone (KDS), A. A. Tsvetkova (AAT) and M. J. Wike (MJW). Specimens without acronyms are in the collections of the authors.

SPECIES ACCOUNTS

HYSTRICHOPSYLLIDAE

Hystrihopsylla dippiei spinata Holland, 1949

Material examined: USA: AK: all from Juneau area; 30.4 km NW, between Amalga Harbor and Windfall Lake, 1♀ ex *Martes americana* (Turton), 13-xii-89, SRP; ca. 34 km NW, Yankee Basin trail, 1♀ same host, 30-xii-89, SRP; Eagle River trail, 1♀ ex *Mustela vison* Schreber or *Martes americana*, 30-xii-89, SRP.

These three records continue a series begun in 1987 with the first record reported by Haas *et al.* (1989). The range of this large flea was only extended ca. 3.3 km farther NW of Juneau. Although most hystrihopsyllids are associated with insectivores or rodents, this flea infests mustelids. The new records provide support for marten as the true host. The Eagle River mink and marten were packed together in the same container. Only one valid record (1♀) for mink (Haas *et al.* 1979) exists. Therefore, the original host for the Eagle River record may have been the marten. Thus, 24 specimens (8♂♂, 16♀♀) and 18 collection records (Haas *et al.* 1978, 1979, 1980, 1982, 1989, present study) in southeastern Alaska including islands are now known. Except for one mink, two humans, and the uncertain host record noted above, all host specimens were marten. There are no Alaskan records from shrews or rodents although such collections have been made in British Columbia and Oregon (Holland 1957; Hopkins and Rothschild 1962; Lewis *et al.* 1988). Most specimens were from skunks (*Spilogale* spp.). Holland (1949) also had two females from marten and ermine (*Mustela erminea*) from Vancouver Island that he excluded from the series of *H. spinata* new species.

Hystrihopsylla occidentalis occidentalis Holland, 1949

Material examined: USA: AK: Berg Bay, 56°21'49"N, 132°00'29"W, 1♀ ex *Clethrionomys gapperi* (Vigors) [AF 21819], 4-viii-97, CTS. Echo Cove, 59°31'45"N, 134°21'58"W, 1♂ ex *Clethriono-*

mys rutilus (Pallas) [AF21587], 16-vii-97, CTS. Frosty Bay, S side, 56°03'28"N, 131°58'01"W, 1♀ ex *C. gapperi* [AF22904], 8-viii-97, CTS. Klukwan, 17 km W & 30 km N, Kelsall River drainage, 1♂, 1♀ ex *Sorex cinereus* Kerr [AF8096], 30-vii-94, JAC, SOM. Taku River, Canyon Island, 58°33'N, 133°41'W, 1♀ ex *Peromyscus keeni* (Rhoads) [AF8272], 17-vii-94, JAC; same data but *C. gapperi* [AF2856], 16-vii-94, JAC.

This small relative of *H. d. spinata* is a hygrophilous parasite of shrews, voles (type host: *Clethrionomys gapperi*) and mice and occurs in a long narrow range with a noticeable concentration of collection localities along the coast from northern California to southwestern Alaska (Holland 1949: Map 6; Campos and Stark 1979: Fig. 60; Holland 1985: Map 12; Lewis *et al.* 1988: p. 63). The six new mainland records for five new localities as well as the four earlier records indicate that this flea is uncommon on trapped hosts, in accordance with its behaviour like a nest flea. Consequently, the majority of the fleas reside in nests of the hosts. For example, from two nests of *Microtus oeconomus* (Pallas) on the Chilkat Peninsula, Haas (1982) collected a total of 5♂♂ and 4♀♀ *H. o. occidentalis*. This exceeds the total of 2♂♂ and 5♀♀ from the six trapped host specimens listed above. The predominance of nest populations was confirmed for *H. occidentalis linsdalei* Holland with large samples of nests (179) and hosts (877) during a 2.5-y survey in northern California by Stark (2002). He reported a seasonal association with higher populations in nests of voles than on trapped voles except during a short time in fall.

Sorex cinereus is a new host record for southeastern Alaska. Haas *et al.* (1980) listed *Sorex monticolus* Merriam (as *Sorex vagrans* Baird - see MacDonald and Cook 1996) as a host of *H. o. occidentalis* near Yakutat. The two species of red-backed voles, *C. gapperi* and *C. rutilus*, are also new host records for *H. o. occidentalis* in southeastern Alaska.

CTENOPHTHALMIDAE

Catallagia charlottensis (Baker, 1898)

Material examined: Hosts were *Peromyscus keeni* unless otherwise indicated. USA: AK: Gwent Cove, 54°57'00"N, 130°20'00"W, 1♀ [AF26560], 17-viii-98, SOM. Haines, Chilkoot Lake, 59°18'39"N, 135°34'02"W, 2♀♀ [AF4593], 11-vi-93, MJW. Klukwan, 5 km W of, Klehini River, 59°24'39"N, 136°00'09"W, 1♀ ex *Microtus pennsylvanicus* (Ord) [AF8036], 29-vi-94, JAC. Mosquito Lake, 59°27'08"N, 136°01'38"W, 2♀♀ [AF28822], 5-vi-99, AMR. Reflection Lake, W side, 56°00'33"N, 131°34'32"W, 1♀ ex *Clethrionomys gapperi* [AF29075], 30-vi-99, AMR. Rudyerd Bay, Point Louise, 55°32'42"N, 130°52'13"W, 1♀ ex *C. gapperi* [AF29307], 10-vii-99, AMR. Rudyerd Bay, 55°33'16"N, 130°51'33"W, 1♀ [AF29381], 12-vii-99, AMR. Smeaton Bay mouth, 55°18'09"N, 130°50'38"W, 2♀♀ [AF29276], 9-vii-99, AMR. Taku River, Canyon Island, 58°33'N, 133°41'W, 1♂ [AF8274], JAC; same data but 1♀ [AF8276]. Turner Creek, 58°10'40"N, 133°57'30"W, 1♀ [AF10126], 20-vii-94, SOM, JAC, CTS. Walker Cove, Ledge Point, 55°42'20"N, 130°53'34"W, 1♀ [AF29458], 14-vii-99, AMR.

The distribution patterns of this hygrophilous nest flea and of *H. o. occidentalis* are similar (Holland 1963: Fig 2, 1985: Map 14; Lewis *et al.* 1988: p. 82; Haas *et al.* 1989: Fig 2; Lewis and Haas 2001). In southeastern Alaska both fleas have been recorded from *P. keeni* (as *P. maniculatus*) and *M. oeconomus* (nests) at mainland localities (Haas 1982; Haas *et al.* 1982; Holland 1985). Our new records of these two fleas and a record of *C. charlottensis* ex *C. rutilus* in Haines (Holland 1985) linked the fleas as parasites of *C. rutilus*, *C. gapperi*, and *M. pennsylvanicus* on the mainland. Thus far however, only *C. charlottensis* is known from *M. longicaudus* in our survey area (Haas *et al.* 1982). Another similarity in our records for *H. o. occidentalis* and *C. charlottensis* from trapped hosts was the infrequency of more than a single specimen collected per host. The larger number of *H. o. occidentalis* specimens in nests of *M.*

oeconomus than on all trapped hosts applies to *C. charlottensis* for its occurrence in the same two nests found along the shore of the Chilkat Peninsula. Both nests were infested with breeding populations from which were collected a total of 13♂♂ (four reared) and 11♀♀ (three reared); an additional male was collected from a third nest. Again, more specimens (25) were collected from nests (3) than those (15) from trapped hosts (12).

CERATOPHYLLIDAE

Ceratophyllus ciliatus protinus Jordan, 1929

Material examined: Hosts were *Tamiasciurus hudsonicus* (Erxleben) unless otherwise indicated. USA: AK: Berg Bay, 56°21'49"N, 132°00'29"W, 4♂♂, 2♀♀ [AF21810], 2-viii-97, CTS. Chickamin River, Wolf Cabin, 55°46'N, 130°53'W, 1♂ [AF4930], 25-vii-93, SOM. Dyea National Historical Park, 59°30'24"N, 135°20'52"W, 1♂, 2♀♀ [AF12532], 2-vii-95, CTS. Gwent Cove, 54°57'00"N, 130°20'00"W, 2♂♂, 1♀ [AF26585], 19-viii-98, SOM. Klukwan, 5 km W, Klehini River, 59°24'39"N, 136°00'09"W, 1♂ [AF8117], 1-vii-94, JAC. Peterson Creek, Juneau Quad., 58°29'N, 134°47'W, 1♀ ex *Clethrionomys rutilus* [AF8243], 11-vii-94, JAC. Rudyerd Bay, 55°33'16"N, 130°51'33"W, 2♀♀ [AF29409], 13-vii-99, AMR. Taku River, Canyon Island, 58°33'N, 133°41'W, 1♂ ex *Peromyscus keeni* [AF8272], 17-vii-94, JAC; same data but 2♂♂ [AF8273]. Walker Cove, Hut Point, 55°42'48"N, 130°54'04"W, 1♂ ex *P. keeni* [AF29442], 13-vii-99, AMR.

This member of the Vancouverian group (Holland 1963) has a typical Northwest Pacific coast distribution similar to two other members of the group, *H. o. occidentalis* and *C. charlottensis* (Haddow *et al.* 1983: Map 17; Holland 1985: Map 71; Lewis *et al.* 1988: p. 179). These authors described the changes of preferred hosts along the coast from south to north with Townsend's chipmunk (*Neotamias townsendii* (Bachman)) in Oregon, Douglas's squirrel (*Tamiasciurus douglasii* (Bachman)) in southwestern British Colum-

bia, and the red squirrel (*T. hudsonicus*) in southeastern Alaska. Originally thought to be the only truly specific flea of the red squirrel in this area of Alaska, this view has been modified as the result of collection of the much wider-ranging true red squirrel flea, *Orchopeas caedens* Jordan, along the Taiya River in 1995 (see below).

Megabothris abantis (Rothschild, 1905)

Material examined: USA: AK: Bartlett Cove, 10 km NW of Gustavus Airport, 58° 27'N, 135°53'W, 1♂ ex *Clethrionomys rutilus* [AF2379], 16-vii-92, collector unknown. Berg Bay, 56°21'49"N, 132° 00'29"W, 1♀ ex *C. gapperi* [AF21819], 4-viii-97, CTS. Chickamin River, Wolf Cabin, 55°46'N, 130°53'W, 1♂ ex *Synaptomys borealis* (Richardson) [AF4973], 26-vii-93, SOM *et al.* Chilkat Peninsula, Mud Bay, 59°09'45"N, 135°21'28"W, 1♂, 1♀ ex *Clethrionomys rutilus* (2) [AF22019, 22020], 6-vii-97, CTS *et al.* Frosty Bay, S side, 56°03'28"N, 131°58'01"W, 1♀ ex *C. gapperi* [AF22904], 8-viii-97, CTS. Klukwan, 5 km W of, Klehini River, 59° 24'39"N, 136°00'09"W, 2♂♂, 1♀ ex *Zapus hudsonius* (Zimmerman) (2) [AF8068, 8070], 30-vi-94, JAC. Nakat Inlet, 54°57'N, 130°45'W, 1♀ ex *C. gapperi* [AF4265], 8-vii-93, JAC, SOM. Rudyerd Bay, 55°33'16"N, 130°51'33"W, 2♀♀ ex *C. gapperi* [AF29315], 10-vii-99, AMR; same data but 1♀ [AF29375], 12-vii-99; same data but 1♀ [AF29408], 13-vii-99; same data but 55°41'58"N, 130° 31'12"W, 1♀ ex *P. keeni* [AF22589], 8-vi-99, RH, AMR. Rudyerd Bay, Point Louise, 55°32'42"N, 130°52'13"W, 4♀♀ ex *C. gapperi* (2) [AF29304, 29307], 10-vii-99, AMR. Salmon River, mouth of Texas Creek, 56°01'37"N, 130°04'14"W, 1♀ ex *P. keeni* [AF12736], 2-viii-95, CTS. Smeaton Bay mouth, 55°18'09"N, 130° 50'38"W, 1♂, 1♀ ex *C. gapperi* [AF29290], 10-vii-99, AMR; same data but 1♂ ex *P. keeni* [AF29292]. Stikine River, Figure 8 Lake, 56°42'N, 132°15'W, 1♀ ex *P. keeni* [AF2628], 14-vii-92, SOM; same data but [AF2650], 15-vii-92. Taku River, Canyon Island, 58°33'N, 133°41'W, 1♂ ex *C. gapperi* [AF8254], 16-vii-94, JAC; same

data but 1♀ [AF8270], 17-vii-94; same data but 1♂, 2♀♀ [AF8271]; same data but 2♀♀ ex *M. pennsylvanicus* [AF8268], 16-vii-94. Turner Creek, 58°10'40"N, 133° 57'30"W, 2♀♀ ex *P. keeni* [AF10126], 20-vii-94, SOM, JAC, CTS; same data but 1♀ ex *C. gapperi* [AF10119]; same data but 1♀ ex *Microtus longicaudus* [AF10120]. Unuk River mouth, 56°05'N, 131°06'W, 1♂ ex *C. gapperi* [AF4359], 20-vii-93, SOM *et al.* Walker Cove, Hut Point, 55°42'48"N, 130° 54'04"W, 2♂♂, 1♀ ex *P. keeni* (2) [AF29428, 29442], 13-vii-99, AMR; same data but 1♀ ex *C. gapperi* [AF29434]. Walker Cove, Ledge Point, 55°42'20"N, 130°53'34"W, 2♀♀ ex *C. gapperi* [AF29416], 13-vii-99, AMR. Willard Inlet, inlet 2 km NW of mouth of, 54°49'N, 130° 39'W, 1♀ ex *P. keeni* [AF4299], 9-vii-93, JAC, SOM. Yakutat, 59°30'47"N, 139° 40'46"W, 1♀ ex *C. rutilus* [AF7769], 26-vii-94, CJC, AAT.

Megabothris abantis is a common vole flea in southern regions of Alaska. Holland (1958) originally grouped it with *C. charlottensis* and *C. c. protinus* because all three have a similar Pacific Coast distribution. Subsequently, he (Holland 1963: Fig. 2) classified *M. abantis* as a member of the Cordilleran Group B because it is not restricted to the coastal strip but ranges widely eastward into the Rocky Mountains (Haddow *et al.* 1983: Map 76, Holland 1985: Map 76).

Other than the closely grouped collection sites on the southeastern Alaska mainland, Holland (1958), Haas *et al.* (1980), Haas (1982), and Haas *et al.* (1982) recorded only six other localities, all northwest of the Taku River: Chilkat Peninsula, near Juneau, Klondike Highway at Moore Creek, Mosquito Lake, Taiya River, and Yakutat. Twenty-nine of our 34 new mainland records of *M. abantis* fill the large void mapped by Haas *et al.* (1989: Fig. 5) southeast of the Taku River with 16 new localities.

The recorded hosts of *M. abantis* on the mainland are *Sorex monticolus* (as *S. vagrans*), *P. keeni* (as *P. maniculatus*), *C. rutilus*, *M. oeconomus* (nests), *M. longi-*

caudus and *Z. hudsonius* (Haas 1982; Haas *et al.* 1982). Thus, three of the seven hosts of our 34 new mainland records of *M. abantis* are new for the region: *C. gapperi* (18), *M. pennsylvanicus* (1), and *S. borealis* (1). *Clethrionomys gapperi* was the most commonly collected mammal infested with this flea and produced 5♂♂ and 20♀♀ fleas, more than half of the 45 fleas (12♂♂, 33♀♀) collected. With the emphasis of the mainland survey on areas south of Juneau, only two *C. rutilus* with fleas (1♂, 1♀) were trapped. The abundance on *C. gapperi* alone, however, was concordant with the classification of host parasitism by Haddow *et al.* (1983) with the top ranking of members of the genus *Clethrionomys* along with *Microtus* as the only major hosts of this flea. Our data for *Microtus* spp., however, were insufficient for analysis with only 3♀♀ fleas ex one *M. pennsylvanicus* and one *M. longicaudus*. Consequently, the second best source of fleas from trapped hosts was *P. keeni* with 11 fleas (3♂♂, 8♀♀) from nine mice. Although *M. abantis* is not a nest flea, as indicated above with *H. o. occidentalis* and *C. charlottensis*, more specimens were found in a series of *M. oeconomus* nests collected on the Chilkat Peninsula shoreline (Haas 1982) than on a larger number of trapped hosts. Four nests were infested with *M. abantis*; of these, two had breeding populations from which were collected a total of 45 fleas (18♂♂ (9 reared), 27♀♀ (13 reared)). With the addition of our specimens, 90 specimens have been collected. The sex ratio of 1♂: 2♀♀ appears typical for *M. abantis*. Marshall (1981) calculated 30% males in a sample of 456 specimens from trapped hosts in New Mexico (Haas *et al.* 1973).

Megabothris asio megalopus (Jordan, 1929)

Material examined: All ex meadow voles, *Microtus pennsylvanicus*. USA: AK: Klukwan, 11 km E & 12 km S, 59° 20'44"N, 135°46'11"W, 1♀ [AF8067], 30-vi-94, JAC. Klukwan, 10 km E & 9 km S, 59°21'58"N, 135°47'58"W, 1♀ [AF8081], 30-vi-94, JAC; same data but [AF8164], 2♂♂, 1♀, 1-vii-94; same data but

[AF8165], 1♀; same data but [AF8185], 1♂, 2-vii-94.

Previously unknown in Alaska, *M. a. megalopus* was first collected (three ♂♂, four ♀♀) in late June and early July 1994 by one of us (JAC) at two localities south-east of Klukwan in one of the small extensions of the range of the host, *Microtus pennsylvanicus*, from Canada into south-eastern Alaska. The range of the host in this area, subspecies *M. p. alcorni* Baker, extends south from southwestern Yukon across northwestern British Columbia and into the Chilkat River valley of Alaska as far south as Haines (Miller and Kellogg 1955).

The distribution of this vole flea coincides almost completely with the range of *M. pennsylvanicus* over much of northern North America from Yukon Territory to Quebec south into the Rocky Mountains and the western Great Lakes (Haddow *et al.* 1983: Map 82; Holland 1985: Map 77). The Stikine and Taku River valleys on the southeastern Alaskan mainland also support populations of *M. pennsylvanicus* (MacDonald and Cook 1996) and may eventually yield additional specimens of *M. a. megalopus*.

Malaraeus telchinus (Rothschild, 1905)

Material examined: Hosts *Peromyscus keeni* except as indicated. USA: AK: Gwent Cove, 54°57'00"N, 130°20'00"W, 3♂♂ [AF26560], 17-viii-98, SOM. Rudyerd Bay, 55°33'16"N, 130°51'33"W, 1♀ [AF29317], 10-vii-99, AMR; 1♂, 1♀ [AF29361], 11-vii-99, AMR; 2♀♀ [AF29379]; 2♀♀ [AF29381]; 1♀ [AF29382], 12-vii-99, AMR; same locality but 1♀ ex *C. gapperi* [AF29375], 12-vii-99, AMR; same data but [AF29378]. Rudyerd Bay, Point Louise, 55°32'42"N, 130° 53'34"W, 1♂, 2♀♀ [AF29372], 12-vii-99, AMR. Walker Cove, Ledge Point, 55° 42'20"N, 130°53'34"W, 1♀ [AF29417], 13-vii-99, AMR; 1♂, 3♀♀ [AF29458], 14-vii-99, AMR; same locality but 1♀ ex *C. gapperi* [AF29416], 13-vii-99, AMR.

The western vole and mouse flea, *M. telchinus*, eluded detection in Alaska until 3♂♂ were collected from one *P. keeni* at

Gwent Cove (across Pearse Canal from Pearse Island, British Columbia) in 1998. The next two localities were farther north at Rudyerd Bay where 2♂♂ and 9♀♀ were collected ex six *P. keeni*, and 2♀♀ ex 2 *C. gapperi*. The collector (AMR) then moved north to Ledge Point on the south shore of the mouth of Walker Cove and established the most northern locality for *M. telchinus* in North America with 1♂ and 4♀♀ ex two *P. keeni* and 1♀ ex *C. gapperi*. This new locality is ca. 236 km northwest of Kitimat, the most northern mainland locality in British Columbia (Holland 1985). Holland (1949, 1985) listed other *M. telchinus* off-shore records close to southeastern Alaska on the Queen Charlotte Islands and Pitt Island. Most of his many records were clustered farther southeastward in British Columbia at inland montane and coastal localities (Holland 1985: Map 84). South of Canada these populations diverge into a coastal branch that reaches southern California and a montane branch that almost bypasses the Great Basin to reach the mesic habitats on mountains and high plateaus in Arizona and New Mexico (Haddow *et al.* 1983: Map 74).

Malareus telchinus is recorded from a wide range of hosts. Haddow *et al.* (1983) listed four *Peromyscus* species as the major hosts of *M. telchinus* but omitted *P. sitkensis* Merriam (= *P. keeni*, see Hogan *et al.* 1993); no *Clethrionomys* species were listed. Holland (1949, 1985) only listed four records from *C. gapperi* including one for Kitimat. The great majority of hosts on the mainland were *P. maniculatus* with *P. keeni* in the Queen Charlotte Islands. *Clethrionomys californicus* (Merriam) is a major host in Oregon; Lewis *et al.* (1988) reported more specimens of *M. telchinus* from this vole than from each of two *Peromyscus* species, three *Microtus* species, and *Lemmiscus curtatus* (Cope). This wide host range of *M. telchinus* confirms adaptability for changing major hosts when entering a region with a different fauna of potential hosts (e.g. moving from mainland British Columbia and *P. maniculatus* to mainland southeastern Alaska and *P. keeni*). We ex-

pect that *M. telchinus* occurs north of its present known northern range limit of Walker Cove because *P. keeni* occurs on the mainland north to Haines and Skagway (MacDonald and Cook 1996) and this flea occurs in "rather mesic habitats" elsewhere (Haddow *et al.* 1983: p. 108).

Opisodasys vesperalis (Jordan, 1929)

Material examined: All ex northern flying squirrels, *Glaucomys sabrinus* (Shaw). USA: AK: Chilkat River, 6.3 km WNW of Haines, 59°15'42"N, 135°33'35"W, 2♂♂, 1♀ [AF12539], 4-vii-95, CTS. Rudyerd Bay, 55°33'16"N, 130°57'33"W, 2♂♂, 3♀♀ [AF29318], 10-vii-99, AMR. St. James Bay, W side Lynn Canal, 58°34'30"N, 135°09'30"W, 1♂, 2♀♀ [AF10306], 9-i-95, JF.

Glaucomys sabrinus, the host of *O. vesperalis*, is found along the mainland of southeastern Alaska, and on islands in the Alexander Archipelago south of Frederick Sound (MacDonald and Cook 1996). Records of its fleas are few with only one for the mainland and one for Revillagigedo Island (Haas *et al.* 1982, 1989: Fig. 7). Our three new records are the first for trapped hosts (the mainland collection near Skagway was from a nest). Lacking a pleural arch, *O. vesperalis* is a crawling nest flea (rather than a jumping flea) and remains in the nest when the host is absent (Traub 1972). Collections from other mammals are strictly accidental and rare; the flea is "essentially specific to *Glaucomys sabrinus*" (Haddow *et al.* 1983: p. 130). *Opisodasys vesperalis* is among the minority of fleas considered to be "ultraspecific", i.e., "limited to infestation of a single species of host" (Traub 1985: p. 332). It is a west coastal flea ranging from southeastern Alaska to northern California and eastward into montane squirrel habitat as far as Idaho and Montana (Haddow *et al.* 1983: Map 107; Holland 1985: Map 89; Lewis *et al.* 1988: p. 201; Haas *et al.* 1989: Fig 7).

Opisodasys keeni keeni (Baker, 1896)

Material examined: USA: AK: Chickamin River, Wolf Cabin, 55°46'N, 130°53'W, 3♂♂, 1♀ ex *Peromyscus keeni* [AF4953], 26-vii-93, SOM *et al.*; same data

but 1♀ ex *Synaptomys borealis* [AF4973]. Crescent Lake, 58°11'N, 133°19'W, 5♂♂, 7♀♀ ex *P. keeni* (4) [AF8309, 8310, 8311, 8316], 22-vii-94, SOM. Echo Cove, 58°31'45"N, 134°54'28"W, 2♂♂, 5♀♀ ex *P. keeni* [AF21759], 21-vii-97, CTS. Gwent Cove, 54°57'00"N, 130°20'00"W, 3♂♂, 4♀♀ ex *P. keeni* [AF26560], 17-viii-98, SOM. Reflection Lake, SW side, 55°59'59"N, 131°33'59"W, 5♂♂, 4♀♀ ex *P. keeni* [AF29116], 1-vii-99, AMR. Rudyerd Bay, 55°18'09"N, 130°50'38"W, 1♂, 4♀♀ ex *P. keeni* (2) [AF29317, 29320], 10-vii-99, AMR; same data but 2♀♀ (2) [AF29360, 29361], 11-vii-99; same data but 4♂♂, 11♀♀ (5) [AF29379, 29380, 29381, 29382, 29383], 12-vii-99; same data but 3♂♂, 1♀ (2) [AF29407, 29408], 13-vii-99. Rudyerd Bay, Point Louise, 55°32'42"N, 130°52'13"W, 2♂♂ ex *P. keeni* [AF29372], 12-vii-99, AMR. Smeaton Bay mouth, 55°18'09"N, 130°50'38"W, 1♂, 3♀♀ ex *P. keeni* (3) [AF29276, 29278, 29279], 9-vii-99, AMR; same data but 4♂♂, 1♀ [AF29292], 10-vii-99. Smeaton Bay, E Skull Creek, 55°17'27"N, 130°49'25"W, 1♂, 1♀ ex *P. keeni* [AF29283], 9-vii-99, AMR. Stikine River, Figure 8 Lake, 56°42'N, 132°15'W, 1♂, 1♀ ex *P. keeni* [AF2627], 14-vii-92, SOM; same data but 2♀♀ [AF2628]; same data but 1♀ [AF2650], 15-vii-92, Taku River, Canyon Island, 58°33'N, 133°41'W, 1♀ ex *P. keeni* [AF8272], 17-vii-94, JAC *et al.*; same data but 2♂♂, 2♀♀ [AF8273]. Unuk River mouth, 56°05'N, 131°06'W, 2♂♂, 2♀♀ ex *P. keeni* (3) [AF4355, 4360, 4428], 20-21-vii-93, SOM *et al.* Walker Cove, Hut Point, 55°42'48"N, 130°54'04"W, 3♂♂, 2♀♀ ex *P. keeni* (3) [AF29428, 29438, 29442], 13-vii-99, AMR. Walker Cove, Ledge Point, 55°42'20"N, 130°53'34"W, 1♂ ex *P. keeni* [AF29458], 14-vii-99, AMR.

This common and abundant *Peromyscus* flea is another member of the Vancouverian Group (Holland 1963) with a west coastal distribution including the Queen Charlotte Islands, extending eastward into montane habitats of its major host *P. maniculatus* in British Columbia and Alberta (Holland 1949:Map 28, 1985: Map 88). Southeast of

Canada *O. k. keeni* occurs in Montana, Utah, Colorado and New Mexico (Ecke and Johnson 1952; Stark 1959; Eads and Campos 1983; Haddow *et al.* 1983: Map 108; Fagerlund *et al.* 2001; Ford *et al.* 2004). Its coastal range extends from northern California as far north as Skagway, Alaska (Haas *et al.* 1982; Haddow *et al.* 1983: Map 108; Lewis *et al.* 1988: p. 203). In British Columbia, *O. k. keeni* and *M. telchinus* have the same host, *P. maniculatus* (*P. keeni* in the Queen Charlotte Islands), and distribution (Holland 1985: Maps 84 & 88). Host sharing by these fleas also occurs in southeastern Alaska: with *M. telchinus*, *P. keeni* was host for nine collections, *C. gapperi* for three; with *O. k. keeni*, *P. keeni* was host for 37 collections (43♂♂, 55♀♀) and *S. borealis*, a new host record, was host for one (♀).

Orchopeas caedens (Jordan, 1925)

Material examined: USA: AK: 500 m S of Taiya River bridge, 59°30'11"N, 135°20'44"W, 1♀ ex *Tamiasciurus hudsonicus* [AF12525], 1-vii-95, CTS, KDS.

The collection of 1♀ of the common, "ultraspecific" (Traub 1985) red squirrel flea, *O. caedens*, in southeastern Alaska was unexpected. The niche was already filled by *C. ciliatus protinus*, an arboreal squirrel flea well-adapted to the west coastal maritime climate on the coast and islands of British Columbia and north through the length of southeastern Alaska. Until now, there has been no record of *O. caedens* within the range of the red squirrel in this region. Elsewhere, *O. caedens* is found throughout most of the transcontinental range of the red squirrel and occurs with other red squirrel fleas, such as *Ceratophyllus vison* Baker and *Tarsopsylla octodecimdentata coloradensis* (Baker) in nests in Alaska west of the Yukon Territory (Haas and Wilson 1982). The limiting factor for *O. caedens* in southeastern Alaska is probably the high humidity and precipitation of the coastal climate. The Taiya River valley lies in the area of lowest mean annual precipitation in southeastern Alaska, i.e., less than 101.6 cm (Watson 1959).

DISCUSSION

Nineteen mammal fleas have been documented for southeastern Alaska (Haas *et al.* 1989). Three of these are known only from islands: the bat flea, *Myodopsylla gentilis* Jordan and Rothschild, and the bear flea, *Chaetopsylla tuberculaticeps* (Bezzi), on Admiralty and Chichagof Islands (Haas *et al.* 1979, 1980, 1989) and the dog flea, *Ctenocephalides canis* (Curtis), on Revillagigedo Island (Holland 1985: p. 38). Our three additions (*M. asio megacolpus*, *M. telchinus* and *O. caedens*) bring the mainland total to 19 taxa. Because of the high humidity and precipitation in the area, these new records (especially that of *O. caedens*) were not expected.

We have tried to collect the northern *Peromyscus maniculatus* flea, *Aetheca thamba* (Jordan), in the Klondike Highway pass at the Alaska/British Columbia border without success. Holland (1949: Map 40, 1958: Fig. 5, 1985: Map 73) mapped and discussed the split distribution pattern of transcontinental *A. thamba* (then *Monopsyllus thambus*). Most of the many records range from southern Yukon Territory (e.g., 1.6 km S of Carcross) eastward into northern British Columbia (e.g., Atlin) to northern and southern Alberta, northwestern Saskatchewan, and southwestern Northwest Territories. A small disjunct population exists in Quebec and Labrador. The proximity of many collections of a cold climate flea from a common and abundant host are conditions favourable for the collection of *A. thamba* in the northern Alaska/British Columbia border passes.

The bushy-tailed woodrat, *Neotoma cinerea* (Ord), is one of several wide-ranging mammals of British Columbia that has established itself in corridors of some

major rivers such as the Taku, Stikine and Unuk that transect the Alaska/British Columbia border mountains (MacDonald and Cook 1996). The common woodrat flea, *Orchopeas agilis* (Rothschild) (formerly *O. sexdentatus agilis*), is the most widespread member of the *sexdentatus* group. It ranges from high mountains with the cool summers required by *N. cinerea* in New Mexico and Colorado northwestward to British Columbia (e.g., Atlin) and questionably Yukon Territory (Finley 1958; Haas *et al.* 1973; Holland 1985: Map 94; Lewis 2000; Haas *et al.* 2004). Haddow *et al.* (1983: Map 115) mapped two localities on the Alaska/British Columbia border but none in Alaska. We believe *O. agilis* probably occurs on the southeastern Alaskan mainland where *N. cinerea* occurs. Well sheltered nests should be good sources of fleas in that region.

Catallagia ioffi Scalon (formerly *C. jellisoni* Holland; see Lewis and Haas 2001) is an uncommonly collected, Holarctic mammal flea with only six known localities in Canada scattered from near Dawson in Yukon Territory southeastward through British Columbia (e.g., Atlin) to Banff National Park, Alberta (Holland 1954; Hopkins and Rothschild 1962; Haas and Johnson 1981; Holland 1985: Map 17). The likelihood of collecting specimens on the southeastern Alaskan mainland is suggested by this elongated distribution pattern in western Canada as well as the diversity of known hosts, e.g., *P. maniculatus*, *N. cinerea*, *C. rutilus*, *C. gapperi*, *M. pennsylvanicus* and *Lemmus trimucronatus* (Richardson). The latter species has not been recorded for southeastern Alaska (MacDonald and Cook 1996).

ACKNOWLEDGEMENTS

We thank C. J. Conroy, J. Foreit, R. Heinen, S. R. Peterson, C. T. Seaton, K. D. Stone, A. A. Tsvetkova and M. J. Wike for collecting, labeling and preserving the flea specimens regardless of difficult field conditions. We thank the US Fish and Wildlife

Service, USDA Forest Service, and Alaska Department of Fish and Game for financial and logistic support for the fieldwork. Michael K. MacDonald kindly reviewed the manuscript.

REFERENCES

- Campos, E.G. and H.E. Stark. 1979. A revaluation of the *Hystrichopsylla occidentalis* group, with description of a new subspecies (Siphonaptera: Hystrichopsyllidae). *Journal of Medical Entomology* 15: 431-444.
- Eads, R.B. and E.G. Campos. 1983. Deer mouse, *Peromyscus maniculatus*, and associated rodent fleas (Siphonaptera) in the arctic-alpine zone of Rocky Mountain National Park, Colorado. *The Great Basin Naturalist* 43: 168-174.
- Ecke, D.H. and C.W. Johnson. 1952. Plague in Colorado. Part I of Plague in Colorado and Texas. United States Public Health Service, Public Health Monograph 6: 1-37.
- Fagerlund, R.A., P.L. Ford and P.J. Polechla, Jr. 2001. New records for fleas (Siphonaptera) from New Mexico with notes on plague-carrying species. *The Southwestern Naturalist* 46: 94-96.
- Finley, R.B. Jr. 1958. The wood rats of Colorado: distribution and ecology. *University of Kansas Publications, Museum of Natural History* 10: 213-552.
- Ford, P.L., R.A. Fagerlund, D.W. Duszynski and P.J. Polechla. 2004. Fleas and lice of mammals in New Mexico. General Technical Report RMRS-GTR-123, United States Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado.
- Haas, G.E. 1982. Fleas (Siphonaptera) from vole nests in subarctic Alaska. *Canadian Journal of Zoology* 60: 2157-2161.
- Haas, G.E. and L. Johnson. 1981. A Siphonaptera collection from small mammals by the Canol Road, Yukon Territory. *The Canadian Entomologist* 113: 567.
- Haas, G.E. and N. Wilson. 1982. Fleas (Siphonaptera) from nests of the red squirrel (*Tamiasciurus hudsonicus*) and burrows of the arctic ground squirrel (*Spermophilus parryi*) in Alaska. *Wasmann Journal of Biology* 40: 59-65.
- Haas, G.E., R.E. Barrett and N. Wilson. 1978. Siphonaptera from mammals in Alaska. *Canadian Journal of Zoology* 56: 333-338.
- Haas, G.E., L. Johnson and N. Wilson. 1980. Siphonaptera from mammals in Alaska. Supplement II. Southeastern Alaska. *Journal of the Entomological Society of British Columbia* 77: 43-46.
- Haas, G.E., L. Johnson and R.E. Wood. 1982. Siphonaptera from mammals in Alaska. Supplement IV. Revised check list for Southeastern Alaska. *Journal of the Entomological Society of British Columbia* 79: 54-61.
- Haas, G.E., N. Wilson and C.T. McAllister. 2004. Fleas (Siphonaptera: Ceratophyllidae, Ctenophthalmidae) from rodents in five Southwestern states. *Western North American Naturalist* 64: 514-517.
- Haas, G.E., R.P. Martin, M. Swickard and B.E. Miller. 1973. Siphonaptera-mammal relationships in north-central New Mexico. *Journal of Medical Entomology* 10: 281-289.
- Haas, G.E., T. Rumpfelt, L. Johnson and N. Wilson. 1979. Siphonaptera from mammals in Alaska. Supplement I. *Canadian Journal of Zoology* 57: 1822-1825.
- Haas, G.E., N. Wilson, T.O. Osborne, R.L. Zarnke, L. Johnson and J.O. Wolff. 1989. Mammal fleas (Siphonaptera) of Alaska and Yukon Territory. *Canadian Journal of Zoology* 67: 394-405.
- Haddow, J., R. Traub and M. Rothschild. 1983. Distribution of ceratophyllid fleas and notes on their hosts, pp. 42-163. *In* R. Traub, M. Rothschild and J.F. Haddow (eds.), *The Rothschild collection of fleas, The Ceratophyllidae: key to the genera and host relationships*. Privately published by M. Rothschild and R. Traub (distributed by Academic Press, Inc., London).
- Hogan, K.M., M.C. Hedin, H.S. Koh, S.K. Davis and I.F. Greenbaum. 1993. Systematic and taxonomic implications of karyotypic, electrophoretic, and mitochondrial-DNA variation in *Peromyscus* from the Pacific Northwest. *Journal of Mammalogy* 74: 819-831.
- Holland, G.P. 1949. The Siphonaptera of Canada. *Canada Department of Agriculture Technical Bulletin* 70:1-306.
- Holland, G.P. 1954. A new species of *Catallagia* Rothschild from the Rocky Mountains of Alberta (Siphonaptera: Hystrichopsyllidae: Neopsyllinae). *The Canadian Entomologist* 86: 381-384.
- Holland, G.P. 1957. Notes on the genus *Hystrichopsylla* Rothschild in the New World, with descriptions of one new species and two new subspecies (Siphonaptera: Hystrichopsyllidae). *The Canadian Entomologist* 89: 309-324.
- Holland, G.P. 1958. Distribution patterns of northern fleas (Siphonaptera), pp. 645-658. *In* *Proceedings, Tenth International Congress of Entomology, 1956. Montreal, Quebec, Canada*.
- Holland, G.P. 1963. Faunal affinities of the fleas (Siphonaptera) of Alaska: with an annotated list of species, pp. 45-63. *In* *Proceedings, Tenth Pacific Science Congress, Pacific Basin biogeography, Honolulu, 21 August - 6 September 1961*. Bishop Museum Press, Honolulu.
- Holland, G.P. 1985. The fleas of Canada, Alaska and Greenland (Siphonaptera). *Memoirs of the Entomological Society of Canada* 130: 1-631.

- Hopkins, G.H.E. and M. Rothschild. 1962. An illustrated catalogue of the Rothschild collection of fleas (Siphonaptera) in the British Museum (Natural History). Vol. III. Hystrichopsyllidae [in part]. University Press, Cambridge.
- Lewis, R.E. 2000. A taxonomic review of the North American genus *Orchopeas* Jordan, 1933 (Siphonaptera: Ceratophyllidae: Ceratophyllinae). *Journal of Vector Ecology* 25: 164-189.
- Lewis, R.E. and G.E. Haas. 2001. A review of the North American *Catallagia* Rothschild, 1915, with the description of a new species (Siphonaptera: Ctenophthalmidae: Neopsyllinae: Phalacroscyllini). *Journal of Vector Ecology* 26: 51-69.
- Lewis, R.E., J.H. Lewis and C. Maser. 1988. The fleas of the Pacific Northwest. Oregon State University Press, Corvallis.
- MacDonald, S.O. and J.A. Cook. 1996. The land mammal fauna of Southeast Alaska. *Canadian Field-Naturalist* 110: 571-598.
- Marshall, A.G. 1981. The sex ratio in ectoparasitic insects. *Ecological Entomology* 6: 155-174.
- Miller, G.S., Jr. and R. Kellogg. 1955. List of North American Recent mammals. United States National Museum Bulletin 205: 1-954.
- Murrell, B.P., L.A. Durden and J.A. Cook. 2003. Host associations of the tick, *Ixodes angustus* (Acari: Ixodidae) on Alaskan mammals. *Journal of Medical Entomology* 40: 682-685.
- Stark, H.E. 1959. The Siphonaptera of Utah. United States Department of Health, Education, and Welfare, Public Health Service, Atlanta, Georgia.
- Stark, H.E. 2002. Population dynamics of adult fleas (Siphonaptera) on hosts and in nests of the California vole. *Journal of Medical Entomology* 39: 818-824.
- Traub, R. 1972. Notes on zoogeography, convergent evolution and taxonomy of fleas (Siphonaptera), based on collections from Gunong Benom and elsewhere in south-east Asia. II. Convergent evolution. *Bulletin British Museum Natural History (Zoology)* 23: 307-387.
- Traub, R. 1985. Coevolution of fleas and mammals, pp. 295-437. *In* K.C. Kim (ed), *Coevolution of parasitic arthropods and mammals*. John Wiley & Sons, New York.
- Watson, C.E. 1959. *Climates of the states – Alaska*. United States Weather Bureau Climatography of the United States No. 60-49. U.S. Department of Commerce, Washington, DC.

