

Retrospective Study

Occurrence and Species of Lice on Free-living and Captive Raptors in California

Teresa Y. Morishita, DVM, PhD, Dipl ACPV, James W. Mertins, PhD,
David G. Baker, DVM, PhD, Dipl ACLAM, Clifton M. Monahan, DVM, PhD, and
Dale L. Brooks, DVM, PhD, Dipl ACLAM

Abstract: This study determined the occurrence and identity of chewing lice (Mallophaga) on 35 clinically healthy raptors presented with traumatic injuries at the California Raptor Center during the summers of 1993 and 1994. Samples of lice were collected and preserved in 70% ethanol during physical examinations within 24 hours of admission. Eleven species of chewing lice were collected and identified from 7 species of raptors, including 2 long-term captive birds. All louse species except 1 were on their usual, previously documented raptor hosts. Four of the 10 species of free-living birds examined had no lice, but their sample sizes were small (1–3 birds each). At least 1 bird from each of the other 6 raptor species harbored some lice, but only 2 species, an American kestrel (*Falco sparverius*) and a barn owl (*Tyto alba*) were sampled in useful numbers. One of 8 kestrels yielded lice (1 species), and 4 of 14 barn owls were infested with lice (representing 2 species). Two captive birds, a spotted owl (*Strix occidentalis*) and a Swainson's hawk (*Buteo swainsoni*), were infested with lice (1 species each) after 463 days and 1198 days in captivity, respectively.

Key words: lice, parasites, Mallophaga, rehabilitation center, birds, avian, raptor

Introduction

Veterinarians and wildlife rehabilitators frequently admit free-living raptors into their clinics or rehabilitation centers. Judicious preventive avian health programs will ensure that these transient patients do not transmit any potential pathogens or parasites to other patients during their rehabilitations.^{1,2} Parasite prevention and monitoring programs require minimal time and cost.^{1,2} Incoming birds can be examined routinely for external parasites, and infested birds can be treated easily.

The documented ectoparasites of raptors include lice, mites, ticks, fleas, hippoboscid flies, cimicid

bugs, and fly larvae.^{1,3–12} Although raptors infested with some ectoparasites may show no clinical signs, large numbers of lice and mites may cause ragged-looking feathers. Captive birds of prey commonly support chewing lice (Mallophaga) that may increase in numbers when hosts are unable to preen themselves.¹³ Hence, sick raptors may bear more ectoparasites than clinically healthy ones. Poorly fed raptors also may sustain greater louse populations than those present on well-fed birds.^{1,14} Rehabilitation centers and veterinary clinics see more emaciated, nutritionally deficient birds during winter, when food supplies are lowest, than during other seasons.^{15,16} In the spring, nestling raptors supplant nutritionally stressed adults as the most frequent new patients at rehabilitation centers, and numbers of parasites on these birds vary with the quality of their nest environments.¹⁵

Normal prevalence for ectoparasites on well-fed, clinically healthy raptors during the low-stress summer season would be desirable data to have for comparative purposes. Some studies have looked at the abundance of chewing lice on individuals and groups of clinically healthy raptors,¹⁷ but current

From the Department of Veterinary Preventive Medicine, The Ohio State University, 1900 Coffey Road, Columbus, OH 43210, USA (Morishita, Monahan); the US Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, National Veterinary Services Laboratories, 1800 Dayton Road, Ames, IA 50010, USA (Mertins); and the Division of Veterinary Medicine, School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA 70803, USA (Baker). Present address (Morishita, Baker, Brooks): California Raptor Center, School of Veterinary Medicine, University of California–Davis, Davis, CA 95616, USA.

Table 1. Raptor species examined for lice at the California Raptor Center during the summers of 1993 and 1994.

Free-living birds (number examined)	Captive birds (number examined)
American kestrel, <i>Falco sparverius</i> (8)	American kestrel, <i>Falco sparverius</i> (4)
Barn owl, <i>Tyto alba</i> (14)	Bald eagle, <i>Haliaeetus leucocephalus</i> (2)
Burrowing owl, <i>Speotyto cunicularis</i> (1)	Barn owl, <i>Tyto alba</i> (8)
Golden eagle, <i>Aquila chrysaetos</i> (2)	Black-winged kite, <i>Elanus caeruleus</i> (1)
Northern harrier, <i>Circus cyaneus</i> (3)	Burrowing owl, <i>Speotyto cunicularia</i> (2)
Red-shouldered hawk, <i>Buteo lineatus</i> (1)	Cooper's hawk, <i>Accipiter cooperii</i> (3)
Red-tailed hawk, <i>Buteo jamaicensis</i> (2)	Ferruginous hawk, <i>Buteo regalis</i> (1)
Rough-legged hawk, <i>Buteo lagopus</i> (1)	Golden eagle, <i>Aquila chrysaetos</i> (4)
Swainson's hawk, <i>Buteo swainsoni</i> (2)	Great horned owl, <i>Bubo virginianus</i> (5)
Western screech-owl, <i>Otus kennicottii</i> (1)	Northern goshawk, <i>Accipiter gentilis</i> (1)
	Northern harrier, <i>Circus cyaneus</i> (1)
	Saw-whet owl, <i>Aegolius acadicus</i> (1)
	Prairie falcon, <i>Falco mexicanus</i> (1)
	Red-shouldered hawk, <i>Buteo lineatus</i> (11)
	Red-tailed hawk, <i>Buteo jamaicensis</i> (11)
	Sharp-shinned hawk, <i>Accipiter striatus</i> (1)
	Short-eared owl, <i>Asio flammeus</i> (2)
	Swainson's hawk, <i>Buteo swainsoni</i> (1)
	Spotted owl, <i>Strix occidentalis</i> (1)
	Turkey vulture, <i>Cathartes aura</i> (1)

knowledge on the subject is sparse. Our observations add to existing information by including a broader array of host species affected by lice and sites preferentially affected on their host species.

Materials and Methods

Selection of raptors

We examined all free-living raptors admitted to the California Raptor Center (Davis, CA, USA) between July 1 and September 1 in 1993 and 1994 for ectoparasites. Free-living raptors are defined as birds in captivity for fewer than 24 hours and admitted solely because of acute traumatic injuries, thus increasing the probability of otherwise healthy subjects, free from seasonal dietary stresses, and with normal parasite burdens. For comparison, we also examined long-term captive raptors at the California Raptor Center for ectoparasites during the 1993 study period.

Parasite collection

We thoroughly examined each bird for 10–15 minutes. Feathers were parted to visually examine for ectoparasites. The predilection site and estimated numbers of ectoparasites were recorded. Low ectoparasite numbers were defined as having less than or equal to 5 ectoparasites observed after 10 random partings of the feathers. Moderate ectoparasite numbers were defined as having greater than 5 ectoparasites after 10 random partings of the feathers. Se-

vere ectoparasitism was defined as having a moderate ectoparasite level and the presence of nits. Ectoparasites were collected manually and placed into a vial of 70% ethyl alcohol that was labeled and given a unique number code.

Parasite preparation and identification

Lice were prepared and mounted on slides in glycerol (D.G.B.). Lice were identified (J.W.M.) with a compound microscope and standard identification keys, host-parasite lists, and other published resources.^{4,18–27}

Results

During the specified assessment periods, 35 free-living, healthy raptors were admitted and examined, including 10 different free-living bird species and 55 captive raptors representing 20 different species (Table 1). Six of 10 free-living bird species had lice (Table 2), and 2 of 20 captive bird species were infested in low numbers, even after long-term confinement. All ectoparasites were found on the trunk of all birds, except in 2 cases where the ectoparasites were found on the head. All ectoparasites were low in numbers except for those on 2 red-tailed hawks, which had numerous specimens.

American kestrels (*Falco sparverius*) and barn owls (*Tyto alba*) were most commonly admitted for traumatic injury (Table 3). *Laemobothrion tinnunculi* was seen in 13% (1/8) of American kestrels

Table 2. Chewing lice (Mallophaga) collected from raptors in 1993 and 1994. Lice listed represent species found on 11 free-living individuals and on 2 captive individuals.

Bird host (identification number)	Lice collected
Diurnal hosts	
American kestrel (4-237)	<i>Laemobothrion tinnunculi</i>
Swainson's hawk (3-174)	<i>Laemobothrion maximum</i>
Swainson's hawk (captive)	<i>Craspedorrhynchus hirsutus</i>
Swainson's hawk (4-264)	<i>Colpocephalum turbinatum</i>
Golden eagle (3-175)	<i>Colpocephalum impressum</i>
Golden eagle (3-173)	<i>Colpocephalum impressum</i>
	<i>Falcolipeurus suturalis</i>
	<i>Degeeriella fulva</i>
Nocturnal hosts	
Barn owl (3-143)	<i>Kurodaia subpachygaster</i>
Barn owl (3-0151)	<i>Kurodaia subpachygaster</i>
Barn owl (3-152)	<i>Kurodaia subpachygaster</i>
Barn owl (3-059)	<i>Kurodaia subpachygaster</i>
	<i>Strigiphilus aitkeni</i>
Burrowing owl (3-165)	<i>Strigiphilus speotyti</i>
Spotted owl (captive)	<i>Strigiphilus syrni</i>

examined. *Kurodaia subpachygaster* was seen in 29% (4/14) of barn owls examined, and a coinfection with *Strigiphilus aitkeni* was seen in 7% (1/14) of these barn owls sampled. Raptors serving as hosts for lice displayed no clinical signs of the infestations. Low numbers of a *Craspedorrhynchus* louse were observed on a Swainson's hawk (*Buteo swainsoni*) held in captivity for 1198 days.

Discussion

Most, if not all, species of raptors support their own unique fauna of chewing lice. Research studies that fail to identify ectoparasites beyond the ordinal level add little to our understanding of host-parasite ecology.

Nocturnal raptors

Kurodaia subpachygaster is restricted to barn owls, but various *Kurodaia* species may be found on nocturnal or diurnal raptors.²³ Barn owls occur

on 5 continents and many islands, and *K subpachygaster* seems to have a coextensive distribution.^{4,11,23,27} Its presence in 4 barn owls examined is not unexpected.

The other species of lice found on owls in this study belong to *Strigiphilus*, the only genus of lice with all its members restricted to owl hosts. *Strigiphilus aitkeni* was observed on 1 barn owl along with the previously mentioned *K subpachygaster* (Tables 2 and 3). *Strigiphilus aitkeni* occurs only on barn owls, and only on those in the New World, Australia, and Southeast Asia.²⁸ Another species, *S rostratus*, infests barn owls in Europe, Africa, and Southwest Asia. We observed *S speotyti* on this study's only burrowing owl (*Speotyto cunicularia*), which is its only host.²⁹ *Strigiphilus speotyti* occurs on these birds throughout their range in North and South America.³⁰ We observed *S syrni* on a spotted owl (*Strix occidentalis*) held in captivity for 463 days. This louse occurs on the circumboreal great grey owl (*Strix nebulosa*), 2 other New World owls

Table 3. Prevalence^a of chewing lice on raptors most commonly admitted for traumatic injury at the California Raptor Center in 1993 and 1994.

Bird host (number examined)	Louse species	Prevalence, %
American kestrel (8)	<i>Laemobothrion tinnunculi</i>	13
Barn owl (14) ^b	<i>Kurodaia subpachygaster</i>	29
	<i>Strigiphilus aitkeni</i>	7

^a Number of birds infested/number examined expressed as a percentage.

^b One barn owl was infested with 2 species, *K subpachygaster* and *S aitkeni*.

(rufous-legged owl [*S rufipes*] and barred owl [*S varia*]), and on the great horned owl (*Bubo virginianus*), an unusual diversity of hosts for *Strigiphilus* lice.²⁹ Hunter et al³¹ observed this louse on all 3 subspecies of spotted owls in California and Arizona.

Diurnal raptors

At least 25 species of *Colpocephalum* lice are known from North America,³² many of them from raptors.²² We identified 2 *Colpocephalum* species. *Colpocephalum impressum* occurs worldwide on various eagles, primarily *Aquila* species.²² The only host of *C impressum* in North America is the golden eagle (*A chrysaetos*), and it was present on both eagles examined. Two free-living Swainson's hawks were examined and 1 was infested with *C turbinatum*. This highly variable, cosmopolitan louse has a large and unusual host spectrum, including the domestic pigeon (*Columba livia*)²² and more than 35 species of Falconiformes worldwide, including the Swainson's hawk.^{4,22,26,33}

One of the 2 golden eagles in this study was coin-fested with the louse *Falcolipeurus suturalis*. Most *Falcolipeurus* occur worldwide on vultures,¹⁹ but 4 of 5 North American species infest other large falconiform hosts.²⁶ Golden eagles seem to be the only North American hosts for *F suturalis*.³⁴

Two *Laemobothrion* species were observed (Table 2). Only 4 species of *Laemobothrion* infest raptors worldwide, but each species has a large number of hosts.²⁴ *Laemobothrion maximum* was observed on the other free-living Swainson's hawk in this study. More than 35 hosts are documented for this louse, most in the family Acciptridae; *Buteo* species are its most common hosts.²⁴ *Laemobothrion tinunculi*, found in 1 American kestrel, has been documented from more than 12 species of *Falco* worldwide,²⁴ including *F sparverius* in North America.^{26,34}

One of 2 red-tailed hawks (*Buteo jamaicensis*) had many *Degeeriella fulva*. This louse has a wide host range, including the golden eagle, red-tailed hawk, and at least 5 other North American *Buteo* species.^{4,20,34}

The *Craspedorrhynchus* louse observed on a Swainson's hawk has not been recorded previously. Eleven species of *Craspedorrhynchus* are known from North American accipiter hosts,^{32,34} and they seem to be host specific. One female adult louse, which may have been *C hirsutus*, was collected. This louse has been reported in ferruginous hawks (*B regalis*).³⁵ Species in the genus *Craspedorrhynchus* are relatively homogeneous morphologically,²¹

and the male genitalia are the most reliable means for identifying them.³⁶ Without a male specimen, we are not certain of the species for the louse observed. Although the presence of immature stages indicates establishment of a breeding population, these lice may represent an accidental transfer from an undetermined species of hawk (*B regalis*?) in captivity. They also could have been transferred by caregivers.

All louse species found were consistent with previously known host-parasite relationships, except for the *Craspedorrhynchus* species on the captive Swainson's hawk. This study demonstrates that it is not unusual for free-living, clinically healthy raptors to harbor 1 or more species of chewing lice, even during the low-stress summer season. All lice were present in low numbers, and their hosts displayed no clinical signs of the infestations.

These findings suggest that all incoming raptors should be examined for ectoparasites and treatment can be initiated, if detected. From this study, it seems that the trunk of the bird is the predilection site, followed by the head region. These areas should be checked for ectoparasites during the initial phase of a physical exam.

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