# THE LICE (INSECTA: PHTHIRAPTERA) OF SHORT-TAILED SHEARWATERS, *ARDENNA TENUIROSTRIS*, IN BASS STRAIT, TASMANIA

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(with two tables)

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Lice from 3● adult and 6● pre-fledgling chick Short-tailed Shearwaters, *Ardenna tenuirostris*, on Great Dog Island in Bass Strait, Tasmania, were sampled using the fumigation method. Five species of chewing lice (Phthiraptera: Ischnocera and Amblycera) were collected, including: *Naubates harrisoni*, *Halipeurus diversus*, *Trabeculus hexakon*, *Austromenopon paululum* and *Ancistrona vagelli*, none of which were new species records for this seabird. The highest rates of louse infestation were on pre-fledgling shearwater chicks.

**Key Words: lice, Phthiraptera, procellarid, Tasmania, shearwater, *Ardenna tenuirostris*.**

## INTRODUCTION

There is a paucity of research into the louse fauna of Short-tailed Shearwaters, *Ardenna tenuirostris* (Temminck, 1835), despite this species being one of the world's most studied seabirds (Bradley *et al.* 1991 and references therein). Research has been undertaken on these shearwaters at their breeding grounds in Bass Strait, Tasmania, since 1947 (Bradley *et al.* 1991). As Short-tailed Shearwaters are long-lived, with an estimated average longevity of 38 years (Skira *et al.* 1985), they may offer a long-term host potential to host-dependent ectoparasites (i.e., lice) (Crompton 1997). Also, with approximately 23 million shearwaters breeding in burrows in dense rookeries on the islands and headlands of southern Australia, from southern New South Wales to Tasmania and from Victoria to Western Australia (Marchant & Higgins 1990), there may be the potential for increased transmission of ectoparasites between individual birds. Increased infestation rates by lice have been shown in colonial living birds. For instance, Rózsa *et al.* (1996) found an increase in louse infestation on Colonial Rooks, *Corvus frugilegus* Linnaeus, 1758, as compared to the territorial Hooded Crow, *Corvus corone cornix* Linnaeus, 1758.

Short-tailed Shearwaters undertake an annual trans-equatorial migration to the Bering Sea for the austral winter (Serventy 1967), and so may act as vectors for the transmission of parasites across hemispheres (Lopez *et al.* 2005, Price *et al.* 2003).

There are three publications that list the lice of Short-tailed Shearwaters. Green & Munday (1971) were the first to document the ectoparasites of Tasmanian fauna, albeit from personal communications – no published literature was cited. Twenty years later, Green & Palma (1991) listed the lice of Tasmania's vertebrates. They essentially used Green & Munday's (1971) list of lice on shearwaters and added *Austromenopon paululum,* listed as *Austromenopon* sp. in Green & Munday (1971).

Price *et al.* (2003), in their checklist of the chewing lice (Phthiraptera) of the world, also listed the lice of Short-tailed Shearwaters. Included in this list were two louse species, *Naubates harrisoni* (Bedford, 1930) and *Ancistrona vagelli* (Fabricus, 1787), not mentioned in Green & Munday (1971). As part of the long-term research into Bass Strait's Short-tailed Shearwaters, this study aimed to confirm their current louse fauna, detailing the specific location, and collection method, to fill a gap in the primary literature.

## METHODS

This research was conducted on Great Dog Island (40°15'S, 148°15'E; Skira & Brothers 1988), located in the Furneaux Group of islands in Bass Strait, off the northeast coast of Tasmania during austral summer 2009/2010. Lice were sampled as part of the long-term examination of the breeding success of Short-tailed Shearwaters on this island (Bradley & Meathrel 2006). Research was conducted over two periods corresponding to the Short-tailed Shearwater's breeding season: in December 2009 immediately after the egg-laying period (25–28 November), and in April 2010, just prior to the chick fledging period at the beginning of May (Serventy 1963).

Lice were collected from randomly chosen shearwaters, 30 adults (December) and 60 pre-fledglings (April), using the fumigation method as outlined in Furness & Palma (1992) and Steele *et al.* (1997). Birds were removed from their burrows by hand and placed inside a plastic bag containing a cotton ball soaked with trilene (trichloroethylene), an anaesthetic. The head of the bird remained out of the bag with nares directed into the wind to ensure the bird did not inhale the trilene. The bird was fumigated in the plastic bag for a total of one minute to minimise stress. After one minute the bird was returned to its burrow and the ectoparasites were collected from the plastic bag and cotton ball and placed into a labelled zip lock bag. The ectoparasites were then removed from the zip lock bag and preserved in vials containing propylene glycol. All work was conducted under La Trobe University Animal Ethics Committee Licence AEC05/15 (W) and Tasmanian Department of Primary Industries, Water and Environment Permit to take Wildlife for Scientific Purposes FA 09118 held by CEM.

## RESULTS AND DISCUSSION

All species of lice that inhabit birds belong to the suborders Amblycera and Ischnocera (chewing lice) in the order Phthiraptera (Price *et al.* 2003). Among the ca. 4000 species of chewing lice from birds distributed worldwide (Price *et al.* 2003), only five species, from the two suborders, were collected from Short-tailed Shearwaters on Great Dog Island (table 1). All of these lice are pan-global (Price *et al.* 2003) and have been previously reported on Short-tailed Shearwaters and other procellarids (table 1).

The incidence of louse infection is shown in table 2. Infestations with ischnocerans were more common than with amblycerans, particularly on pre-fledgling shearwater chicks. Low infestation rates, with some birds harbouring no lice, are common in some procellarid species (Gomez-Diaz *et al.* 2008). Gomez-Diaz *et al.* (2008) found infestation rates from 20.2% sampled birds infected to 100% sampled birds infected.

Ischnoceran lice feed on the keratin of feathers and dermal debris (Marshall 1981, Clayton *et al.* 1992). They have tarsal claws as morphological specialisations for attachment to feathers and are rarely found on the skin of birds. Amblyceran lice, however, are more mobile than ischnoceran lice and will freely roam upon the host's skin and readily drop from their host. They feed on dead dermis, feathers and dried blood around wounds. These differences in louse morphology and feeding mode may explain the higher infestation rates of ischnoceran lice on pre-fledgling compared to adult shearwaters. Pre-fledglings have actively growing, highly vascularised down (Warham 1996) which may be preferential to ischnoceran lice compared to the hard central shaft feathers of adults.

The primary defence of birds to ectoparasite infestation is preening (Warham 1996), a learnt behaviour which can strip ischnoceran lice from the feather shaft and remove amblyceran lice from the skin, reducing infestation rates. Pre-fledgling chicks are ineffective at preening compared to their parents. This may result in the higher infestation rates of lice on pre-fledglings compared to adult Short-tailed Shearwaters. Such a result has been shown in Brown Pelicans, *Pelecanus occidentalis* Linnaeus, 1786 by Eggert & Jodice (2008). The higher infestation rates on chicks may also be explained by the burrow-nesting behaviour of Short-tailed Shearwaters. Extraction of birds from their burrows by hand may mean that amblyceran lice simply drop off the host as the bird is extracted from the burrow, whereas ischnocerans remained attached. When feathers, on which ischnoceran eggs, nymphs and adults are attached, are shed and lost, the infestation rates of adults are reduced compared to burrow-bound chicks.

This research provides the first documentation on the location, collection method and date of collection of the lice of Short-tailed Shearwaters. Price *et al.* (2003) believe that this information is important for the further understanding of the factors affecting the distribution of lice.

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## REFERENCES

**Bradley, J.S. & Meathrel, C. E.** 2006: Prediction of individual reproductive success in short-tailed shearwaters, *Puffinus tenuirostris*. *In*: Schodde, R. (ed): *Proceedings of the 23rd International Ornithological Congress. Beijing, China. Acta Zoologica Sinica,* Beijing 52 (Supplement): 91–95.

**Bradley, J.S., Skira, I.J. & Wooller, R.D.** 1991: A long-term study of Short-tailed Shearwaters *Puffinus tenuirostris* on Fisher Island, Australia. *Ibis* **133**: 55–61.

**Clayton, D.H., Gregory, R.D. & Price, R.D.** 1992: Comparative ecology of Neotropical bird lice (Insecta: Phthiraptera). *Journal of Animal Ecology* **61**: 781–796.

**Crompton, D.W.T.** 1997: Birds as habitat for parasites. *In* Clayton, D.H. & Moore J. (eds): *Host-parasite evolution: genetic principles and avian models.* Oxford University Press, Oxford: 253–270.

**Eggert, L.M.F. & Jodice, P.G.R.** 2008: Growth of brown pelican nestlings exposed to sublethal levels of soft tick infestation. *The Condor* **110**: 134–142.

**Furness, R.W. & Palma, R.L.** 1992: Phthiraptera of petrels and skuas from Gough Island, South Atlantic Ocean. *Seabird* **14**: 33–42.

**Gomez-Diaz, E., Navarro, J. & Gonzales-Solis, J.** 2008: Ectoparasite community structure on three closely related seabird species: a multi-scale approach combining ecological and genetic data. *Ecography* **31**: 477–489.

**Green, R.H. & Munday, B.L.** 1971: Parasites of Tasmanian native and feral fauna Part 1: Arthropoda. *Records of the Queen Victoria Museum* **41**: 1–17.

**Green, R.H. & Palma, R.L.** 1991: A list of lice (Phthiraptera) recorded from Tasmania. *Records of the Queen Victoria Museum* **100**: 1–43.

**Lopez, J.E., Gallinot, L.P. & Wade, M.J.** 2005: Spread of parasites in metapopulations: an experimental study of the effects of host migration rate and local host population size. *Parasitology* **130**: 323–332.

**Marchant, S. & Higgins, P.J.** (eds.) 1990: *Handbook of Australian, New Zealand and Antarctic Birds. Volume 1. Ratites to Ducks.* Oxford University Press, Melbourne, Australia: 1048 pp.

**TABLE 1**
**Lice recorded from Short-tailed Shearwaters and other Tasmanian shearwaters**

| Sub-order | Family | Species | Hosts (references) |
|---|---|---|---|
| Ischnocera | Philopteridae | *Naubates harrisoni* | Palma & Pilgrim 2002; Price *et al.* 2003; this study |
| Ischnocera | Philopteridae | *Halipeurus diversus* | Green & Palma 1991; Price *et al.* 2003; this study |
| Ischnocera | Philopteridae | *Trabeculus hexakon* | Green & Palma 1991, this study |
| Amblycera | Menoponidae | *Austromenopon paululum* | Green & Palma 1991, Price *et al.* 2003, this study |
| Amblycera | Menoponidae | *Ancistrona vagelli* | Price *et al.* 2003, this study |

**Table 2**
**The incidence of louse infection on Short-tailed Shearwaters from Great Dog Island, austral summer 2009/10**

| Louse species | Adult (n=30) | Pre-fledgling (n=60) |
|---|---|---|
| *Naubates harrisoni* (I) | 1 | 20 |
| *Halipeurus diversus* (I) | 4 | 26 |
| *Trabeculus hexakon* (I) | 2 | 0 |
| *Austromenopon paululum* (A) | 2 | 8 |
| *Ancistrona vagelli* (A) | 1 | 1 |

(I) = *Ischnocera*, (A) = *Amblycera*

**Marshall, A.G.** 1981: *The ecology of ectoparasitic insects.* Academic Press, London: 459 pp.

**Palma, R.L. & Pilgrim, R.L.C.** 2002: A revision of the genus *Naubates* (Insecta: Phthiraptera: Philopteridae). *Journal of the Royal Society of New Zealand* **32**(1): 7–60.

**Price, R.D., Hellenthal, R.A. & Palma, R.L.** 2003: World checklist of chewing lice with host associations and keys to families and genera. *In:* Taylor, P. (ed): *The chewing lice: world checklist and biological overview.* Illinois Natural History Survey Special Publication 24, Illinois: 1–415.

**Rózsa, L., Rékási, J. & Reiczigel, J.** 1996: Relationship of host coloniality to the population ecology of avian lice (Insecta: Phthiraptera). *Journal of Animal Ecology* **65**: 242–248.

**Serventy, D.L.** 1963: Egg-laying timetable of the Slender-billed Shearwater, *Puffinus tenuirostris. Proceedings of the XIII International Ornithology Congress* **1962**: 338–343.

**Serventy, D.L.** 1967: Aspects of the population ecology of the Short-tailed Shearwater *Puffinus tenuirostris. Proceedings of the XIV International Ornithological Congress* **1**: 165–190.

**Skira, I.J. & Brothers, N.P.** 1988: Seabird Islands No. 184: Great Dog Island, Tasmania. *Corella* **12**: 82–84.

**Skira, I.J., Wapstra, J.E., Towney, G.N. & Naarding, J.A.** 1985: Conservation of the short-tailed shearwater *Puffinus tenuirostris* in Tasmania, Australia. *Biological Conservation* **37**: 225–236.

**Steele, W.K., Pilgrim, R.L.C. & Palma, R.L.** 1997: Occurrence of the flea *Glacypsillus antarcticus* and avian lice in central Droming Maud Land. *Polar Biology* **18**: 168–177.

**Warham, J.** 1996: *The behaviour, population biology and physiology of the petrels.* Academic Press, San Diego: 613 pp.

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