

# Checklist of marine mammal parasites in New Zealand and Australian waters

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## Review Article

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### Abstract

Marine mammals are long-lived top predators with vagile lifestyles, which often inhabit remote environments. This is especially relevant in the oceanic waters around New Zealand and Australia where cetaceans and pinnipeds are considered as vulnerable and often endangered due to anthropogenic impacts on their habitat. Parasitism is ubiquitous in wildlife, and prevalence of parasitic infections as well as emerging diseases can be valuable bioindicators of the ecology and health of marine mammals. Collecting information about parasite diversity in marine mammals will provide a crucial baseline for assessing their impact on host and ecosystem ecology. New studies on marine mammals in New Zealand and Australian waters have recently added to our knowledge of parasite prevalence, life cycles and taxonomic relationships in the Australasian region, and justify a first host–parasite checklist encompassing all available data. The present checklist comprises 36 species of marine mammals, and 114 species of parasites (helminths, arthropods and protozoans). Mammal species occurring in New Zealand and Australian waters but not included in the checklist represent gaps in our knowledge. The checklist thus serves both as a guide for what information is lacking, as well as a practical resource for scientists working on the ecology and conservation of marine mammals.

## Introduction

In the oceanic waters around New Zealand (NZ) and Australia, marine mammals are considered as vulnerable wildlife and often endangered due to anthropogenic impacts on their habitat. Strandings of these long-lived top predators and often pelagic species are rare and individuals are seldom available for data collection. A recent assessment has shown that the conservation status of NZ marine mammals has not improved (Baker *et al.*, 2010). Furthermore, three endemic NZ marine mammals, i.e. NZ sea lion (*Phocarctos hookeri*), Hector's dolphin (*Cephalorhynchus hectori hectori*) (both endangered) and Maui's dolphin (*Cephalorhynchus hectori maui*) (nationally critical) are regarded as threatened. Thirteen taxa are considered data deficient (Baker *et al.*, 2010). Around Australia, at least seven species are classified threatened, among them the iconic blue whale (*Balaenoptera musculus*), and the conservation status of 25 cetacean species is unknown due to insufficient data (Schumann *et al.*, 2013). Australian and NZ waters include critical feeding and breeding grounds for permanent cetacean residents and visitors that migrate from summer feeding grounds in the Antarctic to the warmer waters of the Australian coast during the winter (Bannister *et al.*, 1996; Salgado Kent *et al.*, 2012). Recent dangers to pinnipeds in Australasian waters include exposure to marine debris and bycatch in fishing gear, which is an acute threat for the endangered Australian sea lion (*Neophoca cinerea*) (Kovacs *et al.*, 2012) and NZ sea lion (Robertson & Chilvers, 2011). Continuous pressure of anthropogenic impacts such as fisheries, entanglement, vessel strike and chemical and noise pollution has prompted researchers to evaluate the effects of cumulative stress on marine mammals in Oceania and to implement conservation strategies to protect their survival (Kingsford *et al.*, 2009).

Parasitism is ubiquitous in wildlife, and parasites in marine mammals are common. While a certain parasite load may not hamper host physiology, heavy infections can have serious pathogenic effects on host fitness (Measures, 2001; Siebert *et al.*, 2001). Although Australian and NZ waters are a hotspot for marine mammal species richness (Pompa *et al.*, 2011), little is known of their parasite diversity.

Parasitic infections, their prevalence and intensity as well as emerging species have proven to be valuable bioindicators of the ecology and health of marine mammals (Siebert *et al.*, 2006; Lehnert *et al.*, 2014), reflecting habitat use (Aznar *et al.*, 1995), diet (Marcogliese, 2002), social behaviour and population dynamics (Balbuena and Raga, 1994), but also as markers for exposure and detrimental effects of xenobiotics (Sures, 2004; Pascual & Abollo, 2005; Marcogliese & Pietrock, 2011). They reveal evolutionary host–parasite relationships and highlight their biogeography and phylogeny over historical timescales (Anderson, 1982; Leidenberger *et al.*,

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2007). In the future, metazoan parasites, emerging infectious diseases and microparasites like viruses may be used as markers for the effects of anthropogenic stress on the health of marine mammals, as their role also as indicators for global change has become evident (Gulland & Hall, 2007; van Bresse *et al.*, 2009). Additionally, some parasites of marine mammals have zoonotic potential, causing public health concerns and economic harm. Both the tapeworm *Diphyllobothrium latum* and anisakid nematodes (e.g. *Anisakis* spp., *Pseudoterranova* spp.) increasingly cause zoonotic infections in humans (Dorny *et al.*, 2009; Shamsi, 2014), and can induce severe gastro-intestinal disease when ingested via undercooked fish (Mattiucci *et al.*, 2013; Bao *et al.*, 2017). These parasites are transmitted to their definitive cetacean and pinniped hosts via infective larvae within prey intermediate hosts, while infected fillets cause economic losses for the fishery industries (Llarena-Reino *et al.*, 2015). Zoonotic protozoans like *Giardia* and *Cryptosporidium* are significant enteropathogens in NZ, causing higher infection rates than in other developed countries (Britton *et al.*, 2010). Faeces from humans, pets and farm animals are discharged in runoff, bringing encysted parasites to coastal waters. They are filtered and concentrated by invertebrates and consumed by marine mammals, infecting a wide range of hosts, resulting in morbidity and mortality to some species (Fayer *et al.*, 2004).

Collecting information about parasite diversity in marine mammals will provide a crucial baseline for assessing their impact on host and ecosystem ecology (Poulin *et al.*, 2016). Study design in live marine mammals is restricted by legal as well as ethical constraints so that, since the cessation of whaling, data are collected mostly opportunistically from stranded or bycaught individuals. In the oceanic waters of the southern hemisphere, many species are seldom found stranded; therefore, few parasitological records (Berón-Vera *et al.*, 2008; Nikolov *et al.*, 2010) exist. Parasitology increasingly complements marine ecology to further our understanding of ecosystem dynamics (Poulin *et al.*, 2016), but, so far, little is known about the biodiversity of Australasian marine parasites (Poulin, 2004; Stockin *et al.*, 2009). New studies on marine mammals in NZ and Australian waters have recently added to our knowledge about parasite prevalence, life cycles (Tomo *et al.*, 2010; Lehnert *et al.*, 2017) and taxonomic relationships (Shamsi *et al.*, 2012; Hernández-Orts *et al.*, 2017), and justify a first host-parasite checklist encompassing all available data. Previous marine mammal parasite checklists include Baylis (1932), Delyamure (1955), Dailey & Brownell (1972), Raga (1994), Felix (2013) and Fraija-Fernández *et al.* (2016). Most include host data, but geographical data are scanty. Australian lists include that of the internal parasites of mammals by MacKerras (1958), the references of which are unfortunately disconnected from the text and, therefore, not useable, and Arundel (1978), which records parasites found in all marine mammals that are found in Australian waters. This list, however, does not differentiate between parasites found in the host species within Australian waters and those found in the same species in other parts of the world. There are no equivalent lists for the marine mammals of NZ.

A couple of useful lists are available for particular host taxa (e.g. Blair, 1981: dugong monostome digeneans; Bowie, 1984: bottle-nosed dolphin parasites), and parasite taxa (e.g. Price, 1932: trematodes in marine mammals; Leung, 1967: whale lice of cetaceans). There have also been compilations with a veterinary perspective (e.g. Duignan, 2000; Dailey, 2001; Ladds, 2009; McFarlane *et al.*, 2009) and those looking at certain pathologies (e.g. Baylis & Daubney, 1925: lungworms of cetacean; Spratt,

2002: respiratory parasites in Australian mammals; Measures, 2001: lungworms of marine mammals).

Here, we present a host-parasite checklist collating all information about the metazoan and protozoan parasites of marine mammals in NZ and Australian waters. Although viruses (e.g. morbillivirus) and bacteria (e.g. *Brucella*) are relevant pathogens with zoonotic potential that can cause mortality in marine mammals (Castinel *et al.*, 2007), we limit our list to the better-known eukaryotic parasites. Where possible, we also identify knowledge gaps and research needs, especially with regard to human interactions and zoonoses, as well as marine mammal conservation.

## Material and methods

We present a list of the parasites found in pinnipeds, cetaceans and sirenians of NZ and Australia, as far as possible up to date at the time of publication. The list was assembled from primary publications found through searches on Google Scholar using all combinations of relevant keywords, plus searches of the reference lists in those publications. The parasites are presented in alphabetical order of Families under their relevant Phylum, Class and Order. Within Families, species are listed in alphabetical order. Classifications followed for helminths are: Anderson *et al.* (2009) (Nematoda); Caira & Jensen (2017) (Cestoda); Olson *et al.* (2003), Gibson *et al.* (2002), Jones *et al.* (2005) and Bray *et al.* (2008) (Trematoda); and Amin (2013) (Acanthocephala). For arthropods and protozoa higher taxonomy was taken from the records cited, or from searches for more up-to-date phylogenetic studies. Synonyms are taken from the references in square brackets following the entries, with corrections and updates from primary sources in some cases.

Localities of records are given as indicated in the original source. Standard abbreviations are used for Australian states: New South Wales, NSW; Queensland, QLD; South Australia, SA; Victoria, VIC; Tasmania, TAS; Western Australia, WA; and New Zealand, NZ. We have included only those records that fall within the geographical boundaries of Australia and NZ, and their subantarctic islands. Records for mainland Antarctica have not been included, because there is no geographical distinction between Australian or NZ-held territory, and those territories belonging to other countries. Although there are many records for mainland Antarctica, these are best dealt with as a separate entity.

Where there is more than one reference source, hosts and localities bear a superscript number that refers to the numbered reference. In a few cases, where references cite differing infection sites, these are also numbered with the relevant superscript number. Multiple references are listed in chronological order.

For host taxonomy we have adhered to WoRMS (2018) (Pinnipeda and Cetacea), Berta and Churchill (2012) (Pinnipeda) and Perrin (2018) (Cetacea). Host names listed are considered to be up to date as of publication. Where hosts were named differently in the original source, we have noted this in the relevant Remarks section. Hosts' common names can be found in the host-parasite list.

The developmental stage of the parasite has been noted, where given in the original source. If such information was not given, worms are assumed to be adult if egg presence is noted or egg measurements are given.

Remarks sections contain information on intermediate hosts when available, notes on prevalence and intensity, and on pathology when available; short summaries of the latest research on disputed or complicated species; and mention of molecular data

if available (i.e. from papers listed in the references and placed on GenBank) with the genetic markers used.

A list of host–parasite associations follows the parasite–host checklist.

## Results

### Parasite–host list

Phylum: Acanthocephala

Class: Palaeoacanthocephala Meyer, 1931

Order: Polymorphida Petrochenko, 1956

Family: Polymorphidae Meyer, 1931

#### Parasite name: *Bolbosoma balaenae* (Gmelin, 1790) Porta, 1908

*Synonyms.* *Bolborhynchus porrigens* Porta, 1906; *Bolbosoma porrigens* (Rudolphi, 1814) Porta, 1908; *Echinorhynchus balaenae* Gmelin, 1790; *E. lendix* Phipps, 1774; *E. mysticeti* Beneden, 1870; *E. porrigens* Rudolphi, 1819; *Sipunculus lendix* Phipps, 1774 [Amin, 2013; Yamaguti, 1963].

*Hosts.* *Megaptera novaeangliae*.

*Localities.* Bondi Beach, NSW.

*Infection site.*

*Stage.*

*References.* Johnston & Deland (1929).

*Remarks.* Called *B. porrigens* in this paper. Host reported as probably *M. nodosa* (= *longimana*); both now synonymized with *M. novaeangliae*.

#### Parasite name: *Bolbosoma capitatum* (von Linstow, 1880) Porta, 1908

*Synonyms.* *Bolborhynchus capitatus* (von Linstow, 1880) Porta, 1908; *B. physeteris* Gubanov, 1952 (*fide* Amin & Margolis, 1998); *Echinorhynchus capitatus* von Linstow, 1880 [Amin, 2013; Felix, 2013].

*Hosts.* *Pseudorca crassidens* (1, 3), *Globicephala melas* (2).

*Localities.* (1) Prime's Beach, St. Vincent Gulf, SA; (2) Macquarie Harbour, TAS; (3) Augusta WA.

*Infection site.* Intestine.

*Stage.*

*References.* (1) Edmonds (1957b); (2) McManus *et al.* (1984); (3) Edmonds (1987).

*Remarks.* Host reported in Edmonds (1957b) as Melon-headed whale (*G. melaenas* = *G. melas*); later corrected to false killer whale in Edmonds (1987).

#### Parasite name: *Bolbosoma* sp.

*Synonyms.*

*Hosts.* *Tursiops truncatus*.

*Localities.* Otago Harbour, NZ.

*Infection site.* Intestine.

*Stage.* Immature.

*References.* Bowie (1984).

*Remarks.* Single specimen.

#### Parasite name: *Corynosoma australe* Johnston, 1937

*Synonyms.* *Corynosoma otariae* Morino & Boero, 1960 [Amin, 2013].

*Hosts.* *Arctocephalus pusillus doriferus* (3), *Arctophoca australis forsteri* (4), *Hydrurga leptonyx* (2), *Neophocus cinerea* (1, 5), *Phocartos hookeri* (2, 6).

*Locality.* (1) Pearson Island, SA; (2) Auckland/Campbell Island, NZ; (3) Phillip Island, VIC; (4) in captivity, NZ; (5) Port Adelaide and Dangerous Reef, SA; (6) NZ.

*Infection site.* Small and large intestine.

*Stage.* Adult.

*References.* (1) Johnston (1937); (2) Johnston & Edmonds (1953); (3) Obendorf & Presidente (1978); (4) Cordes & O'Hara (1979); (5) Smales (1986); (6) García-Varela *et al.* (2013).

*Remarks.* Johnston (1937) described host as *A. forsteri*, but corrected this to *N. cinerea* in Johnston & Mawson (1941). Although Johnston & Edmonds (1953) listed a number of ways in which their specimens differed from those of Johnston (1937), they nonetheless record them as *C. australe*. Smales (1986) agrees in her list of comparative specimens of the species. In her paper, the host is called *A. pusillus*. Johnston & Edmonds (1953) found immature specimens in *Phalacrocorax colensoi*. Molecular data available (18S, 28S, *cox1*) (6).

#### Parasite name: *Corynosoma bullosum* (von Linstow, 1892) Railliet & Henry, 1907

*Synonyms.* *Corynosoma arctocephali* Zdzitowiecki, 1984; *C. mirabilis* Skrjabin, 1966 (*fide* Zdzitowiecki, 1986); *C. singularis* Skrjabin & Nikolski, 1971, in part; *Echinorhynchus bullosum* von Linstow, 1892 [The World Register of Marine Species (WoRMS); Amin, 2013].

*Hosts.* *Hydrurga leptonyx* (2), *Mirounga leonine* (1–3).

*Locality.* (1) Auckland/Campbell Island, NZ; (2, 3) Heard Island, Australia; (2) Macquarie Island, Australia.

*Infection site.* Intestine.

*Stage.* Adult.

*References.* (1) Johnston & Edmonds (1953); (2) Edmonds (1955); (3) Edmonds (1957a).

*Remarks.* Edmonds reported 200 (1957a), and over 100 (1955) specimens from single hosts. He states that the larval stages are found encysted in the mesenteries of *Notothenia coriiceps*.

#### Parasite name: *Corynosoma cetaceum* Johnston & Best, 1942

*Synonyms.* *Corynosoma semerme sensu* Cordero, 1933; *Polymorphus arctocephali* Smales, 1986 (nec *arctocephalus*); *Polymorphus (Polymorphus) cetaceum* (Johnston & Best, 1942) Schmidt & Dailey, 1971 [Amin, 2013].

*Hosts.* *Arctocephalus pusillus doriferus* (2), *Delphinus delphis* (1), *Tursiops truncatus* (1).

*Locality.* (1) Port Lincoln, SA; (1) St. Vincent Gulf, SA; (2) Phillip Island, VIC.

*Infection site.* Stomach and small intestine.

*Stage.* Adult.

*References.* (1) Johnston & Best (1942); (2) Smales (1986).

*Remarks.* Described as new species in Johnston & Best (1942). Described as *P. arctocephali* n. sp., and host as *A. pusillus* in Smales (1986), synonymized by Aznar *et al.* (1999).

#### Parasite name: *Corynosoma semerme* (Forssell, 1904) Lühe, 1905

*Synonyms.* *Corynosoma gibber* (Olsson, 1894) Lühe, 1911; *Echinorhynchus semermis* Forssell, 1904 (Amin, 2013).

*Hosts.* *Phocartos hookeri*.

*Locality.* Auckland/Campbell Island, NZ.

*Infection site.*

*Stage.*

*References.* Johnston & Edmonds (1953).

*Remarks.* Host called *Otaria hookeri* in this paper.

**Parasite name: *Corynosoma* sp.**

*Synonyms.*

*Hosts.* *Arctophoca australis forsteri* (2), *Cephalorhynchus hectori* (3), *Delphinus delphis* (1), *Hydrurga leptonyx* (2), *Neophoca cinerea* (4).

*Locality.* (1) St. Vincent Gulf, SA; (2) Auckland/Campbell Island, NZ; (3) Canterbury coast, NZ; (4) Port Adelaide, SA.

*Infection site.* Intestine.

*Stage.*

*References.* (1) Johnston & Deland (1929); (2) Johnston & Edmonds (1953); (3) McKenzie & Blair (1983); (4) Smales (1986).

*Remarks.* The specimens of Johnston and Deland (1929) were later designated as *C. cetaceum* (Johnston & Best, 1942). Host called *Otaria forsteri* in Johnston and Edmonds (1953). McKenzie & Blair (1983) reported finding seven specimens in one of three dolphins.

Phylum: Nematelminthes

Class: Nematoda Rudolphi, 1808

Order: Ascaridida Sprehn, 1927

Family: Anisakidae Railliet & Henry, 1912

**Parasite name: *Anisakis berlandi* Mattiucci, Nascetti, Cianchi, Paggi, Arduino, Margolis, Bratney, Webb, D'Amelio, Orecchia & Bullini, 1997**

*Synonyms.* *Anisakis simplex* C, of Mattiucci et al. (1997).

*Hosts.* *Kogia sima*.

*Locality.* Coast of NSW.

*Infection site.* Stomach.

*Stage.* Larva.

*References.* Shamsi et al. (2012).

*Remarks.* Molecular data available (ITS1&2). The specimens in this paper referred to as *A. simplex* C following Mattiucci et al. (1997) were later assigned to *A. berlandi* by Mattiucci et al. (2014).

**Parasite name: *Anisakis brevispiculata* Dollfus, 1966**

*Synonyms.*

*Hosts.* *Kogia sima*.

*Locality.* Coast of NSW.

*Infection site.* Stomach.

*Stage.* Adult.

*References.* Shamsi et al. (2012).

*Remarks.* Molecular data available (ITS1&2).

**Parasite name: *Anisakis nascettii* Mattiucci, Paoletti & Webb, 2009**

*Synonyms.* *Anisakis* sp. of Pontes et al. (2005) and Iglesias et al. (2008); *Anisakis* sp. of Valentini et al. (2006).

*Hosts.* *Mesoplodon bowdoini*, *M. grayi*, *M. layardii*.

*Locality.* South Pacific Ocean, off NZ.

*Infection site.* Stomach.

*Stage.* Adult.

*References.* Mattiucci et al. (2009).

*Remarks.* Molecular data available (*cox2*). The intermediate host was confirmed molecularly as the squid, *Onykia ingens* by Mattiucci et al. (2009) (then *Moroteuthis ingens*).

**Parasite name: *Anisakis oceanica* (Johnston & Mawson, 1951) Davey, 1971**

*Synonyms.* *Stomachus oceanicus* Johnston & Mawson, 1951.

*Hosts.* *Globicephala melas*.

*Locality.* Coast of NSW.

*Infection site.* Stomach.

*Stage.*

*References.* Johnston & Mawson (1951).

*Remarks.* Described as *S. oceanicus* in this paper, with the host called *Globicephalus ventricosas*. Davey (1971) synonymized this species with *A. physeteris*, but Shamsi et al. (2012) and Shamsi (2014) have kept the species separate as a *sp. inq.* Species is also accepted by Mattiucci et al. (2005).

**Parasite name: *Anisakis pegreffii* Campana-Rouget & Biocca, 1955**

*Synonyms.*

*Hosts.* *Delphinus delphis*, *Tursiops truncatus*.

*Locality.* Blairgowrie and Apollo Bay, VIC.

*Infection site.* Stomach.

*Stage.* Adult plus immatures in *D. delphis*, larvae in *T. truncatus*.

*References.* Shamsi et al. (2012).

*Remarks.* Molecular data available (ITS1&2).

**Parasite name: *Anisakis physeteris* Baylis, 1923**

*Synonyms.* *Anisakis skrjabini* Mozgovoi, 1949 [WoRMS].

*Hosts.* *Kogia breviceps*.

*Locality.* Wellington Beach, NZ.

*Infection site.* Stomach.

*Stage.*

*References.* Hurst (1980).

*Remarks.* A single host harboured 61 specimens.

**Parasite name: *Anisakis simplex sensu lato***

*Synonyms.* *Anisakis catodontis* Baylis, 1929; *A. ivanizkii* Mozgovoi, 1949; *A. kogiae* Johnston & Mawson, 1939; *A. kuekenthalii* (Cobb, 1889) Baylis, 1920; *A. marina* (Linnaeus, 1767) van Thiel, 1966; *A. patagonica* (von Linstow, 1880) Davey, 1971; *A. rosmari* (Baylis, 1916) Baylis, 1920; *A. similis* (Baird, 1853) Baylis, 1920; *A. simplex* (Rudolphi, 1809) Dujardin, 1845; *A. tridentata* Kreis, 1939; *Ascaris kuekenthalii* Cobb, 1889; *As. similis* Baird, 1853; *Capsularia marina* (Linnaeus, 1767) Johnston & Mawson, 1943; *Stomachus similis* (Baird, 1853) Davey, 1971 and many more [WoRMS; Davey 1971].

*Hosts.* *Arctophoca australis forsteri* (11), *Delphinus delphis* (2), *Globicephala melas* (14), *Hydrurga leptonyx* (2, 5, 6), *Kogia breviceps* (1, 11), *Lagenodelphis hosei* (12), *Lagenorhynchus obscurus* (3, 7), *Mirounga leonine* (4, 6, 9, 10), *Peponocephala electra* (8), *Tursiops truncatus* (13).



**Locality.** (1) Port Victoria, Spencer Gulf, SA; (1) Moreton Bay, QLD; (2) Sydney Harbour, NSW; (2) Port Adelaide, SA; (3) Cook Strait, NZ; (4, 6, 9) Macquarie Island, TAS; (5) Campbell Island, NZ; (6) Heard Island, Australia; (7) NZ coast; (8) Moreton Island, QLD; (8) Tweed Heads, NSW; (10) in captivity, NZ; (11) Wellington Beach, NZ; (12) Corio Bay, VIC; (13) Otago Harbour, NZ; (14) McIntyres Beach, Falmouth, and Macquarie Harbour, TAS.

**Infection site.** Stomach.

**Stage.** All stages are reported from larvae to adults.

**References.** Johnston & Mawson ((1) 1939, (2) 1941, (3) 1942, (4) 1945, (5) 1953); (6) Mawson (1953); (7) Brundson (1956); (8) Cannon (1977); (9) Morgan *et al.* (1978); (10) Cordes & O'Hara (1979); (11) Hurst (1980); (12) McColl & Obendorf (1982); (13) Bowie (1984); (14) McManus *et al.* (1984).

**Remarks.** *Anisakis simplex* is widely accepted to be a complex of closely related species (Nascetti *et al.*, 1986; Mattiucci *et al.*, 1997, 2009, 2014; D'Amelio *et al.*, 2000; Abe *et al.*, 2006; Abe, 2008), and the name has been attached to specimens the world over and in numerous hosts. Davey (1971) alone lists 34 different hosts from both Cetacea and Pinnipedia. While it is not possible to assign specimens reported in the literature over the years, Mattiucci *et al.* (2014) have made worthy inroads into resolving some of the ambiguity. As a result of their findings, it is likely that at least some of those specimens found in NZ will be their newly erected *A. berlandi* Mattiucci, Cipriani, Webb, Paoletti, Marcer, Bellisario, Gibson & Nascetti, 2014 (See entry for *Anisakis berlandi* above). Without further information, or examining each of the specimens mentioned in the literature, we here assign all references to *A. simplex* in the Australasian region, except those of Mattiucci *et al.* (2014), which have been characterized to *A. simplex sensu lato*. *Anisakis simplex* has been shown to occur as a larva in many species of fish under various names (Johnston & Mawson, 1943a, b, 1945, 1951, 1953). Brundson (1956) was able to infect eels with encapsulated *A. simplex* from barracouta, where they re-established, demonstrating that horizontal infection is possible. This is not surprising in a system where the species complex appears to be highly generalist in its choice of host and where there exists a cascade in size of predatory fish. The larva must be able to withstand being eaten by a succession of fish before being finally taken by a cetacean, where it can mature in the stomach. Hurst (1980) completed the life cycle of *A. simplex* with *Nyctiphanes australis* (first intermediate host), large fish – for example, *Thyrstites atun*, *Trachurus* sp. (second intermediate host) – and squid or small fish – for example, hoki, anchovy, sprat (paratenic host). While host specificity does appear extremely broad when all reports are taken into account, this effect may be exaggerated by the fact that *A. simplex* is, in fact, many cryptic species that are yet to be fully disentangled. In the above references the species is called *A. kogiae* (1), *A. similis* (2), *S. marinus* (7) and *S. similis* (4, 6). Host species are called *D. forsteri* (2). In the literature cited in this section, the maximum number of worms per infection amounted to several hundred (13). The species is widely reported to cause gastric ulceration and, according to some sources, mortality (10, 11).

**Parasite name:** *Anisakis* sp.

**Synonyms.**

**Hosts.** *Arctcephalus pusillus doriferus* (1), *Arctophoca australis forsteri* (2), *Balaenoptera acutorostrata* (3), *Globicephalus*

*melas* (6), *Kogia breviceps* (7), *Mesoplodon grayi* (5), *M. hectori* (4), *Phocoena dioptrica* (7).

**Locality.** (1) Franklin Island Derwent Heads, TAS; (2) in captivity, NZ; (3) Pigeon Bay, Banks Peninsula, NZ; (4) Oneroa Bay, Waiheke Island Hauraki Gulf, NZ; (5) NZ coast; (6) Farewell Spit, Golden Bay, NZ; (7) Moeraki Beach, NZ; (7) Caroline Bay, Timaru, NZ.

**Infection site.** Stomach and intestine. Mouth (*K. breviceps*).<sup>7</sup>

**Stage.** Larva, immature, adult.

**References.** (1) Johnston & Mawson (1941); (2) Cordes & O'Hara (1979); (3) Dawson & Slooten (1990); (4) Baker *et al.* (2001); (5) Valentini *et al.* (2006); (6) Beatson & O'Shea (2009); (7) Lehnert *et al.* (2017).

**Remarks.** Molecular data available (*cox2*) (5). The specimens from Grey's beaked whale (Valentini *et al.*, 2006) grouped with some from the South African coast, also unnamed. They were closest to *Anisakis ziphidarum* in phylogenetic analyses. A lack of adult specimens limited the morphological description and proper naming of this new species. Type 1 larvae were identified from *Aphanopus carbo* (black scabbard fish) from Madeira and from *Trachurus trachurus* (Atlantic horse mackerel) from the North Atlantic. The host in Johnston & Mawson's (1941) report is called *Gypsophoca tasmanica*.

**Parasite name:** *Anisakis typica* (Diesing, 1860) Baylis, 1920

**Synonyms.** *Anisakis alexandri* Hsü & Hoeppli, 1933; *A. tursiopsis* Cruz, 1946; *Ascaris typica* (Diesing, 1860) Jägerskiöld, 1894; *Conocephalus typicus* Diesing, 1860; *Peritracheilus typicus* (Diesing, 1860) Jägerskiöld, 1894 [WoRMS; Li *et al.*, 2016].

**Hosts.** *Peponocephala electra*.

**Locality.** Moreton Island, QLD; Tweed Heads, NSW.

**Infection site.** Stomach.

**Stage.** Adults and immatures.

**References.** Cannon (1977).

**Remarks.** Shamsi (2014) note that *A. typica* specimens in Australia appear to be genetically different from those reported in other countries. Jabbar *et al.* (2012) found larval stages (confirmed by DNA sequence) in a number of different fish species.

**Parasite name:** *Anisakis ziphidarum* Paggi, Nascetti, Webb, Mattiucci, Cianchi & Bullini, 1988

**Synonyms.**

**Hosts.** *Mesoplodon bowdoini*.

**Locality.** South Pacific Ocean, off NZ.

**Infection site.** Stomach.

**Stage.** Adult.

**References.** Mattiucci *et al.* (2009).

**Remarks.** Molecular data available (*cox2*).

**Parasite name:** *Contracaecum mirounga* Nikolskii, 1974

**Synonyms.**

**Hosts.** *Hydrurga leptonyx*, *Mirounga leonina*.

**Locality.** Heard Island and Macquarie Island, Australia.

**Infection site.** Stomach.

**Stage.**

**References.** Fagerholm (1988).

**Remarks.** Using the arrangement of the male caudal papillae, this study found that *C. mirounga* was restricted to southern

hemisphere hosts, compared to *C. osculatum* and *C. ogmorhini*, which were more widespread in both hemispheres.

**Parasite name: *Contracaecum ogmorhini* Johnston & Mawson, 1941**

*Synonyms.* *Contracaecum corderoi* Lent & Freitas, 1948; *C. ogmorhini* Johnston & Mawson, 1941 (*lapsus*); *C. osculatum* of Flores-Barroeta et al., 1961 [Fagerholm & Gibson, 1987].

*Hosts.* *Arctocephalus pusillus doriferus* (2), *Hydrurga leptonyx* (1).  
*Locality.* (1) Port Adelaide, SA; (2) coast of NZ.

*Infection site.*

*Stage.* Adult.

*References.* (1) Johnston & Mawson (1941); (2) Mattiucci et al. (2003).

*Remarks.* Molecular data available (*cytb*) (2). Described as new species in Johnston & Mawson (1941), but with a *lapsus* in the main heading of 'ogmorhini'. Has been accepted as *ogmorhini* ever since.

**Parasite name: *Contracaecum osculatum* (Rudolphi, 1802) Baylis, 1920**

*Synonyms.* *Ascaris osculata* Rudolphi, 1802; *C. antarcticum* Johnston, 1937; *C. gypsophocae* Johnston & Mawson, 1941; *Phocascaris hydrurgae* Johnston & Mawson, 1941 [WoRMS].

*Hosts.* *Arctocephalus pusillus doriferus* (3), *Arctophoca australis forsteri* (3, 5, 6), *Hydrurga leptonyx* (2, 3), *Mirounga leonine* (3, 4), *Neophoca cinerea* (1).

*Locality.* (1) Pearson Island, SA; (2) Port Adelaide, SA; (3) Franklin Island Derwent Heads, TAS; (3, 4) Macquarie Island, TAS; (3) Heard Island, Australia; (5) in captivity, NZ; (6) Open Bay Island, Wellington, NZ.

*Infection site.* Stomach and small intestine.

*Stage.* Adults and immatures.

*References.* (1) Johnston (1937); (2) Johnston & Mawson (1941); (3) Mawson (1953); (4) Morgan et al. (1978); (5) Cordes & O'Hara (1979); (6) Hurst (1980).

*Remarks.* Described as new species, *C. gypsophocae* and as *P. hydrurgae* in Johnston & Mawson (1941). Both synonymized by Johnston & Mawson (1945). Original host recorded as *Gypsophoca tasmanica*. Hosts recorded as *Arctocephalus forsteri* (5, 6). Johnston's (1937) original description stated the host as *A. forsteri*, but this was corrected to *N. cinerea* in Johnston and Best (1942). Hurst (1980) recorded 100% prevalence for this anisakid in the NZ fur seal. They found an infection range of 5–344 in the seals examined, and the presence of *C. osculatum* was associated with gastric ulcers.

**Parasite name: *Contracaecum radiatum* (von Linstow, 1907) Baylis 1920**

*Synonyms.* *Ascaris falcigera* Railliet & Henry, 1907; *A. osculaia* von Linstow, 1892; *A. radiata* von Linstow, 1907; *Contracaecum falcigerum* (Railliet & Henry, 1907) Baylis, 1920; *Kathleena radiata* Leiper & Atkinson, 1915 [WoRMS; Baylis 1937].

*Hosts.* *Hydrurga leptonyx*, *Mirounga leonina*.

*Locality.* Heard Island, Australia.

*Infection site.*

*Stage.*

*References.* Mawson (1953).

*Remarks.*

**Parasite name: *Contracaecum* sp.**

*Synonyms.*

*Hosts.* *Cephalorhynchus hectori*.

*Locality.* Canterbury coast, NZ.

*Infection site.* Stomach.

*Stage.*

*References.* McKenzie & Blair (1983).

*Remarks.* The material reported in this paper may have been two different species of *Contracaecum* from three dolphins. One was found as a single immature female in one dolphin, the second species was in all three dolphins, and 15 specimens were taken in total.

**Parasite name: *Phocascaris* sp.**

*Synonyms.*

*Hosts.* *Cephalorhynchus hectori*.

*Locality.* Canterbury coast, NZ.

*Infection site.* Stomach.

*Stage.* Immature.

*References.* McKenzie & Blair (1983).

*Remarks.* A single, female, specimen in one of three dolphins.

**Parasite name: *Pseudoterranova decipiens* (Krabbe, 1878) Gibson, 1983**

*Synonyms.* *Agamonema piscium* Schneider, 1862; *Ag. campbelli* Chatin, 1885; *Ascaris bulbosa* Cobb, 1888; *A. capsularia* Stiles and Hasall, 1899, in part; *A. capsularia* Baylis, 1916, in part; *A. decipiens* Krabbe, 1878; *A. rectangula* Linstow, 1888; *A. simplex* von Linstow, 1888; *Phocanema decipiens* (Krabbe, 1878) Myers, 1959; *Physaloptera guiarti* Garin, 1913; *Porrocaecum decipiens* (Krabbe, 1878) Baylis, 1920; *Por. piscium* Johnston & Mawson, 1943; *Por. capsularia* Dogiel, 1932; *Terranova decipiens* (Krabbe, 1878) Mozgovoï, 1953; *T. piscium* (Rudolphi, 1809) Johnston and Mawson, 1943 [Johnston & Mawson, 1945; Myers, 1959].

*Hosts.* *Arctophoca australis forsteri* (3, 5), *Hydrurga leptonyx* (3, 4), *Mirounga leonine* (2, 3), *Kogia breviceps* (5), *Phocartos hookeri* (1, 3, 5).

*Locality.* (1, 3) Campbell Island, NZ; (2, 4) Macquarie Island, TAS; (3, 5) Auckland Island, NZ; (5) Wellington Beach, NZ.

*Infection site.* Stomach.

*Stage.* Adult plus immatures.

*References.* (1) Johnston & Mawson (1943a); (2) Johnston & Mawson (1945); (3) Johnston & Mawson (1953); (4) Mawson (1953); (5) Hurst (1980).

*Remarks.* Mawson (1953) reported a prevalence of seven out of nine leopard seals from Macquarie Island. Hurst reported a range of infection between one and 122 per host animal. Hurst's (1980) data include both pinniped and cetacean hosts. Johnston & Mawson (1943a) referred to this species as *Por. decipiens* (Krabbe, 1878) Baylis, 1920 and (1945, 1953) *T. piscium*. Various fish are recorded as intermediate hosts; *Thyrsites atun* (5), notothenioid species (1, 3) and the flounder *Rhombosolea* sp. (3). Hosts variously called *Arctocephalus hookeri* (1), *Otaria forsteri* (3), *O. hookeri* (3). Mawson (1953) also reported this species from the Royal penguin *Eudyptes schlegeli* Finsch, 1876.

**Parasite name:** *Pseudoterranova kogiae* (Johnston & Mawson, 1939) Mozgovi, 1951

**Synonyms.** *Porrocaecum kogiae* Johnston & Mawson, 1939; *Terranova kogiae* (Johnston & Mawson, 1939) Johnston & Mawson, 1945 [Johnston & Mawson, 1945; Deardorff & Overstreet, 1981].

**Hosts.** *Kogia breviceps* (1, 2).

**Locality.** (1) Port Victoria, Spencer Gulf, SA and Moreton Bay, QLD; (2) Wellington Beach, NZ.

**Infection site.** Stomach.

**Stage.** Adults and larvae.

**References.** (1) Johnston & Mawson (1939); (2) Hurst (1980).

**Remarks.** Called *P. kogiae* in Johnston & Mawson (1939). Intermediate fish hosts include the barracouta (*Thyrsites atun*), subantarctic cod (*Notothaenia* sp.) (Hurst, 1984), hoki (*Macruronus novaezelandiae*) and ling (*Genypterus blacodes*) (Grabda & Ślósarczyk, 1981).

Family: Ascarididae Baird, 1853

**Parasite name:** *Paradujardinia halicoris* (Owen, 1833) Travassos, 1933

**Synonyms.** *Ascaris dugonis* Brandt, 1846; *A. halichoris* Owen, 1833; *Dujardinia halicoris* (Owen, 1833) Baylis, 1920; *Dujardiniascaris halicoris* (Owen, 1833) Baylis, 1947 [Sprent, 1980].

**Hosts.** *Dugong dugon* (1–4).

**Locality.** (1) Wallum Creek, North Stradbroke Island, QLD; (2) Yarrabah, near Cairns, QLD; (3) north coast of QLD; (4) coast of QLD.

**Infection site.** Stomach and intestine.

**Stage.**

**References.** (1) Dexler & Freund (1906); (2) Johnston & Mawson (1941); (3) Sprent (1980); (4) Owen *et al.* (2012).

**Remarks.** Johnston & Mawson (1941) called their specimens *Dujardinia halicoris*. Owen *et al.* (2012) reported the presence of 5500 to 6000 worms in a single dugong, with the massive impaction possibly the cause of death of the individual.

Order: Spirurida Chitwood, 1933

Family: Acuariidae Railliet, Henry & Sisoff, 1912

**Parasite name:** *Acuaria* sp.

**Synonyms.**

**Hosts.** *Cephalorhynchus hectori*.

**Locality.** Canterbury coast, NZ.

**Infection site.** Stomach.

**Stage.** Larva.

**References.** McKenzie & Blair (1983).

**Remarks.** A single specimen was found in one of three dolphins.

Family: Filariidae Weinland, 1858

**Parasite name:** *Filaria sensu lato* sp.

**Synonyms.**

**Hosts.** *Mirounga leonina*.

**Locality.** Heard Island, Australia.

**Infection site.** Blood vessels.

**Stage.** Adult.

**References.** Mawson (1953).

**Remarks.**

Family: Gnathostomatidae Railliet, 1895

**Parasite name:** *Echinocephalus overstreeti* Deardorff & Ko, 1983

**Synonyms.**

**Hosts.** *Delphinus delphis*.

**Locality.** St. Vincent Gulf, SA.

**Infection site.** Intestine.

**Stage.** Immature.

**References.** Johnston & Mawson (1941).

**Remarks.** This species is usually found as adults in elasmobranchs, with the larval stages in molluscs and teleosts. This finding of a larval stage in the intestine of a dolphin almost certainly represents an accidental infection from predation on a paratenic fish host. Johnston and Mawson (1941) listed this as *Echinocephalus uncinatus* Molin, 1858. However, Beveridge (1987) showed that all adult and larval specimens found in elasmobranchs in Australian waters belonged to *E. overstreeti*, and that earlier records of *E. uncinatus* can probably be attributed to *E. overstreeti*. Moravec and Justine (2006), however, questioned this decision.

Family: Tetrameridae Travassos, 1914

**Parasite name:** *Crassicauda boopis* Baylis, 1920

**Synonyms.** *Crassicauda pacifica* Margolis & Pike, 1955 [WoRMS].

**Hosts.** *Ziphius cavirostris*.

**Locality.** Kiritehere Beach, Purakanui Bay, Mahia Peninsula, NZ.

**Infection site.** Kidneys.

**Stage.** Adult.

**References.** Duignan (2003).

**Remarks.** *Crassicauda boopis* is recorded as pathogenic in this paper. The worms destroy functional renal elements and cause physical obstruction of the urinary ducts, likely causing renal failure in some cases.

**Parasite name:** *Crassicauda grampicola* Johnston & Mawson, 1941

**Synonyms.**

**Hosts.** *Grampus griseus*.

**Locality.** Manley, NSW.

**Infection site.** Pterygoid sinus.

**Stage.** Adults and immatures.

**References.** Johnston & Mawson (1941).

**Remarks.**

**Parasite name:** *Crassicauda magna* Johnston & Mawson, 1939

**Synonyms.** *Crassicauda duguyi* Dollfuss, 1966 [Jabbar *et al.*, 2015].

**Hosts.** *Kogia breviceps* (1, 2).

**Locality.** (1, 2) Moreton Bay, QLD; (1) Port Victoria and Spencer Gulf, SA.

**Infection site.** Subcutaneous tissue and connective tissue of neck.

**Stage.** Adult.



**References.** (1) Johnston & Mawson (1939); (2) Jabbar *et al.* (2015).

**Remarks.** Molecular data available (18S) (2). The phylogeny in Jabbar *et al.* (2015) moves the genus *Crassicauda* from Tetrameridae to Acuariidae. This huge worm seems to be found only in fragments due to the difficulty of extracting it whole from the subcutaneous flesh.

**Parasite name: *Crassicauda* sp.**

**Synonyms.**

**Hosts.** *Lagenorhynchus obscurus* (1, 2), *Ziphius cavirostris* (1), *Pseudorca crassidens* (3), *Delphinus delphis* (4, 5).

**Locality.** (1, 2, 4) NZ; (3) NSW; (5) Buckland's Beach, Howick, NZ.

**Infection site.** (1, 3) Pterygoid sinus; (1, 2) kidneys; (1, 2) urogenital system; (1, 2) cranial sinuses; (1, 5) fascia; (3) middle ear; (4) mammary ducts.

**Stage.**

**References.** Duignan ((1) 2000, (2) 2003); (3) J. Boulton in Ladds (2009); (4) Stockin *et al.* (2009); (5) Lehnert *et al.* (2017).

**Remarks.** Undoubtedly, based upon infection site alone, these records refer to different species of *Crassicauda*. Most records agree that worms of this genus embed their cephalic end into the tissues of their favoured organ, with the body of the worm projecting freely into the lumen or sinus for the release of the eggs. The species occurring in kidneys of *Z. cavirostris* caused '...massive destruction of reniculi with fibrosis and necrosis...' (Duignan, 2000 p. 452). Twenty specimens were present in this host animal (1).

Order: Strongylida Molin, 1861

Family: Ancylostomatidae Looss, 1905

**Parasite name: *Uncinaria hamiltoni* Baylis, 1933**

**Synonyms.**

**Hosts.** *Neophoca cinerea*.

**Locality.** Kangaroo Island, SA.

**Infection site.**

**Stage.**

**References.** Beveridge (1980).

**Remarks.** *Uncinaria hamiltoni sensu* Beveridge (1980) should be treated as a synonym of *U. sanguinis* (Professor Ian Beveridge, pers. comm.).

**Parasite name: *Uncinaria sanguinis* Marcus, Higgins, Slapeta & Gray, 2014**

**Synonyms.**

**Hosts.** *Neophoca cinerea* (1, 2).

**Locality.** (1, 2) Dangerous Reef, Spencer Gulf, SA; (1) South Page Island, Backstairs Passage, SA; (1, 2) Seal Bay, Kangaroo Island, SA.

**Infection site.** Intestine.

**Stage.** Adults and immatures.

**References.** (1) Haynes *et al.* (2014); (2) Marcus *et al.* (2014).

**Remarks.** Molecular data available (*cox1*) (1). Haynes *et al.* (2014) found that all pups examined were infected and that the infection route was trans-mammary. They also found that hookworms were genetically highly variable, but female host natal site fidelity and the transmammary route of infection do not restrict hookworm gene flow between *N. cinerea* populations.

**Parasite name: *Uncinaria* sp.**

**Synonyms.**

**Hosts.** *Phocarcos hookeri* (1, 2, 4, 5), *Arctophoca australis forsteri* (3, 7), *Neophoca cinerea* (6, 7).

**Locality.** (1, 2) NZ; (3) Ohau Point, Kaikoura, NZ; (4, 5) Sandy Bay, Enderby Island, Auckland Island, NZ; (6) Adelaide Zoo, SA; (7) Kangaroo Island, Dangerous Reef, Spencer Gulf, SA.

**Infection site.** Stomach, intestine.

**Stage.** Adults and immatures.

**References.** (1) Duignan (1998); (2) Duignan (2000); (3) Boren (2005); Castinel *et al.* ((4) 2006, (5) 2007); (6) I. Beveridge in Ladds 2009; (7) Ramos *et al.* (2013).

**Remarks.** Molecular data available (ITS1&2) (7). Hookworms are the cause of haemorrhagic enteritis and are the main cause of death to pups in some seasons and localities. Sources report up to 7000 worms in a single pup. Route of infection is trans-mammary and worms develop into adults within three weeks of infection (4). Castinel *et al.* (2006) found a high level of size variability within adult worm populations in a single host. We suspect that most or all of the specimens reported in these papers could be referred to *U. sanguinis* or to the unnamed species of Nadler *et al.* (2013) in the following.

**Parasite name: *Uncinaria* sp. NZSL of Nadler *et al.*, 2013**

**Synonyms.**

**Hosts.** *Phocarcos hookeri*.

**Locality.** Sandy Bay Beach, Enderby Island, NZ.

**Infection site.**

**Stage.**

**References.** Nadler *et al.* (2013).

**Remarks.** Molecular data available (ITS1&2, 28S, 12S). The phylogeny of Nadler *et al.* (2013) included *Uncinaria* spp. from pinniped hosts worldwide and recovered seven independent evolutionary lineages or species, including the two described species (*U. hamiltoni* and *U. lucasi*) and five undescribed species, each from a different host. *Uncinaria* sp. NZSL was restricted to the NZ sea lion. Note, however, that Ramos *et al.* (2013) concluded that the three species found in Australian hosts *A. p. doriferus*, *A. forsteri* and *N. cinerea* were not distinguishable.

**Parasite name: *Uncinaria* sp. AFS of Nadler *et al.*, 2013**

**Synonyms.**

**Hosts.** *Arctocephalus pusillus doriferus* (1, 2).

**Locality.** (1, 2) Lady Julia Percy Island and Seal Rocks, Phillip Island, VIC; (2) Kanowna Island, VIC.

**Infection site.**

**Stage.**

**References.** (1) Nadler *et al.* (2013); (2) Ramos *et al.* (2013).

**Remarks.** Molecular data available (ITS1&2, 28S, 12S) (1, 2). Although not explicitly stated in their paper, we understand that the specimens from *A. p. doriferus* of Ramos *et al.* (2013) are the same as those of Nadler *et al.* (2013) from the same host.

**Parasite name: *Uncinaria* sp. SES of Nadler *et al.*, 2013**

**Synonyms.**

**Hosts.** *Mirounga leonine* (1, 2).



**Locality.** (1) Macquarie Island, TAS; (2) Possession Island, QLD and Lady Julia Percy Island, VIC.

**Infection site.**

**Stage.**

**References.** (1) Nadler *et al.* (2013); (2) Ramos *et al.* (2013).

**Remarks.** Molecular data available (ITS1&2, 28S, 12S) (1, 2). Although not explicitly stated in their paper, we understand that the specimens from *M. leonina* of Ramos *et al.* (2013) are equivalent to those of Nadler *et al.* (2013) from the same host.

Family: Filaroididae Schultz, 1951

**Parasite name: *Parafilaroides decorus* Dougherty & Herman, 1947**

**Synonyms.**

**Hosts.** *Phocarctos hookeri*.

**Locality.** NZ.

**Infection site.** Lungs.

**Stage.**

**References.** Duignan (2000).

**Remarks.** Duignan reported mild sub-pleural lesions caused by *P. decorus*.

**Parasite name: *Parafilaroides hydrurgae* Mawson, 1953**

**Synonyms.**

**Hosts.** *Hydrurga leptonyx*.

**Locality.** Heard Island, Australia.

**Infection site.** Lungs and bronchi.

**Stage.**

**References.** Mawson (1953).

**Remarks.**

**Parasite name: *Parafilaroides normani* Dailey, 2009**

**Synonyms.**

**Hosts.** *Arctocephalus pusillus doriferus* (1, 2), *Arctophoca australis forsteri* (1).

**Locality.** (1) Dog Beach, Ocean Grove, VIC; (1) Foxton Beach, Palmerston North, NZ; (2) Phillip Island, VIC.

**Infection site.** Lungs.

**Stage.** Adult.

**References.** (1) Dailey (2009); (2) Jabbar *et al.* (2014).

**Remarks.** Molecular data available (mitochondrial genome) (2).

**Parasite name: *Parafilaroides* sp.**

**Synonyms.**

**Hosts.** *Arctocephalus pusillus doriferus* (3), *Arctophoca australis forsteri* (2, 3), *Delphinus delphis* (4), *Hydrurga leptonyx* (3), *Neophoca cinerea* (1).

**Locality.** (1) Dangerous Reef, Spencer Gulf and Seal Bay, Kangaroo Island, SA; (2) Ohau Point, Kaikoura, NZ; (3) Cape Woollamai and Ocean Grove, VIC; (3) Taranaki Bight, NZ; (3) Geelong, VIC; (4) coast of NZ.

**Infection site.** Lungs.

**Stage.** Adults and larvae.

**References.** (1) Nicholson & Fanning (1981); (2) Boren (2005); (3) Norman in McFarlane *et al.* (2009); (4) Stockin *et al.* (2009).

**Remarks.** Nicholson & Fanning (1981) stated that their specimens were probably a new species of *Parafilaroides*, but did not describe or name them. These authors also reported that, although the animals appeared healthy when captured, they showed signs of acute verminous pneumonia. The report of Stockin *et al.* (2009) seems unlikely in a dolphin host, and may represent an accidental infection or possible misidentification.

Family: Pseudaliidae Railliet & Henry, 1909

**Parasite name: *Halocercus lagenorhynchi* Baylis & Daubney, 1925**

**Synonyms.**

**Hosts.** *Delphinus delphis* (2), *Tursiops aduncus* (2), *Tursiops truncatus* (1).

**Locality.** (1) Encounter Bay, SA; (2) coast of SA.

**Infection site.** Lungs.

**Stage.**

**References.** (1) Johnston & Mawson (1941); (2) Tomo *et al.* (2010).

**Remarks.** Tomo *et al.* (2010) report 'necrotic microabscesses, in serious acute to chronic infections, lung function would have been compromised' in lungworm infections of dolphins, 'moderate and heavy burdens may have contributed to animals' deaths.' Predominantly calves and juveniles were infected. During the 18-year study, the prevalence of lung nematode infections increased in 2005–2006 fourfold from 14% before the outbreak to 63% in short-beaked common dolphins; some cases were also recorded in Indo-Pacific bottlenose dolphins and common bottlenose dolphins.

**Parasite name: *Halocercus delphini* Baylis & Daubney, 1925**

**Synonyms.**

**Hosts.** *Stenella coeruleoalba*.

**Locality.** Carter's Beach, Te Akau, NZ.

**Infection site.** Lungs.

**Stage.**

**References.** Lehnert *et al.* (2017).

**Remarks.**

**Parasite name: *Halocercus* sp.**

**Synonyms.**

**Hosts.** *Cephalorhynchus hectori* (1, 2), *Delphinus delphis* (3), *Stenella coeruleoalba* (3).

**Locality.** (1) Canterbury coast, NZ; (2) NZ; (3) Kawaa Kawaa Bay, NZ; (3) Muriwai Beach, NZ.

**Infection site.** Lung.

**Stage.** Adult.

**References.** (1) McKenzie & Blair (1983); (2) Duignan (2000); (3) Lehnert *et al.* (2017).

**Remarks.**

**Parasite name: *Pharurus alatus* (Leuckart, 1848) Stiles & Hassall, 1905**

**Synonyms.** *Prosthecosacter alatus* (Leuckart, 1848) Diesing, 1851; *Pseudalius alatus* (Leuckart, 1848) Diesing, 1851; *Stenurus alatus* (Leuckart, 1848) Yorke & Maplestone, 1926; *Strongylus*

*alatus* Leuckart, 1848; *Str. (Pharurus) alatus* (Leuckart, 1848) Diesing, 1851; *Torynurus alatus* (Leuckart, 1848) Delyamure, 1952 [WoRMS; Baylis & Daubney, 1925].

*Hosts.* *Delphinus delphis*.

*Locality.* Coast of SA.

*Infection site.* Lungs.

*Stage.*

*References.* Tomo et al. (2010).

*Remarks.*

**Parasite name: *Skrjabinalius cryptocephalus* Delyamure, 1942**

*Synonyms.*

*Hosts.* *Tursiops truncatus*.

*Locality.* Otago Harbour, NZ.

*Infection site.* Lungs.

*Stage.*

*References.* Bowie (1984).

*Remarks.* The anterior end of this nematode was tightly knotted, embedded in the parenchyma of the lung and surrounded by purulent fluid in a fibrous or calcified capsule (Bowie, 1984).

**Parasite name: *Stenurus globicephalae* Baylis & Daubney, 1925**

*Synonyms.*

*Hosts.* *Globicephala melas* (3, 5), *Globicephala* sp. (1), *Grampus griseus* (4), *Peponocephala electra* (2).

*Locality.* (1) Prosperine, QLD; (2) Moreton Island and Tugun Beach, QLD; (3) McIntyres Beach, Falmouth, TAS; (4) NSW; (5) Big River, Kahurangi National Park, NZ; (5) Kaka Point, NZ.

*Infection site.* Guttural pouch, ear canals, auditory sinuses.

*Stage.* Adult.

*References.* (1) Arnold in Cannon (1977); (2) Cannon (1977); (3) McManus et al. (1984); (4) J. Boulton in Ladds (2009); (5) Lehnert et al. (2017).

*Remarks.* Molecular data available (ITS2) (5). McManus et al. (1984) reported 'huge masses of worms: average 2300, range 1140–4200 per ear' in the lead bulls, and their data led them to conclude that this auditory parasitism played a significant role in the mass stranding of 183 pilot whales on this occasion. However, a study on by-caught porpoises with good nutritional status has revealed high loads of *Stenurus minor*, with no apparent effect on echo-location or hunting ability, and no pathological changes (Faulkner et al., 1998). Another recent study on *S. minor* in the inner ear of harbour porpoises highlights the need of further research to assess the impact these nematodes may have on hearing (Morell et al., 2017). Host named *G. malaenas* in McManus et al. (1984).

**Parasite name: *Stenurus minor* (Kuhn, 1829) Baylis & Daubney, 1925**

*Synonyms.* *Pharurus minor* (Kuhn, 1929) Cobbold, 1879; *Prosthecosacter minor* (Kuhn, 1829) Diesing, 1851; *Pseudalius minor* (Kuhn, 1829) Schneider, 1866; *Stenurus inflexus* Dujardin, 1845; *Stenurus phocoenae* Dougherty, 1943; *Stenurus vagans* Dougherty, 1943; *Strongylus minor* Kuhn, 1829 [WoRMS; Baylis & Daubney, 1925].

*Hosts.* *Phocoena dioptrica*.

*Locality.* Pipikaretu, Otago Peninsula, NZ.

*Infection site.* Sinuses and tympanic cavity.

*Stage.* Adult.

*References.* Lehnert et al. (2017).

*Remarks.* Molecular data available (ITS2).

**Parasite name: *Stenurus ovatus* (von Linstow, 1910) Baylis & Daubney, 1925**

*Synonyms.* *Pseudalius ovatus* von Linstow, 1910 [WoRMS].

*Hosts.* *Delphinus delphis* (3), *Lagenodelphis hosei* (1), *Tursiops aduncus* (3), *T. truncatus* (2, 3).

*Locality.* (1) Corio Bay, VIC; (2) Otago Harbour, NZ; (3) coast of SA.

*Infection site.* Lungs.

*Stage.* Adults and larvae.

*References.* (1) McColl & Obendorf (1982); (2) Bowie (1984); (3) Tomo et al. (2010).

*Remarks.* McColl & Obendorf (1982) report the lungs of their host specimen were highly congested with worms, causing verminous pneumonia and greatly impairing respiratory function.

**Parasite name: *Stenurus* sp.**

*Synonyms.*

*Hosts.* *Cephalorhynchus hectori*.

*Locality.* NZ.

*Infection site.* Lungs.

*Stage.*

*References.* Duignan (2000).

*Remarks.*

Phylum: Platyhelminthes

Class: Cestoda

Order: Diphylobothriidea Kuchta, Scholz, Brabec & Bray, 2008

Family: Diphylobothriidae Lühe, 1910

**Parasite name: *Adenocephalus pacificus* Nybelin, 1931**

*Synonyms.* *Adenocephalus septentrionalis* Nybelin, 1931; *Bothriocephalus* sp. of Stiles & Hassall (1899); *B. macrophallus* von Linstow, 1905, in part; *Dibothriocephalus atlanticum* Delyamure & Parukhin, 1968; *Diphylobothrium glaciale* (Cholodkovsky, 1915) Markowski, 1952; *Dip. krotovi* Delyamure, 1955; *Dip. pacificum* (Nybelin, 1931) Margolis, 1956; *Dip. septentrionalis* Nybelin, 1931 [WoRMS; Hernández-Orts et al., 2015].

*Hosts.* *Arctocephalus pusillus doriferus* (1), *Neophoca cinerea* (2).

*Locality.* (1) Lady Julia Percy Island, VIC; (2) Pearson Island, SA.

*Infection site.* Intestine.

*Stage.* Adult plus immatures.

*References.* (1) Drummond (1937); (2) Johnston (1937).

*Remarks.* Described in Drummond (1937) as *Dip. arctocephali* n. sp., and host called *A. tasmanicus*. Described in Johnston (1937) as *Dip. arctocephalinum* n. sp. and host called *A. forsteri*, but Johnston corrected this to *N. cinerea* in Johnston & Mawson (1941) and Johnston & Best (1942). Johnston (1937) described the worms as a 'tangled mass' in the intestine.

**Parasite name: *Diphylobothrium* sp.**

*Synonyms.*

*Hosts.* *Arctophoca australis forsteri*, *Hydrurga leptonyx*.

*Locality.* In captivity, NZ.

*Infection site.* Intestine.

*Stage.* Adult.

*References.* Cordes & O'Hara (1979).

*Remarks.* Cordes & O'Hara (1979) described these worms as occurring in huge masses, their scoleces embedded in a cyst in the colon wall and their strobilae free in the lumen. In the leopard seal, they described a 2–3 lb mass of worms blocking the intestine.

Order: Phyllobothriidea Caira, Jensen, Waeschenbach, Olson & Littlewood, 2014

Family: Phyllobothriidae Braun, 1900

**Parasite name:** *Monorygma chamissonii* (Linton, 1905) Meggitt, 1924

*Synonyms.* *Cysticercus delphini* Rudolphi, 1819; *Phyllobothrium chamissonii* (Linton, 1905) Southwell & Walker, 1936; *Taenia chamissonii* Linton, 1905.

*Hosts.* *Peponocephala electra*.

*Locality.* Moreton Island and Tugun Beach, QLD.

*Infection site.* Stomach wall and peritoneum.

*Stage.* Encysted larvae.

*References.* Cannon (1977).

*Remarks.* Called *Phyllobothrium chamissonii* in this paper. Found in cysts 20–25 mm in diameter with thick fibrous walls. The inner blastocysts (metacestode) were almond-shaped, with fat droplets in the wall giving them an orange colour.

**Parasite name:** *Monorygma grimaldii* (Moniez, 1899) Meggitt, 1924

*Synonyms.* *Cephalocotyleum delphini delphis* Diesing, 1850; *Cysticercus delphini* Rudolphi, 1819; *Cysticercus grimaldii* Braun, 1898; *Cysticercus Taenia grimaldii* Moniez, 1889; *Cysticerque du groupe grimaldii* Baer, 1932; *Dubium delphini* Rudolphi, 1810; *Phyllobothrium* sp. Beneden, 1868; *P. delphini* Beneden, 1870; *Taenia grimaldii* Moniez, 1889; *T. schamissonii* Linton, 1905 [Baylis 1932; Delyamure, 1955].

*Hosts.* *Delphinus delphis* (2, 3), *Lagenodelphis hosei* (1), *Stenella coeruleoalba* (4).

*Locality.* (1) Corio Bay, VIC; (2) Barwon Heads, VIC; (3) coast of NZ; (4) Carter's Beach, Te Akau, NZ; (4) Kawera Parade, Paramon East, NZ; (4) Miruwai Beach, NZ.

*Infection site.* (1) Abdominal muscle; (2, 3) peritoneal cavity; (4) urogenital area; (4) mammary gland; (4) blubber.

*Stage.* Merocercoid larva.

*References.* (1) McColl & Obendorf (1982); (2) Norman (1997); (3) Stockin *et al.* (2009); (4) Lehnert *et al.* (2017).

*Remarks.* Norman (1997) reported localized lymphoplasmacytic response to the cysts. These metacestodes are merocercoids of marine tapeworms infecting various marine mammals (Agustí *et al.*, 2005; Aznar *et al.*, 2007); historically, they have been referred to as '*Phyllobothrium delphini*' (Bosc, 1802) and '*Monorygma grimaldii*' (Moniez, 1889), but molecular evidence suggests that they belong to the '*Clistobothrium*' clade (Aznar *et al.*, 2007; Randhawa, 2011; Randhawa & Brickle, 2011). Recently, they were found in subcutaneous blubber from fur seals and shown to be intermediate stages of the cestode *Clistobothrium*, infecting sharks (Klotz *et al.*, 2018). The merocercoids represented the *delphini*-morphotype but were identified as *grimaldii*-genotype using 18S and 28S sequences.

**Parasite name:** *Phyllobothrium delphini* (Bosc, 1802) Gervais, 1885

*Synonyms.* *Cephalocotyleum delphini delphis* Diesing, 1850; *Cysticercus delphini* Laennec, 1804; *Cy. delphini* Rudolphi, 1810; *Cy. mysticeti* Diesing, 1850; *Cy. physeteris* Diesing, 1863; *Cysticercus* sp. Bennett, 1937; *Hydatid delphini* Bosc, 1802; *H. delphinii* Bosc, 1802; *Phyllbothrium* sp. Beneden, 1868; *Phyllobothrium* sp. Carnot, 1822; *Phyllobothrium* sp. Rennie and Reid, 1912; *P. inchoatum* Leidy, 1891; *P. tumidum* Linton, 1922; *Scolex delphini* Stossich, 1897; *Vermis delphini delphis* Rudolphi, 1810 [Baylis, 1932; Delyamure, 1955; Williams, 1968].

*Hosts.* *Cephalorhynchus hectori* (3), *Delphinus delphis* (4, 5, 6), *Kogia breviceps* (1), *Lagenorhynchus obscurus* (6), *Mirounga leonina* (2), *Phocoena dioptrica* (6), *Stenella coeruleoalba* (6).

*Locality.* (1) Port Victoria, Spencer Gulf, SA; (2) Macquarie Island, TAS; (3) Kaikoura coast, NZ; (4) Barwon Heads, VIC; (5) coast of NZ; (6) Sandspit Estuary, Green's Point, NZ; (6) Portobello Bay, Otago Harbour and off Kaikoura, NZ; (6) Caroline Bay, Timaru, NZ; (6) Carter's Beach, Te Akau, NZ.

*Infection site.* Blubber, especially around tail and genital area.

*Stage.* Merocercoid larva.

*References.* (1) Johnston & Mawson (1939); (2) Morgan *et al.* (1978); (3) McKenzie & Blair (1983); (4) Norman (1997); (5) Stockin *et al.* (2009); (6) Lehnert *et al.* (2017).

*Remarks.* Morgan *et al.* (1978) found this cestode encysted in each of three elephant seals examined. As evidenced by the long list of synonyms, this cestode has a complicated history. Reviews of the literature can be found in Delyamure (1955), Dollfus (1964), Johnston & Mawson (1939) and Williams (1968). Molecular evidence suggests that this species belongs to the '*Clistobothrium*' clade (Aznar *et al.*, 2007; Randhawa, 2011; Randhawa & Brickle, 2011). See also *Monorygma grimaldii*.

**Parasite name:** *Phyllobothrium* sp.

*Synonyms.*

*Hosts.* *Arctophoca australis forsteri* (3), *Balaenoptera acutorostrata* (2), *Cephalorhynchus hectori* (3), *Delphinus delphis* (3), *Lagenorhynchus obscurus* (3), *Phocartctos hookeri* (3), *Tursiops truncatus* (1).

*Locality.* (1) Otago Harbour, NZ; (2) Pigeon Bay, Banks Peninsula, NZ; (3) NZ.

*Infection site.* Ventral blubber.

*Stage.* Merocercoid larva.

*References.* (1) Bowie (1984); (2) Dawson & Slooten (1990); (3) Duignan (2000).

*Remarks.* Duignan (2000) found that prevalence was higher in dusky dolphins than in common or Hector's dolphins. In pinnipeds they found a higher prevalence in NZ fur seals than in NZ sea lions. They also reported granulomatous mastitis associated with the cysts that resulted in underfed pups. Dawson and Slooten (1990) reported several hundred cysts in the blubber of a dwarf minke whale.

**Parasite name:** *Phyllobothriidae* gen. sp.

*Synonyms.*

*Hosts.* *Arctophoca australis forsteri*.

*Locality.* In captivity, NZ.

*Infection site.* Ventral blubber.

Stage. Merocercoid larva.

References. Cordes & O'Hara (1979).

Remarks.

Order: Tetrabothriidea Baer, 1954

Family: Tetrabothriidae Linton, 1891

**Parasite name: *Tetrabothrius forsteri* (Kreffft, 1871) Fuhrmann, 1904**

Synonyms. *Prosthecotyle forsteri* (Kreffft, 1871) Monticelli, 1892; *Taenia forsteri* Krefft, 1871; *Tetrabothrius dalli* Yamaguti, 1952 [Linton, 1923; WoRMS].

Hosts. *Delphinus delphis* (1), *Mesoplodon hectori* (2).

Locality. (1) Port Jackson, NZ; (2) Oneroa Bay, Waiheke Island, NZ.

Infection site. Stomach and intestine.

Stage.

References. (1) Krefft (1871); (2) Baker et al. (2001).

Remarks. Described in Krefft (1871) as *Taenia forsteri* n. sp., and host recorded as *D. forsteri*.

**Parasite name: *Tetrabothrius* sp.**

Synonyms.

Hosts. *Delphinus delphis* (2), *Lagenodelphis hosei* (1).

Locality. (1) Corio Bay, VIC; (2) unknown locality, Australia.

Infection site. Stomach and intestine.

Stage.

References. (1) McColl & Obendorf (1982); (2) Ladds (2009).

Remarks. McColl & Obendorf (1982) reported minor haemorrhaging in pancreatic ducts caused by this cestode.

Class: Trematoda Rudolphi, 1808

Order: Diplostomida Olson, Cribb, Tkach, Bray & Littlewood, 2003

Family: Brauninidae Wolf, 1903

**Parasite name: *Braunina cordiformis* Wolf, 1903**

Synonyms.

Hosts. *Cephalorhynchus hectori* (1, 2).

Locality. (1) Canterbury coast, NZ; (2) unknown locality, NZ.

Infection site. Stomach.

Stage.

References. (1) McKenzie & Blair (1983); (2) Duignan (2000).

Remarks. McKenzie & Blair (1983) found a maximum of 57 worms in one of three dolphins, attached to the stomach wall.

Family: Cyathocotylidae Mühling, 1898

**Parasite name: *Mesostephanus neophocae* Dubois & Angel, 1976**

Synonyms.

Hosts. *Mirounga leonina*, *Neophoca cinerea*.

Locality. In captivity and St. Vincent Gulf, SA.

Infection site. Intestine.

Stage. Adult.

References. Dubois & Angel (1976).

Remarks. Dubois & Angel (1976) put forward the suggestion that species of this genus are more usually parasites of

phalacrocoracid birds, and that perhaps the sea lion had taken on the parasite after predated a bird.

Family: Spirorchiidae Stunkard, 1921

**Parasite name: Spirorchiidae gen. sp.**

Synonyms.

Hosts. *Dugong dugon*.

Locality. Mornington Island and Townsville, QLD.

Infection site. Ovaries, myometrial blood vessels.

Stage. Eggs.

References. Marsh et al. (1984).

Remarks. Found in 18 of 46 dugongs. Lesions were found on ovaries, containing refractile eggs 25–30 µm in diameter. Pigmented eyespots of miracidia were visible. Marsh et al. (1984) postulate that these could be the eggs of a spirorchid trematode, members of which parasitize the circulatory system of aquatic reptiles in the same habitat as dugongs.

Order: Echinostomida La Rue, 1957

Family: Cladorchiidae Fiscoeder, 1901

**Parasite name: *Solenorthis travassosi* Hilmy, 1949**

Synonyms. *Indosolenorthis hirudinaceus* Cruzs, 1951; *Solenorthis baeri* Hilmy, 1949; *S. gohari* Hilmy, 1949; *S. naguimbahfouzi* Hilmy, 1949 [WoRMS].

Hosts. *Dugong dugon* (1, 2).

Locality. (1) Mornington Island and Townsville, QLD; (2) Lucinda, QLD.

Infection site. Caecum and large intestine.

Stage. Adult.

References. (1) Blair (1980); (2) Olson et al. (2003).

Remarks. Molecular data available (18S, 28S) (2). In his redescription of *I. hirudinaceus*, Blair (1980) is adamant that it is a separate species and genus. He states that Hilmy's (1949) specimens should be *S. travassosi* but still retains his specimens as distinct. He mentions that their size range is large and that the Australian specimens do not overlap the Indian ones in size. Sey (1980) synonymized *I. hirudinaceus* with *S. travassosi*, and now only one species, *S. travassosi*, is accepted from dugong.

Family: Labicolidae Blair, 1979

**Parasite name: *Labicola cf. elongata***

Synonyms.

Hosts. *Dugong dugon*.

Locality. Lucinda, QLD.

Infection site.

Stage.

References. Olson et al. (2003).

Remarks. Molecular data available (18S, 28S).

**Parasite name: *Labicola elongata* Blair, 1979**

Synonyms.

Hosts. *Dugong dugon* (1, 2).

Locality. (1) Mornington Island and Townsville, QLD; (2) unknown locality, Australia.

Infection site. Upper lip.



Stage. Adult.

References. (1) Blair (1979); (2) Blanshard (2001).

Remarks. Blair (1979) found these trematodes in all 21 specimens he observed. They were so unusual that he erected the Family Labicolidae to contain the species. Several worms together formed pus-filled abscesses along the sides of the upper lip, with pores to the outside.

Family: Notocotylidae Lühe, 1909

**Parasite name: *Ogmogaster* sp.**

Synonyms.

Hosts. *Caperea marginata*.

Locality. Fotheringate Bay, Flinders Island, TAS.

Infection site. Intestine.

Stage. Adult.

References. McManus *et al.* (1984).

Remarks.

Family: Opisthotrematidae Poche, 1926

**Parasite name: *Folitrema jecoris* Blair, 1981**

Synonyms.

Hosts. *Dugong dugon*.

Locality. Mornington Island, Thursday Island and Townsville, QLD.

Infection site. Gall bladder and bile ducts.

Stage. Adult.

References. Blair (1981).

Remarks.

**Parasite name: *Lankatrema macrocotyle* Blair, 1981**

Synonyms.

Hosts. *Dugong dugon*.

Locality. Mornington Island, Thursday Island and Townsville, QLD.

Infection site. Intestine.

Stage. Adult.

References. Blair (1981).

Remarks. *Lankatrema* spp. are found encapsulated in the wall of the intestine. Different species may be found in the same capsule (Blair, 1981).

**Parasite name: *Lankatrema mannarensis* Crusz & Fernand, 1954**

Synonyms.

Hosts. *Dugong dugon* (1, 2).

Locality. (1) Mornington Island, QLD; (2) Townsville, QLD.

Infection site. Stomach and intestine.

Stage. Adult.

References. (1) Blair (1981); (2) Olson *et al.* (2003).

Remarks. Molecular data available (18S, 28S) (2). Blair (1981) admits they are poor specimens in his paper, and that the record is questionable.

**Parasite name: *Lankatrema microcotyle* Blair, 1981**

Synonyms.

Hosts. *Dugong dugon*.

Locality. Mornington Island, Thursday Island and Townsville, QLD.

Infection site. Intestine.

Stage. Adult.

References. Blair (1981).

Remarks. Found encapsulated in wall of ileum, 2–7 in each capsule.

**Parasite name: *Lankatrema minutum* Blair, 1981**

Synonyms.

Hosts. *Dugong dugon*.

Locality. Mornington Island and Townsville, QLD.

Infection site. Stomach.

Stage. Adult.

References. Blair (1981).

Remarks. Occurs in pairs in the wall of the stomach glands with their posterior ends towards the lumen of the gland. Their capsules are similar to those reported by Crusz & Fernand (1954) for *L. mannarensis*. There appears to be no host response to their presence (Blair, 1981).

**Parasite name: *Lankatrematoides gardneri* Blair, 1981**

Synonyms.

Hosts. *Dugong dugon*.

Locality. Mornington Island, Thursday Island and Townsville, QLD.

Infection site. Pancreatic ducts.

Stage. Adult.

References. Blair (1981).

Remarks.

**Parasite name: *Opisthotrema australe* Blair, 1981**

Synonyms.

Hosts. *Dugong dugon*.

Locality. Mornington Island, Thursday Island and Townsville, QLD.

Infection site. Eustachian tubes and middle ear.

Stage. Adult.

References. Blair (1981).

Remarks.

**Parasite name: *Opisthotrema dujonis* (Leuckart, 1874) Price, 1932**

Synonyms. *Monostomum dujonis* Leuckart, 1874; *Opisthotrema cochleare* Fischer, 1883; *O. cochleariforme* Travassos and Vogelsang, 1931 (*lapsus*) [WoRMS; Blair, 1981].

Hosts. *Dugong dugon* (1–4).

Locality. (1) Wallum Creek, North Stradbroke Island, QLD; (2) coast of QLD; (3) Mornington Island, QLD; (3) Thursday Island, QLD; (3, 4) Townsville, QLD.

Infection site. (1, 3) Eustachian tubes; (3) middle ear; (2, 3) oesophagus.

Stage. Adult and immature.

References. (1) Dexler & Freund (1906); (2) Johnston (1913); (3) Blair (1981); (4) Olson *et al.* (2003).

Remarks. Molecular data available (18S, 28S) (4). Dexler and Freund (1906) and Johnston (1913) record this species as *O. cochleare*.

**Parasite name: *Pulmonicola pulmonalis* (von Linstow, 1904) Poche, 1926**

*Synonyms.* *Cochleotrema indicum* (Sharma & Gupta, 1971); *Opisthotrema nasalis* (n. n.) Purnomo, Palmieri & Budiarmo in Budiarmo, Palmieri, Imes, Allen & Lepes, 1979; *Opisthotrema pulmonale* von Linstow, 1904; *Paracochleotrema indicum* Sharma & Gupta, 1971; *Pulmonicola indicus* (Sharma & Gupta, 1971); *Pulmonicola pulmonale* (von Linstow, 1904) Ruiz, 1946 [WoRMS; Blair, 1981].

*Hosts.* *Dugong dugon* (1–4).

*Locality.* (1) Torres Strait, Australia; (2) Mornington Island, Thursday Island, Townsville, QLD; (3) unknown location, Australia; (4) coast of QLD.

*Infection site.* (2) Nasal passages and lungs; (4) bronchi and trachea.

*Stage.* Adult.

*References.* (1) von Linstow (1904); (2) Blair (1981); (3) Blanshard (2001); (4) Owen et al. (2012).

*Remarks.* Described as *Opisthotrema pulmonale* by von Linstow (1904). Called *Cochleotrema indicum* in Blanshard (2001) and Owen et al. (2012). Cause of chronic bronchitis, tracheitis and bronchopneumonia (3, 4).

*Family:* Rhabdiopoeidae Poche, 1926

**Parasite name: *Faredifex clavata* Blair, 1981**

*Synonyms.*

*Hosts.* *Dugong dugon*.

*Locality.* Mornington Island, Thursday Island and Townsville, QLD.

*Infection site.* Small intestine.

*Stage.* Adult.

*References.* Blair (1981).

*Remarks.* Found in abscesses in wall of ileum.

**Parasite name: *Rhabdiopoeus taylori* Johnston, 1913**

*Synonyms.*

*Hosts.* *Dugong dugon* (1–3).

*Locality.* (1) Coast of QLD; (2) Mornington Island, Thursday Island and Townsville, QLD; (3) Lucinda, QLD.

*Infection site.* Intestine.

*Stage.* Adult.

*References.* (1) Johnston (1913); (2) Blair (1981); (3) Olson et al. (2003).

*Remarks.* Molecular data available (18S, 28S) (3). Johnston (1913) found *R. taylori* in both dugongs he examined, ten in one and 16 in the other.

**Parasite name: *Haerator caperatus* Blair, 1981**

*Synonyms.*

*Hosts.* *Dugong dugon*.

*Locality.* Mornington Island, Thursday Island and Townsville, QLD.

*Infection site.* Intestine and caecum.

*Stage.* Adult.

*References.* Blair (1981).

*Remarks.*

**Parasite name: *Taprobanella bicaudata* Cruz & Fernand, 1954**

*Synonyms.*

*Hosts.* *Dugong dugon* (1, 2).

*Locality.* (1) Mornington Island, QLD; (1) Thursday Island, QLD; (1, 2) Townsville, QLD.

*Infection site.* Large intestine.

*Stage.* Adult.

*References.* (1) Blair (1981); (2) Olson et al. (2003).

*Remarks.* Molecular data available (18S, 28S) (2).

*Order:* Plagiorchiida La Rue, 1957

*Family:* Brachycladiidae Odhner, 1905

**Parasite name: *Brachycladium delphini* (Poirier, 1886) Looss, 1899**

*Synonyms.* *Campula delphini* (Poirier, 1886) Bittner & Sprehn, 1928; *Cladocoelium delphini* (Poirier, 1886) Stossich, 1892; *Distomum delphini* Poirier, 1886; *Lecithodesmus delphini* (Poirier, 1886) Yamaguti, 1958 [WoRMS; Felix, 2013].

*Hosts.* *Delphinus delphis*.

*Locality.* Bethell's Beach, Auckland, NZ.

*Infection site.* Liver.

*Stage.* Adult.

*References.* Lehnert et al. (2017).

*Remarks.*

**Parasite name: *Brachycladium palliatum* (Looss, 1885) Looss, 1899**

*Synonyms.* *Campula palliata* (Looss, 1885) Looss, 1899; *Cladocoelium palliatum* (Looss, 1885) Stossich, 1892; *Distomum palliatum* Looss, 1885; *Lecithodesmus palliatus* (Looss, 1885) Yamaguti, 1958 [WoRMS; Felix, 2013].

*Hosts.* *Delphinus delphis* (1, 2).

*Locality.* (1) In captivity NZ; (2) Battey's Beach, Warkworth, NZ; (2) Shakespeare Peak and Waiake Beach, Auckland, NZ.

*Infection site.* Liver and bile ducts.

*Stage.* Adult.

*References.* (1) Cordes & O'Hara (1979); (2) Lehnert et al. (2017).

*Remarks.* Cordes and O'Hara (1979) found over 100 of this species in one dolphin. The worms were associated with parasitic hepatitis in four dolphins with lesions, but no worms were found in the livers of two more. Worms and lesions blocked bile ducts, and were either contributory to, or the cause of, death.

**Parasite name: *Campula* sp.**

*Synonyms.*

*Hosts.* *Cephalorhynchus hectori* (2, 3), *Lagenodelphis hosei* (1).

*Locality.* (1) Corio Bay VIC; (2) New Brighton Beach, Christchurch and Gillespies Point, NZ; (3) NZ.

*Infection site.* (1) Pancreatic ducts; (2, 3) mesenteric lymph nodes.

*Stage.* Adult and eggs.

*References.* (1) McColl & Obendorf (1982); (2) Hutton et al. (1987); (3) Duignan (2000).

*Remarks.* Both Duignan (2000) and Hutton et al. (1987) found these worms encapsulated within the mesenteric lymph nodes of the host. The lymph node had granulomatous lesions with inflammatory response associated with eggs/was enlarged with a tumour-like mass which contained purulent necrotic debris and a single parasitic worm. A secondary bacterial infection, *Eikenella corrodens*, was cultured from the lesion (2).

**Parasite name: *Nasitrema* sp.***Synonyms.**Hosts.* *Lagenodelphis hosei*.*Locality.* Corio Bay, VIC.*Infection site.* Blowhole.*Stage.* Eggs.*References.* McColl & Obendorf (1982).*Remarks.***Parasite name: *Synthesium tursionis* (Marchi, 1873) Stunkard & Alvey, 1930***Synonyms.* *Distomum longissimum* Poirier, 1886 *nec D. longissimum* von Linstow, 1896; *D. tursionis* Marchi, 1873; *Hadwenius tursionis* (Marchi, 1873) Fernández, Balbuena & Raga, 1994; *Orthosplanchnus tursionis* (Marchi, 1873) Odhner, 1926; *Synthesium tursionis* (Marchi, 1873) [Price, 1932; Marigo *et al.*, 2008].*Hosts.* *Tursiops truncatus*.*Locality.* Otago Harbour, NZ.*Infection site.* Small intestine.*Stage.* Adult.*References.* Bowie (1984).*Remarks.***Parasite name: *Synthesium* sp.***Synonyms.**Hosts.* *Neophoca cinerea*.*Locality.* St. Vincent Gulf, SA.*Infection site.* Intestine.*Stage.**References.* Dubois & Angel (1976).*Remarks.* Genus *Hadwenius* in this paper. This genus was synonymized with *Synthesium* by Gibson (2005).

Family: Heterophyidae Leiper, 1909

**Parasite name: *Galactosomum angelae* Pearson, 1973***Synonyms.**Hosts.* *Neophoca cinerea*.*Locality.* St. Vincent Gulf, SA.*Infection site.* Intestine.*Stage.* Adult.*References.* Dubois & Angel (1976).*Remarks.* This species was originally described by Pearson (1973) from the Caspian tern – as mentioned in the passing reference to *G. angelae* in Dubois and Angel (1976). There is a perpetuated error in the citation of this species and the referencing of this paper. Note that both Dailey *et al.* (2002) and Hernández-Orts *et al.* (2012) list Dubois and Angel (1976) with the title '*Galactosomum angelae* Pearson 1973 in *Neophoca cinerea* (Péron, 1816) the Australian sea-lion.' There does not appear to be any paper with this title. The 1976 paper is actually entitled '*Mesostephanus neophocae* n. sp. (Strigeata: Prohemistomidae), parasite d'une otarie d'Australie, *N. cinerea* (Péron et Lesueur)'. In addition, the volume and page reference given in both of these works – that is, '82: 191–229' – apply to a paper by Dubois and Mahon published in the Bulletin de la Société Neuchâteloise des Sciences

Naturelles in 1959. The corrected reference for the Dubois and Angel (1976) paper is '99: 29–32'.

**Parasite name: Heterophyidae 'Gen.' sp.***Synonyms.**Hosts.* *Delphinus delphis*.*Locality.* In captivity, NZ.*Infection site.* Adipose tissue of omasum.*Stage.**References.* Cordes & O'Hara (1979).*Remarks.***Parasite name: *Stictodora diplacantha* Johnston, 1942***Synonyms.**Hosts.* *Neophoca cinerea*.*Locality.* St. Vincent Gulf, SA.*Infection site.* Intestine.*Stage.**References.* Dubois & Angel (1976).*Remarks.* This species was originally described from the pied cormorant.

In addition to the above records, 'gastrointestinal parasites' were reported in *Arctophoca australis forsteri* from Ohau Point, NZ (Boren, 2005); 'lung worms' in *Delphinus delphis* from Mooloolaba Beach, QLD (Greenland & Limpus, 2008); 'cestodes' in *Tursiops truncatus* from Otago Harbour, NZ (Bowie, 1984) and *Globicephala melas* from McIntyres Beach, TAS (McManus *et al.*, 1984); and 'trematodes' in *A. a. forsteri* from Ohau Point, NZ (Boren, 2005), *Lagenodelphis hosei* from Corio Bay, VIC (McColl & Obendorf, 1982) and *Dugong dugon* from Wallum Creek, QLD (Dexler & Freund, 1906).

Phylum: Arthropoda

Class: Arachnida Lamarck, 1801

Subclass: Acari Leach, 1817

Order: Parasitiformes

Family: Halarachnidae Oudemans, 1906

**Parasite name: *Halarachne miroungae* Ferris, 1925***Synonyms.* *Halarachne erratica* Fain & Mortelmans, 1959; *H. taita* Eichler, 1958 [Domrow, 1962].*Hosts.* *Mirounga leonine*.*Locality.* Macquarie Island, TAS.*Infection site.* Respiratory tract.*Stage.* Adult, larvae.*References.* Domrow (1979).*Remarks.***Parasite name: *Orthohalarachne attenuata* (Banks, 1910) Newell, 1947***Synonyms.* *Halarachne attenuata* Banks, 1910; *H. magellanica* Finnegan, 1934; *H. reflexa* Tubb, 1937; *H. rosmari* Oudemans, 1916; *H. zalophi* Oudemans, 1916; *Orthohalarachne reflexa* (Tubb, 1937) Strandtmann and Wharton, 1958 [Newell, 1947; Domrow, 1974].*Hosts.* *Arctocephalus pusillus doriferus* (1–4), *Neophoca cinerea* (4–6).

**Locality.** (1) Lady Julia Percy Island, VIC; (2) Portarlington, VIC; (3) Newcastle, NSW; (4–6) Dangerous Reef, SA; (4) Seal Rocks and Geelong, VIC; (6) Kangaroo Island, SA.

**Infection site.** Nasopharynx, anterior and ethmoid nasal turbinates, distal third of the trachea and in the proximal 10 cm of both bronchi.

**Stage.** Adults, larva.

**References.** (1) Tubb (1937); (2) Domrow (1963); (3) Seawright (1964); (4) Domrow (1974); (5) Marlow (1975); (6) Nicholson & Fanning (1981).

**Remarks.** Tubb (1937) reports heavy infestations, cephalothorax and legs embedded in the mucous membrane, abdomen protruding, the locus of infection was inflamed and swollen, impossible to dislodge the mites without causing extensive damage to the mucous membrane. The host in Tubb's (1937) report is named *A. tasmanicus*. Seawright (1964) cites the host name as *Gypsophoca tasmanica*.

**Parasite name: Orthohalarachne diminuata (Doetschman, 1944) Newell, 1947**

**Synonyms.** *Halarachne diminuata* Doetschman, 1944; *Orthohalarachne chabaudi* Gretillat, 1960; *O. letalis* Popp, 1961 [Newell, 1947; Domrow, 1974].

**Hosts.** *Arctocephalus pusillus doriferus* (1), *Neophoca cinerea* (2).

**Locality.** (1) Seal Rocks and Geelong, VIC; (2) Dangerous Reef and Kangaroo Island, SA.

**Infection site.** Nasopharynx, nasal turbinates, lungs.

**Stage.** Adult, larvae.

**References.** (1) Domrow (1974); (2) Nicholson & Fanning (1981).

**Remarks.** Domrow (1974) reports mixed infections with *O. attenuata*.

Order: Trombidiformes Reuter, 1909

Family: Demodecidae Nicolet, 1855

**Parasite name: Demodex zalophi Dailey & Nutting, 1980**

**Synonyms.**

**Hosts.** *Zalophus californianus*.

**Locality.** Australia.

**Infection site.** Skin, hair follicles.

**Stage.** Adult, larvae.

**References.** Dailey & Nutting (1980).

**Remarks.** In Californian sea lion in captivity in Australia. First record of a demodecid in marine mammals.

Class: Insecta Linnaeus, 1758

Order: Phthiraptera Haeckel, 1896

Family: Echinophthiriidae Enderlein, 1904

**Parasite name: Antarctophthirus microchir (Trouessart & Neumann, 1888) Enderlein, 1906**

**Synonyms.** *Echinophthirus microchir* Trouessart & Neumann, 1888 [Leonardi, 2009].

**Hosts.** *Phocarctos hookeri* (1–3), *Neophoca cinerea* (4, 6), *Arctophoca australis forsteri* (5).

**Locality.** (1) Auckland Island, NZ; (2) Campbell Island, NZ; (3) Snares Island, NZ; (4, 6) Kangaroo Island and Dangerous Reef, SA; (4) Pages Island, SA.

**Infection site.** Fur/skin, body.

**Stage.** Adults.

**References.** (1) Enderlein (1906); (2) Clay (1964); (3) Horning et al. (1980); (4) McIntosh & Murray (2007); (5) Leonardi et al. (2009); (6) Marcus et al. (2015).

**Remarks.** Leonardi et al. (2009) report examining a group of specimens from a NZ fur seal in the Te Papa collection. Te Papa collection data show that these specimens were from Kaikoura and Open Bay Islands, NZ. This species has been found in otariids the world over and Leonardi and Palma (2013) suggest that the existing records may represent a complex of cryptic species. Host is called *Arctocephalus forsteri* in Leonardi et al. (2009).

**Parasite name: Antarctophthirus ogmorhini Enderlein, 1906**

**Synonyms.** *Echinophthirus setosus* Rothschild, 1902 (*nec* *E. setosus* Burmeister 1838 = *E. phocae* Lucas, 1834) [Harrison, 1937].

**Hosts.** *Hydrurga leptonych* (1, 2).

**Locality.** (1, 2) Macquarie Island, TAS.

**Infection site.** Fur/skin, body.

**Stage.** Adults.

**References.** (1) Harrison (1937); (2) Watson (1967).

**Remarks.** Leonardi et al. (2014) erected *Antarctophthirus carlinii* for specimens from the Weddell seal (*Leptonychotes weddelli* (Lesson, 1826)). *Antarctophthirus carlinii* was, in turn, listed by Palma (2017) who included, as synonyms, many occurrences of *A. ogmorhini* in the literature.

**Parasite name: Lepidophthirus macrorhini Enderlein, 1904**

**Synonyms.**

**Hosts.** *Mirounga leonina* (1, 2–6).

**Locality.** (1, 2–4, 6) MacQuarie Island, TAS; (5) Snares Island, NZ.

**Infection site.** Fur/skin.

**Stage.** Adult.

**References.** (1) Harrison (1937); (2) Murray & Nicholls (1965); (3) Watson (1967); (4) Lowry et al. (1978); (5) Horning et al. (1980); (6) Palma & Horning (2002).

**Remarks.** Host named *Macrorhinus leoninus* in Harrison (1937). A specimen in Te Papa Museum was collected from Kaikoura NZ.

Subphylum: Crustacea

Class: Hexanauplia Oakley, Wolfe, Lindgren & Zaharof, 2013

Order: Sessilia Lamarck, 1818

Family: Platylepadidae Newman & Ross, 1976

**Parasite name: Platylepas hexastylus (Fabricius, 1798) Pilsbry, 1916**

**Synonyms.** *Coronula bissexlobata* Blainville, 1824; *C. californiensis* Chenu, 1825; *Lepas hexastylus* Fabricius, 1798; *Platylepas bissexlobata* (Blainville, 1824) Darwin, 1854; *P. pulchra* Gray, 1825 [Pilsbry, 1916].

**Hosts.** *Dugong dugon* (1, 2).

**Locality.** (1) Sydney Harbour, Australia; (2) Magnetic Island, QLD.

**Infection site.** Skin, ventral surface.

**Stage.**

**References.** (1) Marlow (1962); (2) Zann & Harker (1978).

**Remarks.**



Order: Lepadiformes Buckeridge & Newman, 2006  
Family: Lepadidae Darwin, 1852

**Parasite name: *Lepas australis* Darwin, 1851**

*Synonyms.*

*Hosts.* *Arctocephalus tropicalis*.

*Locality.* Adelaide, SA.

*Infection site.* Body and flippers.

*Stage.*

*References.* Shaughnessy *et al.* (2014).

*Remarks.* Shaughnessy *et al.* (2014) reported this barnacle from the pelage of the subantarctic fur seal, a vagrant in Australian waters.

Family: Balanidae Leach, 1817

**Parasite name: *Balanus* sp.**

*Synonyms.*

*Hosts.* *Dugong dugon*.

*Locality.* Wallum Creek, North Stradbroke Island, QLD.

*Infection site.* Skin of back.

*Stage.*

*References.* Dexler & Freund (1906).

*Remarks.* The authors state, 'The dugong is the host of great numbers of parasites, both external and internal. On its back, as with whales, numerous barnacles establish themselves; a few *Balanus* but mostly *Chelonobia* [sic].'

Family: Chelonibiidae Pilsbry, 1916

**Parasite name: *Chelonibia* sp.**

*Synonyms.*

*Hosts.* *Dugong dugon*.

*Locality.* Wallum Creek, North Stradbroke Island, QLD.

*Infection site.* Skin of back.

*Stage.*

*References.* Dexler & Freund (1906).

*Remarks.* The authors report, 'The dugong is the host of great numbers of parasites, both external and internal. On its back, as with whales, numerous barnacles establish themselves; a few *Balanus* but mostly *Chelonobia* [sic].'

Class: Malacostraca Latreille, 1802

Order: Amphipoda Latreille, 1816

Family: Cyamidae Rafinesque, 1815

**Parasite name: *Cyamus boopis* Lütken, 1870**

*Synonyms.* *Cyamus ceti* Chilton, 1883; *C. elongatus* Hiro, 1938; *C. pacificus* Lütken, 1873; *C. suffuses* Dall, 1872 [WoRMS].

*Hosts.* *Megaptera novaeangliae* (1), unidentified South Australian whale (2), unidentified NZ whale (2).

*Locality.* (1) Picton, NZ; (1) Carnarvon, WA; (2) unknown locality, SA, and unknown locality, NZ.

*Infection site.* Skin.

*Stage.* Adults, juveniles.

*References.* (1) Leung (1965); (2) Sedlak-Weinstein (1991).

*Remarks.* This species has been found to be highly specific in its choice of host, the humpback whale, *M. novaeangliae*

(Carvalho *et al.*, 2010), so it seems probable that the unidentified whales belonged to this species.

**Parasite name: *Cyamus catadontis* Margolis, 1954**

*Synonyms.*

*Hosts.* *Physeter macrocephalus*.

*Locality.* Albany, WA.

*Infection site.*

*Stage.*

*References.* Leung (1965).

*Remarks.* In his paper, Leung (1965) lists a large number of cyamid specimens from all over the world, collected for a study of ectocommensal protozoans. No details are given other than the locality, date and collector. Leung names the sperm whale host as *P. catodon*.

**Parasite name: *Isocyamus delphinii* (Guérin-Méneville, 1836) Gervais & Beneden, 1859**

*Synonyms.* *Cyamus delphinii* Guérin-Méneville, 1836; *C. globicipitis* Lütken, 1873; *Isocyamus globicipitis*, Hiro, 1938 [Leung, 1967].

*Hosts.* *Globicephala melas* (1), *Phocoena phocoena* (2), *Pseudorca crassidens* (3).

*Locality.* (1) Jarvis Bay, NSW; (2) Australia; (3) Little Manly and Crowdy Heads, NSW.

*Infection site.* Skin.

*Stage.* Adults, juveniles.

*References.* (1) Leung (1965); (2) Berzin & Vlasova (1982); (3) Sedlak-Weinstein (1991).

*Remarks.* Leung (1965) names the host *G. malaena*. Berzin and Vlasova (1982) list this species as occurring in *Phocoena phocoena*, which is probably a host identification error, as this porpoise does not inhabit the Australasian region. It seems probable that this host was *Phocoena dioptrica*.

**Parasite name: *Isocyamus deltobranchium* Sedlak-Weinstein, 1992**

*Synonyms.*

*Hosts.* *Globicephala melas*.

*Locality.* Coast of TAS.

*Infection site.* Skin.

*Stage.* Adults.

*References.* Sedlak-Weinstein (1992b).

*Remarks.* Host named *G. malaena* in Sedlak-Weinstein (1992b).

**Parasite name: *Isocyamus kogiae* Sedlak-Weinstein, 1992**

*Synonyms.*

*Hosts.* *Kogia breviceps*.

*Locality.* Moreton Island, QLD.

*Infection site.* Skin.

*Stage.* Adults.

*References.* Sedlak-Weinstein (1992a).

*Remarks.*

**Parasite name: *Platycyamus thompsoni* (Gosse, 1855) Lütken, 1870**

*Synonyms.* *Cyamus thompsoni* Gosse, 1855 [WoRMS].

*Hosts.* *Mesoplodon grayi*.

*Locality.* Younghusband Peninsula, SA.

*Infection site.* Skin.

*Stage.* Adults.

*References.* Sedlak-Weinstein (1991).

*Remarks.* New location and new host record.

**Parasite name: *Scutocyamus antipodensis* Lincoln & Hurley, 1980**

*Synonyms.*

*Hosts.* *Cephalorhynchus hectori* (1), *Phocoena dioptrica* (2).

*Locality.* (1) Cook Strait, NZ; (2) Caroline Bay, NZ.

*Infection site.* Skin.

*Stage.* Adults, juveniles.

*References.* (1) Lincoln & Hurley (1980); (2) Lehnert *et al.* (2017).

*Remarks.*

**Parasite name: *Syncyamus aequus* Lincoln & Hurley, 1981**

*Synonyms.*

*Hosts.* *Tursiops truncatus*, *Stenella longirostris*.

*Locality.* Arafura Sea, north-west Australia.

*Infection site.* Skin.

*Stage.* Adults, juveniles.

*References.* Sedlak-Weinstein (1991).

*Remarks.* New host location in Arafura Sea for this species.

**Parasite name: *Syncyamus pseudorcae* Bowman, 1955**

*Synonyms.*

*Hosts.* *Pseudorca crassidens*.

*Locality.* Crowdy Heads, NSW.

*Infection site.* Skin.

*Stage.* Adults, juveniles.

*References.* Sedlak-Weinstein (1991).

*Remarks.*

Subphylum: Apicomplexa

Class: Conoidasida Levine, 1988

Order: Eucoccidiorida Léger & Duboscq, 1910

Family: Sarcocystidae Poche, 1913

**Parasite name: *Cryptosporidium hominis* Morgan-Ryan, Fall, Ward, Hijawi, Sulaiman, Fayer, Thompson, Olson, Lal & Xiao, 2002**

*Synonyms.* *Cryptosporidium parvum* Tyzzer, 1912 (in part).

*Hosts.* *Dugong dugon* (1, 2).

*Locality.* (1, 2) Hervey Bay, QLD.

*Infection site.* Small intestine.

*Stage.*

*References.* (1) Hill *et al.* (1997); (2) Morgan *et al.* (2000).

*Remarks.* Hill *et al.* (1997) do not give a species name for *Cryptosporidium*. Three animals were found dead, one euthanized with anorexia and lethargy, putative oocysts found. Using the same specimens, Morgan *et al.* (2000) provide molecular data leading to identification as *C. parvum* 'human' genotype. This genotype was later described as *C. hominis* by Morgan-Ryan *et al.* (2002).

**Parasite name: *Toxoplasma gondii* Nicolle & Manceaux, 1908**

*Synonyms.*

*Hosts.* *Tursiops aduncus* (1), *Sousa chinensis* (2), *Dugong dugon* (3), *Arctophoca australis forsteri* (4), *Phocarctos hookeri* (5).

*Locality.* (1) In captivity, Australia; (2) Townsville and Gladstone Harbour, QLD; (3) south-east QLD; (4) Sydney, NSW; (5) Otago, NZ.

*Infection site.* Brain (tissue cysts), heart, lungs, liver, spleen, adrenal glands (tachyzoite stages).

*Stage.*

*References.* (1) Jardine & Dubey (2002); (2) Bowater *et al.* (2003); (3) Owen *et al.* (2012); (4) Donahoe *et al.* (2014); (5) Roe *et al.* (2017).

*Remarks.* Congenital toxoplasmosis in a stillborn late-term foetus with myocardial necrosis and nonsuppurative necrotizing encephalitis were associated with tachyzoites and tissue cysts (Jardine & Dubey, 2002); systemic toxoplasmosis, molecular data (Donahoe *et al.*, 2014); encephalitis associated with *T. gondii* cysts, emaciation, ataxia in one live stranded animal (Bowater *et al.*, 2003). Host called *Arctocephalus forsteri* in Donahoe *et al.* (2014).

Family: Hexamitidae Kent, 1880

**Parasite name: *Giardia duodenalis* (Lambl, 1859) Kofoid & Christiansen, 1915**

*Synonyms.* *Cercomonas intestinalis* Lambl, 1859; *Giardia agilis* Kunstler, 1882; *G. lamblia* Stiles, 1914; *Hexamita duodenalis* Davaine, 1875; *Lambliia intestinalis* Blanchard, 1888.

*Hosts.* *Neophoca cinerea*.

*Locality.* WA, SA, in captivity QLD and NSW.

*Infection site.* Intestine.

*Stage.*

*References.* Delport *et al.* (2014).

*Remarks.* Analysed from faecal samples, molecular data (18S).

**Host-parasite list**

*Host taxon:* *Pinnipedia*

Family: Otariidae

**Host name: *Arctocephalus pusillus doriferus* (Australian fur seal)**

Acanthocephala

*Corynosoma australe*

*Corynosoma cetaceum*

Nematoda

*Anisakis* sp.

*Contracaecum ogmorhini*

*Contracaecum osculatum*

*Parafilaroides normani*

*Parafilaroides* sp.

*Uncinaria* sp. 2 of Nadler *et al.* (2013)

Cestoda

*Adenocephalus pacificus*

Arachnida

*Orthohalarachne attenuata*

*Orthohalarachne diminuata*

**Host name: *Arctocephalus tropicalis* (subantarctic fur seal)**

Crustacea

*Lepas australis*

**Host name: *Arctophoca australis forsteri* (NZ fur seal)**

Gastrointestinal parasites

Acanthocephala

*Corynosoma australe**Corynosoma* sp.

Nematoda

*Anisakis simplex* s.l.*Anisakis* sp.*Contracaecum osculatum**Parafilaroides normani**Parafilaroides* sp.*Pseudoterranova decipiens**Uncinaria* sp.

Cestoda

*Diphyllobothrium* sp.*Phyllobothrium* sp.

Trematoda gen. sp.

Insecta

*Antarctophthirus microchir*

Protozoa

*Toxoplasma gondii***Host name: *Neophoca cinerea* (Australian sea lion)**

Acanthocephala

*Corynosoma australe**Corynosoma* sp.

Nematoda

*Contracaecum osculatum**Parafilaroides* sp.*Uncinaria hamiltoni**Uncinaria sanguinis**Uncinaria* sp.

Cestoda

*Adenocephalus pacificus*

Trematoda

*Galactosomum angelae**Mesostephanus neophocae**Stictodora diplacantha**Synthesium* sp.

Arachnida

*Orthohalarachne attenuata**Orthohalarachne diminuta*

Insecta

*Antarctophthirus microchir*

Protozoa

*Giardia duodenalis***Host name: *Phocarctos hookeri* (NZ sea lion)**

Acanthocephala

*Corynosoma australe**Corynosoma semerme*

Nematoda

*Anisakis simplex* s.l.*Pseudoterranova decipiens**Parafilaroides decorus**Uncinaria* sp.*Uncinaria* sp. 1 of Nadler *et al.* (2013)

Cestoda

*Phyllobothrium* sp.

Insecta

*Antarctophthirus microchir*

Protozoa

*Toxoplasma gondii***Host name: *Zalophus californianus* (California sea lion) captive animal**

Arachnida

*Demodex zalophi*

Family: Phocidae

**Host name: *Hydrurga leptonyx* (Leopard seal)**

Acanthocephala

*Corynosoma australe**Corynosoma bullosum**Corynosoma* sp.

Nematoda

*Anisakis simplex* s.l.*Contracaecum mirounga**Contracaecum ogmorhini**Contracaecum osculatum**Contracaecum radiatum**Parafilaroides hydrurgae**Parafilaroides* sp.*Pseudoterranova decipiens*

Cestoda

*Diphyllobothrium* sp.

Insecta

*Antarctophthirus ogmorhini***Host name: *Mirounga leonina* (Southern elephant seal)**

Acanthocephala

*Corynosoma bullosum*

Nematoda

*Anisakis simplex* s.l.*Contracaecum mirounga**Contracaecum osculatum**Contracaecum radiatum**Filaria* s.l. sp.*Pseudoterranova decipiens**Uncinaria* sp. 3 of Nadler *et al.* (2013)

Cestoda

*Phyllobothrium delphini*

Trematoda

*Mesostephanus neophocae*

Arachnida

*Halarachne miroungae*

Insecta

*Lepidophthirus macrorhini**Host taxon: Cetacea*

Family: Balaenopteridae

**Host name: *Balaenoptera acutorostrata* (Minke whale)**

Nematoda

*Anisakis* sp.

Cestoda  
*Phyllobothrium* sp.

**Host name:** *Megaptera novaeangliae* (Humpback whale)

Acanthocephala  
*Bolbosoma balaenae*

Crustacea  
*Cyamus boopis*

Family: Neobalaenidae

**Host name:** *Caperea marginata* (pygmy right whale)

Trematoda  
*Ogmogaster* sp.

Family: Delphinidae

**Host name:** *Cephalorhynchus hectori* (Hector's dolphin)

Acanthocephala  
*Corynosoma* sp.

Nematoda  
*Acuaria* sp.  
*Contraeacum* sp.  
*Halocercus* sp.  
*Phocascaris* sp.  
*Stenurus* sp.

Cestoda  
*Phyllobothrium delphini*  
*Phyllobothrium* sp.

Trematoda  
*Braunina cordiformis*  
*Campula* sp.

Crustacea  
*Scutocyamus antipodensis*

**Host name:** *Delphinus delphis* (short-beaked common dolphin)

Acanthocephala  
*Corynosoma cetaceum*  
*Corynosoma* sp.

Nematoda  
lung worms  
*Anisakis pegreffii*  
*Anisakis simplex* s.l.  
*Crassicauda* sp.  
*Echinocephalus overstreeti*  
*Halocercus lagenorhynchi*  
*Halocercus* sp.  
*Parafilaroides* sp.  
*Pharurus alatus*  
*Stenurus ovatus*

Cestoda  
*Monorygma grimaldii*  
*Phyllobothrium delphini*  
*Phyllobothrium* sp.  
*Tetrabothrius forsteri*  
*Tetrabothrius* sp.

Trematoda  
*Brachycladium delphini*

*Brachycladium palliatum*  
Heterophyidae gen. sp.

**Host name:** *Globicephala melas* (long-finned pilot whale)

Acanthocephala  
*Bolbosoma capitatum*

Nematoda  
*Anisakis oceanica*  
*Anisakis simplex* s.l.  
*Anisakis* sp.  
*Stenurus globicephalae*

Crustacea  
*Isocyamus delphinii*  
*Isocyamus deltobranchium*

**Host name:** *Globicephala* sp.

Nematoda  
*Stenurus globicephalae*

**Host name:** *Grampus griseus* (Risso's dolphin)

Nematoda  
*Crassicauda grampicola*  
*Stenurus globicephalae*

**Host name:** *Lagenodelphis hosei* (Fraser's dolphin)

Nematoda  
*Anisakis simplex* s.l.  
*Stenurus ovatus*

Cestoda  
*Monorygma grimaldii*  
*Tetrabothrius* sp.

Trematoda  
*Campula* sp.  
*Nasitrema* sp.

**Host name:** *Lagenorhynchus obscurus* (dusky dolphin)

Nematoda  
*Anisakis simplex* s.l.  
*Crassicauda* sp.

Cestoda  
*Phyllobothrium delphini*  
*Phyllobothrium* sp.

**Host name:** *Peponocephala electra* (melon-headed whale)

Nematoda  
*Anisakis simplex* s.l.  
*Anisakis typica*  
*Stenurus globicephalae*

Cestoda  
*Monorygma chamissonii*

**Host name:** *Pseudorca crassidens* (false killer whale)

Acanthocephala  
*Bolbosoma capitatum*

Nematoda



*Crassicauda* sp.  
Crustacea  
*Isocyamus delphini*  
*Syncyamus pseudorcae*

**Host name:** *Sousa chinensis* (Indo-Pacific humpbacked dolphin)

Protozoa  
*Toxoplasma gondii*

**Host name:** *Stenella coeruleoalba* (striped dolphin)

Nematoda  
*Halocercus* sp.  
*Halocercus delphini*  
Cestoda  
*Monorygma grimaldii*  
*Phyllobothrium delphini*

**Host name:** *Stenella longirostris* (spinner dolphin)

Crustacea  
*Syncyamus aequus*

**Host name:** *Tursiops aduncus* (Indo-Pacific bottlenose dolphin)

Nematoda  
*Halocercus lagenorhynchi*  
*Stenurus ovatus*  
Protozoa  
*Toxoplasma gondii*

**Host name:** *Tursiops truncatus* (common bottlenose dolphin)

Acanthocephala  
*Bolbosoma* sp.  
*Corynosoma cetaceum*

Nematoda  
*Anisakis pegreffii*  
*Anisakis simplex* s.l.  
*Halocercus lagenorhynchi*  
*Skrjabinalius cryptocephalus*  
*Stenurus ovatus*

Cestoda  
*Phyllobothrium* sp.

Trematoda  
*Synthesium tursionis*

Crustacea  
*Syncyamus aequus*

Family: Kogiidae

**Host name:** *Kogia breviceps* (pygmy sperm whale)

Nematoda  
*Anisakis physeteris*  
*Anisakis simplex* s.l.  
*Anisakis* sp.  
*Crassicauda magna*  
*Pseudoterranova decipiens*  
*Pseudoterranova kogiae*

Cestoda  
*Phyllobothrium delphini*  
Crustacea  
*Isocyamus kogiae*

**Host name:** *Kogia sima* (dwarf sperm whale)

Nematoda  
*Anisakis berlandi*  
*Anisakis brevispiculata*

Family: Phocoenidae

**Host name:** *Phocoena dioptica* (spectacled porpoise)

Nematoda  
*Anisakis* sp.  
*Stenurus minor*  
Cestoda  
*Phyllobothrium delphini*  
Crustacea  
*Scutocyamus antipodensis*

**Host name:** *Phocoena* (harbour porpoise)

Crustacea  
*Isocyamus delphini*

Family: Physeteridae

**Host name:** *Physeter macrocephalus* (sperm whale)

Crustacea  
*Cyamus catadontis*

Family: Ziphiidae

**Host name:** *Mesoplodon bowdoini* (Andrew's beaked whale)

Nematoda  
*Anisakis nascetti*  
*Anisakis ziphidarum*

**Host name:** *Mesoplodon grayi* (Gray's beaked whale)

Nematoda  
*Anisakis nascetti*  
*Anisakis* sp.  
Crustacea  
*Platycyamus thompsoni*

**Host name:** *Mesoplodon hectori* (Hector's beaked whale)

Nematoda  
*Anisakis* sp.  
Cestoda  
*Tetrabothrius forsteri*

**Host name:** *Mesoplodon layardii* (strap-toothed whale)

Nematoda  
*Anisakis nascetti*

**Host name: *Ziphius cavirostris* (Cuvier's beaked whale)**

## Nematoda

*Crassicauda boopis*  
*Crassicauda* sp.

**Host taxon: *Sirenia***

Family: Sirenidae

**Host name: *Dugong dugon* (dugong)**

## Nematoda

*Paradujardinia halicoris*

## Trematoda

*Faredifex clavata*  
*Folitrema jecoris*  
*Haerator caperatus*  
*Labicola cf. elongata*  
*Labicola elongata*  
*Lankatrema macrocotyle*  
*Lankatrema mannarensis*  
*Lankatrema microcotyle*  
*Lankatrema minutum*  
*Lankatrematoides gardneri*  
*Opisthotrema australe*  
*Opisthotrema dujonis*  
*Pulmonicola pulmonalis*  
*Rhabdiopoeus taylora*  
*Solenorchis travassosi*  
*Spirorchidae* gen. sp.  
*Taprobanella bicaudata*

## Crustacea

*Platylepas hexastylus*  
*Balanus* sp.  
*Chelonibia* sp.

## Protozoa

*Cryptosporidium hominis*  
*Toxoplasma gondii*

**Discussion**

In this first host–parasite checklist, information about metazoan and protozoan parasites of marine mammals in NZ and Australian waters was collated. From 51 species of cetacean known from Australian and NZ waters, only 27 species have recorded parasites. From 11 species of pinnipeds known from Australian and NZ waters, eight have recorded parasites. The absence of records certainly does not signify that the remaining hosts are parasite free. There is still a lot left to learn. However, checklists such as this one remain valuable tools to ecologists and can help to further our understanding of parasite diversity and be a practical resource for scientists.

Nematodes were the most diverse group reported, with 30 different species determined, and many more records where identification was restricted to the genus or family level. Anisakid stomach nematodes (14 species) represented the family most often found in a wide range of host species, reflecting their generalist nature, followed by pseudaliid lungworms (seven species), specific to the respiratory tract of odontocetes. Trematodes (22 species), mostly from the gastro-intestinal tract, were found in sirenians (15 species), cetaceans (six species) and pinnipeds (six species). Six species of acanthocephalans were identified from

pinniped ( $n = 6$ ) and cetacean ( $n = 3$ ) hosts. Adult cestodes (five species) were recorded in the intestinal tract of three cetacean and two pinniped species. Cestode larvae within the subcutaneous blubber and the peritoneum were recorded from multiple cetacean ( $n = 9$ ) and pinniped ( $n = 3$ ) species. Thirteen different ectoparasitic crustacean species were found on cetaceans and sirenians. Other arthropod ecto- (Insecta, three species) and endoparasites (Arachnida, four species) were recorded from pinniped species. Three protozoan species were encountered in several marine mammal species including sirenians, pinnipeds and cetaceans within studies dating from 1997 to 2017. This may reflect, on the one hand, the relatively recent occurrence of some of these pathogens in the marine environment due to human activities and, on the other hand, new survey and diagnostic techniques (Lasek-Nesselquist *et al.*, 2010), as well as growing awareness of these emerging zoonotic agents in the research community.

Thirty-four parasite records were from dugongs and 25 species were found in common dolphins, while leopard seals with 17 parasite species were the pinnipeds most often infected. This reflects the opportunistic nature of sampling these animals. The findings indicate that, for example, sperm whales with one crustacean ectoparasite record or elusive beaked whales with 2–3 species records are seldom encountered hosts.

Many old records have complicated histories with multiple synonyms, which need updating. Also, the advent of molecular tools has identified several species complexes (Mattiucci *et al.*, 2014; Klotz *et al.*, 2018), for which retrospective analyses would be useful. New techniques will likely also continue to improve the identification of parasite fragments and minute larvae (Jabbar *et al.*, 2015), as well as provide insights on the phylogeny of parasite species (Hernández-Orts *et al.*, 2017).

The protozoans *Toxoplasma*, *Giardia* and *Cryptosporidium* are emerging parasites in marine mammals. In the future, the combination of prevalence surveys with molecular techniques will probably identify further protozoans and provide knowledge on host specificity and transmission pathways (Fayer *et al.*, 2004; Applebee *et al.*, 2005; Grilo *et al.*, 2018).

Foodborne parasites like cestodes (*Diphyllobothrium* sp.) and anisakids (*Anisakis* sp., *Pseudoterranova* sp.) are abundant in marine mammals in Australasia and pathogenic for humans when infective larvae are accidentally consumed with undercooked fish (Yamasaki & Kuramochi, 2009; Shamsi & Butcher, 2011). Human health concerns as well as implications for fisheries and seafood control underline the importance of better understanding the epidemiology of relevant species (Cipriani *et al.*, 2016).

Opportunistic parasite surveys of dead or live stranded cetaceans, in cooperation with established stranding networks (e.g. that of NZ's Department of Conservation) and systematic, minimally invasive studies to monitor live and free ranging pinnipeds (e.g. analysing faeces from pinniped colonies; Presswell & Lagrue, 2016), would enable a better overview of prevalence, intensity of infections and emerging parasite species. The importance of well-maintained and curated museum collections cannot be underestimated in their contribution towards our ongoing knowledge of parasite biodiversity (Lehnert *et al.*, 2017). It remains unclear how contaminant exposure causing immune suppression or cumulative effects of human-induced pressures (shipping, fisheries, global change) make marine mammals more susceptible to infectious disease in Australasian waters (Van Bressems *et al.*, 2009). Studies combining ecotoxicological analyses with systematic monitoring of parasite prevalence and impact (Lehnert

*et al.*, 2018) would help to elucidate these relationships in the future.

Parasites should be an integral part of biodiversity and conservation research in their marine mammal hosts (Aznar *et al.*, 2010; Poulin *et al.*, 2016). Ultimately, this research can inform managers and may guide species, habitat and population assessment and conservation, as well as encourage further investigations into the biodiversity and ecology of marine mammal parasites.

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## References

- Abe N (2008) Application of the PCR-sequence-specific primers for the discrimination among larval *Anisakis simplex* complex. *Parasitology Research* **102**, 1073–1075.
- Abe N, Tominaga K and Kimata I (2006) Usefulness of PCR-restriction fragment length polymorphism analysis of the internal transcribed spacer region of rDNA for identification of *Anisakis simplex* complex. *Japanese Journal of Infectious Diseases* **59**, 60–62.
- Agusti C, Aznar F, Olson P, Littlewood D, Kostadinova A and Raga J (2005) Morphological and molecular characterization of tetraphyllidean merocercoids (Platyhelminthes: Cestoda) of striped dolphins (*Stenella coeruleoalba*) from the Western Mediterranean. *Parasitology* **130**, 461–474.
- Amin OM (2013) Classification of the Acanthocephala. *Folia Parasitologica* **60**, 273–305.
- Anderson R (1982) Host-parasite relations and evolution of the Metastrongyloidea (nematoda) [mammals]. *Mémoires du Muséum National d'Histoire Naturelle. Série A. Zoologie* **123**, 129–133.
- Anderson RC, Chabaud AG and Willmott S (2009) *Keys to the nematode parasites of vertebrates: archival volume*. 463pp. Wallingford, CABI.
- Applebee AJ, Thompson RA and Olson ME (2005) *Giardia* and *Cryptosporidium* in mammalian wildlife—current status and future needs. *Trends in Parasitology* **21**, 370–376.
- Arundel J (1978) Parasites and parasitic diseases of Australian marine mammals. pp. 323–333 in *Proceedings No 36, Part B, course for veterinarians*, University of Sydney Post Graduate Committee in Veterinary Science.
- Aznar F, Raga J, Corcuera J and Monzón F (1995) Helminths as biological tags for franciscana (*Pontoporia blainvillei*) (Cetacea, Pontoporiidae) in Argentinian and Uruguayan waters. *Mammalia* **59**, 427–436.
- Aznar F, Bush AO and Raga JA (1999) *Polymorphus arctocephali* Smales, 1986, a synonym of *Corynosoma cetaceum* Johnston & Best, 1942 (Acanthocephala: Polymorphidae). *Systematic Parasitology* **44**, 59–70.
- Aznar FJ, Agustí C, Littlewood DTJ, Raga JA and Olson PD (2007) Insight into the role of cetaceans in the life cycle of the tetraphyllideans (Platyhelminthes: Cestoda). *International Journal for Parasitology* **37**, 243–255.
- Aznar F, Fernández M and Balbuena J (2010) Why we should care about the parasite fauna of cetaceans: a plea for integrative studies. pp. 811–820 in Murray CA (Ed.) *Whales and dolphins: behaviour, biology and distribution*. New York, Nova.
- Baker AN, Duignan PJ, Norman RJ and Helden AL (2001) A juvenile Hector's beaked whale, *Mesoplodon hectori* (Gray 1871), without functional throat grooves, plus notes on endoparasites (Cetacea: Ziphidiidae). *Marine Mammal Science* **17**, 171–175.
- Baker C, Chilvers B, Constantine R, DuFresne S, Mattlin R, Van Helden A and Hitchmough R (2010) Conservation status of New Zealand marine mammals (suborders Cetacea and Pinnipedia), 2009. *New Zealand Journal of Marine and Freshwater Research* **44**, 101–115.
- Balbuena J and Raga J (1994) Intestinal helminths as indicators of segregation and social structure of pods of long-finned pilot whales (*Globicephala melas*) off the Faeroe Islands. *Canadian Journal of Zoology* **72**, 443–448.
- Bannister J, Kemper CM and Warneke RM (1996) *The action plan for Australian cetaceans*. Canberra, Australian Nature Conservation Agency.
- Bao M, Pierce GJ, Pascual S, González-Muñoz M, Mattiucci S, Mladineo I, Cipriani P, Bušelić I and Strachan NJ (2017) Assessing the risk of an emerging zoonosis of worldwide concern: anisakiasis. *Scientific Reports* **7**, 43699.
- Baylis HA (1932) A list of worms parasitic in Cetacea. *Discovery Reports* **6**, 393–418.
- Baylis H (1937) On the ascarids parasitic in seals, with special reference to the genus *Contracaecum*. *Parasitology* **29**, 121–130.
- Baylis H and Daubney R (1925) A revision of the lung-worms of Cetacea. *Parasitology* **17**, 201–215.
- Beatson EL and O'Shea S (2009) Stomach contents of long-finned pilot whales, *Globicephala melas*, mass-stranded on Farewell Spit, Golden Bay in 2005 and 2008. *New Zealand Journal of Zoology* **36**, 47–58.
- Berón-Vera B, Crespo EA and Raga JA (2008) Parasites in stranded cetaceans of Patagonia. *Journal of Parasitology* **94**, 946–948.
- Berta A and Churchill M (2012) Pinniped taxonomy: review of currently recognized species and subspecies, and evidence used for their description. *Mammal Review* **42**, 207–234.
- Berzin A and Vlasova L (1982) Fauna of the cetacean Cyamidae (Amphipoda) of the world ocean. *Investigations on Cetacea* **13**, 149–164.
- Beveridge I (1980) *Uncinaria hydromyidis* sp. n. (Nematoda: Ancylostomatidae) from the Australian water rat, *Hydromys chrysogaster*. *The Journal of Parasitology* **66**, 1027–1031.
- Beveridge I (1987) *Echinocephalus overstreeti* Deardorff & Ko, 1983 (Nematoda: Gnathostomatoidea) from elasmobranchs and molluscs in South Australia. *Transactions of the Royal Society of South Australia* **111**, 79–92.
- Blair D (1979) Helminth parasites of the Dugong, their collection and preservation. pp. 8–13 in Marsh H (Ed.) *The Dugong. Proceedings of a Seminar/Workshop held at James Cook University*, James Cook University of North Queensland, Australia.
- Blair D (1980) *Indosolenorchis hirudinaceus* Cruz, 1951 (Platyhelminthes: Digenea) from the Dugong, *Dugong dugon* (Müller) (Mammalia; Sirenia). *Annales de Parasitologie Humaine et Comparée* **55**, 511–525.
- Blair D (1981) The monostome flukes (Digenea: Families Opisthotrematidae Poche and Rhodbiopoeidae Poche) parasitic in sirenians (Mammalia: Sirenia). *Australian Journal of Zoology Supplementary Series* **29**, 1–54.
- Blanshard WH (2001) Dugong strandings. in Martin A and Vogelneust L (Eds) *Veterinary conservation biology: wildlife health and management in Australia. Marine Mammal Strandings*. Sydney, Taronga Zoo.
- Boren LJ (2005) *New Zealand fur seals in the Kaikoura region: colony dynamics, maternal investment and health*. Unpublished PhD thesis, University of Canterbury, Christchurch, New Zealand.
- Bowater RO, Norton J, Johnson S, Hill B, O'Donoghue P and Prior H (2003) Toxoplasmosis in Indo-Pacific humpbacked dolphins (*Sousa chinensis*), from Queensland. *Australian Veterinary Journal* **81**, 627–632.
- Bowie J (1984) Parasites from an Atlantic bottle-nose dolphin (*Tursiops truncatus*), and a revised checklist of parasites of this host. *New Zealand Journal of Zoology* **11**, 395–398.
- Bray RA, Gibson DI and Jones A (Eds) (2008) *Keys to the Trematoda* (Vol. 3). Wallingford, UK: CABI Publishing and The Natural History Museum.
- Britton E, Hales S, Venugopal K and Baker MG (2010) The impact of climate variability and change on cryptosporidiosis and giardiasis rates in New Zealand. *Journal of Water and Health* **8**, 561–571.



- Brundson RV** (1956) Studies on nematodes of New Zealand fishes. A systematic and parasitological study of the nematodes occurring in New Zealand marine and freshwater fishes, including biological studies on the genus *Anisakis* Dujardin, 1845. Unpublished PhD thesis, Victoria University of Wellington, New Zealand.
- Caira JN and Jensen K** (2017) *Planetary biodiversity inventory (2008–2017): Tapeworms from vertebrate bowels of the earth*. Natural History Museum, University of Kansas, Lawrence, Kansas, US.
- Cannon L** (1977) Some aspects of the biology of *Peponocephala electra* (Cetacea: Delphinidae). II. Parasites. *Marine and Freshwater Research* **28**, 717–722.
- Carvalho VL, Bevilacqua CML, Iñiguez AM, et al.** (2010) Metazoan parasites of cetaceans off the northeastern coast of Brazil. *Veterinary Parasitology* **173**, 116–122.
- Castinel A, Duignan P, Pomroy W, Lyons E, Nadler S, Dailey M, Wilkinson I and Chilvers B** (2006) First report and characterization of adult *Uncinaria* spp. in New Zealand Sea Lion (*Phocarcos hookeri*) pups from the Auckland Islands, New Zealand. *Parasitology Research* **98**, 304–309.
- Castinel A, Duignan P, Pomroy W, Lopez-Villalobos N, Gibbs N, Chilvers B and Wilkinson I** (2007) Neonatal mortality in New Zealand sea lions (*Phocarcos hookeri*) at Sandy Bay, Enderby Island, Auckland Islands from 1998 to 2005. *Journal of Wildlife Diseases* **43**, 461–474.
- Cipriani P, Acerra V, Bellisario B, Sbaraglia GL, Chelieschi R, Nascetti G and Mattiucci S** (2016) Larval migration of the zoonotic parasite *Anisakis pegreffii* (Nematoda: Anisakidae) in European anchovy, *Engraulis encrasicolus*: Implications to seafood safety. *Food Control* **59**, 148–157.
- Clay T** (1964) Insects of Campbell Island. Phthiraptera. *Pacific Insects Monograph* **7**, 230–234.
- Cordes D and O'Hara P** (1979) Diseases of captive marine mammals. *New Zealand Veterinary Journal* **27**, 147–150.
- Cruz H and Fernand V** (1954) The trematode parasites of the dugong with descriptions of two new monostomes and histopathological changes in the host. *The Journal of Parasitology* **40**, 499–507.
- Dailey MD** (2001) Parasitic diseases. pp. 357–397 in Dierauf LA and Gulland FMD (Eds) *CRC handbook of marine mammal medicine*. 2nd edn. Boca Raton, FL, CRC Press.
- Dailey MD** (2009) A new species of *Parafilaroides* (Nematoda: Filaroididae) in three species of fur seals (Carnivora: Otariidae) from the southern hemisphere. *Journal of Parasitology* **95**, 156–159.
- Dailey MD and Brownell BL** (1972) A checklist of marine mammal parasites. pp. 528–589 in Ridgway SH (Ed.) *Mammals of the sea: biology and medicine*. Springfield, IL: Charles C Thomas.
- Dailey M and Nutting W** (1980) *Demodex zalophi* sp. nov. (Acari: Demodicidae) from *Zalophus californianus*, the California sea lion. *Acarologia* **21**, 423–428.
- Dailey MD, Demaree RS and Critchfield RL** (2002) *Galactosomum stelleri* sp. n. (Trematoda: Heterophyidae) from the northern sea-lion, *Eumetopias jubatus* (Schreber, 1776) (Carnivora: Otariidae). *Comparative Parasitology* **69**, 58–61.
- D'Amelio S, Mathiopoulos K, Santos CP, Pugachev O, Webb S, Picanço M and Paggi L** (2000) Genetic markers in ribosomal DNA for the identification of members of the genus *Anisakis* (Nematoda: Ascaridoidea) defined by polymerase-chain-reaction-based restriction fragment length polymorphism. *International Journal for Parasitology* **30**, 223–226.
- Davey J** (1971) A revision of the genus *Anisakis* Dujardin, 1845 (Nematoda: Ascaridata). *Journal of Helminthology* **45**, 51–72.
- Dawson S and Slooten E** (1990) Stranding of a dwarf minke whale at Banks Peninsula, New Zealand. *New Zealand Natural Sciences* **17**, 89–93.
- Deardorff TL and Overstreet RM** (1981) *Terranova ceticola* n. sp. (Nematoda: Anisakidae) from the dwarf sperm whale; *Kogia simus* (Owen), in the Gulf of Mexico. *Systematic Parasitology* **3**, 25–28.
- Delport TC, Asher AJ, Beaumont LJ, Webster KN, Harcourt RG and Power ML** (2014) *Giardia duodenalis* and *Cryptosporidium* occurrence in Australian sea lions (*Neophoca cinerea*) exposed to varied levels of human interaction. *International Journal for Parasitology: Parasites and Wildlife* **3**, 269–275.
- Delyamure SL** (1955) *Heminthofauna of marine mammals (ecology and phylogeny)*. 522pp. Izdatel'stvo Akademii Nauk SSSR, Moscow (Israel Program of Scientific Translations, 1968, Jerusalem, Israel).
- Dexler H and Freund L** (1906) Contributions to the physiology and biology of the dugong. *The American Naturalist* **40**, 49–72.
- Dollfus RPH** (1964) A propos de la récolte, a Banyuls d'un cystique de cestode chez *Tursiops truncatus* (Montagu, 1821). Les cystiques de cestodes chez les cétacés et pinnipèdes. *Vie et Milieu (suppl.)* **17**, 177–204.
- Domrow R** (1962) *Halarachne miroungae* Ferris redescribed. *Pacific Insects* **4**, 859–863.
- Domrow R** (1963) New records and species of Australomalayan laelapid mites. *Proceedings of the Linnean Society of New South Wales* **88**, 199–220.
- Domrow R** (1974) Notes on halarachnine larval morphology and a new species of *Pneumonyssus* Banks (Acari: Dermanyssidae). *Australian Journal of Entomology* **13**, 17–26.
- Domrow R** (1979) Some dermanyssid mites (Acari), mostly from Australasian rodents. *Proceedings of the Linnean Society of New South Wales* **103**, 189–208.
- Donahoe SL, Rose K and Šlapeta J** (2014) Multisystemic toxoplasmosis associated with a type II-like *Toxoplasma gondii* strain in a New Zealand fur seal (*Arctocephalus forsteri*) from New South Wales, Australia. *Veterinary Parasitology* **205**, 347–353.
- Dorny P, Praet N, Deckers N and Gabriël S** (2009) Emerging food-borne parasites. *Veterinary Parasitology* **163**, 196–206.
- Drummond FH** (1937) Reports of the expedition of the McCoy Society for field investigations and research. Lady Julia Percy Island. 16. Cestoda. *Proceedings of the Royal Society of Victoria* **49**, 401–406.
- Dubois G and Angel LM** (1976) *Mesostephanus neophocae* n. sp. (Strigeata: Prohemistomidae), parasite d'une otarie d'Australie, *Neophoca cinerea* (Péron et Lesueur). *Bulletin de la Société Neuchâteloise des Sciences Naturelles* **99**, 29–32.
- Dubois G and Mahon J** (1959) Étude de quelques trématodes Nord-Américains (avec note sur la position systématique de *Parorchis* Nicoll 1907) suivie d'une revision des genres *Galactosomum* Looss 1899 et *Ochetosoma* Braun 1901. *Bulletin de la Société des Sciences Naturelles de Neuchâtel* **82**, 191–229.
- Duignan PJ** (1998) Gross pathology, histopathology, virology, serology and parasitology. pp. 29–33 in Baker AN (Ed.) *Unusual mortality of the New Zealand sea lion, Phocarcos hookeri, Auckland Islands. Report of a workshop held 8–9 June 1998*. Wellington, NZ, Department of Conservation.
- Duignan PJ** (2000) Diseases of cetaceans and pinnipeds. Marine Wildlife: the Fabian Fay Course for Veterinarians. pp. 419–447 in *Post Graduate Foundation in Veterinary Science*, Vol. 335, University of Sydney.
- Duignan PJ** (2003) *Disease investigations in stranded marine mammals, 1999–2002*. Wellington, NZ, Department of Conservation.
- Edmonds SJ** (1955) Acanthocephala collected by the Australian National Antarctic Expedition on Heard Island and Macquarie Island during 1948–1950. *Transactions of the Royal Society of South Australia* **78**, 141–144.
- Edmonds SJ** (1957a) Acanthocephala. *British, Australian and New Zealand Antarctic Research Expedition Reports, Series B* **6**, 91–98.
- Edmonds SJ** (1957b) Australian Acanthocephala n° 10. *Transactions of the Royal Society of South Australia* **80**, 76–80.
- Edmonds SJ** (1987) A note on the occurrence of *Bolbosoma capitatum* (Linstow, 1880) (Acanthocephala) from a false killer whale stranded on the coast of Western Australia. *Records of the West Australian Museum* **13**, 317–318.
- Enderlein G** (1906) Läusestudien. V. Schuppen als sekundäre Atmungsorgane, sowie über eine neue antarctische Echinophthiriiden-Gattung. *Zoologischer Anzeiger* **29**, 659–665.
- Fagerholm H-P** (1988) Patterns of caudal papillae in *Contracaecum osculatum* (Nematoda) and some related species from different regions of the world. *International Journal for Parasitology* **18**, 1039–1051.
- Fagerholm H-P and Gibson DI** (1987) A redescription of the pinniped parasite *Contracaecum ogmorhini* (Nematoda, Ascaridoidea), with an assessment of its antiboreal circumglobal distribution. *Zoologica Scripta* **16**, 19–24.
- Faulkner J, Measures LN and Whoriskey FG** (1998) *Stenurus minor* (Metastrongyloidea: Pseudaliidae) infections of the cranial sinuses of the



- harbour porpoise, *Phocoena phocoena*. *Canadian Journal of Zoology* **76**, 1209–1216.
- Fayer R, Dubey JP and Lindsay DS** (2004) Zoonotic protozoa: from land to sea. *Trends in Parasitology* **20**, 531–536.
- Felix J** (2013) *Reported incidences of parasitic infections in marine mammals from 1892 to 1978*. Zea E-Books. Book 20. Lincoln, University of Nebraska. Available at: <http://digitalcommons.unl.edu/zeabook/20> (accessed March 2018).
- Flores-Barroeta L, Hidalgo-Escalante E and Oiea C** (1961) Nematodes from birds and mammals IV (1). Erratic parasitosis in *Zalophus californianus* from Asuncion Island, Baja California, Mexico. *Helminthologia* **3**, 112–116.
- Fraija-Fernández N, Fernández M, Raga JA and Aznar FJ** (2016) Helminth diversity of cetaceans: an update. Chapter 3. *Advances in Marine Biology* **1**, 29–100.
- García-Varela M, Pérez-Ponce de León G, Aznar FJ and Nadler SA** (2013) Phylogenetic relationships among genera of Polymorphidae (Acanthocephala), inferred from nuclear and mitochondrial gene sequences. *Molecular Phylogenetics and Evolution* **68**, 176–184.
- Gibson DI** (2005) Trematoda. pp. 641–652 in Jones A, Bray RA and Gibson DI (Eds) *Keys to the Trematoda*. Vol. 2. London, CAB International and the Natural History Museum.
- Gibson DI, Jones A and Bray RA** (Eds) (2002) *Keys to the Trematoda*. Vol. 1. London, CABI Publishing and The Natural History Museum.
- Grabda J and Ślósarczyk W** (1981) Parasites of marine fishes from New Zealand. *Acta Ichthyologica et Piscatoria* **11**, 85.
- Greenland JA and Limpus CJ** (2008) Marine wildlife stranding and mortality database annual report 2007. II. Cetacean and Pinniped. 226pp. *Conservation technical and data report, Volume 2006*. Brisbane, Environmental Protection Agency.
- Grilo ML, Gomes L, Wohlsein P, de Carvalho LM, Siebert U and Lehnert K** (2018) *Cryptosporidium* species and *Giardia* species prevalence in marine mammal species present in the German North and Baltic Seas. *Journal of Zoo and Wildlife Medicine* **49**(4), 1002–1006.
- Gulland FM and Hall AJ** (2007) Is marine mammal health deteriorating? Trends in the global reporting of marine mammal disease. *EcoHealth* **4**, 135–150.
- Harrison L** (1937) Mallophaga and Siphunculata. pp. 1–47 in Johnston TH (Ed.) *Scientific reports, Australasian Antarctic Expedition 1911–14, series C. Zoology and Botany*. Sydney, Government Printer.
- Haynes BT, Marcus AD, Higgins DP, Gongora J, Gray R and Šlapeta J** (2014) Unexpected absence of genetic separation of a highly diverse population of hookworms from geographically isolated hosts. *Infection, Genetics and Evolution* **28**, 192–200.
- Hernández-Orts JS, Montero FE, Crespo EA, García NA, Raga JA and Aznar FJ** (2012) A new species of *Ascocotyle* (Trematoda: Heterophyidae) from the South American sea lion, *Otaria flavescens*, off Patagonia, Argentina. *Journal of Parasitology* **98**, 810–816.
- Hernández-Orts J, Scholz T, Brabec J, Kuzmina T and Kuchta R** (2015) High morphological plasticity and global geographical distribution of the Pacific broad tapeworm *Adenocephalus pacificus* (syn. *Diphyllobothrium pacificum*): Molecular and morphological survey. *Acta Tropica* **149**, 168–178.
- Hernández-Orts JS, Smales LR, Pinacho-Pinacho CD, García-Varela M and Presswell B** (2017) Novel morphological and molecular data for *Corynosoma hanna* Zdzitowiecki, 1984 (Acanthocephala: Polymorphidae) from teleosts, fish-eating birds and pinnipeds from New Zealand. *Parasitology International* **66**(1), 905–916.
- Hill B, Fraser I and Prior H** (1997) *Cryptosporidium* infection in a dugong (*Dugong dugon*). *Australian Veterinary Journal* **75**, 670–671.
- Hilmy I** (1949) New paramphistomes from the Red Sea Dugong, *Halicore halicore*, with description of *Solenorchis* gen. n. and *Solenorchinae* subf. n. *Proceedings of the Egyptian Academy of Sciences* **4**, 1–14.
- Horning DS, Palma RL and Pilgrim RLC** (1980) The lice (Insecta, Phthiraptera) from the Snares Islands, New Zealand. *National Museum of New Zealand Miscellaneous Series* **3**, 1–17.
- Hurst RJ** (1980) Studies on the life cycle of some New Zealand Anisakidae (Nematoda). Unpublished PhD thesis, Victoria University, Wellington, New Zealand.
- Hutton J, Blair D, Slooten E and Dawson S** (1987) Case studies of fluke-induced lesions in mesenteric lymph nodes of Hector's dolphins, *Cephalorhynchus hectori*. *Diseases of Aquatic Organisms* **2**, 83–86.
- Iglesias R, D'Amelio S, Ingrassio S, Farjallah S, Martinez-Cedeira JA and Garcia-Estevez JM** (2008) Molecular and morphological evidence for the occurrence of *Anisakis* sp. A (Nematoda, Anisakidae) in the Blainville's beaked whale *Mesoplodon densirostris*. *Journal of Helminthology* **82**, 305–308.
- Jabbar A, Asnoussi A, Norbury LJ, Eisenbarth A, Shamsi S, Gasser RB, Lopata AL and Beveridge I** (2012) Larval anisakid nematodes in teleost fishes from Lizard Island, northern Great Barrier Reef, Australia. *Marine and Freshwater Research* **63**, 1283–1299.
- Jabbar A, Mohandas N and Gasser RB** (2014) Characterisation of the mitochondrial genome of *Parafilaroides normani* (lungworm) of *Arctocephalus pusillus doriferus* (Australian fur seal). *Parasitology Research* **113**, 3049–3055.
- Jabbar A, Beveridge I and Bryant MS** (2015) Morphological and molecular observations on the status of *Crassicauda magna*, a parasite of the subcutaneous tissues of the pygmy sperm whale, with a re-evaluation of the systematic relationships of the genus *Crassicauda*. *Parasitology Research* **114**, 835–841.
- Jardine J and Dubey J** (2002) Congenital toxoplasmosis in a Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). *Journal of Parasitology* **88**, 197–199.
- Johnston SJ** (1913) On some Queensland trematodes, with anatomical observations and descriptions of new species and genera. *Quarterly Journal of the Microscopical Society* **59**, 361–400.
- Johnston TH** (1937) Entozoa from the Australian hair seal. *Proceedings of the Linnean Society of New South Wales* **62**, 9–19.
- Johnston TH and Best EW** (1942) Australian Acanthocephala No.3. *Transactions of the Royal Society of South Australia* **66**, 250–254.
- Johnston TH and Deland EW** (1929) Australian Acanthocephala, No.1. Census of recorded hosts and parasites. *Transactions of the Royal Society of South Australia* **53**, 146–154.
- Johnston TH and Edmonds SJ** (1953) Acanthocephala from Auckland and Campbell Islands. *Records of the Dominion Museum, Wellington* **2**, 55–61.
- Johnston TH and Mawson PM** (1939) Internal parasites of the pygmy sperm whale. *Records of the South Australian Museum* **6**, 263–274.
- Johnston TH and Mawson PM** (1941) Nematodes from Australian marine mammals. *Records of the South Australian Museum* **6**, 429–434.
- Johnston TH and Mawson PM** (1942) Remarks on some parasitic nematodes. *Records of the South Australian Museum* **7**, 183–186.
- Johnston TH and Mawson PM** (1943a) Endoparasites from the subantarctic islands of New Zealand. *Records of the South Australian Museum* **7**, 237–243.
- Johnston TH and Mawson PM** (1943b) Some ascarid nematodes from Australian marine fish. *Transactions of the Royal Society of South Australia* **67**, 20–35.
- Johnston TH and Mawson PM** (1945) Parasitic nematodes. *British, Australian and New Zealand Antarctic Research Expedition 1929-1931 Report series B* **5**, 73–159.
- Johnston TH and Mawson PM** (1951) Report on some parasitic nematodes from the Australian Museum. *Records of the Australian Museum* **22**, 289–297.
- Johnston TH and Mawson PM** (1953) Parasitic nematodes and trematodes from Campbell and Auckland Islands (Cape Expedition). *Records of the Dominion Museum* **2**, 63–71.
- Jones A, Bray RA and Gibson DI** (Eds) (2005) *Keys to the Trematoda*. Vol. 2. London, CABI Publishing and The Natural History Museum.
- Kingsford R, Watson JE, Lundquist C, et al.** (2009) Major conservation policy issues for biodiversity in Oceania. *Conservation Biology* **23**, 834–840.
- Klotz D, Hirschmann J, Bauer C, Schöne J, Iseringhausen M, Wohlsein P, Baumgärtner W and Herder V** (2018) Subcutaneous meroceroids of *Clistobothrium* sp. in two Cape fur seals (*Arctocephalus pusillus pusillus*). *International Journal for Parasitology: Parasites and Wildlife* **7**, 99–105.
- Kovacs KM, Aguilar A, Auriolles D, et al.** (2012) Global threats to pinnipeds. *Marine Mammal Science* **28**, 414–436.
- Krefft G** (1871) On Australian Entozoa, with descriptions of new species. *Transactions of the Entomological Society of New South Wales* **2**, 206–232.

- Ladds P** (2009) *Pathology of Australian native wildlife*. 648 pp. Victoria, Australia, CSIRO Publishing.
- Lasek-Nesselquist E, Welch DM and Sogin ML** (2010) The identification of a new *Giardia duodenalis* assemblage in marine vertebrates and a preliminary analysis of *G. duodenalis* population biology in marine systems. *International Journal for Parasitology* **40**(9), 1063–1074.
- Lehnert K, Seibel H, Hasselmeier I, Wohlsein P, Iversen M, Nielsen NH and Siebert U** (2014) Increase in parasite burden and associated pathology in harbour porpoises (*Phocoena phocoena*) in West Greenland. *Polar Biology* **37**(3), 321–331.
- Lehnert K, Randhawa H and Poulin R** (2017) Metazoan parasites from odontocetes off New Zealand: new records. *Parasitology Research* **116**, 2861–2868.
- Lehnert K, Desforges JP, Das K and Siebert U** (2018) Ecotoxicological biomarkers and accumulation of contaminants in pinnipeds. pp. 261–289 in Fossi C and Panti C (Eds) *Marine mammal ecotoxicology*. London, Academic Press.
- Leidenberger S, Harding K and Härkönen T** (2007) Phocid seals, seal lice and heartworms: a terrestrial host–parasite system conveyed to the marine environment. *Diseases of Aquatic Organisms* **77**, 235–253.
- Leonardi MS and Palma RL** (2013) Review of the systematics, biology and ecology of lice from pinnipeds and river otters (Insecta: Phthiraptera: Anoplura: Echinophthiriidae). *Zootaxa* **3630**, 445–466.
- Leonardi MS, Crespo EA, Raga JA and Fernández M** (2009) Redescription of *Antarctophthirus microchir* (Anoplura: Echinophthiriidae) from the South American sea lion, *Otaria flavescens*, from Patagonia, Argentina. *Journal of Parasitology* **95**, 1086–1092.
- Leonardi MS, Poljak S, Carlini P, Galliari J, Bobinac M, Santos M, Márquez ME and Negrete J** (2014) *Antarctophthirus carlinii* (Anoplura: Echinophthiriidae), a new species from the Weddell seal *Leptonychotes weddellii*. *Parasitology Research* **113**, 3947–3951.
- Leung YM** (1965) A collection of whale-lice (Cyamidae: Amphipoda). *Bulletin of the Southern California Academy of Sciences* **64**, 132–143.
- Leung YM** (1967) An illustrated key to the species of whale-lice (Amphipoda, Cyamidae), ectoparasites of Cetacea, with a guide to the literature. *Crustaceana* **12**, 279–291.
- Li L, Gibson DI and Zhang LP** (2016) An annotated catalogue of the ascaridoid nematode parasites of Chinese vertebrates. *Systematic Parasitology* **93**, 1–35.
- Lincoln RJ and Hurley DE** (1980) *Scutocyamus antipodensis* n. sp. (Amphipoda: Cyamidae) on Hector's dolphin (*Cephalorhynchus hectori*) from New Zealand. *New Zealand Journal of Marine and Freshwater Research* **14**, 295–301.
- Linton E** (1923) A new cetacean cestode (*Prostheocotyle monticellii* sp. nov.), with a note on the genus *Tetrabothrius* Rudolphi. *Journal of Parasitology* **10**, 51–55.
- Llarena-Reino M, Abollo E, Regueira M, Rodríguez H and Pascual S** (2015) Horizon scanning for management of emerging parasitic infections in fishery products. *Food Control* **49**, 49–58.
- Lowry JK, Horning DS, Poore GCB and Ricker RW** (1978) *The Australian Museum Macquarie Island Expedition, Summer 1977–1978*. Sydney, The Australian Museum Trust.
- Mackerras MJ** (1958) Catalogue of Australian mammals and their recorded internal parasites. Part II. Eutheria. *Proceedings of the Linnean Society of New South Wales* **83**, 126–143.
- Marcogliese D** (2002) Food webs and the transmission of parasites to marine fish. *Parasitology* **124**, 83–99.
- Marcogliese DJ and Pietrock M** (2011) Combined effects of parasites and contaminants on animal health: parasites do matter. *Trends in Parasitology* **27**, 123–130.
- Marcus AD, Higgins DP and Gray R** (2014) Epidemiology of hookworm (*Uncinaria stenocephala*) infection in free-ranging Australian sea lion (*Neophoca cinerea*) pups. *Parasitology Research* **113**, 3341–3353.
- Marcus AD, Higgins DP and Gray R** (2015) Ivermectin treatment of free-ranging endangered Australian sea lion (*Neophoca cinerea*) pups: effect on hookworm and lice infection status, haematological parameters, growth, and survival. *Parasitology Research* **114**, 2743–2755.
- Marigo J, Paulo Vicente AC, Schifino Valente AL, Measures L and Portes Santos C** (2008) Redescription of *Synthesium pontoporiae* n. comb. with notes on *S. tursionis* and *S. seymouri* n. comb. (Digenea: Brachycladiidae Odnher, 1905). *Journal of Parasitology* **94**, 505–514.
- Marlow B** (1962) A recent record of the dugong, *Dugong dugon*, from New South Wales. *Journal of Mammalogy* **43**, 433–433.
- Marlow B** (1975) The comparative behaviour of the Australasian sea lions *Neophoca cinerea* and *Phocarctos hookeri* (Pinnipedia: Otariidae). *Mammalia* **39**, 159–230.
- Marsh H, Heinsohn GE and Channells P** (1984) Changes in the ovaries and uterus of the dugong, *Dugong dugon* (Sirenia: Dugongidae), with age and reproductive activity. *Australian Journal of Zoology* **32**, 743–766.
- Mattiucci S, Nascetti G, Cianchi R, et al.** (1997) Genetic and ecological data on the *Anisakis simplex* complex, with evidence for a new species (Nematoda, Ascaridoidea, Anisakidae). *The Journal of Parasitology* **83**, 401–416.
- Mattiucci S, Cianchi R, Nascetti G, et al.** (2003) Genetic evidence for two sibling species within *Contracaecum ogmorhini* Johnston & Mawson, 1941 (Nematoda: Anisakidae) from otariid seals of boreal and austral regions. *Systematic Parasitology* **54**, 13–23.
- Mattiucci S, Nascetti G, Dailey M, Webb SC, Barros NB, Cianchi R and Bullini L** (2005) Evidence for a new species of *Anisakis* Dujardin, 1845: morphological description and genetic relationships between congeners (Nematoda: Anisakidae). *Systematic Parasitology* **61**, 157–171.
- Mattiucci S, Paoletti M and Webb SC** (2009) *Anisakis nascettii* n. sp. (Nematoda: Anisakidae) from beaked whales of the southern hemisphere: morphological description, genetic relationships between congeners and ecological data. *Systematic Parasitology* **74**, 199–217.
- Mattiucci S, Fazii P, De Rosa A, et al.** (2013) Anisakiasis and gastroallergic reactions associated with *Anisakis pegreffii* infection, Italy. *Emerging Infectious Diseases* **19**, 496.
- Mattiucci S, Cipriani P, Webb SC, Paoletti M, Marcer F, Bellisario B, Gibson DI and Nascetti G** (2014) Genetic and morphological approaches distinguish the three sibling species of the *Anisakis simplex* species complex, with a species designation as *Anisakis berlandi* n. sp. for *A. simplex* sp. C (Nematoda: Anisakidae). *The Journal of Parasitology* **100**, 199–214.
- Mawson PM** (1953) Parasitic nematoda collected by the Australian national Antarctic research expedition: Heard Island and Macquarie Island, 1948–1951. *Parasitology* **43**, 291–297.
- McColl K and Obendorf D** (1982) Helminth parasites and associated pathology in stranded Fraser's dolphins, *Lagenodelphis hosei* (Fraser, 1956). *Aquatic Mammals* **9**, 30–34.
- McFarlane R, Norman RdB and Jones H** (2009) Diseases and parasites of Antarctic and Sub-Antarctic seals. pp. 57–93 in Kerry KR and Riddle MJ (Eds) *Health of Antarctic wildlife: a challenge for science and policy*. Berlin, Springer-Verlag.
- McIntosh R and Murray M** (2007) Louse infestations of the Australian sea lion *Neophoca cinerea*. *Australian Mammalogy* **29**, 103–106.
- McKenzie J and Blair D** (1983) Parasites from Hector's dolphin (*Cephalorhynchus hectori*). *New Zealand Journal of Zoology* **10**, 126–127.
- McManus T, Wapstra J, Guiler E, Munday B and Obendorf D** (1984) Cetacean strandings in Tasmania from February 1978 to May 1983. *Papers and Proceedings of the Royal Society of Tasmania* **118**, 117–135.
- Measures LN** (2001) Lungworms of marine mammals. pp. 279–300 in Samuel WM, Pybus MJ and Kocan AA (Eds) *Parasitic diseases of wild mammals*. Ames, IA, Iowa State University Press.
- Moravec F and Justine J-L** (2006) Three nematode species from elasmobranchs off New Caledonia. *Systematic Parasitology* **64**, 131–145.
- Morell M, Lehnert K, IJsseldijk LL, Raverty SA, Wohlsein P, Gröne A and Shadwick RE** (2017) Parasites in the inner ear of harbour porpoise: cases from the North and Baltic Seas. *Diseases of Aquatic Organisms* **127**(1), 57–63.
- Morgan I, Cople I, Westbury H and Campbell J** (1978) Disease investigations of penguins and elephant seals on Macquarie Island [Australia], no. 47. *Research Project Series*. Department of Agriculture Victoria, Australia.
- Morgan UM, Xiao L, Hill BD, O'Donoghue P, Limor J, Lal A and Thompson RCA** (2000) Detection of the *Cryptosporidium parvum* “human” genotype in a dugong (*Dugong dugon*). *Journal of Parasitology* **86**, 1352–1354.

- Morgan-Ryan UM, Fall A, Ward LA, et al.** (2002) *Cryptosporidium hominis* n. sp. (Apicomplexa: Cryptosporidiidae) from *Homo sapiens*. *Journal of Eukaryotic Microbiology* **49**, 433–440.
- Murray M and Nicholls D** (1965) Studies on the ectoparasites of seals and penguins. 1. The ecology of the louse *Lepidophthirus macrorhini* Enderlein on the southern elephant seal, *Mirounga leonina* (L). *Australian Journal of Zoology* **13**, 437–454.
- Myers BJ** (1959) *Phocanema*, a new genus for the anisakid nematode of seals. *Canadian Journal of Zoology* **37**, 459–465.
- Nadler SA, Lyons ET, Pagan C, et al.** (2013) Molecular systematics of pinniped hookworms (Nematoda: Uncinaria): species delimitation, host associations and host-induced morphometric variation. *International Journal for Parasitology* **43**, 1119–1132.
- Nascetti G, Paggi L, Orecchia P, Smith J, Mattiucci S and Bullini L** (1986) Electrophoretic studies on the *Anisakis simplex* complex (Ascaridida: Anisakidae) from the Mediterranean and North-East Atlantic. *International Journal for Parasitology* **16**, 633–640.
- Nicholson A and Fanning J** (1981) Parasites and associated pathology of the respiratory tract of the Australian sea lion, *Neophoca cinerea*. Wildlife disease of the Pacific Basin and other countries. pp. 178–181 in Proceedings of the Fourth International Conference of the Wildlife Disease Association, Sydney, Australia.
- Nikolov PN, Cappozzo HL, Berón-Vera B, Crespo EA, Raga JA and Hernández M** (2010) Cestodes from Hector's beaked whale (*Mesoplodon hectori*) and spectacled porpoise (*Phocoena dioptrica*) from Argentinean waters. *Journal of Parasitology* **96**, 746–751.
- Norman RJdB** (1997) *Tetraphyllidean cysticerci* in the peritoneal cavity of the common dolphin. *Journal of Wildlife Diseases* **33**, 891–895.
- Obendorf DL and Presidente P** (1978) Foreign body perforation of the esophagus initiating traumatic pericarditis in an Australian fur seal. *Journal of Wildlife Diseases* **14**, 451–454.
- Olson P, Cribb T, Tkach V, Bray R and Littlewood D** (2003) Phylogeny and classification of the Digenea (Platyhelminthes: Trematoda). *International Journal for Parasitology* **33**, 733–755.
- Owen H, Gillespie A and Wilkie I** (2012) Postmortem findings from dugong (*Dugong Dugon*). Submissions to the University of Queensland: 1997–2010. *Journal of Wildlife Diseases* **48**, 962–970.
- Palma R** (2017) *Phthiraptera (Insecta): a catalogue of parasitic lice from New Zealand*. Lincoln, NZ, Landcare Research.
- Palma RL and Horning DS** (2002) The lice (Insecta: Phthiraptera) from Macquarie Island. *Anare Research Notes* **105**, 1–27.
- Pascual S and Abollo E** (2005) Whaleworms as a tag to map zones of heavy-metal pollution. *Trends in Parasitology* **21**, 204–206.
- Pearson J** (1973) A revision of the subfamily Haplorchinae Looss, 1899 (Trematoda: Heterophyidae) - II. Genus *Galactosomum*. *Philosophical Transactions of the Royal Society of London B* **266**, 341–447.
- Perrin WF** (2018) *World cetacea database*. Available at <http://www.marinespecies.org/cetacea> (accessed 6 March 2018).
- Pilsbry HA** (1916) The sessile barnacles (Cirripedia) contained in the collections of the U.S. National Museum. *Bulletin of the United States National Museum* **60**, 1–122.
- Pompa S, Ehrlich PR and Ceballos G** (2011) Global distribution and conservation of marine mammals. *Proceedings of the National Academy of Sciences* **108**, 13600–13605.
- Pontes T, D'Amelio S, Costa G and Paggi L** (2005) Molecular characterization of larval anisakid nematodes from marine fishes of Madeira by a PCR-based approach, with evidence for a new species. *Journal of Parasitology* **91**, 1430–1434.
- Poulin R** (2004) Parasite species richness in New Zealand fishes: a grossly underestimated component of biodiversity? *Diversity and Distributions* **10**, 31–37.
- Poulin R, Blasco-Costa I and Randhawa HS** (2016) Integrating parasitology and marine ecology: seven challenges towards greater synergy. *Journal of Sea Research* **113**, 3–10.
- Presswell B and Lagrue C** (2016) Assessing parasite infections from avian faecal samples: the old methods are still the best. *Notornis* **63**, 32–36.
- Price EW** (1932) The trematode parasites of marine mammals. in *Proceedings of the United States National Museum* **81**, 1–68.
- Raga JA** (1994) Parasitismus bei den Cetacea. pp. 132–179 in Robineau D, Duguay R, Robineau D and Klima M (Eds) *Handbuch der Säugetiere Europas: Meeressäuger, Band 6, Teil I*. Wiesbaden, Aula-Verlag.
- Ramos P, Lynch M, Hu M, Arnould JP, Norman R and Beveridge I** (2013) Morphometric and molecular characterization of the species of *Uncinaria* Frölich, 1789 (Nematoda) parasitic in the Australian fur seal *Arctocephalus pusillus doriferus* (Schreber), with notes on hookworms in three other pinniped hosts. *Systematic Parasitology* **85**, 65–78.
- Randhawa HS** (2011) Insights using a molecular approach into the life cycle of a tapeworm infecting great white sharks. *The Journal of Parasitology* **97**, 275–280.
- Randhawa HS and Brickle P** (2011) Larval parasite gene sequence data reveal cryptic trophic links in life cycles of porbeagle shark tapeworms. *Marine Ecology Progress Series* **431**, 215–222.
- Robertson BC and Chilvers BL** (2011) The population decline of the New Zealand sea lion *Phocarctos hookeri*: a review of possible causes. *Mammal Review* **41**, 253–275.
- Roe W, Michael S, Fyfe J, Burrows E, Hunter S and Howe L** (2017) First report of systemic toxoplasmosis in a New Zealand sea lion (*Phocarctos hookeri*). *New Zealand Veterinary Journal* **65**, 46–50.
- Salgado Kent C, Jenner C, Jenner M, Bouchet P and Røstad E** (2012) Southern Hemisphere breeding stock 'D' humpback whale population estimates from North West Cape, Western Australia. *Journal of Cetacean Research and Management* **12**, 29–38.
- Schumann N, Gales NJ, Harcourt RG and Arnould JP** (2013) Impacts of climate change on Australian marine mammals. *Australian Journal of Zoology* **61**, 146–159.
- Seawright A** (1964) Pulmonary acariasis in a Tasmanian fur seal. *Journal of Comparative Pathology and Therapeutics* **74**, 97–120.
- Sedlak-Weinstein E** (1991) Three new records of cyamids (Amphipoda) from Australian cetaceans. *Crustaceana* **60**(1), 90–104.
- Sedlak-Weinstein E** (1992a) A new species of *Isocyamus* (Amphipoda: Cyamidae) from *Kogia breviceps* (De Blainville, 1838) in Australian waters. *Systematic Parasitology* **23**, 1–6.
- Sedlak-Weinstein E** (1992b) The occurrence of a new species of *Isocyamus* (Crustacea, Amphipoda) from Australian and Japanese pilot whales, with a key to species of *Isocyamus*. *Journal of Natural History* **26**, 937–946.
- Sey O** (1980) Amphistome parasites of the dugong and a revision of the subfamily Solenorchhiinae (Trematoda: Paramphistomidae). *Acta Zoologica Academiae Scientiarum Hungaricae* **26**, 223–228.
- Shamsi S** (2014) Recent advances in our knowledge of Australian anisakid nematodes. *International Journal for Parasitology: Parasites and Wildlife* **3**, 178–187.
- Shamsi S and Butcher AR** (2011) First report of human anisakidosis in Australia. *Medical Journal of Australia* **194**(4), 199–200.
- Shamsi S, Gasser R and Beveridge I** (2012) Genetic characterisation and taxonomy of species of *Anisakis* (Nematoda: Anisakidae) parasitic in Australian marine mammals. *Invertebrate Systematics* **26**, 204–212.
- Shaughnessy PD, Kemper CM, Stemmer D and McKenzie J** (2014) Records of vagrant fur seals (family Otariidae) in South Australia. *Australian Mammalogy* **36**, 154–168.
- Siebert U, Wünschmann A, Weiss R, Frank H, Benke H and Frese K** (2001) Post-mortem findings in harbour porpoises (*Phocoena phocoena*) from the German North and Baltic Seas. *Journal of Comparative Pathology* **124**, 102–114.
- Siebert U, Gilles A, Lucke K, Ludwig M, Benke H, Kock KH and Scheidat M** (2006) A decade of harbour porpoise occurrence in German waters—analyses of aerial surveys, incidental sightings and strandings. *Journal of Sea Research* **56**, 65–80.
- Smales LR** (1986) Polymorphidae (Acanthocephala) from Australian mammals with descriptions of two new species. *Systematic Parasitology* **8**, 91–100.
- Spratt DM** (2002) Parasites and pathology of the respiratory tracts of native and feral mammals in Australia – a review. *Australian Mammalogy* **24**, 177–192.
- Sprent J** (1980) Ascaridoid nematodes of Sirenians—the Heterocheilinae redefined. *Journal of Helminthology* **54**, 309–328.
- Stockin KA, Duignan PJ, Roe WD, Meynier L, Alley M and Fettermann T** (2009) Causes of mortality in stranded common dolphin (*Delphinus* sp.)



- from New Zealand waters between 1998 and 2008. *Pacific Conservation Biology* **15**, 217–227.
- Sures B** (2004) Environmental parasitology: relevancy of parasites in monitoring environmental pollution. *Trends in Parasitology* **20**, 170–177.
- Tomo I, Kemper CM and Lavery TJ** (2010) Eighteen-year study of South Australian dolphins shows variation in lung nematodes by season, year, age class, and location. *Journal of Wildlife Diseases* **46**, 488–498.
- Tubb J** (1937) Lady Julia Percy Island: Report of the expedition of the McCoy Society for Field Investigation and Research. No. 18. Crustacea. *Proceedings of the Royal Society of Victoria* **49**, 408–411.
- Valentini A, Mattiucci S, Bondanelli P, Webb SC, Mignucci-Giannone AA, Colom-Llavina MM and Nascetti G** (2006) Genetic relationships among *Anisakis* species (Nematoda: Anisakidae) inferred from mitochondrial *cox2* sequences, and comparison with allozyme data. *Journal of Parasitology* **92**, 156–166.
- Van Bressem M-F, Raga JA, Di Guardo G, et al.** (2009) Emerging infectious diseases in cetaceans worldwide and the possible role of environmental stressors. *Diseases of Aquatic Organisms* **86**, 143–157.
- von Linstow OFB** (1904) Neue Helminthen. *Zentralblatt für Bakteriologie Parasitenkunde, Infektionskrankheiten und Hygiene* **1**, 678–683.
- Watson KC** (1967) The terrestrial Arthropoda of Macquarie Island. *ANARE Scientific Reports series B (I) Zoology* **99**, 90 pp.
- Williams HH** (1968) The taxonomy, ecology and host-specificity of some Phyllobothriidae (Cestoda: Tetraphyllidea), a critical revision of *Phyllobothrium* Beneden, 1849 and comments on some allied genera. *Philosophical Transactions of the Royal Society of London B* **253**, 231–307.
- WoRMS** (2018) World Register of Marine Species. Available at <http://www.marinespecies.orgatVLLZ> (accessed March 2018).
- Yamaguti S** (1963) *Systema Helminthum*. Vol. V. *Acanthocephala*. 423 pp. New York, Interscience Publishers.
- Yamasaki H and Kuramochi T** (2009) A case of *Diphyllobothrium nihonkaiense* infection possibly linked to salmon consumption in New Zealand. *Parasitology Research* **105**(2), 583.
- Zann LP and Harker BM** (1978) Egg production of the barnacles *Platylepas ophiophilus* Lanchester, *Platylepas hexastylus* (O. fabricius), *Octolasmis warwickii* Gray and *Lepas anatifera* Linnaeus. *Crustaceana* **35**, 206–214.