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The New Zealand *Pagurus traversi* (Filhol, 1885) (Crustacea: Decapoda: Anomura: Paguridae) in Australia, first record of a translocated hermit crab

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Abstract

Eichler, J., Hall, B., Farrelly, C., Falconer, A., and Poore, G.C.B. 2024. The New Zealand *Pagurus traversi* (Filhol, 1885) (Crustacea: Decapoda: Anomura: Paguridae) in Australia, first record of a translocated hermit crab. *Memoirs of Museum Victoria* 83: 317–323.

The New Zealand hermit crab *Pagurus traversi* (Filhol, 1885) was first reported in Tasmania and Victoria, Australia, in 2022 as photographs on iNaturalist. Its identity was confirmed by specimens collected and examined at Museums Victoria. The species, widespread on the eastern coast of New Zealand, has now been reported from northern and eastern Tasmania, from as early as 2013, eastern Victoria and southern New South Wales. This is the first record of a presumed established translocated hermit crab. Introductions and range extensions of anomurans are reviewed.

Keywords

Pagurus traversi; hermit crab; exotic species; Australia

Introduction

The decapod crustacean fauna of southern Australia is well known (Poore, 2004, 2007). Intertidal hermit crabs of the family Paguridae are rare. In July 2022 Victorian scuba diver, Nick Shaw, posted an observation of a hermit crab from Cape Conran, Victoria, Australia, on the citizen science website iNaturalist, which he tentatively identified as *Pagurus traversi* (Filhol, 1885), a New Zealand species. One of us (JE) concurred that the image on iNaturalist agreed with those from New Zealand. Another poster to iNaturalist, Tim Binns, then reported prior observations from Tomahawk, northeastern Tasmania, Australia. In August 2022 BH photographed a hermit crab from Bastion Point, Mallacoota, Victoria, that was subsequently identified as the same species.

This paper confirms the identification of *P. traversi*, records its arrival in Australia, and discusses the translocation of anomurans globally.

Material and methods

Colour photographs of the new hermit crab from Cape Conran, Vic., taken in July 2022, were first compared with those of hermit crabs from New Zealand on iNaturalist. Later, photographs were compared with those taken at Tomahawk, Tasmania, and at Bastion Point, Mallacoota, Victoria (fig. 1). No specimens were

collected. In October and November 2023, JE collected and photographed several specimens of the same hermit crab from rock pools in the intertidal zone at Bastion Point, Mallacoota. Collection was made in accordance with research permit RP-1218 issued by the Victorian Fisheries Authority to the Marine Research Group (MRG) of the Field Naturalists Club of Victoria (<https://www.fncv.org.au/>). Specimens were preserved in 95% ethanol and lodged at Museums Victoria (NMV).

To identify the species, BH and JE used the live colour and morphology of preserved specimens (fig. 2). CF and GCBP compared specimens with the redescription and figures of de Saint Laurent and McLaughlin (2000) and with a specimen from New Zealand in Museums Victoria. Photographs in fig. 3 were taken using a Leica 205C microscope and the Leica Application Suite multifocus routine. Size is given as shield length (sl.).

Further observations (colour photographs) posted on iNaturalist were reviewed and personal photographic libraries were revisited. Records from previous visits by the MRG to intertidal sites in eastern Victoria were reviewed.

Results of surveys

The MRG has not previously recorded *Pagurus traversi* (Phillips et al., 1984). The MRG's previous visits to locations where this species has been found since 2022 were: Mallacoota,

Bastion Point, 13 May 1982, 8 March 2002, 19 January 2011, 1 March 2018; Cape Conran, 19 May 1982, 15 March 1983, 9 March 2005, 25 February 2006; and Walkerville North, 23 March 1974, 6 March 1982, 14 March 2009. All of these trips included visits to nearby sites on adjacent days, and *P. traversi* was not noted during any of them.

On 15 March 2024, during an intertidal survey of the rock platforms at Walkerville North, AF sieved the sediments around the roots of the green alga *Caulerpa brownii* using a kitchen sieve and found one individual of *P. traversi*.

Further to the observations and collections from Mallacoota, Cape Conran and Walkerville North, several observations have been posted on iNaturalist: Ulverstone, Hawley Beach and Tomahawk on the northern Tasmanian coast, Tasman Peninsula, Hobart and Blackmans Bay in southeastern Tasmania. A photograph taken by JE at Tessellated Pavement, Eaglehawk Neck, Tasman Peninsula, on 23 February 2013, predates the oldest observations on iNaturalist by 7.5 years. There was a single sighting in December 2023 from Tathra, southern NSW.



Figure 1. Map of southeastern Australia with records of *Pagurus traversi* shown as red dots.

Based on the 27 observations (26 April 2024) posted on iNaturalist, it appears specimens have been found in both rocky and sandy habitats in the intertidal zone. One posting noted that the species also occurred in the shallow subtidal

zone in Tasmania. JE saw approximately 100 individuals at Mallacoota in November 2023. Tim Binns reported densities of up to 100 animals per square metre at Tomahawk, Tasmania (fig. 1).

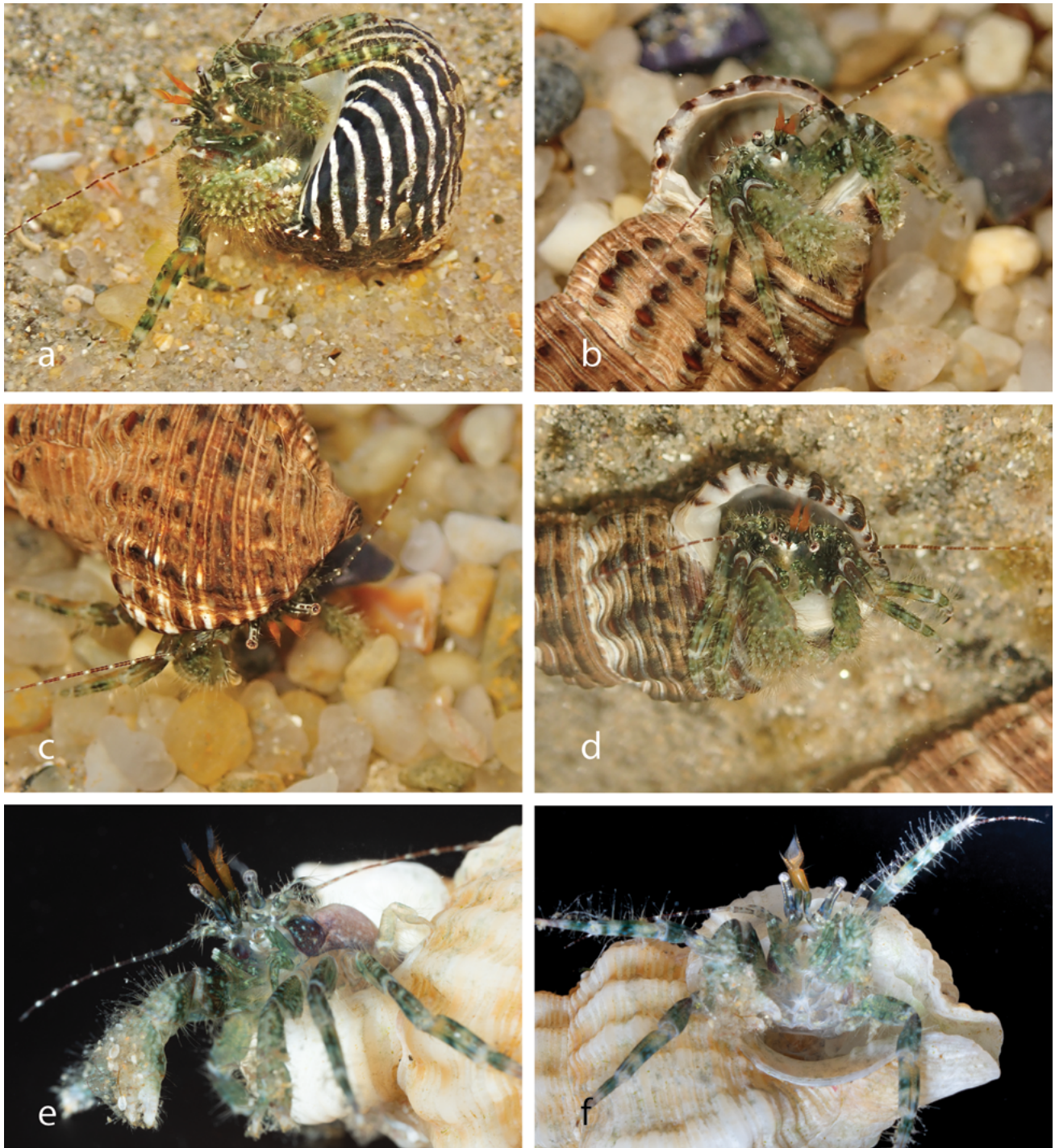


Figure 2. Colour photos of live individuals of *Pagurus traversi*. a–d, photos of four individuals taken by John Eichler at Bastion Point, Mallacoota, 31 Oct and 1 Nov 2023; e, f, photos of one individual taken by Leon Altoff at Walkerville North, 15 March 2024. Not to same scale.

Taxonomy and identification

Material examined. New Zealand. Wairepo Flats, Kaikoura, 42.42° S, 173.72° E, NMV J39509 (female, sl. 1.0 mm). Australia, Victoria. Walkerville North, Waratah Bay, 38.84° S, 146.00° E, NMV J76662 (female, sl. 2.9 mm); Bastion Point, Mallacoota, 37.57° S, 149.76° E, NMV J75729 (male, sl. 4.3 mm; ovigerous female, sl. 3.6 mm).

Remarks on identification. The colour of *Pagurus traversi* has been described as “eyestalks green-blue with lighter markings; antennules reddish-orange; antennae dark red with narrow white bars; chelipeds and walking legs dark blue-green ground colour with small pale blue spots and pale blue patches in [carpal-meral] joint regions” (Schembri and McLay, 1983; de Saint Laurent and McLaughlin, 2000: pl. 6 fig. 1). Examination of photographs on iNaturalist of *P. traversi* from New Zealand show the coloration to be quite variable. A more detailed description of the live colour is provided here based on the Australian specimens: eyestalks dark green or brown with longitudinal white dashes and stripes; basal antennular articles greenish, third basal article and flagellum bright orange; antennal peduncle dark red, bearing tiny blue/white spots; antennal flagellum dark red with narrow white bars; chelipeds and ambulatory legs vary from blue-green to dark brown, with lines of pale blue spots (particularly on the merus); distal articles of walking legs often striped with broad green, white and dark red bands, a thicker band of white on distal carpal margin, with narrow dark red lines inside each leg; third maxillipeds dark red with small blue spots; carapace with pale blue/white spots. This is consistent with the colour reported from New Zealand (fig. 2).

The morphology of *P. traversi* is well described (de Saint Laurent and McLaughlin, 2000: 190, 206–209, fig. 66, pl. 6 fig. 1). Diagnostic features from their key to New Zealand species of *Pagurus* and the description are: ocular peduncles moderately long and slender, 0.50–0.65 length of shield. Ocular acicles with 2–5 terminal spines. Right cheliped dorsal surface with 4–6 regular or irregular rows of acute tubercles; carpus not strongly produced ventrally to form distinct triangular lobe. Dactyli of walking legs shorter than propodi, each without longitudinal sulcus on mesial and lateral face. Pereopods 3 without dense dorsal and ventral fringe of long plumose setae. This is consistent with the Australian specimens (fig. 3).

Discussion

Ecology. *Pagurus traversi* has been found in New Zealand occupying a variety of gastropod shells; the species occurs primarily on intertidal rocky shores but occurs down to 15 m depth, usually on coralline algae (*Corallina*) patches and under rocks (de Saint Laurent and McLaughlin, 2000). The ecology of the species is well studied (Schembri, 1982; McLay, 1985; Wada et al., 2014). All Australian collections were made intertidally in eastern Victoria and NSW and others have been recorded intertidally and subtidally in Tasmania, in similar environments to those in New Zealand.

Paguridae in Australia and New Zealand. The hermit crab *Pagurus sinuatus* (Stimpson, 1858) is the only species of *Pagurus* Fabricius, 1775 until now recorded from intertidal and shallow water in southeastern Australia (Poore, 2004). *Pagurus*

minutus Hess, 1865 and *P. filholi* (De Man, 1887) both reported from Sydney are unlikely to have been collected there (Sandberg and McLaughlin, 1993) and are more likely to be tropical Indo-West Pacific species. *Pagurus sinuatus* is widespread in southern Australia and recorded from New Zealand only in the Kermadec Islands. Another species has been recorded in southwestern Australia (Poore, 2004): *P. janitor* (Alcock, 1905), now *P. hirtimanus* (Miers, 1880), a widespread Indo-West Pacific species.

Thirty-three species of pagurid hermit crabs are known from New Zealand. In addition to *P. sinuatus*, four other species of *Pagurus* occur in New Zealand (de Saint Laurent and McLaughlin, 2000; Webber et al., 2010). Of these, *P. iridocarpus* de Saint Laurent and McLaughlin, 2000 is known only from 84 m depth off the Kermadec Islands; *P. novizealandiae* (Dana, 1852), *P. albidianthus* de Saint Laurent and McLaughlin, 2000 and *P. traversi* (Filhol, 1885) are known from throughout New Zealand, including the subantarctic islands from intertidal and subtidal depths. All were described and figured in detail by de Saint Laurent and McLaughlin (2000), who provided a key to differentiate the species. In addition to these another pagurid *Hachijopagurus rubrimaculata* Osawa and Okuno, 2003, native to southern Japan, has been recorded from a floating shipwreck north of New Zealand (Williams et al., 2008; Ahyong et al., 2011).

Anomurans as introduced species. This is the first record of the introduction of a hermit crab (Superfamily Paguroidea) across an oceanic boundary (DecaNet eds, 2024). The only other paguroid recorded in the World Register of Introduced Marine Species (WRIMS) database is the lithodid king crab *Paralithodes camtschaticus* (Tilesius, 1815), which is invasive in the Arctic Ocean and Barents Sea (Dvoretzky and Dvoretzky, 2013). The remaining Anomura listed by WRIMS are three introduced species of porcelain crabs of the family Porcellanidae. *Porcellana africana* Chace, 1956 has been introduced from northwestern Africa to southwestern South Africa (Griffiths et al., 2018). *Petrolisthes armatus* (Gibbes, 1850) is a tropical porcelain crab occurring on both sides of the Atlantic and along the western coast of the Americas. Recently the species has extended its range into the warm temperate coast of the USA (Hiller and Lessios, 2017). The third is *Petrolisthes elongatus* (H. Milne Edwards, 1837), native to intertidal New Zealand, but introduced to southern Tasmania in the late 19th century but now occupying much of the Tasmanian northern and eastern coast (Gregory et al., 2012). Despite being very common in Tasmania, *Petrolisthes elongatus* has been recorded from only three sites on the north side of Bass Strait: Phillip Island, 2013, NMV catalogue number J63793; Eagles Nest, Inverloch, MRG record 23 Feb 2022; Bird Rock, Walkerville South, MRG record 18 March 2024. This distribution is similar to that of the brachyuran crab, *Metacarcinus novaezelandiae* (Hombron and Jacquinet, 1846) (Cancridae), introduced from New Zealand to Tasmania in about 1930 but now recorded from few places in eastern Victoria (Poore, 2004: 402, fig. 124a).

Exotic marine species in Victoria. The number of introductions to the exposed Bass Strait coast of Victoria is far fewer than in Port Phillip Bay. The bay, containing the

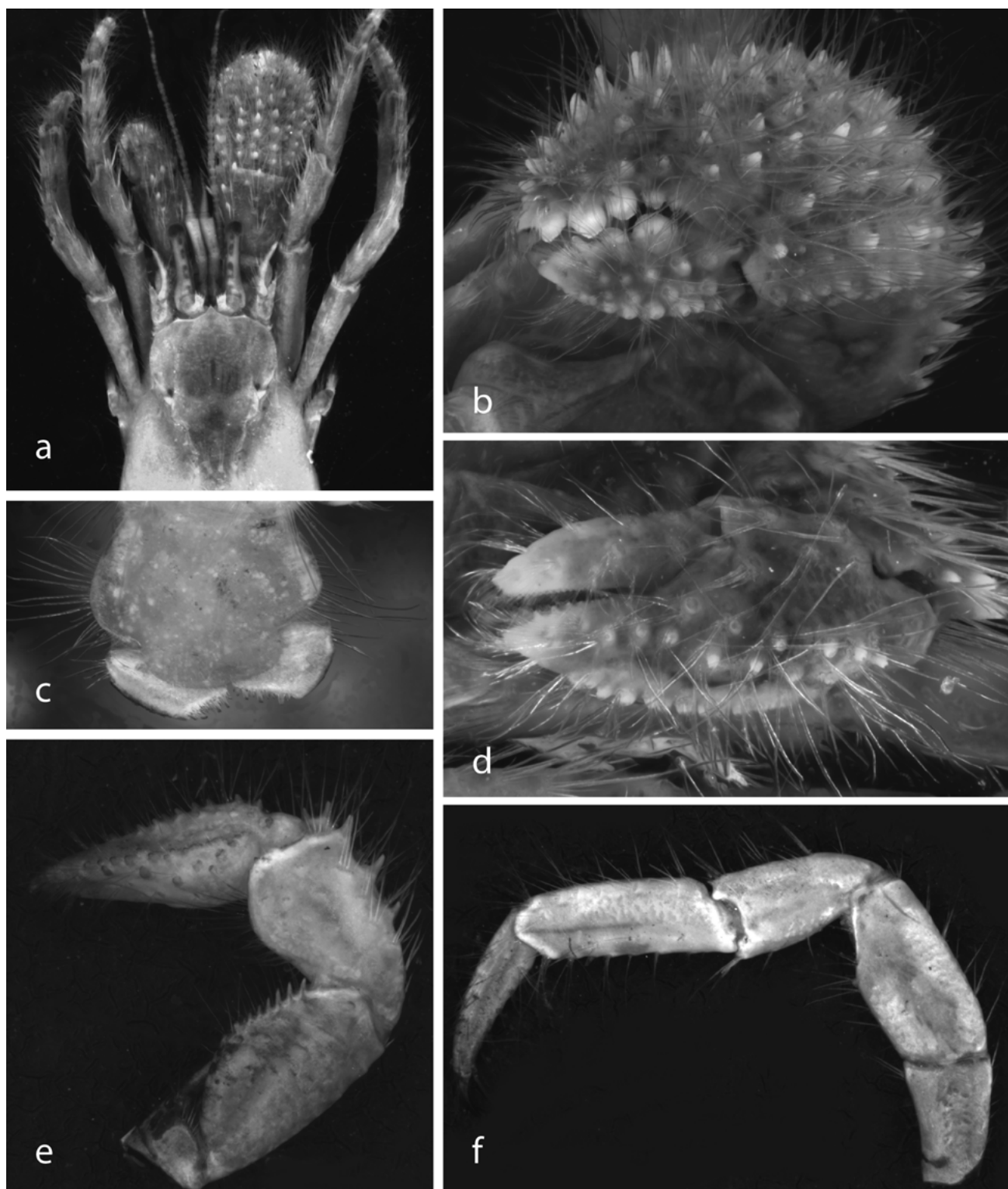


Figure 3. Photographs of preserved individuals of *Pagurus traversi* taken by Caroline Farrelly. Bastion Point, Mallacoota, NMV J75729, male: a, dorsal shield, chelipeds, pereopods 2, 3, eyestalks, antennae; b, right chela, outer face; c, telson; d, left chela, outer face. Walkerville North, NMV J76662, female: e, left chela, lower view; f, pereopod 3, outer face. Not to same scale.

port of a major metropolis (Melbourne), is one of the most invaded waterways globally, with 99 introduced and 61 cryptogenic marine species (Hewitt et al., 2004). Shipping and associated ballast water and fouling can explain the high number of exotic species in Port Phillip Bay, but not introductions to remote small harbours and rocky shores in eastern Victoria and Tasmania.

Conjecture on the introduction of Pagurus traversi. The larval life of temperate hermit crabs of the genus *Pagurus* reared in the laboratory is a few (about four) weeks but is highly variable (cf. Kim and Hong, 2005; Erwin et al., 2006), so the species is unlikely to have crossed the Tasman Sea unaided. Ships and recreational vessels travel between New Zealand and ports in Australia (Ahyong et al., 2011). Discounting Melbourne and Western Port in central Victoria (where the hermit crab has not so far been reported) the only candidate deep-water ports are Hobart, Tasmania, and Eden in southern NSW. Mallacoota is a shallow embayment but home to a local trawling fishing fleet. Bastion Point, where the hermit crabs were recorded, is outside the bay. The hermit crab may have arrived in ballast water or sea-chests or on fouled hulls of vessels travelling from New Zealand to Hobart and crossed Bass Strait as larvae (as other decapod species have before).

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Authors' contributions

JE and BH made the initial identification; AF organised field trips; CF and GP confirmed the identification in the lab; GP drafted the paper.

References

- Ahyong, S.T., and Wilkens, S.L. 2011. Aliens in the antipodes: non-indigenous marine crustaceans of New Zealand and Australia. Pp. 451–485 in: Galil, B.S., Clark, P.F., and Carlton, J.T. (eds), *In the wrong place – alien marine crustaceans: distribution, biology and impacts*. Springer Basel: Netherlands. <https://doi.org/10.1007/978-94-007-0591-3>
- Alcock, A. 1905. Marine Crustaceans. XIV. Paguridae. Pp. 827–835, pl. 48 in: Gardiner, J.S. (ed.), *The fauna and geography of the Maldive and Laccadive Archipelagoes. Being the account of the work carried on and of the collections made by an expedition during the years 1899 and 1900*. Vol. 2 (4). Cambridge University Press: Cambridge. <https://www.biodiversitylibrary.org/page/10780097>
- Chace, F.A. 1956. Porcellanid crabs. *Expédition océanographique Belge dans les eaux côtières Africaines de l'Atlantique sud 1948–1949*. *Résultats Scientifiques* 3: 1–54.
- Dana, J.D. 1852. Crustacea. Part I. *United States exploring expedition during the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, U.S.N.* 13: 1–685, with a folio atlas of 96 plates (published 1855). <http://biodiversitylibrary.org/page/18991909>
- DecaNet eds. 2024. Paguroidea Latreille, 1802. Accessed through Rius, M., Ahyong, S., Bieler, R., Boudouresque, C., Costello, M.J., Downey, R., Galil, B.S., Gollasch, S., Hutchings, P., Kamburska, L., Katsanevakis, S., Kupriyanova, E., Lejeune, C., Marchini, A., Occhipinti, A., Pagad, S., Panov, V.E., Poore, G.C.B., Robinson, T.B., Sterrer, W., Turon, X., Valls Domedel, G., Verleye, T., Vieira, L.M., Willan, R.C., Yeo Chong Jinn, D., and Zhan, A. (2024) World Register of Introduced Marine Species (WRiMS) at: <https://www.marinespecies.org/introduced%20aphia.php?p=taxdetails&id=106687> on 19 Mar 2024.
- Dvoretzky, A.G., and Dvoretzky, V.G. 2013. Population dynamics of the invasive lithodid crab, *Paralithodes camtschaticus*, in a typical bay of the Barents Sea. *ICES Journal of Marine Science* 70: 1255–1262. <https://doi.org/10.1093/icesjms/fst037>
- Erwin, M.B., Eduardo, E.D., and Jara, C.G. 2006. Larval development of the hermit crab *Pagurus edwardsii* (Decapoda: Anomura: Paguridae) under laboratory conditions. *Journal of Crustacean Biology* 26: 154–167. <https://doi.org/10.1651/C-2577.1>
- Filhol, H. 1885. Considerations relatives a la faune des Crustacés de la Nouvelle Zélande. *Bibliothèque de l'École des Hautes Études, Section des Sciences Naturelles, Paris* 30: 1–60. <https://www.marinespecies.org/aphia.php?p=sourcedetails&id=45695>
- Gibbes, L.R. 1850. On the carcinological collections of the United States, and an enumeration of species contained in them, with notes on the most remarkable, and descriptions of new species. *Proceedings of the American Association for the Advancement of Science* 3: 167–201. <https://www.biodiversitylibrary.org/page/63690893>
- Gregory, L.P., Campbell, M.L., Primo, C., and Hewitt, C.L. 2012. Biotic and abiotic factors affecting the Tasmanian distribution and density of the introduced New Zealand porcelain crab *Petrolisthes elongatus*. *Aquatic Invasions* 7: 491–501. <https://doi.org/10.3391/ai.2012.7.4.006>
- Griffiths, C., Roberts, S., Branch, G.M., Eckel, K., Schubart, C.D., and Lemaitre, R. 2018. The porcelain crab *Porcellana africana* Chace, 1956 (Decapoda: Porcellanidae) introduced into Saldanha Bay, South Africa. *BioInvasions Records* 7: 133–142. <https://doi.org/10.3391/bir.2018.7.2.04>
- Hess, W. 1865. Beitrage zur Kenntnis der Decapoden-Krebse Ost-Australiens. *Archiv für Naturgeschichte* 31 (1): 127–173, pls 6, 7. <https://doi.org/10.5962/bhl.part.15862>
- Hewitt, C.L., Campbell, M.L., Thresher, R.E., Martin, R.B., Boyd, S., Cohen, B.F., Currie, D.R., Gomon, M.F., Keough, M.J., Lewis, J.A., Lockett, M.M., Mays, N., McArthur, M.A., O'Hara, T.D., Poore, G.C.B., Ross, D.J., Storey, M.J., Watson, J.E., and Wilson, R.S. 2004. Introduced and cryptogenic species in Port Phillip Bay, Victoria, Australia. *Marine Biology* 144: 183–202. <https://doi.org/10.1007/s00227-003-1173-x>
- Hiller, A., and Lessios, H.A. 2017. Phylogeography of *Petrolisthes armatus*, an invasive species with low dispersal ability. *Scientific Reports* 7: 3359. <https://doi.org/10.1038/s41598-017-03410-8>
- Hombron, J.B., and Jacquinot, H. 1842. Atlas d'Histoire Naturelle. Crustacés. Pls 1–9 in: *Voyage au Pôle Sud et dans l'Océanie sur les corvettes l'Astrolabe et la Zélée pendant les années 1837–1838–1839–1840 ... Zoologie*. Gide et J. Baudry, Éditeurs: Paris.
- Kim, M.H., and Hong, S.Y. 2005. Larval development of *Pagurus pectinatus* (Stimpson) (Decapoda: Anomura: Paguridae) reared in the laboratory. *Invertebrate Reproduction & Development* 47: 91–100. <https://doi.org/10.1080/07924259.2005.9652149>
- Man, J.G. de 1887. Uebersicht der indo-pacifischen Arten der Gattung *Sesarma* Say, nebst einer Kritik der von W. Hess und E. Nauck in den Jahren 1865 und 1880 beschriebenen Decapoden. *Zoologische Jahrbücher Abteilung für Systematik, Geographie und Biologie der Tiere* 2: 639–722, pl. 17. <https://www.biodiversitylibrary.org/part/189753>

- McLay, C.L. 1985. Moulting and growth in *Pagurus traversi* and *P. novizealandiae* (Decapoda: Anomura: Paguridae): the effects of neighbours. *New Zealand Journal of Marine and Freshwater Research* 19: 327–337. <https://doi.org/10.1080/00288330.1985.9516099>
- Miers, E.J. 1880. On a collection of Crustacea from the Malaysian region. Part III. Crustacea Anomura and Macrura (except Penaeidea). *Annals and Magazine of Natural History (ser. 5)* 5: 370–384. <https://www.biodiversitylibrary.org/part/57089>
- Milne Edwards, H. 1837. *Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*. Vol. 2. Librairie Encyclopédique de Roret: Paris. 531 pp. <https://doi.org/10.5962/bhl.title.16170>
- Osawa, M., and Okuno, J. 2003. A new genus and new species of the family Paguridae (Crustacea: Decapoda: Anomura), from Hachijo-jima Island, Japan, with a list of hermit crab species found in the same collection sites. *Proceedings of the Biological Society of Washington* 116: 943–955.
- Phillips, D.A.B., Handreck, C.P., Bock, P.E., Burn, R., Smith, B.J., and Staples, D.A. 1984. *Coastal invertebrates of Victoria. An atlas of selected species*. Marine Research Group of Victoria in association with the Museum of Victoria: Melbourne. 168 pp.
- Poore, G.C.B. 2004. *Marine decapod Crustacea of southern Australia. A guide to identification (Chapter 12. Ahyong, A, Stomatopoda – mantis shrimps)*. CSIRO Publishing: Melbourne. 574 pp. <https://doi.org/10.1071/9780643092129>
- Poore, G.C.B. 2007. *Crabs, hermit crabs and allies*. Museum Victoria: Melbourne. 60 pp.
- Saint Laurent, M. de, and McLaughlin, P.A. 2000. Superfamily Paguroidea, family Paguridae. In: Forest, J., de Saint Laurent, M., McLaughlin, P.A., and Lemaitre, R. The marine fauna of New Zealand: Paguroidea (Decapoda: Anomura) exclusive of the Lithodidae. *NIWA Biodiversity Memoir* 114: 104–209.
- Sandberg, L., and McLaughlin, P.A. 1993. Reexamination of *Pagurus minutus* Hess, 1865, and *Pagurus filholi* (de Man, 1887) (Crustacea: Anomura: Paguridae) *Zoologische Mededelingen* 67: 197–206.
- Schembri, P.J. 1982. Feeding behaviour of fifteen species of hermit crabs (Crustacea: Decapoda: Anomura) from the Otago region, southeastern New Zealand. *Journal of Natural History* 16: 859–878. <https://doi.org/10.1080/00222938200770691>
- Schembri, P.J., and McLay, C.L. 1983. An annotated key to the hermit crabs (Crustacea: Decapoda: Anomura) of the Otago region (southeastern New Zealand). *New Zealand Journal of Marine and Freshwater Research* 17: 27–35. <https://doi.org/10.1080/00288330.1983.9515984>
- Stimpson, W. 1858. Prodromus descriptionis animalium evertibratorum, quae in expeditione ad Oceanum Pacificum septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit. Pars V. Crustacea Ocypodoida. *Proceedings of the Academy of Natural Sciences of Philadelphia* 10: 93–110. <https://www.biodiversitylibrary.org/part/64016>
- Tilesius, G. 1815. De cancris Camtschaticis, oniscis, entomotraxis et cancellis marinis microscopicis noctiluculentibus, cum tabulis IV. Aeneis et appendice adnexo de acaribus et ricinis Camtschaticis. *Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg* 5: 331–405, pls 5–8.
- Wada, S., Yasuda, C.I., and McLay, C. 2014. Sexual size dimorphism in two endemic hermit crabs, *Pagurus traversi* and *P. novizealandiae*, in New Zealand. *Bulletin of Fisheries Sciences, Hokkaido University* 64: 31–35.
- Webber, W.R., Fenwick, G.D., Bradford-Grieve, J.M., Eagar, S.H., Buckeridge, J.S., Poore, G.C.B., Dawson, E.W., Watling, L., Jones, J.B., Wells, J.B.J., Bruce, N.L., Ahyong, S.T., Larsen, K., Chapman, M.A., Olesen, J., Ho, J.-S., Green, J.D., Shiel, R.J., Rocha, C.E.F., Lörz, A.-N., Bird, G.J., and Charleston, W.A. 2010. Chapter 8. Phylum Arthropoda. Subphylum Crustacea. Shrimps, crabs, lobsters, barnacles, slaters, and kin. Pp. 98–232 in: Gordon, D.P. (ed.), *New Zealand Inventory of Biodiversity. Vol. 2. Kingdom Animalia*. Canterbury University Press: Christchurch.
- Williams, R., Gould, B., and Christian, S. 2008. Shipwrecks – an international biosecurity risk? *Surveillance* 35: 4–6.