

Women in marine science in Australia

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Two broad initiatives provide a backdrop to this special issue of *Marine and Freshwater Research*, which highlights women in marine science in Australia. The first is that Australia is currently piloting the Athena Swan accreditation framework from the United Kingdom, which is raising awareness of gender equity and diversity issues. The current focus of the Science in Australia Gender Equity (SAGE) initiative is on the Bronze Institutional award for higher education and research institutions. This initiative stemmed from recognition of the need for a more coordinated national approach to improving gender equity in STEMM (science, technology, engineering, mathematics and medicine) disciplines. Launched in 2015, to date there has been one round of awards to cohort 1 members, with a further two cohorts underway. Further, Australia has just released the Women in STEM (science, technology, engineering, and mathematics) decadal plan (Australian Academy of Science 2019). Both the Australian Academy of Science and the Australian Academy of Technology and Engineering authored this decadal plan, which was overseen by an expert working group. The plan recognises the strong demand for STEM skills and the need to maximise the attraction, participation and retention of both women and men in the workforce (Australian Academy of Science 2019).

In Australia, data suggest that from Bachelor degrees through to early post-doctoral level appointments (Level A and B) there are similar proportions of men and women in STEMM fields, but a significant decline in proportion of women occurs after this with just 20% of women at Professorial levels (Fig. 1). This scissor graph suggests Australia is losing significant talent at least from higher education institutions, although some of this loss may represent women moving into alternative STEMM-related careers. Similar data are not available for marine sciences alone although data from other broader disciplines suggest that with the exception of medical science there tend to be fewer women than men in all other STEMM subdisciplines^A. For comparison male/female ratios in non-STEMM disciplines are close to parity.

With this backdrop, *Marine and Freshwater Research* brings together 12 contributions led by women and involving other women (or men) as co-authors (Buddle *et al.* 2019; Coleman *et al.* 2019; Day *et al.* 2019; Deaker *et al.* 2019; Green *et al.* 2019; Heupel *et al.* 2019; Joyce *et al.* 2019; Lara-Lopez *et al.* 2019; Morgan *et al.* 2019; Schaefer *et al.* 2019; Wood *et al.* 2019; Woodings *et al.* 2019). These contributions span a diversity of fields within marine science and represent ~40 women across all career stages from ~20 institutions. Although this issue doesn't represent the full complement of women in marine science in Australia, it aimed to include a broad spectrum of women in this community. In this special issue, we aimed to provide a series of contributions highlighting women as lead authors and representing the breadth of the research they lead. Australia has a strong history of women's involvement in marine science for which this issue provides a showcase. Below we briefly review some of the contributions women have made, focusing particularly on the professional bodies for marine science or aspects of it in Australia. We have by no means covered every contribution or person. We recognise that there are many great women marine scientists who will continue to produce outstanding scientific contributions. Our vision for the future is that there will be many more female role models to encourage young women to pursue science careers because visibility counts, and ultimately to see numbers of women in professorial levels of science increase to match those of men.

Our professional bodies have already recognised the importance of women in science through special symposia. Australia has at least five professional bodies with a focus on marine sciences. The first, the Australian Marine Sciences Association (AMSA) was formed in the early 1960s. The first council comprised six elected members, one of whom was a woman, Hope McPherson from Victoria (Beckley 2013). She was a pioneering scientist involved in malacology and marine biology focusing on southern Australia and the sub-Antarctic environments and was the first woman to achieve a curatorial role at the National Museum of Victoria^B. She became a school teacher after

^ASee <https://www.sciencegenderequity.org.au/gender-equity-in-stem/>.

^BSee <http://www.antarctica.gov.au/about-antarctica/history/people/hope-black-macpherson>.

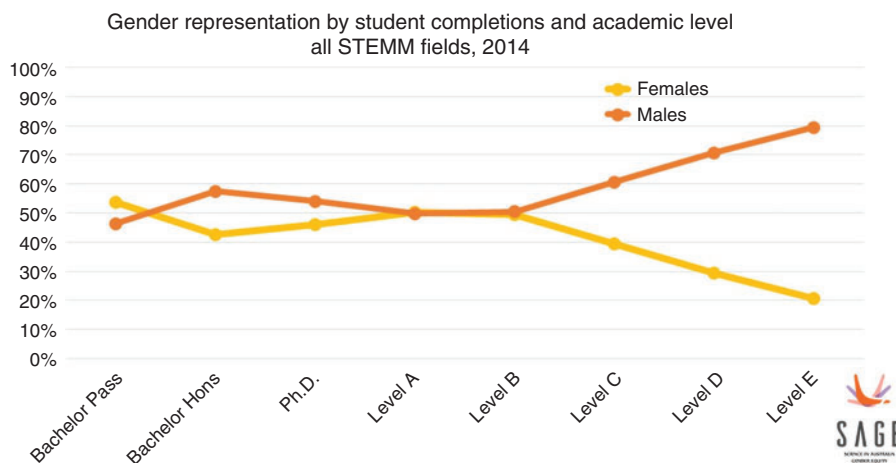


Fig. 1. Gender distribution for STEMM (science, technology, engineering, mathematics and medicine) degrees and academic levels in 2014. Data are from Higher Education research data, 2014 with the figure taken from Science in Australia Gender equity website (see <https://www.sciencegenderequity.org.au/gender-equity-in-stem/>).

being caught by the marriage bar and forced to resign from the public service in 1965. A fellow contemporary, Isobel Bennett, was noted as a 40-year member of AMSA in 2002 alongside Jan Watson. Many a marine biologist or natural historian would recollect having used Dakin's *Australian Seashores* book for identifying intertidal organisms (Dakin *et al.* 1952). Despite having no formal scientific education, Bennett spent more than 40 years working in the Zoology Department at the University of Sydney after Prof. William Dakin offered her a temporary position^C. After Dakin died in 1950, she completed the *Australian Seashores* book, first published in 1952. She went on to edit multiple editions (at least 11), largely associated with updating the taxonomy, but then, in 1986, aged 77 years, completely rewrote the book and updated it with colour images. She was recognised as a co-author in some editions and in the updated version as having fully revised it. Alongside her and recognised as assisting with Dakin's book was Elizabeth Pope who started as a scientific assistant at the Australian Museum before becoming a curator and Deputy Director^D.

Other notable names among the 40-year members are Helene Marsh, Loisetete Marsh, Pat Hutchings, Penny Berents, Lesley Clementson and Anne Hoggett^E. Although there were no women Presidents of AMSA in its first 28 years, there certainly were in the next 20 years, including Wendy Craik, Maria Byrne, Gina Newton, Lynnath Beckley, Sabine Dittmann and Penny Berents. AMSA's Jubilee Award recognises a scientist who has made an outstanding contribution to marine research in Australia and was established in 1988 to commemorate its silver jubilee year. The award has been made 29 times through to 2019 including to 6 women. The inaugural award was made in 1988 to Shirley Jeffrey who worked on microalgae. Other awardees include Patricia Mather (1992), June Olley (2005), Pat Hutchings (2010), Maria Byrne (2015) and Helene Marsh

(2019). Maria Byrne is a co-author on a paper in this special issue (Deaker *et al.* 2019).

The Australian Society for Fish Biology (ASFB) was founded almost 10 years after AMSA in 1971. It aimed to promote research, education and management of fish and fisheries in Australia and to provide a forum for the exchange of information. Besides marine fish and fisheries, there is also a focus on freshwater fish and fisheries. Although no women were elected officers at its inaugural meeting, a number were listed as members in the first newsletter (Australian Society for Fish Biology 1971). Over the societies almost 50-year history there have been just two women Presidents: Patricia Dixon (1997–99) and Bronwyn Gillanders (2012–13), although another is likely with the current Vice President also being a woman (Alison King). ASFB also has an award recognising outstanding contributions in fish or fisheries science – this award has been made 12 times since 1995 including to 1 woman.

The Australian Coral Reef Society, founded in 1922, is the world's oldest organisation focused on the study and conservation of coral reefs. Since 2015, the society has awarded medals for an established researcher, science education and conservation and early career researcher. Maria Byrne received the established researcher medal in 2019. The current executive (2018–19) of 20 is dominated by women with just 6 males. Over the past 20 years, 3 of the 10 Presidents have been women (Pat Hutchings, Selina Ward, Anna Scott).

The Australian Society for Phycology and Aquatic Botany (ASPAB) was formally established in 1980 with the aim to promote, develop and assist in the study of macro and micro-algae and other aquatic plants. Of its 15 Presidents to date, 6 have been women including Margaret Clayton, Di Walker, Wendy Nelson and Alecia Belgrove. Interestingly 4 of the 5 life members are women.

^CSee <https://www.science.org.au/learning/general-audience/history/interviews-australian-scientists/dr-isobel-bennett-1909-2008>.

^DSee <https://australianmuseum.net.au/about/history/people/elizabeth-carrington-pope/>.

^ESee <https://www.amsa.asn.au/history>.

Finally, the fifth society in the marine area is the Oceania Chondrichthyan Society (OCS) focused on understanding, sustainable use and conservation of sharks in the Asia-Pacific and Indian Ocean. A fairly young society, OCS was founded in 2006 with several women being central to its initiation and also serving on the inaugural Executive Committee (Sarah Irvine, Christine Dudgeon, Cynthia Awruch). The initial Executive Council and Executive Committee of OCS were established with equal numbers of men and women. OCS has continued to have women well represented in these roles with several women having served as President and Vice President.

Women have and will continue to make significant contributions to marine science in Australia. Through recognising, showcasing and celebrating the contributions of women in science we encourage greater participation by women in science and create future opportunities. Here we celebrate contributions of women in marine science as a beacon for future work and broader recognition of their contributions. Recognition and support of women in science will help facilitate women achieving higher positions and normalise women in these roles, ultimately reducing barriers. Working together and appreciating the science of everyone who contributes, male and female alike, can only serve to strengthen our community and enhance our collective achievements.

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