Women in Freshwater Science – Invisible Histories?

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Abstract. Women scientists have historically been subject to direct and indirect discrimination. This opinion piece argues for a history of freshwater science that recognises the scientific achievements of women. It suggests that lack of opportunity for women scientists in the twentieth century is typified by the stereotype that women were naturally predisposed to non-intellectual pursuits and, therefore, ill fitted to science. Freshwater science in Britain possibly provided a distinctive space for women in science in spite of widespread lack of opportunity. Over 20 women scientists were working in one institution in the interwar period, and during and immediately after the Second World War. Yet outside of that specific context their work is barely known. We give examples of these women and their work and argue that the historical invisibility of women in aquatic sciences needs to be more thoroughly addressed in order to understand the work of women scientists as having historical, social, as well as scientific, significance.

Additional keywords: gender, inequality, freshwater science, history of science.

Introduction.

It is a lamented truism that women in science, technology, engineering, mathematics and medicine (STEMM) face barriers in their education and difficulties in breaking through glass ceilings in their careers. Women also make up less of scientific workforces. In the UK in 2017, for example, estimates of the percentage of STEMM posts held by women range from 15-23% (Price Waterhouse Cooper 2017, WISE 2018).
This situation is paralleled in Australia, the wider European Union and North America (Jones and Hawkins 2015). Moreover, this underrepresentation is greatest in later, more senior career stages. For example, in natural and physical sciences in Australia a 2016 study found that at undergraduate level, women make up over 50 percent of students (SAGE 2016). At PhD level, representation of women and men was about even. However, in professional science grades, women were underrepresented: 47.1% of junior academics were women and only 16.3% of senior positions were held by women (SAGE 2016). In the UK, women occupy 13% of management positions in STEMM (WISE 2018). This vertical segregation parallels other contexts such as in the European Union (Caprile et al. 2012).

Women scientists should rightly be recognised because of the merit of their professional achievements. However, for some women scientists, even the highest scientific achievement does not necessarily correspond to academic career standing. A case in point is Donna Strickland who became only the third woman in history to receive the Nobel Prize for physics in 2018. Upon the announcement of this award for her work on ultra-short laser pulses, a disproportionate amount of media attention seemed to focus on her career grade rather than her scientific achievement (Stack 2018).

There are all sorts of reasons for this situation, ranging from scientific culture itself, to the construction of gender within scientific roles; from the socialisation of young women in education, to unequal pay, lack of opportunities, and relatively precarious and slow career progression for women in STEMM professions. Yet, despite knowledge of these reasons, women in the history of science are in the curious position of being either stand-
out geniuses, or invisible (Kass-Simon and Farnes 1990). The effect of this is an
acknowledgement that (super-talented, highly notable) women scientists are thin on the
ground, leading to a false conclusion that women are justifiably absent from the history
of science. Contrary to this, we suggest that we need to tell more ordinary ‘herstories’ of
science. We need, that is, to avoid searching the archives for uniquely talented women
scientists, and make more visible what we can glean about those women whose work has
been important, constructive and valuable within specific scientific contexts. Through
our ongoing research, “Gender and Science through the Archives of the Freshwater
Biological Association”, we are attempting to bring such narratives to light.

Lack of scientific opportunity for women.
We are not alone in suggesting that, historically, the research of women scientists has
frequently been conducted in the face of a general lack of opportunity and overt official
and unofficial discrimination much more prevalent than that which we witness today
(Des Jardins 2010, Abir-Am and Outram 1987). When women in the nineteenth and
eyear twentieth centuries, however, were given opportunities to access scientific
education and work they often seized it, sometimes in the face of opposition. One
example of this is the Balfour Biological Laboratory for Women, established at
Cambridge University between 1884-1914 which educated women who were directly
excluded from scientific education at Cambridge (Richmond 1997). A further example is
the range of hidden histories of women scientists who, during the First World War,
became doctors, chemists developing weapons, biologists studying pathogens and
mathematicians working in signals and ciphers (Fara 2015, 2018).
Of course, there is now awareness of examples of women scientists’ work being ignored and obscured from the historic record. The example of Eunice Foote from the nineteenth century has become something of a cause celebre. Foote read a short paper about her experiments on solar heat absorption by climate gases to the August 1856 meeting of the American Association for the Advancement of Science (AAAS) (Foote 1856). This presentation (women were not permitted to publish full papers), apparently received only polite and patronizing acknowledgement, partly perhaps because she was, after all, not a full AAAS Fellow; women’s scientific status allowed them only membership (Warner 1978). John Tyndall’s similar theory published a few years later, omitted to acknowledge Foote’s experimental and theoretical work, (Tyndall 1859, 1861). Tyndall has subsequently gained recognition as the first theorist of climate change.

Research has revealed how women with scientific training and qualifications in the twentieth century were subtly and not-so-subtly steered towards editing, teaching and librarianship, and away from the laboratory and the field (Des Jardins 2010). They were frequently relegated to scientific drudgery: repetitive, relatively low status scientific tasks that would have frustrated men with comparable scientific training. Their careers were also held back by the assumption that marriage required them to resign from their scientific posts (this ‘marriage bar’ was official policy in the UK until 1946 and in British colonies until the mid-1950s) (Mccarthy 2009). If we recognise such women scientists who managed to deal with and, even, flourish in such a climate and can tell their stories, then we should reveal detailed and a more nuanced history of (women) scientists.
Women in freshwater research

We now draw on our own research to pursue the arguments and suggestions made above through the history of women in British freshwater science. Our archival research into gender and science at the Freshwater Biological Association (FBA), founded in 1929, shows that the freshwater sciences provided opportunity for women during the first half of the twentieth century when science was widely segregated by gender. In the context of the UK, at least 20 women were working or training at this institution in its early years before and after the Second World War. The FBA was part of a network - of universities, and of colonial and Commonwealth science organisations - that provided openings for women scientists in the then novel aquatic sciences. Whilst there do exist some specific, largely biographical, accounts of the history of particular aquatic sciences (see Balon et al, 1994, for example), none of these focus on women scientists and the cultures of research they entered and helped create. Hence we have the opportunity to bring to bear new stories and insights about the role that women scientists played in this new scientific institution.

We give examples of the work of several of these women here. Some of these instances are of women who surmounted challenges and achieved success. Other individuals are harder to assess than their contemporaries, having abandoned their scientific research.

One of the key conduits for affording these scientists opportunities in the Freshwater Biological Association’s early days was the annual “Easter class” held for students from across the UK and beyond. Two of these young scientists in the 1930s, Maud Godward and Carmel Humphries, went on to have notably distinguished academic careers.
Godward was a freshwater phycologist and carried out postgraduate research at Lake Windermere with the FBA. This experience gained her employment as a lecturer at Queen Mary College, University of London. She became a founding member of the British Phycological Society in 1953 and went on to gain a Chair in Phycology at Queen Mary’s. A fellow of Godward’s at the FBA was Carmel Humphries, who worked on benthic fauna (Humphries 1936). She also benefitted from her experiences at the FBA, becoming a lecturer at University College Dublin. She was made professor of zoology there in 1957 and frequently returned to the FBA to conduct her research on chironomids.

In 1939, Winifred Frost, an ichthyologist, became the second female full-time professional naturalist at the FBA (FBA 1939). During her career she collaborated with many other women scientists, devising innovative experiments and programmes of research, and extending networks globally from her empirical sites around lake Windermere. Together with her research assistant, Rosemary Lowe, she created an innovative programme of research into eels (*Anguilla anguilla*) during the years 1939-1944 (Frost 1945, 1946; Bagenal 1970). Their wartime experiments utilised a home-made tank they called ‘the River Styx’ to investigate the young elvers’ relationship to different light sources and intensities. Winifred Frost was often the only permanent member of scientific staff left at the FBA when male scientists were away serving in the armed forces. She went on to collaborate with Charlotte Kipling and Margaret Brown on Salmonidae (Frost and Brown 1967) and her experimental work on eels, including on otoliths, produced a thorough understanding of the autecology of the species (Frost 1945, 1946, Lowe 1952). Rosemary Lowe went on to research tilapiids in tropical freshwater
systems. Her work is acknowledged to have “revolutionized global studies on freshwater ecosystems and fish production” (Reid 2016, 443).

Penelope Jenkin, graduated from Cambridge University in freshwater biology in 1925 – although she would have received a certificate rather than a degree as Cambridge did not award degrees to women until 1948 (Dyhouse 1995). Supported by her supervisor at Cambridge, John Saunders, who also was on the FBA Council (Anonymous 1933), she began research on the zooplankton of Windermere in 1932. This was, in fact, the first research undertaken at the FBA, yet, few details are yet known about her apparently diverse career, her collaborations with other scientists and her contributions to life and work at the FBA (Lund and Monaghan 2000, Jenkin 1942, 1962). We do know that she was among the first women to get a postgraduate degree from Cambridge University after 1948 when it finally awarded degrees to women. She also continued her work on diatoms in the marine environment, going to work at the Marine Biological Association in Plymouth in the late 1930s (Haines 2001).

Marie Rosenberg achieved her doctorate at the University of Vienna in May 1930. In July 1932 she was appointed to a research post at the Institut für Strahlenforschung (Institute of Radiation Research) at the University of Berlin where she conducted her own independent research including into freshwater algae. A year later the Nazis were in power and she, like many other academics of Jewish descent, received a seven-line communication from the university declaring that she was ‘nichtarischen’ (non-Aryan) and therefore her post would ‘aufgeben müssen’ (have to be given up). Marie stayed in Berlin the rest of the summer of 1933. She made contact with the newly established
Academic Assistance Council (AAC) run by Tess Simpson, a pacifist Quaker from Leeds (The Times 1996). The AAC made an award to Marie that allowed her to come to London in October 1933. The AAC also functioned as an academic labour exchange of sorts and, through that connection, Marie was invited by Professor Dame Helen Gwynne-Vaughan to work in the Botany Department at Birkbeck College, University of London. As luck would have it, Helen Gwynne-Vaughan was a life member of the FBA. This connection facilitated Marie to first conduct research on freshwater algae, then to receive a studentship (which she held between 1935 and 1937, working alongside Penelope Jenkin) (Freshwater Biological Association 1936). In January 1938, she became the first female to obtain a permanent paid Assistant Naturalist position, focusing on Algology. After the outbreak of war, however, in June 1940, north Lancashire was declared a ‘protected area’ and, consequently, and certainly paradoxically, Marie was interned as an enemy alien. Campaigning by FBA colleagues and applications by the Royal Society and the successor organisation to the AAC, the Society for the Protection of Science and Learning, led to her release in January 1941. The freshwater science network supported Marie throughout her ordeal. The occasion of her liberty was commemorated in doggerel verse by her FBA colleague, Thomas Macan:

‘Twas not for crime that Rosie was doing time;
I know it sounds tyrannic
But celebrated British phlegm
In times of stress deserted them,
They got into a panic
And gathered in the high and low
And locked them up both friend and foe,
Selection uninvituous,
And as they shut the prison doors
They shouted ‘Freedom is our Cause’,  
Oh, Albion Perfidious!  
(Macan 1941, 23)

Although relatively little is yet known of Rosenberg’s career after 1941, it seems that she  
was unable to continue work on the ecology of phytoplankton. She did not depart the  
freshwater science network, however, and moved to the Botany School in Cambridge  
laboratory in early 1942, publishing at least once more paper on freshwater algae before  
– we think – retiring from freshwater research (Rosenberg 1942).

Another friend of Marie Rosenberg’s was the Cambridge marine biologist, Anna Bidder  
whose father, George Bidder, was a FBA life member and also a marine biologist.  
Bidder’s mother was Marion Greenwood, supervisor of the aforementioned Balfour  
Biological Laboratory at Cambridge University. It seems likely that Anna Bidder and her  
father provided assistance to Marie Rosenberg when she arrived in Cambridge from  
Windermere. Anna Bidder also had another connection to FBA women scientists. One of  
her many achievements was the co-founding in 1955 of Lucy Cavendish College at  
Cambridge University, the only college for graduate women students. She became its  
first President, 1965-1970, and her successor as the second President was the FBA  
freshwater scientist, Kate Ricardo.

Winifred Pennington, who first came to the FBA in 1936 has received wider recognition  
than the previously mentioned women scientists. Her early explorations of lake  
sediments in Lake Windermere are reported to have become “the seedbed for the
flowering of British limnology” (Lund 1984, 2), and her later wartime and post-war work on post-glacial vegetation changes was pioneering in the field of paleolimnology (Pennington 1943, 1947). After a period at Cambridge University Pennington returned to the FBA to serve on the FBA Council between 1958-1967. In 1967 she became a permanent member of staff, founding the Quaternary Research Unit there.

Conclusion

We could continue to list more women freshwater scientists from the inter- and post-War period who worked at the FBA, such as Hilda Canter, Vera Collins, Elizabeth Howarth, Brenda Knudson, and Peggy Varley, who, outside of their specific fields are unacknowledged and, importantly, whose roles as scientists and as women in a scientific culture are generally unexplored. We do not know, for example, whether FBA women scientists were subject to various phenomena described by the sociology of science. For example, the ‘Matthew effect’ (Merton 1968), defines the way social and cultural process in science confer cumulative advantages. For male scientists these have historically conferred opportunity, recognition and enhancement, thereby disadvantaging women. Another issue to explore is whether women freshwater scientists were subject to the comparable ‘Matilda effect’ – in which male scientists take credit for women scientist collaborators’ work - impacting upon their achievement (Rossiter 1993). Lastly, and perhaps the ultimate definition of historical invisibility, is the converse of the ‘scientific pipeline’, the ‘leaky pipeline’, a metaphor that describes women who drop-out, or are pushed out of scientific careers (Etzkowitz et al.2000).
These scientific lives are increasingly gaining attention, yet the history of science still tends to isolate women scientists, rather than think of women working in scientific cultures. The aquatic sciences have, it seems, a rich history. It is about time to open these up, to simultaneously consider science and women in the twentieth century, and more recently, and to define their wider significance.

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