Examining Gender Authorship *in Aquaculture Journals*

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WHY LOOK AT AUTHORSHIP ORDER?

...because authorship in peer-reviewed journals is an important factor in assessing professionals in research and science for promotions, future funding, and tenure-tracked positions. Assigning authorship position can be unclear and hold inherent bias; thus it is important to evaluate the process for assigning authorship position.

Challenges:

- Difficult to objectively determine exactly how much work any contributor has put into a paper (Laurance 2006; Tscharntke et al. 2007)
- The number of authors listed per paper has grown over the last few decades (Wren et al. 2007). This could be from increased engagement in collaborative and cross-disciplinary research, and more pressure to publish

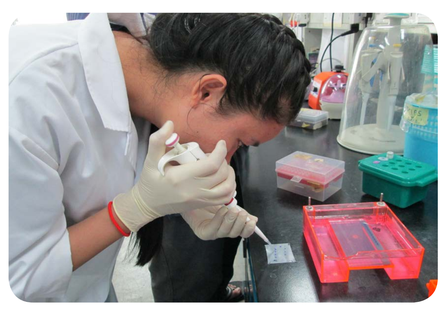
Authorship order has intent, can be politically motivated, and is culturally embedded within a system and the surrounding environment.

While gender disparities are decreasing in some areas of academia, studies have shown that gender inequities in scholarly literature still persist (West et al. 2013; Breuning and Sanders 2007; Jagsi et al. 2006; Dubey et al. 2016; Arismendi and Penaluna 2016). West et al. (2013) found that men dominate in the first and last authorship positions and that women are underrepresented as single authors in more than eight million papers across disciplines in natural sciences, social sciences, and humanities. Other studies have assessed women authorship in disciplines including political science and medicine, and found that not only does a gender gap in published literature still remain, women authorship has been levelling off in recent years (Breuning and Sander 2007, Jagsi et al. 2006, and Dubey et al. 2016). While women's representation in science, engineering, technology, and academia has improved in general, studies reveal that women are not remaining in science at the same rate as men – a phenomena called the leaky pipeline (Blickenstaff 2005). This trend could also affect authorship in peer-reviewed literature.

Learning how authorship gender has changed in the aquaculture field over the last few decades is critical for promoting gender equity.

RESEARCH QUESTION:

Are women publishing in the field of aquaculture proportionately to their involvement in the field?



OUR APPROACH:

- In the entire JSTOR Corpus (**>8** million papers), women hold only **21.9%** of total authorship for papers published between 1665-2011 (West et al. 2013). For fisheries-related fields such as Icthyology and Aquatic Ecology, women represent **21.0%** and **9.0%** of total authors, respectively. This research, however, did not explicitly calculate authorship gender for the interdisciplinary field of aquaculture or correct for unknowns.
- We applied the West et al. (2013) methodology to the field of aquaculture to understand how gender has changed in aquaculture over time. We generated a subsample of the JSTOR corpus for aquaculture, and corrected for unknown gender designations:
  - **23,000** articles (**43,146** authorships) in **8** aquaculture-related journals[1] from the JSTOR Corpus (published since **1913**) were assessed for authorship gender.
- A curated international aquaculture database of **543** articles (**1706** authors) in **121** journals, all published between **1983-2016,** was analyzed for comparison to the JSTOR corpus and subsample.
  - The databse draws from peer-reviewed papers whose research was supported by four separate international aquaculture programs at Oregon State University developed by Hillary Egna:
    1. Pond Dynamics/Aquaculture CRSP (1982-1996)
    2. Aquaculture CRSP (1996-2008)
    3. AquaFish CRSP (2006-2013)
    4. AquaFish Innovation Lab (2013-Present)

PRELIMINARY FINDINGS AND NEXT STEPS :

%WOMEN AUTHORS
In Three Databases of Peer-Reviewed Literature

Authorship Position of women	International Curated Aquaculture Database	JSTOR – Aquaculture subsample	JSTOR Corpus
Any position	15.7% (5.3% genders unknown)	13.8% (23.7% genders unknown)	16.1% (26.7% genders unknown)
Single Author	>1990: 11.1%[2]	11.0% (All years)	All years: 17.0% <1990: 12.0%[2] >1990: 26.0%[2]
First Author	14.2%	15.8%	19.2%
Last Author	14.0%	16.5%	19.6%

WOMEN AUTHORSHIP BY POSITION OVER TIME:
International Aquaculture Curated Database

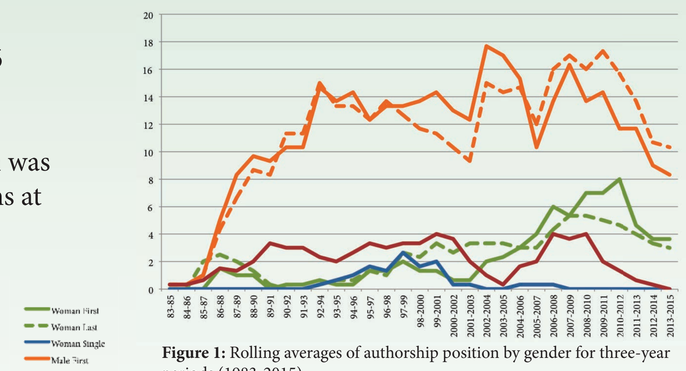


Figure 1: Rolling averages of authorship position by gender for three-year periods (1983-2015).

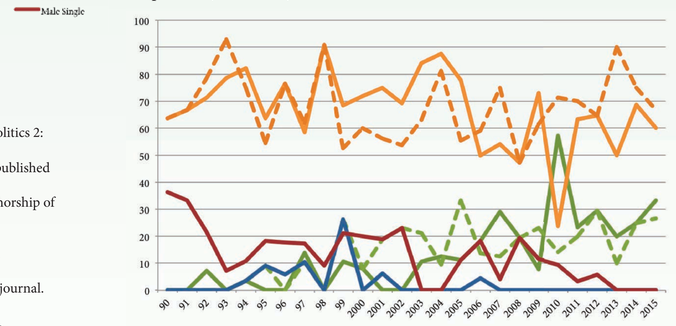


Figure 2: Authorship position as a percent of total papers per year (1990-2015) by gender.

- *Any position*: Women represent **16.1%** of authorshship in all positions in the recalibrated JSTOR Corpus, after correcting for unknowns. The percentage of women authors was consistent for the JSTOR aquaculture subsample (**13.8%**) and the journals in the International Curated Aquaculture Databse (**15.7%**). Women authorship in aquaculture closely reflects the recalibrated JSTOR Corpus covering many fields.
- *Single-authorship:* The JSTOR Corpus shows an overall decline in single-authored papers. However, there has been an increase in sole authorship by women. In the JSTOR-Aquaculture subsample, women represent **11.0%** of single-authored papers since 1913. The result for single authorship by women in the International Curated Aquaculture Database is **11.1%** since 1990[2].
- *First and last position:* Percentages of first and last authorship positions were comparable for the publications in the International Curated Aquaculture Database and JSTOR-Aquaculture: **14.4%** and **15.8%**, respectively for first authors and **14.0%** and **16.5%**, respectively for last authors. First and last author results from the overall JSTOR Corpus for all fields were slightly higher than for the field of aquaculture at **19.2%** and **19.6%**, respectively.

Based on this analysis, **women remain underrepresented as authors in any position in aquaculture journals,** and reinforces results found by West et al. (2013).

NEXT STEPS

- Compare the gender of authorship positions over time in the JSTOR Corpus and JSTOR-Aquaculture subsample with those in the International Aquaculture Curated Database (IACD).
- Expand the JSTOR dataset and include more journals, examine sub-areas within the field of aquaculture.
- Contextualize data from the IACD and JSTOR with the population of women graduates with aquaculture degrees over time, and of a curated population of professional and student participants in the IACD.

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1. Ambio, Copeia, Estuaries and Coasts, Journal of Coastal Conservation, Journal of the North American Benthological Society, Limnology and Oceanography, and Water and Environment Research.
2. Half of all of the articles in the JSTOR Corpus (1665-present) were published after 1990.

All photos are courtesy of the AquaFish Innovation Lab.
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