

Multimodal models of animal sex in scientific literature: breaking binaries leads to a better understanding of ecology and evolution

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Introduction

- 'Sex' is used to describe a suite of phenotypic and genotypic traits of an organism related to reproduction
- We conducted a meta-analysis of terms used to describe diversity in sexual phenotypes

Materials & Methods

- We identified 2,222 papers, and filtered to 1,817 papers that were:
 - Exclusive to non-human animals
 - Assigned a taxonomic class
 - Available to Loyola University Chicago in the Web of Science Core Collections.
- We evaluated data for:
 - Taxonomic biases
 - Publication type biases
 - Search term usage change over time
- Gender & sex conflation is when the two frameworks were equated as the same & therefore interchangeable
- Used a chi-square test to test for significant taxonomic bias
- Produced lines of best fit for each search & its change over time

Article Type Bias

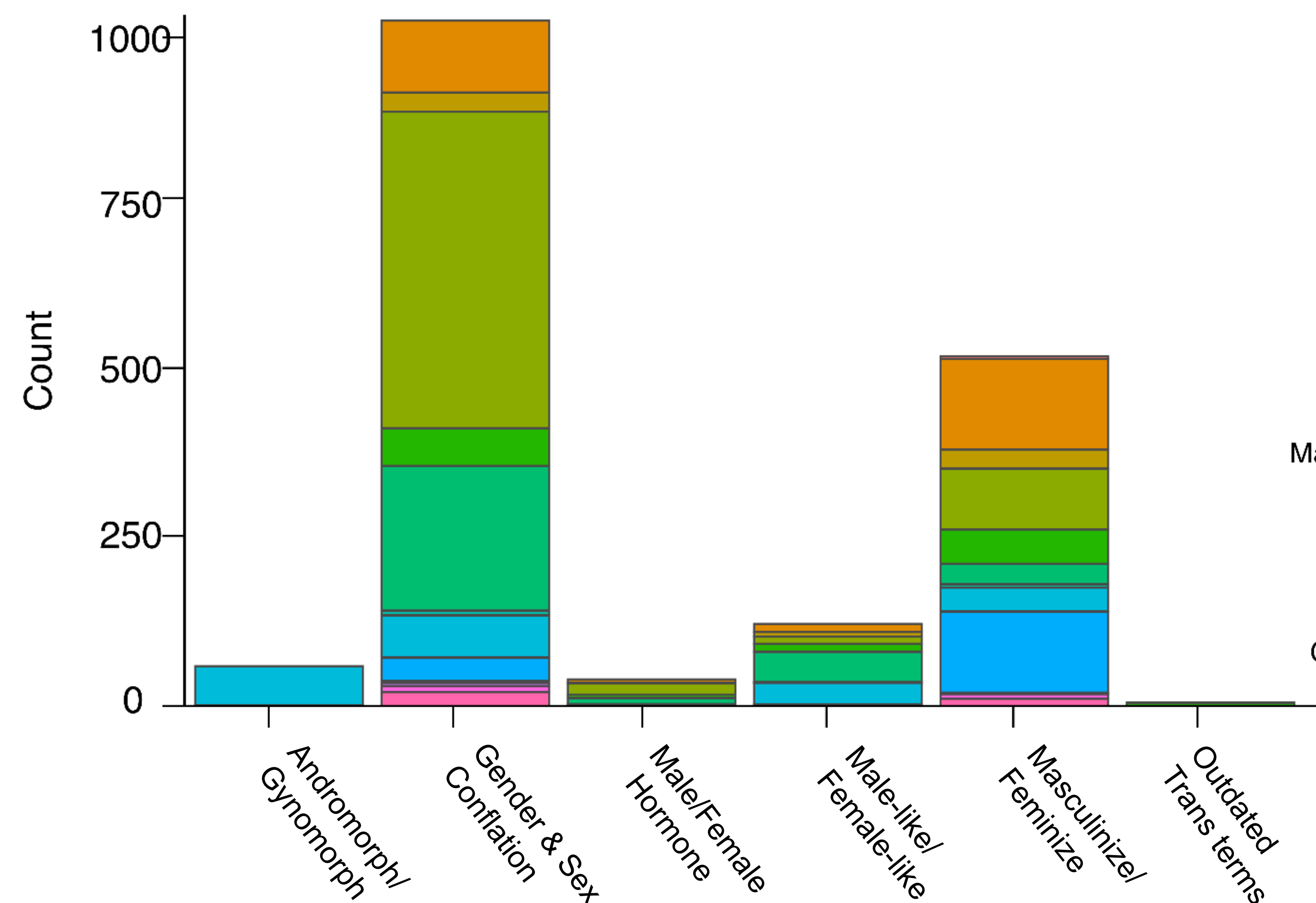
Article Type	Andromorph/Gynomorph	Gender/Sex Conflation	Male/Female Hormone	Male-like/Female-like	Masculinize/Feminize	Outdated Trans Terms	Total
Experiment	9	228	20	102	159	2	520
Inventory	0	2	0	0	0	0	2
NHN	0	8	0	1	39	1	49
Nomenclature	0	10	0	0	88	0	98
Observational Study	48	743	18	17	189	1	1,016
Review	0	32	1	0	13	1	47
Survey	1	12	1	3	0	0	17
Theory	2	6	0	1	1	0	10
Total	60	1,041	40	124	489	5	1,759

- Majority of studies were observational and experimental
- Nomenclature articles were most commonly associated with the terms masculinize/feminize

Scan for the Article Pre-Print & Supplementary Materials

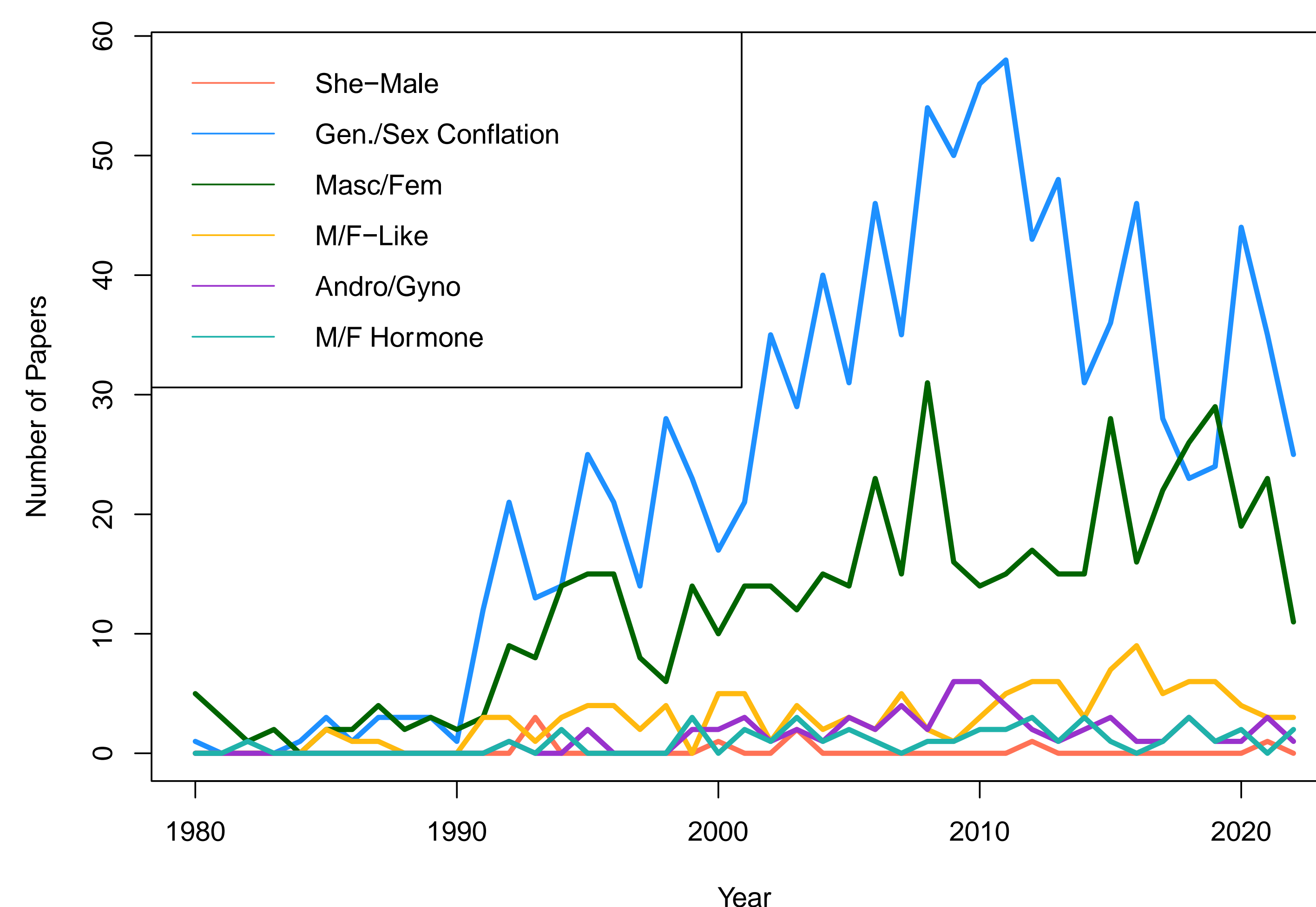


Search Terms by Taxonomic Class



- Using a chi square test, we found a significant relationship between taxonomic class and all search terms ($p < 0.05$) except for gender/sex and masculinize/feminize.
- 80% of mammalian counts were from our search for the conflation of gender and sex
- Actinopterygii and Malacostraca appeared in the masculinized/feminized search more than other taxa
- Andromorph/gynomorph were specific to Insecta
- Outdated trans terms were specific to Reptilia

Term Usage



- Gender & sex conflation has increased in the past three decades, with the most counts in 2011
- 'Masculinize' and 'feminize' has steadily increased, while 'andromorph', 'gynomorph', and 'she-male' have decreased

Conclusions

- Conflation of sex and gender in scientific literature increased in the past 3 decades.
- Binary categorizations of sexual phenotypes are almost all on an upward trend, which demonstrates that while more inclusive cultural ideas of gender and sex have evolved, our descriptions in scientific literature have not.
- Taxa representation varied by search term, implying different descriptions of sexual phenotype across taxonomy.
- Mammalian literature is the most prevalent, demonstrating a mammalian bias in zoological research and sexual phenotype description.
- Article type bias may demonstrate the utilization of less inclusive language in experimental and observational studies, or that sexual phenotypic terms are more prevalent because these type of studies are more common.
- Binary sexual phenotype descriptions in scientific work may reflect cultural biases, which inherently limit our ability to collect scientific data.

Acknowledgments

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