Evolving Interdisciplinary and International Social Networks – Insights from Canada's Department of Fisheries and Oceans in the Pacific Region (1990-2024)

Session 15 (S15) – 2025 PICES Annual Meeting

Yokohama, Japan – November 13, 2025

Raphael Roman & Karen Hunter

Context – WG-51 Project

This case study analysis is part of **Working Group 51**: *"Exploring Human Networks to Power Sustainability"*

- ❑ Increase our understanding of **characteristics and gaps in ocean science** between the northeast and northwest Pacific Ocean,
- ❑ Develop a **methodology** to evaluate how the **human networks** can power 'transformative ocean science'

Context – WG-51 Project

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- ❑ Increase our understanding of **characteristics and gaps in ocean science** between the northeast and northwest Pacific Ocean,
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Fisheries and Oceans Canada

As our focus is on **national marine science organizations** in each PICES member country, this case study will concentrate on **Fisheries and Oceans Canada (DFO).**

DFO is the primary federal institution responsible for managing Canada's fisheries and ocean resources.

Context – WG-51 Project

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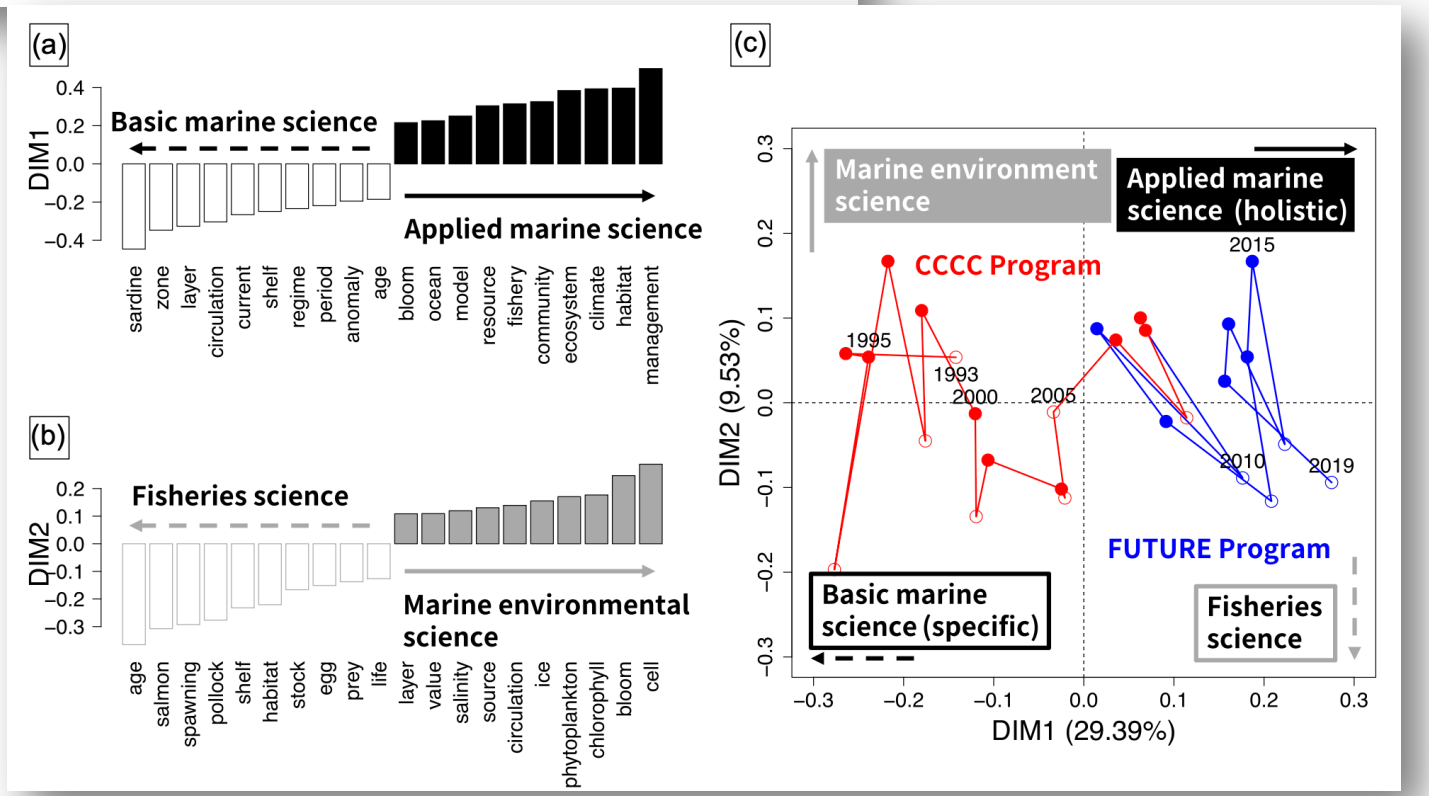
Received: 2 October 2024; **revised:** 9 July 2025; **accepted:** 9 July 2025
Quo Vadimus

ICES CIEM International Council for the Exploration of the Sea / Conseil International pour l'Exploration de la Mer

Lessons learned from the PICES FUTURE Program on development of an interdisciplinary international science program to advance ocean sustainability

Shion Takemura [1,*,†], Hanna Na [2], Jennifer L. Boldt [3], Steven J. Bograd [4], Daisuke Hasegawa [5], Karen L. Hunter [3], Sukyung Kang [6], Oleg N. Katugin [7], Saeseul Kim [8], Vyacheslav B. Lobanov [9], Emanuele Di Lorenzo [10], Mackenzie Mazur [3], Hitomi Oyaizu [1], Fangli Qiao [11], Ryan R. Rykaczewski [12], Erin V. Satterthwaite [13], Seongbong Seo [14], Chengjun Sun [11], Thomas W. Therriault [3], Mitsutaku Makino [15,†]

Quantitative text analysis



Clarivate Web of Science™

Extracting Abstract Data from Web of Science

Search Criteria

- **Location**: British Columbia, Canada
- **Organization**: Fisheries & Oceans Canada (DFO)
- **Years**: 1990-2024

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Number of publications retrieved - ALL SCIENCES **(n= 5,723)**

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Collaborative landscape

- **93** unique countries across all regions
- **1,908** institutional affiliations

State of Pacific Ocean Basin Research

npj | ocean sustainability

www.nature.com/npjoceansustain

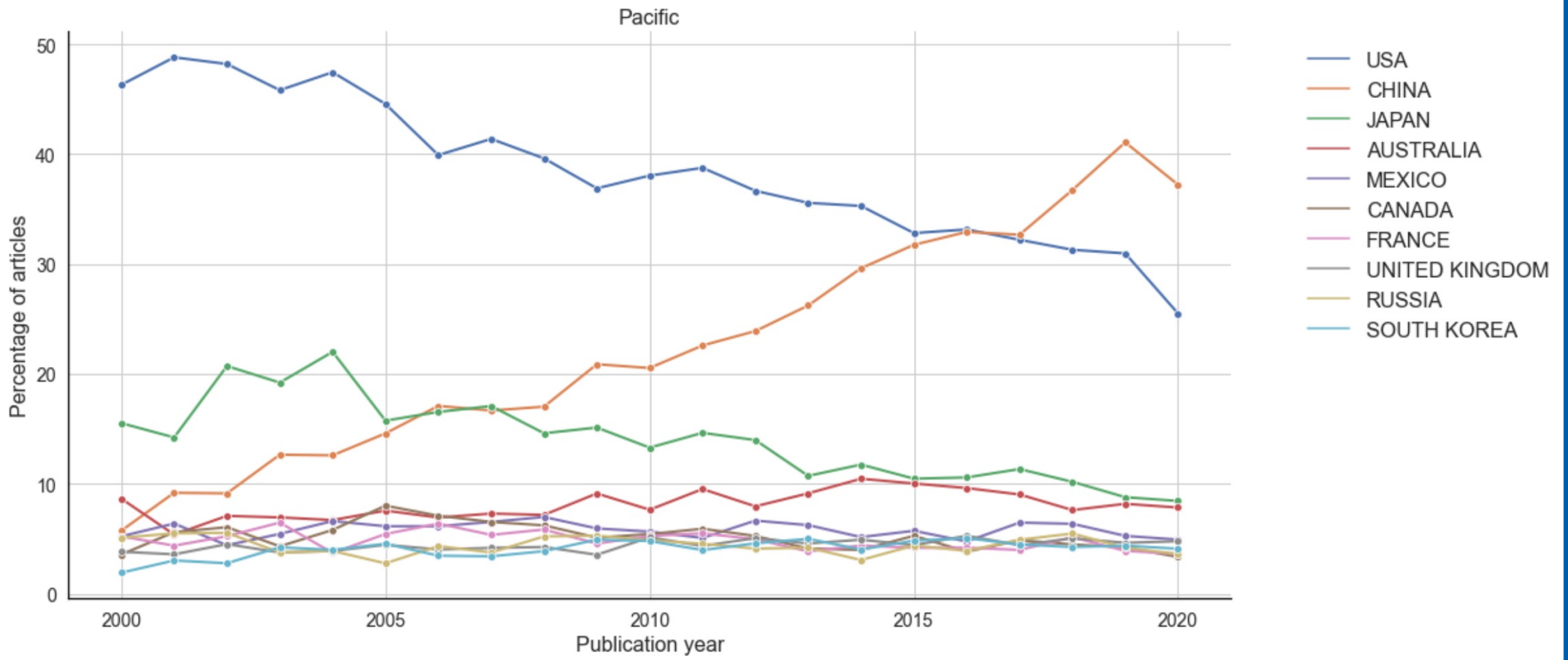
ARTICLE OPEN

Check for updates

Assessing the global ocean science community: understanding international collaboration, concerns and the current state of ocean basin research

Ross W. K. Potter [1] ✉ and Brodie C. Pearson [2]

Publications Trends per country



State of Pacific Ocean Basin Research

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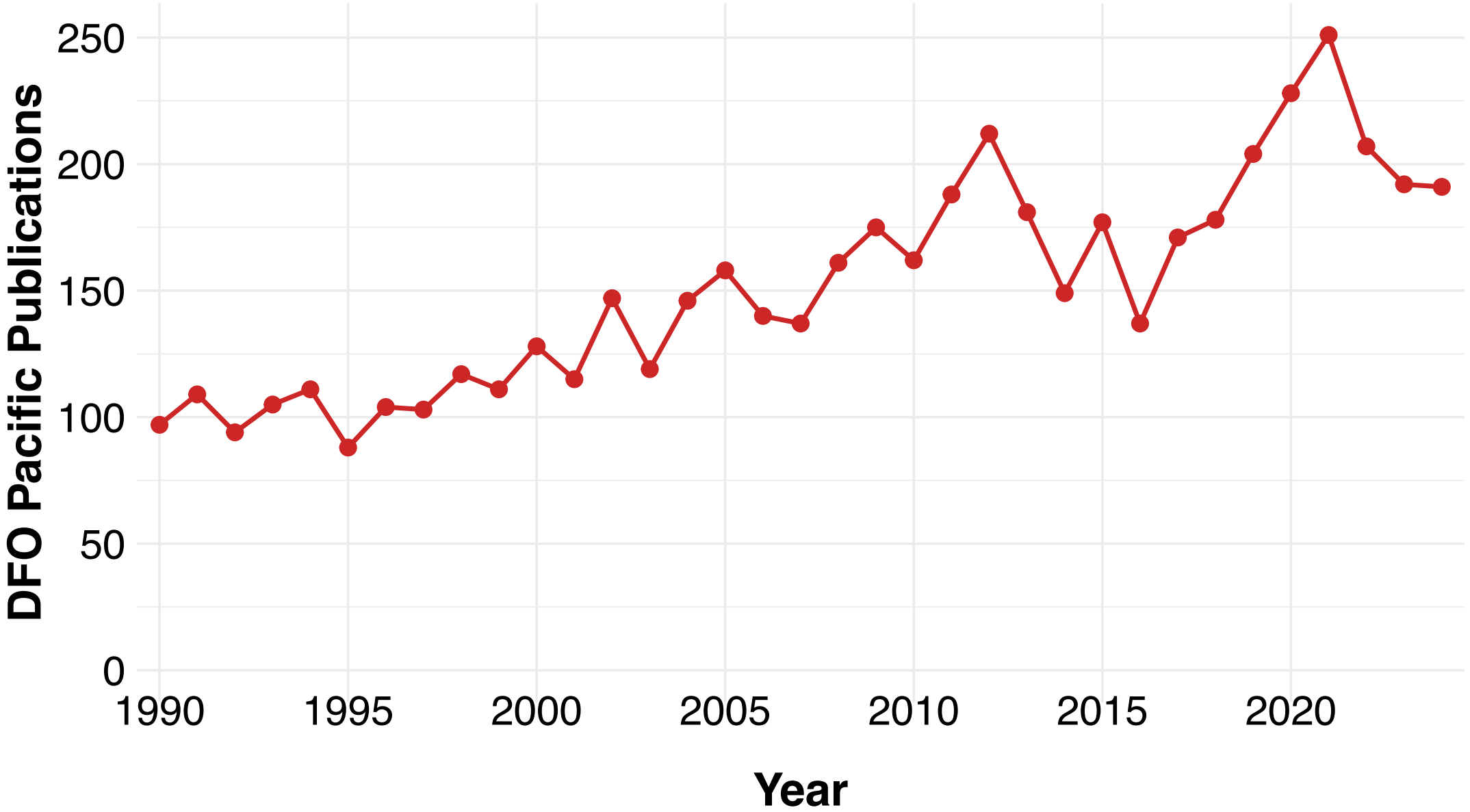
Shares of G20 Research Output by Ocean Basin

Table 1. Percentage share of research output by ocean basin for G20 countries and five comparators.

Country	Arctic	Atlantic	Indian	Pacific	Southern
Argentina	0.08	1.94	0.05	0.22	1.07
Australia	1.37	2.48	6.47	8.37	**16.72**
Brazil	0.15	9.8	0.48	0.69	1.17
Canada	**18.92**	9.13	1.74	4.92	3.97
China	6.33	2.4	8.19	**26.57**	4.32
France	4.01	9.43	9.15	4.64	**10.38**
Germany	**13.85**	8.89	8.02	3.88	**17.84**
India	0.17	0.32	**26.12**	1.09	2.82
Indonesia	0.02	0.04	1.01	0.79	0
Italy	1.49	4.43	1.85	0.89	7.91
Japan	4.24	1.23	7.97	**12.72**	4.44
Mexico	0.08	2.99	0.23	5.77	0.2
Russia	**29.84**	1.89	1.85	4.35	3.49
Saudi Arabia	0.17	0.23	7.38	0.17	0.15
South Africa	0.17	0.81	3.25	0.31	3.39
South Korea	1.95	0.4	1.31	4.26	2.87
Turkey	0.12	0.67	0.21	0.13	0.02
United Kingdom	6.83	**13.98**	7.15	4.54	**22.33**
USA	**28.79**	**32.95**	**20.01**	**35.98**	**36.7**
Egypt	0.08	0.18	5.29	0.05	0
Iran	0.02	0.08	9.01	0.15	0
Malaysia	0.02	0.07	0.63	1.01	0.12
New Zealand	0.14	0.38	0.7	3.13	7.31
Norway	**18.51**	9.89	1.04	0.69	3.52

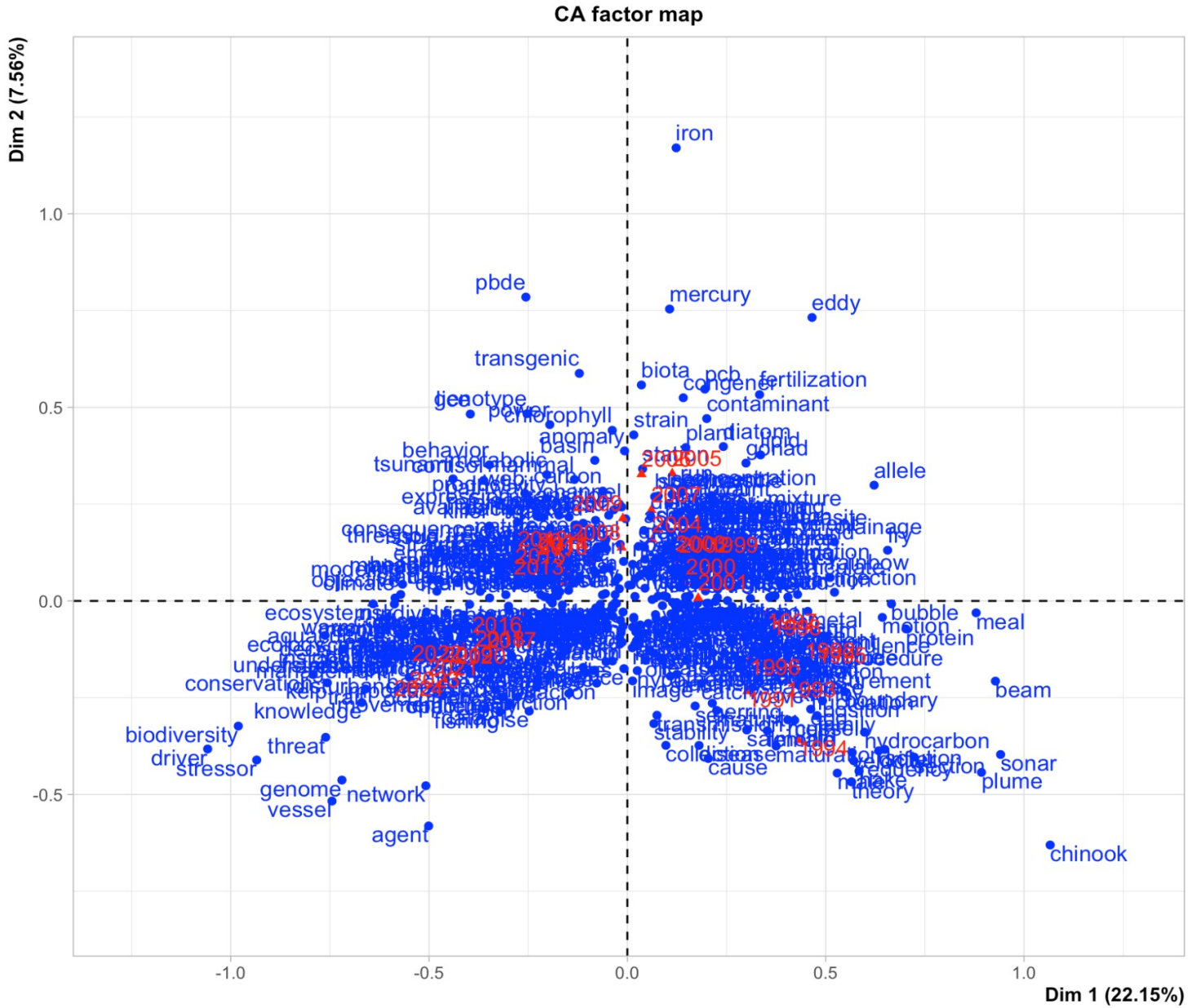
Comparators were chosen based on research output, GERD (gross domestic expenditure on research and development), and location (i.e., coastal). Shares may total more than 100% for any basin as collaborative efforts count towards multiple countries. Countries with at least a 20% share have values underlined and in bold, countries with shares between 10 and 20% are in bold.

DFO Publications Time Series (1990-2024)



Correspondence Analysis Factor Map

Top 500 Words



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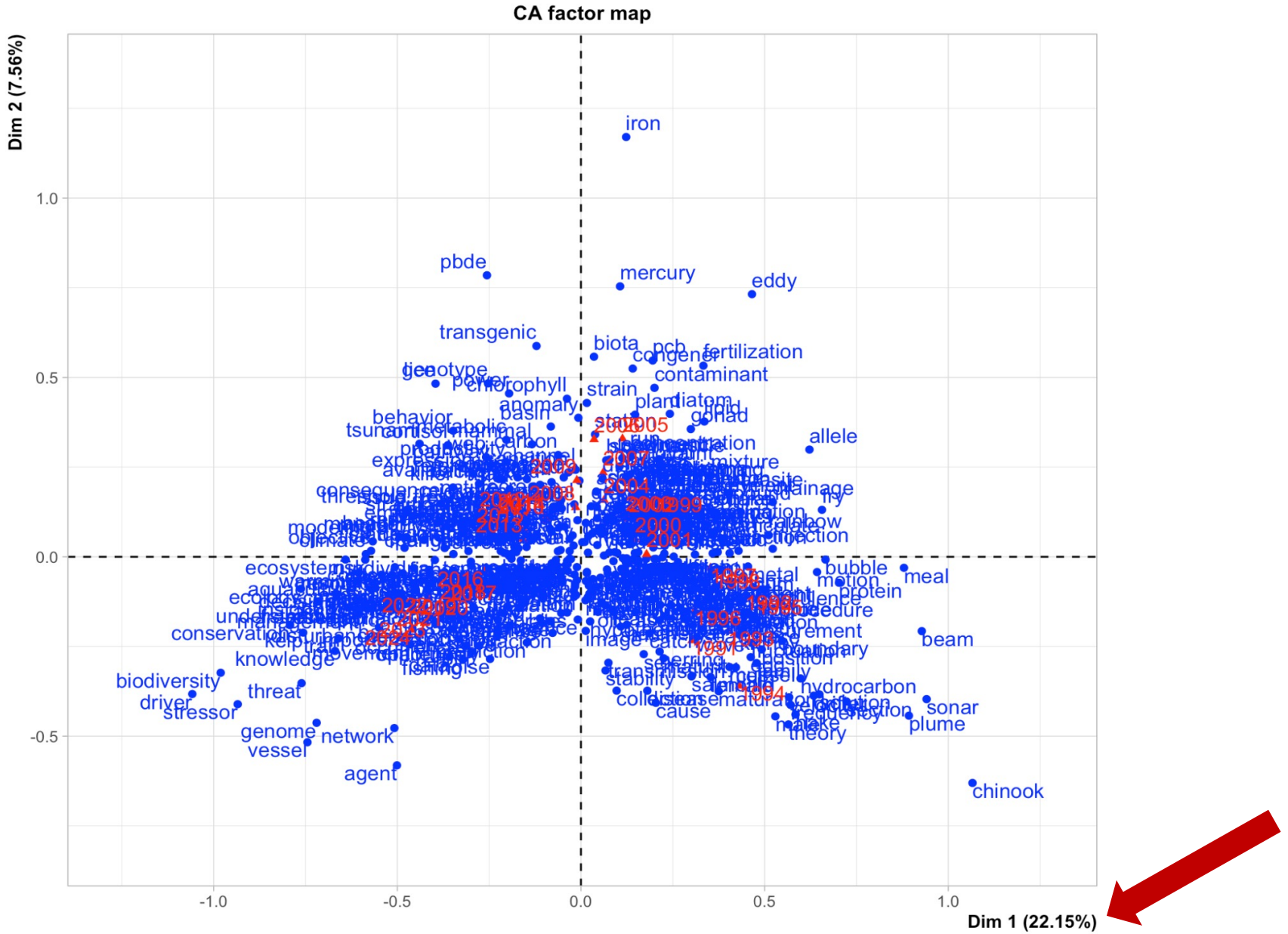
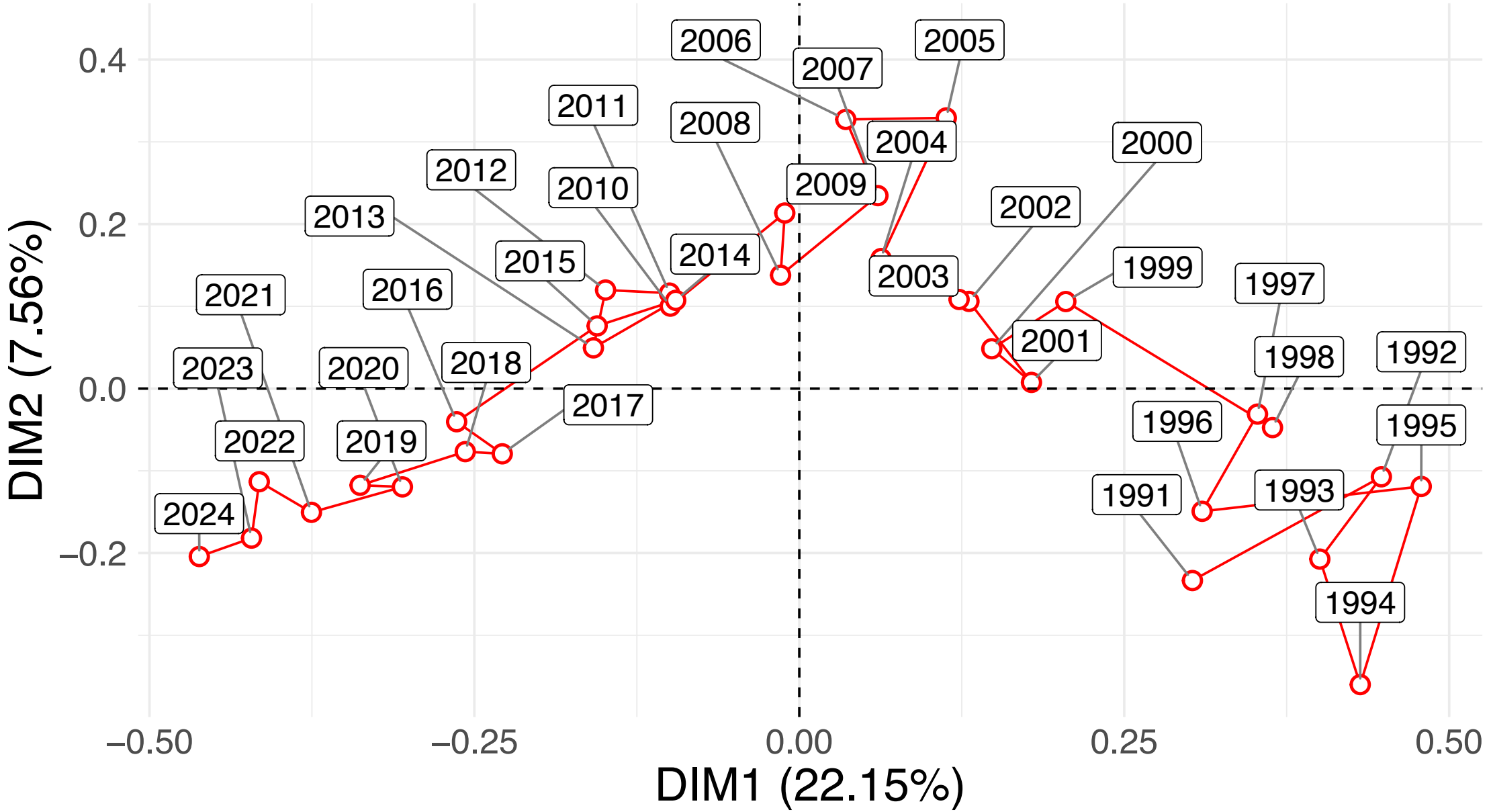
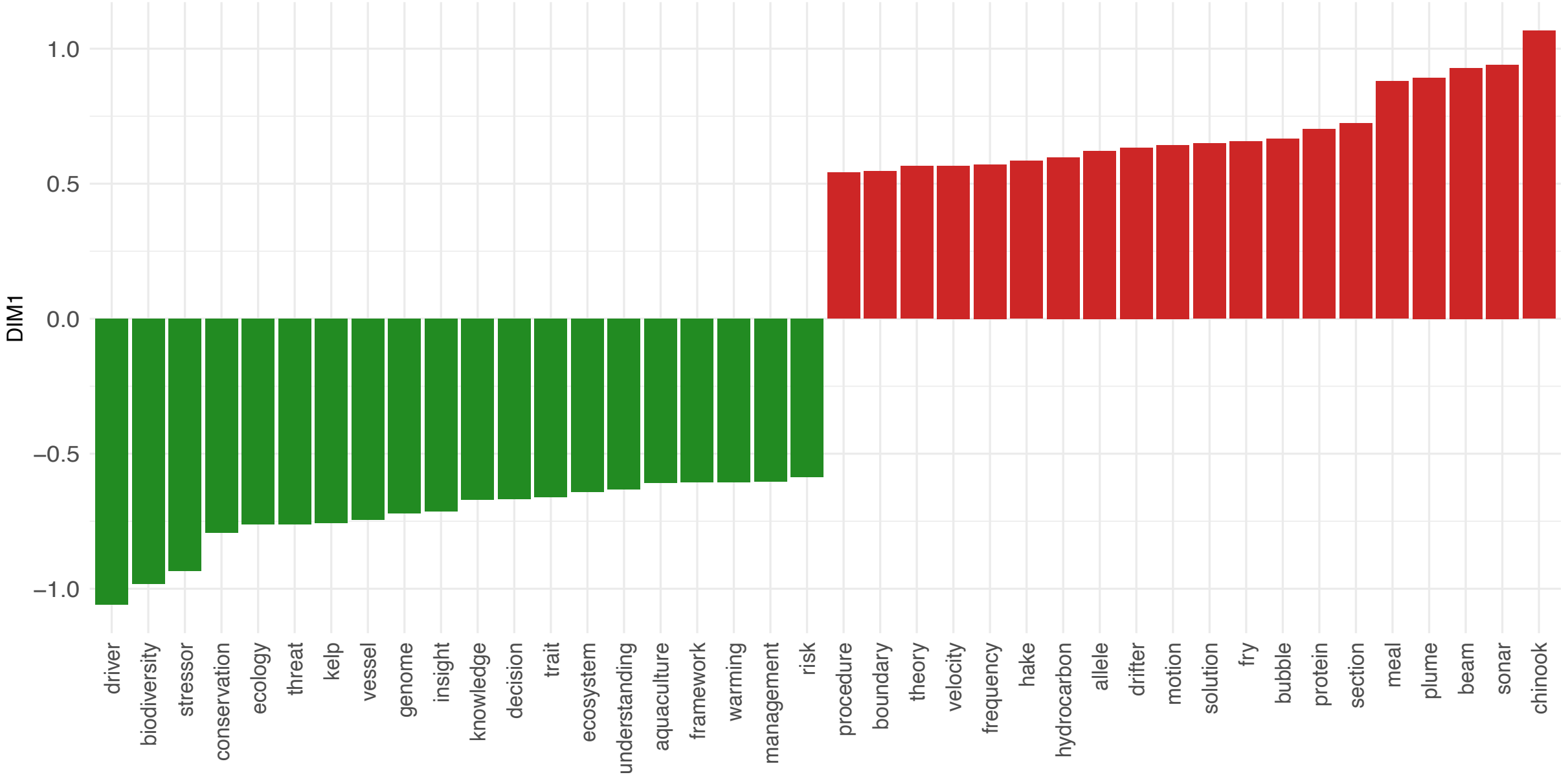


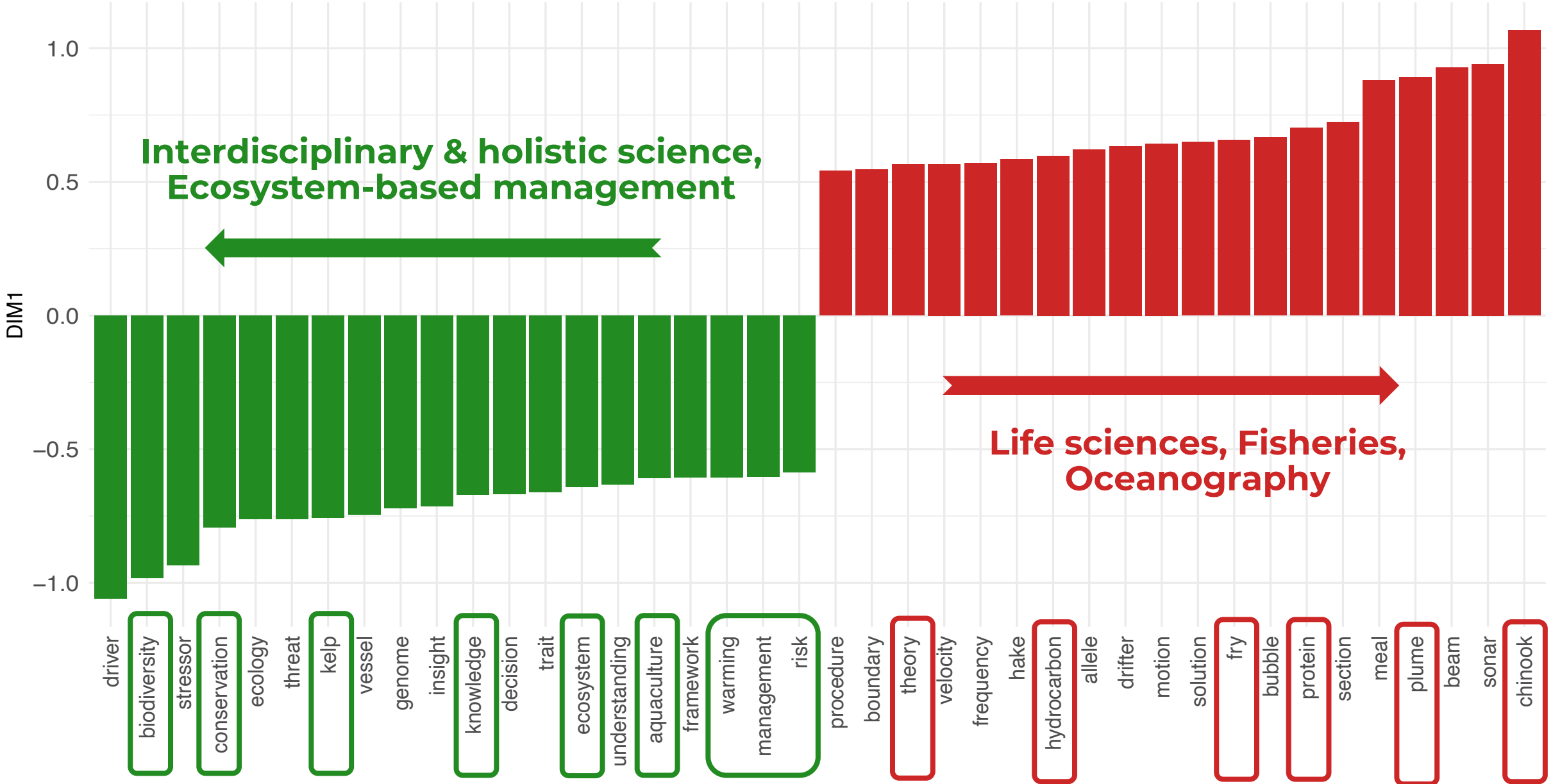
Correspondence Analysis Years (1990-2024)



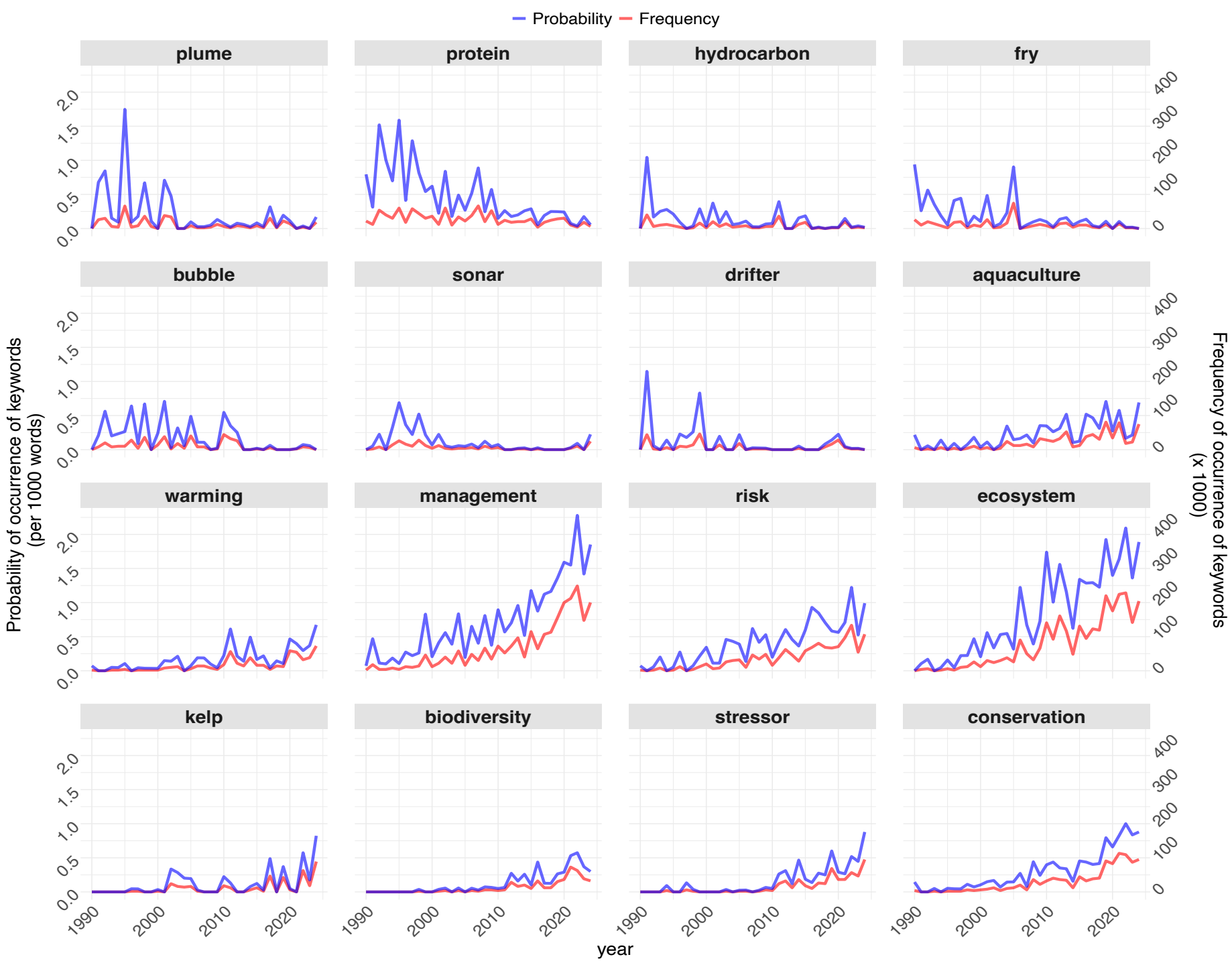
Top 10 Keywords of Dim1



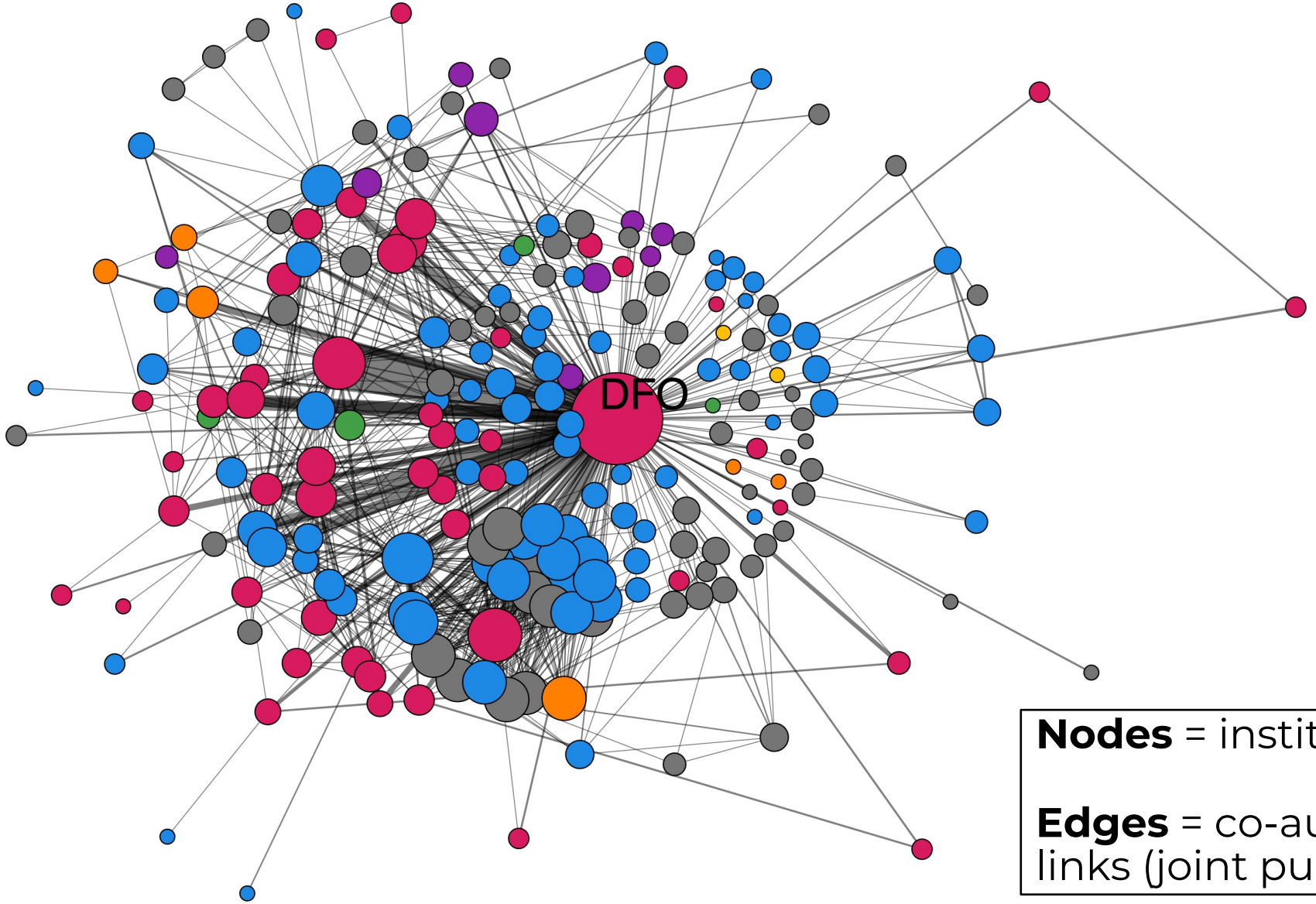
Top 10 Keywords of Dim1



Frequency and Probability of Dim1 keywords occurrence



DFO's Institutional Collaboration Network in the 1990s



degree

50

100

150

200

Country

Canada

China

Japan

Others

Russia

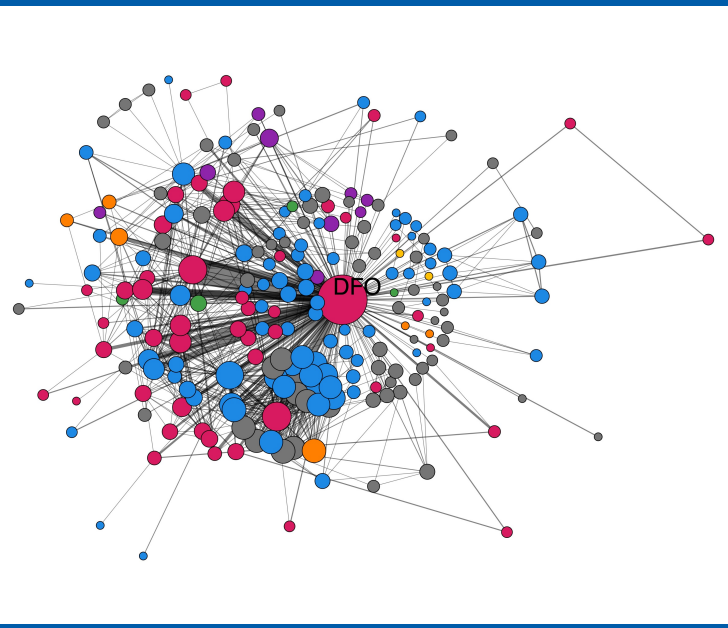
South Korea

USA

Nodes = institutions

Edges = co-authorship links (joint publications)

1990–1999



N = 226

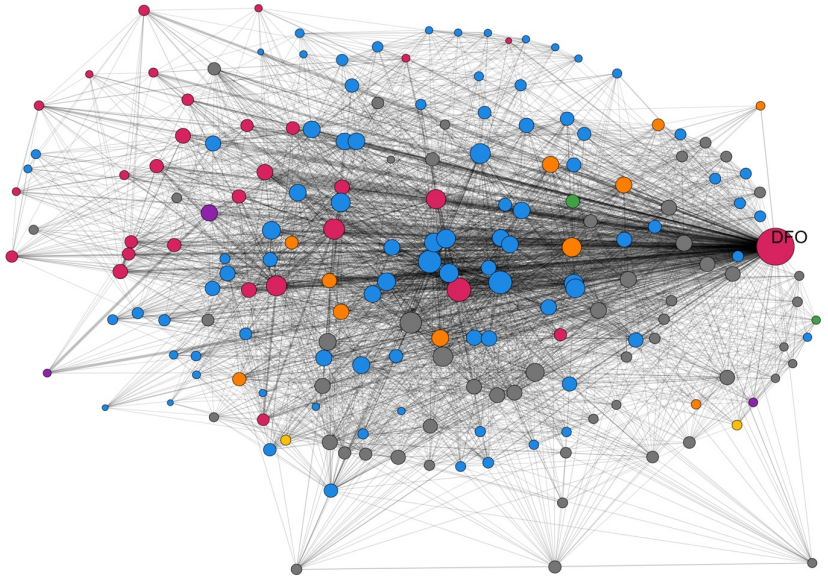
Degree = 203

Strength = 651

HHI = 0.44

PICES = 76.5%

2000–2009



N = 486

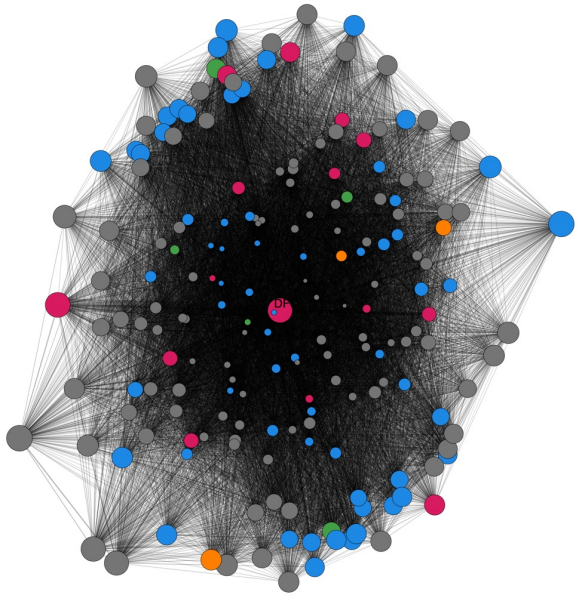
Degree = 479

Strength = 2,804

HHI = 0.39

PICES = 80.5%

2010–2019



N=1,346

Degree = 939

Strength = 6,477

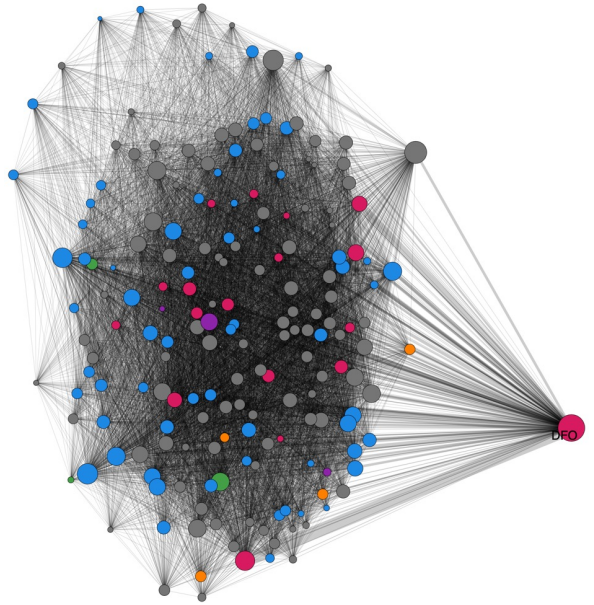
HHI = 0.25

PICES = 73%

Country

- Canada
- China
- Japan
- Others
- Russia
- South Korea
- USA

2020–2024



N = 1,217

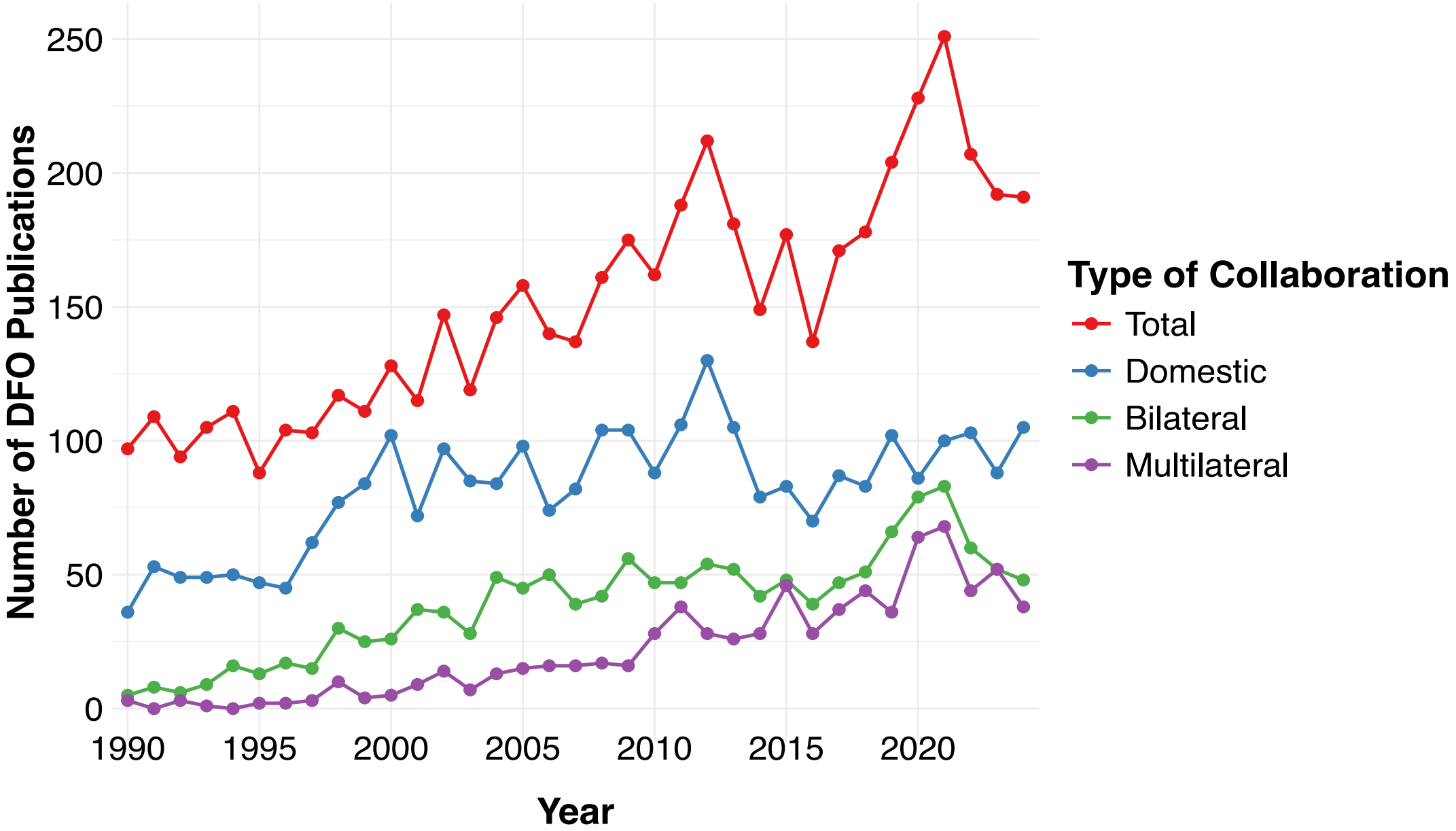
Degree = 1,216

Strength = 6,117

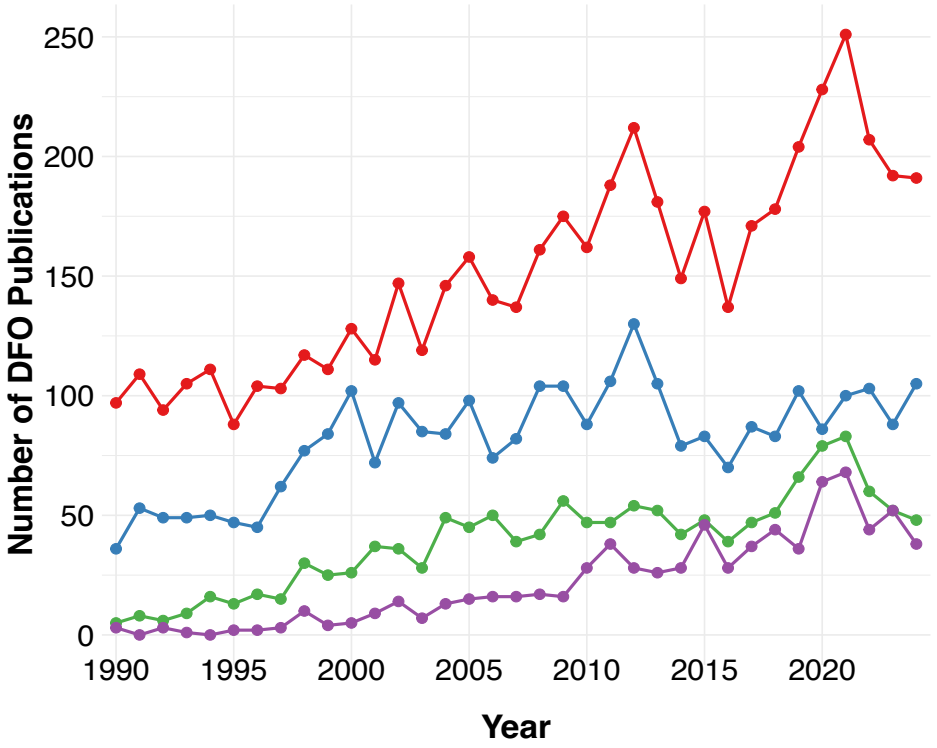
HHI = 0.20

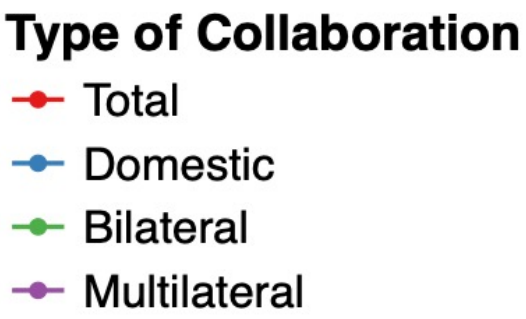
PICES = 78%

Types of Collaboration (1990-2024)

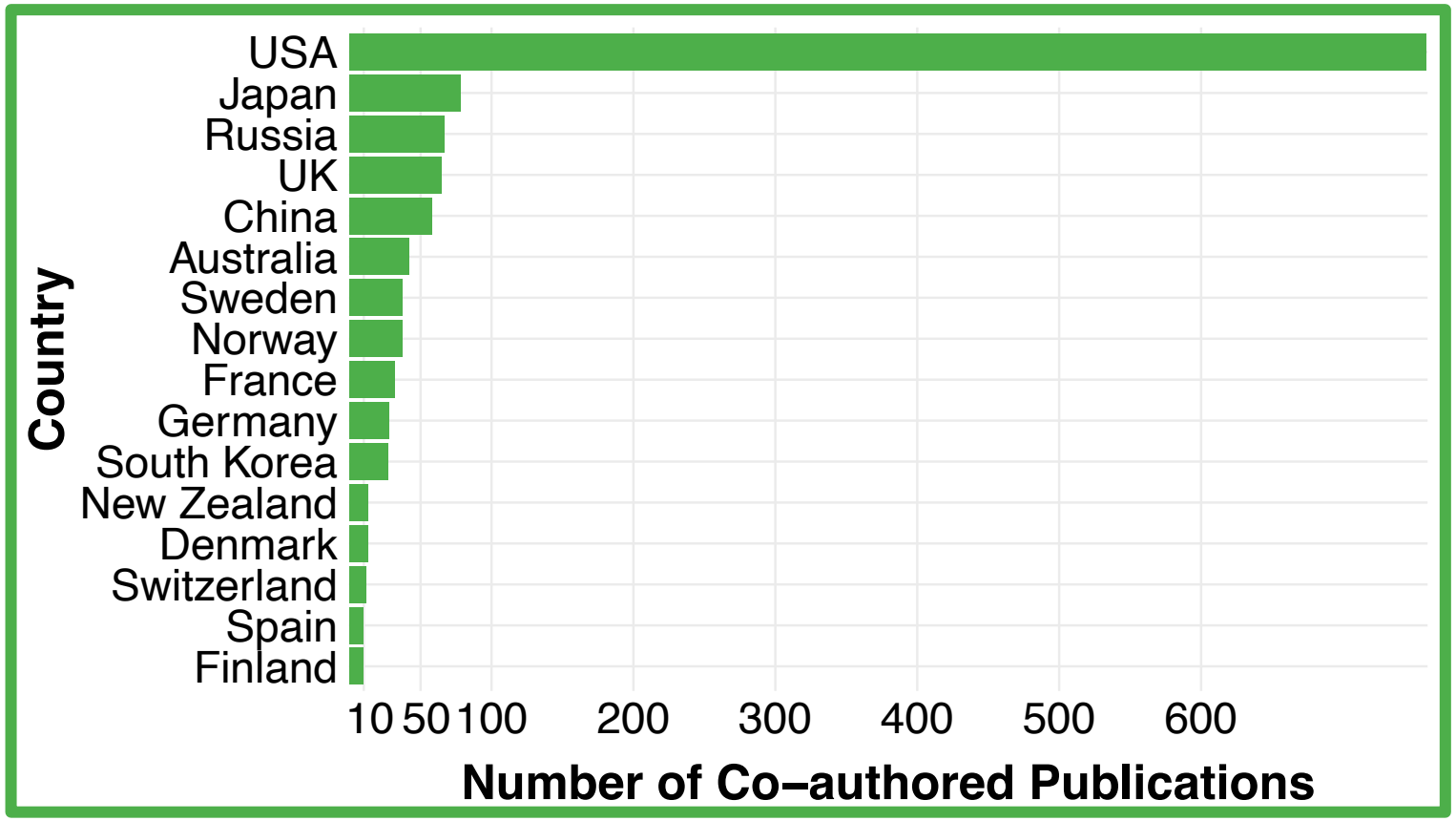


Bilateral Collaborations (1990-2024)





Top 10 Countries in Bilateral Collaborations



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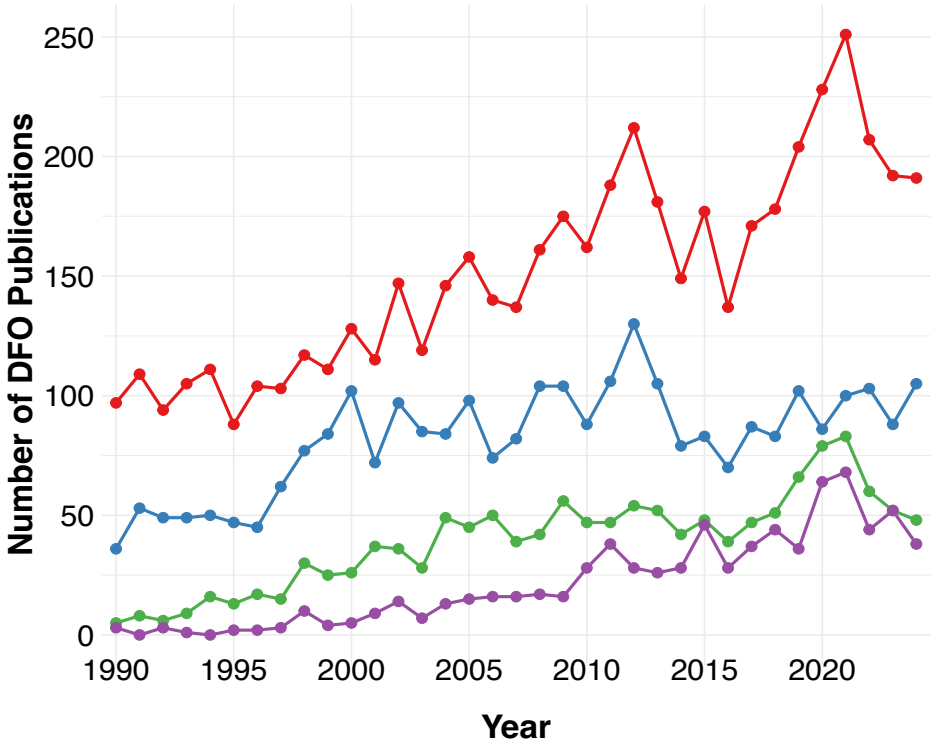

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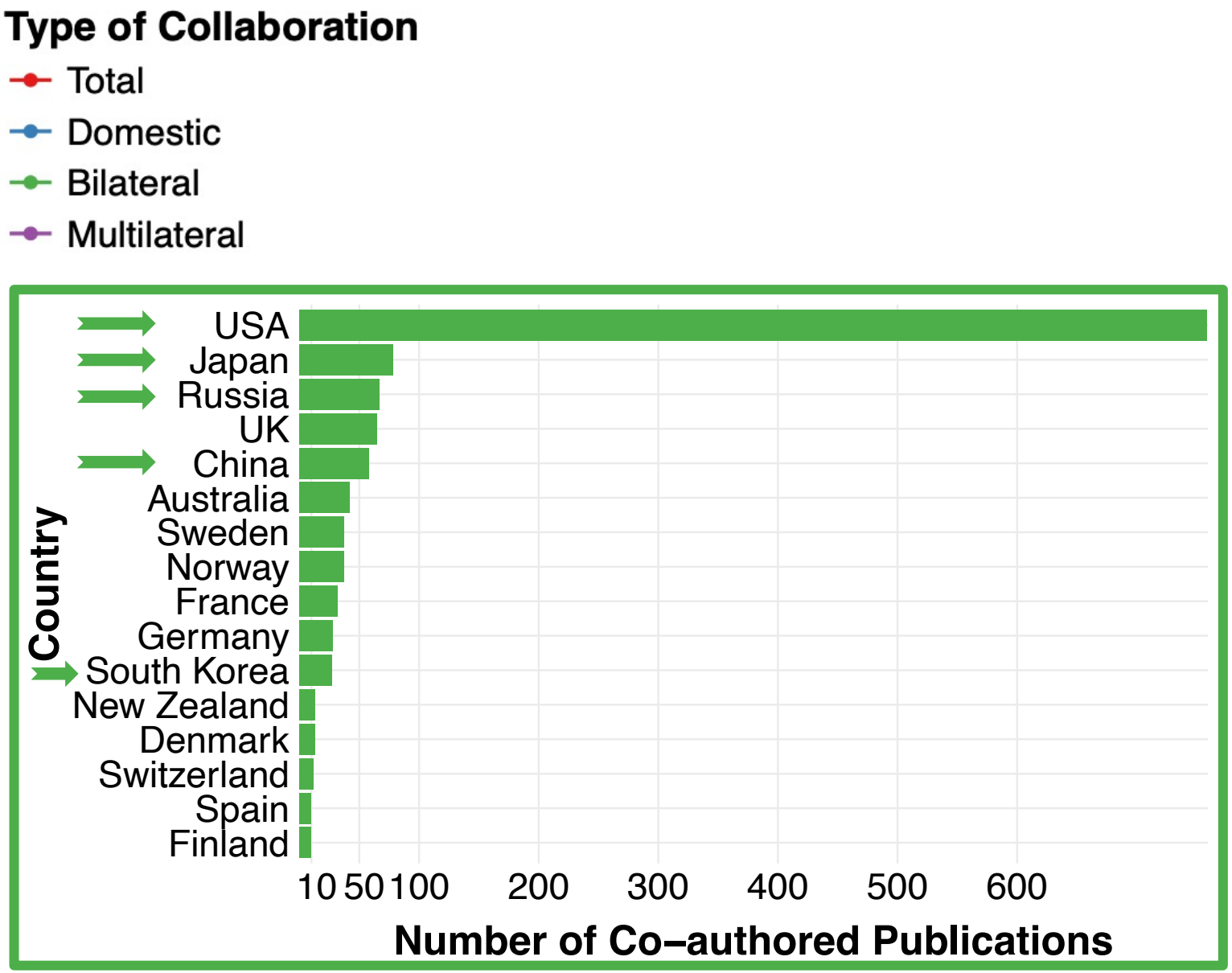
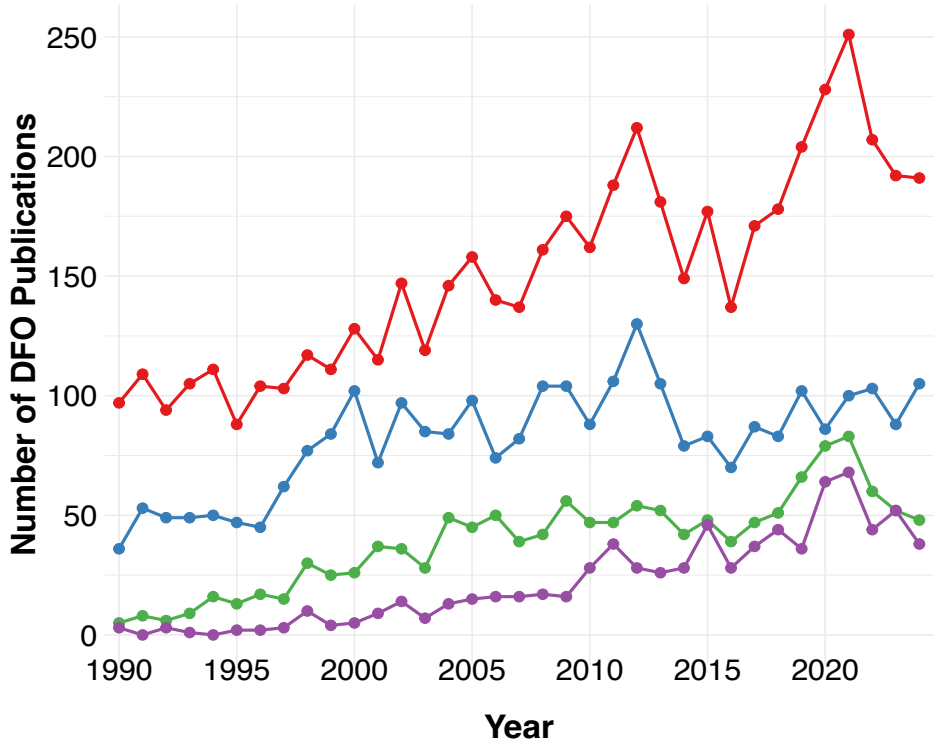
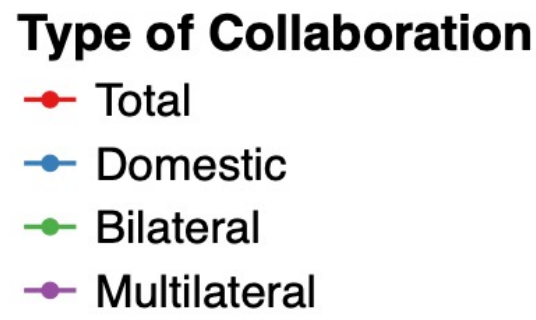
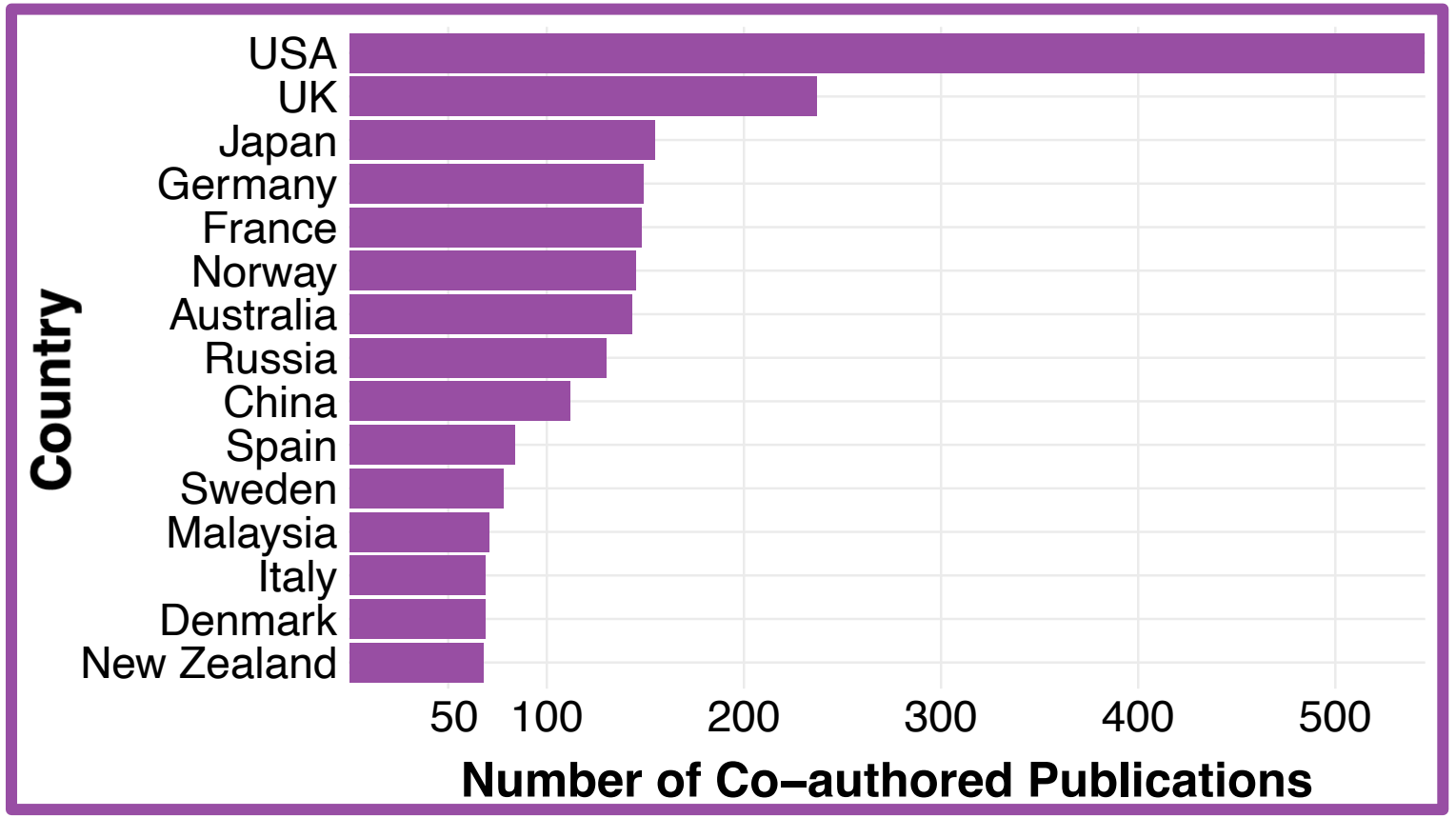


Multilateral Collaborations (1990-2024)

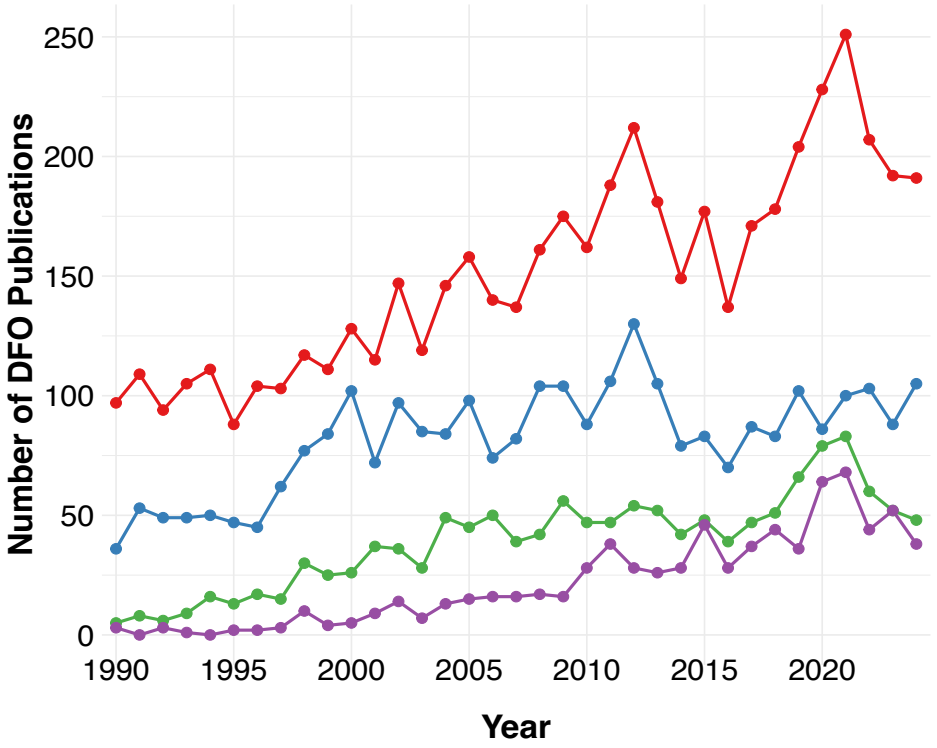


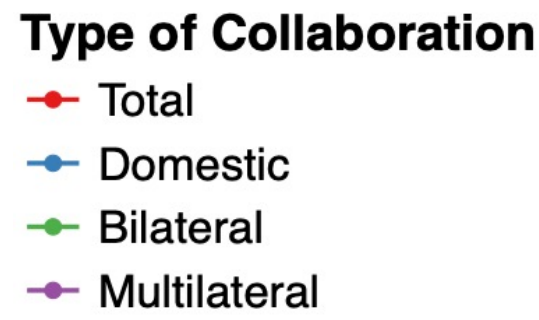


Top 10 Countries in Multilateral Collaborations



Multilateral Collaborations (1990-2024)





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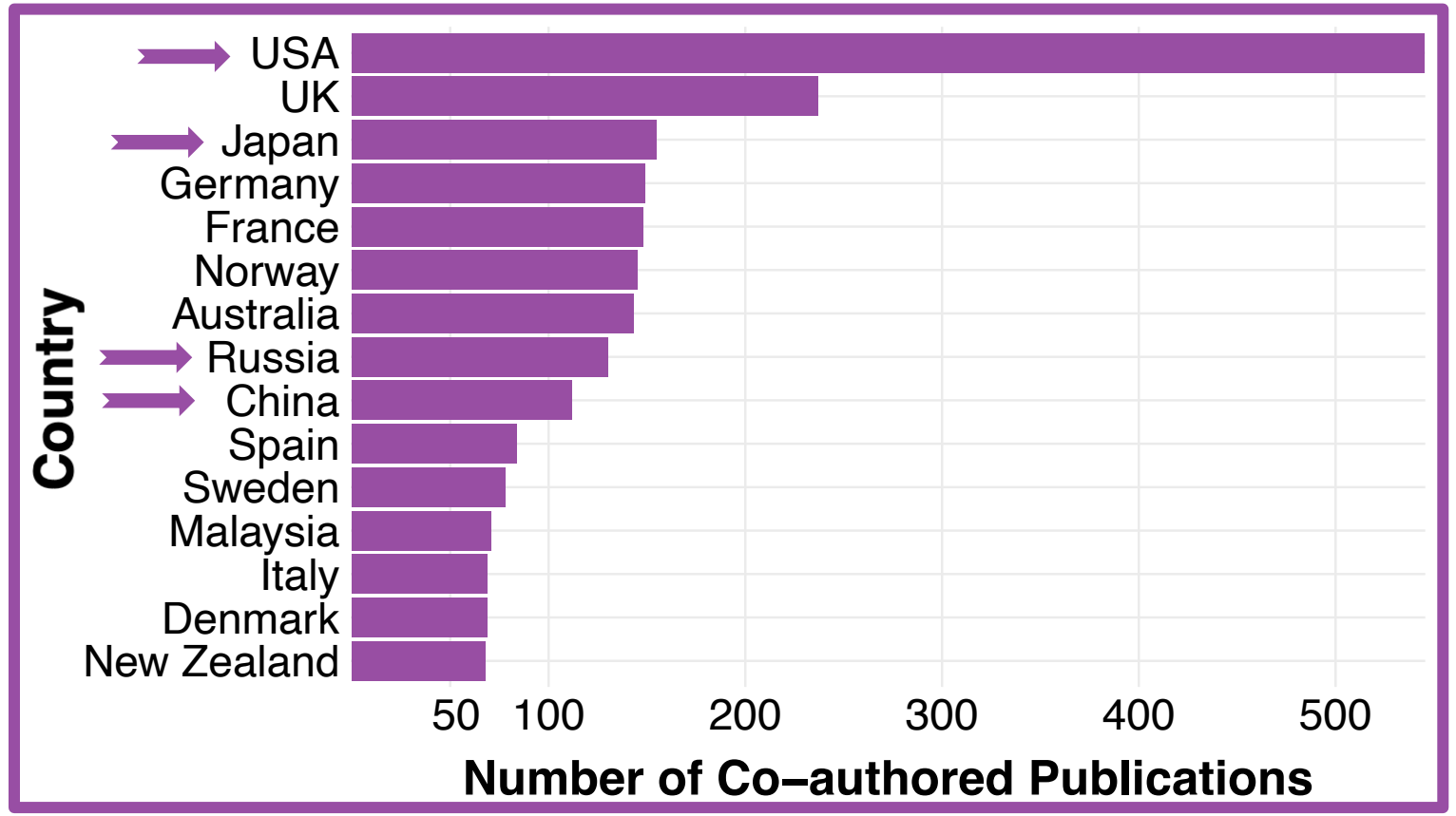
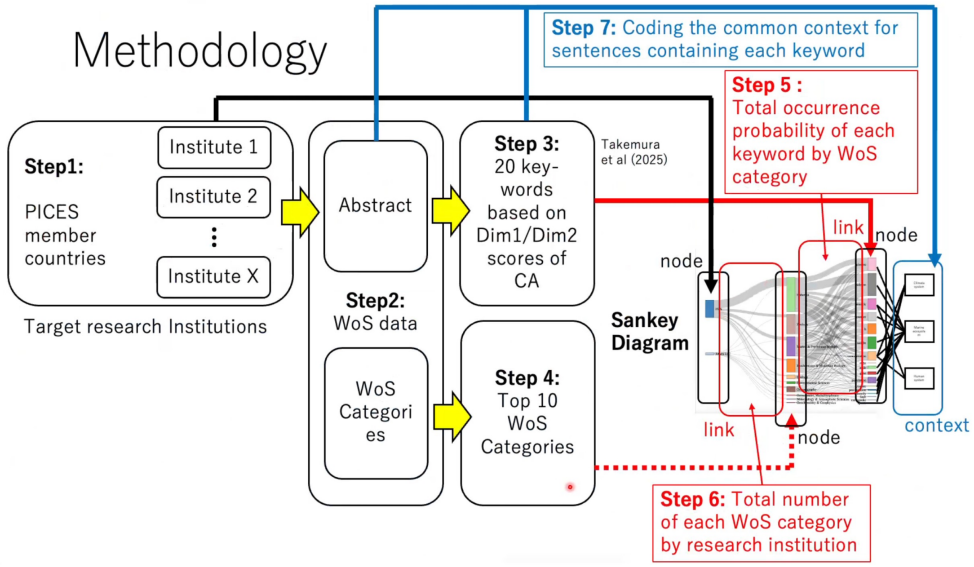


Next Steps

01. Generate a **Sankey Diagram** to connect DFO's main Web of Science Categories with research keywords and contexts/systems.



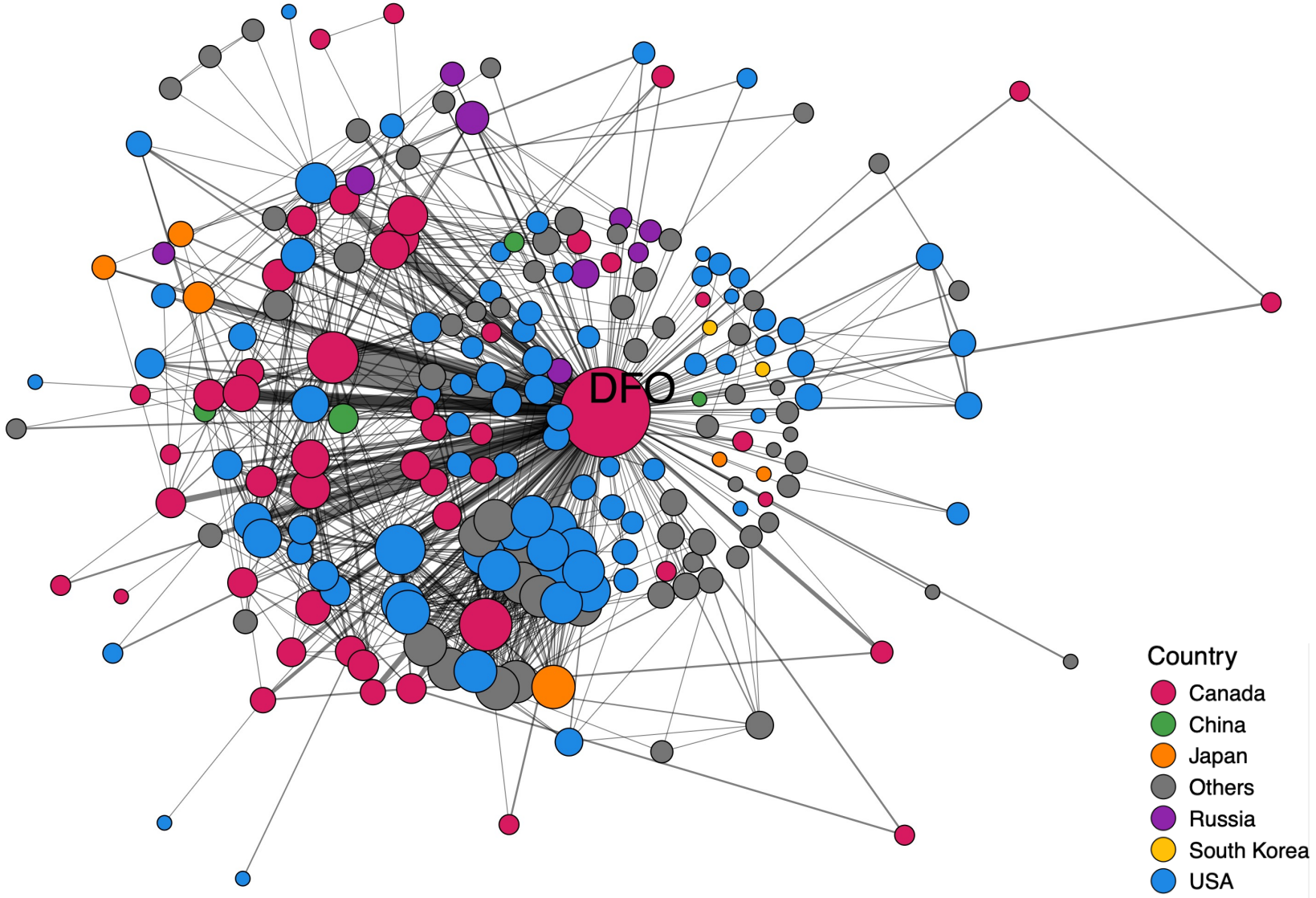
02. Refine the analysis further and prepar a manuscript for a Special Issue.

03. Comparative analysis with other national science organizations (WG-41). For example, NOAA (USA), JAMSTEC & FRA (Japan), etc.

04. Circulate the findings among PICES DFO members and provide actionable recommendations.

05. Foster more collaboration opportunities between DFO and **South Korean scientists.**

Top 10 DFO collaborators in terms of paper counts in the 1990s (*degree centrality*)



1. Bedford Institute of Oceanography **(Canada)**

2. University of British Columbia **(Canada)**

3. University of California System **(USA)**

4. Scripps Institution of Oceanography **(USA)**

5. University of California San Diego **(Canada)**

6. Ifremer **(France)**

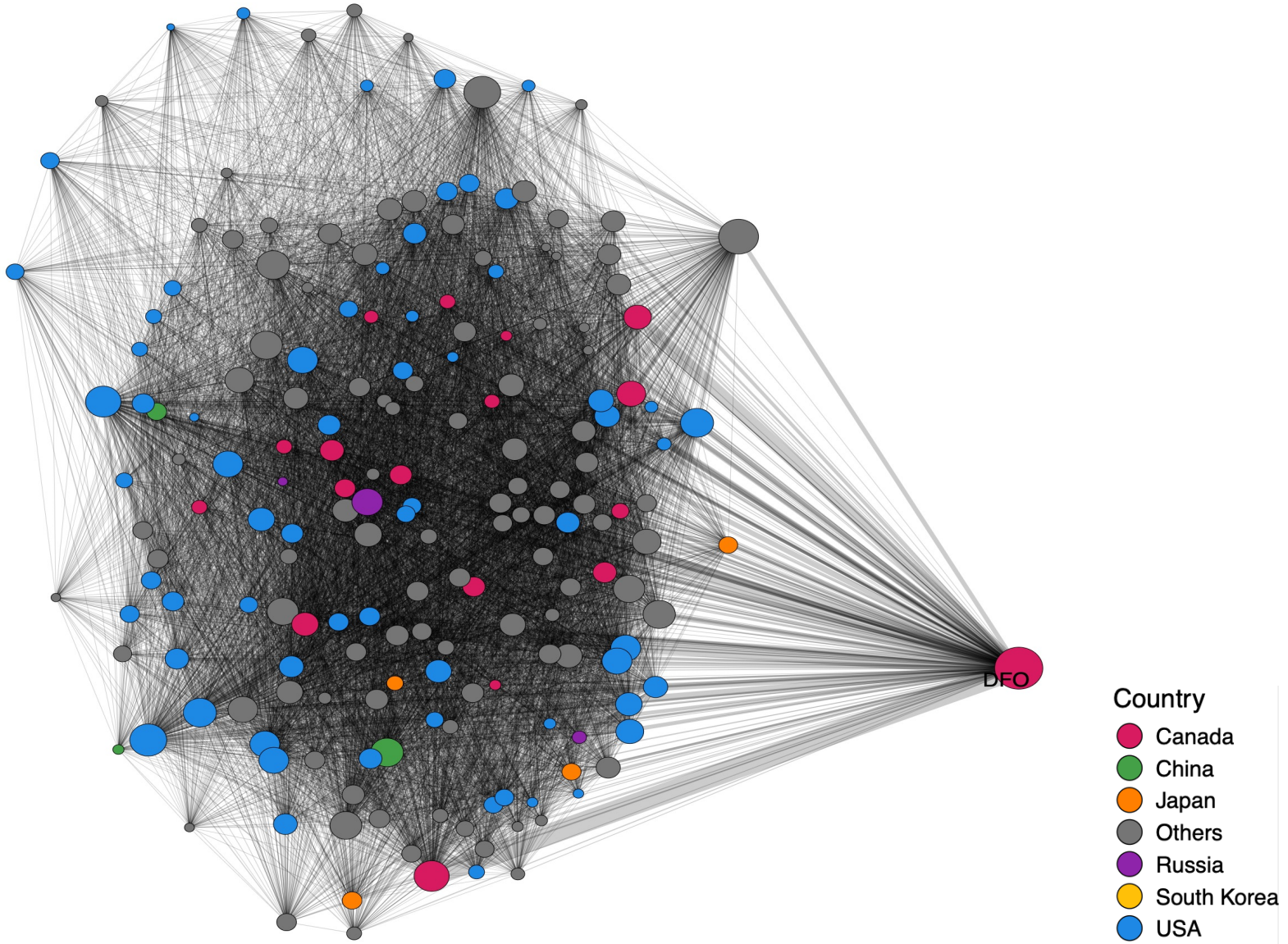
7. University of Tokyo **(Japan)**

8. University of Birmingham **(UK)**

9. University of Hawaii **(USA)**

10. Stockholm University **(Sweden)**

Top 10 DFO collaborators in terms of paper counts in the 2020s (*degree centrality*)



1. CNRS **(France)**

2. University of California System **(USA)**

3. Institut de Recherche pour le Développement **(France)**

4. NOAA **(USA)**

5. University of British Columbia **(Canada)**

6. University of Washington **(USA)**

7. CSIRO **(Australia)**

8. Consiglio Nazionale delle Ricerche **(Italy)**

9. Consejo Superior de Investigaciones Cientificas **(Spain)**

10. Université de Montpellier **(France)**