



**Gender Gap in Computing, Mathematics, and
Natural Sciences
International Science Council Project**

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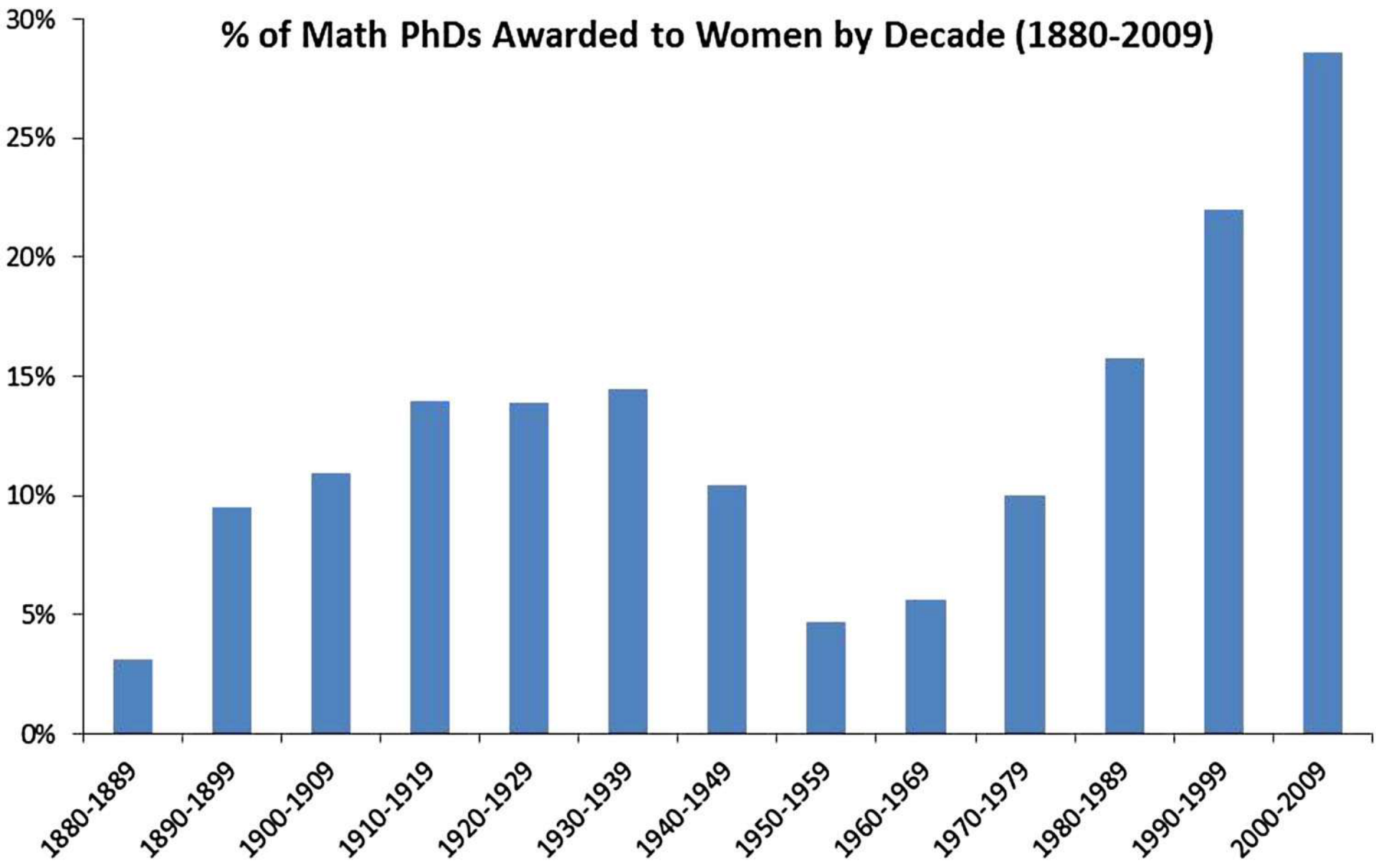
<https://gender-gap-in-science.org/>

Project Overview

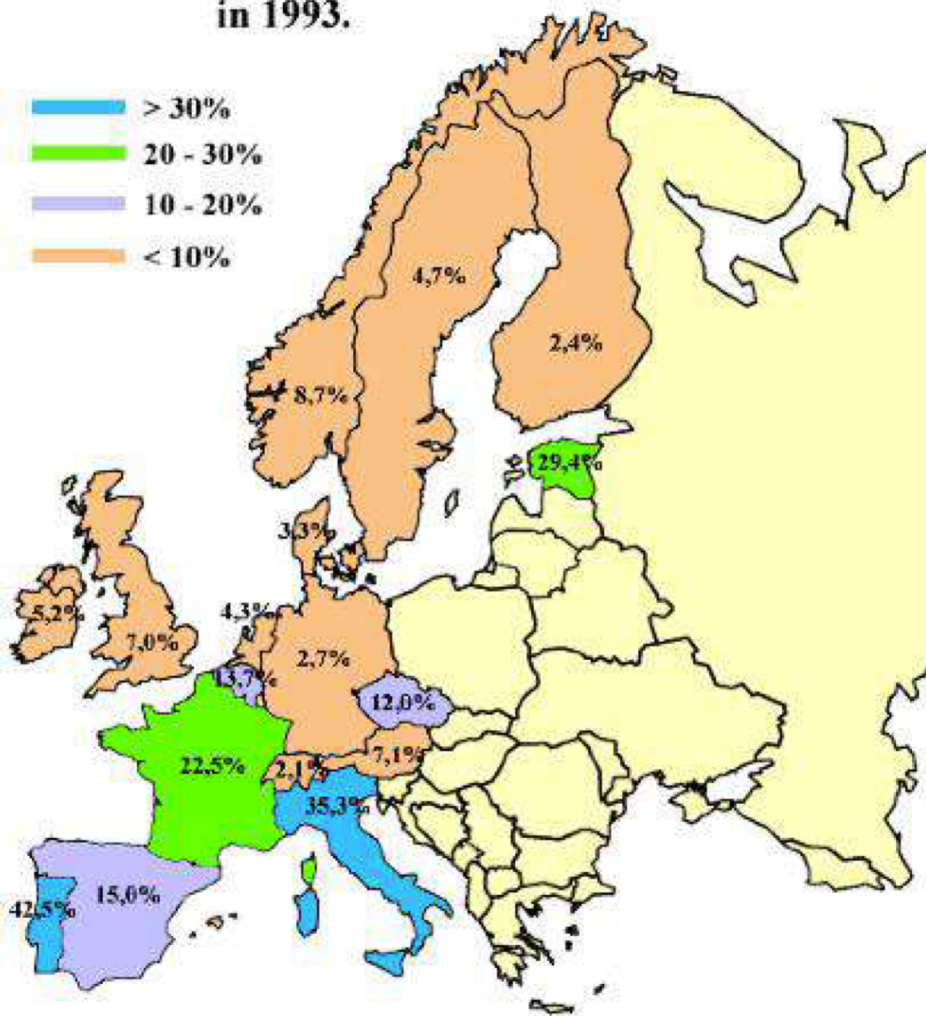
- **The motivation** of the project is that the percentages of women scientists remain shockingly low, and there is a continuing significant gender gap at all levels between women and men.
- **It is a three years project, 2017-2019**, awarded by International Council for Science (**ICSU**) with a budget of 100 000 euros each year.
- The gender gap project will:
 - **Produce sound data** to support the choices of interventions that ICSU and member unions can feasibly undertake.
 - **Identify the barriers** to achievement for women which still exist, especially in developing countries.
 - **Identify contrasts** and common ground across regions, cultures, developed and developing countries, men and women, and disciplines.
 - **Encourage young women** to study and work in Mathematical, Computing and Natural Sciences.

<https://council.science/what-we-do/funding-programmes/icsu-grants-programme>

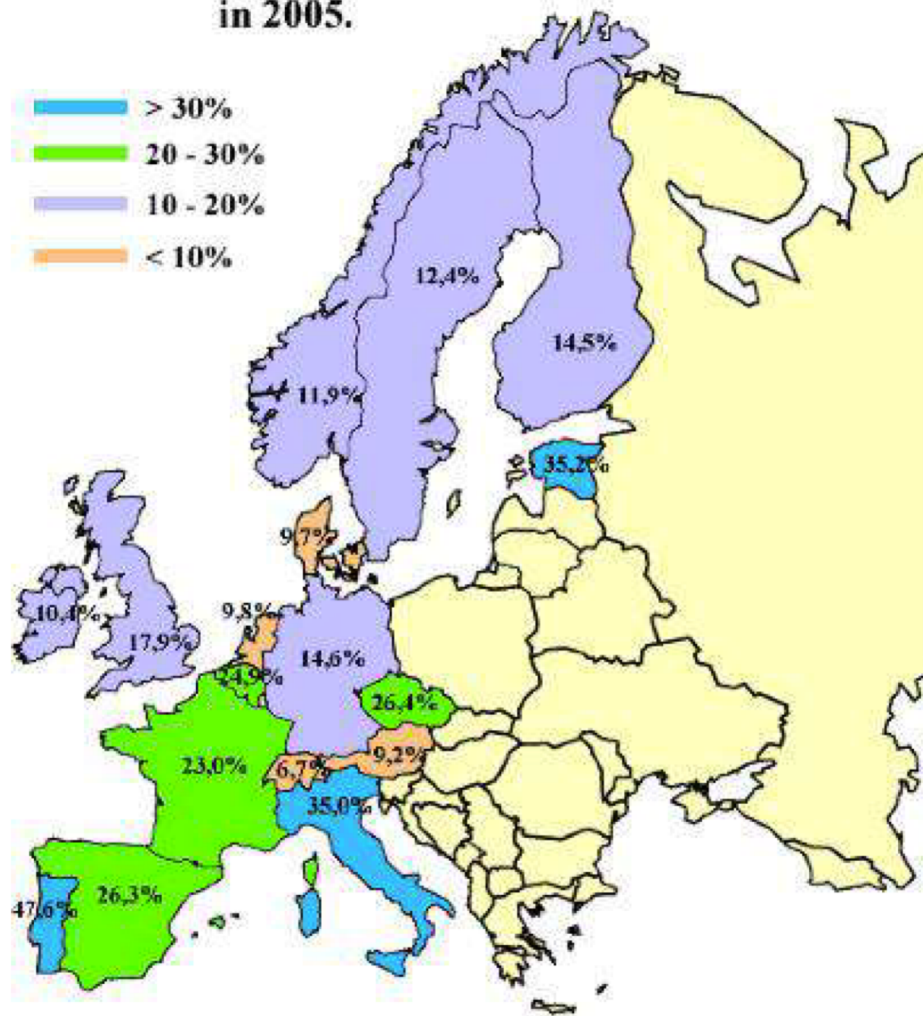
% of Math PhDs Awarded to Women by Decade (1880-2009)



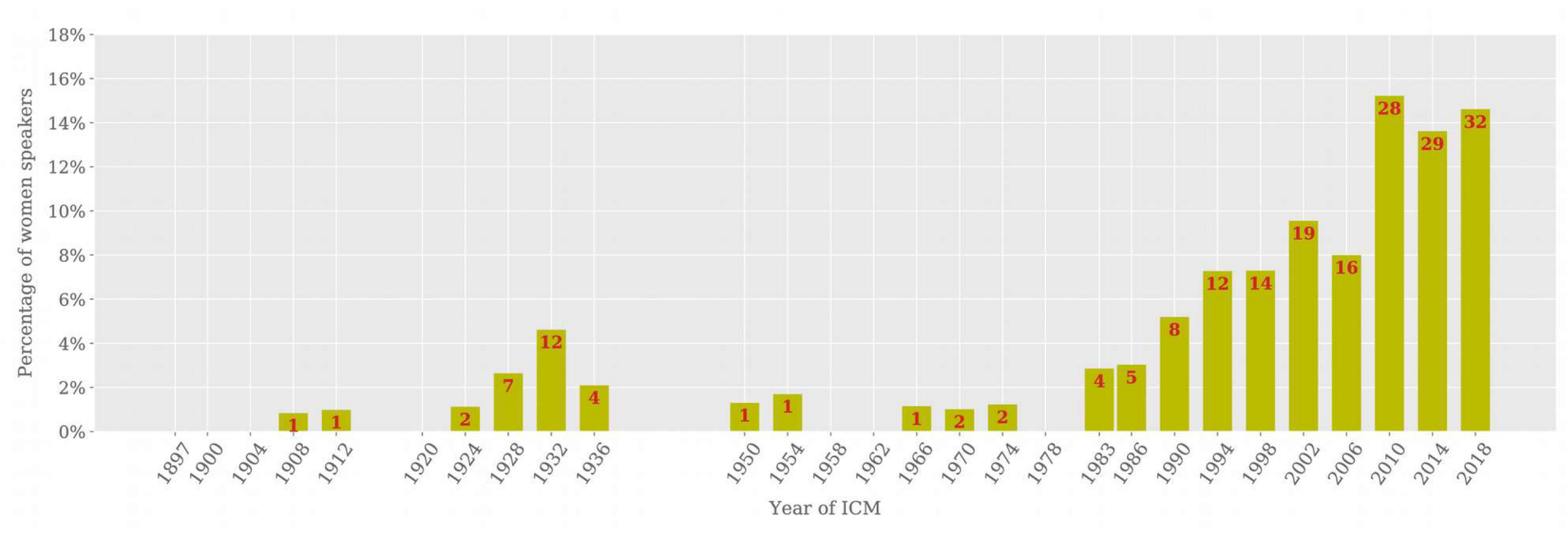
Percentage of women mathematicians in 1993.



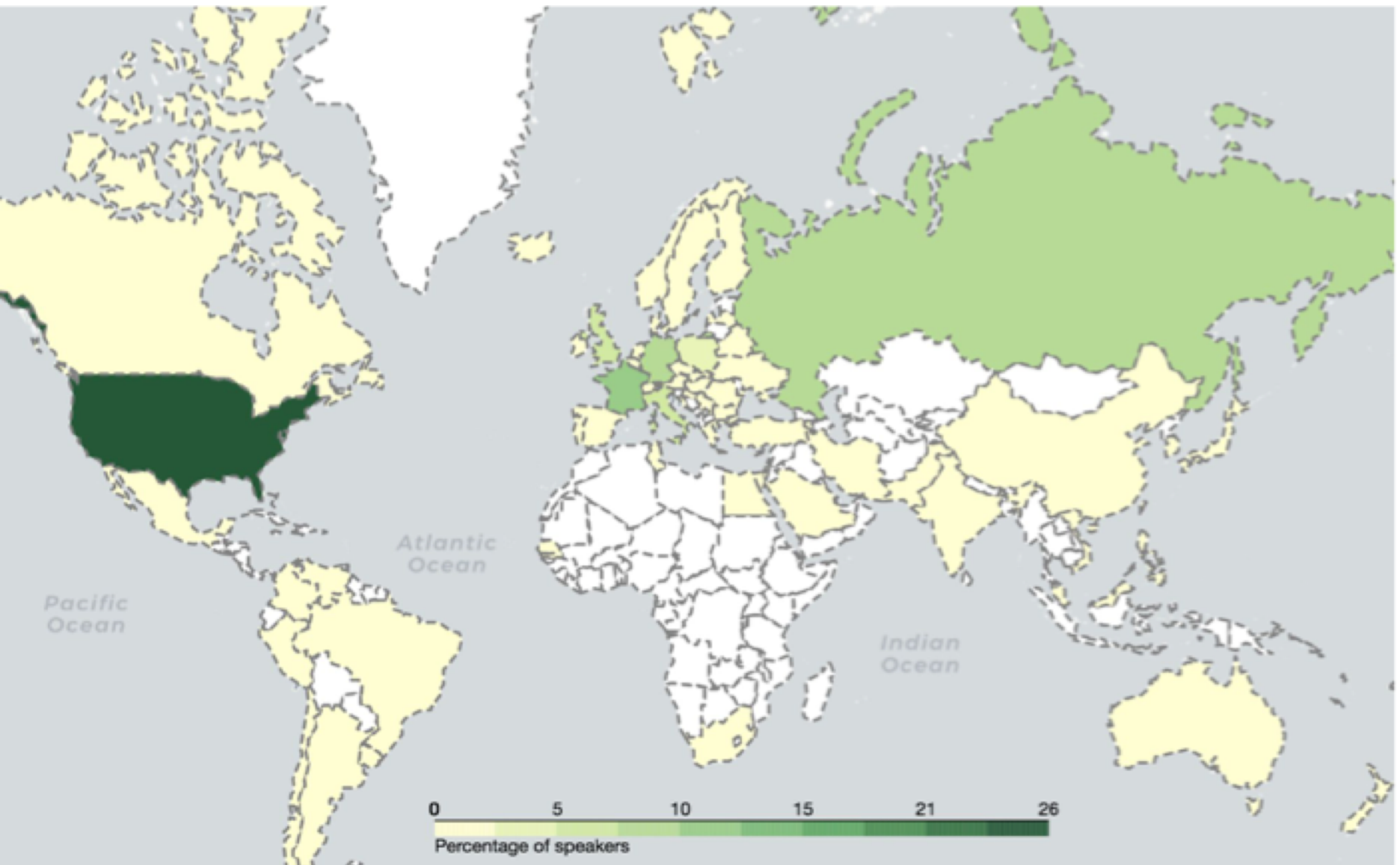
Percentage of women mathematicians in 2005.



Percentage of women speakers at ICM (as well as numbers)



Geographical distribution of all women speakers at ICM according to their country of residence.



Objectives

Provide **evidence** via a **joint global survey** and a **study of publication patterns** to provide reliable data on which to orient future actions.
Goal: 45,000 respondents.

Collaborate with social scientists working in gender and science, obtaining **contrasts and commonalities** across regions and cultures, less and more highly developed countries, and across different disciplines.

Provide easy access to **materials to encourage young women** to work in our fields, including information about careers and salaries directed at parents, schools, and others who influence the careers of girls, in particular in the developing world.

Recommend **practical policies and actions** that reduce the gender gap.

Description

Data will be collected via a **joint global survey (Task 1)** planned to reach 45,000 respondents in more than 130 countries using 7 languages.

➤ Contrasts and common ground across regions and cultures, less developed and highly developed countries, men and women, mathematical, computing and natural sciences, will be studied.

A **bibliographic study of publication patterns (Task 2)** will correspond to publications of more than 500,000 scientists since 1970.

➤ This will highlight contrasts between men and women in publishing their research papers.

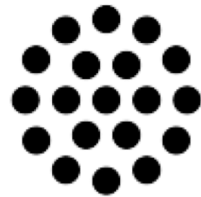
The project also aims to **provide a database (Task 3) giving easy access to materials** proven to be useful in encouraging girls and young women to study and pursue education in mathematical, computing and natural sciences.

❖ *The project was **launched in Paris** during a **Coordination Workshop** held in **UNESCO and IHP** in **June 1-3, 2017**.*







<https://gender-gap-in-science.org/>

Funding and Partner Organizations



**International
Science Council**

	International Mathematical Union
	International Union of Pure and Applied Chemistry
	International Union of Pure and Applied Physics
	International Union of History and Philosophy of Science and Technology
	International Astronomical Union
	United Nations Educational, Scientific and Cultural Organization

	International Union of Biological Sciences
	Gender in Science, Innovation, Technology and Engineering
	International Council for Industrial and Applied Mathematics
	Organization for Women in Science for the Developing World
	Association for Computing Machinery

Budget

1. 100 000 euros from **ICSU** during 3 years, hence 300 000 euros altogether.
 2. 41 500 euros each year contribution from **some of the partners**, hence 124 500 altogether.
 3. About 30 000 euros each year from the **other partners**, as indirect contribution (support of their members when they participate to our meetings).
- **Total budget amount: 454 500 euros** with distribution:
- Research content: 240 000
 - Accomodation and travel for meetings: 168 000
 - Coordination, communication, translations: 46 500
- **IMU office in Berlin** is managing the financial matters.

Meetings

Coordination meetings

Launching meeting, Paris June 1-3, 2017; UNESCO and IHP.

Coordination meeting, year 2, Paris June 11-12, 2018 ; EHESS and IHP.

Coordination meeting year 3, Berlin, february 18-19, 2019.

Final International Conference, Trieste November 4-8, 2019

Regional Workshops

Asian meeting, Tapei, National Taiwan Normal University (NTNU), Taiwan, November 7-8, 2017. 38 participants from 12 countries.

Latin America meeting, Bogota, Colombia, Universidad de los Andes, November 22-24, 2017. 30 participants from 10 Latin America countries.

African meeting, Le Cap (AIMS in Muizenberg) South Africa, December 1-2 2017. 39 participants (5 men) from 15 african countries.

Science Education Building

♀ 2017 ICSU Gender-Gap in Science
A Global Approach to the Gender Gap in Mathematical and Natural Sciences
How to Measure It, How to Reduce It?
Regional Workshop NTNU
November 7 - November 8, 2017, Taipei, Taiwan
Conference Room, General Hall B1
2017 國際科學理事會 科學領域性別差異
數學與自然科學性別差異的全球途徑：如何評估與消除性別差異
臺師大區域工作坊
公館校區綜合館B1 小型演講廳
國立臺灣師範大學







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NO FIREARMS
NO HAZARDOUS MATERIAL
ALIGNED

GENDER GAP
2017



AIMS
ASSOCIATION OF
INDEPENDENT
MUSICIANS
SOUTH AFRICA

Communication

Website: <https://gender-gap-in-science.org/>

Flyers and Posters: <https://gender-gap-in-science.org/promotional-materials/>

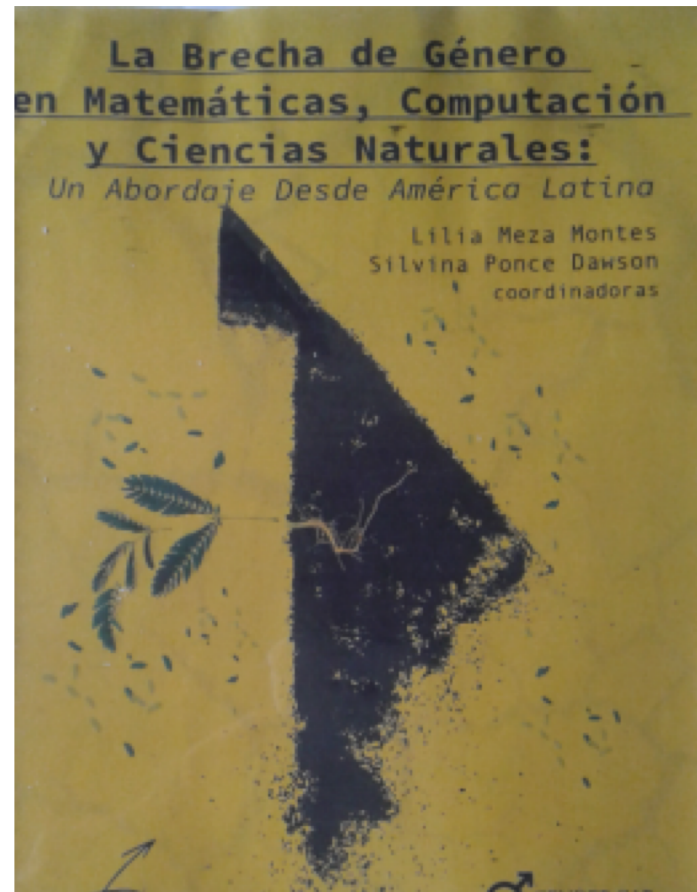
Twitter: [@GenderGapSTEM](https://twitter.com/GenderGapSTEM)

Facebook: [GenderGapSTEM](https://www.facebook.com/GenderGapSTEM)

Note that **STEM** = science, technology, engineering, and mathematics.

Lot of articles related to the gender Gap in Science project:
<https://gender-gap-in-science.org/project-publications/>

Among these references **a book** containing articles written by workshop participants (Gender Gap in Science Project, Bogota, Colombia, November 2017) on initiatives to reduce the gender gap in science in the region. Under the coordination of **Lilia Meza Montes** from the Benemerita Universidad Autonoma de Puebla, Mexico and **Silvina Ponce Dawson** from Universidad de Buenos Aires, Argentina.



Task 1

➤ In 2010, the *International Union of Pure and Applied Physics (IUPAP)* and the *American Institute of Physics (AIP)* conducted the **Global Survey of Physicists** comparing experiences of men and women physicists around the world.

There were 14 932 respondents to the physicist survey from 130 countries and 8 languages. The results highlighted contrasts between women and men, and between less and more highly developed countries. A glance to this survey:

<https://www.aip.org/statistics/reports/global-survey-physicists>

➤ **The joint global survey (Task 1) of our project** has been inspired by the previous one on Physicists, and is planned to reach 45,000 respondents in more than 130 countries using 7 languages.

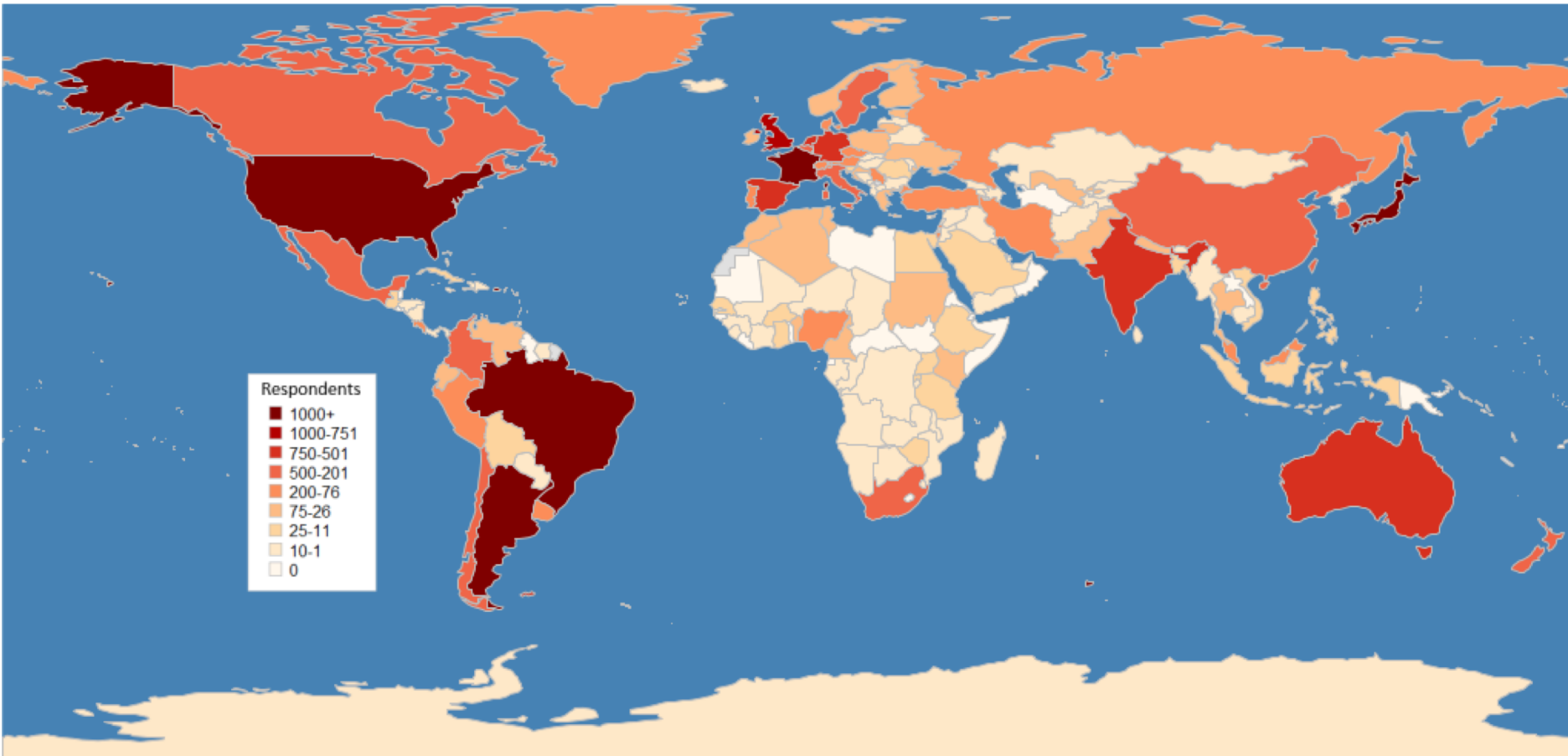
➤ <https://aipsurveys.aip.org/cgi-bin/global18print.pl?language=3>

➤ **It is possible to answer the questionnaire till December 31, 2018.** On November 1st 2018, there were about 24 000 respondents.

➤ <https://statisticalresearchcenter.aip.org/cgi-bin/global18.pl>

Total Survey Respondents as of November 1, 2018

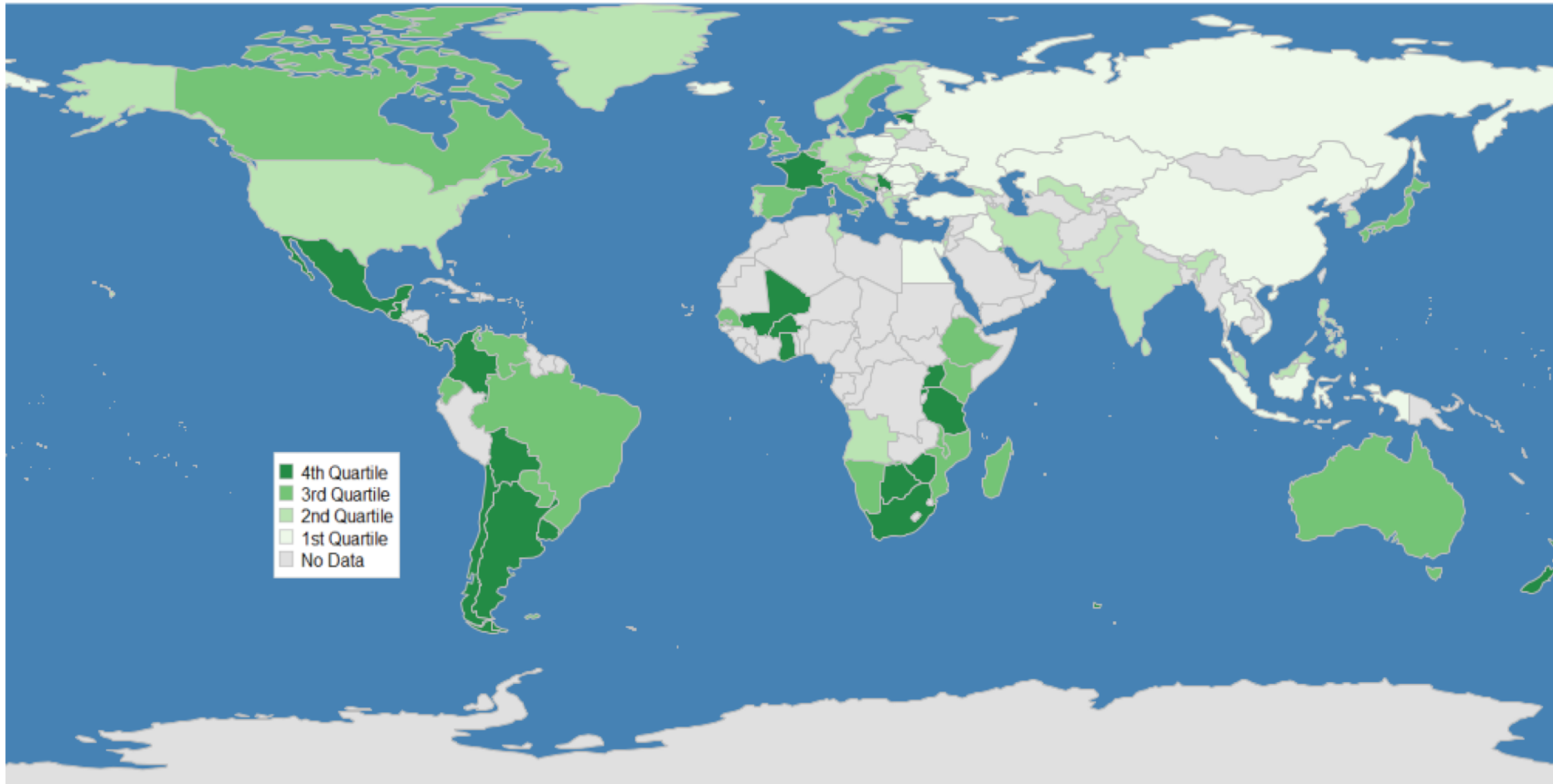
Number of Respondents to the Global Survey of Scientists Per Country, 1/11/2018



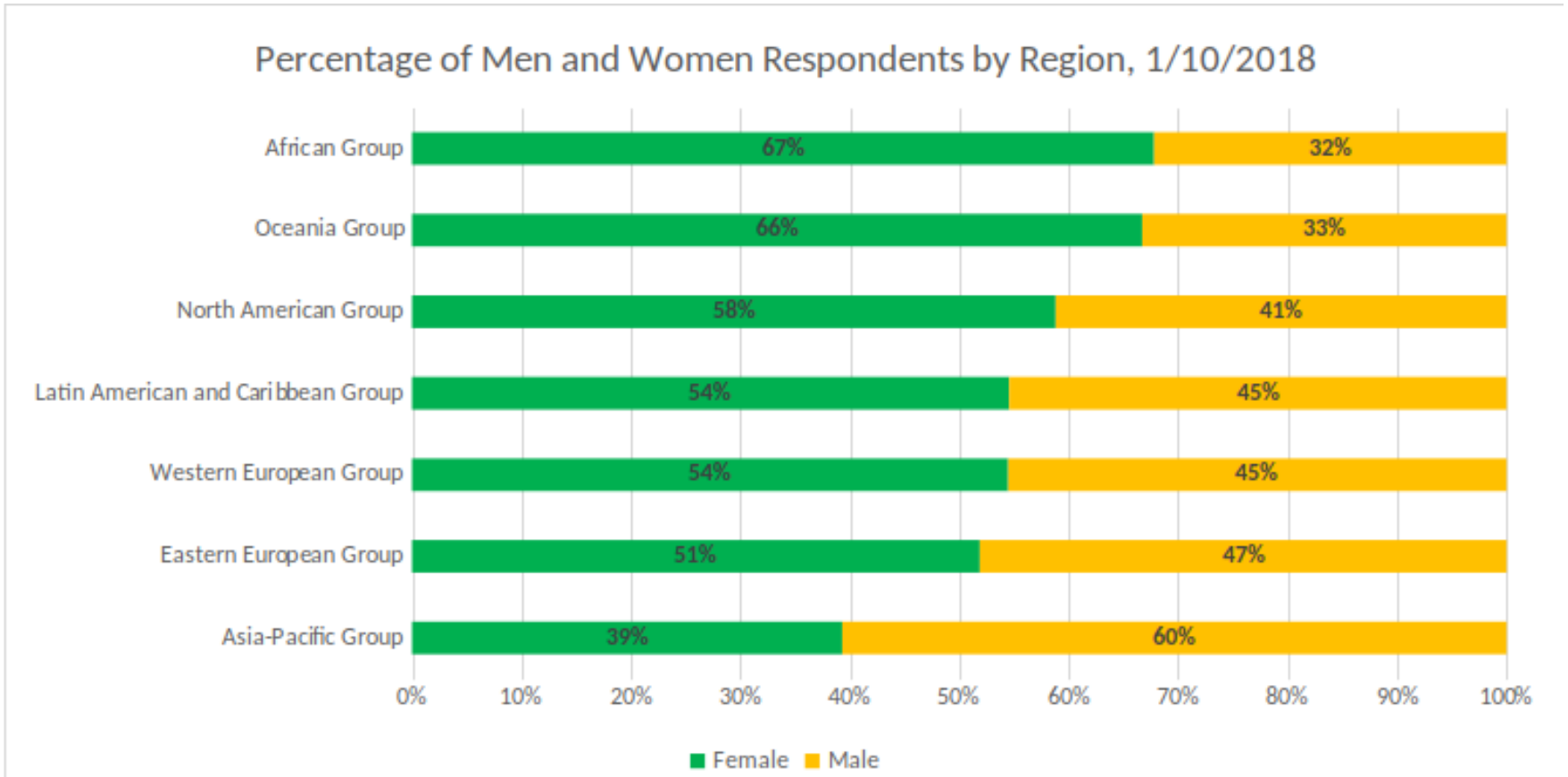
<https://gender-gap-in-science.org/>

Proportion of Responding Scientists. 1/11/2018

Proportion of Responding Scientists , 1/11/2019



Men/Women Respondents

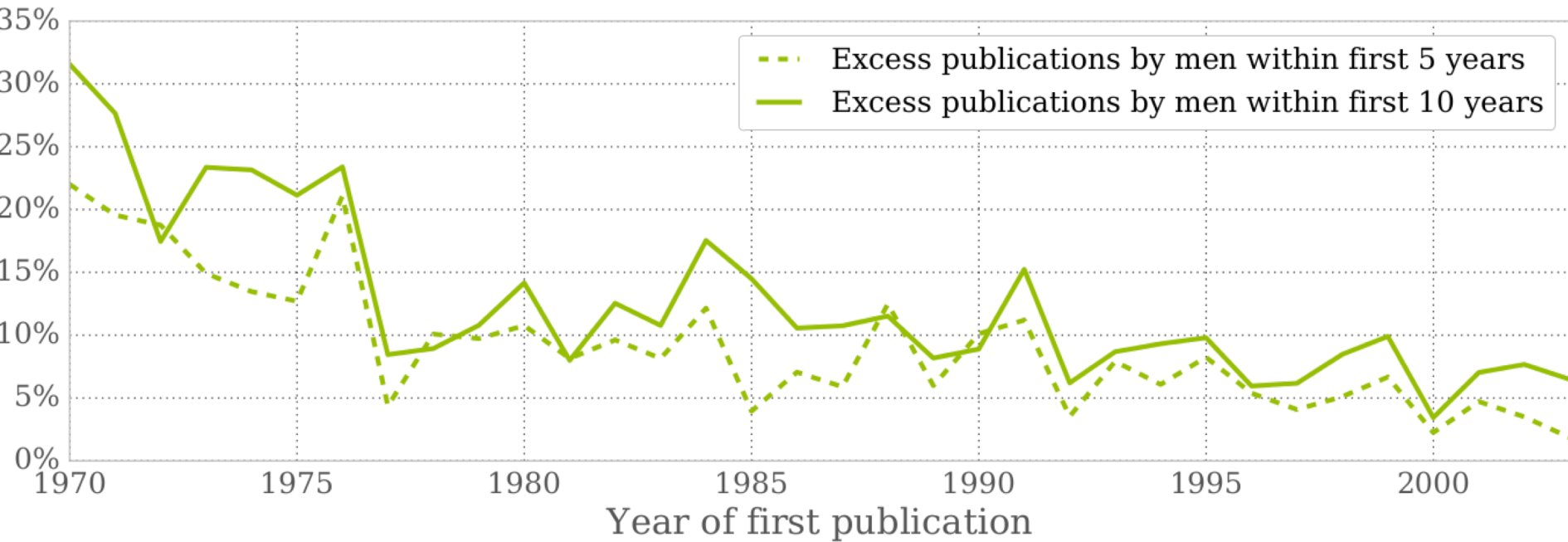


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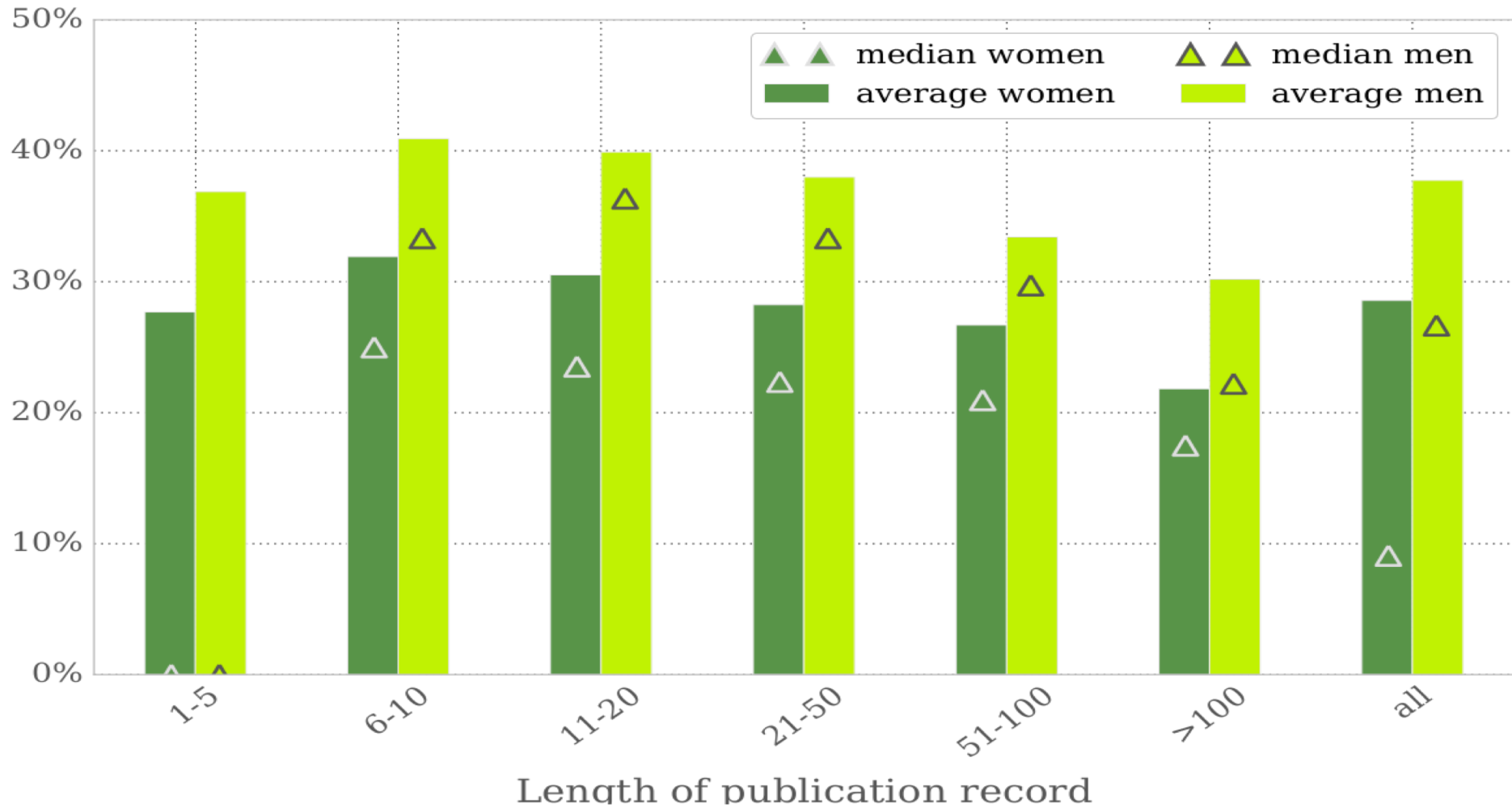
Task 2

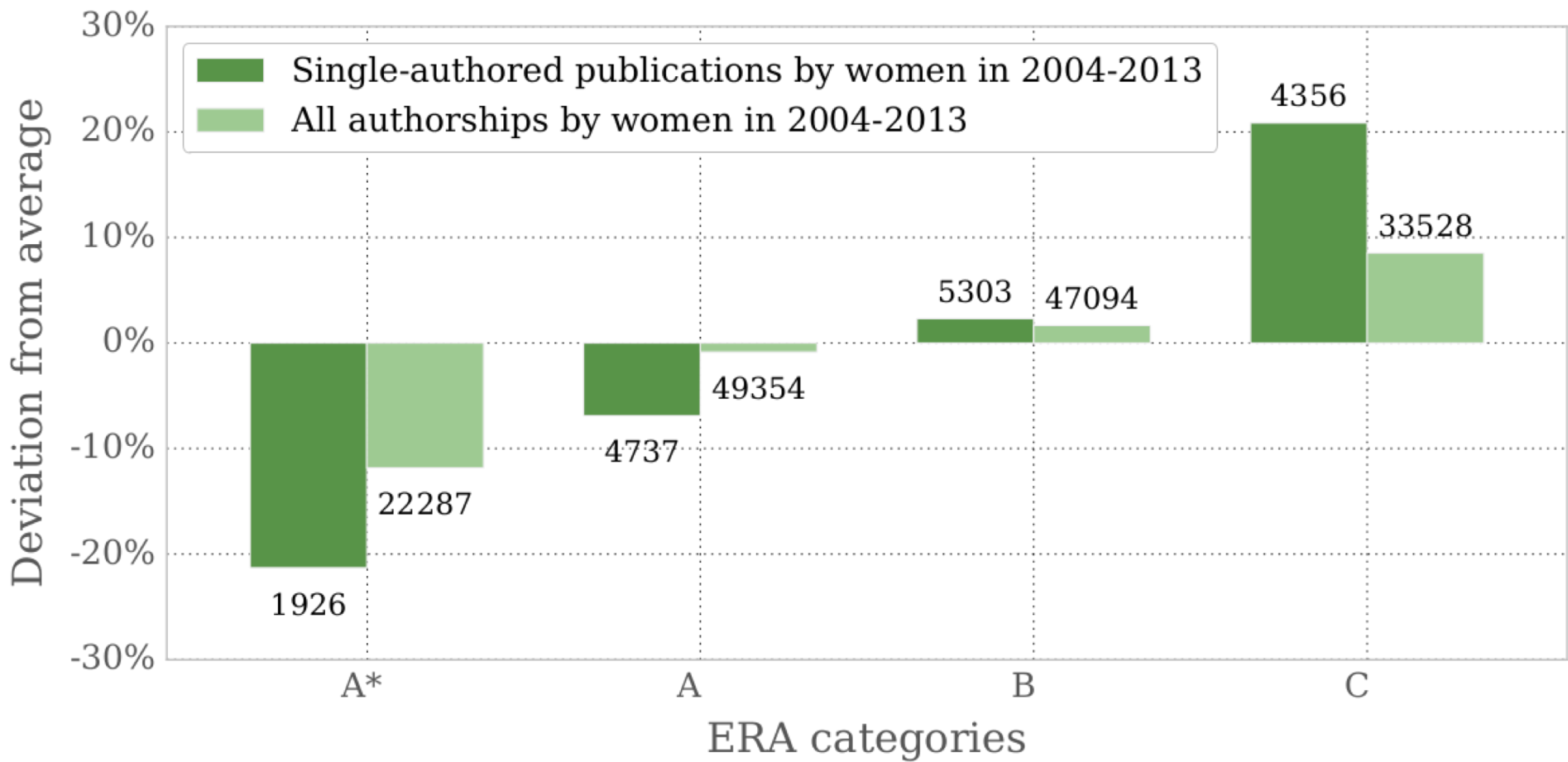
- A previous data backed study on gender differences in mathematics publication patterns has been led by Helena Mihaljević-Brandt, Lucía Santamaría, Marco Tullney.
- **A bibliographic study of publication patterns (Task 2)** is extended to other disciplines and will correspond to publications of more than 500 000 scientists since 1970.
This will highlight contrasts between men and women in publishing their research papers.
- We present after **some results of the previous study concerning Mathematics**, it is based on zbMATH.
Using the authors' first names they algorithmically infer the gender of ~150.000 mathematicians active since 1970.

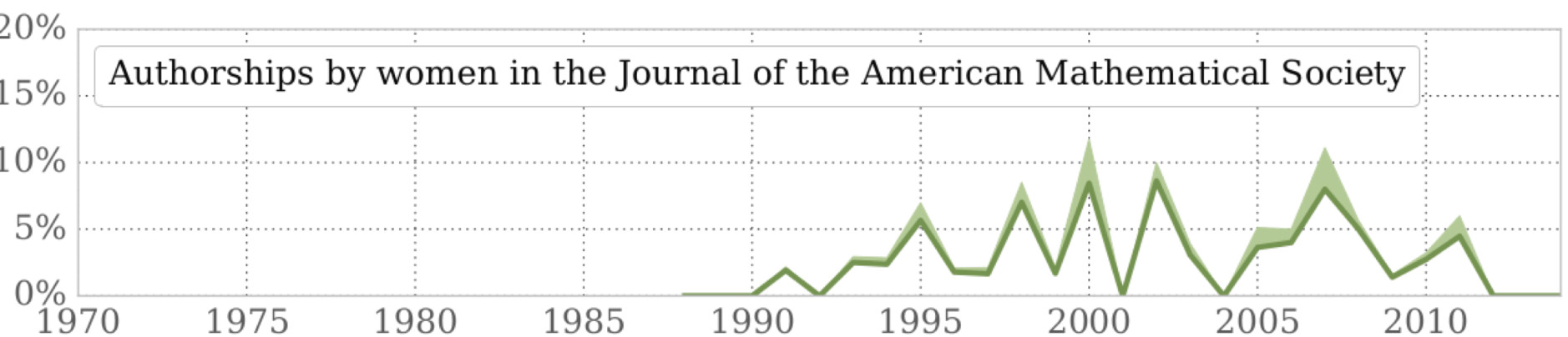
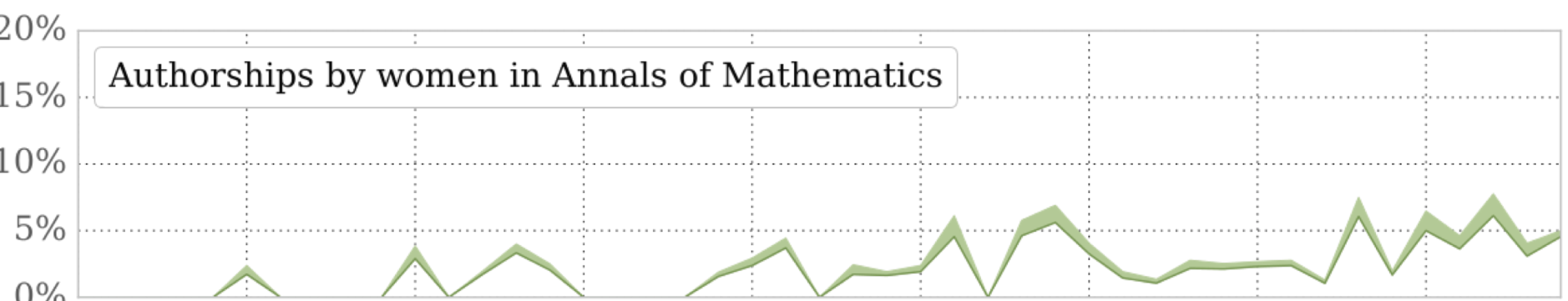
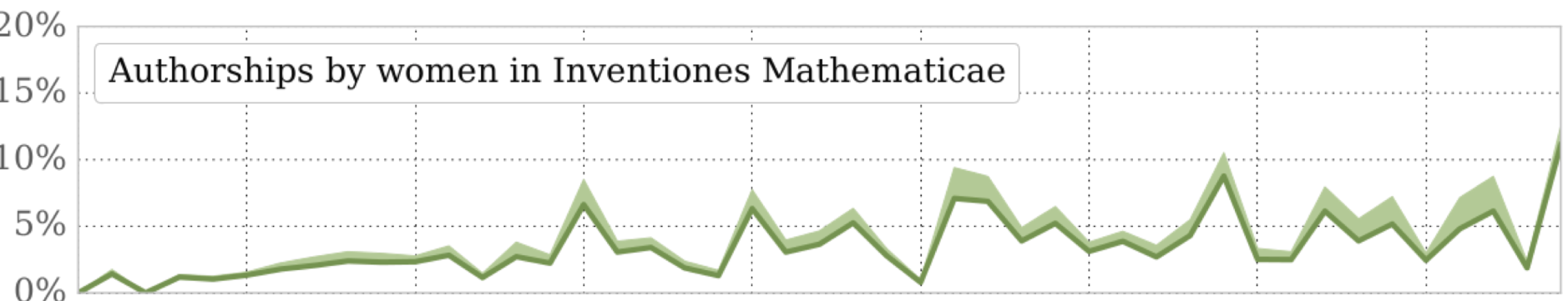
Women publish less than men at the beginning of their careers



On average, women (men) write 29% (38%) of their scientific records as single authors.







TASK 3

Database of good practices

- Addressing the gender gap in Science, Technology, Engineering and Mathematics (STEM) is a **major goal of many countries.**

- *Aims of task 3:*
 - **To gather and make available information and resources on effective practices** for enhancing the participation of girls and women in science at all levels.

 - **To gather and generate evidence about effectiveness** of the collected practices.

 - **To develop, translate, and disseminate** selected practices worldwide, focusing on contexts where participation of girls and women is particularly low.

Brief Description

- An **online database** will be created containing information on **existing initiatives for which evidence of effectiveness** exists.
 - The database will include **searches and categorizations**.
 - Information will be gathered through existing networks.
- The data base will include a **facility for adding new items**, and **translations** of selected information (in english, spanish and french).
 - **The Task includes distributing** this information.
- Proven effective practices are not always available for consideration or use by others.
 - **We hope to construct an ongoing developing source of such information.**

Method

- Task 3 is planned on Year 2 and 3.
- A Ph D student, **Regina Kelly**, is involved under supervision of **Merrilyn Goos** in University of Limerick (Ireland)
- First action is **to identify a few existing initiatives** that we could use as **a test to develop the structure of the database.**
- **To nominate an existing initiative** and participate in the pilot study/form: Email to: merrilyn.goos@ul.ie
- **Initial Webform link to collect initiatives:**
https://docs.google.com/forms/d/e/1FAIpQLSd5MiOBB_SmSQCPjTDDK2OpFnNThOd25rYso6RsPPg3cqFWaw/viewform?c=0&w=1&includes_info_params=true

Structure of database of good practices

- The Science, Technology and Innovation Gender Objectives List (STI GOL) was created with the intention of classifying policies and their associated instruments
 - The UNESCO STI GOL was used as a conceptual schema to capture elements of “good practice” regarding each initiative.
- STI GOL originally created with the intention of classifying policies and their associated instruments: **adaptions needed**.
 - A brief justification of these adaptions was sent to the creators of STI GOL, STEM and Gender Advancement (SAGA) UNESCO.
- The Saga Toolkit is a set of instruments that were designed to monitor and evaluate gender equality in policy documents.
 - Ongoing work of the project is to source and code 150 initiatives for the database.

The Saga Toolkit for coding

1. **Change** perceptions, attitudes, behaviours, social norms and stereotypes towards women in STEM in society
2. **Engage** girls and young women in STEM primary and secondary education, as well as in technical and vocational education and training
3. **Attraction, access to and retention** of women in STEM higher education at all levels
4. Gender equality in **career progression** for scientists and engineers (S&E)
5. Promote the **gender dimension in research content**, practice and agendas
6. Promote gender equality in **STEM-related policy-making**
7. **Promote gender equality** in science and technology-based entrepreneurship and innovation activities

databaseofgoodpractices@gmail.com

Database Pilot

- ✓ Athena SWAN,
<https://www.ecu.ac.uk/equality-charters/athena-swan/>
- ✓ Million Women Mentors,
<https://www.millionwomenmentors.com/about>
- ✓ For Women in Science (National Program),
<https://www.forwomeninscience.com/fr/home>
- ✓ Mind the Gap Promoting Girls and Women in STEM
<http://mindthegaproject.eu/>
- ✓ Forum des Jeunes Mathématiciennes
<http://www.femmes-et-maths.fr/index.php?page=contenu&cat=3>
- ✓ Landelijk Expertise Bureau Meisjes/ Vrouwen En Beta/ Techniek (National Expert Organisation on Girls/Women and Science/Technology)
<http://www.genderandstem.com/>

➤ **Primary keys were specified:**

Name, Acronym, Web Link, Year Origin, Participating Country/s, Funding Source, Discipline/s, Target Audience, Evidence of Effectiveness and Impact, STI Gender Objectives.

How to target parents and schools ?

- **To gather information from this audience**
- **To disseminate the existence of the data base**
 - Use the network of each partner of ICSU project to target associations and institutions
 - Take the opportunity of all events on february 11 to disseminate:

<http://www.un.org/fr/events/women-and-girls-in-science-day/>

<http://www.epsnews.eu/2017/03/february-11th-the-un-international-day-of-women-and-girls-in-science/>

Sources for principles

- It will be useful to have some principles with respect to the nature of “good practices”. There are several sources of such principles we could use :

Charters and statements of principles from Women in Physics (ICWIP),
<http://www.if.ufrgs.br/iupap/uk-delegation.pdf>

The Baltimore Charter
<http://www.stsci.edu/stsci/meetings/WiA/BaltoCharter.html>)

Pasadena Recommendations of the astronomers,
<https://cswa.aas.org/pasadenarecs.html>

The Juno Project
<http://www.iop.org/policy/diversity/initiatives/juno/index.html>

The Athena Swan Scheme
<https://www.ecu.ac.uk/equality-charters/athena-swan/>

Committee for Women in Mathematics of IMU
<http://www.mathunion.org/cwm/home>

Choosemaths: <https://choosemaths.org.au/>

Evaluation of effectiveness

- **The Task involves significant research** in addition to gathering information: Proving “*effectiveness*” and “*potential for use in other contexts*” are methodologically difficult.
- **Alessandro Bello (UNESCO) indicated some links for evaluation** (relevance, effectiveness, efficiency, sustainability and impact), **and how effectiveness can be measured, by using UN evaluation tools.**

<http://web.undp.org/evaluation/policy.shtml> (a very good senior evaluator now at the GEF wrote this policy)

<http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/IOS/temp/UNEGHandbookNormativeWorkENG.pdf>

<http://ieg.worldbankgroup.org/blog/rethinking-evaluation-development-effectiveness>

<http://www.sfe-asso.fr/> Société Française de l'Evaluation

http://www.enterprise-development.org/wp-content/uploads/Opportunities_Limitations_Randomized_Experiments.pdf (former UNESCO evaluator now at World Bank wrote this article)

Conclusions of the project

Conclusions to be drawn during the second half of 2019

Final international conference at ICTP 4-8 November

QUESTION: Continuation after three years ?...

Sources

➤ <https://gender-gap-in-science.org/>

➤ Report of panel *The Gender Gap in Mathematical and Natural Sciences from a Historical Perspective*, organised by the Committee for Women in Mathematics (CWM) of the International Mathematical Union (IMU) which took place at the International Congress of Mathematicians (ICM) on August 2nd, 2018. By June Barrow-Green, Silvina Ponce Dawson and Marie-Françoise Roy

➤ Some slides from an UNESCO presentation by Marie-Françoise (Task 1)

➤ Some slides from *A data-backed study on gender differences in mathematics publication Patterns* by Helena Mihaljević-Brandt, Lucía Santamaría and Marco Tullney (Task 2)

➤ Some slides from *Database of Good Practices* by Merrilyn Goos (Task 3)

THANK YOU FOR YOUR ATTENTION!