

Heuschele, J., Ekvall, M. T., Mariani, P. and Lindemann, C. 2017. On the missing link in ecology: improving communication between modellers and experimentalists. – Oikos doi: 10.1111/oik.03885

## Appendix 1

### Bibliometric analysis

We searched ISI web of knowledge (Core collection) for all ecology (topic: Ecology) related papers published in leading journals for the time period 1990–2010. This was done on the 18 October 2016. We narrowed the dataset further down by restricting it to the following journals: Ecology, Functional Ecology, Marine Ecology Progress Series, Journal Of Ecology, Hydrobiologia, Oecologia, Oikos, Ecological Modelling, Science, Biological Conservation, Journal Of Experimenta Marine Biology And Eecology, Proceedings Of The Royal Society B Biological Sciences, Avimal Behaviour, Proceedings Of The National Acadamy Of Sciences Of The United States Of America, Nature, Marine Biology, Ecological Applications, Landscape Ecology, American Naturalist, Ecology Letters, and for the document type: Article and the ‘Web of science category’: Ecology. This yielded a total of 7415 articles. From these, we used the information in the abstract, keywords and the title to manually classify every fifth article (1484 articles) into three categories: modelling article, experimental article and articles that combined an experimental and a modelling approach. If it was unclear from the given information we excluded this article from the further analysis. Summary statistics for each group were calculated using the R package ‘bibliometrix’ (Aria and Cuccurullo 2016), including the average number of authors, citations, and the collaboration index (no. of authors of multi-authored articles/sum of articles with co-authors) for each group).

We also compared the three groups of articles (experimental, modeling and mixed approach) for differences in citation rates using a linear model with approach, publication year, and journal as fixed factors. The number of citations was power transformed (0.25) prior to analysis. Pairwise comparisons between groups were then compared using a Tukey post hoc test.

The difference in the number of authors between groups was tested with a Kruskal–Wallis test due to the non normal distribution of the data.

## References

Aria, M. and Cuccurullo, C. 2016. bibliometrix: a R tool for comprehensive bibliometric analysis of scientific literature. – *Scientometrics* 1: 1–17.

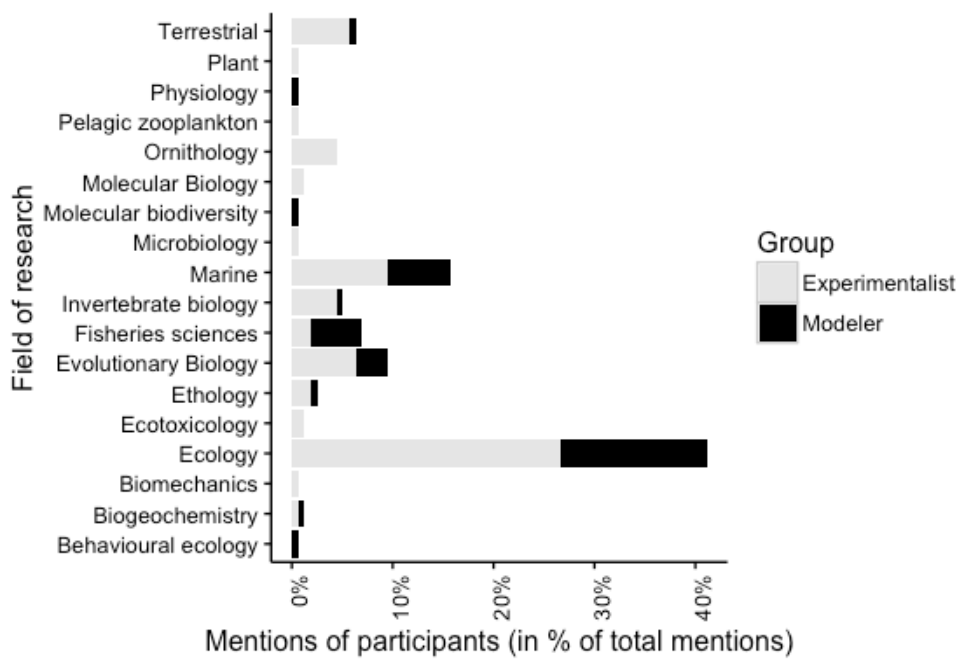


Figure A1. Field of research. The research fields of the survey participants. Multiple answers were possible.

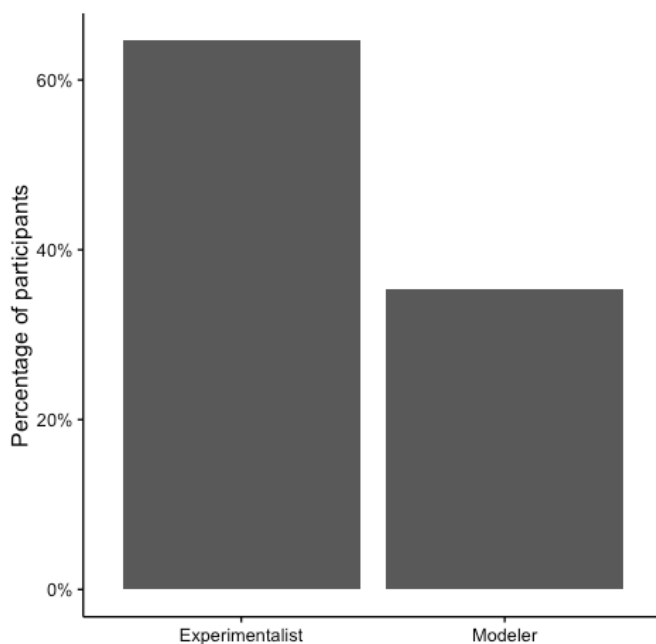


Figure A2. Survey participants by field. Of the participants 30% were modellers, and the rest described themselves as experimentalists.

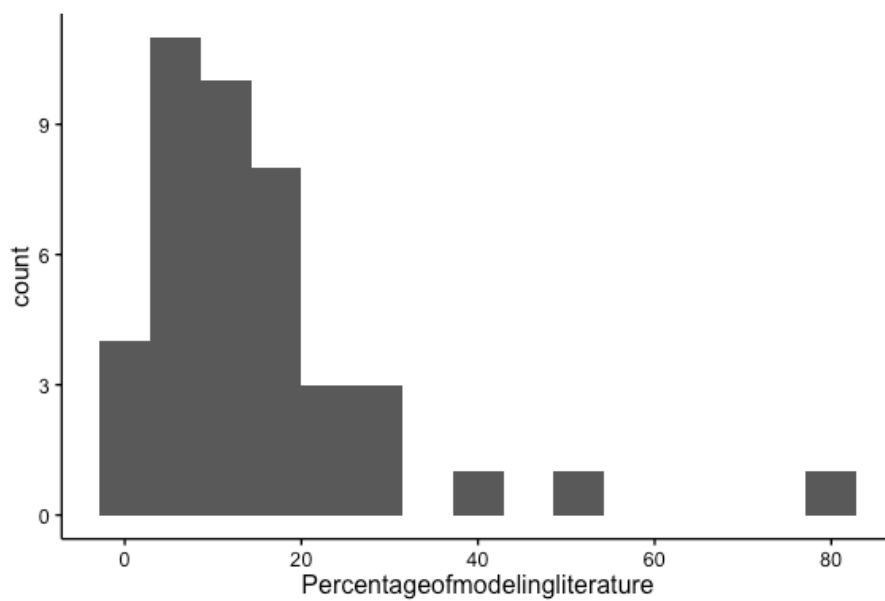


Figure A3. Percentage of modelling literature read by experimentalists. The percentage of ‘modelling papers’ as part of the general literature of experimentalists.

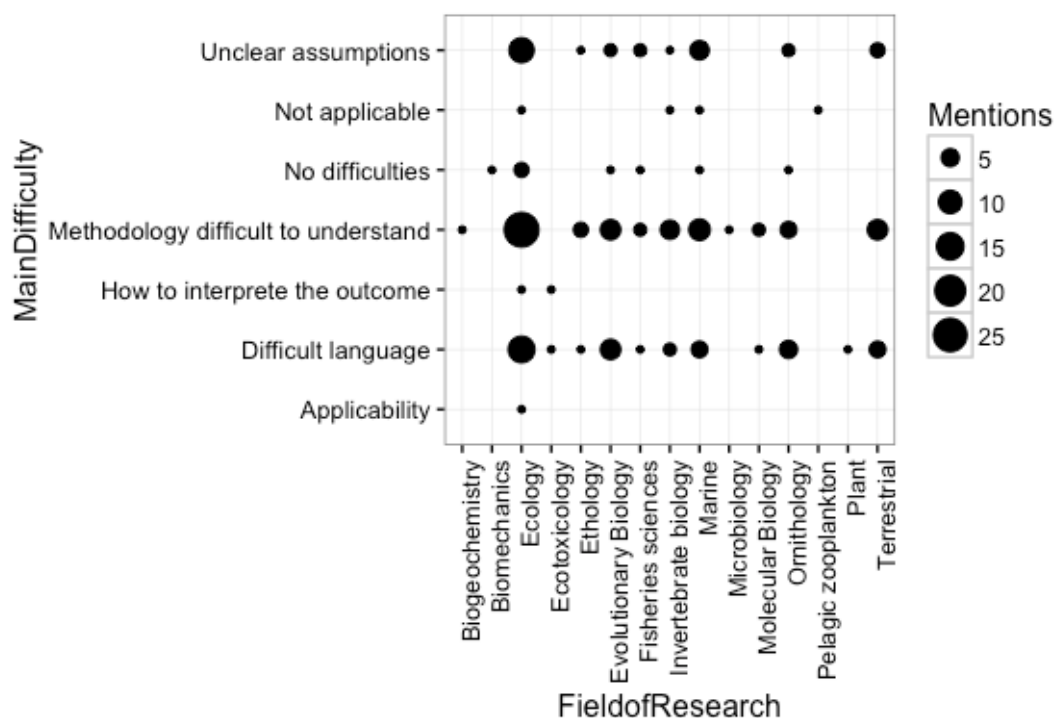


Figure A4. Difficulty with modelling papers that experimentalists have in different research fields. The mentioned difficulties of experimentalists with modelling papers, broken down by their research background.

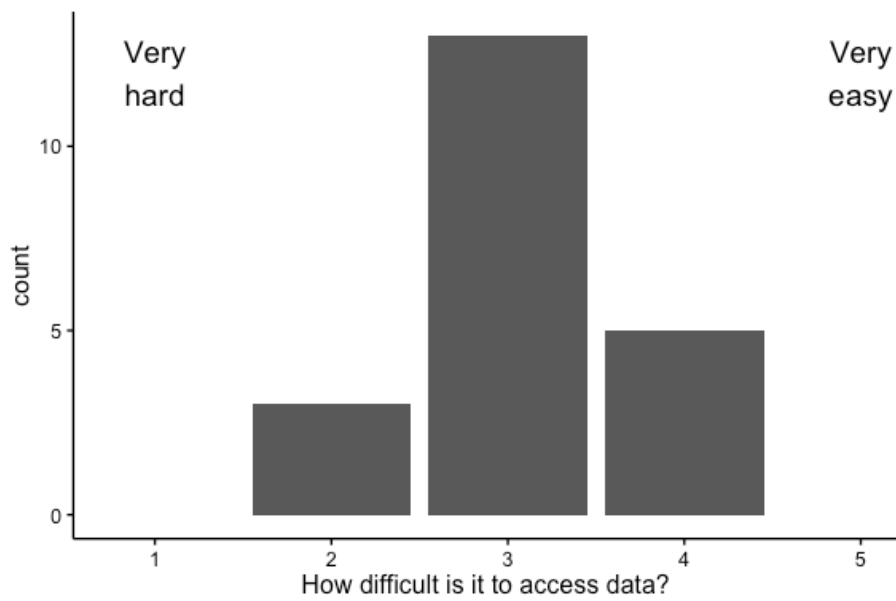


Figure A5. How difficult is it to access data? The impression on how easy it is to access empirical data for modellers.

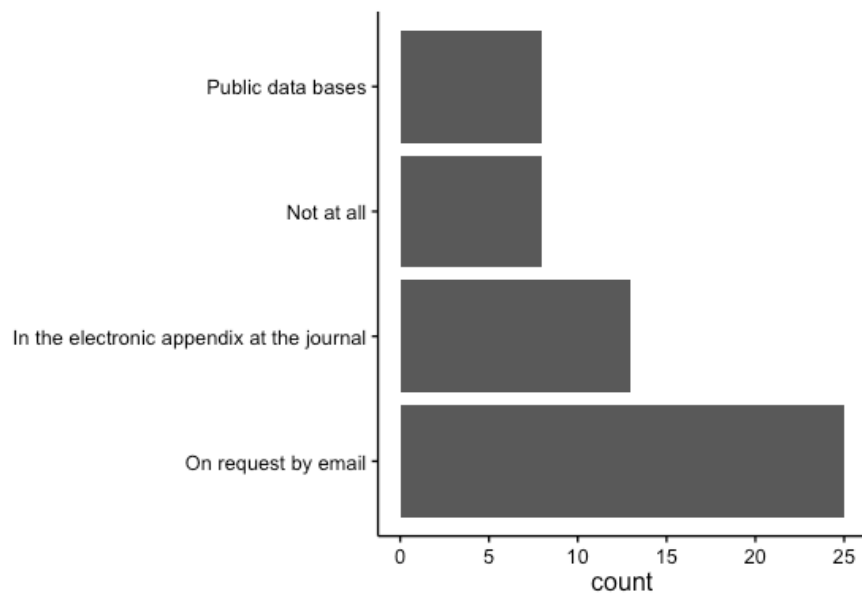


Figure A6. Where and how do you share data? The way the participating experimentalists share their empirical data.

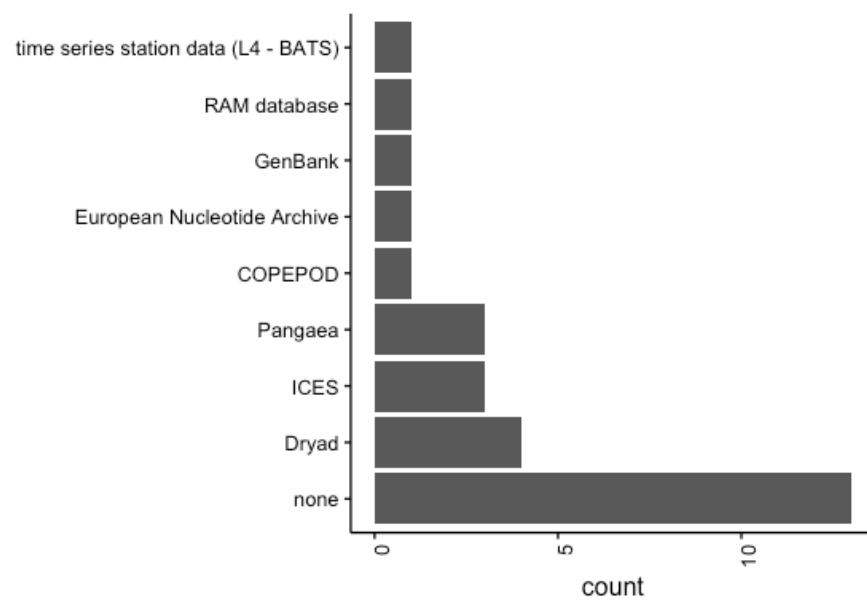


Figure A7. Data repository. Data repositories used by modellers. Several answers were possible.

## Appendix 2

### Bridging the gap between modelers and experimentalists

The aim of this poll is to investigate the interaction between modelers and experimentalists in biology. We want to detect whether there are problems, and if yes how these can be overcome to improve the communication and collaboration between the two fields. The study was initiated by Dr Jan Heuschele (Lund University, Sweden). The questionnaire will be open until the 12th of June 2015. Thanks a lot for your participation.

Questions? Feel free to contact me: [Jan.Heuschele@biol.lu.se](mailto:Jan.Heuschele@biol.lu.se)

\* Required

#### 1. Which terms best describe your field of research

multiple choices are possible

*Check all that apply.*

- ☐ Ecology
- ☐ Evolutionary Biology
- ☐ Molecular Biology
- ☐ Marine
- ☐ Terrestrial
- ☐ Fisheries sciences
- ☐ Ornithology
- ☐ Ethology
- ☐ Invertebrate biology
- ☐ Other: .....

#### 2. Which country do you live in?

*Mark only one oval.*

- ☐ Afghanistan
- ☐ Albania
- ☐ Algeria
- ☐ Andorra
- ☐ Angola
- ☐ Antigua and Barbuda
- ☐ Argentina
- ☐ Armenia
- ☐ Aruba
- ☐ Australia

- ☐ Austria
- ☐ Azerbaijan
- ☐ Bahamas, The
- ☐ Bahrain
- ☐ Bangladesh
- ☐ Barbados
- ☐ Belarus
- ☐ Belgium
- ☐ Belize
- ☐ Benin
- ☐ Bhutan
- ☐ Bolivia
- ☐ Bosnia and Herzegovina
- ☐ Botswana
- ☐ Brazil
- ☐ Brunei
- ☐ Bulgaria
- ☐ Burkina Faso
- ☐ Burma
- ☐ Burundi
- ☐ Cambodia
- ☐ Cameroon
- ☐ Canada
- ☐ Cape Verde
- ☐ Central African Republic
- ☐ Chad
- ☐ Chile
- ☐ China
- ☐ Colombia
- ☐ Comoros
- ☐ Congo, Democratic Republic of the
- ☐ Congo, Republic of the
- ☐ Costa Rica
- ☐ Cote d'Ivoire
- ☐ Croatia
- ☐ Cuba
- ☐ Curacao



- ☐ Cyprus
- ☐ Czech Republic
- ☐ Denmark
- ☐ Djibouti
- ☐ Dominica
- ☐ Dominican Republic
- ☐ East Timor
- ☐ Ecuador
- ☐ Egypt
- ☐ El Salvador
- ☐ Equatorial Guinea
- ☐ Eritrea
- ☐ Estonia
- ☐ Ethiopia
- ☐ Fiji
- ☐ Finland
- ☐ France
- ☐ Gabon
- ☐ Gambia
- ☐ Georgia
- ☐ Germany
- ☐ Ghana
- ☐ Greece
- ☐ Grenada
- ☐ Guatemala
- ☐ Guinea
- ☐ Guinea-Bissau
- ☐ Guyana
- ☐ Haiti
- ☐ Holy See
- ☐ Honduras
- ☐ Hong Kong
- ☐ Hungary
- ☐ Iceland
- ☐ India
- ☐ Indonesia
- ☐ Iran

- ☐ Iraq
- ☐ Ireland
- ☐ Israel
- ☐ Italy
- ☐ Jamaica
- ☐ Japan
- ☐ Jordan
- ☐ Kazakhstan
- ☐ Kenya
- ☐ Kiribati
- ☐ Korea, North
- ☐ Korea, South
- ☐ Kosovo
- ☐ Kuwait
- ☐ Kyrgyzstan
- ☐ Laos
- ☐ Latvia
- ☐ Lebanon
- ☐ Lesotho
- ☐ Liberia
- ☐ Libya
- ☐ Liechtenstein
- ☐ Lithuania
- ☐ Luxembourg
- ☐ Macau
- ☐ Macedonia
- ☐ Madagascar
- ☐ Malawi
- ☐ Malaysia
- ☐ Maldives
- ☐ Mali
- ☐ Malta
- ☐ Marshall Islands
- ☐ Mauritania
- ☐ Mauritius
- ☐ Mexico
- ☐ Micronesia

- ☐ Moldova
- ☐ Monaco
- ☐ Mongolia
- ☐ Montenegro
- ☐ Morocco
- ☐ Mozambique
- ☐ Namibia
- ☐ Nauru
- ☐ Nepal
- ☐ Netherlands
- ☐ Netherlands Antilles
- ☐ New Zealand
- ☐ Nicaragua
- ☐ Niger
- ☐ Nigeria
- ☐ North Korea
- ☐ Norway
- ☐ Oman
- ☐ Pakistan
- ☐ Palau
- ☐ Palestinian Territories
- ☐ Panama
- ☐ Papua New Guinea
- ☐ Paraguay
- ☐ Peru
- ☐ Philippines
- ☐ Poland
- ☐ Portugal
- ☐ Qatar
- ☐ Romania
- ☐ Russia
- ☐ Rwanda
- ☐ Saint Kitts and Nevis
- ☐ Saint Lucia
- ☐ Saint Vincent and the Grenadines
- ☐ Samoa
- ☐ San Marino

- ☐ Sao Tome and Principe
- ☐ Saudi Arabia
- ☐ Senegal
- ☐ Serbia
- ☐ Seychelles
- ☐ Sierra Leone
- ☐ Singapore
- ☐ Sint Maarten
- ☐ Slovakia
- ☐ Slovenia
- ☐ Solomon Islands
- ☐ Somalia
- ☐ South Africa
- ☐ South Korea
- ☐ South Sudan
- ☐ Spain
- ☐ Sri Lanka
- ☐ Sudan
- ☐ Suriname
- ☐ Swaziland
- ☐ Sweden
- ☐ Switzerland
- ☐ Syria
- ☐ Taiwan
- ☐ Tajikistan
- ☐ Tanzania
- ☐ Thailand
- ☐ Timor-Leste
- ☐ Togo
- ☐ Tonga
- ☐ Trinidad and Tobago
- ☐ Tunisia
- ☐ Turkey
- ☐ Turkmenistan
- ☐ Tuvalu
- ☐ Uganda
- ☐ Ukraine

- ☐ United Arab Emirates
- ☐ United Kingdom
- ☐ United States of America
- ☐ Uruguay
- ☐ Uzbekistan
- ☐ Vanuatu
- ☐ Venezuela
- ☐ Vietnam
- ☐ Yemen
- ☐ Zambia
- ☐ Zimbabwe
- ☐ Option 207

**3. Are you primarily a modeler or an experimentalist \***

*Mark only one oval.*

- ☐ Modeler      *Skip to question 4.*
- ☐ Experimentalist      *Skip to question 13.*

*Skip to question 4.*

## Modeler section

**4. What kind of modeling do you do?**

*Check all that apply.*

- ☐ Statistical modeling (including Meta analysis)
- ☐ Mechanistic modeling

**5. What input data are you using to parameterize your models**

*Check all that apply.*

- ☐ Means and SDs
- ☐ Linear functions
- ☐ Non-linear functions
- ☐ Raw data
- ☐ Categorical data
- ☐ Other: .....

**6. What data would be ideal for you to use in your models?**

If you would have the choice, what data would you want to access and use?

*Check all that apply.*

- ☐ Means and SDs
- ☐ Linear functions
- ☐ Non-linear functions
- ☐ Raw data
- ☐ Categorical data
- ☐ Other: .....

**7. From your experience, how easy is it to gain access to data?**

*Mark only one oval.*

	1	2	3	4	5	
very hard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	very easy

**8. From where do you get your input data?**

*Check all that apply.*

- ☐ Colleagues
- ☐ Scientific articles
- ☐ Electronic appendix of scientific articles
- ☐ Public databases
- ☐ Other: .....

**9. Which data repositories do you use?**

You can add several answers to the "Other" field.

*Check all that apply.*

- ☐ Dryad
- ☐ Pangaea
- ☐ none
- ☐ Other: .....

**10. What is your main source of experimental ideas/hypotheses?***Mark only one oval.*

- ☐ Your own previous research
- ☐ Experimental studies
- ☐ Reviews
- ☐ Modeling articles
- ☐ Conference presentations
- ☐ Discussions with colleagues
- ☐ Other: .....

**11. Where do you think the problem between experimentalist and modelers arises?**

(e.g. communication, different type of questions/hypotheses, need to design a 1:1 experiment with model, ...)?

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**12. Do you have any other comments on the communication between modelers and experimentalists?**

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*Stop filling out this form.***Experimentalist section**

**13. What is your main source of experimental ideas/hypotheses?***Mark only one oval.*

- ☐ Your own previous research
- ☐ Other experimental studies
- ☐ Reviews
- ☐ Modeling articles
- ☐ Conference presentations
- ☐ Discussions with colleagues
- ☐ Other: .....

**14. Roughly, what percentage of your scientific reading consists of modeling based articles?**

.....

**15. What is your main difficulty (if any) regarding modeling papers?***Check all that apply.*

- ☐ No difficulties
- ☐ Unclear assumptions
- ☐ Difficult language
- ☐ Methodology difficult to understand
- ☐ Other: .....

**16. How many treatment levels do you typically test in one experiment?**

(for example growth rate at 2 temperature levels)

*Mark only one oval.*

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more

**17. How many factors do you typically simultaneously test in one experiment?**

for example Temperature and Salinity

*Mark only one oval.*

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4 or more



**18. Where and how do you normally share your raw experimental data?***Check all that apply.*

- ☐ Not at all
- ☐ On request by email
- ☐ In the electronic appendix at the journal
- ☐ Public data bases

**19. Are you generally open to the idea of sharing your data?***Check all that apply.*

- ☐ no
- ☐ if its easy
- ☐ if I get acknowledged (citation)
- ☐ Other: .....

**20. Where do you think the problem between experimentalist and modelers arises?**

(e.g. communication, different type of questions/hypotheses, need to design a 1:1 experiment with model, ...)?

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**21. Do you have any other comments on the communication between modelers and experimentalists?**

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## Appendix 3

This appendix is a separate Excel-file with more information about the participants and their answers to the questionnaire.