National Oceanography Centre

UNIVERSITY OF PLYMOUTH

Perceptions and experiences in zooplankton taxonomy, identification, and monitoring

The National Oceanographic Center (UK) and the University of Plymouth (UK) are conducting research on perceptions and experiences around zooplankton taxonomy, identification, and monitoring. You are invited to participate in this research project because you work with zooplankton taxonomy, identification, or monitoring.

Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized and your data will not be used.

The procedure involves filling an online survey of 36 questions that will take approximately 10 minutes. Your responses will be confidential and we do not collect identifying information such as your name or email address. The survey questions will be about your perceptions and experiences in zooplankton taxonomy, identification, and monitoring.

Your information will be kept confidential. To help protect your confidentiality, the survey will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with representatives of University of Plymouth and the National Oceanographic Center.

If you have any questions about the research study, please contact Sari Giering at s.giering@noc.ac.uk or Abigail McQuatters-Gollop at Abigail.mcquatters-gollop@plymouth.ac.uk.

This research has been reviewed according to the National Oceanographic Center's ethics procedures.

I confirm that I have read and agree to the survey conditions. *

○ I agree.

Have you got experience in zooplankton taxonomy/identification/monitoring? *

- ○ Yes
- ○ No

Section 1 - About you

1-1. Which age range do you belong to? *

- ○ 18-29
- ○ 30-39
- ○ 40-49
- ○ 50-59
- ○ Over 60

1-2. Which gender do you identify with? *

- ○ Woman
- ○ Man
- ○ Other / prefer not to say

1-4. What is the highest level of education you have achieved? *

- ○ Primary school
- ○ High school or secondary school
- ○ Certificate or diploma
- ○ Tertiary or Bachelor degree
- ○ Postgraduate (MSc, PhD, etc)

Section 2 - Zooplankton taxonomy qualification and experience

This section explores your qualifications and experience in working in zooplankton taxonomy/identification/monitoring.

2-1. How long have you professionally worked in zooplankton taxonomy/identification/monitoring (including during your MSc and PhD)? *

- ○ < 5 years
- ○ 5-10 years
- ○ 10-20 years
- ○ > 20 years

2-2. Which of the below best reflects how regularly you engage in zooplankton taxonomic identification training (e.g. courses, workshops, ring trials, etc)? *

- ○ Never
- ○ Not since my initial training
- ○ Occasionally (once every 1-5 years)
- ○ Regularly (once per year)
- ○ Often (>1 time per year)

2-3. In your opinion, which of the options of the below scale best reflects your current perceived level of zooplankton taxonomy/identification/monitoring expertise? *

- ○ 1 - Novice
- ○ 2 - Competent
- ○ 3 - Intermediate
- ○ 4 - Advanced
- ○ 5 - Expert

2-4. Which type(s) of zooplankton samples do you work with? *

- ○ physical samples (e.g. net samples, CPR samples)
- ○ image samples (e.g. camera system, UVP)
- ○ both

2-5. In your opinion, what level of correct zooplankton identification (accuracy) do you think a human zooplankton taxonomic expert can achieve? *

- ○ 90-100%
- ○ 80-90%
- ○ 70-80%
- ○ 50-70%
- ○ less than 50%

Section 3 - Experience in imaging and artificial intelligence/machine learning

This section will explore your experience and perceptions around using imaging tools and artificial intelligence (AI) and machine learning (ML) to analyse zooplankton image data. For the following questions, please consider imaging and AI/ML separately.

For this survey, please consider the following definitions:

Imaging: Collection of images of zooplankton as data, e.g. use of camera system, development of instrument; also includes use of images as produced by the system, etc.

AI/ML: Use of computer algorithms to analyze images, e.g. classification algorithms, training data sets, evaluation metrics, etc.

3-1. How long have you used imaging for zooplankton taxonomy/identification/monitoring (including during your MSc and/or PhD)? *

- ○ < 5 years
- ○ 5-10 years
- ○ 10-20 years
- ○ > 20 years

3-2. Which of the below options best reflects how regularly you engage in zooplankton imaging training (e.g. courses, workshops, etc)? *

- ○ Never
- ○ Not since my initial training
- ○ Occasionally (once every 1-5 years)
- ○ Regularly (once per year)
- ○ Often (>1 time per year)

3-3. In your opinion, which of the options on the below scale best reflects your current perceived level of imaging expertise for zooplankton taxonomy/identification/monitoring? *

- ○ 1 - Novice
- ○ 2 - Competent
- ○ 3 - Intermediate
- ○ 4 - Advanced
- ○ 5 - Expert

3-4. Which zooplankton imaging systems do you use? *

- ☐ CPICS
- ☐ ISIIS
- ☐ HoloSea
- ☐ LISST-Holo
- ☐ LOKI
- ☐ Plankton Imager
- ☐ SIPPER
- ☐ UVP
- ☐ VPR
- ☐ FlowCam Macro
- ☐ None
- ☐ _____

3-5. How long have you used artificial intelligence/machine learning (including during your MSc and/or PhD)? *

- ○ < 5 years
- ○ 5-10 years
- ○ 10-20 years
- ○ > 20 years

3-6. Which of the below options best reflects how regularly you engage in artificial intelligence/machine learning training (e.g. courses, workshops, etc)? *

- ○ Never
- ○ Not since my initial training
- ○ Occasionally (once every 1-5 years)
- ○ Regularly (once per year)
- ○ Often (>1 time per year)

3-7. In your opinion, which of the below best reflects your current perceived level of expertise about the artificial intelligence/machine learning aspect of zooplankton image identification? *

- ○ 1 - Novice
- ○ 2 - Competent
- ○ 3 - Intermediate
- ○ 4 - Advanced
- ○ 5 - Expert

Section 4a - Taxonomic potential of imaging

The following questions are not tailored to your favourite or familiar imaging system. Instead, they are about your perceptions of whether - with the appropriate imaging system - the level of zooplankton taxonomy noted below can be resolved.

4a-1. In your opinion, for copepods, using images generated from an appropriate imaging system, what is the highest level of taxonomic resolution an artificial intelligence/machine learning algorithm can positively identify? *

- ○ It is a copepod
- ○ Family
- ○ Genus
- ○ Species
- ○ Don't know

4a-2. Is your above answer most influenced by your understanding of: *

- ○ The image quality
- ○ The capability of artificial intelligence/machine learning
- ○ Equally both
- ○ Don’t know

4a-3. In your opinion, for gelatinous zooplankton, using images generated from an appropriate imaging system, what is the highest level of taxonomic resolution an artificial intelligence/machine learning algorithm can positively identify? *

- ○ It is a gelatinous zooplankton
- ○ Family
- ○ Genus
- ○ Species
- ○ Don't know

4a-4. Is your above answer most influenced by your understanding of: *

- ○ The image quality
- ○ The capability of artificial intelligence/machine learning
- ○ Equally both
- ○ Don’t know

4a-5. In your opinion, what level of correct zooplankton identification (accuracy) do you think an artificial intelligence/machine learning algorithm can achieve? *

- ○ 90-100%
- ○ 80-90%
- ○ 70-80%
- ○ 50-70%
- ○ less than 50%
- ○ Don't know

4a-6. What is your level of trust in current zooplankton training data sets? *

- ○ Very low
- ○ Low
- ○ Moderate
- ○ High
- ○ Very high
- ○ Don't know

Section 4b - Potential of imaging for zooplankton research

Please indicate how much you agree or disagree with the following statements about zooplankton imaging.

4b-1. An image of a zooplankton can provide the same information as a physical sample.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4b-2. An image of a zooplankton can provide meaningful information for environmental monitoring.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4b-3. In situ imaging has some clear advantages over net samples.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4b-4. Physical samples are preferable over images in most cases.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4b-5. Once technology has evolved sufficiently, long-term time-series can be continued with image samples.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4b-6. For data continuity, we will always require physical plankton samples.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

Section 4c - Potential of AI/ML for zooplankton taxonomy

Please indicate how much you agree or disagree with the following statements about zooplankton imaging.

4c-1. With proper training datasets, AI/ML can learn to taxonomically identify images as well as humans.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4c-2. AI/ML will never be as accurate as human taxonomists at identifying images.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4c-3. AI/ML is unbiased and more reliable than humans at identifying images.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4c-4. Human taxonomists will not be required in future once AI/ML has been trained sufficiently.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4c-5. AI/ML can help to analyze zooplankton data faster than current methods.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○

4c-6. AI/ML is limited in its abilities and will always require human supervision.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Opinion	○	○	○	○	○