

Japanese Activity in collaboration with the international ocean literacy survey

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Abstract

The ocean plays important roles not only in the global climate system but also in the global material cycling through biogeochemical processes, and has close relationships with the daily lives of people through fisheries, marine energy and resources, ocean transportation, marine sports, ocean relaxation activities, and others. The Ocean Literacy movement began in the U.S. in the early 2000s, and has recently become international as shown by the Ocean Literacy Portal website operated by IOC/UNESCO. In Japan, the present national standard course of study at elementary school has not given any room for ocean education while the Oceanographic Society of Japan (JOS) and 34 other academic societies/committees gave a proposal entitled, “On the Setting up of a class named, ‘the role of Ocean’ in the national standard course of study for the 4th grade students in the elementary science education” to the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in April 2016. In the U.S., aiming to serve as a community-based measurement tool that allows the comparison of levels of ocean knowledge across time and location, the International Ocean Literacy Survey (IOLS) project has been started since 2015. Fauville et al. (2018, <https://doi.org/10.1080/13504622.2018.1440381>) published the results from IOLS Version 2, and the English version IOLS Version 4 was finalized after reviewing the English IOLS Version 3 by IOLS Advisory Board consisting of international marine researchers, communicators, teachers, and psychometricians. The English version of the IOLS Version 4 was translated into 14 languages (Catalan, Chilean, Dutch, Greek, Italian, Japanese, Korean, Polish, Portuguese, Simplified Chinese, Spanish, Tagalog, Thai, and Traditional Chinese) and its field testing was conducted during February and March 2019 with nominal 6945 participants worldwide including nominal 567 participants from Japan. In collaboration with IOLS Version 4 field testing, JOS and the Marine Learning Center took part in correcting the original Japanese draft of IOLS Version 4, sponsored IOLS Version 4 field testing, and made a wide campaign to high-school teachers through sending recommendation letters to academic societies and other ocean-related organizations.

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 For a Borderless World of Geoscience
 Japan Geoscience Union, American Geophysical Union

OCEAN LITERACY - SUMMARY

[VIDEO] <https://www.youtube.com/embed/MNXqOuXg9g4?feature=oembed&fs=1&modestbranding=1&rel=0&showinfo=0>
Ocean Literacy – Summary (<http://oceanliteracy.wp2.coexploration.org/>) from College of Exploration

2. INTERNATIONAL OCEAN LITERACY SURVEY (IOLS) PROJECT

In the U.S., aiming to serve as a community-based measurement tool that allows the comparison of levels of ocean knowledge across time and location, the International Ocean Literacy Survey (IOLS) project (<https://www.geraldinefauville.com/international-ocean-literacy-survey>) has been started since 2015. Fauville et al. (2019) (<https://doi.org/10.1080/13504622.2018.1440381>) published the results from IOLS Version 2, and the English version IOLS Version 4 was finalized after reviewing the English IOLS Version 3 by IOLS Advisory Board consisting of international marine researchers, communicators, teachers, and psychometricians.

The English version of the IOLS Version 4 was translated into 14 languages (Catalan, Chilean, Dutch, Greek, Italian, Japanese, Korean, Polish, Portuguese, Simplified Chinese, Spanish, Tagalog, Thai, and Traditional Chinese) and its field testing was conducted during February and March 2019 with nominal 6945 participants worldwide including nominal 567 participants from Japan.

Using the US data of the IOLS Version 4 field testing, Chen et al. (2020) (https://static1.squarespace.com/static/5970e07ad2b857f9aa5f153f/t/5dbb5b027bb30152d476edce/1572559620727/IOLS+EN_AERA2020) presented the question system of the IOLS Version 4 as a measurement tool of ocean literacy with Rasch measurement model, and reported their results at the American Educational Research Association (AERA) annual meeting. They concluded that the English version of the IOLS is a psychometrically sound instrument with good measurement properties including internal consistency reliability, construct validity, goodness of fit structure, item level characteristics, and absence of gender DIF.

1. OCEAN LITERACY MOVEMENT IN THE WORLD

The grass roots movement for Ocean Literacy started in 2002 in the United States with concerned scientists, and formal and informal educators raising their voices to include ocean sciences in the school curriculum. This resulted in a two-week online workshop and extensive follow-up dialogue between hundreds of U.S. ocean sciences and education stakeholders in 2004 (Fauville et al., 2019 (<https://doi.org/10.1080/13504622.2018.1440381>)).

This community discussion process resulted in seven overarching ideas called the essential principles of Ocean Literacy (watch 'Ocean Literacy - Summary' Video in this poster) and 44 fundamental concepts (In the 2013 revision, an additional concept was added, resulting in the total of 45) that elaborate each principle.

Supported by Intergovernmental Oceanographic Commission (IOC) of UNESCO, Santoro et al. (2018) (<https://unesdoc.unesco.org/ark:/48223/pf0000260721>) published a book entitled by 'Ocean literacy for all: a toolkit', and IOC/UNESCO began operating the Ocean Literacy Portal (<https://oceanliteracy.unesco.org/home/>) website in 2018.

In Japan, in order to promote the ocean education in the national standard course of study at schools, the ocean education group was established in the oceanographic society of Japan (JOS) (<https://kaiyo-gakkai.jp/jos/en/>) in 2003. Responding with the ocean literacy movement in the US, the group started the ocean science café twice a year in 2008, investigated the Ocean Literacy in Japan in 2007-2009, and changed its name as Ocean Literacy and Education Panel (<http://jos-edu.jp/>) (OLEP) in 2010.

JOS and 34 other academic societies/committees gave a proposal entitled, "On the Setting up of a class named, 'the role of Ocean' in the national standard course of study for the 4th grade students in the elementary science education" to the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in April 2016.

The NPO Marine Learning Center (<https://www.marinelearning.org/mare/index.html>) (MLC) was established in 2005 to deal with research on oceans as well as to promote marine/ocean science education in Japan. As one of its activities, the MLC has disseminated the Marine Activities, Resources, and Education (MARE) developed at Lawrence Hall of Science, University of California, Berkeley (<https://www.lawrencehallofscience.org/>).

The Ocean Policy Research Institute (OPRI), (<https://www.spf.org/en/opri/profile/>) The Sasakawa Peace Foundation, established in 1975 at first as the Japan Foundation for Shipbuilding Advancement, began promoting the ocean education in Japan under the name of the Ocean Policy Research Foundation in 2005-2015 with strong collaboration with high-school teachers and educational researchers and ocean scientists in universities.

3. IOLS VER.4 FIELD TESTING IN JAPAN

In Fall of 2018, the Marine Learning Center sent a letter to JOS requesting an official support for promoting IOLS Version 4 project in Japan. JOS accepted the proposal as considering that IOLS is expected to help much promoting the ocean literacy in Japan, and officially sponsored IOLS Version 4 field testing together with the Marine Learning Center. In January 2019, members of the Marine Learning Center and OLEP/JOS worked hard in correcting the original Japanese draft of IOLS Version 4.

In February 2019, IOLS Version 4 started worldwide, and JOS sent the invitation letter to several tens organizations such as JpGU and other academic societies of various kinds of ocean science research, societies of science educators, and associations of museum, aquarium, and zoo. JOS opened a website and show public the background of IOLS Version 4. The Marine Learning Center also opened a website and show high-school teachers a guide for participation to IOLS Version 4 field testing.

On the day of the first dead line of IOLS Version 4 field testing, the nominal number of participants in the Japanese version of IOLS Version 4 reached 567.

4. WHAT WE LEARN FROM IOLS VER.4 FIELD TESTING IN JAPAN -PRELIMINARY REPORT-

We analyzed the data obtained by the Japanese version of IOLS Version 4 field testing conducted during February and March in 2019, and provided by the organizer. While the nominal number of participants was 567, the cleaned total number of participants is 469. The total number of questions in the original data was 86 in which 41 questions request selecting one from 4 options, and another 45 questions request answering false or true. In this study, we analyzed answers to the same questions as adjusted by Chen et al. (2020) (https://static1.squarespace.com/static/5970e07ad2b857f9aa5f153f/t/5dbb5b027bb30152d476edce/1572559620727/IOLS+EN_AERA2020) in which 40 questions (Q1-40) request selecting one from 4 options, and another 42 questions (Q41-82) request answering false or true. The list of questions and answers are shown in Chen et al. (2020) (https://static1.squarespace.com/static/5970e07ad2b857f9aa5f153f/t/5dbb5b027bb30152d476edce/1572559620727/IOLS+EN_AERA2020). From the data of 469 (cleaned) persons, the data of 7 persons are rejected in this report because they answered to none of the questions.

While we made many works for promoting the field testing, participants are living in the limited 19 out of 47 prefectures (Fig. 3). Figure 4 shows that participants are learning or working mainly in the high-schools which had fisheries course in its origin (Fig. 4), suggesting that the education for ocean literacy is not attractive for students and teachers at the general high-schools. However, it gives us hope that 154 persons learning or working in the high-schools without ocean-relating course participated the IOLS field testing.

It should be emphasized that only 378 (81.8 %) out of 462 respondents answered all 82 questions (Fig. 5). The correct answer ratio, the percentage of persons who selected correct answer out of all persons who responded to the same question, may indicate what question many respondents do not understand well. From Fig. 8, five questions in Q1-40 and three questions in Q41-82 are identified to have relatively low correct answer ratio. These give us what item we should focus on in the ocean education. The number of persons who selected no answer to individual question shown in Fig. 9 may indicate the reason why respondent selects no answer to some questions, which should be elucidated in future study.

AUTHOR INFORMATION

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See his private website: <https://hiroichiweb.jimdofree.com/top-page-in-english/> (<https://hiroichiweb.jimdofree.com/top-page-in-english/>)

ABSTRACT

The ocean plays important roles not only in the global climate system but also in the global material cycling through biogeochemical processes, and has close relationships with the daily lives of people through fisheries, marine energy and resources, ocean transportation, marine sports, ocean relaxation activities, and others. The Ocean Literacy movement began in the U.S. in the early 2000s, and has recently become international as shown by the Ocean Literacy Portal website operated by IOC/UNESCO. In Japan, the present national standard course of study at elementary school has not given any room for ocean education while the Oceanographic Society of Japan (JOS) and 34 other academic societies/committees gave a proposal entitled, “On the Setting up of a class named, ‘the role of Ocean’ in the national standard course of study for the 4th grade students in the elementary science education” to the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in April 2016. In the U.S., aiming to serve as a community-based measurement tool that allows the comparison of levels of ocean knowledge across time and location, the International Ocean Literacy Survey (IOLS) project has been started since 2015. Fauville et al. (2018, <https://doi.org/10.1080/13504622.2018.1440381>) published the results from IOLS Version 2, and the English version IOLS Version 4 was finalized after reviewing the English IOLS Version 3 by IOLS Advisory Board consisting of international marine researchers, communicators, teachers, and psychometricians. The English version of the IOLS Version 4 was translated into 14 languages (Catalan, Chilean, Dutch, Greek, Italian, Japanese, Korean, Polish, Portuguese, Simplified Chinese, Spanish, Tagalog, Thai, and Traditional Chinese) and its field testing was conducted during February and March 2019 with nominal 6945 participants worldwide including nominal 567 participants from Japan. In collaboration with IOLS Version 4 field testing, JOS and the Marine Learning Center took part in correcting the original Japanese draft of IOLS Version 4, sponsored IOLS Version 4 field testing, and made a wide campaign to high-school teachers through sending recommendation letters to academic societies and other ocean-related organizations.

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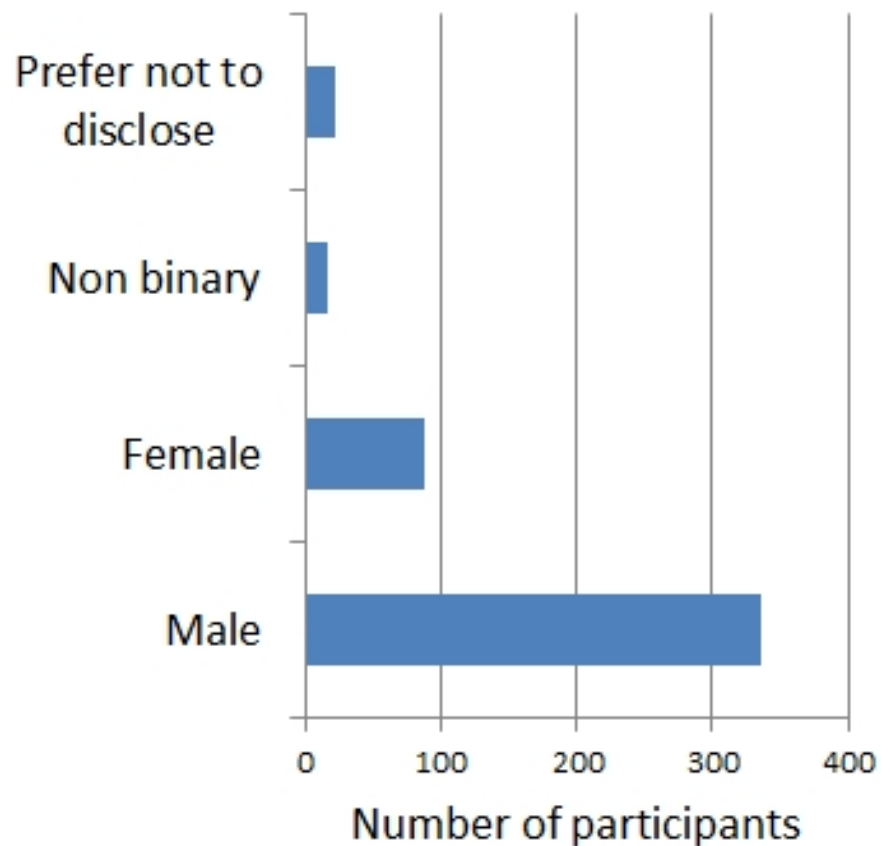


Fig. 1 Gender distribution of participants

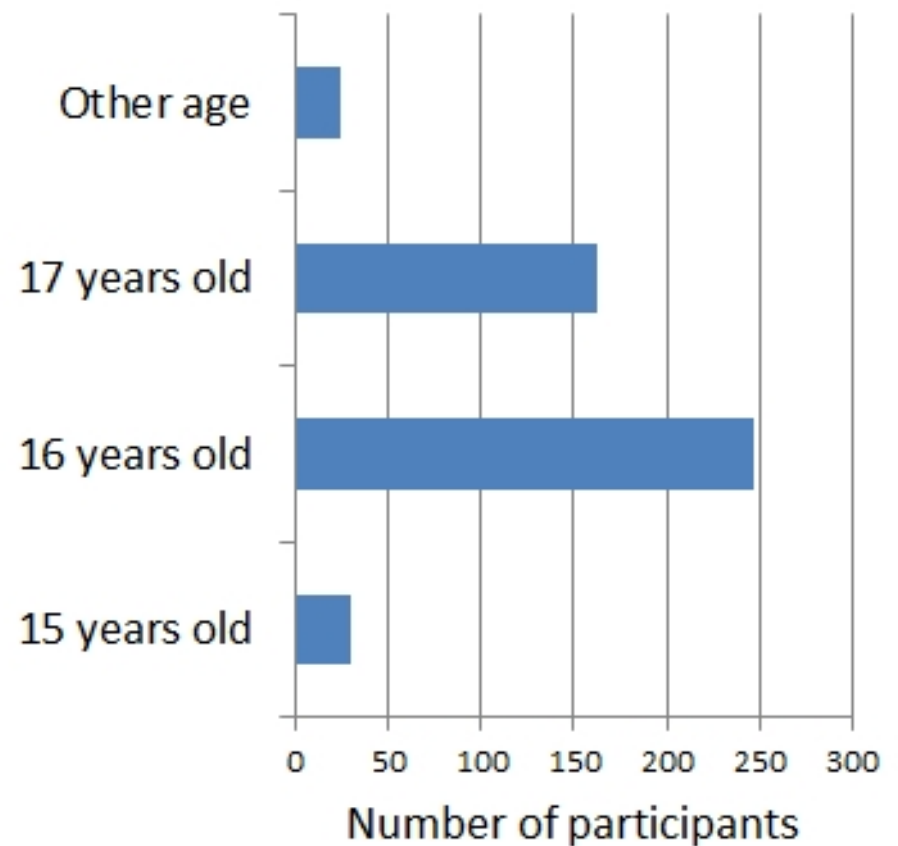


Fig. 2 Age distribution of participants

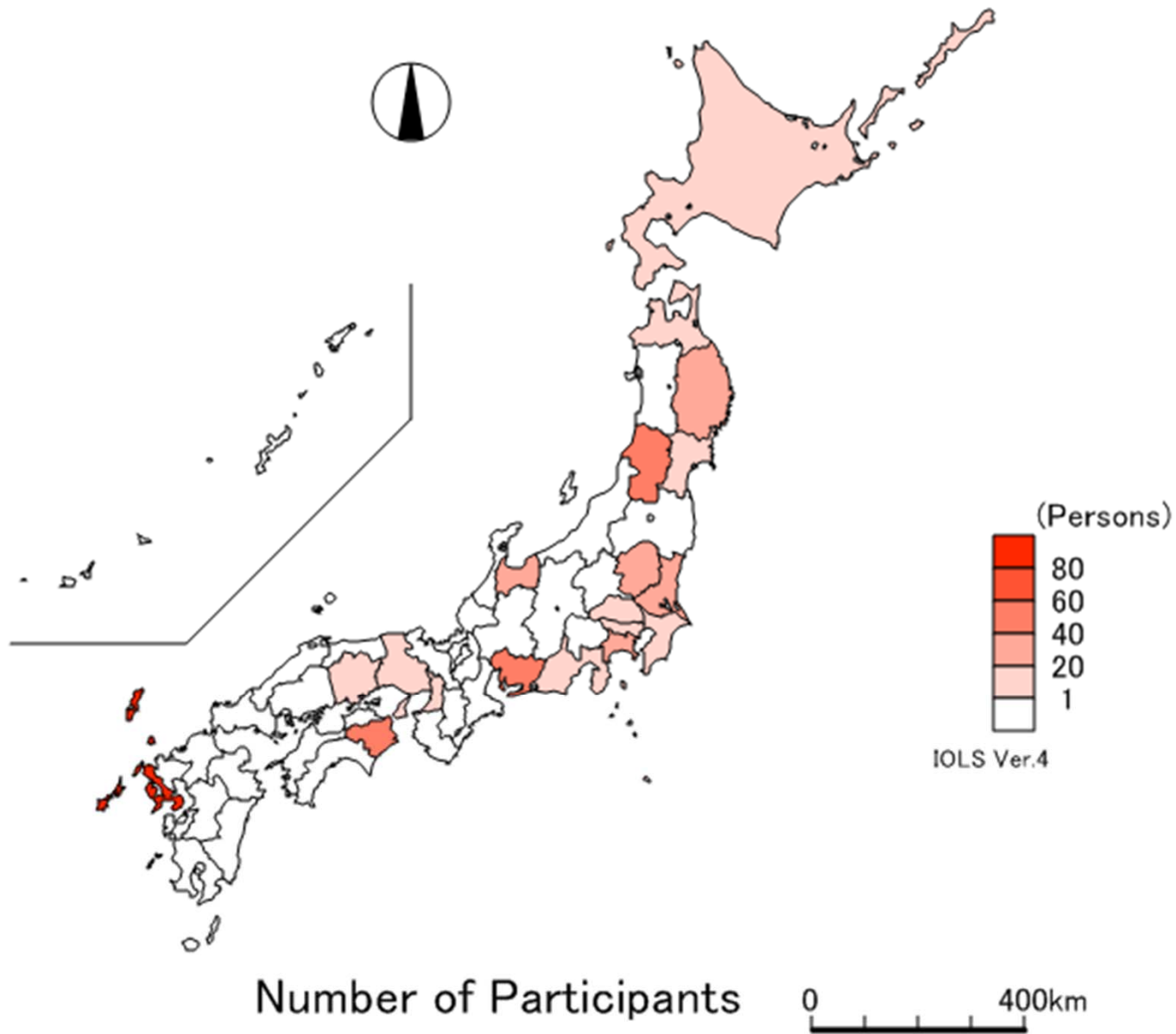


Fig. 3 Participants from each of 19 prefectures.

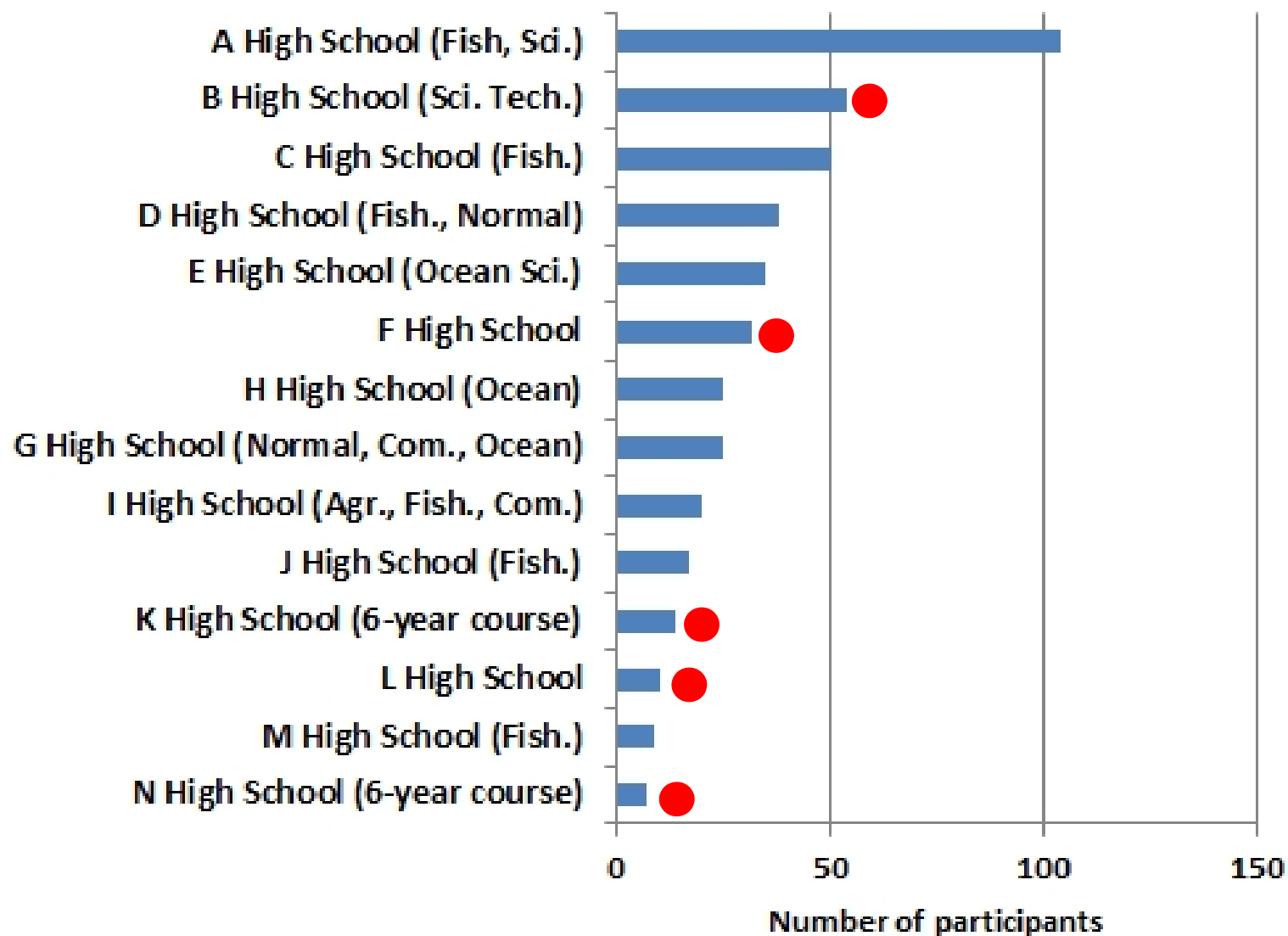


Fig. 4 Participants from each of top 14 high-schools. Red circle indicates the high-school not established for fisheries education in the beginning.

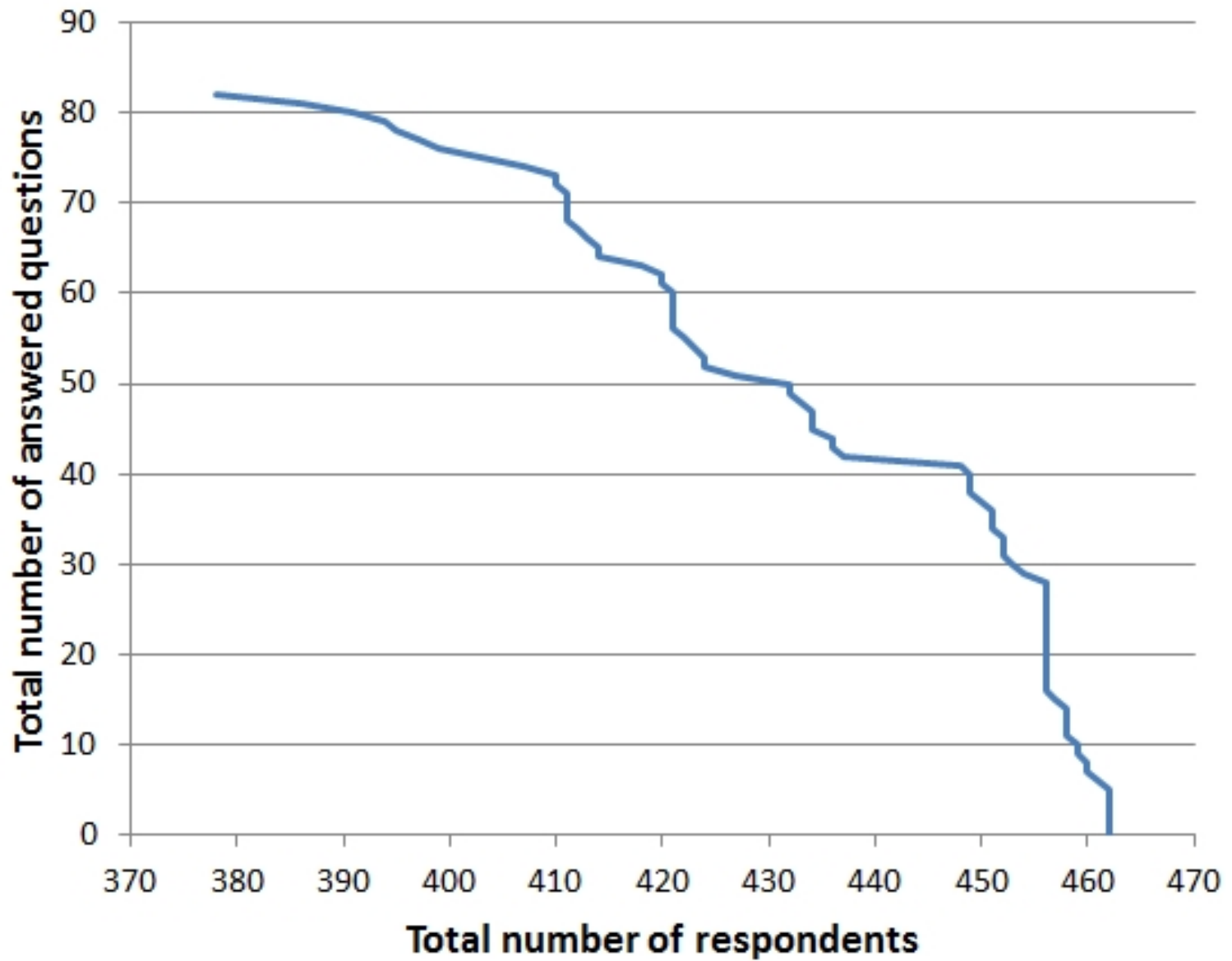


Fig. 5 Total number of questions answered by respondents. Only 378 out of 462 respondents answered all 82 questions.

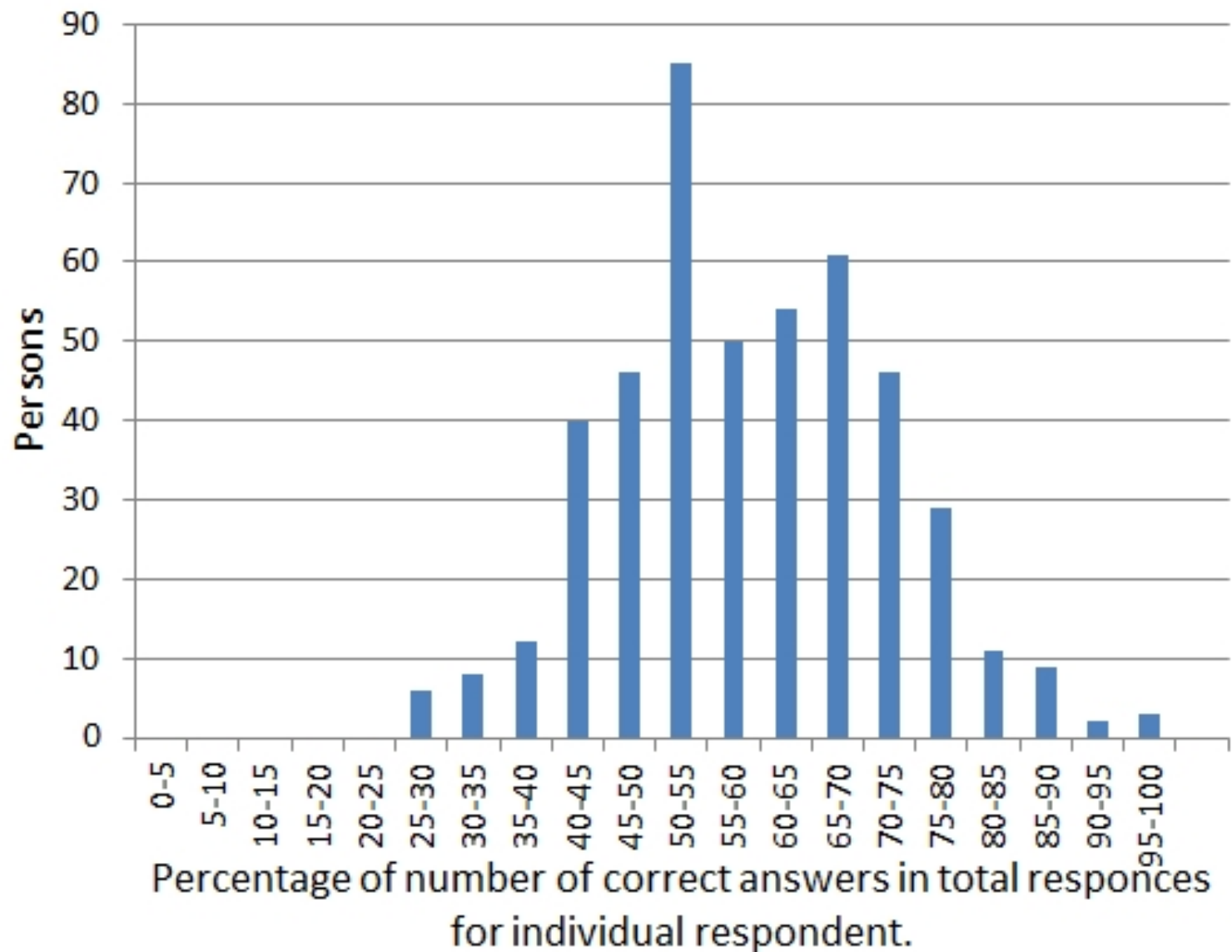


Fig. 6 Histogram of percentage of number of questions which respondents selected correct answers. 86 persons selected correct answer in 50-55 % of questions they responded (not all).

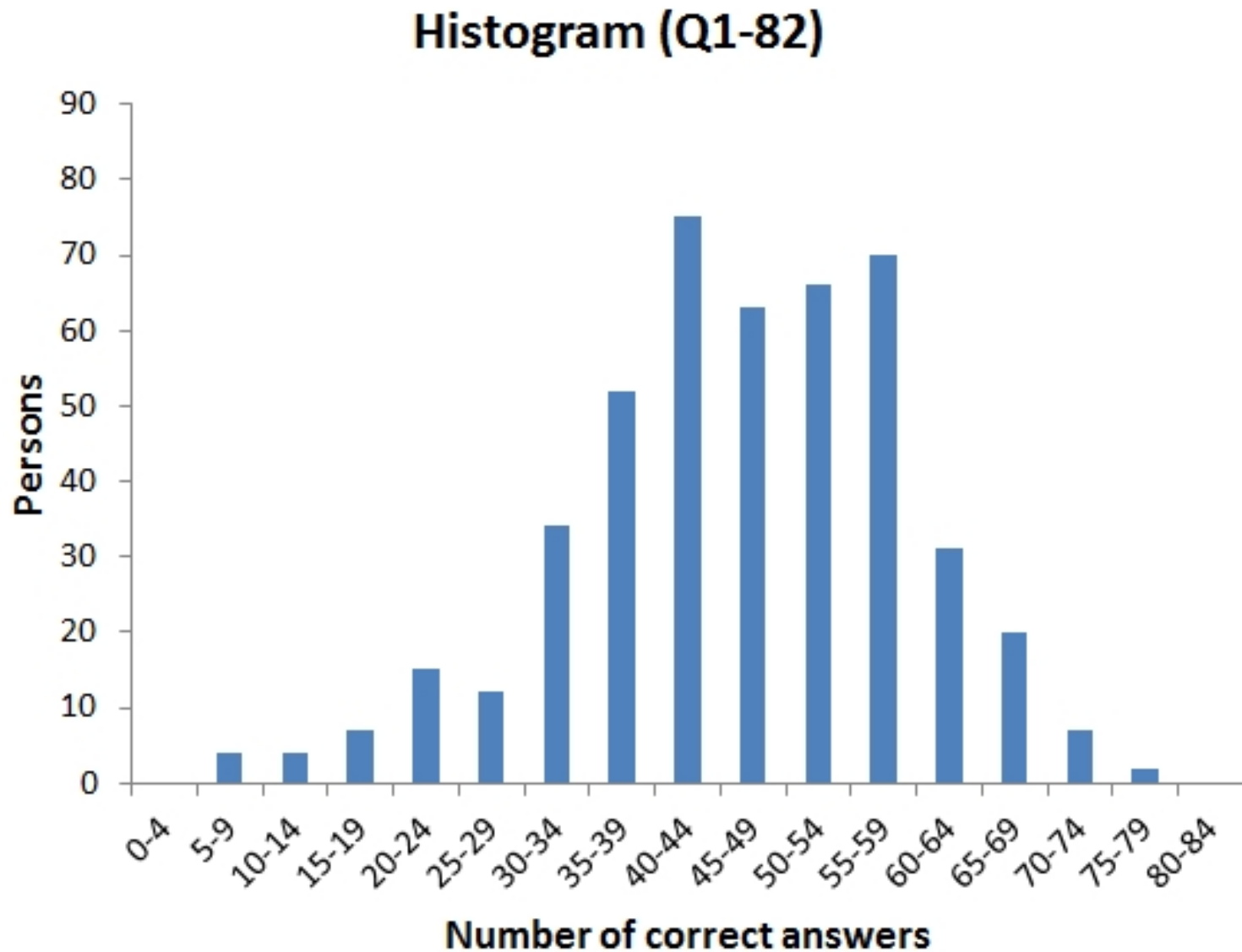


Fig. 7a Histogram of number of questions which respondents selected correct answer.

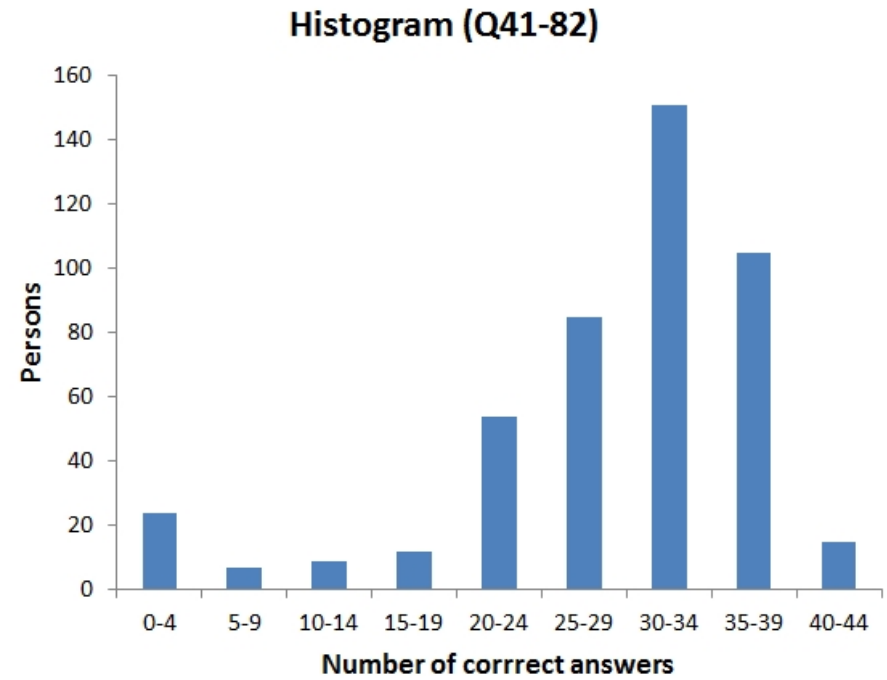
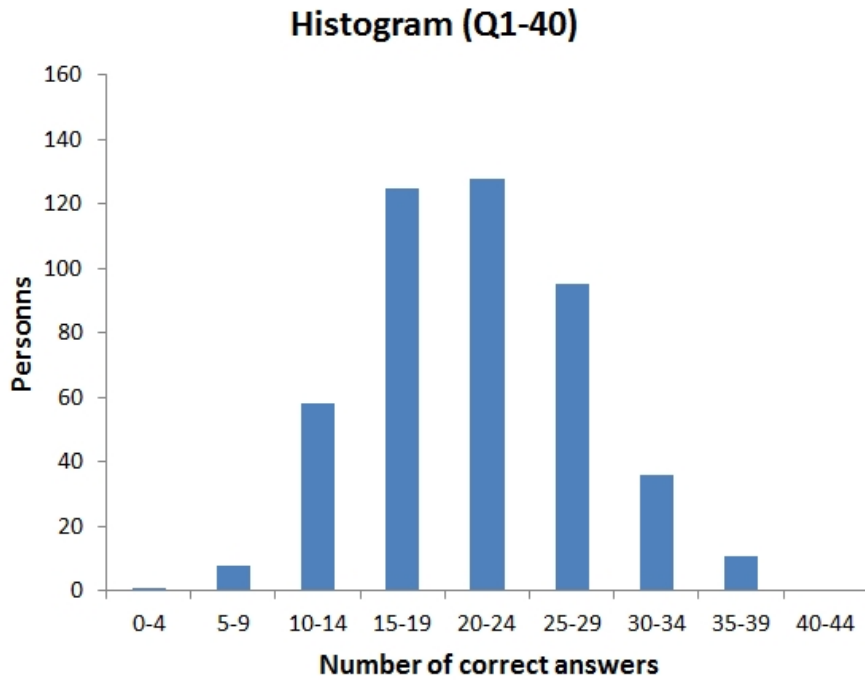


Fig. 7b Histogram of number of questions which respondents selected correct answer in Q1-40 (left) and Q41-82 (right).

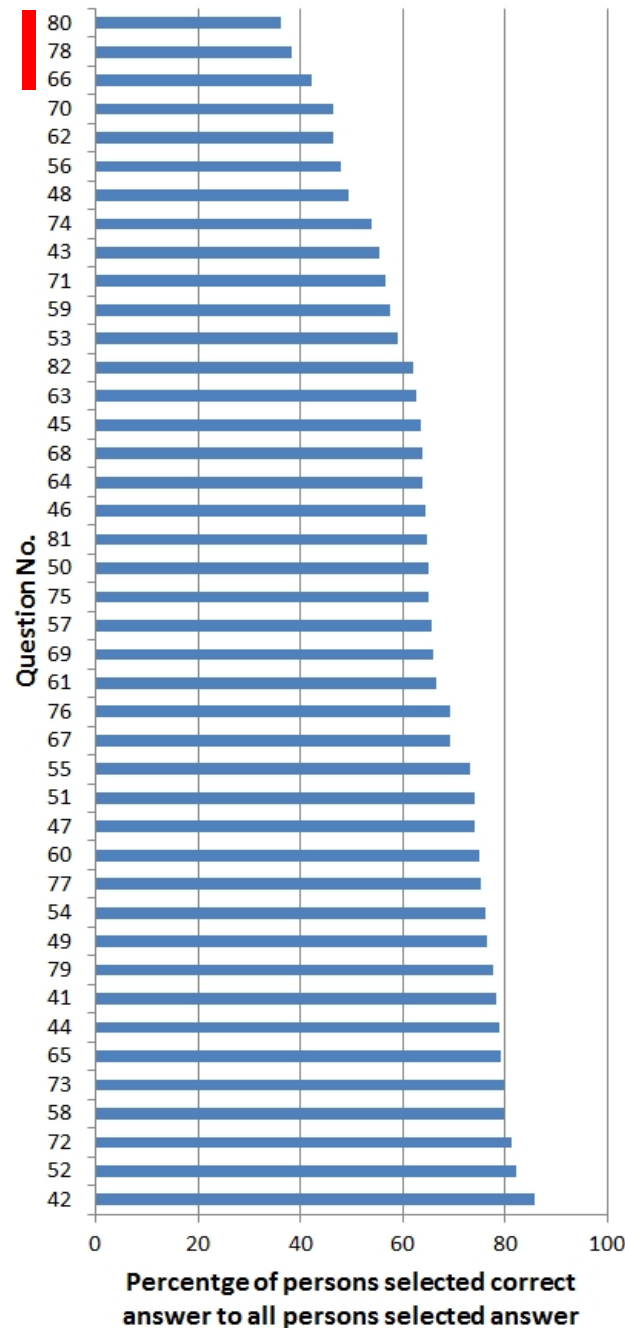
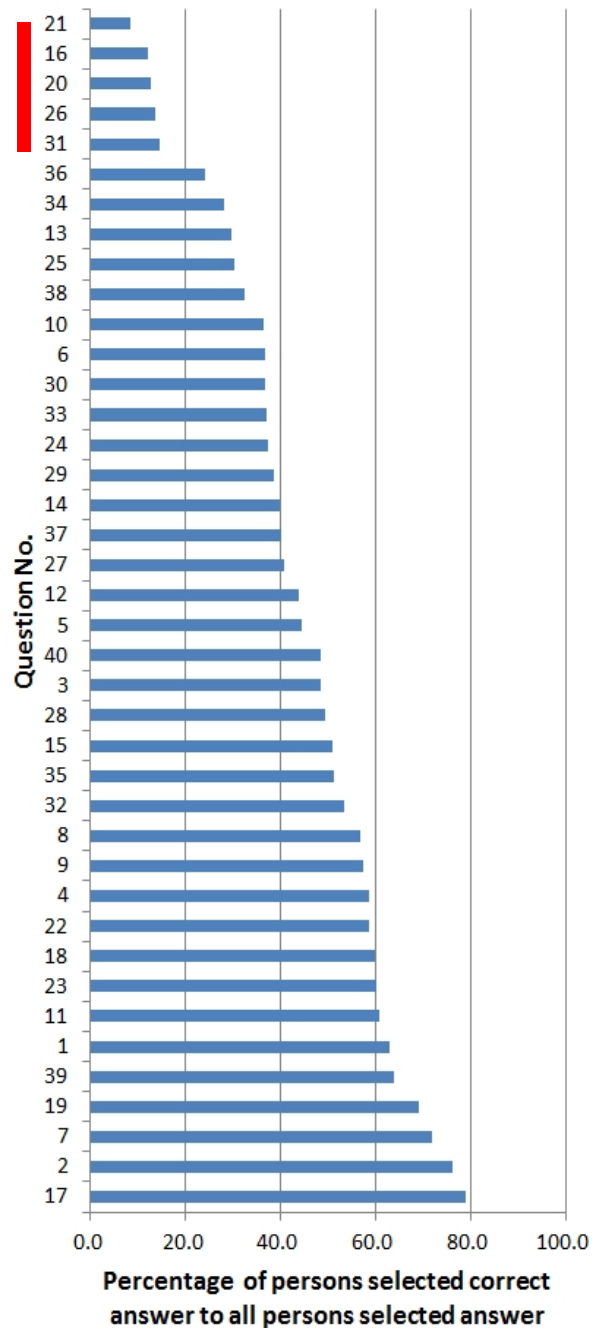


Fig. 8 Question numbers of Q1-40 (left) and Q41-82 (right) sorted by the correct answer ratio, the percentage of persons who selected correct answer out of all persons who responded to the question.

Answers to the five questions with lowest correct answer ratio in Q1-40 (No. 1)

O21 Both land and ocean provide space for organisms to live. How much of Earth's living space is found in the ocean?

- 54: Only a little bit (less than 10%).
- 151: About half (40–60%).
- 209: More than half (60–80%).
- 38: Nearly all (more than 90%).**
- 10: No response.

O16 Where did most of the oxygen in the atmosphere originally come from?

- 48: Released into the atmosphere by volcanos erupting.
- 69: From interstellar gases when the Earth was first formed.
- 281: Released during photosynthesis by land plants.
- 55: Released during photosynthesis by marine organisms.**
- 9: No response.

Answers to the five questions with lowest correct answer ratio in Q1-40 (No. 2)

O20 There are over 30 major groups of organisms (vertebrates, arthropods, molluscs, etc.) on Earth. Where are most of these major groups found?

- 52: Most are found exclusively in the tropical rainforests.
- 234: Most are found on both land and in the ocean.
- 106: About half are found exclusively in the ocean.
- 58: Almost all are found exclusively in the ocean.**
- 12: No response.

O26 Which of the following marine ecosystems is the most important nursery areas for many marine species?

- 240: Coral reefs (reefs formed by living corals).
- 71: The deep sea (more than 100m below the ocean surface).
- 77: The open ocean (away from the shoreline).
- 61: Estuaries (where rivers meet the ocean).**
- 12: No response.

Answers to the five questions with lowest correct answer ratio in Q1-40 (No. 3)

O31 Scientists are discovering that more species than they expected live in the deep sea. These discoveries are only being made now because:

- 98: environmental conditions are causing species to migrate to the deep sea.
- 185: deep sea species evolve more rapidly than shallow water species.
- 95: shallow water species have been overfished.
- 64: scientists are just beginning to explore the deep sea.**
- 20: No response.

Answers to three questions with lowest correct answer ratio in Q41-82

O80 There are different seasons throughout the year because the ocean absorbs much of the heat from the sun.

152: FALSE

268: TRUE

42: No response

O78 People who live near the ocean contribute more to ocean acidification than people who live far from the ocean.

160: FALSE

256: TRUE

46: No response

O66 Humans use the ocean for transportation.

240: FALSE

175: TRUE

47: No response

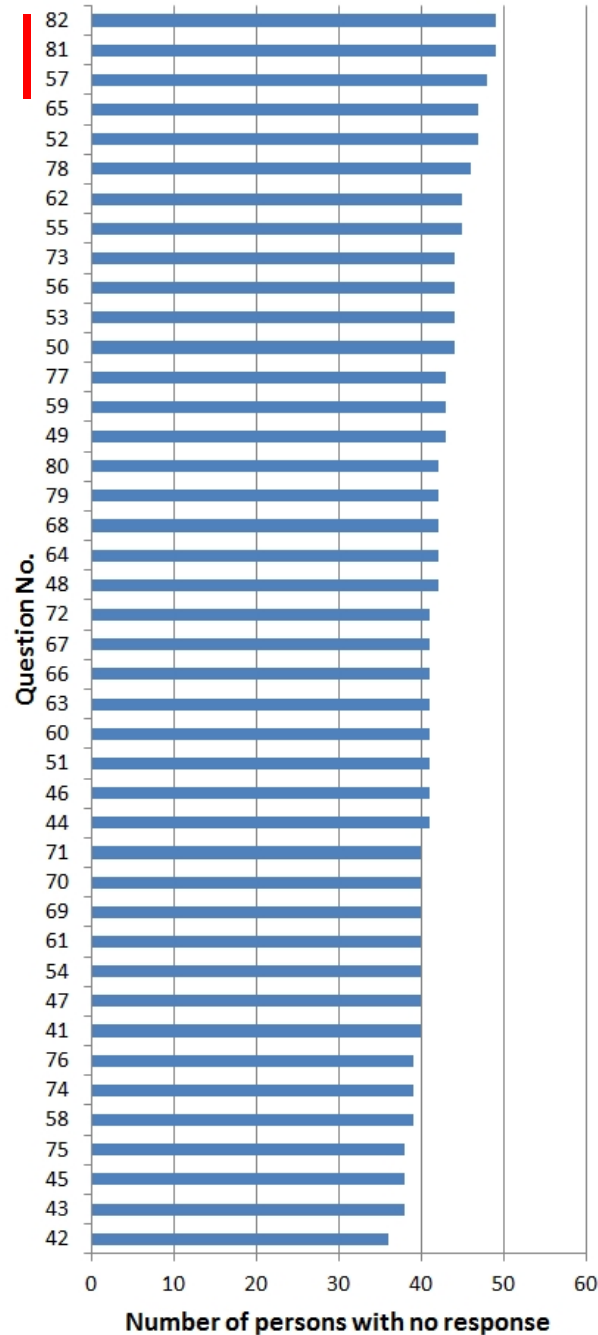
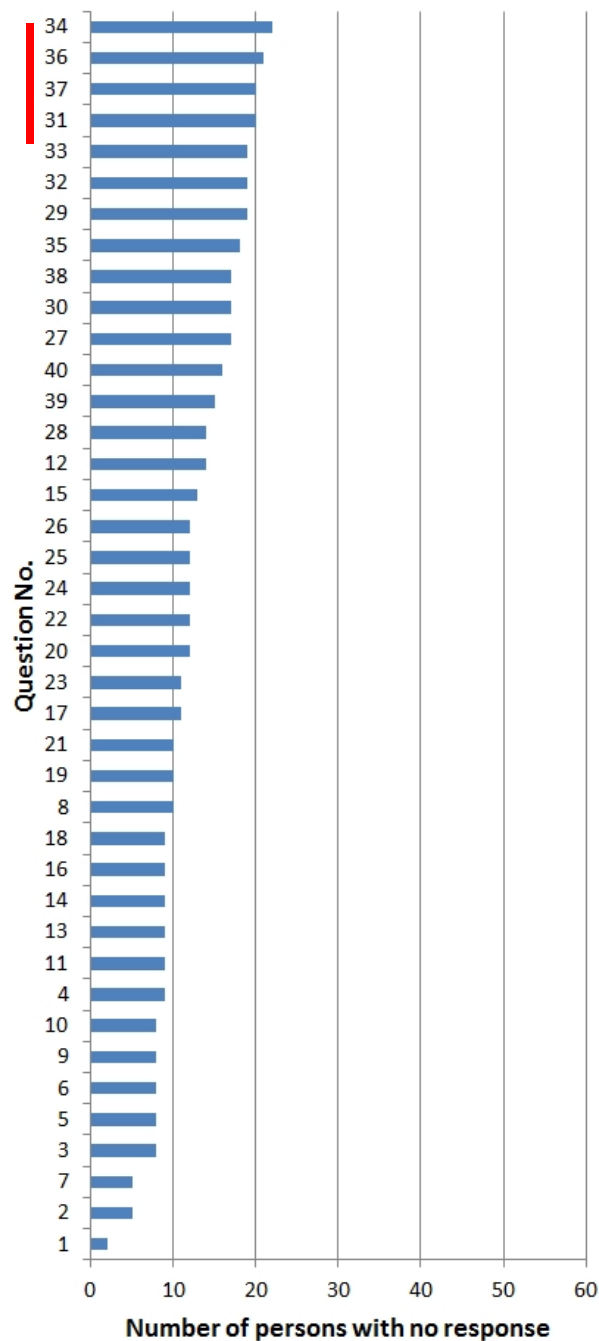


Fig. 9 Question numbers of Q1-40 (left) and Q41-82 (right) sorted by the number of persons who selected no answer. N = 462.

Answers to the four questions with largest number of no response in Q1-40 (No. 1)

O34 Absorption of carbon dioxide (CO₂) by the ocean has a direct influence on which of the following?

106: The greenhouse effect and dead zones in the ocean.

100: Acid rain and harmful algal blooms.

110: Acid rain and ocean acidification.

124: The greenhouse effect and ocean acidification

22: No response.

Answers to the four questions with largest number of no response in Q1-40 (No. 2)

O36 Which of the following is true about ecological relationships in the ocean?

164: They are very similar to those on land, including similar food web, life cycle, and symbiotic relationships.

97: They are mostly unknown since so much of the ocean has not been explored.

73: They are mostly very simple compared to those on land.

107: There are unique features of food webs, life cycles, and symbiotic relationships in the ocean that are not found on land.

21: No response.

Answers to the four questions with largest number of no response in Q1-40 (No. 3)

O37 Which of the following is true concerning the exploration of the ocean?

73: People have been exploring the ocean for thousands of years and most of it has been explored.

93: Almost all of the ocean has been explored in the last 50 years because of new technology.

178: Most of the ocean is still unexplored despite improvements in technology in the last 50 years.

98: Most of the ocean is still unexplored because scientists focus on the areas where most organisms live

20: No response.

Answers to the four questions with largest number of no response in Q1-40 (No. 4)

O31 Scientists are discovering that more species than they expected live in the deep sea. These discoveries are only being made now because:

98: environmental conditions are causing species to migrate to the deep sea.

185: deep sea species evolve more rapidly than shallow water species.

95: shallow water species have been overfished.

64: scientists are just beginning to explore the deep sea.

20: No response.

Answers to the three questions with largest number of no response in Q41-82.

O82 Transfer of heat between the ocean and the atmosphere drives global circulation of water and air and can cause storms around the world.

157: FALSE

256: TRUE

49: No response

O81 The water cycle is powered by the transfer of heat between the ocean and the atmosphere.

146: FALSE

267: TRUE

49: No response

O57 Humans depend on the ocean for nuclear fusion.

272: FALSE

142: TRUE

48: No response