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Promoting marine science: International science camp as a platform

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ABSTRACT

The interest of the general public, especially young people, in ocean and coastal issues is crucial, and yet high school students often do not consider scientific careers to be attractive. Raising student awareness of careers in marine science is not only a task for educators, but for scientists engaged in marine research as well. This paper summarises the experience of three years of international science camp organized for 15–19 year old students from countries of the Baltic Sea region (Europe) and discusses international science camps as a platform for encouraging interest in marine science.

1. Introduction

Intensified exploitation of marine resources and human impacts [1,24] has brought attention to the need for developing integrated frameworks which enables scientists and professionals to solve complex problems in ocean and coastal issues [15]. Coastal and ocean management schemes integrate natural and social sciences and engineering [11] with the aim to connect policy, management, and science. Natural sciences provide the basis for understanding effects on ecosystems whereas the social sciences are important in clarifying the origin of human-caused problems [11]. The need to train future professionals in integrated disciplines [21,39,8] has led to more development opportunities which primarily target Masters and Ph.D. students [38,43,49,9]. However, there has been comparatively little attention given to promoting careers in marine sciences among secondary school students.

The training of teachers is considered to be one of the main pathways for enhancing science literacy and interest in scientific careers among students [15,16]. Despite these efforts, general interest in scientific careers among young people is declining globally. For example, in the United States and many European countries, fewer young people are choosing science and technology studies and scientific professions are considered to be less attractive than other popular career choices [26,32,41].

Secondary school students consider scientific subjects to be unengaging, lacking in contextualised content, insufficiently attending to practical concerns compared to theory, not as important for personal context, and not the best option for maximizing monetary rewards and job security [12,22,32,4]

The incorporation of marine science concepts in school curricula provides an opportunity to integrate diverse subjects such as physics, mathematics, geography, and biology [18,30], and to apply this knowledge to practical problems in natural resource management [35].

Much effort is invested in raising awareness of ocean and coastal issues among the larger public, especially the younger generations. It is recognised that an increase in marine environmental education and information availability via school activities, informal learning, and even television programmes creates higher levels of awareness and concern about the marine environment, behaviour improvement (marine citizenship), and involvement at all levels of decision-making (marine governance) [15,36,5]. But can we expect that general awareness of coastal and ocean issues will become the reason for young people to choose careers related to marine science? Or should we as scientists do more about this, for example, provide opportunities to discover marine environments through practical involvement, help understand scientific processes, and open venues to interact personally with scientists working in this field?

The role of scientists in attracting young people to careers in science is crucial [34,46]. Talley et al. [46] identified key factors motivating student interest in marine science: (a) early and continued exposure; (b) engagement in authentic research; (c) interaction with practising scientists; (d) participation in experiential, hands-on projects; and (e) practical work in the field. Documenting the success of these activities is key to optimising future efforts. However, information about the involvement of high school students with projects focused on marine research is based mainly on assessments conducted in single schools within individual countries; we are not aware of any prior studies that have considered the potential benefits of international experiences in

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promoting interest in marine sciences.

During 2010–2012 we organized international science camps focused on marine research in three countries with a shared interest in the Baltic Sea. The series of camps was organized with the goal of attracting potential students to marine sciences, with a particular focus on high school students. Having the camps in three different countries provided an opportunity to assess how students from different educational systems and cultural backgrounds responded to a common set of activities.

The specific objectives were to reveal student interest and talent for doing science, develop skills, and provide access to marine science professionals. This paper analyses the success of these efforts, focusing on: (1) what attracted students to participate in camps dedicated to marine sciences; (2) whether a two-week science camp can encourage interest in science among students with backgrounds in different subject areas; and (3) which activities were most effective in encouraging student interest.

2. Methods

2.1. Science camp design

The camps were held in Germany (2010), Poland (2011), and Lithuania (2012). The camps were designed for 15- to 19-year-old high school students from Germany, Poland, Lithuania, Sweden, and Denmark. The organization procedure included: (1) design of the science program; (2) advertisement and call for applications via emails, press releases, websites, and regular mail; (3) evaluation and selection of students; (4) preparatory meeting with participants; (5) participation in science camp; (6) post-camp meeting. The participants for all science camps were chosen based on the following criteria: (a) grades in science subjects; (b) proficiency in English; (c) personal statements submitted by the students; (d) gender equity.

The science camps lasted 10 days, with a similar number of participants in each camp, except for the camp in Germany (Table 1), where the participant number was limited by the size of the ship. None of the organizing institutions had experience in international camp organization, so the first camp in 2010 was a pilot. The experience gained and lessons learned were used to improve the next two science camps. The following improvements were implemented: (a) students were given an introduction to the scientific research process (from idea of the experiment to the presentation of the results); (b) students were given an introduction to sampling equipment (later used for individual research projects); (c) students representing different countries gave presentations during initial discussions about the main Baltic Sea problems; (d) scientists lectured only on student research topics. The research projects involved: (1) a brief scientist-led presentation on possible study topics (e.g., phytoplankton, benthos); (2) student choice of the most attractive topic; (3) scientist-led group work on the research hypotheses, including analyses of results and presentations. The camp was organized so that the students needed to conduct research in teams. In all camps they were divided into five groups for different research tasks (Supplementary Table 1). The division of students into equal groups assured that all scientists had the same workload and, for the students, the same level of involvement. During the camp English was used as a common language. Teachers helped students deal with daily issues while travelling and living in the camp.

Activities in addition to daily research tasks included: daily blog writing, e-module testing (http://www.balticweblab.eu/modules.html), and visiting different research institutions, museums, and protected areas related to marine environments (Supplementary Table 2).

Table 1
Baltic Sea issues which students considered important (groups by country of origin, n = 5).

Considered by all groups	Considered by one group
Eutrophication	Tourism pressure
Oil pollution	Noise pollution
Unsustainable fishing	Maritime traffic
Toxic algal blooms	Biological invasions
Oxygen demand	Beach cast

2.2. Evaluating motivation to take part in science camp

Students wanting to take part in the science camp were required to provide a personal statement as part of the application process. They were asked the following questions: (1) What motivated them to take part in this science camp and how can they profit from it? (2) What are their major interests in science? (3) Have they ever worked on a marine subject before? (4) If yes, describe the project. This information allowed us to assess the background of the students with respect to prior exposure to marine sciences and to identify the elements which can be used for attracting motivated students. Because the same selection procedure was used for all three camps, in this report only information from the last camp in 2012 has been included. Our analysis was performed on data from 95 applications from five countries.

2.3. Evaluating interest in marine science after camp

One month following the science camp, the students who participated in camp were asked to fill out anonymous questionnaires to identify the elements of the camp that most strongly influenced their interest in marine science. In the questionnaire they were asked to rank the answers on a 5-point Likert scale (1 = fully disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = fully agree). In total we received responses from 55 respondents (79% of participants). The response rates were 80% in 2010, 76% in 2011, and 80% in 2012.

3. Results

3.1. Students' motivation to attend science camp and prior experience in marine science

In each year of the program, between 43% and 47% of all those students who applied were residents of the country in which the camp was organized. In 2012 we received 95 applications, about half from Lithuania (47%), and the rest from other countries: Denmark (21%), Sweden (15%), Germany (12%), and Poland (5%). There were more applications from girls (65%) than boys (35%). The applicants were mostly aged 17 (42%), 18 (28%), and 16 (16%), with the remainder aged 15 or 19.

The motivation for more than half of applicants to attend the camp was to learn more about marine science in an international environment (Fig. 1). Forty percent of the students expressed an interest in all kinds of science, with biology (74%) ranked as most interesting. Fewer students indicated interest in chemistry (40%), physics (17%), geography (7%), and math (6%). About a third (35%) of students had previous experience in marine science from having conducted practical or theoretical research projects for class, 38% had participated in some other type of biological or ecological project, and 27% had not had previous experience.

About a quarter (26%) of the students expected that the science camp would help them to make decisions regarding their future studies or career (Fig. 1). Some of them gave more details regarding their future plans: they wanted to become biologists, medics, veterinarians, biochemists, or scientists in a broader sense. Only girls wanted to become marine scientists (10% of total applicants, 16% of girls). Activities not directly related to science such as the chance to meet new friends, improve English, and build teamwork skills played an important role. Only 30.5% of students were motivated by the possibility to meet a real scientist in the camp (Fig. 1).