Oceans and Human Health: A rising tide of challenges and opportunities for Europe

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A B S T R A C T

The European Marine Board recently published a position paper on linking oceans and human health as a strategic research priority for Europe. With this position paper as a reference, the March 2014 Cornwall Oceans and Human Health Workshop brought together key scientists, policy makers, funders, business, and non governmental organisations from Europe and the US to review the recent interdisciplinary and cutting edge research in oceans and human health specifically the growing evidence of the impacts of oceans and seas on human health and wellbeing (and the effects of humans on the oceans). These impacts are a complex mixture of negative influences (e.g. from climate change and extreme weather to harmful algal blooms and chemical pollution) and beneficial factors (e.g. from natural products including seafood to marine renewable energy and wellbeing from interactions with coastal environments). Integrated approaches across disciplines, institutions, and nations in science and policy are needed to protect both the oceans and human health and wellbeing now and in the future.

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1. Overviews

Oceans and humans have interacted since ancient times. Over thousands of years, the oceans and seas have served as a source of food, provided livelihoods, and generated commerce, as well as disseminating people and connecting civilizations around the world. Their importance is reflected in many cultural practices, and is manifest in inspirational art. Inevitably the oceans influence our health and wellbeing. Damaged coastal and marine ecosystems arising from natural disasters or as a result of human exploitation have led to a range of negative consequences for human health (including loss of life); at the same time, there is increasing evidence that interactions with coastal and marine environments may also have important beneficial impacts on wellbeing (Bowen et al., 2006; Fleming et al., 2006; Fleming and Laws, 2006; Walsh et al., 2008; Bowen et al., 2014).

Over the past two decades, the importance of oceans for human health as an area for research, training and policy has been
recognized in the US. This is evidenced by the establishment of a
network of dedicated oceans and human health research centres
in both academic and government institutions funded by the
National Science Foundation (NSF), the National Institute of
Environmental Health Sciences (NIEHS), and the National Ocean-
ographic and Atmospheric Administration (NOAA) (National
Research Council, 1999; Knap et al., 2002; Laws et al., 2008).
With the exception of a few specific regional programmes (e.g. EU
BONUS as a joint Baltic Sea regional research and development
initiative), Europe has largely failed to promote an integrated
interdisciplinary and collaborative research effort in this area on a
scale necessary to address the public health implications of rapidly
increasing human activity in European seas and oceans, and
especially in the coastal zones. The European Union has set a
policy objective of achieving “good environmental status” (GES) in
European marine waters by 2020 through its adoption of the
Marine Strategy Framework Directive (EC, 2008). However, the
extent to which the specific measures required to achieve good
environmental status are, in turn, linked to human health and
wellbeing is limited, and there are important gaps in our knowl-
edge of the complex interactions between the marine environ-
ment and human health. Despite the concern for the marine
environment which has been translated into the European Union
Marine Strategy Framework Directive, there still remains a need,
therefore, to link climate change, ecosystem understanding, and
life sciences with public health and social sciences (Moore et al.,
2013; Depledge et al., 2013).

The recently published European Marine Board position paper on
“Linking Oceans and Human Health: A Strategic Research Priority for
Europe” (http://www.marineboard.eu/images/publications/Oceans
%20and%20Human%20Health-214.pdf) highlights the substantive
and complex interactions between the marine environment and its
ecological status on one hand, and human health and wellbeing on
the other, drawing attention to a range of societally important
research questions and challenges. The paper makes a strong case for
the development and support of an interdisciplinary and collabo-
Table 1
Currently identified issues presenting risks and benefits to human and ocean health.
- Climate change, extreme weather, natural events (e.g. tsunamis)
- Ocean acidification
- Harmful algal blooms (HABs)
- Microbes, antibiotic resistance
- Anthropogenic chemicals, marine plastics/litter, and nanomaterials
- Exotic species
- Sustainable fisheries, aquaculture, seafood, food security
- Coastal communities (including cities) and sustainability, resiliency and
  adaptation
- Sustainable marine biotechnology, pharmaceuticals, natural products
- Marine models, sentinel species, biodiversity, and one health
- “Blue gym” recreation, health and wellbeing from the coasts
- “Blue carbon” and marine protected areas
- Marine renewable energy

Fig. 1. Risks, benefits and opportunities of oceans and human health.
lessons learnt from the U.S. over the past two decades were discussed. In addition, there was exploration of the existing evidence for the interactions between the impacts on human health and wellbeing and changing marine ecosystems, and the identification of information and data gaps and resource needs, with a “horizon scanning” exercise by the participants (Table 2). Finally, policy interactions and other needs for exploring and addressing oceans and human health were discussed. The resulting series of recommendations to take this emerging topic of oceans and human health forward in the EU and beyond (Table 3) were summarized in a prepared concise summary statement, “Message from Bedruthan: unanimous call for a coordinated, transnational and interdisciplinary Oceans and Human Health research programme in Europe” (http://www.enehi.org/wp-content/uploads/2013/11/Message-from-Bedruthan.pdf).

2. Main messages

Overall, the Workshop identified new research evidence and questions, and important opportunities in the area of benefits from interactions with the oceans for human health and wellbeing. These ranged from promising business opportunities within marine biotechnology, aquaculture, and marine energy to new evidence suggesting that interactions with coasts and the marine environment may offer significant benefits for both physical and mental health (http://ec.europa.eu/maritimeaffairs/policy/ocean_energy/forum/index_en.htm; EU Commission 2009; EU Commission 2012; Wheeler et al., 2012; White et al., 2013a, 2013b). The Workshop also identified a number of areas for concern, particularly current and future interactions between climate change, ocean acidification, microbial and chemical pollution (including plastics), and their impacts on coastal and marine ecosystems as well as seafood and food security (IAP, 2009; Boxhall, 2012; Redshaw et al., 2013; Koelmans et al., 2014; Wyles et al., 2014). In addition, there was an appreciation of the complexity of these interactions, presenting both risks and opportunities to the health of both humans and the ocean and coastal ecosystems.

The interactions and discussions between the participants identified that integrated approaches across disciplines, institutions, and nations in science and policy are needed to protect both the oceans and human health and wellbeing now and in the future. Furthermore, improved collaborations across academia, business, government, civil society, and NGOs with ongoing stakeholder input will be essential for moving forward this new area of science, research, training, and policy forward.

It was noted that the majority of participants, all experts in their fields and representing diverse institutions, had never interacted before; and few had previously viewed their own research through the lens of oceans and human health. The participants stressed the importance of long-term funding and support for interdisciplinary science and training in oceans and human health to create a sustained programme of research and a vibrant interdisciplinary community of interested researchers, trainees, policy makers and other stakeholders (e.g. the Gordon Research Conference and Graduate Research Seminar in Oceans and Human Health biannual since 2008 http://www.grc.org/programs.aspx?year=2014&program=ohh). They identified six essential areas to build the capacity for oceans and human health research in Europe:

1. community building (among researchers as well as policy makers and other stakeholders)
2. international cooperation (collaborations among researchers and other stakeholders, as well as evidence of the global nature of oceans and human health)
3. strategic analyses (identifying priority knowledge gaps and the necessary research infrastructure and resources to address them)
4. human capacities (improving interdisciplinary training)
5. policy assessment and support (integrating oceans and human health within the existing and future EU policy framework)
6 stakeholder engagement and knowledge transfer (including ocean literacy, citizen science and the promoting the link between of ocean stewardship and human wellbeing).

Finally, the gap in understanding of these interactions and the value of marine ecosystems for human health and wellbeing among researchers, policy makers, healthcare providers and public health practitioners, and the general public was identified as a particular concern by the conference participants. Ultimately, the ability to communicate and engage with these disparate but important stakeholder communities will determine the future health of both humans and the oceans.

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References


