

## Executive summary

Interest in marine biotechnology has grown as a result of scientific advances that have increased our knowledge of marine biodiversity and the development of technology and tools to access and study marine organisms and ecosystems. Knowledge of marine life is expanding rapidly as new species are discovered and as the complexity and biodiversity of marine organisms and ecosystems is better recognised. Marine bioresources hold great potential as a source of novel products and processes yet remain largely untapped. The application of biotechnology to these resources may help to address the global challenges of food, energy security and health and contribute to green growth and sustainable industries. At the same time, the conditions for maintaining a sustainable relationship between the conservation and use of marine bioresources is becoming better understood.

Marine organisms live in a vast interconnected system of oceans that contribute to the regulation of the planet's temperature and atmospheric conditions. Ocean currents carry marine life, nutrients and wastes within and across national borders. This fluid, shared environment and the mobile and geographically dispersed organisms contained within it present governance challenges that relate both to access to and development of marine resources. The interrelation of marine bioresources in complex marine ecosystems raises further challenges for studying marine life and for its development and conservation.

This report considers the tension between productivity and sustainability faced by those seeking to realise the potential of marine biotechnology. It seeks to identify the field's potential and the support required to achieve that potential, and explores the challenges to sustainable development, in view of the unique features of the marine environment and the need to maximise its integrity and sustainability for future generations.

The application of biotechnology to marine organisms raises several issues that create challenges for policy makers. Two recurrent themes have appeared important for the sustainable development of marine biotechnology: the need for communication among stakeholders and the need for internationally coordinated action. While these themes are not unique to the field, their emergence from this study's focus on the distinctive features of marine biotechnology makes them especially noteworthy and in need of attention in

future policy work. As governments work to develop appropriate frameworks for marine biotechnology, it will be important to consider the main messages that emerge from this report:

- Advances in science and technology are providing new insights into the diversity of life in the oceans and contributing to a greatly improved understanding of marine bioresources. As knowledge of these resources increases, it is becoming clear that the biodiversity of the ocean offers manifold possibilities for development and exploitation.
- The biodiversity of the marine environment may help to address some global challenges through innovative food production systems, new sources of renewable energy, products for health and well-being and sustainable industries. Many countries have recognised this potential and are integrating marine biotechnology into national bioeconomy and innovation strategies.
- Strong marine biodiversity underpins healthy marine ecosystems, which contribute positively to the healthy functioning of the planet. Development of ocean bioresources must therefore occur in a manner that conserves the ocean's biodiversity. This will require a governance framework that will enable the development of marine bioresources in a sustainable manner.
- The interconnectedness of the world's oceans and their complex, widely distributed ecosystems suggests that governance of marine bioresources will be most effective if considered at international level. Several international conventions and agreements provide a framework for the conservation of marine biodiversity and for access to and sharing the benefits of marine bioresources. Yet these agreements tend to break down in areas beyond national jurisdictions; this suggests the need for finding ways to address this gap.
- Better R&D infrastructure and platforms will be needed to improve our understanding of marine bioresources and to improve our access to and development of these resources. The shared and dynamic nature of ocean bioresources, together with the sheer size of the development opportunities (and challenges), means that national and international co-operation will be needed to develop infrastructure to support marine biotechnology.
- As marine biotechnology becomes a focus of government innovation strategies and investment, it will be important to measure the return on government and private-sector investment. New measures and indicators may be needed to measure the impact of investment and the effectiveness of government policies.

- Marine biotechnology has applications in sectors such as energy (e.g. algal biofuels), pharmaceuticals (e.g. novel antibacterials), food (e.g. genomics of major food fish species) and chemical industries (a host of chemical types, such as polysaccharides). They will require different types of industry incentives and partnership strategies to foster the effective development and diffusion of technology. All sectors will benefit from discussions and engagement with relevant stakeholders at an early stage.
- Characterising and monitoring the health of marine ecosystems at many levels requires new tools and measures. Given the shared nature and complexity of marine bioresources and marine ecosystems, such tools will be most effective if developed and applied internationally. Similarly, it will be necessary to monitor and evaluate relevant policy and governance measures.

The OECD Working Party on Biotechnology is proposing to take forward work on marine biotechnology and on its potential contribution to green growth in 2013-14. This will provide the WPB an opportunity to build on this report and, with other organisations and stakeholders, to explore further the issues raised with a view to contributing to international policy and governance on marine biotechnology.



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