



Innovation for the Blue Economy

WORKSHOP SUMMARY

www.csiro.au



Notes from a workshop co-hosted by CSIRO and the
Department of Foreign Affairs and Trade's innovationXchange

September 2015

INNOVATION CHANGE

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Opening

This century, the ocean is likely to become an economic force. The drivers include:

- new technologies that make it feasible and economically viable to tap previously unattainable ocean resources;
- longer-term growth and demographic trends fuelling the search for food security and for alternative sources of minerals; and energy
- the expansion of seaborne trade, industrial and municipal growth along our coasts.

While there is no internationally agreed definition, the Australian Department of Foreign Affairs and Trade has noted that:

A 'blue economy' strikes the right balance between reaping the economic potential of our oceans with the need to safeguard their longer term health. A blue economy is one in which our ocean ecosystems bring economic and social benefits that are efficient, equitable and sustainable Department of Foreign Affairs and Trade. What is a blue economy?:

www.innovationxchange.dfat.gov.au/project/innovating-blue-economy

The concept of a blue economy incorporates the traditional maritime industries of fisheries, coastal tourism, energy and mineral production, boat building, shipping, and ports activity. It also includes new and developing industries such as aquaculture and renewable energy technologies for wind, wave and tidal energy, bio-products (pharmaceutical and agrichemicals), blue carbon (carbon sequestration) and desalination. Thus, used wisely, our coastal and ocean resources can help address poverty, food security, sustainable livelihoods and conservation.

Countries within the Indian Ocean Rim region account for 30 per cent of the world's population and are now becoming aware of the overall value of their potential marine resources. For these nations, especially the small island states, the blue economy offers the potential to address key developmental constraints, such as energy, food security and fisheries management in a sustainable manner.

Australia's international engagement in the blue economy (e.g. IORA Economic Declaration, 9 October 2014) aims to improve regional economic prosperity and stability. This workshop was organised by CSIRO and the Department of Foreign Affairs and Trade's innovationXchange to provide insights on scientific, technological and other innovations for the blue economy that will help unleash the economic potential of our Indian Ocean neighbours' ocean resources in an efficient, equitable and sustainable way.

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1 Introduction

1.1 Context

DEFINITION OF THE BLUE ECONOMY

The concept of a ‘blue economy’ is one that balances sustainable economic benefit from the world’s oceans and coastlines with the need to protect their long-term health. Given Australia’s geopolitical position, the blue economy is fundamental to our, and our neighbours’, ongoing economic, environmental and social prosperity.

The blue economy is generally taken to consider all aspects of the marine, maritime and coastal regions that have a direct or indirect impact on the economy. This could include:

- The ocean and coastal environment.
- Oceanography, climatology and meteorology.
- Maritime safety and security.
- Shipping traffic (particularly international) and ports.
- Offshore oil and gas.
- Fisheries.
- Aquaculture (ocean/coastal).
- Ocean renewable energy.
- Oil spills and other human-induced marine incidents.
- Tsunamis, coastal surges, sea level rise and other climate-related incidents including climate change.
- Tourism (ocean/coastal).
- Seabed mineral exploration.
- Marine biotechnology.

AUSTRALIA AND THE BLUE ECONOMY

Australia has a long history of supporting marine economic activity in the Pacific. Foreign Minister Bishop announced Australia’s commitment to the blue economy in the Indian Ocean at the 2014 Indian Ocean Rim Association (IORA) Council of Ministers’ Meeting.¹

The Department of Foreign Affairs and Trade (DFAT) in particular has a strong interest in the blue economy. Other departments taking an interest include the Department of Industry and Science and the Department of the Environment.

Other key players in the blue economy include government agencies (e.g. the UNESCO Intergovernmental Oceanographic Commission, CSIRO, the Australian Institute of Marine Sciences, Geoscience Australia), various academic institutions (e.g. University of Western Australia,

Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong, Institute of Marine and Antarctic studies, University of Tasmania, UWA Oceans Institute, James Cook University), the marine industry sector (e.g. renewable energy, oil and gas, fisheries, minerals, World Ocean Council) and research partnership institutions such as the Indian Ocean Marine Research Centre located on the campus of the University of Western Australia.

Australia has:²

- the world’s third largest Exclusive Economic Zone – 8.2 million square kilometres – which is larger than the 7.69 million square kilometres of the Australian mainland states and territories;
- 60,000 kilometres of coastline with 12,000 islands;
- 79 ports receiving over 23,000 international visits; and
- 10 per cent of world sea trade.

The significance of the blue economy to Australia’s foreign and trade policy is clear. In 2011–12, it was estimated that the total contribution of marine-based industries to Australia’s economy had doubled over the previous decade to approximately AUD \$47 billion.³ This figure is expected to grow to \$100 billion annually by 2025.⁴ An additional \$25 billion worth of ‘ecosystem services’ has also been estimated to be provided by Australia’s oceans and coasts, such as the provision of food and water, coastal protection, regulation of climate and natural hazards such as floods and disease, waste control and nutrient regeneration, and social and cultural benefits including tourism.

BLUE ECONOMY AROUND THE WORLD

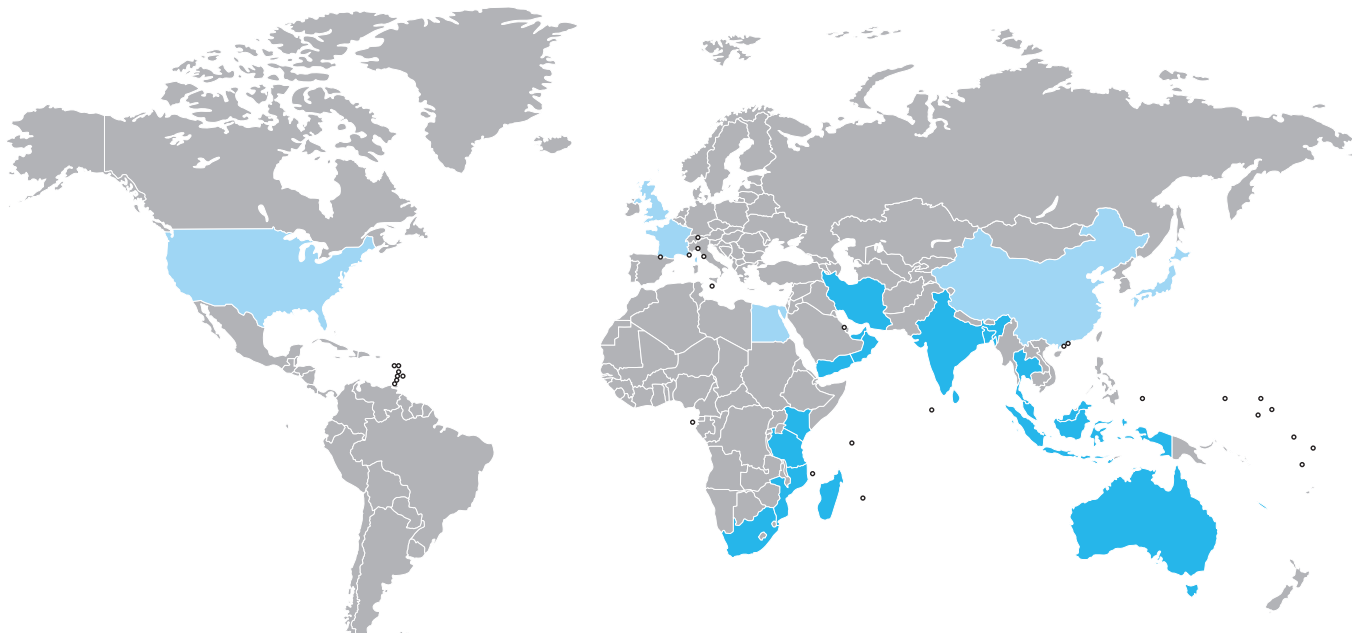
Oceans provide a substantial portion of the global population with food and livelihoods and are the means of transport for 80 per cent of global trade.⁵ With growing pressure to diversify economically in response to global competition, and faced with depleting natural resources, countries are looking for opportunities for a deeper and more creative (yet sustainable) exploitation of the sea through the blue economy. As such, many of Australia’s neighbouring small-island and coastal states in the Pacific and Indian Oceans are using the blue economy concept to promote their own economic growth and development agendas. Figure 1 describes some of the recent global events targeted at addressing blue economy issues.

FIGURE 1 – RECENT BLUE ECONOMY EVENTS

		<ul style="list-style-type: none"> • Held in Mauritius on 2–3 September. The focus was on fisheries and aquaculture, renewable ocean energy, seaport and shipping, and offshore hydrocarbons and seabed minerals. • More information at: http://www.blueplanetsymposium.com
		<ul style="list-style-type: none"> • Held in Portugal on 3–6 June. It included a ministerial summit, a blue business week and the World Ocean Summit (sponsored by the Economist). Themes included scientific innovation, food security, energy and resources (notably deep sea mining), seaborne trade and ocean governance. • Australia was represented by Parliamentary Secretary for the Minister for Foreign Affairs and Minister for Trade and Investment Mr Steven Ciobo MP • Portugal has advised that this will become an annual event. More information at: http://www.blueweek.pt/en/
		<ul style="list-style-type: none"> • Blue Economy workshop held in Mauritius on 2–3 September. • Australia was represented by Environment Minister Greg Hunt. • Resulted in the IORA Mauritius Declaration on the Blue Economy which can be accessed at: http://www.iora.net/media/158070/mauritius_blue_economy_declaration.pdf

Australia is currently the chair of the Indian Ocean Rim Association (IORA), which seeks to expand mutually beneficial cooperation through a consensus-based approach. Figure 2 below outlines the countries that are part of the (IORA).

FIGURE 2 – INDIAN OCEAN RIM ASSOCIATION MEMBERSHIP (BLUE COUNTRIES)⁶



The Indian Ocean Rim region is home to nearly one-third of the world's population and the region possesses a variety of natural resources that are vital for the wellbeing of its inhabitants.⁷ As such, IORA has placed more emphasis on growing the blue economy within the region in a sustainable and inclusive manner.

INNOVATIONXCHANGE

innovationXchange is a new area within DFAT established ‘to catalyse and support innovation across the Australian aid program.’⁸ An early initiative of innovationXchange is focused on the blue economy and seeks to identify and support science, technology and innovation related to oceans and coastlines that can support economic development and diversification in developing economies in the Indian Ocean region.

1.2 Workshop scope and objectives

To kick-off the blue economy initiative, CSIRO assisted the innovationXchange team by assembling a range of blue economy experts to engage in a one-and-a-half day workshop from 25–26 August 2015. Participants included relevant stakeholders from research, industry and government, including the Australian Institute of Marine Science, Carnegie Wave, Woodside, and the Australian Strategic Policy Institute amongst many others.

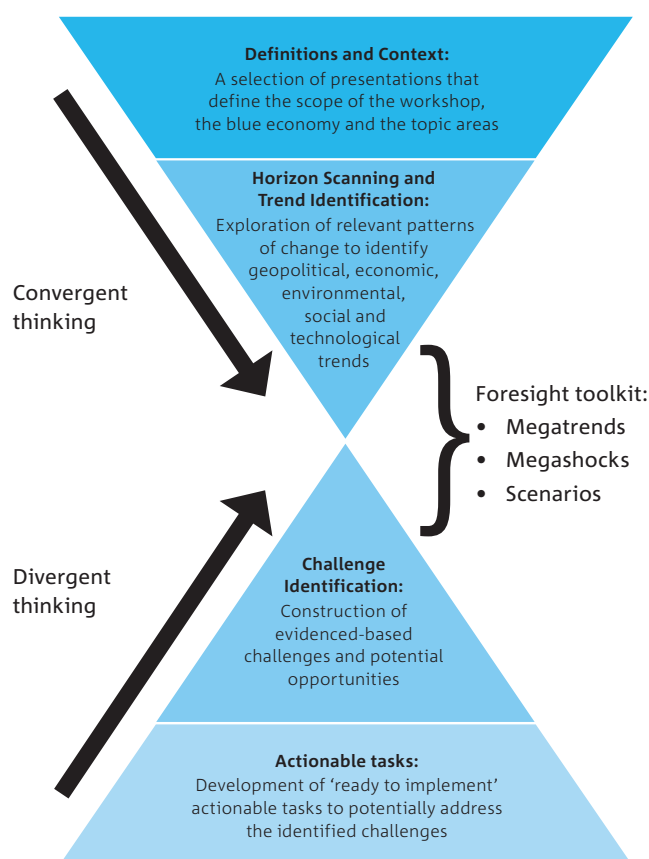
The workshop was designed to assist the innovationXchange team in developing a broad understanding of relevant research and commercial capabilities in Australia and globally that could be applied to meet opportunities and challenges in target countries. More specifically, the workshop had two key objectives:

OBJECTIVE 1: To develop a prioritised list of challenges/barriers to growth facing developing countries in the Indian Ocean blue economy.

OBJECTIVE 2: To develop a prioritised list of actionable tasks that could potentially address the identified challenges/barriers.

The workshop utilised the CSIRO Futures Foresight Methodology, outlined in Figure 3.

FIGURE 3 – CSIRO FUTURES FORESIGHT METHODOLOGY



Challenges and actionable tasks were discussed, developed and refined in the context of four core topic areas identified within the Economist Intelligence Unit briefing paper from the 2015 World Ocean Summit.⁹ In addition, consideration was also given to two cross-cutting topics that had implications across the four core topic areas (Figure 4). To promote and align discussions during the workshop, scientific experts with knowledge of the ‘blue economy’ were invited to provide an overview of each of the 6 topic areas before breakout sessions into individual groups.

FIGURE 4 – BLUE ECONOMY DISCUSSION TOPIC AREAS

DISCUSSION TOPIC AREAS	
1. HARVESTING OF LIVING RESOURCES	2. EXTRACTION OF NON-LIVING RESOURCES, GENERATION OF NEW RESOURCES
3. COMMERCE AND TRADE IN AND AROUND THE OCEAN	4. RESPONSE TO OCEAN HEALTH CHALLENGES
CLIMATE AND WEATHER EXTREMES	
MANAGING MULTIPLE USES AND SUSTAINABLE LIVELIHOODS	



2 Trends in the blue economy

Australia is part of a rapidly changing world. While the future is uncertain and complex, understanding the current trends in business can help predict and prepare for the various futures that may play out. Trends can describe shifts in geopolitical, environmental, economic, social or technology conditions that have the potential to substantially change the way people live, and can eventually lead to business models, social structures and cultural paradigms.

Paul Holthus, CEO of the World Ocean Council and international keynote speaker for the workshop, provided the following insights on future trends in his presentation entitled, 'The Ocean Economy, the Blue Economy, and Innovation for Ocean Sustainable Development':

- By 2035, deep-sea oil and gas production will double.
- Container shipping has increased at 10 per cent a year since 1985.
- Fisheries sustain the livelihood of 30 million people, but will be increasingly found further offshore.
- Aquaculture is the fastest growing food production system at 7.5 per cent a year growth over the past 20 years. By 2030, aquaculture will make up 65 per cent of fish protein, and by 2050, 30 Mt/year of extra aquatic productions will be required to feed the planet.
- Cruise line tourism is growing at 8.5 per cent a year over the next decade.
- Offshore wind energy grew at a rate of 59 per cent in 2010. By 2020, Europe will need 20 turbine installation ships and 200–300 support vessels.
- Ocean energy is making up a growing share of energy demand. By 2020, ocean energy will make up 1 per cent of Europe's energy demand, and 15 per cent by 2050 (188GW).
- Coastal construction of ports, shoreline protection, piers, jetties and dredging are constantly growing.
- Desalination is doubling every 20 years. By 2025 demand is expected to exceed supply by 56 per cent.

- Sea bed mining will account for 5 per cent of the world's minerals by 2020. By 2030, this will double to 10 per cent and account for \$12 billion in economic value.
- Expansion of marine industries into the Arctic is set to grow.
- The ability to sustainably grow the multiple uses of the ocean, while protecting assets is increasing in importance. This increasingly complex and challenging business environment for ocean industries will require policy, planning and research to maintain social licence to operate.

Existing and anticipated trends specific to the Indian Ocean's blue economy were subsequently identified and discussed, both in small groups and as a whole, to set the scene for the potential environment in which relevant governments and businesses will be operating. These discussions provided the foundation upon which current and future challenges were identified.

Consolidation of findings from the individual groups revealed five primary factors that influenced the trends occurring now or on the horizon for the Indian Ocean's blue economy (Table 1).

Aquaculture is the fastest growing food production system at 7.5 per cent a year growth over the past 20 years. By 2030, aquaculture will make up 65 per cent of fish protein, and by 2050, 30 Mt/year of extra aquatic productions will be required to feed the planet.

TABLE 1 – PRIMARY FACTORS INFLUENCING THE FUTURE TRENDS WITHIN THE INDIAN OCEAN’S BLUE ECONOMY

TREND	DESCRIPTION
Increasing climate and environmental variability	<ul style="list-style-type: none"> • Ocean acidification can result in reduced metabolic rates and immune responses in some organisms, as well as coral bleaching. This presents as an issue for the many industries that harvest living organisms, but also industries such as tourism which rely on coral for tourist attraction. • Rising temperatures can influence the migratory patterns of living organisms and the safe unrefrigerated storage time of fresh produce. • Rising sea levels can impede on existing coastal infrastructure/assets and change the make-up of the coastal ecosystem. • Increasing intensification of extreme and unpredictable weather events – floods, monsoons, storm surges and cyclones are just some of the extreme weather events that are growing in magnitude. These events have the potential to cause significant damage to all elements of the blue economy through physical asset damage and the disruption of ecosystems. • A related environmental trend is that ocean health is becoming an increasingly popular consideration in policy setting and business decision making.
Technological change	<ul style="list-style-type: none"> • More sophisticated data collection mechanisms are leading to greater amounts of information being accessible, leading to more valuable/accurate insights for decision making (both business and government). • Growing use of, and capability in, sensing devices, data management, analysis, data streams from satellites (remote sensing). • This trend is coupled with an increasing need for developing countries in the region to improve their ability to predict the environment to inform decision-making. • While there is a trend towards greater availability of information and data, there is still a poor ability to absorb the information in developing countries and inadequate governance in place to use it. • Marine biotechnology growth is based on the discovery and processing of potential marine organisms which may be found in the IORA region.
Increasing interconnectivity and mobility	<ul style="list-style-type: none"> • The technological rise is accelerating communication pathways and interconnectivity between countries and regions that were previously isolated from each other. • There is a growing need for and awareness of the benefits of collaboration. • An increasingly mobile labour force enables skill shortages to be addressed.
Population and economic growth	<ul style="list-style-type: none"> • Substantial population growth, particularly in India, China and Africa, and coastal zones. • A growing middle class will increase consumption of resources and demand for wealth from the coasts – such as protein, oil and gas – but will also provide more educated consumers and workers. • Increased population density increases food security issues and the level of migration across borders. • The global economic centre is drifting back towards Asia as a result of population and economic growth in Asia.
Growing need for stronger governance	<ul style="list-style-type: none"> • A lack of social and economic empowerment of coastal communities is fast becoming a key barrier to future growth. • Economic growth in the Indian Ocean region has to be based on regional security and self-governance, both of which are intertwined with global security and socio-economic trends. There is also a shift in power away from countries and towards businesses which has compounded the issue. • The number and type of political super-powers exerting influence across each region is growing e.g. EU, China and India moving aid and investment into areas favouring their national interest. • There is increasing political and economic uncertainty and stability in these regions. • Science is increasingly being thought of as a potential stabiliser for the region (through collaboration, cooperation).



3 Challenges and opportunities

After identifying Indian Ocean blue economy trends and hearing presentations on all four topic areas (as well as the two cross-cutting issues), participants were asked to self-nominate a topic group based on their expertise and interest.

Through a series of break-out discussions in these groups, the challenges listed below in Table 2 were identified for the four topic areas. Given the varying subject matter, the challenges took a variety of shapes and forms.

TABLE 2 – CHALLENGE STATEMENTS

TOPIC AREA	CHALLENGE STATEMENTS
Harvesting of living resources	<ul style="list-style-type: none"> • How do you achieve sustainability of living resources without increasing unemployment or poverty? • How can regional and national governance frameworks and institutions be strengthened to increase net economic and social benefits, including environments? • How can countries and regions increase benefits from biodiversity?
Extraction of non-living resources; generation of new resources	<ul style="list-style-type: none"> • How can developing countries effectively and efficiently demonstrate resource feasibility and developments to attract and encourage private investment? • How do you achieve a social licence to operate in a low capability environment? • How can the existing burdensome regulatory frameworks around resource-development approvals be improved to provide an easier path to market? • How do you integrate new sources of energy, such as wave energy, within the existing frameworks?
Commerce and trade in and around the ocean	<ul style="list-style-type: none"> • How do we build infrastructure and governance to support regional shipping networks in light of future needs? • How do we build diversified local, national and regional economies that are big enough to cope with shocks (climate, economic, health, terrorism) through capability building and regional networks? • How do we improve maritime security and safety in key shipping lanes and ports from environmental, economic and political perspectives? • How can we improve collection and analysis of data for multiple applications e.g. maritime safety and security, fishing, ocean health? • How do we develop secondary opportunities and benefits from port infrastructure through the services sector?
Response to ocean health challenges	<ul style="list-style-type: none"> • How can Australia support the development and operations of coastal and ocean health monitoring and observation systems? • How can coastal zones be developed in a sustainable way while achieving an increase in social and economic benefits? • What would be an appropriate governance model to guide the sustainable development of the Indian Ocean blue economy as a regional objective?

3.1 Harvesting of living resources

Since sustainability usually requires limits of some sorts which means less harvesting than unfettered harvesting – which of course implies less jobs and short-term cash return – how do you achieve sustainable harvesting of living resources without increasing unemployment or poverty?

- With the exception of a few locations where wild harvest yield has peaked, current harvest levels are still rapidly growing in fisheries and aquaculture. While this growth is directly tied to employment and food security, it is not sustainable due to eventual stock depletion and poses risks to the future prosperity of countries across the Indian Ocean Rim.
- Both an institutional and community culture needs to be developed that maximises value and ensures/increases likelihood of sustainability. In addition to understanding environmental impacts, such a culture requires an understanding of the social and economic implications of failure to maintain living resource stocks at a level that can replenish harvested animals (e.g. failure to maintain fisheries stocks). The culture of competition and wanting to get more fish than your competitor needs to shift toward being more efficient with your catch or finding untapped markets to become more profitable.
- Many countries across the Indian Ocean Rim could not describe their oceans if asked today, with low levels of awareness around understanding the triple bottom line benefits. A large part of this challenge relates to limited or in some cases non-existent data management systems.
- Illegal, Unreported and Unregulated (IUU) fishing is a key issue. Chain of custody, market access and public-private-partnerships may be effective mechanisms to reduce IUU so full economic benefits flow through to developing nations. There are often tensions between large scale industrial and small scale (domestic/artisanal) fisheries. The challenge is to achieve both food security and economic development across these two, sometimes competing sectors.

- How do you more effectively manage interaction and competition for access to resources, space and ecosystem services?
- By knowing where the fish have come from (provenance) then the consumer/market will know they have come from sustainable fishing practices and approved locations – this increases market pressure for ‘approved’ product.

How can regional and national governance frameworks and institutions be strengthened to increase net economic and social benefits, including environments?

- Improved alignment of global, regional and national governance is required to strengthen triple bottom line benefits. The key challenge is that developing countries in the Indian Ocean often have a number of governments influencing their markets – global, regional and national. This challenge is accentuated through the diversity of economies and cultures across the Indian Ocean. It is difficult, but necessary, to have these aligned to a certain degree.
- Governance frameworks need to address the food security problem; what is most effective and efficient for one culture may not be for another.
- Markets are currently disconnected and not necessarily supported by culture.
- Scientific technologies are not the greatest need. What these regions need are corporate transparency, knowledge and data.

How can countries and regions increase benefits from biodiversity?

- Food security issues are resulting in a growing need to identify alternative sources of protein (other than fish) or to identify unknown fish species that could be a new source of protein.
- Greater use of biotechnology and associated access to intellectual property rights.
- The current levels of biodiversity cannot be maintained without significant changes.

3.2 Extraction of non-living resources; generation of new resources

How can developing countries effectively and efficiently demonstrate resource feasibility and developments to attract and encourage private investment?

- Many developing nations are still trying to determine what economic non-living resources they have at their disposal. Assistance with scoping studies could develop this potential.
- However, current resource mapping activities can take years and requires access to broad and fine scale information to demonstrate the feasibility of non-living resources and to ultimately improve the confidence of private investors. Such mapping is beyond the capability of many nations; and broad-scale mapping could be provided by nations where this capability already exists (e.g. Australia).
- The effectiveness and efficiency of resource mapping is impeded by challenges related to governance and capability. For example issues related to licensing and permits and the lack of technical ability to conduct a risk assessment (economic and environmental).
- Once a potential resource is identified, there exist challenges regarding financing. Access to financing is often more difficult for small scale projects (which may be common for developing countries in the Indian Ocean Rim). This requires further thinking about how to promote, commodify, package and scale up projects for larger investors or promote projects in a way that attracts a large number of social investors looking for impact.
- For many nations, resource development will also require adequate national infrastructure – ports, power, communications infrastructure, etc. Therefore, the feasibility of non-living resource developments may require co-development of infrastructure for broader use.

How do you achieve a social licence to operate in a potentially less informed and low capability environment?

- Greater sharing of governance, education and technology is required.
- The benefits need to flow through to the local population, and this needs to be transparent.

How can the existing burdensome regulatory frameworks around resource-development approvals be improved to provide an easier path to market?

- Provide support to develop frameworks based on that from Australia, to countries where current frameworks are opaque, slow and disorganised.
- Support mechanisms to address current policy and regulatory issues.

How do you integrate new sources of energy, such as wave energy, within the existing frameworks?

- New forms of energy, such as wave energy, offer new opportunities for energy security for many nations across the Indian Ocean Rim.
- However, deploying such technologies have high start-up costs and infrastructure / technology challenges.
- For example how do you integrate new technologies with existing grid networks? Is it possible to set up pilot demonstration facilities and/or an island micro grid?

3.3 Commerce and trade in and around the ocean

How do we build infrastructure and governance to support regional shipping networks in light of future needs?

- Increasing transport connections within the Indian Ocean Region (IOR), e.g. shipping of manufactured goods, agriculture, mineral and energy resources, would provide potential gains to a range of developing countries.
- A lack of adherence to regional port state controls have stemmed from issues of capacity, priorities and governance. This results in environmental risks and links to IUU fishing.

- Shipping efficiency, for all types of shipping, has significant opportunity for improvement in the region – fuel efficiency (e.g. LNG), environmental efficiency (e.g. automated hull cleaning, autonomous shipping), self-regulation vs accountability, port efficiency (e.g. instant ports, floating ports).

How do we build diversified local, national and regional economies that are big enough to cope with shocks (climate, economic, health, terrorism) through capability building and regional networks?

- Increasing labour mobility will provide more flexible and adaptable skill availability.
- Cultural differences present as a barrier to regional connectedness.
- As economies grow, issues develop around ensuring the benefits continue to be passed through to the developing economies.
- Increasing the capacity of countries to predict environmental and societal shocks (e.g. floods, terrorism etc.)

How do we improve maritime security and safety in key shipping lanes and ports from environmental, economic and political perspectives?

- Enforcing laws and ratifying treaties can result in reduced access to markets for developing economies.
- Issues result from the variation in focus and prioritisation of political entities (which target less than 3 years into the future) and businesses (which tend to target at least 10 years into the future).

How can we improve collection and analysis of data for multiple applications e.g. maritime safety and security, fishing, ocean health?

- Developing countries first need to understand the value of data and prioritise its collection before they can begin to recognise the value in applying the information for multiple uses.

How do we develop secondary opportunities and benefits from port infrastructure through the services sector?

- There are trade-offs between ports and tourism that need to be considered.
- Education and training would be required in the developing countries to open up many of the opportunities in the services sector (e.g. tourism).

3.4 Response to ocean health challenges

How can Australia support the development and operations of coastal and ocean health monitoring and observation systems?

- Currently ocean health is under-observed, with a lack of monitoring capability and poor coordination of existing efforts. There is also a lack of capacity and capability to interpret monitoring outputs.
- Technologies need to be applicable to needs of stakeholders and useable by stakeholders.

How can coastal zones be developed in a sustainable way while achieving an increase in social and economic benefits?

- Indian Ocean rim nations include some of the highest densities of some of the poorest people on Earth, and many engage in unsustainable practices that have perverse social and environmental outcomes. Coastal zones are usually the priority for developing countries in the region, with fewer individuals and businesses operating beyond the continental shelf.
- Effective responses likely to be country-specific, because each country has varying needs, different capacities for development, and will vary in the magnitude of social and economic benefits that can be generated from specific activities.
- Sustainability needs to be a priority for each country and should be built into the national and regional government priorities.
- Improving a nation's resilience to climate driven processes (e.g. storm surges, tidal surges) will support coastal development activities in a sustainable manner while improving socio-economic benefits.

What would be an appropriate governance model to guide the sustainable development of the Indian Ocean blue economy as a regional objective?

- Some of the governance models used in the Pacific Ocean might be transferable to the Indian Ocean, but in some regions the frameworks might already exist and need to be harnessed.

- It is important to find a common thread that connects countries and use it to incentivise them to develop and implement better governance models. Governance is not a natural priority for these regions, and regional identity is weak.
- Introducing new governance models can be a sensitive matter, potentially impinging on national sovereignty. Governments need assistance in identifying the cost and benefits of implementing good policies.

3.5 Summary

A number of common themes arose across the challenges associated with the four topic areas. These included:

- Governance – All groups raised the underlying need for stronger governance in most developing countries in the Indian Ocean rim. Without more transparent decision making, improved governance structures and common agreed goals, it is unlikely that the region could benefit (or achieve the full benefit) from adopting innovative technologies. This challenge also relates to trans-boundary governance of shared resources and pollution.
- Data availability – A lack of data collection, data management and decision making systems was raised by all groups. Improved information was generally thought to be required for all major challenges identified, but was also considered part of the solution. The (currently untapped) potential of data collection could provide both economic and environmental benefits.
- Cultural differences – All groups noted that what works for Australia or the Pacific has no guarantee of working for developing countries in the Indian Ocean rim. The differences go well beyond culture, however culture was frequently raised as a barrier to changing unsustainable practices. Many of these countries have been running blue economy enterprises the same way for centuries and are not necessarily looking to change the way they go about their interactions with the ocean. Cultural differences also exist within the Indian Ocean rim, meaning that challenges and applicable solutions differ markedly and need to be tailored.



4 Actionable tasks

Once topic-specific challenges had been identified, discussed, tested and refined, participants were asked to develop actionable tasks that Australia could perform to potentially address or assist with these challenges in the developing regions of the Indian Ocean blue economy.

With a view to having more immediate impacts, participants were asked to come up with actionable tasks that were ready to implement (due to existing capability either within Australia or elsewhere). For actionable tasks that were longer term in nature (e.g. three or more years), participants were asked to subdivide that task and consider immediate actions that could occur within 6 to 12 months.

Each of the four topic area groups then identified the most appropriate and impactful actionable tasks based on:

- **Relevance to target region** – i.e. is the re-purposing of this idea suitable to developing coastal countries of the Indian Ocean rim?
- **Impact** – i.e. is the targeted challenge one of great significance, is the actionable task likely to have a significant impact?
- **Time and path to market** – i.e. how quickly can the actionable task be implemented?
- **Existing capabilities** – i.e. does Australia have existing capabilities to assist or will Australia need to engage with another country?

The following section outlines these prioritised actionable tasks and provides an indication of some of the other potential actions put forward during the group discussions. Some groups were also able to agree on next steps.

4.1 Harvesting of living resources

Apply technology to oceanic compliance and reporting

– Introduce compliance monitoring systems to existing licenses to reduce prevalence of IUU fishing and other illegal activities.

NEXT STEPS

- Establish partnership with Indian Ocean nation ‘blue economy’ champions.
- Identify compliance and reporting requirements that need improvement.
- Pilot new approaches and technologies.
- Evaluate.
- Australian support of improvements at the Indian Ocean Tuna Commission (IOTC).

CASE STUDY – TRACING THE PROVENANCE OF TUNA TO REDUCE IUU FISHING

Multi-million dollar strategic investments by CSIRO over the past five years have delivered the technical foundation required to make the large-scale, cost-effective, forensic-grade genotyping required for identification of species, provenance and individuals an operational and economic reality. Long-term relationships with Indonesia and the Maldives, and partnerships with the Australian Centre for International Agricultural Research (ACIAR) and the Marine Stewardship Council (MSC), have resulted in proof of concept applications for species and provenance of bigeye, yellowfin and skipjack tuna in the NE Indian Ocean.

Model coastal management options – Model both business-as-usual and alternative future scenarios using participatory processes to build local capacity and skills in modelling tools (see ‘No regrets – sustaining adaptive and rural livelihoods in Eastern Indonesia’ brochure).

<http://wp.csiro.au/r4da/?p=485>

CASE STUDY – SCENARIO PLANNING FOR COASTAL DEVELOPMENT OPTIONS

CSIRO has developed participatory modelling tools to assist local stakeholders (communities, local government, national government, NGOs and private sector) to assess alternative coastal development pathways and decisions, and trade-offs for livelihoods, economic growth and ecosystem services. The approach has been developed in Indonesia, Papua New Guinea and northern Australia. Evaluation has demonstrated that stakeholders' capacity to make integrated and coordinated decisions has been enhanced, with economic benefits for marginalised communities and groups including women and children.

NEXT STEPS

- Identify willing partners (e.g. Myanmar or Oman Ministry of Agriculture and Fisheries Wealth). It was thought that partnering with single Indian Ocean countries would be more effective than a collection of countries, agreement on prioritisation and approach can be difficult to achieve. There is also benefit in a pilot approach which can iron out the creases based on existing relationships and partnerships. For example, a Letter of Intent is currently being drafted between CSIRO and Oman to facilitate bilateral opportunities in areas of coastal ecosystems and development, artisanal and commercial fisheries, and aquaculture, including prawn aquaculture and alternative feeds (NovacqTM).
- Perform benchmarking on existing management.
- Undertake scenario planning approaches and evaluate impacts
- Identify appropriate assessment and management models and development options e.g. data-limited assessment approaches, community-based fishery management.

Audit prawn aquaculture business – Evaluate existing Indian Ocean prawn aquaculture businesses. Based on this assessment identify and engage with appropriate aquaculture businesses and implementation partners (private and public sector) to undertake technology transfer to improve productivity and reduce environmental impact.

For example, CSIRO would apply our expertise developed in Asian and Australian aquaculture businesses over the past decades in: sustainable feed technologies, disease management, domestication and selective breeding systems and environmentally sustainable farms management systems. This would include the operating systems that have been developed in Australia and that have operated adjacent to the Great Barrier Reef lagoon for 25 years with no adverse environmental impacts. This would ensure that aquaculture business achieves a balance between economic gains and conserving the ecosystems of adjacent environments.

CSIRO would work with identified IORA communities to rank the key research activities and initially target those with the highest likelihood to deliver early impacts to those communities whilst ensuring that aquaculture businesses achieve a balance between economic gains and conserving the ecosystems of adjacent environments.

NEXT STEPS

- Identify national partner home to industry and community.
- Collect basic statistics – e.g. production values and quantities, relevant diseases and incident rates, costs and losses.
- Technology foresighting (and application of existing technology).

OTHER ACTIONABLE TASKS RAISED

- Provide site demonstrations of aquaculture in fishing areas that are fit for purpose (i.e. use a domestic species). This would be of most use in African countries.
- Through discussions at IORA, strengthen the coalition of coastal states in the Indian Ocean Tuna Commission (synergy not currently in place). This could build on the planned Letter of Intent between CSIRO and the Oman Ministry of Agriculture and Fisheries Wealth, who is chairing the IOTC.
- Develop a pilot project of community based management that uses best practice.
- Provide training for negotiation skills to empower local businesses.
- Investigate food alternatives to wild fish such as sustainable terrestrial sources.

CASE STUDY – IDENTIFYING OR DEVELOPING ALTERNATIVE SOURCES FOR FISH PRODUCTS

Previously, prawn farmers have needed to feed their prawns with a pellet that included fish meal or fish oil to ensure the prawns grew fast and were a healthy and high-quality product for consumers. CSIRO have since developed Novacq™, an entirely natural bioactive feed ingredient produced by marine microbes. Prawns fed with Novacq grow on average 20–30 per cent faster, are healthier and can be produced with no wild fish products in their diet.

4.2 Extraction of non-living resources; generation of new resources

Providing resource mapping for potential wave-energy

– Helping energy businesses to get started by offering a resource characterisation service, providing a field trial/pilot opportunity for wave power technology.

Development of an IORA Region oil spill response

capability – Oil spill capability and capacity varies considerably between the IORA member nations as identified during a recent IORA meeting. Better coordination/networking between nations in oil spill response research and operational centres has been identified to be a major benefit to support offshore oil and gas exploration as well as marine transport activities.

Digitise and speed up the process for approving permits for exploration – for the initial phase of resource consent, make the process more transparent and accessible digitally and potentially cut the time of the process from multiple years to months.

NEXT STEPS

- Capability development is also required as part of this idea, both for digital platforms and operators, and could potentially occur through copying of existing platforms and staff exchanges from relevant government agencies.

Pre-fabricated porting technology – Develop pre-fabricated pop-up ports and dry docks to assist with increased demand for ports and shipping in an environment where all natural ports are full.

NEXT STEPS

- Identify industry partner. Woodside, for example, has expertise in this area and could facilitate a technology exchange.
- Link to broader coastal development, such as maintenance and capital dredging requirements for ports, including regional development. The port(s) may provide capacity beyond the immediate need and potentially across borders, including construction in neighbouring countries.

Massive Open Online Courses (MOOCs) for education and training

– Develop upskilling training programs to meet the needs of companies who in turn sponsor/subsidise the training topics. Materials would be prepared and delivered digitally.

NEXT STEPS

- Identify skills gaps.
- Identify local partner to allow access to workforce.

Online catalogue of field trial opportunities – Develop an online catalogue (similar to ‘Kickstarter’) of field trial opportunities to match companies with technology solutions and people with unmet needs. Local ideas could be pitched with experts/companies selecting the ideas that best meet the needs of the issue.

Bio-prospecting program – Develop an entrepreneurship program to accelerate opportunities related to bio-prospecting. Leverage a model similar to the KPMG Energiser program, which Woodside are involved in, to help design and accelerate young companies that target bio-prospecting opportunities in the Indian Ocean region.

Mobile data collections – Use mobile solutions to collect environmental impact data. Enlist local parties to collect data on various issues and conditions (e.g. mangroves, reef, etc.) and upload capacity to ‘cloud’ or database servers that have open access.

NEXT STEPS

- Investigate feasibility of Myanmar trial linked to Woodside oils and gas exploration and future monitoring.
- Connect with an Australian organisation as partner to provide mobile, training (e.g. web-based instructions) and upload facility (aiming for mutual benefit).

4.3 Commerce and trade in and around the ocean

Off-grid cold storage – Roll out off-grid cold storage solutions to reduce food wastage and increase market access for smallholder farmers, artisanal fishers and small aquaculture set-ups. This could be combined with assistance in developing an inventory system to link cold stores, producers and markets.

Small scale renewable energy applications – Develop solar, sail or other renewable energy solutions for ship operations on small fishing vessels to reduce shipping costs and increase access to shipping for developing economies.

NEXT STEPS

- Test the market.
- Identify energy generation devices and potential partners.
- Test for functionality, robustness and endurance in local conditions, and improve where required.
- Check and improve interoperability with vessel devices e.g. lights, safety devices, refrigeration, communications equipment and cooking equipment.
- Reduce the cost of manufacture and establish local manufacturing.

Mobile data collections – Develop mobile data collection for small businesses (e.g. artisanal fishers, tourism) to manage trade opportunities, inventory control and environmental management. This could be combined with introducing water quality sensors on fishing vessels and developing automated reef monitoring sensors.

NEXT STEPS

- Test multiple markets and identify the variances in the needs of each.
- Identify existing technology and platforms.
- Rapid prototype development and testing.
- Test functionality, robustness and user acceptability in market (via a pilot).
- Identify data security, regulatory and telecommunication issues and consider role of global information companies (e.g. Google fishing vessel tracking software).
- Consider cross-border functionality.

Micro-financing – Provide micro-financing for artisanal fisheries, smallholder farms, aquaculture, tourism and trade businesses to get around cash flow issues; or crowd funding solutions such as Kiva.

Marketing tool – Develop a marketing tool for local tourism operators to promote their businesses to wholesalers and travel agents in developed countries, with a focus on sustainable tourism operation.

4.4 Response to ocean health challenges

Healthy harbours – Leverage Australia's baseline data collection and monitoring capability in relation to biosecurity, pollution issues and shipping waste treatments. Australia has good systems and technology to monitor water quality, ballast water and invasive species, all of which could be rapidly deployed to Indian Ocean countries. These forms of monitoring grow increasingly important as shipping trade increases and susceptibility to invasive species grows.

Crowd funding – Develop a crowd funding platform for ecosystem restoration projects or community based National Resource Management monitoring e.g. mangrove reforestation. Ideas could be developed in partnership with local communities who would also own the implementation of the ideas that are funded.

Smart phone monitoring – Collecting marine data and monitor ocean data sets through the use of cheap smart phones (only in regions where smart phones and mobile networks are prevalent). Information could be collected for and around new sustainable development activities like fish farms, and relate to weather conditions, water quality or any aspect of ocean health that is relevant to a specific activity.

Talent scout program – Identify local talent who demonstrate either good practice or the potential to do good practice in a given blue economy business area. Once identified, train the individuals and enable them to pass the training on to their communities.

OTHER ACTIONABLE TASKS RAISED

- Regional business leadership community/group.
- Bring tide gauges up to international standards.
- Develop an inventory of port reception facilities.
- Outreach or communications project on economic benefits of sustainable marine resource management.
- Easily deployable water quality monitoring kit.
- Regional IORA hub to provide public good planning, monitoring and evaluation.
- Spatial planning database.

4.5 Summary

A number of common themes arose across the actionable tasks associated with the four topic areas. Ideas were not limited to re-purposing of existing technologies, and often focused on improved processes, management, education and training.

COMMONALITIES INCLUDED

- **Cheap, efficient and pragmatic data collection** – Australia has world class modelling capability that could be utilised to monitor and predict both economic and environmental scenarios. More broadly, there is significant opportunity for data to provide local businesses with a greater understanding of their operations and the impact they are having on the environment. It was frequently noted that data systems needed to be developed in concert with data interpretation capability to ensure the data is used and useful.
- **Increasing connectivity** – As highlighted in the trends chapter, increasing connectivity was thought to already be a trend occurring in the Indian Ocean region. Many of the actionable tasks put forward contribute to this idea at the micro level, attempting to connect smaller businesses and/or innovative ideas with larger businesses and investors. Some actionable tasks also involved pilots that could be expanded to larger regions at a later time after proof of concept.
- **Capability building** – Upskilling and training ideas were raised across all four topic areas. These ranged from simple community awareness education programs around the environmental impact of non-sustainable practices (for cultural impact) to skills-based workforce training (for economic impact). Importantly, this needs to be done in a way that breaks down behaviours that lead to unsustainable practices. For example, pilot projects in a small number of communities that would generate more widespread acceptance of change.

Many of these actionable tasks are designed to develop a foundation of knowledge and quality systems upon which technologies can later be applied. It was largely agreed that without this foundation, other potential solutions will not be able to contribute to the long-term sustainability of ocean health.

CASE STUDY – ALTERNATIVE SUSTAINABLE LIVELIHOODS

Our ability to empower local communities to develop sustainable livelihoods will often rely on identifying and facilitating a transition to alternative sources of food and income. The alternative livelihoods will take different forms because they will rely on the environment and resources surrounding each community. For example, areas with coral reefs might be able to develop opportunities in dive tourism. The path to developing these opportunities should include participatory modelling, but will also need extensions to implementation and capacity building, and in some cases will need assistance in assessments of the environment and resources so that the best alternatives can be identified.

For example coral bleaching is affecting reefs throughout South East Asia. With funding from the Asia Pacific Network for Global Change Research, CSIRO carried out an economic analysis of the value of the reefs to government, industry and communities – particularly dive operators – in Indonesia, Malaysia and Thailand. This project has had a direct impact on policy in several of the areas under consideration. Several local management authorities have imposed small fees for divers visiting their reef areas. This is providing an ongoing source of funding to carry out capacity-building, mitigation and protection activities for the reefs. The work being done to safeguard reefs and train local dive operators in these regions will provide opportunities for Australian tourism operators.

ENDNOTES

¹ Indian Ocean Rim Association Press Conference Transcript, 9 October 2014 <http://foreignminister.gov.au/transcripts/Pages/2014/jb_tr_141009a.aspx?ministerid=4>

² Australian Maritime Safety Authority website <<https://www.amsa.gov.au/community/>>

³ The Hon Ian MacFarlane MP and the Hon Karen Andrews MP 2015 media release, Marine Science Plan to guide blue economy <<http://minister.industry.gov.au/ministers/macfarlane/media-releases/marine-science-plan-guide-blue-economy>>

⁴ Australian Fisheries Management Authority (2015), Australia's Blue Economy: \$100 billion in 2025.

⁵ FAO (2012), The State of World Fisheries and Aquaculture. Rome: FAO.

⁶ IORA website <<http://dfat.gov.au/international-relations/regional-architecture/indian-ocean/iora/pages/indian-ocean-rim-association-iora.aspx>>

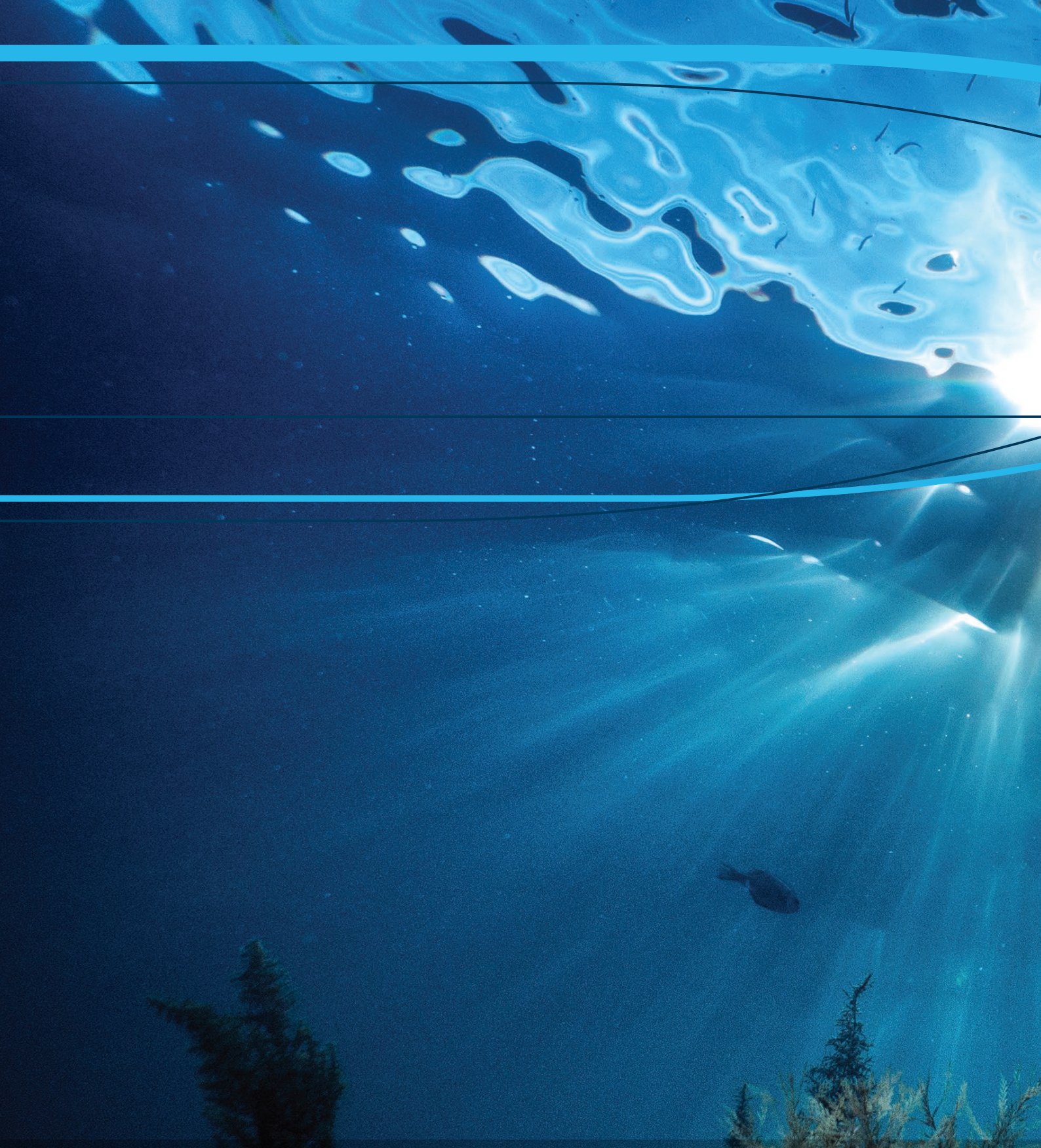
⁷ IORA Blue Economy Conference website <<http://www.iorabec.net/themes.aspx>>

⁸ InnovationXchange website <<https://innovationxchange.dfat.gov.au/about-us>>

⁹ Economist Intelligence Unit briefing paper for the World Ocean Summit 2015.







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