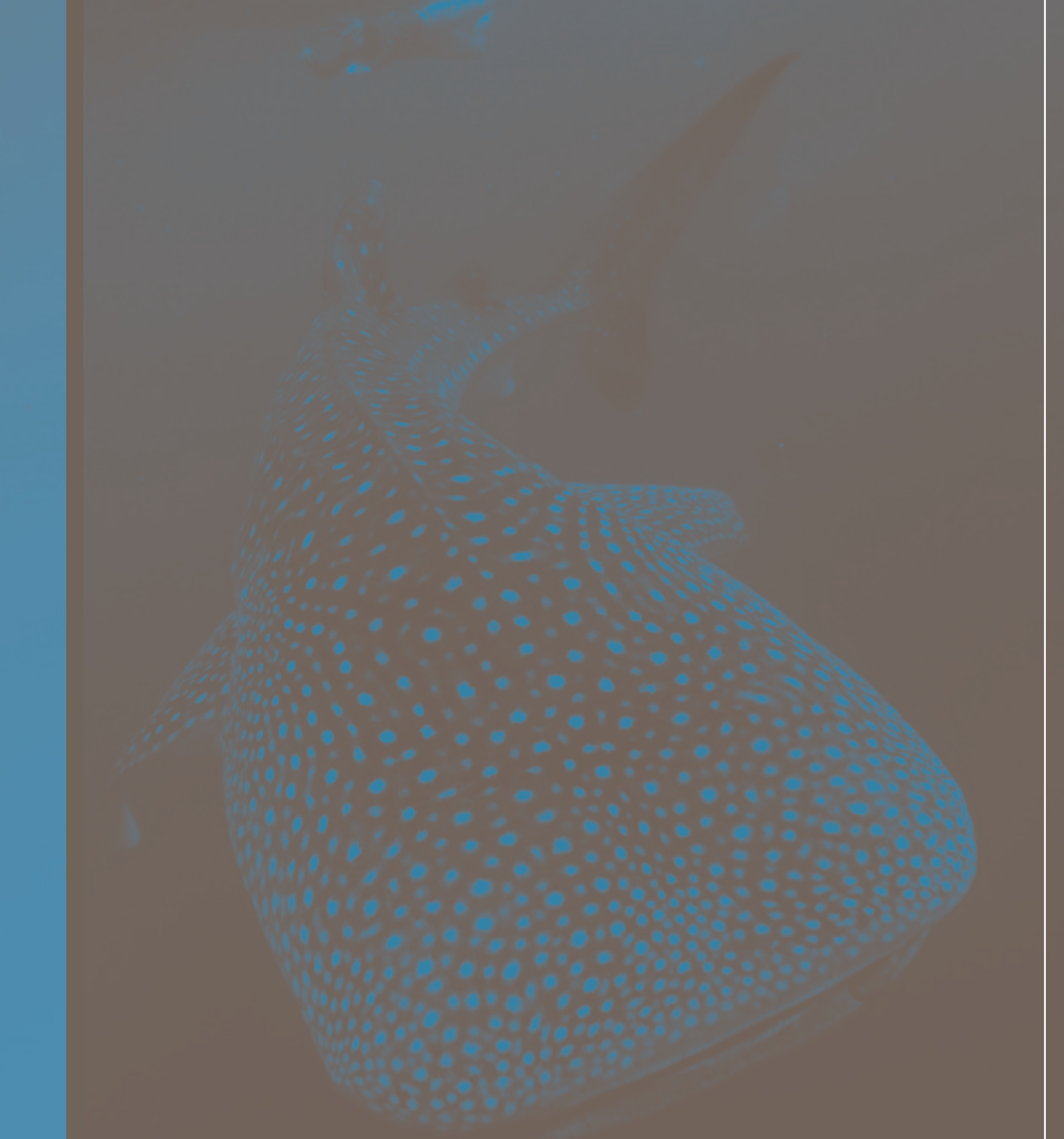

# THE BLUEPRINT FOR MARINE SCIENCE 2050

## SUMMARY

*Research directions to enhance industry competitiveness and government effectiveness in the marine environment off Western Australia*

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*Research directions to enhance industry competitiveness and government effectiveness in the marine environment off Western Australia*

THERE IS A GREAT DEAL WE STILL NEED TO LEARN IF WE ARE TO MAKE INFORMED DECISIONS ABOUT ACTIVITIES THAT ARE INCREASINGLY MARGINAL, COSTLY AND CONTENTIOUS

## AN INDEPENDENT REPORT TO ALL STAKEHOLDERS BY THE BLUEPRINT STEERING GROUP

This ***Blueprint for Marine Science 2050*** (the Blueprint) is an independent, objective assessment of the participating stakeholders' priorities for future marine research in Western Australia.

The Blueprint is stakeholder focussed to ensure any resulting research agenda is guided by real world priorities.

This process has provided a sobering picture of the work required to underpin efficient and sustainable development of our ocean to 2050. There is a great deal we still need to learn if we are to make informed decisions about activities that are increasingly marginal, costly and contentious.

Aside from the priorities identified, this process has begun the important across-sector conversation about the work ahead. This conversation must be continued and expanded as we acknowledge the need for greater collective understanding of our ocean beyond just the project, fishery, or marine park scale.

We encourage Governments of all levels, industry and the research sector to review the Blueprint and to actively support the coordinated, decadal program of research and innovation that is needed.

Some of the priorities identified in this document are not new. However, the limited progress in some areas indicates that a more coordinated approach is required.

As such, we recommend ongoing monitoring of progress and periodic replacement of this Blueprint. It is imperative that this process of review is continued and adapts to evolving priorities.

While not the focus of this assessment, we also acknowledge that fundamental research and the pursuit of knowledge is a critical component of an innovative society. It is our hope that the outcome focussed research that this Blueprint may trigger will also contribute to developing and retaining expert capability in Western Australia and leverage additional opportunities for this fundamental research.

We also congratulate the Western Australian Marine Science Institution for taking the strategic initiative to commission this independent process, and thank it for the trust placed in the Steering Group to oversee this process.

This summary report and the full Blueprint for Marine Science 2050 can be found at **www.wamsi.org.au/blueprint**

**Alistar Robertson** (Independent Chair) on behalf of:
**Heather Brayford** A/Director General WA Department of Fisheries
**David Carter** CEO Austral Fisheries
**John Gunn** Chair National Marine Science Committee
**Jennifer McGrath** Executive Director WA Department of Premier and Cabinet (Office of Science)
**Colin Scott** Subsea & Pipeline Manager, Wheatstone Upstream Project Chevron Australia
**Patrick Seares** CEO WAMSI
**Luke Smith** Principal Environmental Scientist Woodside Energy
**Stuart Smith** CEO NOPSEMA
**Paul Vogel** Chair WA EPA

## AUSTRALIA'S BLUE ECONOMY WILL INJECT $100 BILLION TO THE NATIONAL ECONOMY OVER THE COMING DECADES. ALL OF THESE ACTIVITIES, AND THE BENEFITS THEY PROVIDE, ARE ENABLED BY SCIENCE.

Western Australia is at the forefront of this growth due to the extraordinary scale of the neighbouring ocean, its beautiful habitat and bountiful resources that make up its marine environment.

Activities such as the nation-building oil and gas industry, rapidly increasing shipping in the northwest, ambitions for expanded sustainable fisheries, the expansion of coastal and deep water marine reserves, rapid coastal development in the southwest as well as expanding regional port infrastructure are all effecting our marine environment.

Emerging industries such as aquaculture in the southwest and renewable energy are also developing, along with first thoughts into future opportunities such as deep seabed mining.

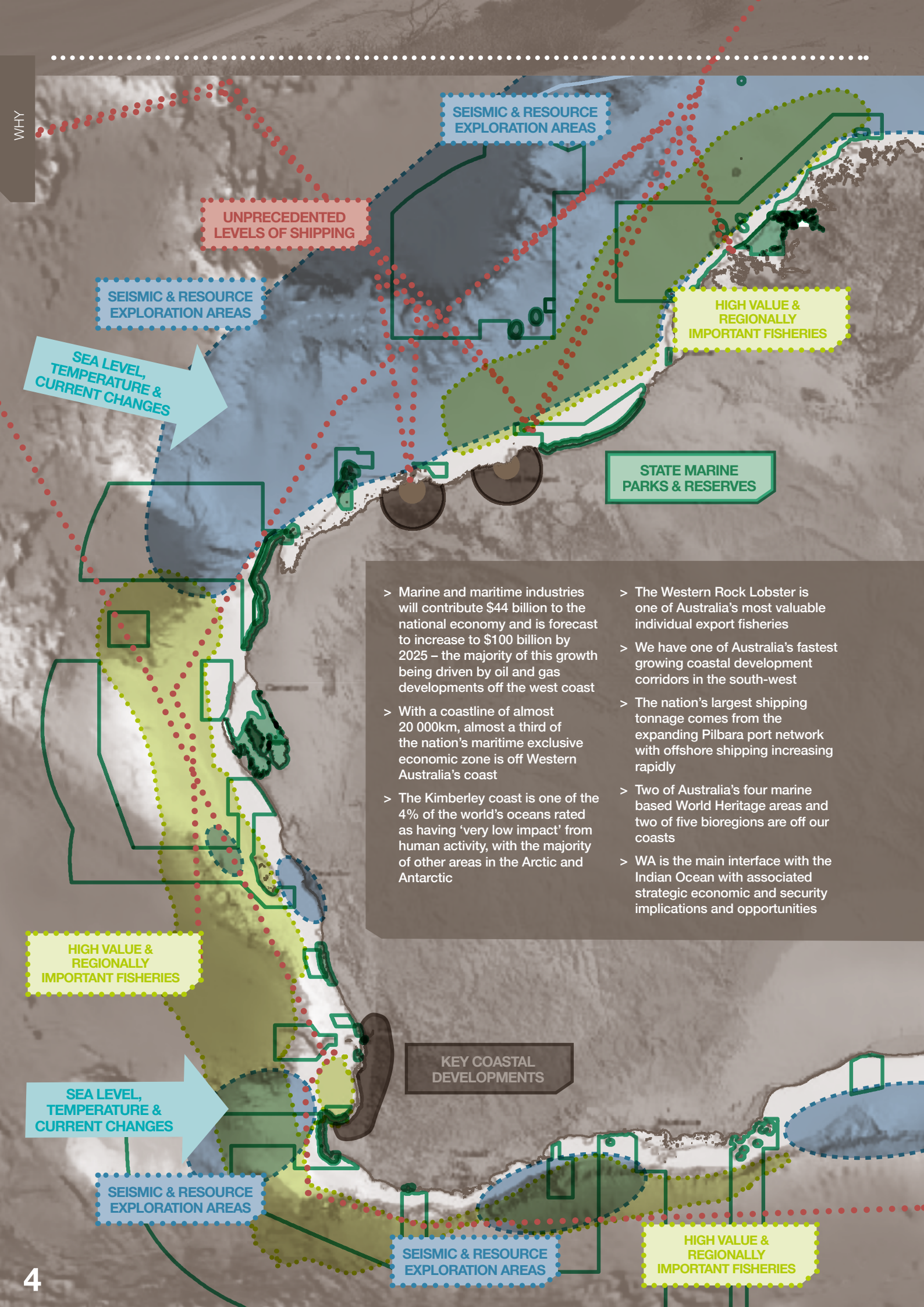
These activities are critical to national and state economies, and even more so to the coastal regions in which they are based. Global competition, however, means that industry can no longer rely on the natural advantage of abundant resources and must find smarter, cheaper and less risky approaches to business to grow these industries.

Alongside the explosion of marine activity over the last few decades, changes to our ocean have started which we will need to adapt to in the future. Warm currents are moving further south affecting fisheries and habitats, acidity is increasing, while sea level and cyclone driven conditions are becoming a greater issue for infrastructure and safety.

All of this development and change is happening in the context of the Western Australian community's fundamental expectation that the ocean and beaches will remain clean and healthy to be enjoyed long into the future.

Our knowledge is still catching up with current development. So as we look further ahead to new decades of development in a changing ocean, the need to better understand our ocean and its ecology has never been greater.

ALONGSIDE THE EXPLOSION OF MARINE ACTIVITY OVER THE LAST FEW DECADES, CHANGES TO OUR OCEAN HAVE STARTED WHICH WE WILL NEED TO ADAPT TO IN THE FUTURE




- Marine and maritime industries will contribute $44 billion to the national economy and is forecast to increase to $100 billion by 2025 – the majority of this growth being driven by oil and gas developments off the west coast
- With a coastline of almost 20 000km, almost a third of the nation's maritime exclusive economic zone is off Western Australia's coast
- The Kimberley coast is one of the 4% of the world's oceans rated as having 'very low impact' from human activity, with the majority of other areas in the Arctic and Antarctic
- The Western Rock Lobster is one of Australia's most valuable individual export fisheries
- We have one of Australia's fastest growing coastal development corridors in the south-west
- The nation's largest shipping tonnage comes from the expanding Pilbara port network with offshore shipping increasing rapidly
- Two of Australia's four marine based World Heritage areas and two of five bioregions are off our coasts
- WA is the main interface with the Indian Ocean with associated strategic economic and security implications and opportunities

# WHY WE NEED TO INVEST IN NEW INFORMATION

Balancing the opportunities and challenges ahead of us requires new knowledge.

Efficient and sustainable growth in our marine environment means that industry has information to support investment decisions and reduce the costs of doing business, and Governments have information to protect the environment and enable sustainable development.

Through this Blueprint, stakeholders from industry and Governments have agreed that there is:

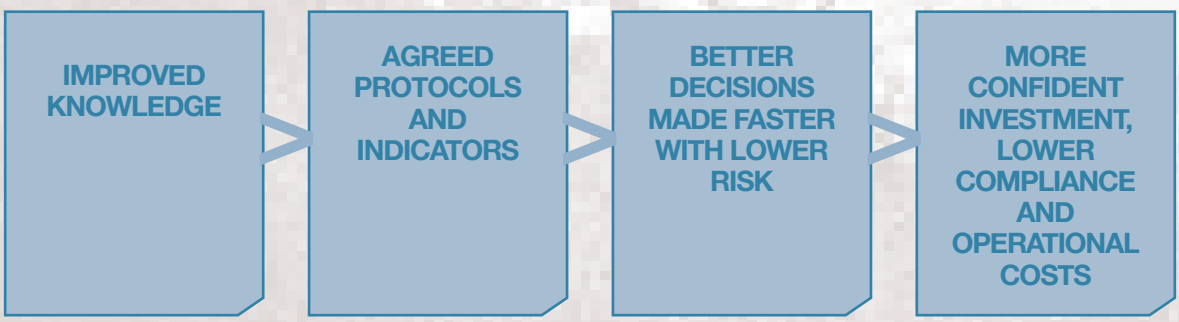
- **a growing gap between our fundamental understanding of the ocean, and the knowledge required to support increasing development and management**
- **the emergence of new activities without the corollary understanding of what effect they will cause**
- **the importance of research dedicated to reducing the cost of operating for both industry and Government, and not just environmental management**
- **a need for greater collaboration, particularly between the public and private sectors, given the scale of the challenge, opportunities for efficiencies and limits of available capability.**

Without better information, we will make either precautionary decisions which can add substantial cost to assessments and operations, or potentially risky decisions, each of which will undermine the competitiveness and sustainability of our Blue Economy as it faces ever increasing global competition.

When delays to offshore infrastructure delivery can cost tens of $millions per day, a climate exposed fishery makes up a major part of a regional centres economy, or there is pressure for urban development in areas of poorly understood coastal risk, the stark costs of not investing in timely knowledge before acting is very apparent.

## THE BLUEPRINT SEEKS TO PROVIDE HEIGHTENED FOCUS AND PRIORITY THAT WILL ALLOW US TO MOVE FROM THIS….


## TOWARDS THIS



# THE BLUEPRINT FOR MARINE SCIENCE

The Blueprint outlines project scale science needs, opportunities for strategically important research programs, and implementation approaches to improve how we deliver marine science in Western Australia.

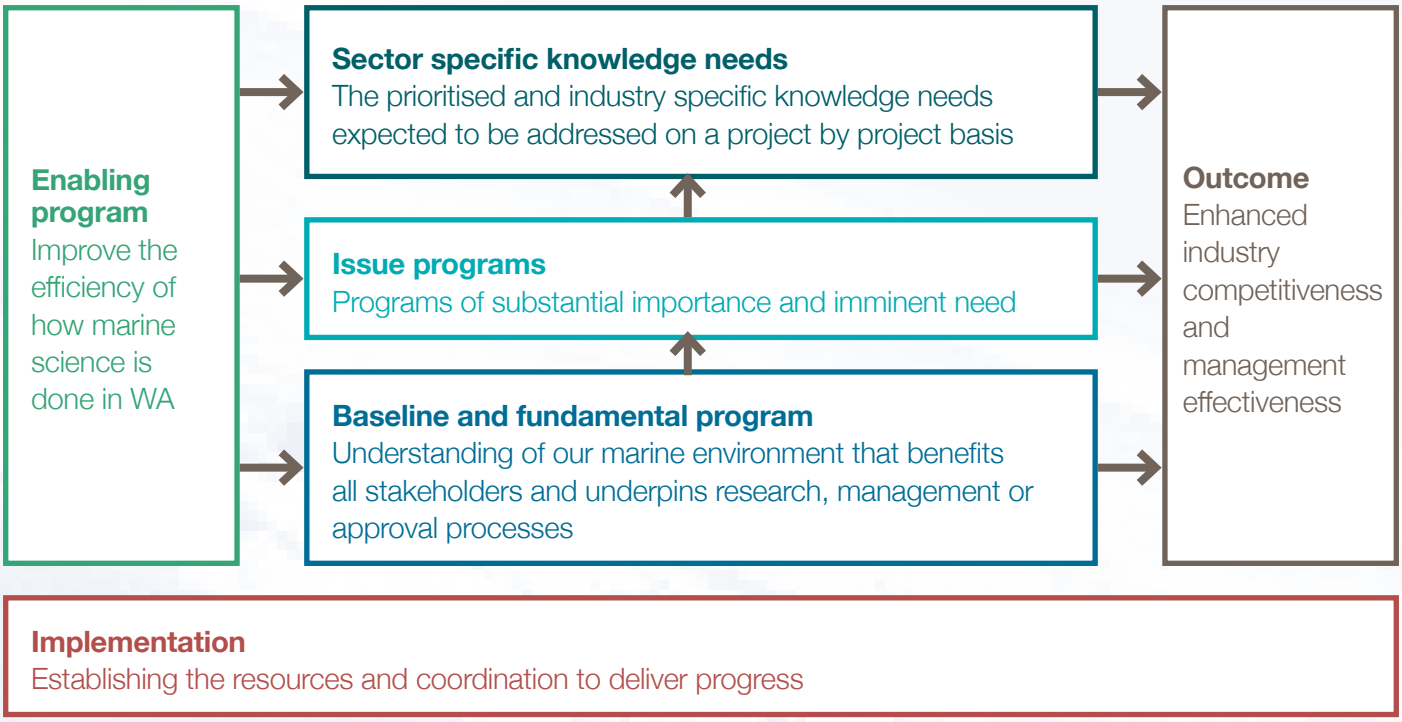
The framework below enhances the existing delivery of marine research by:

- **Building efficiency into marine research and assessments;**
- **Improving coordination and delivery in three fields that underpin most marine management, development and research activities; and**
- **Prioritising the focussed programs of work that are needed to competently respond to complex and multi-sectoral issues arising in the next 10 years**

This approach provides an effective pathway to ensure our understanding of the marine environment keeps pace with our plans to develop it.

The elements of the framework are summarised over the coming pages.

## THE BLUEPRINT FRAMEWORK IS AS FOLLOWS:



# SECTOR SPECIFIC KNOWLEDGE NEEDS

Stakeholders have identified over 100 sector specific knowledge gaps that would contribute to greater effectiveness and better opportunities for sustainable development in our marine environment.

These include:

| SECTOR | | |
|---|---|---|
| | **FISHERIES** | > Impact of climate change events on location and productivity of fisheries<br>> Cumulative impacts on fish and key fish habitats<br>> Health issues and preventative measures for high value aquaculture species |
| | **OFFSHORE OIL AND GAS** | > Cumulative noise profile and effects from seismic and shipping activities<br>> Bottom and boundary-layer currents, and seabed mobility<br>> Risk and cost/benefit of offshore infrastructure decommissioning options |
| | **PORTS AND SHIPPING** | > Precision of marine conservation reserves that affect transport corridors<br>> Definition of dredging impacts to assist with future projects<br>> Improved monitoring and management of invasive species |
| | **COASTAL DEVELOPMENT AND CATCHMENTS** | > Risk and liability of future coastal inundation, erosion and sedimentation<br>> Cumulative impact of anthropogenic effects on estuary condition<br>> Impact of changed inflows, sedimentation and nutrient inputs to estuary and coastal ecosystems |
| | **FUTURE INDUSTRIES** | > Economic competitiveness of ocean energy in the general energy mix, or for specific projects<br>> Improved technologies to support rapid identification of high value naturally occurring compounds (bioprospecting)<br>> Preliminary analysis of subsea prospectively for specific minerals |
| | **PROTECTION AND REGULATION** | > Profile and effect of cumulative impacts under future development scenarios<br>> Connectivity of marine species and environments<br>> Variables to act as pre-emptive indicators of environmental health<br>> Technologies to reduce the cost of monitoring the environment |

**Sector specific knowledge needs** are detailed in sections 2 and 3 of ***The Blueprint for Marine Science 2050 Report***

# BASELINE AND FUNDAMENTAL PROGRAM

Priority baseline research themes have been identified for information that will contribute to nearly all marine activities either directly or indirectly, and underpins the majority of other marine research.

For example, it is not possible to identify the effects of ocean current changes on fisheries or tourism hotspots, enable effective local modelling of oil spills and effects on subsea infrastructure, or flag risks to coastal development without first improving our regional understanding of those ocean currents through oceanographic research.

These baseline research themes should be ongoing as they cover areas where information will be required into the future as development and other pressures expand into new areas and activities.

As such, a single focussed research program of several years will accelerate answers being provided in priority areas right now, but long-term (decadal) and coordinated effort against these baselines will be required with ongoing review of short-term focus and adaptation.

| BASELINE RESEARCH THEMES | PRIORITY AREAS |
|---|---|
| **BASELINE DATA CONSOLIDATION AND SYNTHESIS** | > To optimise the outcomes of marine science and efficient allocation of research funding (particularly with respect to expensive field work) there is an urgent need to identify existing data and knowledge and to synthesise this into a clear and detailed definition of the 'state-of-the-art' for key regions and subjects.<br>> Key priorities include agreeing on the important baseline datasets and trends that require synthesis; synthesis of traditional indigenous knowledge for key coastal development areas, and compiling a Pilbara marine summary after a decade of intense assessment. |
| **REGIONAL OCEANOGRAPHY** | > Physical oceanographic processes underpin our understanding of the connectivity of ecosystems and the effect of broad scale ocean changes on the Western Australian marine environment and development activities. An enhanced understanding of regional oceanography also improves and reduces the risks involved in localised oceanographic modelling.<br>> Key priorities include the hydrocarbon provinces; understanding of hydrocarbon spill risk; coastal development regions and broader changes in the Indian Ocean including its effect on rainfall. |
| **ECOSYSTEM FUNCTION** | > Understanding marine ecosystems is critical to understanding the pressures that they can sustain before the key ecosystem services that they provide are compromised, and whether or not impacts from pressures on these ecosystems are reversible.<br>> Key priorities include the role of microbial activity; connectivity and relationships of trophic levels; eco-toxicoligy of sensitive and at risk environments; as well as ecosystem and protected species resilience to pressures and change. |
| **BIODIVERSITY AND HABITAT** | > A deeper understanding and inventory of the extent and variability of marine biodiversity and habitats that exist within the Western Australian marine environment is required to inform evidence and risk-based regulation, conservation estate decisions and sustainable marine industries.<br>> Key priorities include near shore areas of major across-sector pressures; key regional fishery areas; and the northwest offshore hydrocarbon region. |

**Baseline and fundamental program** is detailed in section 4.2 of ***The Blueprint for Marine Science 2050 Report***

# ISSUE PROGRAMS

Key issue programs have been identified in areas where concerted investigation is needed in the near future to inform major upcoming management and regulatory decisions.

Some of these programs interact with several sectors and some are focussed on particular operations where there is the potential for major economic or risk management outcomes.

These programs should be progressed as a matter of urgency over the coming decade and should be closely managed to ensure timely and quality delivery.

| ISSUE PROGRAMS | PRIORITY AREAS |
|---|---|
| **CUMULATIVE IMPACTS ON ECOSYSTEMS** | > The noise profile and potential impact in the northwest; concentration of offshore assets in Exmouth and Browse Basins; cumulative effects in high population areas and development nodes of the southwest and northwest; and identification of key indicators to monitor cumulative pacts and pressures in each region. |
| **DECOMMISSIONING OF OFFSHORE INFRASTRUCTURE** | > The impact of degraded infrastructure on water quality; the value of decommissioned infrastructure as an environmental and fish attraction asset; the risk profile, cost benefit and liability issues associated with in situ decommissioned offshore infrastructure in the northwest. |
| **BIOSECURITY** | > Technologies to rapidly identify invasive marine organisms; and technologies to improve management of invasive species. |
| **REMEDIATION OF MARINE ECOSYSTEMS** | > The reversibility of seafloor impacts from aquaculture operations, marine stock enhancement; benthic rehabilitation following major offshore and nearshore infrastructure activities; technologies and methods for remediation of the impacts of legacy sediment, nutrient, carbon and contaminant run-off on major Western Australian estuarine and coastal. |
| **ENHANCED PRODUCTIVITY** | > All of the priority themes identified in this Blueprint ultimately impact on the productivity of marine operations. However undertaking operations in the Western Australian marine environment is costly, specific priorities with respect to improving the productivity of those operations need to be addressed.<br>> Priorities include: better targeting of fish and fishing techniques; identifying new sustainable fisheries; more efficient aquaculture; legal liability for impacts on coastal infrastructure; improved design specification for coastal infrastructure and planning. |
| **SOCIAL LICENCE TO OPERATE** | > A key element of maintaining social licence to operate in the marine environment is understanding the cultural and economic aspects of the community's interaction with the marine environment and the values, attitudes and beliefs that the community ascribes to aspects of the marine environment. It is only with this understanding that sectors that require a social license to operate in the marine environment can design their activities so that they meet community expectation. |

**Issue programs** are detailed in section 4.2 of ***The Blueprint for Marine Science 2050 Report***

# ENABLING PROGRAM

The enabling program will reduce the cost of delivering new science, and allow a better and more reliable outcome from research delivered.

Several aspects of the enabling program have been the subject of ongoing discussion and proposals over many years with mixed success. These opportunities for improvement require sometimes difficult across-sector agreements, and changes to the ways in which some groups operate to align with state-wide approaches.

If these short term barriers are removed, the changes will result in a more effective and efficient legacy of research outcomes which will benefit all parties in the longer term.

| ENABLING PROGRAM | PRIORITY AREAS |
|---|---|
| **COST EFFECTIVE MARINE MONITORING AND DATA ACQUISITION** | > Identification of a set of efficiently measurable variables that serve as pre-emptive indicators of change, new technologies for collecting environmental and metocean data in near-shore, turbid and deep offshore environments, cross-sectoral standards for data collection and reporting, a framework for assessing and prioritising environmental monitoring and oceanographic observing |
| **IMPROVED DATA SHARING** | > Expansion or adaptation of I-GEMS metadata collection system as a mechanism to allow assessment of current datasets, adoption of national best practice data management and accessibility standards by all public research and governance institutions, cross sector processes to agree on the specific and critical historic datasets supporting priorities in this Blueprint and negotiation to share these data |
| **CERTAINTY IN MODELLING** | > While physical oceanographic and ecological models pertaining to key aspects of the Western Australian marine environment exist, the validation of those models is based primarily on localised data and limited wide-resolution regional data. There is an urgent need to integrate these models with wider physical and biological data sets of greater resolution to improve and validate these models in order to reduce the risk associated with decisions based on these models<br>> Effort should also be given to establishing consistent approaches to modelling that allow users of that modelling to more easily understand and validate the accuracy and reliability of modelling outputs |

WESTERN AUSTRALIA IS FORTUNATE TO HAVE SUBSTANTIAL PUBLIC CAPABILITY INCLUDING THE WESTERN AUSTRALIAN MARINE SCIENCE INSTITUTION, THE IMOS OBSERVING INFRASTRUCTURE, PAWSEY SUPERCOMPUTING CENTRE AND THE INDIAN OCEAN MARINE RESEARCH CENTRE. OPPORTUNITIES TO UTILISE THESE FACILITIES SHOULD CONTINUE TO BE EXPLORED

**Enabling program** is detailed in section 4.2 of ***The Blueprint for Marine Science 2050 Report***

# IMPLEMENTING THE BLUEPRINT

The Blueprint demonstrates that the challenge is considerable to provide the right information to make competent, informed, de-risked decisions on important matters in five or ten years. Fortunately Western Australia benefits from a relatively collegiate and comprehensive marine science sector and very well informed stakeholders.

With some changes to how work is done, strategic investment in priority research and enhanced collaboration we will be able to make the progress required to underpin a competitive, and sustainable, Blue Economy off the western coast of Australia.

## CONTINUE TO LOOK FORWARDS AND MONITOR SUCCESS

> The Blueprint must be the start of an ongoing process of looking forwards. Monitoring progress and repeating this process every five years will ensure that new challenges and opportunities continue to be addressed.

## DELIVERY OF SPECIFIC SECTOR KNOWLEDGE NEEDS

> Over 100 sector specific knowledge needs have been identified in this document, and tailored solutions to these issues are at the core of improving marine activities off Western Australia. The research sector is encouraged to focus on these areas of science.

## FUNDING

> Substantial and ongoing funding is required to make genuine progress against the knowledge gaps identified through the Blueprint. Senior stakeholders should collectively discuss opportunities to fund at-scale, across-sector, research programs acknowledging the strategic, if not immediate, benefits to future operations.

## COLLABORATION

> While there is strong public is sector collaboration in place, there should be a marked improvement in the collaboration between the public and private sector in addressing enabling issues, and ensuring outcome focussed research that delivers real impact on day to day activities.

## ACCELERATING URGENT AND UNDERPINNING PROGRAMS

> A concerted effort across all sectors to progress baseline, enabling and key issue programs will accelerate our level of understanding to meet imminent timelines for important decisions and future planning.

## KNOWLEDGE TRANSFER

> Improved coordination and consistency in how new information is provided to end-users, and the wider community, will ensure that research has the greatest impact possible.

THE BLUEPRINT FOR MARINE SCIENCE 2050 IS THE TRIGGER FOR AN ONGOING TRANSFORMATIONAL EFFORT TO IMPROVE THE IMPACT AND BENEFITS, OF MARINE SCIENCE. THROUGH REAL COMMITMENT TO DELIVERING THE BLUEPRINT THERE WILL BE A TANGIBLE BENEFIT TO WESTERN AUSTRALIA'S MARINE INDUSTRIES, TO THE PROTECTION OF THE ENVIRONMENT AND TO THE CONSOLIDATION OF PERTH AS THE CENTRE FOR MARINE SCIENCE AND EDUCATION ACROSS THE INDIAN OCEAN.

# THE BLUEPRINT FOR MARINE SCIENCE 2050 SUMMARY

*Research directions to enhance industry competitiveness and government effectiveness in the marine environment off Western Australia*

THIS SUMMARY REPORT AND THE FULL BLUEPRINT FOR MARINE SCIENCE 2050 CAN BE FOUND AT
**WWW.WAMSI.ORG.AU/BLUEPRINT**

BOTH PAPERS WERE COMMISSIONED BY, BUT PREPARED INDEPENDENTLY FROM, THE WESTERN AUSTRALIAN MARINE SCIENCE INSTITUTION (WAMSI).

THE BLUEPRINT FOR MARINE SCIENCE 2050 FULL REPORT WAS PREPARED BY AUSTRALIAN VENTURE CONSULTANTS UNDER THE GUIDANCE OF THE INDEPENDENT STEERING GROUP.

*Photo page 3 centre: Shannon Conway, courtesy Department of Fisheries*