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JOINT INDUSTRY OPERATIONAL AND SCIENTIFIC MONITORING PLAN FRAMEWORK

CONTENTS

Version	Author	Date
Rev. A	Lucy Sands – BlueSands Environmental	15th May 2018
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1. INTRODUCTION

1.1. PURPOSE

An Operational and Scientific Monitoring Plan (OSMP) is a key component of the environmental management document framework for offshore petroleum activities, which also include an Environment Plan (EP) and Oil Pollution Emergency Plan (OPEP). The OSMP and its supporting documents are instrumental in providing situational awareness of a hydrocarbon spill, enabling Incident Management Teams/Emergency Management Teams (IMT/EMTs) to make informed decisions that aim to minimise environmental impacts associated with a spill. The OSMP is also the principle tool for determining the extent, severity and persistence of environmental impacts from a hydrocarbon spill and resultant remediation activities.

As part of the Offshore Petroleum Greenhouse Gas Storage (OPGGS) (Environment) Regulations 2009 and various State/Territory regulations, Titleholders are required to ensure they have a suitable OSMP for their offshore petroleum activities. There is also a requirement to ensure these plans are fit for purpose, flexible and achievable, and ready to implement in the event of a spill. Titleholders must demonstrate that they have adequate capability to conduct the required monitoring activities and make informed decisions regarding its implementation, all of which are audited by regulatory authorities.

To date, Titleholders have worked independently to develop and implement their OSMP frameworks. This has led to a variety of different procedures and methods being produced. In the event of a spill, Titleholders will inevitably use the same contractors and consultants to conduct their monitoring scopes and are likely to call upon each other via mutual aid arrangements to support implementation of monitoring programs. The diversity of OSMP approaches mean that it would take considerable time for monitoring personnel familiarise themselves with each individual Titleholder's approach and finalise the monitoring design, leading to inefficiencies and lost time in collecting valuable data.

Therefore, Titleholders have been working together on a collaborative OSMP, which aims to align approaches and develop a set of industry best practice guidelines. This includes this Joint Industry OSMP Framework and a set of Operational Monitoring Plans (OMPs) and Scientific Monitoring Plans (SMPs). These documents align to individual Titleholders requirements through a Titleholder Bridging Implementation Plan (Section 2).

Benefits of a Joint Industry OSMP Framework include:

- Common set of OMPs and SMPs, including standardised guidance on aims, initiation and termination criteria, monitoring design, resource requirements and reporting procedures
- Increased OSMP capability across Australia, as Titleholders will be familiar with a shared OSMP Framework (and can support each other) and contractors can be trained to a common set of procedures creating long-term efficiencies
- Control and support agencies will be familiar with the standardised approach, resulting in a more effective spill response
- Reduced need for regulators to review multiple and lengthy OSMPs

- Provision of a common set of arrangements across Australia, rather than several different plans.

This OSMP Framework is designed to be adopted by any Australian Titleholder, therefore it must be flexible enough it its approach to cater for different spill scenarios and sensitive receptors. It is not the intention of this Framework to design the OMPs and SMPs to the same level of detail that is possible for impacts of a known timing and location e.g. a dredging program. The individual OMPs and SMPs are guiding templates, sufficient in detail to enable rapid finalisation following a spill and which can be adapted to a specific spill and the specific sensitive receptors at risk.

The Joint Industry OSMP Framework is proposed to be managed through a central organisation that can maintain evidence of the required monitoring capability and be subject to a review and testing schedule to demonstrate suitable arrangements are maintained and continually assessed to identify areas for improvement.

1.2. OBJECTIVES

The objectives of this Joint Industry OSMP Framework are to:

- Provide a standardised approach and guidance to Titleholders, consultants and contractors that are undertaking operational and scientific monitoring
- Describe the suite of OMPs and SMPs that provide the minimum content requirements to meet the monitoring objective of each plan
- Recommend a common set of implementation arrangements that can be managed by a central organisation, resulting in improved industry-wide OSMP capability.

1.3. DEFINITIONS

1.3.1. OPERATIONAL MONITORING

Operational monitoring collects information about the spill and associated response activities to aid planning and decision making for executing effective spill response or clean-up operations.

1.3.2. SCIENTIFIC MONITORING

Scientific monitoring focuses on non-response objectives and evaluating environmental impact and post-impact recovery from the spill and response activities. Scientific monitoring may be undertaken over an extended period to fully understand impacts.

1.4. SCOPE

1.4.1. ACTIVITY TYPES

This OSMP is relevant to activities regulated under the OPGGS (Environment) Regulations 2009 and other corresponding State/Territory legislation, including but not limited to:

- Shipping
- Drilling and completions
- Well workovers and interventions
- Subsea activities
- Pipelay activities
- Operations
- Decommissioning.

1.4.2. HYDROCARBON TYPES AND STATES

Australia's petroleum resources are vast and diverse, ranging from gas to crude oils. This OSMP is applicable to all hydrocarbon types found in Australian Commonwealth, State and Territory waters, including persistent and non-persistent hydrocarbons, as described by ITOPF (Ref.1). It also takes into account the distribution of hydrocarbons the marine environment, including surface, shoreline, entrained and dissolved fractions as well as fresh and weathered states.

1.4.3. GEOGRAPHICAL EXTENT

This OSMP is relevant and applicable to all marine and coastal areas (Commonwealth, State and Territory) around Australia that are potentially at risk of exposure to hydrocarbons in the event of a spill resulting from offshore petroleum activities.

1.5. TARGET AUDIENCE

Titleholders:

- Personnel responsible for the planning and implementation of Operational and Scientific Monitoring
- Incident Management Team (IMT)/ Emergency Management Team (EMT) personnel, including Environment Unit Lead, Incident Commander, Planning Section Chief, Operations Section Chief and Logistics Section Chief
- Environment Plan authors.

Commonwealth and State/Territory Agencies:

- National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)
- Australian Maritime Safety Authority (AMSA)
- State Control Agencies and/or Hazard Management Authorities.

Monitoring Providers:

- OSMP Monitoring/Service Providers

- Independent scientific advisors.

2. OSMP FRAMEWORK STRUCTURE

The purpose of the OSMP Framework is to develop an industry standard for operational and scientific monitoring. Figure 2-1 illustrates the key documents that form part of this Framework and would be required to effectively implement the relevant monitoring programs. These plans include:

- Joint Industry OSMP Framework – this document, which shall be released to key stakeholders for review and input to ensure it aligns with regulatory and operational requirements
- Operational Monitoring Plans and Scientific Monitoring Plans – a series of plans developed through industry collaboration to provide detailed guidance to monitoring personnel, which can be finalised as applicable to the activity location and associated environmental sensitivities, and the nature and scale of an individual spill
- Titleholder OSMP Bridging Implementation Plan – written by individual Titleholders, this plan describes the interface between Titleholder's existing environmental management framework (e.g. EP and OPEP) and the OSMP Framework. This plan lists the key sensitive receptors and operational and scientific monitoring plans that apply to the Titleholder's activities. It also outlines relevant baseline studies to the activity, and Titleholder-specific management systems required to implement monitoring (e.g. capability, logistics, communications, data reporting)
- Titleholder Environment Plan – individual Titleholder plans, which outline the Environment that May be Affected (EMBA) by the spill (or area predicted to be affected by hydrocarbons), assess the potential environmental impacts and risks and list the control measures for the petroleum activity.

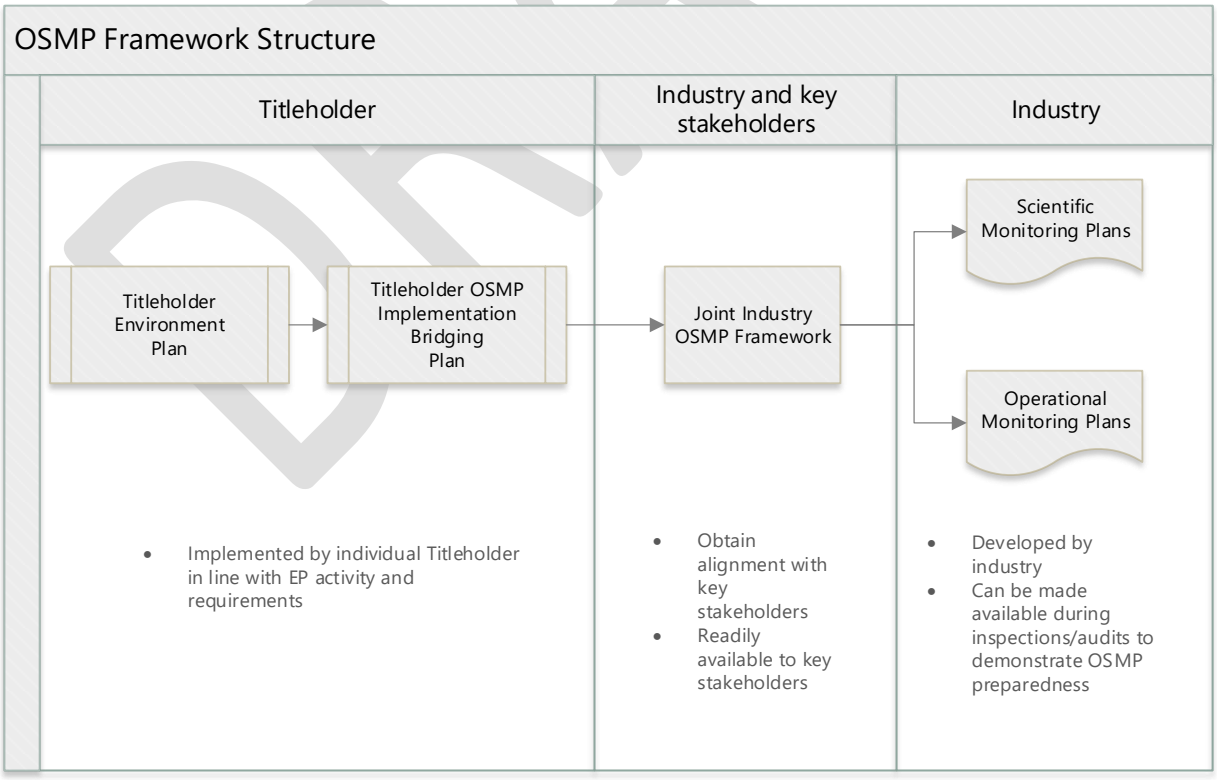


Figure 2-1: OSMP Framework Structure

3. REGULATORY REQUIREMENTS

The aim of the Joint Industry OSMP Framework is for it to be adopted by Titleholders and accepted or endorsed by regulators for use throughout Australia. This would require this OSMP Framework to meet the requirements of the OPGGS (Environment) Regulations 2009 and various State/Territory regulations.

Table 3-1 provides guidance on the requirements of the OPGGS (Environment) Regulations 2009 and reference to the relevant section of this document or the broader suite of documents, which addresses that requirement. State and Territory requirements have not been listed, as the OPGGS (Environment) Regulations 2009 typically require a greater level of detail than the State and Territory legislative requirements and are therefore considered to be addressed by Commonwealth legislation.

Table 3-1: OSMP Regulatory Requirement and Corresponding Demonstration in OSMP Framework

OPGGS (Environment) Regulations 2009 Requirement	Relevant document that demonstrates requirement
Part 2, Division 2.3, Regulation 14 (5) The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of his or her responsibilities in relation to the environment plan, including during emergencies or potential emergencies, and has the appropriate competencies and training	Titleholder Implementation/Bridging Plan to provide detail. Guidance provided in Section 10 and 11
Part 2, Division 2.3, Regulation 14 (8AA) The oil pollution emergency plan must include adequate arrangements for responding to and monitoring oil pollution, including the following: (a) the control measures necessary for timely response to an emergency that results or may result in oil pollution; (b) the arrangements and capability that will be in place, for the duration of the activity, to ensure timely implementation of the control measures, including arrangements for ongoing maintenance of response capability; (c) the arrangements and capability that will be in place for monitoring the effectiveness of the control measures and ensuring that the environmental performance standards for the control measures are met; (d) the arrangements and capability in place for monitoring oil pollution to inform response activities.	Titleholder Implementation/Bridging Plan to provide detail. Guidance provided in Section 10 and 11
Part 2, Division 2.3, Regulation 14 (8D) The implementation strategy must provide for monitoring of impacts to the environment from oil pollution and response activities that: (a) is appropriate to the nature and scale of the risk of environmental impacts for the activity; and (b) is sufficient to inform any remediation activities	Titleholder Implementation/Bridging Plan to provide detail on which OMPs and SMPs apply to the activity

In addition to the OPGGS (Environment) Regulations 2009, relevant NOPSEMA assessment guidance documents have been reviewed and key aspects have been incorporated into this Framework or noted as being required to be addressed in individual OSMP Bridging Implementation Plans. Table 3-2 outlines the relevance of each guidance document.

Table 3-2: NOPSEMA Guidance Documents Relevant to OSMP Framework and Titleholder Bridging Implementation Plan

Guidance document	Relevance to OSMP Framework/Titleholder Bridging Implementation Plan
NOPSEMA (2016) Operational and scientific monitoring programs: Information Paper N-04700-IP1349	Provides guidance to assist Titleholders in the development of an OSMP, with a focus on the design and implementation of scientific monitoring. This Framework and the individual SMPs address the points raised in this paper, with the exception of detailed information on baseline and demonstration of readiness which should be addressed in the Titleholder OSMP Bridging Implementation Plan (Refer to Section 10)
NOPSEMA (2018) Oil pollution risk management: Guidance Note GN1488 Rev 2	Provides guidance to Titleholders on OPEP content requirements to support the development of an acceptable EP submission. This includes information on operational monitoring requirements. This Framework and the individual OMPs address operational monitoring. However, Titleholder's will be required to provide additional detail in their OSMP Bridging Implementation Plan on how this Framework applies to the nature and scale of their activities (e.g. appropriate capability and resourcing), their process for selecting locations for monitoring and their specific arrangements for activation and mobilisation of operational monitoring teams (Refer to Section 10)
NOPSEMA (2019) Oil spill modelling: Bulletin #1:	Provides guidance on selecting exposure values for floating, entrained and dissolved hydrocarbons to help inform spatial extent for risk evaluation and planning for monitoring. Titleholders should explain their risk assessment process, selected exposure values and resultant sensitive receptors in their EP. The OPEP should identify response and monitoring priorities, which should be explained or cross referenced in their OSMP Bridging Implementation Plan (Refer to Section 10)

4. GOVERNANCE ARRANGEMENTS

The APPEA Marine Environment Science Working Group is currently responsible for governance of the Joint Industry OSMP Project, including the provision of funding and supporting the development of this OSMP Framework and supporting documents.

5. OPERATIONAL MONITORING OVERVIEW

Operational monitoring is crucial to ensure an effective oil spill response. Information obtained through operational monitoring provides the IMT/EMT with situational awareness on the trajectory of the spill, its weathering state and hydrocarbon concentrations and its potential impacts to sensitive receptors. This phase of monitoring is also designed to inform the effectiveness of the response options being used to treat the spill, so that the IMT/EMT can make informed decisions as the response progresses through subsequent operational periods. It also provides information on the impacts of the response activities, for example the impacts from shoreline clean-up activities are monitored via OMP: Shoreline Clean-up Assessment Technique. Table 5-1 lists the operational monitoring plans included under the Joint Industry OSMP Framework.

Table 5-1: Joint Industry Operational Monitoring Plans

Operational Monitoring Plan	Aim/Objective
Hydrocarbon properties and weathering behaviour at sea	To provide in field information on the hydrocarbon properties, behaviour and weathering of the spilled hydrocarbons to assist in spill response operations
Pre-emptive assessment of sensitive receptors at risk (desktop only)	To undertake a rapid desktop-based assessment of the presence, extent and current status of sensitive receptors at risk of being affected by a hydrocarbon spill, prior to contact
Shoreline clean-up assessment technique (SCAT)	Provide information on the physical and biological characteristics of shorelines within the predicted trajectory of the hydrocarbon spill or that have been exposed to the spill Conduct sectorisation of shorelines to aid in response planning and implementation of response activities Inform suitable pre-impact and post-impact response options/activities to minimise the threat posed to sensitive receptors from the spill and establish clean-up end points for the shoreline Inform the IMT/EMT of any potential or actual impacts to sensitive receptors from response options/activities Inform the IMT of any sensitive receptors that may be relevant to scientific monitoring programs
Surface chemical dispersant effectiveness and fate	To monitor the effectiveness, distribution and fate of surface chemical dispersants to verify impact/contact predictions for response planning and other monitoring plans
Hydrocarbon spill modelling	To utilise computer-based and first principal forecasting methods to predict spill movement and guide the management and execution of spill response operations to maximise the protection of environmental and other resources at risk
Water quality assessment	To provide a rapid assessment of the presence, type, concentrations and character of hydrocarbons in marine water to assess the extent of spill contact and verify impact predictions for other monitoring plans
Sediment quality assessment	To provide a rapid assessment of the presence, type, concentrations and character of hydrocarbons in marine sediments to assess the extent of spill contact and verify impact predictions for other monitoring plans
Marine fauna assessment • Reptiles	To undertake a rapid assessment of marine fauna at risk to assist in decisions on appropriate management and response actions during a

Operational Monitoring Plan	Aim/Objective
• Cetaceans (observational only) • Dugongs • Pinnipeds • Seabirds and shorebirds • Fish	hydrocarbon spill event to minimise the potential impact on marine fauna
Air quality modelling (responder health and safety)	To assess the impact of the hydrocarbon spill on human health, particularly that of the public and response personnel

The information provided in the plans is designed to enable Titleholders and Monitoring Providers to finalise the monitoring program design, so that it is appropriate to the activity location and associated environmental sensitivities, as well as the nature and scale of the event. The plans include:

- A description of Industry's minimum requirements, adopted standards and/or best practice guidance for monitoring design, sampling techniques and reporting requirements
- A list of resources recommended to implement the monitoring
- Draft standard operating procedures, which would be finalised by the relevant Monitoring Provider in the event of a spill.

Where practicable, the standard operating procedures are aligned with existing standards and processes, including:

- Department of Transport (Western Australia) oiled shoreline assessment (Ref. 2)
- Special Monitoring of Applied Resource Technologies (SMART) protocol (Ref. 3) and the American Petroleum Institute (API) Subsea Dispersant Monitoring method (Ref. 4) for dispersants
- CSIRO Oil Spill Monitoring Handbook (Ref. 5)
- AMSA sampling guides (Ref. 6)
- ANZECC Guidelines (Ref. 7)
- Revised ANZECC/ARMCANZ Sediment Quality Guidelines (Ref. 8).

Operational monitoring plans may be carried out simultaneously, and/or in conjunction with response activities. Table 5-2 identifies the operational monitoring components that may be triggered for the different response options and activities.

Table 5-2: Operational Monitoring Plan Triggered by Response Option

Response Option	Operational Monitoring Plan								
	A	B	C	D	E	F	G	H	I
Source Control – Well Capping	X				X	X	X		X
Source Control – Diverter/Shut-off Valves	X				X	X			X
Natural Recovery	X				X	X			
Dispersant Application	X	X		X	X	X	X	X	X
Containment and Recovery	X				X			X	X
Shoreline Protection	X	X	X		X	X	X	X	X
Shoreline Clean-up	X	X	X		X	X	X	X	X
Oiled Wildlife Response	X	X	X		X			X	X
Waste Management	X	X	X		X		X	X	X

A. Hydrocarbon properties and weathering behaviour at sea
B. Pre-emptive assessment of sensitive receptors at risk (desktop only)
C. Shoreline clean-up assessment technique (SCAT)
D. Surface chemical dispersant effectiveness and fate
E. Hydrocarbon spill modelling
F. Water quality assessment
G. Sediment quality assessment
H. Marine fauna assessment
- *Reptiles*
- *Cetaceans (observational only)*
- *Dugongs*
- *Pinnipeds*
- *Seabirds and shorebirds*
- *Fish*

I. Air quality monitoring (responder health and safety)

Note: This table outlines the operational monitoring component that should be used to monitor and inform response options during the response. For example, the 'dispersant application' response option is monitored through hydrocarbon properties and weathering behaviour, hydrocarbon spill modelling, chemical dispersant effectiveness assessment, water quality assessment, sediment quality assessment, marine fauna assessment and air quality monitoring and therefore these monitoring components are triggered if this option is used.

6. SCIENTIFIC MONITORING OVERVIEW

Scientific monitoring generally has objectives relating to attributing cause-effect interactions of the spill with changes to the surrounding environment. Consequently, such studies are required to account for natural or sampling variation, and study designs must be robust and produce defensible data. Scientific monitoring is typically conducted over a wider study area, extending beyond the spill footprint, and a longer time period, extending beyond the spill response. It is also more systematic and quantitative. Table 6-1 lists the scientific monitoring plans included under the Joint Industry OSMP Framework.

Table 6-1: Joint Industry Scientific Monitoring Plans

Scientific Monitoring Plan	Aim/Objective
Water quality impact assessment	Detect and monitor the presence, concentration and persistence of hydrocarbons in marine waters following the spill and associated response activities. The specific objectives of this SMP are as follows: • Assess and document the temporal and spatial distribution of hydrocarbons and dispersants in marine waters of sensitive receptors; • Consider the potential sources of any identified hydrocarbons • Verify the presence and extent of hydrocarbons (both on water and in water) that may be directly linked to the source of the spill • Assess hydrocarbon/dispersant content of water samples against accepted environmental guidelines or benchmarks to predict potential areas of impact • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs
Sediment quality impact assessment	Detect and monitor the presence, concentration and persistence of hydrocarbons in marine sediments following the spill and associated response activities. The specific objectives of this SMP are as follows: • Assess and document the temporal and spatial distribution of hydrocarbons and dispersants in marine sediments of sensitive receptors • Consider the potential sources of any identified hydrocarbons; and • Verify the presence and extent of hydrocarbons that may be directly linked to the source of the spill • Assess hydrocarbon content of sediment samples against accepted environmental guidelines or benchmarks to predict potential areas of impact
Intertidal and coastal habitat assessment	To assess the impact (extent, severity, and persistence) and subsequent recovery of intertidal and coastal habitats and associated biological

Scientific Monitoring Plan	Aim/Objective
	communities in response to a hydrocarbon release and associated response activities. The specific objectives of this SMP are as follows: • collect quantitative data to determine short-term and long-term (including direct and indirect) impacts of hydrocarbon (and implementation of response options) on intertidal and coastal habitats and associated biological communities, post-spill and post-response recovery • monitor the subsequent recovery of intertidal and coastal habitats and associated biological communities from the impacts of the hydrocarbon release
Seabirds and shorebirds	Document and quantify shorebird and seabird presence; and any impacts and potential recovery from hydrocarbon exposure. The objectives are to: • Identify and quantify, if time allows, the post-spill/pre-impact presence and status (e.g. foraging and/or nesting activity) of shorebirds and seabirds in the study area • Observe, and if possible quantify and assess, the impacts from exposure of shorebirds and seabirds to hydrocarbons (i.e. post-impact) and to the response activities, including abundance, oiling, mortality, and sub-lethal effects • Identify, quantify and evaluate the post-impact status and if applicable, recovery of key behaviour and breeding activities of shorebirds and seabirds (e.g. foraging and/or nesting activity and reproductive success) over time and with regard to control sites
Marine mega-fauna assessment • reptiles • pinnipeds	<u>Reptiles</u> Identify and quantify the status and recovery of marine reptiles, including marine turtles, sea snakes and estuarine crocodiles, related to a hydrocarbon spill The objectives are to: • To observe and quantify the presence of marine reptiles (including life stage) within the area affected by hydrocarbons • Where possible, assess and quantify lethal impacts and/or sub-lethal impacts directly related to the hydrocarbon spill or other secondary spill-related impacts (including vessel strike and/or use of dispersants); • Assess the impact of the hydrocarbon spill on nesting turtles, nests, and hatchlings • Understand changes in nesting beach usage by marine turtles following the hydrocarbon spill

Scientific Monitoring Plan	Aim/Objective
	Pinnipeds Undertake a quantitative assessment to understand hydrocarbon impact and subsequent recovery of affected pinniped populations (Australian Sea Lion, *Neophoca cinerea*, New Zealand Fur Seal, *Arctocephalus forsteri* and the Australian Fur Seal, *A. pusillus*) where they exist within the affected by hydrocarbons The objectives are to: • Identify mortality of pinnipeds, where possible, that is directly related to the hydrocarbon spill or indirectly associated to spill-related impacts (including boat strike and/or use of dispersants) • Assess the impact of the hydrocarbon spill on pinniped species populations as recorded for breeding colonies and haul-out sites of hydrocarbon exposure/contact • Evaluate the recovery of pinniped breeding colonies
Benthic habitat assessment	To assess the impact (extent, severity, and persistence) and subsequent recovery of subtidal benthic habitats and associated biological communities in response to a hydrocarbon release and associated response activities. The specific objectives of this SMP are as follows: • collect quantitative data to determine short-term and long-term (including direct and indirect) impacts of hydrocarbon (and implementation of response options) on benthic habitats and associated biological communities, post-spill and post-response recovery • monitor the subsequent recovery of benthic habitats and associated biological communities from the impacts of the hydrocarbon release
Marine fish assemblages assessment	To assess the impacts to and subsequent recovery of fish assemblages associated with specific benthic habitats (as identified in SMP: Benthic Habitat Assessment) in response to a hydrocarbon release and associated response activities. The specific objectives of this SMP are as follows: • Characterise the status of resident fish populations associated with habitats monitored in SMP: Benthic Habitat Assessment that are exposed/contacted by released hydrocarbons • Quantify any impacts to species (abundance, richness and density) and resident fish population structure (representative functional trophic groups)

Scientific Monitoring Plan	Aim/Objective
	• Determine and monitor the impact of the released hydrocarbons and potential subsequent recovery to residual demersal fish populations
Fisheries impact assessment	To monitor potential contamination and tainting of important finfish and shellfish species from commercial, aquaculture and recreational fisheries to evaluate the likelihood that a hydrocarbon spill will have an impact on the fishing and/or aquaculture industry. The specific objectives of this SMP are as follows: • Assess any physiological impacts to important fish and shellfish species and if applicable, seafood quality and safety • Assess targeted fish and shellfish species for hydrocarbon contamination • Provide information that can be used to make inferences on the health of fisheries and the potential magnitude of impacts to fishing industries (commercial, aquaculture and recreational)

In practice these plans may be carried out simultaneously, and scientific monitoring may commence while response activities are still occurring.

The information provided in the plans is designed to enable Titleholders and Monitoring Providers to finalise the monitoring program design so that it is appropriate to the activity location and associated environmental sensitivities, as well as the nature and scale of the event. The plans include:

- A description of Industry's minimum requirements, industry standards and/or best practice guidance for monitoring design, sampling techniques and reporting requirements
- A list of resources recommended to implement the monitoring
- Draft standard operating procedures, which would be finalised by the relevant monitoring contractor in the event of a spill.

Guidance on various experimental monitoring approaches for scientific monitoring can be found in Section 8. These approaches can be applied to monitor various receptors (e.g. Before-After-Control-Impact, impact vs control, gradient of impacts, lines of evidence, control charts), taking into consideration existing baseline data and current monitoring techniques.

To ensure the application of robust designs and sampling approaches that have the highest likelihood of detecting an environmental impact while allowing suitable flexibility, these guiding principles have been adopted:

- Align with existing baseline sampling design and methods wherever possible to maximise data comparability
- Allow for appropriate spatial and temporal replication to account for natural dynamics in the system
- Use exposure gradients where appropriate
- Use indicator taxa where appropriate
- Use benchmarks where appropriate (see further information below)
- Assess statistical power (if relevant).

If benchmarks[1] are relevant in the scientific studies, they should be selected taking into consideration trigger values that have already been established (e.g. Ref. 7 , Ref. 8, Ref. 9) or if appropriate, follow the process as outlined in Ref. 7 to develop a relevant benchmark value with appropriate statistical power.

7. BASELINE DATA RATIONALE AND APPROACH

Baseline monitoring provides information on the condition of ecological receptors prior to, or spatially independent (e.g. if used in control chart analyses) of, a spill event and is used for comparison with post-impact scientific monitoring where required. This is particularly important for scientific monitoring where the ability to detect changes between pre-impact and post-impact conditions and evaluate impact from the spill (compared to natural variation and/or impacts unrelated to the spill) is necessary.

There are a number of existing baseline data sources listed in

[1] Benchmarks are used to describe concentrations above which there is the possibility of risk to the environmental receptor.

Table 7-1 that are readily available to Titleholders, which may contain suitable baseline data for their monitoring requirements. In addition to these data sources, some Titleholders have elected to analyse existing data sources and compile a list of baseline data relevant to the high value receptors in their EMBA. It is important that baseline data matches the criteria/parameters that are planned to be used in OMPs and SMPs. This may require some Titleholders to examine baseline data sets they plan to use for operational and scientific monitoring. This assessment should be addressed in their Bridging Implementation Plan.

Table 7-1: Existing baseline data sources

Data Source	Description	Access
Industry-Government Environmental Metadata System (I-GEMS)	The I-GEM Project is facilitated by the Australian Petroleum Production and Exploration Association (APPEA). The project is a collaborative approach between industry, marine research institutes and Western Australian government agencies to share metadata on quantitative ecological data for key receptors in the mid to north-west of WA (approximately from the Abrolhos Islands to the Timor Sea) and to represent these in a geospatial database. The marine environmental metadata includes instant online access to a list of available data sets on key receptor sensitivities in the event of spill	Titleholders will need to provide access/login details or a link to it where it can be accessed (i.e. Contacts Directory) in their Bridging Implementation Plan
Australian Ocean Data Network	The Australian Oceans Data Network (AODN) is the primary access point for search, discovery, access and download of data collected by the Australian marine community. Data are presented as a regional view of all the data available from the Australian Ocean Data Network. Primary datasets are contributed to by Commonwealth Government agencies, State Government agencies, Universities, the Integrated Marine Observing System (IMOS) an Australian Government Research Infrastructure project, and the Western Australia Marine Science Institute (WAMSI)	Access is via the following link https://portal.aodn.org.au/search
Western Australian Oil Spill Response Atlas	The Western Australian Oil Spill Response Atlas (OSRA) is a spatial database of environmental, logistical and oil spill response data. Using a geographical information system (GIS) platform, OSRA displays datasets collated from a range of custodians allowing decision makers to visualise environmental sensitivities and response considerations in a selected location. Oil spill trajectory modelling (OSTM) can be overlaid to assist in	Access is via the following link https://www.transport.wa.gov.au/imarine/oil-spill-response-and-planning-tools.asp

Data Source	Description	Access
	determining protection priorities, establishing suitable response strategies and identifying available resources for both contingency and incident planning. OSRA is managed by the Oil Spill Response Coordination unit within Department of Transport (DoT) Marine Safety and is part funded through the National Plan for Maritime Environmental Emergencies and the Australian Maritime Safety Authority	
The Atlas of Living Australia	The Atlas of Living Australia (ALA) is a collaborative, online, open resource that contains information on all the known species in Australia aggregated from a wide range of data providers. It provides a searchable database when considering species within the ZPI. The ALA receives support from the Australian Government through the National Collaborative Research Infrastructure Strategy (NCRIS) and is hosted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Access is via the following link https://www.ala.org.au/

There are operational and scientific monitoring components that are suited to pre-impact/reactive baseline monitoring, although this is not the case for all receptors, especially if a more detailed understanding of natural variability is required to assess the extent of oil spill impacts. In this case, more detailed baseline planning should occur and consideration should be given to the relevance of baseline data (including metrics and parameters) used in EPs and its relationship to the data required for the OSMP. As outlined in NOPSEMA (2016), "*An environmental baseline data set may be considered adequate if it would allow the Titleholder to confidently detect spill effects in view of natural background spatial and temporal variability, and determine the extent, severity and persistence of oil spill impacts on environmental values and sensitivities*".

Reactive pre-impact monitoring can be useful in supplementing existing baseline data to provide a more current view of the state of the environment. Understanding priority areas for reactive pre-impact baseline monitoring is important, as there may be limited time to conduct the monitoring prior to the spill contacting the area. Stochastic modelling used during the EP/OPEP risk assessment process may be used to determine areas likely to be contacted with hydrocarbons above impact thresholds within a specified timeframe and provide direction for baseline monitoring priorities. Titleholders should assess modelling results and determine locations where there is sufficient time to obtain reactive baseline data, taking into account operational readiness of monitoring teams (Refer to Section 10.5). If there is insufficient time to

obtain reactive baseline data then Titleholders should consider whether additional baseline data are required to be collected .

Control sites (i.e. similar to the impact or disturbance location) are sometimes more relevant than reference sites (undisturbed or natural sites) for determining the impact of a hydrocarbon spill as separate from other human or natural stressors (Ref. 11). In the event of a spill, existing baseline information should be used to select relevant control sites outside the impact area of a single spill. It is expected that most control sites will be within the predicted zones of exposure or EMBA, but outside the impacted area for any given single spill. As all possible permutations or combination of sites cannot be realistically assessed in advance, control sites should be selected post spill. The number of samples and/or sampling sites for a particular spill should depend on the extent of the spill, and the statistical power necessary to determine whether there is an impact and the ability of the monitoring program to determine recovery and termination criteria.

8. MONITORING DESIGN

The design of monitoring programs should be based on clear and well thought out aims and objectives and should ensure, as far as possible, that the planned monitoring activities are practicable and that the objectives of the program will be met. The design must result in collection of meaningful data and, where practicable, data that are sufficiently powerful to detect ecologically relevant changes, particularly for Scientific Monitoring Plans.

This section provides guidance on general survey approaches likely to apply to the Scientific Monitoring Plans:

- Impact versus Control (IvC)
- Gradient of Impacts
- Before-After-Control-Impact (BACI)
- Control Chart
- Lines of Evidence.

The survey design(s) chosen depends on these criteria:

- Scale and pattern of potential effects of the spill
- Availability of baseline data and/or ability to rapidly obtain baseline data
- Time frame available to gather pre- and post-spill data
- Availability of Operational Monitoring Plan data
- Availability of appropriate control sites
- Statistical approach proposed for data analysis
- Range of possible chronic and acute effects on the parameters of concern, based on the characteristics of the spill
- Monitoring frequency required to ensure short-and long-term impacts are detected
- Legislative requirements
- Available resources and equipment to conduct the work in terms of personnel, logistics, and access

Note: Data collection depends on several constraints (as outlined above), including but not limited to, the type and location of hydrocarbon spill, and site locations and access given logistical and safety constraints. Therefore, the designs recommended in each Scientific Monitoring Plan may not be implemented exactly as intended in situ. For example, there may be inadequate number of control locations because of the size of the spill. Therefore, data collected as part of Scientific Monitoring Plans may need to be analysed using alternative designs (e.g. data from an expected BACI design may need to be analysed as a Gradient Approach).

8.1. IMPACT VERSUS CONTROL APPROACH

For some locations and receptors, baseline data may not exist, may not be recent and applicable, or was collected using methods that are unrepeatable in the current study. **If there is a lack of baseline information that can feed into a BACI design, an IvC approach can be used to assess impacts.** However,

due to the unknown status of the parameter before impact, there is a **higher likelihood of encountering Type I error** (falsely concluding that an impact has occurred) with this approach. For example, if the status of the parameter to be measured was already naturally lower at impact sites than control sites before the impact occurred, but this was not measured, a conclusion may be reached using the IvC approach that an impact has occurred when it may be natural variation. For this reason, sampling designs should always try to collect or use baseline data (i.e. aim for a BACI design), and if an IvC design is used, it is **important to ensure that the control sites are comparable to the impact sites in every way possible except for the presence or absence of the studied effect (hydrocarbon).** This may include, but not be limited to: site physical aspect, substrate (where applicable), current regimes, and community composition.

Because of the higher likelihood of Type I error, it is also useful to collect additional data on relevant physical environmental parameters that are likely to be different at impact and control sites and may affect the conclusion of the assessment. Biological information may also be relevant, such as degree of sub-lethal and lethal impacts to populations. These parameters can be examined later for any potential co-variance with the observed changes in the parameter of interest, to understand whether hydrocarbons or natural variation affected the outcome. The physical and biological information can therefore augment and act as additional evidence to help interpret conclusions from any IvC analyses. As with the BACI Approach, when using the IvC Approach it is important to understand the scale of natural variation that may affect the outcome of the assessment by replicating sites within sampling locations and replicating samples within each site.

The suggested statistical approach for analysing the data collected using the IvC approach is a multi-factorial ANOVA (to account for nested data), including PERMANOVA and non-parametric tests, to test whether the level of variation among treatments (IvC) is greater than the level of variation within treatments. Components of variation may help partition variance into different sources and help infer whether the effect of hydrocarbons or spatial variation was responsible for any detected change in the receptors.

8.2. GRADIENT APPROACH

The Gradient Approach **can be used in some instances where a lack of suitable control sites prohibits using a BACI or IvC Approach**. Sampling should be established along a gradient of predicted effect (based on input of data from OMPs or modelling), with sites established at various distances from the source of impact or along a gradient of magnitudes of concentrations of hydrocarbons (if known from OMP or SMP data). The Gradient Approach can also be used in combination with a BACI or IvC Approach to help infer the cause of a detected impact and describe thresholds of impacts at which a response appears to have occurred. The Gradient Approach also provides a 'Line of Evidence' that the source of potential impact (hydrocarbons) was responsible for the observed effect, rather than natural variation. However, care should be taken to ensure awareness of any natural gradients in the parameter measured and take these into account when interpreting the data.

When designing a study using a Gradient Approach, relevant OMP data, SMP data (e.g. water and sediment quality), and modelling should be considered. Prior knowledge or prediction of the likely gradient of effect will greatly improve the efficiency of the sampling design by minimising the collection of data points that provide no additional information in the analysis (e.g. data points showing similar or no effects that do not help to characterise the gradient of effect), though noting these may aid in statistical power of gradient description so shouldn't necessarily be discouraged.

Typically, the level of observed impact will decline at distance from the source of a hydrocarbon release, with this decline likely to be exponential (i.e. large changes close to a release that quickly decrease in severity); therefore, sampling effort can be distributed along the gradient of effect in a way that best characterises the changes in the parameter measured.

If possible, multiple (> two) sites could be sampled at each distance along the gradient (if logistics and time permit) to provide an understanding of small scale variation. Sites should also be sampled at distances where no environmental effect is predicted or observed, if possible, to characterise the full extent of the effects gradient.

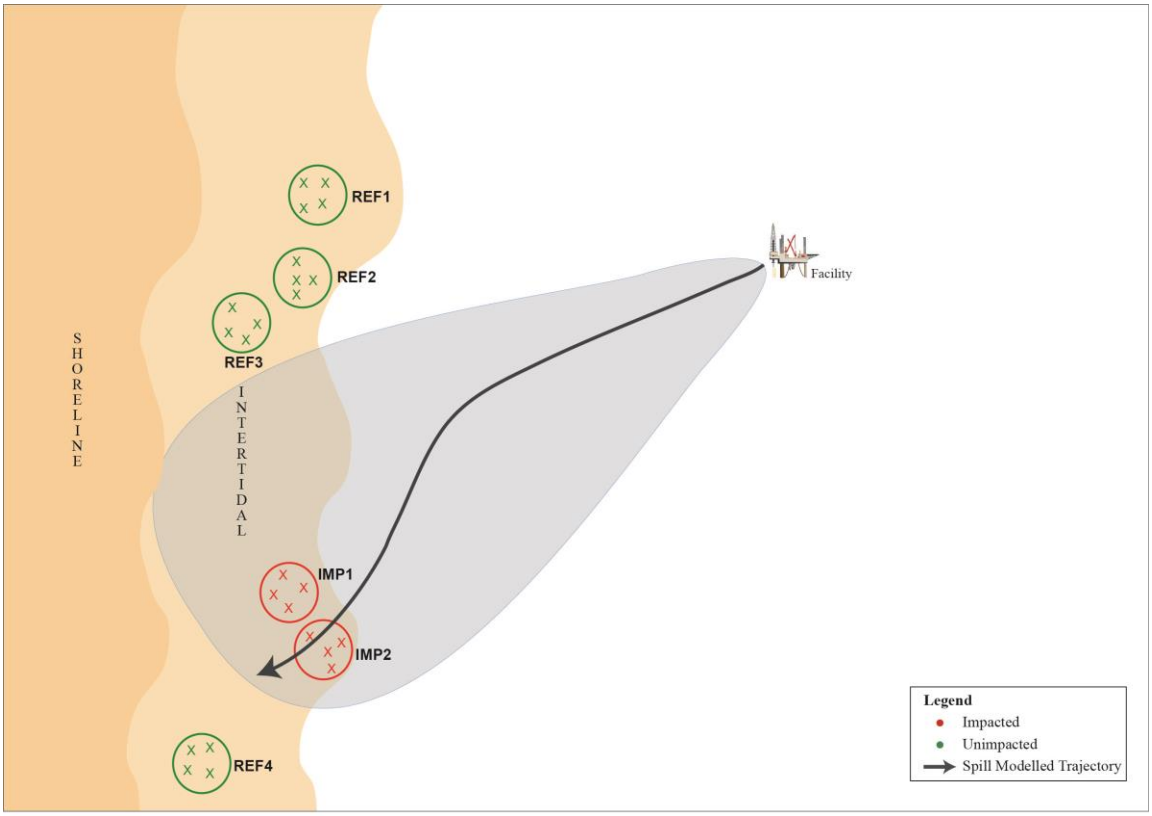
The suggested statistical analysis for the Gradient Approach includes correlation analysis between impact (measurements of hydrocarbon/stress; x-axis) and measurement parameter (biological response; y-axis), and associated regression analyses, may include least-squares regression line and hypotheses testing to determine if the trend is significantly different from zero.

8.3. BACI APPROACH

Where appropriate baseline data are available, consideration should be given to developing a beyond BACI monitoring program design (Ref. 12; Ref. 13) or similar extended BACI design (mBACI), which monitors a range of control and impact sites, and can do so over time (Figure 8-1). Where robust, appropriate baseline data for exposure sites are not available, pre-exposure sampling of locations that lie within the hydrocarbon spill trajectory should be prioritised to obtain baseline data prior to hydrocarbon exposure.

Exposure sites should be selected first, encompassing a representative selection of locations within the area affected by hydrocarbons. Where practicable, the monitoring program design may consider stratified sampling along environmental gradients (e.g. level of hydrocarbon exposure etc.). Comparable control sites beyond the area affected by hydrocarbons should then be selected, with monitoring conducted at all sites. Clearly obtaining control sites pre-exposure can be challenging and is heavily reliant on predicting the extent of hydrocarbon movement.

The suggested statistical analysis of data collected using the BACI approach includes a univariate or multi-factorial analysis of variance (ANOVA) and equivalent non-parametric tests, all of which will compare between treatment (impact versus reference) and time (before versus after). Components of variation may help partition a sum of squares into different sources and describe the importance of factors within tests.



Notes:

1. A modification to the beyond BACI design, is known as an MBACI design. MBACI designs incorporate multiple impact locations, whereas beyond BACI designs include only one impact location.
2. The above design consists of four reference/control locations and two impact locations, with four nested sites in each. The number of replicates (e.g. quadrats or transects) per site should be set based on resourcing, and /or the results of the power analysis (if applicable).
3. The area affected by the spill is indicated by the grey shaded area, or the area of influence.
4. Design assumes the area of influence has been affected equally.

Figure 8-1: Example of a MBACI design for Shoreline and/or Intertidal Communities

8.4. CONTROL CHART APPROACH

The Control Chart Approach is applicable in the following circumstances:

- When long-term (multi-year) datasets exist for the measured parameter
- When a large amount of natural variation exists in the measured parameter
- When predicting the expected range of outcomes from an impact.

One of the causal criteria described in the Lines of Evidence Approach (Section 5.5) is 'Strength of Association' (Ref. 14), exemplified by a 'larger decline in individuals in areas affected by hydrocarbon than in control areas'. The Control Chart Approach takes this causal criterion a step further and uses rules to establish whether a detected change in a parameter at impact sites is outside what would be expected to occur naturally. This technique requires tracking a parameter over time and determining whether an observed change is within the bounds of what has been observed to occur naturally at that impact site or at control sites.

A control chart has a central line for the mean, an upper control limit (UCL; e.g. typically 3 standard deviations [SD] above the mean), and a lower control limit (LCL; e.g. typically 3 SD below the mean), which are typically all determined from historical data (Figure 8-2). The mean line can be constructed using data from i) historical data of an impact site prior to it being affected by hydrocarbons (i.e. what the mean used to be), or ii) control locations, whereby either historical or recent data are used for comparison to other sites (i.e. a control site historical data compared to impact site). Any observations outside the UCL and LCL suggest that increased variation has been observed that are inconsistent with other data and may post a simple way to detect change in a system.

In addition, if ongoing data collection is possible following a potential impact, the Control Chart Approach can be used to examine the direction of change and whether this is consistent or inconsistent with other data. These data and interpretation may provide a weight of evidence of a directional change in a given parameter.

The Control Chart Approach is only useful if there is an adequate knowledge of natural variability in a given parameter whether from historical sources or similar sites/locations. Control Chart Approach can be a powerful tool for detecting impacts for systems that are naturally highly variable.

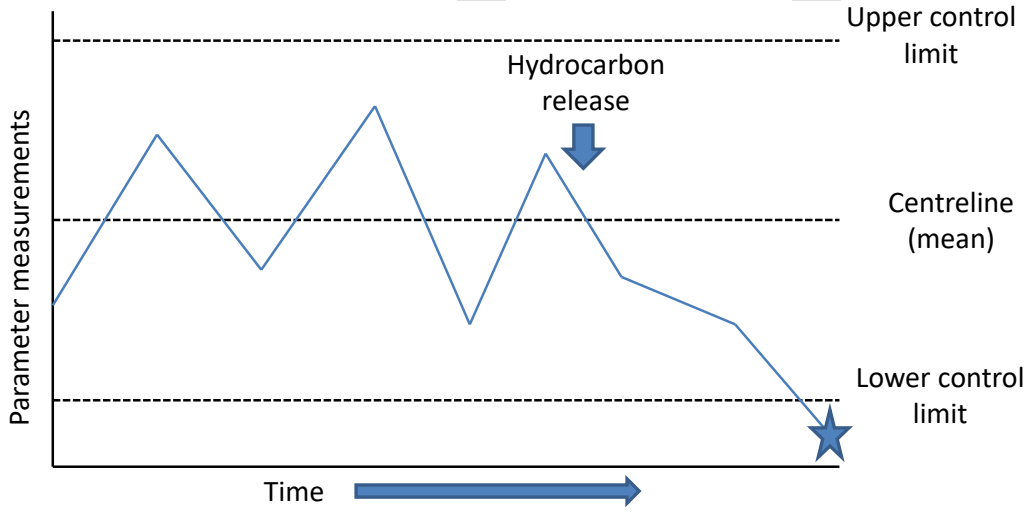


Figure 8-2: Example Control Chart showing Centreline (mean), Upper Control Limit (3 SD above mean), Lower Control Limit (3 SD below mean), and Measurements

Note: The star represents a measurement beyond the likely anticipated variation, which needs to be investigated.

The statistical approach for Control Charts is:

- Calculate the historical/akin site mean for the centreline
- Calculate the upper and lower control limits from historical/akin site data, e.g. typically three SD above and below the mean (Ref. 15)
- Calculate the mean (ongoing) for an impact site to compare against the control chart.

5.2 LINES OF EVIDENCE APPROACH

The Lines of Evidence Approach is applicable in the following circumstances:

- Can be combined with any of the above monitoring designs to provide inferential evidence of an effect.
- Are useful to support evidence of effect if there are limited (or only one) impact locations
- Are useful to support evidence of effect if the effect radiates outward from source
- Are useful to infer cause of change if limited or no baseline data exist
- Are useful to infer cause of change if limited or no control sites exist.

When a sampling design is suboptimal, or if conclusions from more formal tests are inconclusive, a Lines of Evidence Approach can be used to help infer the cause of an observed change (i.e. attribute change to the hydrocarbon release or to other causes, such as natural variation). Within the Lines of Evidence Approach, inference is developed based on carefully structured arguments. A weakness of this method is that the evidence may be largely circumstantial because it is based on correlations (Ref. 16), which does not necessarily imply causation. Each causal argument may be weak when considered independently but combined they may provide strong circumstantial evidence and support for a conclusion (Ref. 16).

This approach was originally developed in medicine (Ref.14) but has been used more recently in ecological studies (Ref. 16; Ref. 17; Ref. 18; Ref. 19; Ref. 20). Causal criteria have been developed for categorizing arguments from studies on disease on humans (Ref.14), and these can be applied to ecological arguments (Ref. 14). With Lines of Evidence, there is a need to seek evidence not only to support the impact prediction, but evidence to rule out plausible alternative predictions, such as that the observed difference was due to natural processes (Ref. 16; Ref. 19).

Table 8-1: Hills (Ref. 14) Causal Criteria and Description in the Context of Ecological Impact Assessment

Causal Criterion	Description
Strength of association	A large proportion of individuals are affected in the impact area relative to control areas
Consistency of association	The association was observed by other investigators at other times and places
Specificity of association	The effect is diagnostic of exposure
Temporality	Exposure must precede the effect in time
Biological gradient	The risk of effect is a function of magnitude of exposure
Biological plausibility	A plausible mechanism of action links cause and effect
Experimental evidence	A valid experiment provides strong evidence of causation
Coherence	Similar stressors cause similar effects
Analogy	The causal hypothesis does not conflict with existing knowledge of natural history and biology

In the Lines of Evidence Approach, a set of descriptions should be developed for all or some of the causal criteria listed in Table 8-1 before the survey is undertaken (see Ref. 16 for further criteria and examples).

Data would then be collected that allows each Line of Evidence to be tested or objectively questioned. The final assessment of whether an impact is likely to have occurred should be based on the 'weight of evidence' from examining multiple Lines of Evidence. Example generalised Lines of Evidence descriptions are provided in Table 8-2**.** These should be modified and tailored to individual SMPs, as required and each parameter investigated.

Table 8-2: Causal Criteria and Example Lines of Evidence Descriptions that could be used to Assess whether a Change in a Measured Parameter was due to the Effects of a Hydrocarbon Release

Causal Criterion	Evidence Supportive of a Hydrocarbon Release Impact	Evidence Unsupportive of a Hydrocarbon Release Impact
Strength of association	Larger decline in individuals in areas affected by hydrocarbon than in control areas	Similar declines in individuals in areas affected by hydrocarbon and control areas
Consistency of association	Consistent finding of declines in a range of biota in areas affected by hydrocarbon	Inconsistent declines in biota in areas affected by hydrocarbon (e.g. declines in one species but not in other similar species)
Specificity of association	Number of individuals affected correlates with hydrocarbon concentrations	No correlation between number of individuals affected and hydrocarbon concentration
Temporality	Decline in individuals immediately preceded by contact with hydrocarbon	Decline in individuals occurred before or long after hydrocarbon contact
Biological gradient	Changes in individuals aligned with exposure to hydrocarbon spills or concentrations	Decline in individuals occurs with increasing distance from a hydrocarbon spill or hydrocarbon concentrations
Biological plausibility	Evidence from literature of sensitivity to detected hydrocarbon concentration for species where declines are observed	Evidence from literature suggests lack of sensitivity to detected hydrocarbon concentration for species where declines are observed
Experimental evidence	A valid experiment provides strong evidence of causation	Not applicable (N/A)
Coherence	Evidence of a decline in species abundance, habitat, and food source with increasing hydrocarbon exposure	Evidence of a decline in species abundance, but no other evidence of expected declines associated with exposure
Analogy	Apparent declines in hatchling numbers despite no apparent decline in numbers of adults	Apparent declines in hatchling numbers associated with decreased numbers of adults

8.5. EFFECT SIZE AND POWER

A critical aspect of monitoring program design is to determine the number of samples required to achieve the objectives of the program. The variability inherent in natural systems gives rise to statistical uncertainty, which can be controlled by sampling an appropriate number of representative sites and taking an appropriate number of replicate samples at each site (Ref. 21). Power is calculable for univariate designs where change occurs in one direction. Multivariate designs are more complicated given change can occur in any number of directions.

Insufficient site and sample replication can bias findings of monitoring programs in one of two ways. Type I errors are effectively false positive outcomes (a cause for concern when it is in fact not warranted) and Type II errors give rise to a 'false sense of security' when it is concluded that there is no effect when, in fact, there is one. Monitoring program design should aim to minimise Type I and Type II error rates and at the same time maximise cost effectiveness and scientific rigour (Ref. 21).

Power is measured in terms of the probability of detecting an impact of a certain effect size, if an impact has actually occurred. Effect size is the magnitude of difference in a measured variable between impact and control samples, taking into account natural variation. It is important to know the power of a sampling design before commencing a study to ensure that there is a likelihood of detecting a biologically or ecologically important effect size.

The statistical power of a test is mostly driven by sample size, e.g. the number of sites sampled or the number of replicates within a site. Other factors driving the power of a test include:

- The effect size (the desired magnitude of change to detect; this should be a biologically or ecologically important level of change)
- The population variance
- Alpha (α) (the acceptable level of Type I error; the chance of falsely detecting a change that is not real; usually set at 0.05).

Free packages such as G-Power (http://www.gpower.hhu.de/en.html), developed by the University of Dusseldorf, provide a useful platform for straightforward tests (utilising fully random or fully fixed factor designs), but are typically inadequate for more complex, mixed model designs, including those of the BACI family, for which Monte Carlo simulations are needed (Ref. 22). Monitoring Providers should consult experienced statisticians to ensure power assessments are undertaken correctly and at the right level of the design i.e. the interaction term of interest (in an ANOVA context).

Monitoring Providers should aim to achieve power of 0.8 for the chosen effect size. The effect size should relate to the study's objectives and should be set at a level that is biologically or ecologically meaningful, taking into account natural variability. For certain parameters, effect size may also need to consider a level of change that is meaningful to stakeholder values, such as fisheries or tourism. None of this is a straightforward process, and Monitoring Providers should engage regulators and other stakeholders. Further considerations are outlined in Table 8-3.

Table 8-3: Considerations When Conducting Statistical Power Assessments

Power test inputs	Considerations
Effect size	• Natural change of varying magnitudes across temporal and spatial scales at impact and control sites make detection of small effect sizes difficult. Small changes due to impacts from an unplanned release are unlikely to be considered biologically or ecologically significant if dwarfed by large-magnitude natural variability • The effect size should take into account what is known of natural variability in the parameter to be measured, such as that observed in baseline studies or known from the literature • It may be trivial for example to aim to detect an effect size of 20% in the benthic cover of tropical seagrasses, which vary naturally from season to season by up to 100%. Detecting such an effect size may also be difficult to achieve in such a highly dynamic community without a logistically unfeasible level of replication. However, detecting an effect size of 20% in a coral community, which is generally more stable over time, is important because changes of this magnitude may be outside the natural levels of change, and the coral community may take longer to recover from such a change because of its greater population stability
Population variance	• Population variability may be estimated from data collected during previous studies (e.g. baseline), or pilot data collected in the initial days following the spill before the parameters are affected. The latter may be difficult depending on the trajectory and speed of the plume • If data are unavailable, natural variability may have to be estimated from published studies elsewhere that use the same parameters and similar sampling methods, or through pilot data collected under the OMPs
Alpha	• Alpha—the probability of falsely detecting a change that is not real (Type I error)—is typically set at 0.05 (5%), although other values are acceptable. Although the level of Type I error (and alpha) should be kept as low as possible to avoid falsely detecting an impact, the lower the level of alpha (e.g. α=0.01), the lower the likelihood that that the null hypothesis will be rejected and hence, the lower the likelihood of a conclusion that an impact has occurred • The flip-side to this is that alpha and power are inversely related: higher alpha levels (0.1 or 0.15) increase the level of making a Type I error, but increase the power of the test to detect an impact. Ultimately this becomes a philosophical debate, with the users weighing up the benefits of power over the increased probability of Type I error

8.6. SETTING THE SPATIAL BOUNDARIES OF THE STUDY

The spatial boundaries of a monitoring program depend primarily on the actual or potential area affected by the spill. Spatial boundaries should be sufficient to meet monitoring objectives, usually by determining impacted areas and the level of effects, linking effects to the spill source, and supporting decisions on clean-up strategies.

The boundaries should also be sufficient to cover representative areas of each:

- Substrate type
- Ecological community
- Shoreline energy level
- Degree of oiling
- Clean-up method used
- Control area.

9. INITIATION AND TERMINATION CRITERIA

Typically, operational monitoring is initiated by:

- The spill event itself;
- Through monitoring and evaluation information collected during the response; and/or
- By implementation of a response option.

Operational monitoring usually finishes when the spill response is terminated, usually because response objectives were met and/or scientific monitoring was initiated.

Specific components of scientific monitoring are initiated by:

- The spill itself;
- Data generated by monitoring and evaluation during the response; and/or
- Data generated through operational monitoring.

Scientific monitoring may occur in parallel to operational monitoring and can continue for some time after the hydrocarbon/chemical spill event.

The initiation and termination criteria for all OMPs and SMPs are provided in **Table 9-1** (Operational Monitoring) and **Table 9-2** (Scientific Monitoring). It is the responsibility of the Titleholder to identify the relevant Jurisdictional Authority in their Bridging Implementation Plan that may be involved in the decision to terminate the response and/or individual monitoring component. Guidance on relevant Jurisdictional Authorities is provided in **Table 10-3**.

Table 9-1: Operational Monitoring Plan Initiation and Termination Criteria

Operational Monitoring Plan	Initiation criteria	Termination criteria
Hydrocarbon properties and weathering behaviour at sea	• The IMT/EMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred	• The IMT/EMT Incident Commander (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT/EMT Incident Commander (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • This OMP is no longer contributing to or influencing spill response decision-making; or • Relevant scientific monitoring components initiation criteria have been triggered.
Pre-emptive assessment of sensitive receptors at risk (desktop only)	• The IMT/EMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • A probable hydrocarbon impact (or impact of dispersed hydrocarbon) on a resource, habitat or shoreline is anticipated on the basis of trajectory modelling or other assessment of the incident; or • Damage to a natural resource or sensitive receptor is possible as a result of that impact.	• Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The assessment of sensitive receptors that were identified as being potentially impacted/contact by the hydrocarbon spill are completed.
Shoreline clean-up assessment technique (SCAT)	• The IMT/EMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and	• This OMP will not result in a change to the scale or location of active response options; or

Operational Monitoring Plan	Initiation criteria	Termination criteria
	• Analysis of data from hydrocarbon spill modelling, monitoring, evaluation and/or surveillance predicts an exposure of hydrocarbons to shoreline habitat; or • Relevant response activities are being undertaken.	• Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • Continuation of monitoring of this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation criteria have been triggered.
Surface chemical dispersant effectiveness and fate	• Application of dispersant has been selected as a response option.	• Dispersant operations have ceased; and • Measurements indicate that dispersed hydrocarbons are diluted to below levels of detection or below levels of concern; or • Monitoring data indicates that dispersant operations are unlikely to cause harm; or • Continuation of monitoring of this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation criteria have been triggered.
Hydrocarbon spill modelling	• The IMT/EMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred.	• Hydrocarbon spill modelling is no longer beneficial to predict spill trajectory and concentrations; or • Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response.

Operational Monitoring Plan	Initiation criteria	Termination criteria
Water quality assessment	• The IMT/EMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred.	• The IMT/EMT Incident Commander (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT/EMT Incident Commander (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The spill is or is likely to be below visible criteria for surface oil (0.5g/m^2), and low thresholds for entrained (10ppb) and dissolved (6ppb) oil concentrations; or • The Monitoring Coordinator (or delegate) considers that continuation of monitoring under this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.
Sediment quality assessment	• The IMT/EMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Modelling and/or analysis of data from MES predicts an exposure of hydrocarbons to marine and/or coastal sediment.	• The IMT/EMT Incident Commander (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT/EMT Incident Commander (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or

Operational Monitoring Plan	Initiation criteria	Termination criteria
		• The Monitoring Coordinator (or delegate) considers that continuation of monitoring under this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.
Marine fauna assessment • Reptiles • Cetaceans (observational only) • Dugongs • Pinnipeds • Seabirds and shorebirds • Fish	• The IMT/EMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Modelling and/or analysis of data from MES predicts, or has reported, an exposure of hydrocarbons to known sensitive fauna habitat.	• The IMT/EMT Incident Commander (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT/EMT Incident Commander (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The Monitoring Coordinator (or delegate) considers that continuation of monitoring under this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.
Air quality modelling (responder health and safety)	• The IMT/EMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Response operations that may pose a risk to the air quality of response personnel and/or public will occur.	• Completion of the gas, vapour and hydrocarbon discharge, containment and recovery, dispersant operations and shoreline clean-up operations; and • Continuing hazardous and noxious plume detection modelling has a low probability of contributing or influencing spill response decision making.

Table 9-2: Scientific Monitoring Plan Initiation and Termination Criteria

Scientific Monitoring Plan	Initiation criteria	Termination criteria
Water quality impact assessment	• Spill modelling (see OMP: Hydrocarbon spill modelling) has indicated that contact on a sensitive resource is possible and it is considered likely that ongoing (scientific) monitoring of impacts will be required, supported by scientifically rigorous water quality monitoring; or • OMP: Water quality assessment has identified hydrocarbon and/or dispersant concentrations exceed accepted guidelines and benchmarks; or • Chemical dispersants have been applied as part of the spill response program.	• Hydrocarbon concentrations in marine waters are below benchmark levels which can be defined as: ○ ANZECC water quality objectives for the protection of aquatic ecosystems (Ref. 7); or ○ the relevant regulatory site-specific trigger level (where these exist); or ○ below baseline levels; or ○ control site values (whichever is applicable).
Sediment quality impact assessment	• OMP: Sediment quality assessment has identified hydrocarbon concentrations exceed accepted guidelines and benchmarks; or • Spill modelling has indicated that an impact on a sensitive resource that is closely linked to marine sediments is possible, and it is considered likely that ongoing (scientific) monitoring of a biological parameter will be required that supported by scientifically rigorous sediment quality monitoring.	• All hydrocarbon concentrations in sediments are below benchmark/guideline levels, which can be defined as: ○ Revised ANZECC/ARMCANZ sediment quality guidelines related to petroleum hydrocarbons (Ref. 8); or ○ the relevant regulatory site-specific trigger level (where these exist); or ○ below baseline levels; or ○ control site values (whichever is applicable).

Scientific Monitoring Plan	Initiation criteria	Termination criteria
Intertidal and coastal habitat assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure of coastal or intertidal habitats or communities to hydrocarbons.	• Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor; and • There has been no impact to coastal and intertidal habitats and associated biological communities (confirmation that habitats and species were not exposed to hydrocarbons); or • Measured parameters of coastal and intertidal habitats and associated biological communities impacted by hydrocarbons spills have returned to within the expected natural dynamics of baseline state (taking into account natural variability) and/or control sites.
Seabirds and shorebirds	• Spill trajectory modelling, surveillance or monitoring predicts contact is possible to seabirds and/or shorebird populations or any of their habitats of importance for breeding, nesting or foraging; or • Monitoring (OMP: Marine fauna assessment seabirds and shorebirds) has identified contact or an impact to seabirds and/ or shorebird populations as a result of the hydrocarbon spill; or • There are reports or scientific evidence of oiled seabirds and/or shorebird populations.	• Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor; and • There has been no impact on seabirds and/or shorebirds or their key biological activities; or • The extent of damage and rate of recovery of key seabird and/or shorebird behaviour and breeding activities has been quantified; and ○ Measured parameters have returned to baseline conditions (taking into account natural variability) in terms of breeding population (for seabirds) or counts (for shorebirds) and impacts on species and taxa are no longer detectable, with regard to control sites; or

Scientific Monitoring Plan	Initiation criteria	Termination criteria
		○ Oil pollution effects/impacts on critical species and taxa are no longer detectable.
Marine mega-fauna assessment a. reptiles b. pinnipeds	a. <u>Reptiles</u> • Spill trajectory modelling, surveillance or monitoring predicts contact is possible at important habitat locations for turtles (foraging and rookery), sea snakes and/or estuarine crocodiles; or • Monitoring (OMP: Marine fauna assessment - reptiles) has identified contact or an impact to reptiles (dead, oiled, or injured reptiles) within area affected by hydrocarbons b. <u>Pinnipeds</u> • Spill trajectory modelling, surveillance or monitoring predicts contact is possible at important habitat locations for pinnipeds (foraging, breeding colonies, and haul out sites); or • Monitoring (OMP: Marine fauna assessment - pinnipeds) has identified contact or an impact to pinnipeds (dead, oiled, or injured pinnipeds) within the area affected by hydrocarbons	a. <u>Reptiles</u> • There has been no impact on reptiles or their key biological activities from the hydrocarbon spill; or • The extent of damage of impacted reptiles has been quantified; and • Measured parameters of turtle (and sea snakes and/or estuarine crocodiles, if determined appropriate) communities impacted by hydrocarbon spill have returned to within the expected natural dynamics of baseline state and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor. b. <u>Pinnipeds</u> • There has been no impact on pinnipeds or their key biological activities from the hydrocarbon spill; or • The extent of damage and rate of recovery of impacted pinnipeds has been quantified at breeding colonies and haul out sites within the area affected by hydrocarbons; and • Measured parameters of pinniped populations impacted by hydrocarbon spill have returned to within the expected natural dynamics of baseline state and/or control sites; and

Scientific Monitoring Plan	Initiation criteria	Termination criteria
		• Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Benthic habitat assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure of benthic habitats or communities to hydrocarbons.	• There has been no impact to benthic habitats and associated biological communities (confirmation that benthic habitats were not exposed to hydrocarbons); or • Measured parameters of benthic habitats and associated biological communities impacted by hydrocarbons spills have returned to within the expected natural dynamics of baseline state (taking into account natural variability) and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Marine fish assemblages assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure to fish areas or fish habitat.	• There has been no impact on fish and fish population structure; or • Measured parameters of fish, fish habitat, and marine fisheries locations impacted by hydrocarbon spills have returned to within the expected natural dynamics of baseline state and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.

Scientific Monitoring Plan	Initiation criteria	Termination criteria
Fisheries impact assessment	• Spill trajectory modelling, surveillance or monitoring predicts contact is possible to commercial, recreational, traditional species and or aquaculture species; or • Advice has been provided to government to restrict, ban or close a fishery; or • Declarations of intent by commercial fisheries or government agencies to seek compensation for alleged or possible damage.	• Agreement has been reached with the relevant Jurisdictional Authorities to cease monitoring of fisheries; and • Contamination in the edible portion or in the stomach/intestinal contents attributable to the spill is no longer detected; or • No differences are detected in commercial, recreational or aquaculture fisheries from control and impact sites; or • The physiological and biochemical parameters in the studied species have returned to baseline levels; or • Evidence that catch rates, species composition, community abundance, distribution and age structure of commercial fisheries and their by-catches have returned to baseline levels.

10. IMPLEMENTATION GUIDANCE

10.1. OSMP BRIDGING IMPLEMENTATION PLAN

The Joint Industry OSMP Framework and the supporting OMPs and SMPs provide a standardised approach to the finalisation and implementation of monitoring programs in the event of a spill. However, there are too many variables across the various spill scenarios, sensitive receptors and Titleholder management systems to develop a one-size-fits-all approach. The Framework needs to be aligned to Titleholder's individual activities and spill scenarios. This interface will need to be outlined through an OSMP Implementation Bridging Plan, prepared by individual Titleholders.

The OSMP Bridging Implementation Plan should form part of the environmental management document framework for offshore petroleum activities and should be linked to the activity's Environment Plan (EP) and Oil Pollution Emergency Plan (OPEP). Titleholders will be required to provide the following information to demonstrate they meet the regulatory requirements associated with OSMP implementation. It is likely that this information will be spread across the Titleholder's environmental management framework documentation. However, it is recommended the Bridging Implementation Plan repeats this content or at least cross references to the relevant document for ease of use during exercises and incidents.

The information required to meet the regulatory requirements includes, but may not be limited to:

- Description of the activities, spill scenarios, risk assessment process, resultant area predicted to be affected by hydrocarbons, summary of receptors, monitoring priorities (including rationale for selection) and relevant baseline information sources
- Description of the OMPs[2] and SMPs that apply to the activities and spill scenarios. This should be clearly linked to the sensitive receptors identified in the area predicted to be affected by hydrocarbons. Appendix B Values and Sensitivities Addressed by OMPs and SMPs provides guidance on which OMPs and SMPs apply to various receptors
- Mobilisation and timing of OMP and SMP implementation, according to spill scenario needs and mobilisation constraints
- Individual Titleholder OSMP Management structure and a detailed explanation of how this integrates with the IMT/EMT
- Roles and responsibilities for OSMP personnel
- Description of relevant individual Titleholder management systems related to operational and scientific monitoring, including health and safety, incident command, logistics, aviation and marine operations requirements
- Any internal demonstration of capability and readiness. This may include a register of internal personnel trained to coordinate or implement component/s of the OMP or SMPs, internal exercises that test the OSMP requirements, own equipment maintained and stored for OMPs

[2] It should be noted that Monitoring, Evaluation and Surveillance (including tactics such as aerial surveillance, vessel surveillance, tracking buoys, spill trajectory modelling, fate and weathering modelling, satellite surveillance and metocean data acquisition) is commonly addressed in Titleholder's OPEPs, and as such it is not included in the Joint Industry OMPs. Titleholders electing to use this Framework should ensure they have sufficiently addressed Monitoring, Evaluation and Surveillance requirements in their OPEP and discuss the linkages to operational monitoring in their Bridging Implementation Plan.

and/or internal contracts that would be used for implementation (e.g. marine and aviation contracts)

- Specific permits required to be obtained for monitoring within the area
- Activation and mobilisation process to engage contracted OSMP Monitoring Provider/s
- Process for finalisation of monitoring design
- Process for obtaining any reactive baseline monitoring data
- Reporting requirements, including how data and information from the monitoring shall be provided to and used by the Titleholder's IMT/EMT during a response, and roles and responsibilities for managing data from scientific monitoring programs
- Process for communicating relevant information to stakeholders (consistent with the EP communication plan/protocols)

If a Titleholder choses to adopt the Joint Industry OSMP Framework, they will remain responsible for demonstrating its applicability and relationship to their activity. Additional guidance on the above points is provided below.

10.2. IMPLEMENTATION CONSIDERATIONS

OSMP implementation may be broken down into a number of phases to help identify considerations for each phase. **Table 10-1** outlines these phases and key actions, which are explained in more detail in Sections 10 and 11.

Table 10-1: Considerations for Monitoring and Response Phases

Phase		Considerations	
		Operational Monitoring	**Scientific Monitoring**
Pre-spill (Preparedness Phase)	**Aim**	Understand area of operations, EMBA, ensure sufficient operational readiness to implement OSMP	
	Actions	• Prepare OSMP Bridging Implementation Plan. In addition to the content requirements outlined in Section 10.1, Titleholders will need to undertake the following actions to support their Bridging Implementation Plan: ○ Assign OSMP roles and responsibilities (internal and external) ○ Establish external contracts to maintain OSMP capability and readiness ○ Determine internal and external personnel competencies and availability (to be monitored and reviewed on a regular basis) ○ Determine equipment providers and laboratories and establish processes/contracts as required ○ Liaise with internal logistics and supply chain departments to advise of OSMP requirements	
Post-spill /Pre-impact Phase	**Aim**	Gain situational awareness and understanding of receptors that may be impacted by the spill	Gather reactive baseline monitoring data

Phase		Considerations	
		Operational Monitoring	**Scientific Monitoring**
	Actions	**Finalise OMPs (for more detail, refer to Appendix A** Mobilisation Requirements**):** • Activate internal OSMP personnel and external contracts • Select priority sites • Finalise sampling technique • Determine suitable sampling frequency • Finalise standard operating procedures • Allocate number of teams, personnel, equipment and supporting resource requirements for each OMP • Finalise HES documentation prior to mobilisation of field teams • Confirm logistics (e.g. flights, accommodation, vessels) • Commence deployment of OMP Field Teams • Initiate OMPs, in particular desktop assessments that can be easily commenced (e.g. spill modelling, pre-emptive assessment)	**Finalise SMPs (for more detail, refer to Appendix A** Mobilisation Requirements**):** • Activate internal OSMP personnel and external contracts • Gather baseline data and/or establish control/reference sites • Confirm monitoring design and technique • Confirm sampling sites • Determine suitable sampling frequency • Establish benchmarks and guidelines to be used • Confirm indicator species • Confirm parameters and metrics • Finalise standard operating procedures • Allocate number of teams, personnel, equipment and supporting resource requirements • Finalise HES documentation prior to mobilisation of field teams • Confirm logistics (e.g. flights, accommodation, vessels) • Commence deployment of SMP Field Teams
Impact Phase	**Aim**	Identify impacted receptors and assess effectiveness of oil spill response operations and techniques	Monitor for effects
	Actions	• Collect samples, video, photographs etc, as relevant • Conduct laboratory analysis, if relevant to OMP • Rapid analysis of data and reporting to IMT/EMT to aid in decision-making • Refine monitoring design, as appropriate	• Collect samples, video, photographs, in-situ data etc • Conduct laboratory and/or specialist data analysis • Conduct data QA/QC • Conduct trend analysis and statistical analysis • Refine monitoring design, as appropriate
Termination of Response	**Aim**	Terminate monitoring once criteria are met	Monitor for change and/or recovery

Phase		Considerations	
		Operational Monitoring	**Scientific Monitoring**
Operations / Recovery Phase	**Actions**	• Rapid analysis of data and reporting to IMT/EMT to aid in decisions to terminate response	• Collect samples, video, photographs, in-situ data etc • Conduct laboratory and/or specialist data analysis • Conduct data QA/QC • Conduct trend analysis and statistical analysis • Refine monitoring design, as appropriate
Post-recovery Phase	**Aim**	Review and incorporate learnings into OMPs and OSMP documentation	Incorporate change, effects, refine methods and assess against termination criteria
	Actions	• Update OMPs and OSMP as appropriate	• Collect samples, video, photographs, in-situ data etc • Conduct laboratory and/or specialist data analysis • Conduct data QA/QC • Conduct trend analysis and statistical analysis • Refine monitoring design, as appropriate

10.3. CAPABILITY ARRANGEMENTS

To ensure Titleholders meet OPGGS (Environment) Regulations 2009 (Part 2, Division 2.3, Regulation 14 (8AA)), they will be required to detail capability arrangements within their own organisation and with external providers for monitoring activation and implementation. This should include:

- Details of nominated positions/personnel to call. This may cross reference to a contacts directory which is updated regularly and includes contact details of internal and external personnel
- Agreed timeframes for activation with external providers
- Agreed process for activation with external providers
- Roles and responsibilities between the Titleholder and external provider for activation and implementation. If there are a number of external providers, the Titleholder must clearly state responsibilities of each provider
- Process for finalising monitoring designs (additional detail provided in Section 10.6)
- Minimum team numbers for initial actions and how capability can be built upon over time
- Minimum competencies for personnel (additional detail provided in Section 11.2)
- Process for inductions and training personnel (note that some operational monitoring field based roles could cater for personnel who receive a brief training course and are supervised on the job by more experienced personnel)
- Logistical arrangements, including nominating analytical laboratories, identifying vessel and aviation contracts to assist with monitoring platforms and identifying diving support services (if required)
- Communication, data management, data transfer methods and reporting protocols with the external provider/s
- Stand down process

10.4. MONITORING PRIORITIES

As part of the risk assessment process, Titleholders are required to identify in the EP a spatially defined area that may be affected by an oil spill from its activities, which is commonly referred to as the Environment that may be Affected (EMBA) or predicted zone of exposure. The EP will comprehensively describe the receptors in that area and any potential impacts from activities (including spills). A summary of values and sensitivities and the relevant OMPs and SMPs is provided in Appendix B Values and Sensitivities Addressed by OMPs and SMPs.

This spatial extent of the EMBA is identified through the use of stochastic modelling, which is based on the possible outcomes of a number of spill runs (typically 100 – 200 simulations). Titleholders will be required to identify in their Bridging Implementation Plan how they have used the results of their risk assessment process, in particular the modelling results, to help determine their likely initial monitoring priorities from their list of receptors. This should include a process to identify priority monitoring locations and suitable control or reference sites for scientific monitoring, noting that some control or reference sites may be situated outside of the EMBA.

Priority monitoring locations should take into account the protection priorities within the EMBA, as identified in the EP and/or OPEP. Titleholders have a range of methods to help determine initial protection priorities, which can be aligned to monitoring priorities. A common method for determining protection priorities includes:

1. Identifying receptors with high environmental value within EMBA, including (but not limited to):
    - high conservation value habitat or species (e.g. World Heritage Areas, State/Commonwealth protected areas, listed species)
    - sensitivity and/or recoverability of receptors to hydrocarbon impacts
    - areas with important socio-economic/heritage value
2. Using modelling results, identifying high value receptors that have the shortest potential timeframes to contact above impact thresholds. This can be evaluated for any relevant season the activity will occur (e.g. summer, winter and transitional).

Note that thresholds for response protection may vary to thresholds used for monitoring. Titleholders commonly align response protection thresholds to the moderate exposure thresholds of 10 g/m^2 for floating oil and 100g/m^2 for shoreline accumulation. However, this may not be suitable for monitoring thresholds. It is likely that water quality triggers and monitoring for some receptors may need to commence at the low exposure thresholds. Titleholders should identify their relevant thresholds in the EP or Bridging Implementation Plan. Ref. 23 provides guidance on thresholds.

Monitoring priorities may change throughout the duration of the monitoring program. Other factors that should be considered when establishing monitoring priorities include:

- Key stakeholder views and opinions
- Seasonality of receptors
- Availability of baseline data and/or ability and timeframe to rapidly obtain pre-impact data
- Availability of appropriate control sites
- Statistical approach proposed to analyse the data (particularly relevant for the SMPs)
- Available resources and equipment to conduct the work in terms of personnel, logistics, and access.

In Western Australia and Victoria, State Government Agencies have conducted protection prioritisation assessments for coastal environments. These projects are designed to assist in decision making during both the preparation and response phases of marine oil pollution incidents. Titleholders should consult with their respective State Government Agency to integrate this information into their EPs/OPEPs and OSMP Bridging Implementation Plans and they should be checked for updates when establishing monitoring priorities during a spill.

10.5. RESOURCE REQUIREMENTS AND IMPLEMENTATION TIMEFRAMES

Resource requirements and implementation timeframes will vary according to the individual spill risk profile (i.e. hydrocarbon characteristics, spatial and temporal extent of spill), proximity of the spill to sensitive receptors, mobilisation constraints and logistical requirements. When determining resource needs and implementation timeframes, Titleholders should consider the following issues (note: this list is not exhaustive. Titleholders should consider their individual requirements and activities when outlining resource needs and implementation timeframes in their Bridging Implementation Plan):

- Monitoring priorities (see above) – using stochastic or deterministic modelling, assess how quickly receptors may be contacted by the spill and at what probability. For example, spill modelling may show an island surrounded by important coral habitat with active turtle nesting and shorebird breeding to be contacted within 7 days of spill release at a 50% probability. Titleholders will need to determine how quickly they would need to mobilise resources to obtain any reactive baseline monitoring (if required) and conduct relevant operational and/or scientific monitoring components for that location. Note that guidance is provided in Appendix B Values and Sensitivities Addressed by OMPs and SMPs on OMPs and SMPs that are relevant to certain receptors;
- Remote locations - offshore islands, shoals, reefs and remote mainland locations are likely to require self-sufficient arrangements on vessels to act as a field base and cater for field personnel and equipment. This requirement will influence number of personnel, equipment/accommodation types and implementation timeframes;
- Vessel and vehicle requirements - remote locations of varying water depth and metocean conditions may need a number of different vessel types (e.g. larger 'base' vessels and shallow water craft). Monitoring components may require certain vessel specifications, depending on the final monitoring design (e.g. cranes and winches, hiab, freshwater supplies, office space). Offshore islands may also require light 'all-terrain' vehicles to transport personnel and equipment;
- Chain of custody of samples – Titleholders should have an established chain of custody procedure that will also be utilised by any contracted Monitoring Providers;
- Storage of samples – samples may need immediate freezing or refrigeration so consideration should be given to how samples will be stored from point of collection to comply with laboratory preservation and holding times;
- Transportation of samples – movement of samples from monitoring locations to staging areas and then to assigned laboratories is likely to require a separate courier vessel/aircraft to limit disruption of sampling continuity and sampling frequency and to comply with laboratory preservation and holding times;
- Permits and access – there may be a requirement to obtain permission to access a site prior to monitoring being conducted or obtain a permit before taking flora and fauna. Additional information on permits and access is provided in Section 10.8;
- Training and inductions – example competencies for key personnel are provided in individual OMPs and SMPs and should also be defined in the Titleholder's Bridging Implementation Plan. However, specific inductions and some training for support staff (e.g. shoreline clean-up support personnel) may be required prior to mobilisation.

Operational readiness, including resource requirements and implementation timeframes can be tested through exercises and drills. Improvement to initial implementation timeframes could be achieved by sharing resources with certain response actions (e.g. shoreline protection, oiled wildlife response).

Titleholders should consider the above issues and map out a resourcing and implementation schedule for OSMP activities in their Bridging Implementation Plan. An example schedule is provided in Table 10-2. This schedule can help Titleholders determine which OMPs and SMPs are the highest priority to implement. For example, the objective of OMP: Hydrocarbon properties and weathering behaviour at sea is 'to provide in field information on the hydrocarbon properties, behaviour and weathering of the spilled hydrocarbons to assist in spill response operations'. The spill site and surrounding waters will typically be the first area to be contacted by hydrocarbons at the highest concentrations, therefore this area would often be the highest

priority location to conduct sampling for this OMP, which in turn will provide useful information to the IMT/EMT to help implement response options that are effective on that hydrocarbon type.

Note: In Table 10-2, 'initiation' means that the monitoring plan has been triggered and the IMT/ OSMP Monitoring Provider has commenced finalisation of plan including implementation of the following actions (it may take 48-72 hours to complete all actions):

- Activate internal OSMP personnel and external contracts
- Select/confirm sites
- Finalise sampling technique
- Determine suitable sampling frequency
- Finalise standard operating procedures
- Allocate number of teams, personnel, equipment and supporting resource requirements
- Finalise HES documentation prior to mobilisation of field teams
- Confirm logistics (e.g. flights, accommodation, vessels)
- Commence deployment of Field Teams

For SMPs:

- Gather existing baseline data and/or establish control/reference sites
- Establish benchmarks and guidelines to be used
- Confirm indicator species
- Confirm parameters and metrics

Table 10-2: Example OMP and SMP implementation schedule for OSMP activities

Proximity to spill source	Monitoring type	0-48 hours	48-72 hours	~7 days	>Two weeks
Spill site and surrounding waters	OM	Initiation of: • OMP: Hydrocarbon Properties And Weathering Behaviour, where resources are available (e.g. Supply Vessel with onboard sampling equipment) • OMP: Oil Spill Modelling • OMP: Air quality modelling (responder health and safety)	Finalisation of the following OMPs (where individual OMP initiation criteria are met): • OMP: Water Quality Assessment • OMP: Sediment Quality Assessment • OMP: Air Quality Modelling • OMP: Marine Fauna Assessment • OMP: Surface Chemical Dispersant Effectiveness	As results from implemented OMPs are available, data ar provided to relevant personnel in IMT/EMT (e.g. Situation/Intelligence Unit) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill.	As results from implemented OMPs are available, data are provided to relevant personnel in IMT/EMT (e.g. Situation/Intelligence Unit) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill.
	SM	Commence activation and mobilisation process. Activation of SMP Team Leads and finalisation of SMPs.	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine fish assemblages assessment	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met
	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive	Initiation of: • OMP: Oil properties and weathering behaviour at sea	As results from implemented OMPs are available, data are provided to relevant personnel in IMT (Situation	As results from implemented OMPs are available, data are provided to relevant personnel in IMT (Situation

Proximity to spill source	Monitoring type	0-48 hours	48-72 hours	~7 days	>Two weeks
Sensitive receptors[3] (including shorelines) where modelling shows contact within 72 hours (3 days)		receptors at risk (desktop only)	• OMP: Water quality assessment • OMP: Sediment quality assessment OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment ○ Reptiles ○ Dugongs ○ Seabirds and shorebirds ○ Fish	Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Activation of SMP Team Leads and finalisation of SMPs requiring reactive baseline monitoring data to be obtained pre-impact.	Implementation of reactive baseline data monitoring (if applicable). Finalisation of the remaining SMPs (where individual OMP initiation criteria are met).	Relevant SMPs are being implemented, where resources are deployed.	Continue SMP implementation.
Sensitive receptors[4]	OM	Initiation of:	As results from implemented OMPs are available, data are	Initiation of:	As results from implemented OMPs are available, data are

[3] It is the responsibility of the Titleholder to determine its relevant sensitive receptors and ensure these align to the existing environment outlined in the EP and any identified protection priorities outlined in the EP and/or OPEP. The receptors listed here are provided as an example only. Time to contact with sensitive receptors may be derived from oil spill modelling results.

[4] It is the responsibility of the Titleholder to determine its relevant sensitive receptors and ensure these align to the existing environment outlined in the EP and any identified protection priorities outlined in the EP and/or OPEP. The receptors listed here are provided as an example only. Time to contact with sensitive receptors may be derived from oil spill modelling results.

Proximity to spill source	Monitoring type	0-48 hours	48-72 hours	~7 days	>Two weeks

(including shorelines) where modelling shows contact within >10 days		OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	• OMP: Oil properties and weathering behaviour at sea
				• OMP: Water quality assessment
				• OMP: Sediment quality assessment OMP: Shoreline clean-up assessment technique (SCAT)
				• OMP: Marine fauna assessment
				  ○ Reptiles
				  ○ Dugongs
				  ○ Seabirds and shorebirds
				  ○ Fish
					provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met

	SM	Commence activation and mobilisation process Activation of SMP Team Leads and finalisation of SMPs	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment -reptiles • SMP: Marine fish assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Proximity to spill source	Monitoring type	0-48 hours	48-72 hours	~7 days	>Two weeks
			• SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment		

10.6. FINALISING MONITORING DESIGN

It is important to note that the OMPs and SMPs provide detailed guidance rather than a prescriptive set of procedures that must be followed. Similar to individual Titleholders existing OMPs and SMPs, at the time of a spill monitoring personnel would be expected to finalise individual monitoring plans, including standard operating procedures, sampling frequency, parameters and number of teams to deploy. This is essential to ensure the finalised monitoring plan is fit for purpose and tailored to the Titleholder's specific location and associated sensitivities, and the nature and scale of the individual spill.

This flexibility must also be extended to the methodologies proposed. The methods presented in the individual OMPs and SMPs should be considered the base methods to be used. If the OMPs and SMPs are utilised for a spill, then the monitoring providers involved should be allowed the ability to employ the latest expertise and equipment, latest sampling methods and variables to be measured.

Whilst the methods may be varied, the individual monitoring plans aim/objectives, initiation and termination criteria and deliverables should not be varied outside the formal review process outlined in Section 12. In addition, the following are considered to be the minimum requirements in the individual monitoring plans (where listed) and modification of these must be justified by individual Titleholders if they are varied:

- Data and information requirements (applicable to scientific monitoring only)
- Monitoring parameters and metrics (as applicable)
- Personnel requirements
- QA/QC requirements (as applicable)
- Data analysis and management (as applicable).

Even when the intended design has been finalised, the approach to data collection may need to be modified in-situ depending on several factors, including (but not limited to):

- Information gathered from monitoring and evaluation and the OMPs;
- The evolution, weathering, behaviour and extent of the spill;
- Weather and sea state conditions; and/or
- Site locations and access given unforeseen logistical and safety constraints.

The OSMP Service Provider Lead and Technical Managers should therefore be qualified (with appropriate skills and experience) to design and/or redesign the monitoring programs adaptively.

10.7. INTERFACE BETWEEN PLANS

The OMPs and SMPs activated for a spill will depend on the spill characteristics, location and response options employed to combat the spill. In addition, information collected through one monitoring plan can initiate another monitoring plan. The plans are purposefully interrelated with sampling undertaken as part of one plan being utilised to understand impacts or spill dynamics in another.

However, monitoring is resource intensive and opportunities should be sought to identify potential competing demands, share resources and maximise efficiencies between monitoring components wherever possible. If Titleholders map out their implementation schedule (Refer to Table 10-2) then they will gain a better understanding of which monitoring components are likely to be required and when. Titleholders can then determine resourcing requirements for the initial stages of monitoring and how resources may be scaled over time, similar to mapping response capability in OPEPs. For example, Titleholders may only have two vessels contracted and able to mobilise to location within 48 hours of notification. Titleholders would need to determine which monitoring components each vessel could conduct, their frequency of sampling and sampling locations. There are many logistical considerations in mapping out implementation timeframes and this is typically best achieved in a workshop environment to help partition resources between competing demands.

When results and outputs from various operational monitoring plans are evaluated together, a dynamic map can be created to understand the spill dynamics and weathering over time. Operational plans can also be utilised alongside each other to build a picture of sensitive receptors that are likely to be affected by the spill to inform the spill response. Outputs from the scientific monitoring plans may also be used alongside each other to assist in understanding broader cause and effect impacts of the spill at a habitat or ecosystem level.

10.8. PERMITS AND ACCESS REQUIREMENTS

In the Implementation Bridging Plan, Titleholders will be required to address the process for obtaining any necessary permits and access requirements for their selected monitoring activities. Permits need to be obtained from the relevant State/Territory and/or Commonwealth jurisdictional authority and other operators/proponents. Table 10-3 provides guidance on the relevant jurisdictional authority for various receptors, although specific access and permit requirements will need to be determined on a case-by-case basis by the Titleholder.

Permit and access requirements apply to Marine Parks, Marine Protected Areas, restricted heritage areas, operational areas of industrial sites, defence locations and managed fisheries but in some cases they may apply to all waters. Titleholders should refer to the relevant Australian Marine Park Management Plan for specific requirements for marine parks and marine protected areas. However, generally actions required to respond to oil pollution incidents, including environmental monitoring and remediation, in connection with mining operations authorised under the OPGGS Act may be conducted in all zones in an Australian Marine Park (Ref. 24).

Titleholders should have provision in their Bridging Implementation Plan and/or OPEP for notifications to be made to the Director of Parks Australia in the event of an oil pollution incident that occurs within, or may impact upon, an Australian Marine Park. Where practicable, this notification should be made prior to any response action being undertaken. In addition, activities (including monitoring) should be conducted in accordance with the relevant accepted EP.

If permits are likely to be required in any area, at the onset of initiation, the OSMP Implementation Lead should be responsible for contacting the relevant jurisdictional authority and/or asset manager and arrange for the pre-issuing of 'blanket' sampling permits to avoid the typical lead times when applying for permits through normal channels. Permits depend on the type of sampling to be undertaken and on the jurisdictions within the response area. Alternatively, permits could be sought pro-actively prior to any spills where possible.

Table 10-3: Jurisdictional Authorities for various receptors

Receptor	Jurisdictional Authority
State/Territory Marine Protected Areas; Fish Habitat Protection Areas	State/Territory government department with jurisdiction for parks and wildlife State/Territory government department with jurisdiction for fisheries
Ramsar wetland	Commonwealth Department of Environment and Energy
Australian (Commonwealth) Marine Parks	Parks Australia
State/Territory Managed Fisheries	State/Territory government department with jurisdiction for fisheries
Commonwealth Managed Fisheries	Australian Fishing Management Authority
Indigenous Cultural Heritage	State/Territory government department with jurisdiction for indigenous heritage
Defence/restricted military area	Department of Defence
Industry (e.g. operational zone of offshore oil or gas platform)	Operating company
Shipwrecks	State/Territory or Commonwealth government department with jurisdiction for maritime cultural heritage/archaeology

10.9. OPERATIONAL MONITORING INFORMING RESPONSE DECISION MAKING

The main purpose of operational monitoring is to aid planning and decision making for the effective implementation of response operations. This is a direct requirement of the OPGGS (Environment) Regulations 2009 (Part 2, Division 2.3, Regulation 14 (8AA) - The oil pollution emergency plan must include adequate arrangements for responding to and monitoring oil pollution, including the following:.. (d) the arrangements and capability in place for monitoring oil pollution to inform response activities). Therefore, it

is important for Titleholders to outline their arrangements for collecting, communicating and using operational monitoring data during a response.

These arrangements will vary according to each Titleholder's Incident Management Structure (e.g. ICS v's AIIMS), whether or not they rely entirely on external monitoring providers and if/how they use NEBA/SIMA, IAP's and tactical plans in their IMT/EMT. The information below provides a guide but this must be tailored to the individual Titleholders requirements and their own process specified in their Bridging Implementation Plan.

In-situ OMP data are typically recorded by field teams, checked by the Field Team Lead and communicated back to the Situation Unit Lead/Intelligence Unit or Planning Chief via field reporting forms, debriefs and reports. Laboratory analysis reports should also be directed to the same position.

If the Situation Unit Lead/Intelligence Unit receives this data, it is then their responsibility to understand who in the IMT/EMT requires this data. Typically this would be the Planning Section/Unit who may provide the data directly to the OSMP Management Team for rapid analysis. This analysis would then be used to inform the Common Operating Picture (managed by the Situation Unit Lead/Intelligence Unit) and would be used by the Environment Unit Lead during development of the operational NEBA/SIMA. The NEBA/SIMA would in turn help inform the IAP or tactical plans as developed by the Planning Section/Unit for the for the current or next operating period.

As ultimately responsible for the IAPs, the Planning Section Chief will be required to determine if the response options can be continued, escalated, terminated, or if controls need to be put in place to manage impacts of the response activities.

Titleholders should also be clear as to why they are collecting data and how it may be used by the IMT/EMT. Table 10-4 provides an outline of the types of data generated from each OMP and how this data may be used by the IMT/EMT during the response.

Titleholders should also outline in their Bridging Implementation Plan how they will use operational monitoring data to ensure that performance standards for the implementation of control measures are met. This is also a requirement of OPGGS (Environment) Regulations 2009, Part 2, Division 2.3, Regulation 14 (8AA) - The oil pollution emergency plan must include adequate arrangements for responding to and monitoring oil pollution, including the following:..(c) the arrangements and capability that will be in place for monitoring the effectiveness of the control measures and ensuring that the environmental performance standards for the control measures are met.

Environmental performance standards vary greatly between Titleholders; therefore it is difficult to provide detailed guidance in this Framework. Titleholders should ensure that their Bridging Implementation Plan has considered any possible linkages between spill response options, their resultant performance standards and operational monitoring. For example, if a Titleholder had a performance standard for dispersant application that stated 'IMT and Operational and Scientific Monitoring (OSMP) Team have discussed dispersant efficacy testing results to ensure they are incorporated into each relevant IAP', then the Titleholder will need to demonstrate there are arrangements in place to ensure this performance standard is met.

Table 10-4: Data generated from each OMP and how this may be used by IMT/EMT in decision making

Operational Monitoring Plan	Data generated[5]	How data may be used by IMT/EMT
Hydrocarbon properties and weathering behaviour at sea	Hydrocarbon physical characteristics (e.g. viscosity, asphaltene content, fingerprinting, weathering ratios of hydrocarbon chains)	Changes to the hydrocarbon properties will affect the window of opportunity for particular responses and the associated logistical requirements of these responses, such as use of chemical dispersants, recovery and pumping equipment suitability, hydrocarbon storage and hydrocarbon disposal requirements
Pre-emptive assessment of sensitive receptors at risk (desktop only)	Location of sensitive receptors in relation to known spill extent (derived initially from spill modelling and any surveillance data)	Confirm initial protection priorities; understand extent of baseline data; provide an understanding of stakeholders to be contacted to obtain local knowledge and validate current information
Shoreline clean-up assessment technique (SCAT)	Assessment of shoreline character; assessment of shoreline oiling; recommendations for response activities; post-treatment surveys	Confirmation of shoreline character, habitats and fauna present which may influence selection of response tactics (e.g. no mechanical recovery if turtles are known to be nesting); Oil removal rate for a shoreline sector will help determine effectiveness of relevant tactics (e.g. shoreline protection and/or clean-up operations); SCAT teams provide ground truthing of sites that are not possible via satellite imagery, therefore the IMT/EMT can rely on recommendations SCAT teams (e.g. flagging access issues, suitable tactics, likely resourcing needs)
Surface chemical dispersant effectiveness and fate	Visual observations of dispersant efficacy; concentration of hydrocarbons in water column (see also water quality assessment);	Determine the effectiveness of dispersant in removing oil from sea surface and how dispersed oil is being distributed through the water column. This information can be used in NEBA/SIMA to help decide if dispersants are being effective at treating high value receptors (NEBA/SIMA to evaluate any trade-offs between receptors)

[5] Summary only. For additional detail, please refer to individual OMPs. Also note data outputs will be reliant on finalised monitoring design.

Operational Monitoring Plan	Data generated[5]	How data may be used by IMT/EMT
Hydrocarbon spill modelling	Forecasting and movement of spill; simulations of spill with different response options applied (e.g. dispersants)	Trajectory will help understand movement of spill and identify receptors that may be at risk of exposure to help direct resources for best effect; modelling will help predict hydrocarbon concentrations, which can be verified when used in conjunction with water quality monitoring and surveillance tactics; simulations with different response options could help the IMT/EMT predict the outcome of applying different response options in different locations (e.g. dispersants in deeper waters and containment and recovery in nearshore waters)
Water quality assessment	Distribution of oil in water column and change in hydrocarbon concentrations (e.g. total recoverable hydrocarbons, BETEXN, PAH), physio-chemical parameters and dispersant detection	Confirm spatial extent of spill and verify spill modelling and surveillance data; extent of spill can in turn influence location of other OMP and SMP monitoring components and sites
Sediment quality assessment	Distribution of oil in sediment and change in hydrocarbon concentrations (e.g. Total recoverable hydrocarbons, BETEXN, PAH)	Confirm spatial extent of spill; extent of spill can in turn influence location of other OMP and SMP monitoring components and sites
Marine fauna assessment • Reptiles • Cetaceans (observational only) • Dugongs • Pinnipeds • Seabirds and shorebirds • Fish	Rapid assessment of presence and distribution of marine fauna; evaluate impact of spill and response activities on fauna	Understanding of species, populations and geographical locations at greatest risk from spill impacts. IMT/EMT's can use this information to help qualify locations with highest level of protection priority (e.g. dugong nursery area is at risk of high contact therefore dispersant use closest to spill source may be a preferred option); understanding the impacts of spill response activities can help IMT/EMTs to modify or terminate activities if they are assessed as creating more harm than the oil alone (e.g. large shoreline clean-up teams and staging areas may disturb shorebird nesting resulting in adults abandoning chicks)

Operational Monitoring Plan	Data generated[5]	How data may be used by IMT/EMT
Air quality modelling (responder health and safety)	Modelled outputs of airborne hydrocarbons, gases and chemicals and their predicted distribution	Determine safe distances from spill source for response personnel; determine the presence and persistence of volatile organic compounds (VOCs) to know if response areas are safe for personnel

10.10. ROLES AND RESPONSIBILITIES

10.10.1. COORDINATION OF THE OSMP FRAMEWORK

The Joint Industry OSMP Framework is proposed to be coordinated through a central organisation, referred to below as an OSMP Coordinator. The terms of reference for this coordination role are yet to be confirmed, however, it is envisaged this organisation would be the custodian of the Framework and the supporting OMPs and SMPs. This may involve supporting Titleholders who elect to use the Framework and guiding them on how to apply it through their Bridging Implementation Plan.

Ultimately, it would create efficiencies if this custodian could also coordinate any updates to the documents, conduct regular reviews and work with Titleholders to identify areas for improvement. Additionally, the custodian could manage the contracts with specialised Monitoring Providers who would be required to finalise and then implement the monitoring plans during a response. This coordination role could include maintaining evidence of the required monitoring capability and coordinating a regular testing schedule to demonstrate capability.

Implementation of the Joint Industry OSMP Framework can be separated into two phases: 1) preparedness phase; and 2) response phase. An example of the division of roles and responsibilities between the Titleholder, OSMP Coordinator and contracted Monitoring Providers is presented in Table 10-5.

Table 10-5: Roles and Responsibilities for the Joint Industry OSMP Framework

Role	Preparedness Phase Responsibilities	Response Phase Responsibilities
Titleholder	• Prepare Titleholder Implementation Bridging Plan • Ensure own personnel are familiar with OSMP Framework, applicable OMPs, SMPs and their individual Titleholder Bridging Implementation Plan • Establish OSMP arrangements/structure within their own IMT/EMT	• Finalise the monitoring design in consultation with the Monitoring Provider/s according to the nature and scale of the spill • Work with the Monitoring Provider/s to implement and report on the relevant monitoring programs
OSMP Coordinator	• Support Titleholders in developing their Implementation Bridging Plan • Manage document updates, reviews and identify areas for improvement	• Due to the familiarity of the documents, there may be a role in supporting Titleholders and

Role	Preparedness Phase Responsibilities	Response Phase Responsibilities
	• Manage contracts with Monitoring Providers, including regular reporting (e.g. three monthly) on personnel and equipment capability • Coordinate annual incident management/tabletop exercises to test OSMP capability • Provide results of reports and exercises to Titleholders	Monitoring Providers during implementation
Monitoring Providers	• Maintain OSMP capability and readiness to establish an OSMP Monitoring Team within a specified timeframe • Demonstrate they have the required equipment, processes, systems and trained personnel to fulfil the relevant OMPs and SMPs (as a minimum) • Participate in an exercise and testing schedule	• Finalise the monitoring design according to the nature and scale of the spill in consultation with the Titleholder OSMP representative • Implement the relevant monitoring program and report as required to the Titleholder OSMP representative

10.10.2. RESPONSE PHASE IMPLEMENTATION

The size and composition of the OSMP Management Team is likely to vary among Titleholders and according to the nature and scale of the spill. The Titleholder Bridging Implementation Plan will need to provide detail on the OSMP Management Team structure and be relevant to the system of incident command used by the Titleholder (either Incident Command System (ICS) or Australasian Inter-Service Incident Management System (AIIMS)). The information below provides an example to help Titleholders determine the structure best suited to their individual needs, which should be described in detail in their Implementation Bridging Plan).

It is recommended that during spill response operations the OSMP Management Team report to either the Planning Section or Operations Section in the IMT/EMT. Figure 10-1 provides an example of how the OSMP Management Team may report to the IMT/EMT. The inset provides an example of an OSMP Management Team structure.

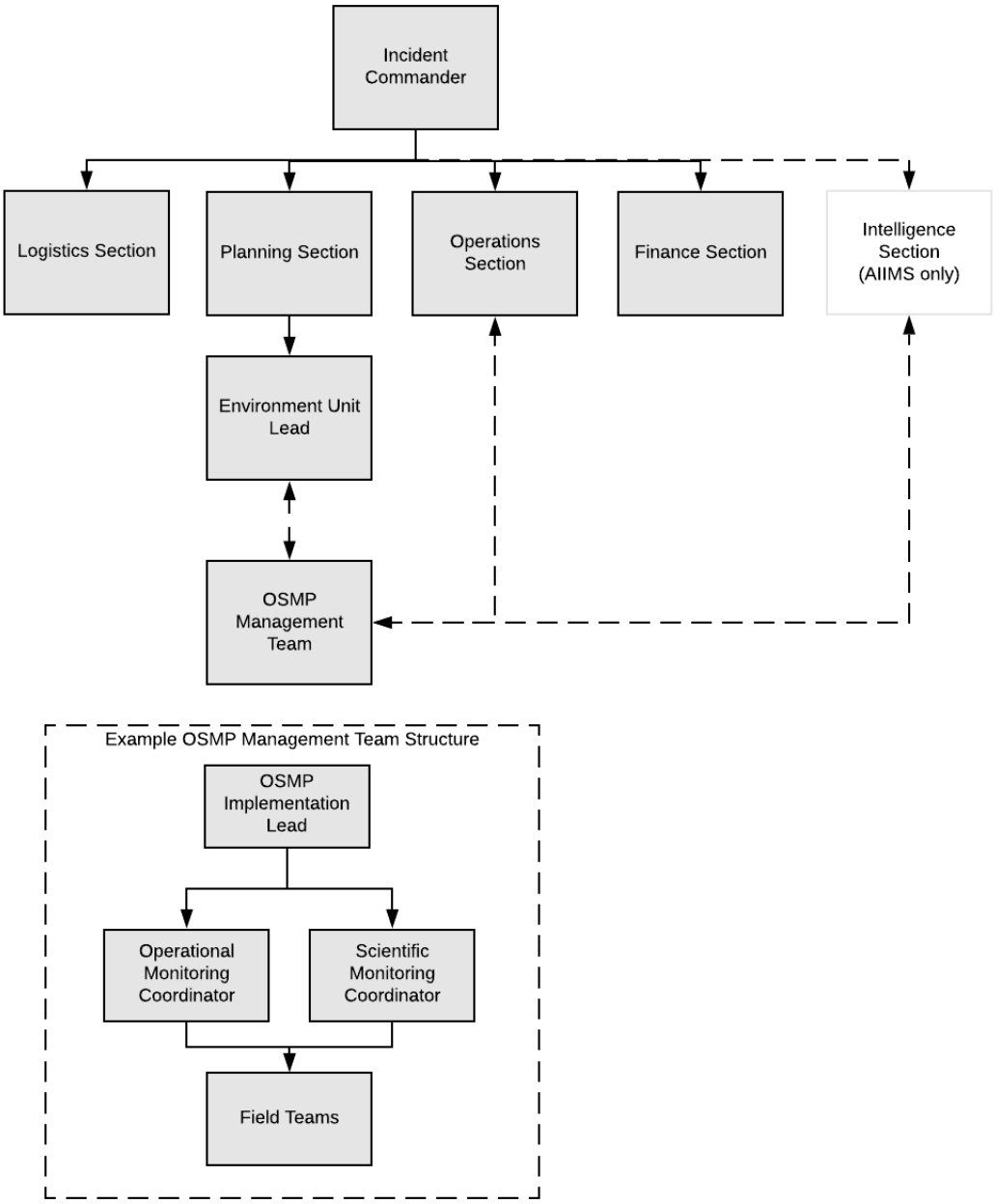


Figure 10-1: Example OSMP Management Team Structure in IMT/EMT

Table 10-6 outlines an example of the responsibilities of keys roles in the IMT/EMT and OSMP Management Team. Titleholders may already present the roles and responsibilities of key IMT/EMT personnel (e.g. Operations Section Chief, Planning Section Chief) in their relevant EP or OPEP. To avoid duplication, Titleholders may choose to cross reference to the relevant document, however all OSMP specific roles should be clearly described in the Bridging Implementation Plan.

Titleholders should clearly articulate responsibility for implementation and decision making of scientific monitoring components. A pragmatic approach would be to assign this responsibility to the same person during the response phase and post-response phase, for continuity of decision making.

Table 10-6: Responsibilities of Key Roles in OSMP Management Team

Role	Key Responsibilities
Incident Commander	Ultimately accountable for the implementation of the OSMP. Specific responsibilities related to the OSMP include: • Ensure OSMP-specific roles are established • Integrate operational and scientific monitoring with the spill response • Ensure that OMP and SMP components are implemented according to their specific initiation criteria and within nominated response times • Ensure that the OSMP Implementation Lead and Environment Unit Lead are sufficiently resourced to oversee and guide implementation of OSMP activities
Environment Unit Lead (EUL) (Titleholder)	The EUL is the key position for relaying information between the IMT/EMT and the OSMP Implementation Lead. Responsibilities include: • Contact point with the IMT/EMT • Provide overarching technical advice • Advise on environmental impact from implementing monitoring • Facilitate activation of external support, if necessary
OSMP Implementation Lead (Titleholder)	Responsible for overseeing implementation of OMP and SMP components in accordance with this Plan, specifically identify: • The relevant OMP and SMP components that may be triggered based on the information collected during the initial response and OMP monitoring • Implementation of response options to ensure that the relevant OMP and SMP components are implemented at the appropriate times • Approve sampling and analysis plans for the SMP components within the nominated time frame of the SMP component being triggered • Ensure mobilisation of resources for sampling and analysis plans within the nominated time frame of the SMP component being triggered • Liaise with relevant stakeholders and regulators on monitoring design, monitoring priorities, and results
Operational Monitoring Coordinator and Scientific Monitoring Coordinator (Monitoring Provider)	The Operational Monitoring Coordinator and Scientific Monitoring Coordinator are the technical leads for each monitoring type. Responsibilities include: • Finalise monitoring design for individual OMPs and/or SMPs • Understand the data metrics collected in the event of a spill • Advise the OSMP Implementation Lead on data collection, logistical support required, and monitoring priorities if constraints (e.g. safety, time, logistics) are encountered • Oversee data analyses and interpretation • Manage data, including spatial data • Present data in an appropriate and informative format to allow for timely decisions

Role	Key Responsibilities
OSMP Field Operations Manager (Monitoring Provider)	Responsible of the coordination of resources and developing a schedule of movements, in close consultation with the IMT/EMT Logistics Section. Key responsibilities include: • Determine locations where monitoring teams are required and resource requirements for specific locations • Keep track of vessel/aerial movements associated with monitoring activities • Monitor resource availability • Direct communications with relevant Monitoring Coordinator and Field Team Leads • Monitor and coordinate simultaneous operations
OSMP Field Teams (Monitoring Provider)	A Field Team includes one Field Team Lead, who is the key contact point to the relevant Monitoring Coordinator during a field deployment. The responsibilities of all Field Team members include: • Understand the details of monitoring methods • Ensure that they are supplied with adequate equipment and field data collection sheets to undertake the monitoring component • Ensure awareness and understanding of QA/QC procedures • Help with report preparation if required

11. CAPABILITY

11.1. PERSONNEL AND EQUIPMENT

The OMPs and SMPs list the equipment and personnel required to implement each monitoring plan. In addition, Titleholders will be required to outline (in their Implementation Bridging Plan) the arrangements that fulfil their individual OSMP Management Structure (see Section 10.10.2) and how the equipment requirements for their selected OMPs and SMPs will be met (e.g. through contracted monitoring providers and/or independent external equipment providers).

It is recommended that Titleholders nominate a representative (preferably an employee and/or IMT/EMT member) to act as the person responsible for overseeing OSMP implementation and liaising with external monitoring providers.

11.2. TRAINING AND COMPETENCY

The OMPs and SMPs list the responsibilities and competencies of personnel required to implement each monitoring plan. In addition to these monitoring roles, Titleholders will need to specify the training and competencies for the OSMP Management Team roles. Table 11-1 provides example competencies for the key OSMP Management Team roles, which Titleholders may choose to adopt in their Implementation/Bridging Plan. It is important to note that Titleholders should involve their most experienced monitoring personnel (Internal or external personnel) in the early stages of monitoring, so that they are able to contribute to the finalisation of the monitoring design for the triggered OMPs and SMPs.

Table 11-1: Example of Competencies Required for Key OSMP Roles

Role	Example Competencies
Environment Unit Lead (Titleholder)	• Bachelor degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • PMAOMIR320 – Manage Incident Response Information or ICS 100 and ICS 200. • Participation in one incident management exercise every two years • Operational and Scientific Monitoring Plan Awareness Training
OSMP Implementation Lead (Titleholder)	• Bachelor degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • PMAOMIR320 – Manage Incident Response Information or ICS 100 and ICS 200. • Participation in one incident management exercise per year • Operational and Scientific Monitoring Plan Awareness Training
Operational Monitoring Coordinator and Scientific Monitoring Coordinator (Monitoring Provider)	• Bachelor degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • >5 years experience in relevant scientific field
OSMP Field Teams (Monitoring Provider)	• Refer to OMPs and SMPs

12. REVIEW

The OSMP Joint Industry Framework shall initially be reviewed bi-annually and incorporate improvements from various continuous improvement sources. Longer term, it is planned that the OSMP Joint Industry Framework shall be reviewed every three years.

13. REFERENCES

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APPENDIX A MOBILISATION REQUIREMENTS

The following list provides generalised information on mobilisation requirements. It is not an exhaustive list and Titleholders and their contracted Monitoring Providers should consider individual needs when preparing their own tailored list.

A.1.1 TITLEHOLDER MOBILISATION REQUIREMENTS

Titleholder's responsibilities prior to mobilisation may include:

- Identify OMPs and SMPs that are relevant to Titleholder(s) activities
- Identify spill-specific health, safety, security and emergency response requirements relevant to executing the monitoring program
- Decide the platform to sample from (e.g. vessel, shoreline)
- Place the monitoring team on standby and arrange and test equipment, including vessels.

Maintain situational awareness of the spill and work with the Planning Section to determine monitoring locations for the relevant operational period.

A.1.2 MONITORING PROVIDER MOBILISATION REQUIREMENTS

The following checklists are designed to provide the Field Team Leader for each monitoring plan with various considerations for implementation.

A.1.3 PRE-SURVEY PLANNING

Table A.1.1 outlines considerations for the survey planning phase.

A -1.1: Pre-survey Planning Tasks

Task	Check
Develop survey objectives with the Titleholder and priorities for initial deployment	☐
Select study area sites (including impact and control sites if applicable)	☐
Examine existing literature, baseline data, and existing monitoring programs to establish priorities for data collection	☐
Confirm sampling approach and technique and update as new data becomes available	☐
Obtain any necessary permits	☐
Develop site-specific health and safety plan	☐
Liaise with NATA-accredited laboratories to confirm availability, limits of detection, sampling holding times, transportation, obtain sample analysis quotes and arrange provision of appropriate sample containers, Chain of Custody (CoC) forms, eskies and ice blocks. Make arrangements for couriers (if necessary).	☐
Determine data management collection requirements	☐
Determine data management delivery needs of the IMT and process requirements, including data transfer approach and frequency/timing.	☐
Brief monitoring team/s on survey objectives, logistics, safety issues, reporting requirements and data management	☐

A.1.4 PRE-SURVEY LOGISTICS

Table A-1-2 outlines activities that should be considered before mobilisation to the field.

A-1-2: Pre-survey Logistics Tasks

Task	Check
Activate survey team/s	☐
Undertake HAZIDs as required and consolidate/review field documentation including safety plans, emergency response plans, and daily field reports	☐
Consider any access issues to survey sites	☐
Confirm data formats and metadata requirements with personnel receiving data	☐
Confirm consumables have been purchased and will be delivered to required location	☐
Arrange survey platform (vessel, vehicle, aircraft) as required to survey or access survey sites and ensure they are equipped with appropriate fridge and freezer space for transportation of carcasses/samples	☐
Confirm flights, accommodation, and car hire arrangement are in place	☐
Conduct pre-mobilisation meeting with the survey team	☐
Develop field survey schedules, detailing staff rotation	☐

A1.5 PRE-SURVEY EQUIPMENT PREPARATION

Table A-1-3 lists tasks that should be considered prior to mobilisation to the field, to ensure equipment is working and that it can be operated safely and efficiently (for an equipment list, see the relevant OMP and SMP).

A-1-3: Pre-survey Equipment Checklist

Task	Check
Confirm specialist equipment requirements and availability (including redundancy)	☐
Check GPS units and digital cameras are working and that sufficient spare batteries and memory cards are available	☐
Confirm sufficient equipment to allow integration of survey software and navigational systems (e.g. GPS, additional equipment and adaptors), and additional GPS units prepared	☐
Confirm GPS survey positions (where available) have been QA/QC checked and pre-loaded into navigation software/positioning system	☐
Check field laptops, ensuring they have batteries, power cable, and are functional	☐
Check if a first aid kit or specialist PPE is required	☐
Confirm arrangements for freight to mobilisation port is in place	☐

APPENDIX B VALUES AND SENSITIVITIES ADDRESSED BY OMPS AND SMPS

Receptor	Relevant OMP and SMP
Primary producers	
Corals, seagrass and macroalgae	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Intertidal and coastal habitat assessment SMP: Benthic habitat assessment
Mangroves	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique SMP: Intertidal and coastal habitat assessment
Invertebrate communities	
Infauna, filter feeders and other sessile and mobile benthic invertebrates	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Intertidal and coastal habitat assessment SMP: Benthic habitat assessment
Marine habitats	
Water quality	OMP: Oil properties and weathering behaviour at sea OMP: Water quality assessment OMP: Sediment quality assessment OMP: Surface chemical dispersant effectiveness and fate OMP: Hydrocarbon spill modelling SMP: Water quality impact assessment
Sediment quality	OMP: Water quality assessment OMP: Sediment quality assessment SMP: Sediment quality impact assessment
Benthic habitats	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Benthic habitat assessment
Shoreline and intertidal habitats	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique SMP: Intertidal and coastal habitat assessment
Marine fauna	
Seabirds and shorebirds	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique SMP: Seabirds and shorebirds
Marine megafauna	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique OMP: Marine fauna assessment SMP: Marine mega-fauna SMP: Fish impact assessment

Receptor	Relevant OMP and SMP
Socio-economic	
Commercial Fisheries and Aquaculture	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Water quality impact assessment SMP: Commercial and recreational fisheries impact assessment
Recreational Fisheries	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Water quality impact assessment SMP: Commercial and recreational fisheries impact assessment