

Non-Indigenous Marine Species Management Plan

Maxima 3D Marine Seismic Survey, Scott Reef

Woodside Energy Ltd.

Rev 0
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1 Introduction

1.1 Project Description

Woodside Energy Ltd. (WEL) is planning to undertake a three-dimensional (3D) marine seismic survey (Maxima 3D MSS) over an area of approximately 362 square kilometres (km^2) of Scott Reef, approximately 430 km north of Broome in Western Australia (**Figure 1-1**).

As part of the environmental management commitments of the survey, WEL has committed to develop and implement a Non-Indigenous Marine Species Management Plan (NIMSMP)[1] for managing the risk of potentially introducing unwanted non-indigenous marine species (NIMS) with known or suspected marine pest credentials. This NIMSMP has been developed in consultation with the Western Australian Department of Fisheries (DoF) and addresses the Ministerial conditions and procedures as listed Condition 10 of the Ministerial Conditions (Government of WA, 2007a). The Plan is developed specifically for this short-duration activity and at Scott Reef.

1.2 Scope and Intent of the NIMSMP

The objective of the NIMSMP is to *'prevent the introduction of non-indigenous marine organisms'* (EPA, 2007) specifically for the Maxima 3D MSS. In accordance with the Ministerial conditions and procedures (Government of WA, 2007a) for the Maxima 3D MSS, this Plan:

1) Documents for all vessels and immersible equipment required for the seismic survey:
    - Recent locations and activities;
    - Fouling control coating (FCC) status;
    - Trim water / ballast water management requirements; and
    - Existing or proposed treatment/s of internal seawater circuits.
2) Identifies proposed risk-reduction management measures, as may be required to avoid introducing pest species, commensurate with the level of risk identified for particular a vessel or equipment item history as determined above (1).
3) Identifies operational protocols and response procedures should a marine pest be identified, including a flow chart of actions, designation of responsibilities and clear communication pathways.

In accordance with Ministerial conditions, WEL will;

- Submit this NIMSMP to the DoF for approval prior to the scheduled deployment to Scott Reef of any vessel or in-water equipment to be used in the preliminary or main components of the Maxima 3D Marine Seismic Survey;
- Implement the approved NIMSMP; and
- Ensure the NIMSMP is publicly available in a manner approved by the CEO (EPA, 2007).

This NIMSMP therefore describes the:

- Current and proposed NIMS regulations and guidelines;
- Proposed vessels and immersible equipment required for the Maxima 3D MSS;
- Risk assessment methodology that will be used to assess all vessels and immersible equipment for the Maxima 3D MSS;
- The risk reduction management measures proposed to mitigate any unacceptable levels of identified risk for the Maxima 3D MSS; and
- The operational protocols should non-indigenous marine species with known or suspected marine pest status become identified during the implementation of this plan for the Maxima 3D MSS.

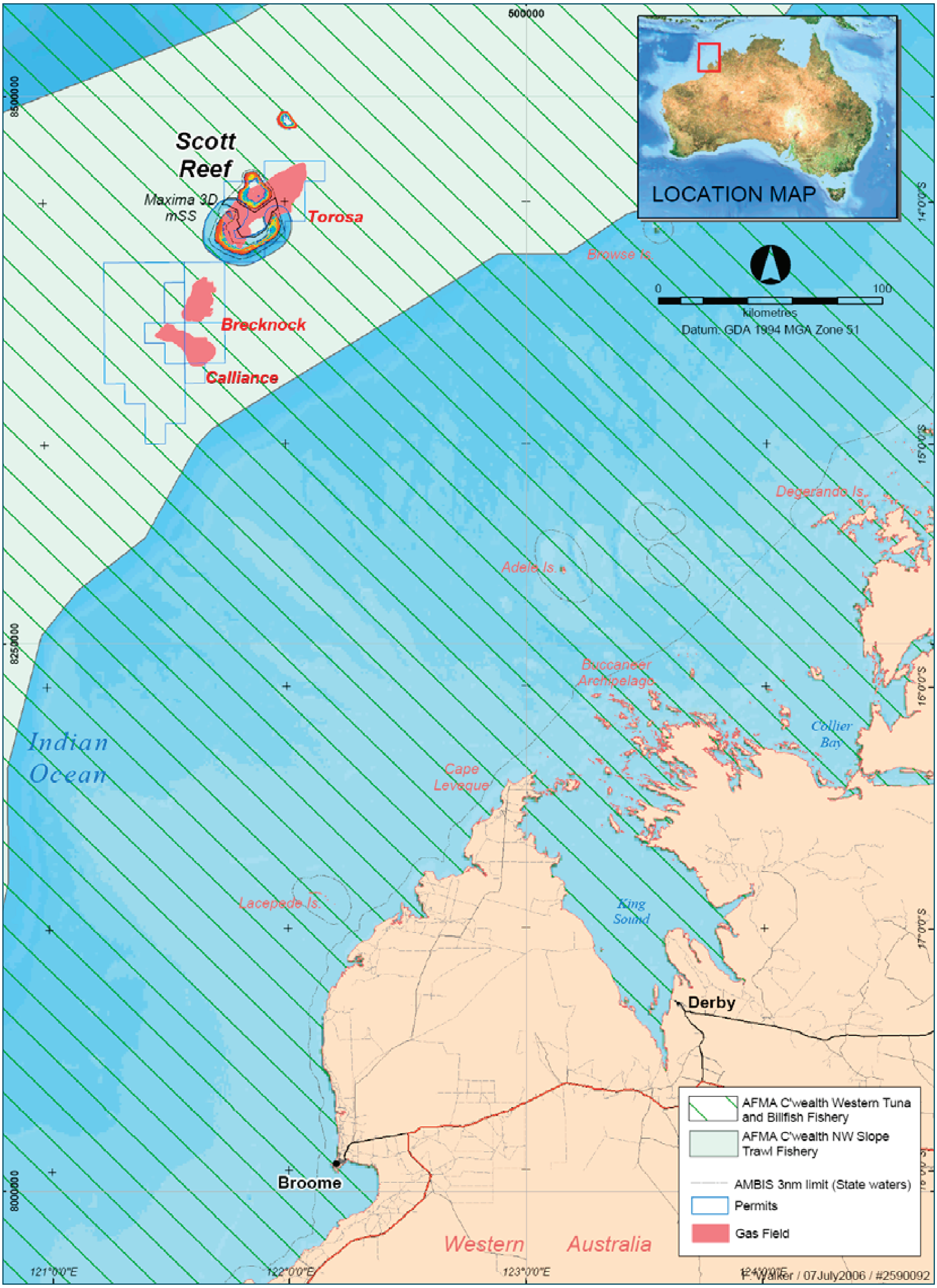
The purpose and intent of the NIMSMP is to:

- Provide summary information on non-indigenous marine species and a description of the vectors and geographic pathways of concern specific for the Maxima 3D MSS;
- Provide clear direction as to the risk-reduction measures and operational protocols that will be employed to minimise the risk of introducing unwanted species with known or suspected invasive marine pest credentials as a result of the vessel movements and equipment deployments during the Maxima 3D MSS.

The procedures defined in this Plan are designed to manage the risk of introducing non-indigenous marine species to Scott Reef in association with the Maxima 3D MSS. The requirements are relatively conservative and further management of non-indigenous marine species beyond the Maxima 3D MSS will be further evaluated. It is likely that different mitigation measures may be suitable for other activities proposed and no part of this Plan should be seen as standard practice for all activities at Scott Reef.

1 Also referred to as 'Plan'

Figure 1-1 Location of Scott Reef and the adjacent gas fields



As a part of the risk reduction management measures of this NIMSMP, 'non-indigenous marine species (NIMS)' that may be introduced through vessels and immersible equipment associated with the Maxima 3D MSS and are likely to have the ability to survive and reproduce in the environments associated with the Maxima 3D MSS survey have been identified (**Appendix C**) and their selection discussed within this Plan (**Section 3.3**). The list of NIMS has been developed in consultation with DoF and with consideration of State and Commonwealth marine species lists of concern (i.e. Hayes *et al*, 2005).

The risk assessment methodologies described in this Plan, including the NIMS specific for the Maxima 3D MSS, has been developed on the best-practice principals and current knowledge at the time of this document preparation (August, 2007). It is acknowledged that as experience is gained with risk assessment process for NIMS across the marine industry, scientific knowledge increases and new regulatory guidance is developed, the risk assessment methodologies will evolve over time.

2 Current Regulations and Guidelines for Introduced Marine Species

2.1 Overview

The respective lead agencies for preventing the introduction and spread of non-indigenous marine species (NIMS) in Commonwealth and Western Australian State waters are the Department of Agriculture, Fisheries and Forestry (DAFF) and the Western Australian Department of Fisheries (DoF). In the case of WA port waters, the Harbour Masters of the State's public ports such as Dampier and Broome also have salient powers with respect to reducing introduction risks in port waters under the *Ports Authorities Act 1999 (WA)* and its associated *Port Authorities Regulations 2001*.

2.2 Commonwealth

DAFF's responsibility is to prevent and manage invasive species which pose a threat to agricultural, fishery and forestry resources. Its key legislation is the *Quarantine Act 1908*. Marine pest incursion risks from international shipping are managed by DAFF, with policy development the responsibility of its Invasive Marine Species Program (IMSP). The main focus of the IMSP is on managing the vectors that may introduce known or suspected marine pests to Australia, including trading ships and non-trading commercial vessels used by the offshore petroleum industry. Under current administrative arrangements, the IMSP's border control responsibilities therefore include the development and implementation of:

- international agreements and undertakings;
- pre-border and border monitoring, detection and control arrangements; and
- national mechanisms to help identify and respond to pest incursions as early as possible.

In developing national policy the IMSP consults closely with various agencies and industry stakeholders including the Commonwealth Departments of Environment and Water Resources (DEW) and Transport and Regional Services (DOTARS), the Australian Maritime Safety Authority (AMSA), and the Australian Petroleum Production and Exploration Association (APPEA).

The Australian Quarantine and Inspection Service (AQIS) is the Commonwealth's operational instrument that implements the policies of DAFF at the day-to-day level, with the pre-border and border management of marine pests falling under the AQIS Seaports Program. As part of the AQIS Seaports Program and its Pratique requirements for vessels arriving from overseas ports, any ship or drilling platform intending to discharge trim or ballast water in coastal Australian waters is required to have undertaken a ballast water exchange (BWE) in open ocean waters, i.e. preferably more than 200 m deep and more than 200 nautical miles from the nearest coastline, and at least in waters >50m deep and beyond the boundary of the 12 nautical mile Territorial Sea (e.g. AQIS 2005). A 95% volumetric exchange must be achieved for all tanks intended to be discharged, either by sequential method, dilution method or 'flow-through' method (in which three times the tank volume of seawater is pumped through a tank that, for hull stress / safety reasons, cannot be emptied en route) (refer **Section 2.3.1** for further explanation).

Apart from the ballast water vector, and as part of the National System (below), AQIS has recently implemented a biofouling management protocol for small international vessels (less than 25 m in length and are currently developing new biofouling management regulations that, when legislation, will apply to all vessels arriving from overseas ports. AQIS intends to extend these regulations to biofouled equipment and biofouling on any vessel imported as deck-cargo, and Seaports inspectors will have remit to inspect or regulate biofouling on arriving ships. Under the current arrangements, AQIS Seaports inspectors bring any notably-infested arrival to the attention of State or Territory agencies for potential action under local regulations.

Apart from the marine pest incursion prevention strategies operated by AQIS for international arrivals, the Coordinating Committee for Introduced Marine Pest Emergencies (CCIMPE) deals with post-border incursions. CCIMPE was established in 2000 with representatives of relevant agencies of the Commonwealth, State and Territory Governments, and is the national body for determining whether or not an incursion from an introduced marine pest represents a marine pest emergency in a national context. CCIMPE has considered six requests for invasion response assistance since 2001. As part of CCIMPE's preparedness and to assist with its decision making process, the criteria established to help it determine what triggers a 'marine pest alert' are:

1) Demonstrable invasive history; or

Demonstrable impact in native or invaded ranges on:

- Economy
- Environment
- Human Health or
- Amenity; or

Inferred as likely to have major impacts in Australia based on the available data and characteristics of Australian environments and marine communities; and

One or more relevant translocation vectors must be operating.

These criteria, together with CSIRO Priority Pest Reports, have formed the basis of CCIMPE's revised 'Trigger List' (**Appendix B**) that contains invasive marine species of concern which, if found in Australia, require CCIMPE's consideration and decision-taking on eradication feasibility.

2.3 Development of the National System

The need for a more coordinated *National System for the Prevention and Management of Marine Pest Incursions* (the National System) was highlighted by the discovery and eradication of the black-striped mussel in Darwin in 1999.

The IMSP has therefore been coordinating the development of the National System, with the key stakeholders involved through the National Introduced Marine Pests Coordination Group (NIMPCG). NIMPCG comprises representatives from all State and Northern Territory governments, plus relevant Australian Government agencies, marine industry stakeholders, researchers and conservation groups.

The present statutory framework and funding arrangements of the National System is based on an Intergovernmental Agreement *(IGA) on a National System for the Prevention and Management of Marine Pest Incursions* (IGA 2005) and there are three major components:

1) Prevention systems to reduce the risk of introduction and translocation of marine pests (including sector-specific management arrangements for biofouling and ballast water).
2) A coordinated emergency response mechanism for new incursions and translocations (currently the responsibility of CCIMPE under an interim arrangement).
3) Control and management of marine pests already established in Australian waters.

The National System will establish a range of coordinated measures to prevent, manage and control NIMS introductions via ballast water, hull fouling and other vectors. It will also have supporting strategic components that are currently being developed, including research and development, communications, monitoring, review and evaluation. The draft *Ballast Water Exchange Methods* as developed through the National System are presented below. Although these guidelines are yet to be legislated, it is the intent of Woodside to apply these ballast water exchange methods, where possible, in addition to those legislated under the *Australian Ballast Water Management Requirements (AQIS, 2005).*

2.3.1 Draft National System Ballast Water Exchange Methods:

a. Sequential method – a process by which a ballast tank intended for the carriage of ballast water is first emptied and then refilled with replacement ballast water to achieve at least a 95 per cent volumetric exchange.

b. Flow-through method – a process by which replacement ballast water is pumped into a ballast tank intended for the carriage of ballast water, allowing water to flow through overflow or other outlet arrangements.

c. Dilution method – a process by which replacement ballast water is filled through the top of the ballast tank intended for the carriage of ballast water with simultaneous discharge from the bottom at the same flow rate and maintaining a constant level in the tank through out the ballast exchange operation.

Note that the 'Flow-through method' and the 'Dilution method' are considered to be pumping through methods.

Ballast Water Exchange Methods

For ships exchanging ballast water by the pumping-through method, pumping through three times the volume of each ballast water tank shall be considered to meet the Ballast Water Exchange Standard described above. Pumping through less than three times the volume may be accepted; subject to approval by the relevant jurisdiction, provided the ship can demonstrate that at least 95 per cent volumetric exchange is met, in accordance with the *Ballast Water Exchange Method* approval procedure.

Ballast Water Exchange Areas/Locations

A ship conducting ballast water exchange shall exchange to the Ballast Water Exchange Standard:

a. at least 200 nm from the nearest land and in water at least 200 metres in depth; or

b. if the ship was unable to conduct ballast water exchange in accordance with the paragraph (a) above, as far from the nearest land as possible and in all cases at least 50 nautical miles from the nearest land and in water at least 200 metres in depth; or

c. if the exchange could not occur in accordance with paragraphs (a) or (b) because the distance from the nearest land or the depth of the sea area does not meet the parameters described in a. and b. above - within a *designated area as defined in the Regulations.

Ships are not required to deviate from their intended voyage, or delay their voyage in order to complete an exchange in accordance with points a. and b. above. A ship that cannot exchange in accordance with points a. and b. above will be required to conduct exchange in a *designated area. *Designated areas will be designed to provide the largest opportunity for ships to exchange en route taking into account environmental and economic factors.

*Given that the proposed National System's *Ballast Water Exchange Standard* is yet to be regulated and thus the proposed 'designated areas' are yet to be defined (under the proposed regulations), WEL will ensure that:

- if the exchange could not occur in accordance with paragraphs (a) or (b) of *Ballast Water Exchange Areas/ Locations*, then all vessels will comply with the *Australian Ballast Water Management Requirements* (AQIS, 2005)

2.4 Western Australian Department of Fisheries (DoF)

DoF is the lead State agency responsible for developing and implementing the necessary management arrangements and biosecurity control activities to, where possible, restrict the introduction and translocation of NIMS in the aquatic environment (Government of WA, 2007). Inspection of Australian and foreign-registered vessels may be carried out by DoF Inspectors in the State's Internal Waters, Coastal (3 nautical mile) Waters and also in Australian Territorial waters under the provisions of the *Fish Resources Management Act 1994* (WA), *Pearling Act 1990* (WA) and *Fisheries Act 1952* (Cwth), the latter for purposes prescribed under Commonwealth-State Government arrangements. The State Acts provide for regulations governing quarantine control and the protection and management of fish habitat reserves, aquaculture, pearling, commercial fishing and recreational fishing. In particular, Regulation 176 of the *Fish Resources Management Act 1994* contains the following directives pertaining to NIMS:

1) A person must not bring into the State, or a particular area of the State, a live fish of a species not endemic to the State, or that area of the State, other than in accordance with:
   a) *the written approval of the Executive Director;*
   b) *the written authority of the Executive Director under subregulation (2); or*
   c) *an aquaculture licence.*

Under Regulation 176, a 'fish' means an aquatic organism of any species (whether alive or dead) and includes:

a) *the eggs, spat, spawn, seeds, spores, fry, larva or other source of reproduction or offspring of an aquatic organism; and*

b) *a part only of an aquatic organism (including the shell or tail), but does not include aquatic mammals, aquatic reptiles, aquatic birds, amphibians or (except in relation to Part 3 and Division 1 of Part 11) pearl oysters.*

WA's present management and response mechanisms pertaining to the prevention and management of marine pest incursions are provided by:

- State Ministerial conditions for specific projects, as set under the provisions of the *Environment Protection Act 1986* (WA), and pertaining to the management of particular activities on the basis of advice from the DoF with respect to activities posing a marine pest introduction or spread threat;
- The EP/EMP approval/management process for offshore petroleum activities, as administered by the State's Department of Industry and Resources (DoIR).

2.5 WA Public Ports

The *Ports Authorities Act 1999 (WA)* and its associated *Port Authorities Regulations 2001* (www.slp.wa.gov.au/statutes/regs.nsf/AllinOne) empower the Harbour Masters of WA's Public Ports to control all vessels and maintenance activities that occur inside the Port Limits with respect to navigational safety and environmental protection, including hull cleaning activities and NIMS risks. 'Port Limits' are the defined boundaries of a port within which a Port Authority may exercise its powers, functions and duties.

Salient powers of WA public port Harbour Masters (including Broome, Derby, Port Hedland, Dampier) include the ability to order the departure (or deny entry) of a vessel that threatens the environmental integrity of a port. This mechanism may be used in response to a vessel which poses a serious marine pest incursion threat identified by Fisheries WA, as well as for leaking oil or other marine pollution risk.

2.6 Port of Darwin and Northern Territory waters

In the case of the Port of Darwin, its Port Limits are defined by the Regulations of the *Marine Act 1981 (NT)*. This port is a major node for cargo, commercial fishing and petroleum industry vessels, and is managed by the Darwin Port Corporation (DPC) under the provisions of the *Darwin Port Corporation Act 2001* (NT). Ever since Darwin's black-striped mussel invasion incident (1998-1999), the NT Department of Primary Industry, Fisheries and Mines (DPIFM) has operated a hull inspection protocol for vessels wishing to enter one of Darwin's four lock-accessed marinas. The current protocol requires any foreign fishing vessel or yacht arriving from an overseas port or the Port of Cairns to have its hull inspected by diver and its internal seawater systems treated. Exceptions include vessels which have been recently anti-fouled within Australia and have subsequently not entered international waters, or vessels which have been out of the water for at least two months. Paperwork needs to be sighted to confirm when the vessel was anti-fouled in Australia or hauled out for the hard-stand period. Hull inspections are not required if vessels can demonstrate evidence of recent (<6 months) application of a fouling control coating (FCC).

Because the open harbour at Darwin is less susceptible to marine pest establishment than the artificial marina environments, plus the logistical difficulties associated with enforcing a protocol for vessels visiting the open Harbour only, vessels not intending to enter any of the marinas do not have to undergo inspections or treatment.

2.7 Port Baseline Surveys

Unlike public ports and privately-operated bulk terminals such as Fremantle, Geraldton, Useless Loop (Shark Bay), Barrow Island, Cape Lambert (Port Walcott), Port Hedland and Darwin, the Ports of Broome, Derby and Dampier have not received a baseline port survey to determine what NIMS with known or suspected invasive pest credentials may be present.

3 Introduced Marine Species of Concern

3.1 Background

Non-indigenous marine species (NIMS) are organisms that have been introduced into a region beyond their natural range and have survived. If the survivors manage to reproduce and establish a founder population in a port or other location beyond their native range, the ability of this population to subsequently spread by natural and/or human-mediated means (e.g. by 'port hopping' translocations) poses a risk to ecological and socio-economic values as it is difficult, and often impossible, to eradicate an introduction after it has developed a viable local population that has started to spread.

Recent estimates indicate that some 200 introduced marine species have been recorded in Australian waters, plus a further ~100 cryptogenic species (e.g. Hewitt, in Taylor and Rigby, 2002). Introduction and subsequent translocation (secondary spread) of known or suspected marine pests (i.e. invasive species with competitive abilities and noxious traits capable of causing harm) pose a significant threat to Australia's coastal ecosystems and their resources (commercial and recreational fisheries, pearling, oyster and mussel mariculture etc), as well as to the maritime industries (e.g. by nuisance fouling) and public health (e.g. by 'red tide' toxic dinoflagellates).

Reducing the risk of entry and/or spread of potentially invasive species therefore represents by far the most effective and cost-efficient means of avoiding these threats, and the proactive tasks carried out to achieve this goal represent the primary and most beneficial element in the hierarchy of marine pest management activities. Introduction of known or suspected marine pests by a vessel or piece of immersible equipment requires three steps (refer Section 8 for description of terminology):

- Vessel or equipment infection at an infection 'source', such as port, harbour or coastal water area where unwanted invasive species are present and reproducing (including both native and non-native taxa, such as populations of the native Asian green mussel and the non-native (Caribbean) black-striped mussel that are present in Singapore and other hub ports in southern Asia).
- Survival of the unwanted biota during their transfer to a site located beyond their present range but with water temperatures, salinities and habitat/s that are sufficiently environmentally 'matched' to permit their survival, growth and reproduction.
- Vessel activities or equipment deployments enabling a successful inoculation by the surviving members of the transferred biota.

Whether or not the introduced organisms and their propagules manage to establish a viable, long-term population at the new site depends on many factors, each with levels of uncertainty that cannot be modelled or quantitatively predicted with useful levels of certainty owing to the gaps in the present level of knowledge and understanding of the marine bioinvasion process and its stochastic nature.

Thus the present practical 'endpoint' of marine pest risk assessments is widely accepted as determining, by qualitative or semi-quantitative procedures, the likelihood that the particular activity of interest may cause the introduction (from overseas) or translocation (from a domestic port) of known or suspected invasive marine pests into a receiving environment that is capable of permitting their survival, reproduction and establishment (Hayes & Hewitt 1998, 2000, Hewitt & Hayes 2002, Raaymakers & Hilliard 2002, Clarke *et al* 2003, Hilliard 2005).

The most common vectors of NIMS introductions have been shipping (hull fouling and ballast water) and aquaculture (e.g. Carlton, 2001; Taylor and Rigby, 2002; Kinloch *et al*., 2003; URS, 2006a, 2007a). In the case of offshore marine surveys such as the Maxima 3D MSS, the key vectors requiring management attention comprise:

- Potential discharge of un-exchanged ballast or trim water taken up at an infected source.
- Origin and extent of biofouling on vessel hulls and their external niches, such as the anode or impressed current (IC) blocks, propulsion units, steering gear and thruster tunnels), which in turn depends on the extent, age and status of the fouling control coatings.
- Origin and amount of potential biofouling of vessel internal niches and compartments (including sea chests and strainers, seawater pipework, anchor cable lockers and bilge spaces).
- Origin and amount of potential biofouling on deck-mounted tenders and immersible survey equipment, such as previously used mooring gear, survey sampling equipment and the various streamers, cables, floats, vanes, airguns and hydrophones deployed by the seismic survey vessel.

To help assess and effectively manage these vectors for the Maxima 3D MSS, it is therefore necessary to identify the present type, distribution and characteristics of the species that are capable of establishing at Scott Reef, Broome or Darwin via vessels mobilising to Scott Reef from overseas ports or from port bases in Western Australia or the Northern Territory (see **Section 4.1**).

3.2 Present Marine Pest Status of Scott Reef and Regional Ports

3.2.1 Scott Reef

An initial survey for NIMS colonising the intertidal and shallow subtidal zones of Scott Reef and nearby Seringapatam Reef was undertaken in February 2006 by URS in conjunction with workers from Murdoch University and the Western Australian Museum (URS 2006b). This study also reviewed the potential NIMS vectors which comprise Indonesian fishing vessels, RAN vessels, patrol boats operated by Australian Customs, research vessels, charter boats and marine debris. The survey did not find any NIMS or cryptogenic species, and attributed this to the relative lack of substrates and water conditions that are amenable to the types of known and suspected marine pests that colonise ports and coastlines in the region (URS, 2006b).

3.2.2 Ports and Supply Bases used by Potentially Contracted Vessels

Reducing the potential risk of vessel-mediated introductions of unwanted invasive marine species to Scott Reef requires identifying the main nodes where vessels likely to be used for the Maxima 3D MSS surveys spend their time spent stationary and in close proximity to infected natural or artificial substrates (including other vessels), as these periods provide the most opportune instances for vessel infection via biofouling and uptake of propagules into trim water and ballast tanks. The following list shows that the port and supply bases of vessels most likely to be contracted to the Maxima 3D MSS survey are located in Western Australia, Northern Territory, Singapore, Batam Island (Indonesia) and Batangas (Philippines).

Western Australia

Dampier: the major petroleum industry supply base for the North West Shelf region.

Broome: a growing supply base for the Browse basin, with some dedicated facilities.

Fremantle: a strategic fabrication and maintenance base, particularly yards in Cockburn Sound.

Geraldton: a minor base and home port for charter and small offshore support vessels (OSVs)

Onslow: a minor logistics base for small OSVs, with no active supply base facilities.

Exmouth: a minor logistics and small vessel base with no dedicated supply base facilities.

Northern Territory

Darwin: a major supply base for the Bonaparte-Browse basins and Timor Sea Joint Area.

Overseas

Singapore: the largest regional hub for petroleum industry vessel dry-docking, work-overs and maintenance.

Batam Island: a major Indonesian logistics base for barges and other vessels used by the industry.

Batangas, Luzon: important supply bases for the Philippines offshore petroleum industry.

In the case of the Western Australian ports, none of the central west coast and north-west ports which have been subjected to a baseline NIMS survey were found to support populations of recognised invasive species of concern that could survive in tropical reefal waters, as based on the evidence collected by the surveys at Fremantle (CSIRO 1998), Geraldton (2003), Useless Loop in Shark Bay (Wyatt *et al.* 2003), Barrow Island (Wells *et al.*2005), the Dampier Archipelago (Jones 2001), Port Walcott at Cape Lambert (URS 2007b) and Port Hedland (CSIRO 1999, URS 2005). Review of these survey reports shows that existing NIMS that could be capable of colonising the present natural and artificial substrates at Scott Reef (i.e. including the wrecks and moorings) comprise some of the cosmopolitan barnacles such as *Megabalanus tinntinabulum*, *Balanus reticulatus*, *Balanus cirratus* and *Balanus amphitrite* (none of which are identified marine pests of concern).

However baseline surveys have not yet been conducted at Broome, Exmouth, Onslow or the various Dampier terminals and supply bases at King Bay, and some previous marine pest quarantine strategies in these ports have exercised caution with respect to the presence of unwanted invasive species with marine pest credentials (see e.g. URS, 2007a). In the case of Broome, there have been several instances where fishing vessels towed into this port following apprehension have been found to be infected with marine pests (e.g. the Caribbean black-striped mussel *Mytilopsis sallei* and the Asian green mussel *Perna viridis*, such as the *Hino* incident in late 2002).

In the case of Darwin, settlement plate monitoring regularly undertaken since its last set of baseline surveys in 1998–1999 (Barry and Hewitt 2003) indicates this port has remained free of the Caribbean *Mytilopsis sallei* and Asian green mussels (*Perna viridis*) infection despite the interception of Indonesian fishing vessels with these species present on their hulls. Following the discovery of the Caribbean fouling tube worm *Hydroides sanctaecrucis* in Cairns in 2001 (Neil *et al.* 2006, Lewis *et al.* 2006a), re-examination of *Hydroides* specimens collected in Darwin in 1998 indicates this species may also be present in this port, although evidence that Darwin has been subject to a massive port-wide infection on the scale of that recorded in Trinity Inlet (Cairns) remains weak. In the context of fouling tube worms, it is worth noting that no *Hydroides* spp. specimens were found at Scott Reef during an intertidal and shallow water survey for NIMS in February 2006 (URS 2006a). Apart from the tropical *H. sanctaecrucis*, the *Hydroides* and *Ficopomatus* genera contains other cosmopolitan serpulid tube worms which cause nuisance small boat fouling in many ports of the world, including in relatively warm-water regions (e.g. *H. elegans*, *H. ezoensis*, *H. diramphus* and *F. enigmaticus*; Lewis *et al.*, 2006a).

3.3 Species of Concern

As recently described in URS (2007a), several marine pest 'target', 'trigger', 'next pest' and 'national monitoring' lists have been developed during the evolution of Commonwealth and State policies on marine pest surveillance, port surveys and emergency response strategies, including for decision-taking guidelines and port monitoring for the *National System for the Prevention and Management of Marine Pest Incursions* (the National System) that is being implemented under the 2005 Inter-Governmental Agreement (IGA). Current relevant lists are:

- Two CSIRO Marine Research lists developed from publications by Hayes *et al.* (2002) and Hayes & Sliwa (2003):
    i. Priority target species list: a 'domestic' list of 53 species considered present in one or more of Australia's 60 Interim Marine Coastal and Regional Area (IMCRA) bioregions.
    ii. Next pest list: an 'international' list of 37 known or suspected species not yet recorded in Australian waters (Hayes *et al.* 2005).
- The revised (2006) CCIMPE 'trigger list' (shown in Appendix B). This list is presently being used by the lead Commonwealth, State and Territory agencies with legislative responsibilities for marine pests to help establish the operational guidelines and protocols of the new National System. It is based on the above 'priority target' species and 'next pest' lists plus further literature searches. It lists species of concern which, when reported in Australia, trigger CCIMPE's consideration of appropriate response actions (see **Section 2**).
- The draft (2006) 'National Monitoring Target Species list': this is a review list drafted by NIMPCG for future port surveys that are to be conducted under the new National System It includes the key species of concern from the CCIMPE list and is also shown in Appendix B.

Species in the draft National Monitoring Target list (Appendix B), plus those noted in the recent review of marine pest biofouling species likely to be transferred by the activities of the offshore petroleum industry (URS 2007a), were examined with respect to:

- Their ability to survive and reproduce at Scott Reef and the Ports of Broome and Darwin (i.e. the two ports planned to be used as the survey's principal mobilising points and supply bases). This included reference to the summary of species thermal and salinity tolerance data collated by O'Loughlin *et al.* (2006; as shown in Appendix C of URS 2007a).
- Non-native species recorded by previous NIMS surveys at Scott Reef, Ashmore Reef and at the ports of Fremantle, Geraldton, Useless Loop, Port Hedland, Dampier and Darwin, i.e. the probable home bases of domestic vessels likely to be contracted to the Maxima survey (the types and operational characteristics of these vessels are reviewed in **Section 4**).

The short-list of known or suspected marine pests which could be present on vessels and equipment engaged for the Maxima 3D MSS survey (**Table 3-1**) was initially compiled by:

- removing species shown in **Appendix B** that have very limited potential to survive or establish in shallow tropical habitats,
- adding other tropical species with known or potential nuisance biofouling ability, as listed in Russel *et al.* (2003), Neil *et al.* (2006) and/or URS (2007a).
- following URS (2007a) by removing some of the most cosmopolitan species in **Appendix B** that are already widely-established in Australian ports (i.e. some barnacles, hydroids, bryozoans and ascidians, most also having poor or at best moderate matches with tropical port and reef habitats).

To finalise the short-list of species of concern for the Maxima 3D MSS, the following characteristics were also checked for each entrant:

- Ability to be entrained in trim or ballast tanks then transferred via discharges made at Scott Reef and/or the Maxima survey's main mobilising and supply base ports (Darwin, Broome).
- Sessile, crawling and swimming species that may respectively settle or nestle on vessel hull surfaces and niches (including strainer boxes and pipework of internal seawater systems).
- Ability to become entrained on immersible gear via biofouling, entanglement or entrapment (including entrapment in sediment accumulations on unwashed anchoring gear and uncleaned equipment).
- Reported distribution, temperature and salinity tolerance ranges that would enable their transfer, inoculation and survival at tropical reef and coastal habitats via vessels contracted and/or mobilising from:
    a) Singapore or other nearby hub ports such as Batam Island.
    b) ports on the central west coast of Western Australia (i.e. Fremantle to Shark Bay).
    c) hub ports in northern Australia (i.e. Dampier, Darwin and Cairns).

This exercise produced a list of known and/or suspected species of concern to the Maxima 3D MSS survey, and these are shown in **Table 3-1** by taxonomic group. These species have been identified as having either a medium of high risk with respect to their probability of introduction and ability to survive if they were introduced to Scott Reef. This assessment is based on the level of environmental match. Species not included on this list are considered to have a low probability of success establishment at Scott Reef and are consequently not considered a species of concern for the Maxima 3D MSS survey. It is acknowledged that this list may change as further information is gathered over time.

Table 3-1 Species of concern relevant to the Maxima 3D MSS survey*

Mode#	Common name	Species name	Environmental match	Marine pest status
Planktonic algae				
w	Toxic dinoflagellate	*Alexandrium monilatum*	Moderate$^{TR/NR}$	3
w	Toxic dinoflagellate	*Gymnodinium catenatum*	Poor$^{TR/NR}$	3^{D}
Red seaweeds				
s	Red alga	*Bonnemaisonia hamifera*	Moderate^{TR}	3
s	Red alga	*Grateloupia turuturu*	High	2
b	Red alga	*Womersleyella setacea*	High	2
Coelenterates				
f	Fouling hydroid	*Antenalla secundria*	Moderate^{TR}	1
s	West Atlantic snowflake coral	*Carijoa riisei*	High	2^{+}
Polychaete tube worms				
f	Caribbean tube worm	*Hydroides sanctaecrucis*	Moderate^{SR}	2
f	Other serpulid tube worms	*Hydroides elegans, H. dianthus*	Moderate^{TR}	2
Barnacles				
f	Caribbean star barnacle	*Chthamalus proteus*	High	2^{+}
f	Ship's barnacle	*Balanus amphitrite* (subsp.)	Moderate^{TR}	1
f	Reticulate barnacle	*Amphibalanus reticulatus*	High	1
f	Javanese giant barnacle	*Australomegabalanus krakatauensis*	High	1^{P}
f	Pink barnacle	*Megabalanus rosa*	High	1
f	Giant barnacle	*Megabalanus tintinnabulum*	High	1
f	Titan barnacle	*Megabalanus coccopoma*	High	2^{+}
Decapod crustaceans				
s	Pacific shore crab	*Hemigrapsus takanoi (H.penicillatus)*	Moderate^{TR}	3
Bivalve molluscs				
b+w	Asian bag mussel	*Musculista senhousia*	Moderate^{SR}	3^{D}
f+w	Bengal mussel	*Brachidontes striatulus*	Moderate^{SR}	2^{+}
f	Caribbean black-striped mussel	*Mytilopsis sallei*	Moderate^{SR}	3
f	Asian green mussel	*Perna viridis*	Moderate^{SR}	3
Gastropod molluscs				
f	Caribbean thaid whelks	*Thais rustica* *Stramonita haemostoma floridana*	High	2^{+}
s	Atlantic false limpet	*Siphonaria pectinata*	Moderate^{TR}	3
Sea squirts				
f	Fouling colonial sea squirt	*Didemnum* spp.	Moderate^{TR}	3

* modified from URS (2007a). Salinity^{SR}, temperature^{TR} and/or nutrient^{NR} range preference causes non-High match.

s = entrainment, entrapment, or benthos entanglement by direct contact anchor gear, spud cans, legs, equipment, etc.

f = direct settlement fouling ; b = both fouling modes; w = trim or ballast water vector. P = already present in region.

1 = low; 2 = moderate; 3 = high. D = domestic pest with unusual distribution (see main text).

\+ = listed as a known or suspected marine pest in reports other than those in Appendix B (refer main text).

\# = common mode of infection determined by life cycle, habitat preference, reported modes of infection and frequency of reported type occurrences on hull and port substrates (from URS 2007a,c).

Seven of the warmer water species in **Table 3-1** (*Carijoa riisei*, *Chthamalus proteus*, *Megabalanus coccopoma*, *Australomegabalanus krakatauensis*, *Brachidontes striatulus*, *Stramonita haemostoma floridana* and *Thais rustica*) are not in the revised CCIMPE or draft National Monitoring lists (Appendix B) but have been considered potential pests and/or nuisance foulers by other workers. Cases for their inclusion with respect to the origin and movements of non-trading vessels in Australia's tropical north are in Russel *et al.* (2003), Neil *et al.* (2006) and URS (2007a,c).

In the case of the Western Atlantic orange soft coral (*Carijoa riisei*; also called snow coral) this has a native distribution that encompasses petroleum exploration and development areas from east of Florida to Brazil, and is now regarded as an invasive marine pest in Hawaii (Kahng 2004). Similarly, the Caribbean star barnacle *Chthamalus proteus* has achieved high densities in the high intertidal zone of rock and artificial shorelines in Hawaii. This barnacle is a rapid coloniser of both artificial and natural hard substrates and has an invasive distribution that includes harbours, marinas and rocky shorelines in the eastern, central and west Pacific (URS 2007a,c).

In the case of the giant barnacles such as *Megabalanus coccopoma* and *Australomegabalanus krakatauensis*, the former is native to the western American seaboard from Mexico to Ecuador but has been on the Brazilian coast for several decades, and has now recently invaded the Caribbean, Gulf of Mexico and Western Atlantic, where it is considered a nuisance fouler in Brazilian ports both north and south of Rio de Janeiro (URS 2007a,c). Recent genetic work indicates it may already be present in some Australian ports (URS 2007a). In the case of *A. krakatauensis* this barnacle was believed to be restricted to the Indo-Malay archipelago but it was found at Ashmore Reef in 2002, a first record for northern Australia, and it has since been identified from a few other north-west Australian sites (WAM data, cited in URS 2007a).

The Bengal mussel *Brachidontes striatulus* has recently been discovered along creeks in Singapore where, together with *Mytilopsis sallei*, it is regarded as a potentially highly invasive marine pest (Morton 1996, Morton & Tan 2006, Tan & Morton 2006, as cited in URS 2007a). As with other ports in South-East and South Asia, Singapore hosts three significant mussel pests (*Mytilopsis*, *Perna*, *Musculista*) as well as the recently-reported *B. strialatulus*.

In the case of the Caribbean black-striped mussel (*Mytilopsis sallei*) this species has proliferated in mostly disturbed or semi-artificial harbour habitats and polluted creeks in and near docks and shipyards in Singapore, Malaysia, Hong Kong, The Philippines (Manila), Indonesia (Jakarta), India (Mumbai and Vizakhapatnam), apart from its incursion into Darwin's marinas in 1998 (e.g. Bax *et al.* 2001; Russel *et al.* 2003; URS 2007a,c).

In the case of the Asian green mussel (*Perna viridis*), this is a priority target species that is present in India, Malaysia, Singapore, Indonesia, the Philippines, southern China (including Hong Kong), Micronesia, southern Japan, Papua New Guinea and French Polynesia, plus a recent temporary incursion in the Port of Cairns (Neil *et al.* 2005, Stafford *et al.* 2007, URS 2007a,c).

Apart from the 2001-2004 Cairns incursion, the Asian green mussel has been intercepted on several occasions on the hulls of various vessels entering Darwin from Vietnam (1991) and Indonesia (1999-present) and entering Broome, the latter on the hull of the *Hino* following its apprehension and sea tow in December 2002. More recently this species was also intercepted on the dredge *Volvox Asia* when entering Dampier (SKM 2006, URS 2006c, 2007a).

4 Maxima 3D Seismic Survey

4.1 Introduction

The Maxima 3D MSS is designed to provide a three dimensional image of the subsurface features under and adjacent to Scott Reef, a reef atoll located 430 kilometres north of Broome. The survey is planned to commence in mid September, 2007 and continue for a period of approximately 50 days. The principal mobilisation ports and supply bases for this survey are planned to be Darwin and Broome.

The Maxima survey will be conducted by a purpose built seismic vessel (M/V *Veritas Voyager*) towing a pair of acoustic airgun arrays and four streamers supporting the acoustic receivers (hydrophones) , each of which will be up to 5 kilometres (approximately) in length. This gear will be towed along sets of parallel linear transects at speeds of four to five knots. The *M/V Veritas Voyager* will operate closely with one support vessel (*OMS Voyager*) and two chase vessels, the *Empress* and *Pacific Crest*.

A Monitoring Program to verify the predicted impacts of acoustic sound on fish will operate in conjunction with the Maxima 3D MSS and will involve two charter vessels (*Kimberley Quest 1* and *Sea Sprint*), one diving support vessel (*Mary V*), and one high-speed crew transfer vessel (*First Class*).

Only the *M/V Veritas Voyager* and the seismic acquisition gear (airgun arrays and streamers) are planned to be mobilised from overseas (Singapore). All the other vessels and their immersible monitoring and sampling equipment will be mobilised from home ports in Western Australia and the Northern Territory (Darwin).

To minimise the risk of introducing NIMS, all vessels and immersible equipment associated with the Maxima 3D MSS will be assessed using the Risk Assessment Scoring Procedure described in **Section 5**. The risk assessment will determine, for each vessel and its equipment, the level of risk it poses with respect to potentially introducing to Broome, Darwin or Scott Reef, the species of concern identified in **Section 3** (**Table 3-1**). The potential for translocating species of concern from Broome or Darwin to Scott Reef is addressed below, in **Section 4.4**.

The level of risk (high, medium, low) will, in turn, determine the actions that will be required to be taken so as to mitigate and reduce the apparent risk to an acceptably low level. These actions are described in **Section 6**. Reporting requirements, including the risk assessment outcomes, inspection reports and associated mitigating actions, are also described and summarised in **Sections 5** and **6** respectively.

Vessel details including vessel specifications, previous history and antifouling details are presented in **Table 4-1**. Please note that not all of the vessel details were available at the time of writing the NIMSMP (as outlined in **Table 4-1**) and those details will be presented to DoF when available but prior to the deployment of those specific vessel to Scott Reef. Please note that it is the intention of the NIMSMP to provide, to DoF, a completed Risk Assessment Score Sheet, completed Vessel Inspection Checklist (if required), description of associated activities and other supporting documentation (ie. Antifouling certification) for every vessel and immersible equipment at least two business days prior to vessel (or immersible equipment) deployment to Scott Reef. At this time, complete vessel information including vessel description, recent history (location and activities) and antifouling maintenance will also be provided to DoF.

The following sections address the inherent biofouling and trim water risks posed by the various types of vessel planned to be used by the survey (**Section 4.2**), then summarise relevant aspects of the ports and home bases from which they will be contracted or mobilised (**Section 4.4**).

4.2 Appraisal of the Vessel Types Planned for Survey

The details of vessels planned to be used for the Maxima 3D MSS have been summarised in the **Table 4-1**. Relevant characteristics of these planned vessel types and other vessel types that may potentially be utilised for the Maxima 3D MSS are summarised in the following subsections. A summary table (**Table 4-2**) of typical Australian petroleum industry vessel types and their relative biofouling propensity has been included in this section to provide a context of the relative biofouling propensity for those vessels proposed for the Maxima 3D MSS.

4.2.1 Seismic Survey Vessels (SSV)

Seismic vessels are relatively large and mostly purpose-built vessels that are designed and equipped to undertake seismic surveys for identifying and delineating petroleum reservoirs. Vessels equipped for 3D surveys operate airgun arrays that are towed up to 150 m behind the stern, plus a set of long cables (3 000–6 000 m) fitted with multiple acoustic receivers (hydrophones) at set intervals along each cable. With the support of floats and vanes, the set of cables (typically 4–6 but sometimes 8–10 depending on survey location, required resolution and ship capability) are also streamed out in parallel from both the stern and aft sides of the vessel.

Seismic vessels are considered a low risk for NIMS introductions

Table 4-1 Specifications of vessels planned to be contracted for the Maxima 3D MSS

Vessel	V/G Veritas Voyager	OMS Voyager	Empress	First Class
Type	Seismic Survey Vessel (SSV)	Offshore Support Vessel (OSV)	Utility Support Vessel	Crew Transfer Vessel (CTV)
Built	2005	1974	1999	1996
Hull	Steel	Steel	Aluminium	Aluminium
Registered or Home Port	Singapore	Cainrs	Geraldton	Geraldton
Port of Mobilisation	Singapore	Darwin	Geraldton / Broome	Geraldton / Broome
Classification / Survey	TBA	ABS +	Transport WA 3B 2B (No: 5010?)	USL 2B
Propulsion	TBA	Twin screw	Propeller x 2	Propeller x 2
Thruster/s	TBA	Bow thrusters	No	No
Dynamic Positioning	TBA	No	No	No
Length	67.8 m	54.76 m	22.25 m	23.0 m
Beam	16 m	11.58 m	6.0 m	6.0 m
Draft	5.5 m	3.62 m (light) 4.27 m (moduled)	1.8 m	1.5 m
Main Engines	2 x Caterpillar 3561B	2 x Nohab Polar FS16RS 1155 hp	2 x Caterpillar 3408C 440 hp	Caterpillar C18 x 2
Generators	2 x 1566 KW (2 x 2100 hp)	2 x 125 KVA; 1 x 90 KVA	Perkins 4TGM 80 KVA	Yammar 30 KVA x 2
POB Capacity / accommodation	TBA	13 pax	4 crew and 9 pax	9 pax
Maximum speed	TBA	12 kts	TBA	25 kts
Economic operational speed	12-13 kts	10 kts	12 kts	20 kts
Work speeds	4-6 kts	4-10 kts	0-12 kts	3 kts
Operational History since last FCC renewal	TBA	Singapore / Darwin	Geraldton	Geraldton
Number of 7-day periods spent layed up or inactive	TBA	TBA	TBA	TBA
Fouling Control Coating Brand	International Paints	TBA	International Yacht Paints	Jotun
Type	Intersmooth 360 Ecoloflex	ArmorShield SPC Av-R1800 Red / ArmorGuard ME Mid Grey	Superior Cruiser	Jotun Sea Safe
Organotin free	Yes	Yes	Yes	Yes
Date of last application	TBA	5-9 June 2007	15 August 2007	June 2007
Applied by	TBA	Armor Sheild Coating PL	Paint Quip	Shaarp Painting
Location of application	TBA	Singapore	Geraldton	Geraldton
Ballast / Trim Water Requirement	Trim Water	Trim water	No	No
Cooling Water treatment system	TBA	TBA	TBA	TBA
No. of strainer boxes	TBA	TBA	5	4

Sea Sprint	Kimberley Quest 1	Mary V	Solander	Pacific Crest
Utility Support Vessel	Utility Support Vessel	Dive Vessel	Research Vessel	Offshore Support Vessel (OSV)
TBA	1976 (Rebuilt 1992)	2007	2007 (Tenix)	2007
TBA	Aluminium	Aluminium	Aluminium	
Darwin	Broome	Fremantle	Fremantle	Melbourne
Darwin/Broome (via Maret Islands)	Broome	Dampier / Broome	TBA	Fremantle / Broome
TBA	ABS + A1 towing + AMS	2B	TBA	TBA
Propeller x 2	Twin screw fixed pitch (2 emergency	2 x Yanmar 6CXM-GYTE	Twin screw	Propeller x 2
No	Bow thrusters	No	TBA	No
No	No	No	TBA	No
21.95 m	23.98 m	19.5 m	34.9 m	30.2 m
5.5 m	8.0 m	6.5 m	8.6 m	4.3 m
1.8 m	3.65 m (light); 4.26 m (loaded)	TBA	2.8 m	3.6 m
2 x Scania V8 DSI 14-575 HP	2 x EMD 645E6 1500 bhp	TBA	TBA	2 x Mitsubishi S6R2 - MPTK3L 1040PS
240 / 415 volt 40 KVA Stamford / Perkins	2 x GMV871 / 100 KW / 125 KVA	TBA	TBA	2 x Cummins 98 KVA Gen Sets
26 pax	13 crew and 10 pax	5 man	TBA	14 pax
24 kts	TBA	20 kts	TBA	12 kts
18 kts	11 kts	16 kts (cruise speed)	TBA	10 kts
TBA	0-10 kts	TBA	TBA	
Darwin	Broome / Kimberley Coast / Rowley Shoals / Seringapatam Reef / Scott Reef	Dampier	Due for completion October 2007	Miri, Malaysia / Broome / Dampier / Broome / Fremantle
TBA	TBA	Been inactive in Broome since FCC renewal	TBA	Layed up in Fremantle for more than 14 days
International	Wattle	International Yacht Paints	Due for completion October 2007	Jotun
Intersmooth 460 SPC	Wattle HA 120	Super Cruiser - Black	TBA	Jotun Sea Force 30
Yes	Yes	Yes	TBA	Yes
To be applied 17 August 2007	January 2007	26 June 2007	TBA	15 March 2007
Broadsword Marine Contractors	North Port Boat Lifters	Batavia Spray Painting Coatings	TBA	Berjaya Dockyard
Darwin	Fremantle	Broome	TBA	Miri, Malaysia
TBA	TBA		TBA	No
TBA	TBA	TBA	TBA	
TBA	TBA	TBA	TBA	4

due to their long periods of offshore work and short and infrequent port visits. However, they can carry seawater in their trim tanks, move frequently across international boundaries, and their hulls provide some external and internal niches that can promote and retain fouling growth. Their immersible equipment such as long streamers of floats and hydrophones can also readily entrap and entangle marine organisms, most typically detached floating seaweed and associated epiphytes and amphipods (Kinloch *et al.*, 2003; URS, 2007a). However, the immersible equipment is typically held out of water for extended periods of time during movements between surveys.

The proposed Maxima 3D MSS will be undertaken by the vessel 'M/V *Veritas Voyager*'. This vessel is diesel, weighs 2943 tonnes (gross registered tonnage) and measures 67.8 metres (LOA) / 66.5 metres (LWL) in length, and has a 16 metre beam and a draft of 4.2 metre / 4.85 metre. This vessel has a crew of approximately 32 personnel with crew rotations on a 6 weekly basis (under normal operating conditions).

4.2.2 Offshore Support Vessel (OSV)

'Offshore support vessel' (OSV) is a term typically associated with the three main types of vessel that tow and tend mobile offshore drilling units (MODUs) for exploration, appraisal and development drilling programmes. Thus OSV is a generic descriptor that includes the three most common types of drilling programme support vessel, namely Platform Supply Vessels (PSVs), Anchor Handling Tugs (AHTs) and Anchor Handling Tug Supply Vessels (AHTSVs).

These are relatively large working vessels that are equipped for rescue operations, fire fighting and oil spill recovery, and they can regularly uplift seawater for trimming and minor ballasting purposes (the largest volumes typically carried by largest PSVs on their 'light' return voyages to a supply base during rough weather). OSVs operate on a 24/7 basis when tending a drilling operation or transferring cargo and waste to and from the nearest supply base, with some 5–10% of their total time spent stationary in port (Kinloch *et al.* 2003, URS 2007a). Their towing and tendering speeds are slow (2–3 knots) while their cruising speeds during supply operations are typically held around 10 knots to optimise fuel consumption / range capability. Their slow towing and voyaging speeds permit retainment of fouling growth. For all of the above reasons, OSVs as a group have been recognised as posing a relatively high risk for transferring marine pests (e.g. ranked 3rd of 23 vessel types by Kinloch *et al.*, 2003; **Table 4-2**).

In general, some but not all OSVs tend to travel long distances from job to job, and therefore may or may not serially visit and/or operate from different supply bases which are usually located inside trading ports. Depending on the specific OSV type, the hull can offer a range of external and internal niches that promote and retain fouling growth, including bow thruster tunnels, azimuth thrusters or other multiple propulsion units and steering gear, as well as moon pools, multiple sea chests, other seawater intakes and outlets, bilge keels, anode blocks and/or impressed current (IC) blocks (see URS 2007a for recent review).

The proposed Maxima 3D MSS will contract two OSV's, the *OMS Voyager* and the *Pacific Crest*, to assist during operations. The *OMS Voyager* will operate as the principal supply vessel to the *Veritas Voyager* for the period of the survey. The Pacific Crest will operate as the principal research vessel (providing accommodation and workshop) during the Monitoring Programme and and as a chase vessel (undertaking faunal observations / liaising with fishermen etc) during the seismic survey.

4.2.3 Utility Support Vessels (USVs)

Utility Support Vessels (USV) encompasses a variety of vessels. Specifically for the proposed Maxima 3D MSS, the USVs will be Charter Vessels mobilised from either a Western Australian port (Fremantle/Geraldton / Dampier / Broome) or the Port of Darwin. Charter vessels are typically small to medium vessels (< 35m in length) and vary considerably in design from small monohulls to large catamarans. This category of vessel is considered to have a medium risk for NIMS inductions due to the typically seasonal work with periods of inactivity during the off-season, and the frequent visitation to high risk areas i.e. marinas (Kinloch, *et al.*, 2003).

It is presently planned to engage three Utility Support Vessels (charter vessels), the *Sea Sprint*, *Kimberley Quest 1* and *Empress* to support operations required during the Monitoring Programme Only the *Empress* will remain at the completion of the Monitoring Programme to support the M/V *Veritas Voyager* and *OMS Voyager* as one of the two chase vessels during the seismic survey.

4.2.4 Fast Ferry / Crew Transfer Vessel (CTV)

A single fast ferry, the *First Class*, will be engaged to the Maxima 3D MSS to provide a rapid light freight and crew change service to the other vessels that will remain operating at Scott Reef. This vessel is most likely to be mobilised from Geraldton to Broome and provide a regular shuttle service between Broome and Scott Reef, with relatively short predicted in-port turn around periods (18–36 hours). This vessel is of similar design and undertakes a similar role as described for USVs and thus would pose a similar threat as that posed by USVs.

4.2.5 Diving Support Vessel (DSV)

DSVs are often contracted to offshore survey jobs as they are equipped with the diving spread, air bank compressor, decompression chamber, accommodation and the emergency medical equipment that are needed to support safe diving operations in remote locations. No deep diving (>50 m) is planned by WEL, so the DSV will not be the large type of DSV that can deploy divers to deep seafloor locations.

Currently WEL is planning to contract the *Mary V*, a newly constructed dive vessel currently based in the Port of Dampier. This vessel, although specifically designed for diving, is of a design and size typically associated with USVs and thus would pose a similar level of risk of NIMS introduction as USVs .

4.2.6 Research Vessel (RV)

As with USVs, the term 'Research Vessel' (RV) encompasses a range of vessel types, from small trailered runabouts to large ships (e.g. the 94 m *Aurora Australis*). RVs therefore vary significantly in their potential NIMS transfer risk. In the case of moderately-sized RVs such as the AIMS *Solander* (currently under construction), these are considered to pose a moderate risk of translocating NIMS given that they may often be mobilised between States and/or overseas, generally spend relatively lengthy periods (>7 days) in both home and distant ports, and operate in inshore, shallow coastal or offshore island waters. They also deploy various seabed equipment, carry trim water and may have purpose-built wells and tanks for holding live marine biota (Kinloch *et al.*, 2003). As with other large vessels, the hulls of the medium-sized RVs such as the *Solander* have various appendages and niches (e.g. multiple sea chests, bow thrusters, a moon pool, etc) that can promote biofouling, particularly if the period since last vessel slipping and fouling control coating (FCC) renewal exceeds 12 months. There are no plans to engage a RV for the Maxima survey however WEL may engage the RV *Solander* for post-Maxima faunal monitoring.

4.3 NIMS Transfer Appraisal of Vessel Types Planned for Maxima Survey

A review of all types of non-trading vessel that operate in Australian waters was undertaken by Kinlock *et al.* (2003) to assess their relative potential to transfer NIMS via biofouling and/or ballast water, as a consequence of the general characteristics of their hull, immersible equipment and operational duties. This hazard analysis ranked commercial fishing units, dredges, OSVs and barges (generic) as posing the highest relative threat of introducing NIMS (ranked 1st to 4th; see **Table 4-2**). High speed ferries and water taxis were ranked 7th overall, while charter boats and research vessels were ranked 11th and 14th out of the 23 types of non-trading vessel examined. Small vessels that are regularly stored out of water received the lowest overall risk scores (**Table 4-2**).

Table 4-2 Marine pest risk ranking scores for 23 types of non-trading vessel*

Vessel Type	Marine pest infection ranking	Marine pest translocation ranking	Overall risk ranking
Commercial fishing vessels	6	1	1
Dredges	1	18	2
Offshore support vessels	7	2	3
Barges and Lighters	2	10	4
Harbour services craft	3	14	5
Mobile drilling rigs	4	16	6
Ferries and water taxis	9	9	7
Defence vessels	16	5	8
Yachts	14	6	9
Sail training vessels	10	12	10
Charter boats	11	13	11
Cable ships	5	22	12
Cruise Ships	8	20	13
Research vessels	12	16	14
Water Police patrol vessels	17	4	15
Motor cruisers	14	21	16
Fisheries patrol boats	20	3	17
Seismic survey ships	12	22	18
Customs launches	18	10	19
Coastguard patrol boats	21	7	20
Small powered craft	19	8	21
Trailer-sailers	22	15	22
Personal water craft	23	18	23

* Reproduced from the semi-quantitative assessment of relative vessel risk by Kinloch *et al.* (2003).

A more industry-specific appraisal of the relative marine pest introduction threat posed by the different types of non-trading vessel that are regularly used (or occasionally contracted) by the Australian petroleum industry was recently undertaken by URS (2007a). This study also used a semi-quantitative approach to identify and rank, for the biofouling vector, the relative risk score of each vessel type, as compared to the risk posed by two types of trading ship (LNG carriers and general cargo ships). The risk ranking scores generated by this study are reproduced in Table 4 3 from URS (2007a), and it includes the specific vessel types planned for the Maxima survey (shaded). Table 4 3 shows that none of the vessel types planned for Maxima pose a high biofouling risk. The risk rating scores (as described above and presented in Table 4 3) were ascribed by identifying and quantifying the behaviour of the vessel types and was undertaken on behalf of DAFF IMS Panel for the Offshore Petroleum Industry biofouling hazard analysis.

4.4 Review of Vessel Home Ports, Mobilising Ports and Supply Bases

4.4.1 Port of Broome

The port of Broome is managed by the Broome Port Authority (BPA) and has been a minor but rapidly growing supply base for petroleum operations in the Browse Basin (over 35% of vessel arrivals in 2006 were associated with offshore industry activities in the Browse Basin; R. Hilliard, URS Perth, pers comm.).

Broome is the only deepwater port servicing the Kimberley region and its deepwater jetty has recently been upgraded and extended. The entrance channel and 331 m long outer berth are 13 m and 10 m deep at zero datum respectively. The two inner berths are 170 m and 96 m long with 9 m depth at zero datum. Its 9.6 m spring tidal range is the highest of any Australian port (URS 2007a).

The port handles livestock carriers, cargo ships, fuel delivery tankers and pearling, fishing and charter vessels, but in recent years has seen a marked increase in the number of cruise ships and OSV visits, the latter almost doubling to around 60 per year since 2004 (unpub. data, R. Hilliard, URS Australia Pty Ltd, pers comm.).

As a growing support base for offshore exploration activities in the Browse Basin since 1998, the BPA has been increasing its capacity to become a significant regional supply base. Installation of a dry bulk (drilling mud) storage facility in partnership with contractors and suppliers has improved OSV loading efficiencies, while the new Broome Supply Base located in the BPA's precinct is operated by Mermaid Marine in conjunction with Toll Energy. No OSVs are permanently based at Broome, but this may change when offshore activities in the Browse Basin evolve from exploration/appraisal programs into development and production (URS 2007a).

Unlike most of the other pubic trading ports in Western Australia and the other States and Territories, no baseline NIMS survey has been conducted at this port, despite the occasional use as reception port for apprehended fishing vessels that can be infected with marine pests such as the Caribbean black-striped mussel and Asian green mussel (**Section 3**).

4.4.2 Port of Darwin

The Port of Darwin lies inside a large (~1000 km^2) natural harbour and is managed by the Darwin Port Corporation (DPC). The port handles a wide range of commercial, government, fishing and recreational vessels, and in 2005-2006 handled 1295 commercial vessel arrivals (URS 2007a). The annual number of OSV visits since 2004 has ranged between 270 and 366 (DPC, in URS 2007a). Of the port's seven precincts, three cater for mostly recreational and government vessels, while the following four focus on commercial ships and working vessels:

1) The new East Arm terminal, which has hosted a MODU mobilisation visit as well as providing OSV berthing and supply facilities.
2) The Stokes Hill Wharf (East and West) multi-use berths.
3) Frances Bay marina, fisherman wharf and adjacent slipways.
4) Hudson's Creek barge landing.

Darwin has long been Australia's premier port for live cattle exports and is set to become the premier service and supply base for offshore petroleum projects in the Timor Sea. Reclaimed land adjacent to the new East Arm complex has the potential to become a dedicated supply base for the offshore industry, and some negotiations have commenced regarding expressions of interest received by the DPC (DPC 2006). In the case of Perkins Shipping which operates at Frances Bay, its existing wharf facilities include five berths that handle domestic and international cargo, break-bulk warehousing, fuel storage and reefer facilities, a slipway, marine engineering workshop and a quarantine and customs facility.

4.4.3 Port of Dampier (WA)

Dampier is one of the busiest ports in Australia, and vessel movements associated with offshore petroleum comprised ~30% of the >3,000 arrivals recorded in FY2005-2006 (R. Hilliard, URS pers comm.). Apart from four privately-operated export terminals (including WELs LNG and LPG export jetties at Withnell Bay), there are public facilities operated by the Dampier Port Authority (DPA's cargo wharf, bulk liquids jetty and a barge ramp), plus the King Bay Supply Base that is divided into OSV wharf and service areas leased to WEL's Mermaid Sound Port and Marine Services Pty Ltd and to Mermaid Marine Australia Pty Ltd (URS 2007a).

Table 4-3 Propensity of vessel types used by the Australian petroleum industry for biofouling-mediated NIMS transfer*

VESSEL TYPE	TRADING SHIP										MODU								
FEATURE	LNG	GCS	SSV	AHT/ AHTSV	USV	PSV	DSV	AV	HLS	CTV	Jack-up	Semi-sub	Drill ship	CONSTR. BARGE	LC	PIPELAY SHIP	RDS	FSO/ FPSO	DREDGE
Long distance transfers between project sites	-	-	3	3	1	2	2	2	3	2	2	2	3	3	1	3	3	-	3
Time spent in port or coastal waters	1	2	2	1	3	2	2	2	1	2	3	1	1	3	3	2	3	1	3
Promiscuity of overall movement patterns	1	2	2	2	3	1	2	3	2	2	3	2	2	3	2	3	3	1	3
Number and range of niches	1	1	2	2	1	2	2	2	2	1	3	3	2	1	2	2	3	2	3
Transit or mobilising speed	1	1	2	3	2	2	2	2	2	1	3	3	2	2	2	2	2	2	2
Working speed at project site	-	-	3	3	3	3	3	3	3	1	3	3	3	3	2	3	3	3	3
FCC presence	1	1	1	1	1	1	1	1	1	1	3	3	1	1	1	1	1	1	2
FCC wear and tear rate	1	1	1	1	2	2	2	1	1	1	-	-	1	3	3	2	2	1	3
Hull cleaning constraints#	2	2	1	2	1	2	2	2	2	1	3	3	2	2	1	2	2	3	3
Mean value	1.1	1.4	1.9	2.0	1.9	1.9	2.0	2.0	1.9	1.3	2.9	2.5	1.8	2.2	1.9	2.2	2.4	1.8	2.8

* reproduced from URS (2007a).

Table notes

Two trading ships (LNG carrier, general cargo ship) are included to provide a comparison of the relative scores. LNG carriers are one of the lowest risk types of trading vessel owing to their consistent ocean-going time-charter trade, high level of hull maintenance level, speed and the relative isolation of LNG terminals for safety needs.

The deliberately simple scoring system does not weight particular factors such as FCC presence or wear/tear:

Score value

1 = Low frequency / low value / low risk;
2 = Medium or moderate frequency / default value / moderate risk;
3 = High frequency / high value / high risk.

Where a feature for a particular vessel type is uncertain, or is known to vary project-by-project or with particular vessel design, the moderate score value (2) was used as a default.

Where a nil score occurs (-), the denominator for calculating the mean value was reduced accordingly.

#Hull cleaning constraints: this feature reflects difficulties in cleaning (and confirming cleaning adequacy), due to vessel size/hull area, amount of hard-to-reach surfaces and availability of suitable slipping locations and opportunities in Australia.

Rating of the mean values:

<2 = Low to moderate biofouling propensity;
2.0 - 2.4 = Moderate biofouling propensity (yellow);
>2.5 = High fouling propensity (orange).

Abbreviations:

LNG: Liquefied natural gas carrie
GCS: General cargo ship
SSV: Seismic survey vessel
AHT: Anchor handling tug
AHTSV: AHT-Support vessel
USV: Utility support vessel
PSV: Platform supply vessel
DSV: Diving support vessel
AV: Accommodation vessel (not barge type)
HLS: Heavy lift ship
CTV: Crew transfer vessel
MODU: Mobile drilling unit
RDS: Rock dumping ship
LC: Landing craft (island base supply)
FSO/FSOP: Floating Storage Off Loader / Floating Production Storage Off-Loader

The DPA's public facilities were developed to promote downstream processing on the Burrup Peninsula, and provide berths, water and fuel to OSVs, including a barge ramp and temporary heavy load out facility. Mermaid Marine also operates service and maintenance facilities on land leased from the DPA in King Bay, including a slipway that can handle vessels to ~2500 DWT, general purpose berths, a construction barge loading wharf, a ro-ro barge ramp, workshops and 12 ha lay-down area. This slipway has handled over 200 vessels since opening in 2001, one of the largest being *Southern Supporter* (2250 DWT; URS 2007a). WEL's supply base, which services the North West Shelf gas project, is on the north-west side of this complex, and approximately 20 OSVs are home-based at Dampier (URS 2007a).

4.4.4 Port of Geraldton

The Port of Geraldton is a State public port managed by the Geraldton Port Authority (GPA). It has a relatively large commercial fishing precinct adjacent to the inner harbour but with its own entrance to the sea. This commercial marina forms the home base for one largest regional sectors of the rock lobster fishing fleet. Geraldton is occasionally used as a supply base for drilling projects in the central west coast region, although it has no dedicated petroleum supply base facilities. However it does provide the home port for a small fleet of multi-purpose OSVs (mostly USVs and AVs) operated by Bagwan Marine.

The GPA organised a baseline NIMS survey in 2002–2003, which found no known or suspected marine pests of concern (GPA 2003), despite previous incidents involving the arrival of dredges infected with potentially invasive crustacean and mollusc species from the Caribbean (**Section 3**).

4.4.5 Port of Fremantle

As noted in URS (2007a), the 2003 opening of the Australian Marine Complex (AMC) in Jervoise Bay (Cockburn Sound), has led to some growth in the logistical support role played by Fremantle to the offshore petroleum industry. The AMC and neighbouring yards have increased the ability of the State's construction and maritime support industry to compete with interstate and overseas suppliers. Apart from the yard facilities in Cockburn Sound, the Fishing Harbour at Fremantle also provides an important strategic marina for many of the rock lobster boats, trawlers, wet-liners and other commercial fishing vessels that operate in Western Australia.

Fremantle was one of the first ports in Australia to participate in a port-wide baseline survey that targeted NIMS, under the framework of the CSIRO port survey guidelines (CSIRO 1998). This survey found the port was infected by several known and suspected marine pests of concern (including the European green crab and the Mediterranean giant fanworm). However all were temperate water species with the possible exception of the Asian Date Mussel *Musculista senhousia* (CSIRO 1998, URS 2007; see **Section 3**). However, as noted in URS (2007a), the haplotype that established in the lower Swan River estuary in previous years is not thought to be the one that colonise tropical port habitats such as in Singapore.

4.4.6 Singapore

As described in URS (2007), Singapore remains the biggest ship repair and rig building centre in the world, and is by far the largest regional hub for the offshore petroleum industry in the Asia-Pacific region. It contains a wide range of dockyard, slipways, repair and fabrication companies including those operating the Keppel, Jurong, Sembawang, PPL and SML yards.

Many of the creeks and inshore waterways around Singapore are known to be infected by several marine pests of concern, particularly the Asian green mussel, the Caribbean black-striped mussel and the Bengal mussel (see **Section 3.1**).

4.4.7 Batam Island (Indonesia)

The dockyards and fabrication facilities of this strategically important Indonesian supply base are located on the north side of Batam Island, approximately 25–35 km south of Singapore. They include fabrication yards, ship conversion and repair yards and a barge maintenance complex. The presence of the J Ray McDermott fabrication yard makes Batam Island one of the most important strategic home ports of construction barges, pipelaying vessels, AHTS and AVs, as well as a supplier of modules, pre-coated piping and other construction items and installation materials used by the offshore petroleum industry in the Asia-Pacific region.

Because of its proximity to Singapore and similarity of habitats and climate, it is widely accepted that Batam Island supports the same range of natural and introduced invasive species that have been reported by researchers that study the coastal habitats of Singapore (URS 2007a).

5 Risk Assessment Procedure Steps

5.1 Risk Factors

From a range of review studies including Russell *et al*. (2003), Kinloch *et al*. (2003), Neil *et al*. (2006) and URS (2006b, 2007a), the level of threat from unwanted marine species incursions at a particular tropical reef or port varies with:

- the type, number and risk status of the specific visiting vectors (i.e. fishing vessels, cruise yachts, patrol boats, research vessels, charter boats, non-trading commercial ships including offshore petroleum industry vessels, drift debris).
- the types, visit frequencies and visit durations of these vector pathways (i.e. their geographical source, route and the number and length of stay).
- the level of environmental similarity between the receiving environment and each potential NIMS source (particularly the temperature and salinity regimes, habitat types and tidal pattern)
- the level of biodiversity protection, conservation status and/or socio-economic values assigned to the receiving environment.
- the 'invader-friendliness' of the receiving environment's habitats and substrates, including water quality and health of the native biological communities and their keystone species.

In the case of biodiversity protection and conservation values, Scott Reef is listed under the Register of the National Estate, while South Scott Reef, including Sandy Islet, is a Class C Reserve managed by the Western Australian State Government for the purpose of conservation (EMEC 2001). The State waters component of South Scott Reef have also been recommended for reservation in a CALM report (*"A Representative Marine Reserve System for Western Australia",* Wilson, 1994).

In the case of its invader-friendliness, the present-day shallow reef and lagoon habitats at Scott Reef are arguably more prone to colonisation by non-native species than other small and remote atoll systems in the Indo-Pacific region because of the marked reduction in shallow coral cover as a result of recent of severe coral bleaching episodes (1998, 2003) followed by severe Tropical Cyclone Fay (2004). These events have produced larger than usual areas of relatively denuded shallow subtidal and lower intertidal hard substrates.

In the case of the Ports of Broome and Darwin, these are essentially modified natural harbours that offer a range of coastal reef, mangrove, rocky shoreline and tidal creek habitats similar to those in Singapore and other SE Asian ports. However there are three important differences experienced at the Australian ports. These comprise their markedly large tidal range, seasonal salinity regime, and level of isolation, as a result of the monsoonal nature of their rainfall runoff events and associated salinity pattern, their unusually large spring tide, and the number of cloudless, low humidity days experienced during their prolonged 'winter' dry period.

Large tidal ranges, together with reduced protective cloud cover and humidity levels during the extended dry season, act to expose and heat all sessile intertidal biota, and this may help to protect Broome, Darwin and other northern Australian ports from invasions of marine pests that are more suited to the equatorial conditions of SE Asian ports (e.g. Hilliard *et al.*1997, Hutchings *et al*. 2002, Hewitt 2002a,b). For example, despite the relatively long presence of reproducing populations of the Caribbean black-striped mussel in the Darwin marinas during its 1998-1999 incursion, extensive searches in and beyond Darwin harbour found no evidence of any cohort that had managed to settle or grow on substrates beyond the lock-gates, i.e. in natural habitats that experience relatively higher salinities, substantial tidal drying and relatively harsh insolation (e.g. Hilliard 1999, Hillman 1999, Bax *et al*. 2001, Hewitt 2002b).

5.2 Factors influencing NIMS Infection status of Vessels and Survey Equipment

This section describes the risk assessment methods that will be used to determine if a particular contracted vessel and/or its survey equipment may be infected by invasive species of concern when mobilised to Darwin, Broome or directly to Scott Reef (i.e. unwanted NIMS with the potential to establish at these ports and/or in the shallow reef and lagoon habitats at Scott Reef; see **Section 3**). The assessments use a transparent and relatively simple semi-quantitative scoring approach that has been developed specifically for the Maxima 3D MSS to help determine what type (if any) of mitigating hull cleaning, equipment cleaning and/or ballast or trim water exchange actions are warranted[2].

2 Adopting a more fully quantitative approach, so as to generate values of invasion likelihood within predicted levels of confidence, is constrained by current knowledge gaps with respect to invasive species distributions, infection rates and environmental tolerance data for each life cycle stage, versus the need to address a series of stochastic events that must occur for a species to achieve a potent (= potentially successful) inoculation via a particular vessel-mediated transfer. These data gaps prevent these approaches from achieving useful levels of certainty for most species of concern.

Each assessment needs to identify what level of threat the contracted vessel or its immersible equipment poses if no risk reduction management measure is carried out, and to help identify what type of measure/s will mitigate this threat to an acceptable low level.

Risk scoring procedures have recently been trialled by AQIS for assessing the biofouling risk posed by yachts and other small vessels (<25 m long) arriving from overseas ports (AQIS, 2006; URS, 2007b). These and similar scoring schemes prepared by URS for WEL (URS, 2006b) and described in a recent hazard analysis of trim water and biofouling-mediated introduction risks posed by the types of vessel used by the Australian petroleum industry (URS, 2007a), provide a practical and transparent approach to help determine and justify what precautionary actions are required if the unmanaged threat is assessed as high, moderate or low.

These schemes share the need to appraise and score the key factors that dictate the likelihood of

(i) pre-mobilising infection by the species of concern, and (ii) their ability to survive the mobilisation via the biofouling or ballast/trim water vectors. The following subsections address the proposed scoring factors for vessels (**Section 5.2.1**), and for immersible equipment, including deck-mounted tenders, airgun arrays, streamers and temporary mooring tackle (**Section 5.2.2**).

5.2.1 Risk Assessment Scoring Factors for Maxima 3D MSS Vessels

5.2.1.1 Vessel Infection

In the case of vessel infection, the following factors are scored by obtaining the movement history (e.g. copy of vessel management sheet or log book entries) since the hull was last hauled out for complete renewal of the Fouling Control Coating (FCC), including yard certificates or other documented evidence concerning the type and date of application of the fouling control coating (FCC), subsequent vessel deployment history, and the date of the last thorough cleaning or maintenance of the vessel's internal seawater pipework, anchor cables lockers, bilge space or other relevant internal niches:

- FCC age and suitability to vessel hull type, speed and activity profile:
    - FCC manufacturers provide a range of coatings, each designed to avoid premature coating failure if it is correctly applied and matched to the vessel's normal speeds and activity profile (i.e. proportion of time spent stationary or below 5 knots), and its main operational region (i.e. tropical, temperate, polar or inland waters). If the FCC details imply an inappropriate match, are not supplied, and/or indicate the coating is more than 2 years old and heavily worn, a substantial risk value [3] is added to the score (refer Appendix C).
    - the FCC aging itself factor scores a high risk [3] if the FCC is 1-2 years old, a moderate risk [2] if 6-12 months old, and a low risk [1] if 3-6 months old. The aging factor reduces to [0.5], [0.1] or [0] if the hull is respectively mobilised within 3 months, 1 month or 14 days since its launch with a renewed FCC.
- <u>Location of home port or principal supply base since last FCC renewal</u>: This factor scores as a high risk [3] if the location is tropical (i.e. north of Carnarvon or Brisbane), a moderate risk [2] if subtropical (Fremantle to Carnarvon / Sydney to Bundaberg), and a low risk [1] if temperate or cooler (south of Fremantle or Sydney).
- <u>Vessel stationary or slow speed periods since new FCC or haul-out for thorough hull cleaning</u>: This factor requires determining, from the vessel's operational history, how many 7 day periods were spent stationary or at low speed (<6 knots) in port or coastal waters (<100 m deep and/or <50 km from nearest coastline). The scoring system adds [0.5] for each 7 day stationary/slow speed period spent in a tropical port or coastal waters, [0.25] for subtropical ports or coastal waters, or [0] if they were temperate, cooler or inland (freshwater) localities.
- The '7 day' period is assumed to be the practical and reasonably cautious stationary time period for the successful colonisation of NIMS (Hilliard, URS, per comm). Practically, the assumption is based on a time period greater than the typical length of time at port for trading vessels (< 96 hrs) (otherwise all vessels would be classed as high risk). Cautiously, the assumption has been based on the deduced infection of the vessel, *Volvox Asia*, which remained stationary for a period of 17 days immediately prior to NIMS infection (Kinloch *et. al.*, 2003; URS, 2006c).

5.2.1.2 NIMS Survival during Maxima 3D MSS Vessel Mobilisation

The following factors are scored to determine the survival potential of any invasive NIMS of concern during the vessel's mobilisation to Broome, Darwin and/or directly to Scott Reef, as may be carried by the biofouling or ballast/trim water vectors.

- <u>Survival potential of fouling biota during mobilisation</u>: Survival rates on external niches or inside any wet or moist enclosed internal area (including the seawater pipework, uncleaned lockers containing wet anchor cables, a bilge space or closed moon pool interior) can remain high during mobilisation, particularly if a vessel self-mobilises to its new project without any pre-mobilisation hull inspection, either in-water or during its haul-out for hull maintenance and cleaning. If the pre-mobilisation checking and maintenance period includes inspections specifically made to determine the presence and type of biofouling, then risk reduction factors can be applied. In the case of biofouling on external hull niches, the proposed scoring system applies a risk reduction factor of [0.5] if an in-water hull inspection made in clear water with adequate visibility by a marine scientist prior to arrival at Scott reef (and 7 days of final departure to

Scott Reef, either directly or via a supply port(s)), improving to [0.3] if two such in-water inspections are made on separate occasions, or if the single inspection is made when the vessel has been hauled out of the water. This scoring approach is based on present evidence showing that a single in-water inspection can miss detection of invasive NIMS of concern, particularly if conducted in turbid water (URS 2007a,c; SKM, unpublished data).

- Survival potential in vessel internal niches: A further risk reduction is applied [0.5] if the pre-mobilising maintenance and inspections include checks of the internal niches, including the anchor cable lockers, bilge spaces and condition of the seawater system, including the strainers. In the case of the seawater system, this risk reduction factor is valid provided:
  a) The vessel has a proprietary marine growth prevention system (MGPS) that is operated and maintained according to the manufacturer / supplier instructions; AND/OR
  b) The main engine, auxiliary or other service log books show no evidence of cooling temperature difficulties or abnormal seawater pressure reduction to the deck or fire main circuits due to suspected fouling build-up, in the period since last haul out, seawater mains overhaul, strainer replacement or seawater circuit cleaning by a commercial fouling removal preparation (e.g. Ridlyme, Conquest, acidic product, etc); AND
  c) Routine strainer box inspections (recorded in Vessel Engineers Logs) since last vessel haul out have not required regular removal of accumulated dead biota (e.g. weed, hydroids, barnacle or mollusc shell), as this indicates biofouling build-up in the pipework from the sea chests or intake ports.
  d) If the above features are not satisfied, the required risk reduction measure will be destruction or removal of suspected potential live biofouling via flushing treatment/s using suitable commercial preparations, and/or replacement of any remaining blocked components.
- Survival reduction due to extended air-drying (desiccation): A final biofouling risk reduction factor can be applied for the chaser boats, tenders and other small survey vessels, if these are hauled out and then mobilised as deck cargo or by road, so becoming air dried over an extended period. If the total air exposure period during a vessel's mobilisation is ≥28 days, a risk reduction factor of [0.1] is added, reducing to [0.5] if this period is 14-27 days, and [0.7] for 7-13 day periods. No .reduction factor can be safely applied if the air exposure period is less than 7 days.
- Source of any seawater carried in any ballast or trim tank during mobilisation: For ballast or trim water that is carried onboard the vessel during mobilisation, a risk score is applied if it is intended to be discharged, and depending on its port or coastal origin. If the water is from temperate or freshwater origin, and/or is not intended to be discharged during the Maxima survey, the risk value is [0]. If a tank adjustment involving an external discharge is expected or considered likely, the risk score is [3] if the seawater carried has tropical port or coastal water origin, and [2] if it has a subtropical origin, in accordance with the risk posed by the potential presence of uplifted NIMS of concern.
- Survival of marine species of concern inside ballast or trim tanks: Biota entrained into steel tanks suffer variable mortality rates depending on their ability to tolerate darkness, declining oxygen levels, and/or produce a tough 'resting' stage (e.g. the cyst stage of toxic dinoflagellates). Risk reduction factors due to the duration of the stored period are not usually applied until the known or predicted storage period since the last uplifted seawater is clearly demonstrated to exceed 50 days. For these cases (which are unlikely owing to the operational characteristics of the contracted vessel types) it is reasonable to argue from published tank biota mortality rates that a risk reduction factor of [0.5] can be applied (Alexandrov *et al.* 2003; Hayes & Hewitt, 1998, 2000; Raaymakers & Hilliard, 2002).
- Any ballasted or trim tank seawater with a tropical or subtropical origin, a storage period of less than 50 days and is intended to be discharged at one or more points in the survey area attracts a potential risk factor of [10], requiring an appropriate management measure to avoid risk outcome scores above [20] or [30.] The most convenient and simple measures that reduce the discharge risk factor from [10] to [0] are (a) a >95% replacement of the tanks' contents with freshwater prior to mobilisation departure, or (b) a >95% deep-water exchange made *en route* that meets:
  - AQIS' ballast water management guidelines for international vessel arrivals (i.e. by the empty/refill or x3 tank volume flushing method in water depths >200 m), or
  - the same >95% volumetric exchange for vessels mobilising from domestic ports to Broome, Darwin or Scott Reef, but in offshore areas that meet the draft National Systems drat *Ballast water Exchange Standard* (refer Section 2.3.1).

The above Vessel Infection and Mobilisation Survival factors are listed in the *Vessel Risk Assessment Score Sheet* (VRASS) and will be used to score, evaluate and, where necessary, reduce the marine pest transfer risk posed by each vessel contracted for the Maxima 3DMSS. Note: The VRASS has been developed specifically for the Maxima 3D MSS and is not intended to be applicable for activities or locations outside the Maxima 3D MSS. Furthermore, the VRASS does not address terrestrial quarantine issues such as insects, weeds, rodents or kitchen waste.

5.2.2 Risk Assessment Scoring Factors for Immersible Equipment

The scoring system for the Equipment Risk Assessment Scoring Sheet (ERASS) is similar but has fewer factors than the VRASS. The ERASS is designed to assess immersible equipment used during the Maxima 3D MSS, including seismic airgun arrays and hydrophone streamers, mooring tackle, side-scan/multi-beam transducers and other acoustic units. Note: The ERASS has been developed specifically for the Maxima 3D MSS and is not intended to be applicable for activities or locations outside the Maxima 3D MSS.

5.2.2.1 Equipment Infection

In the case of equipment deployed on a seafloor mooring or mooring string for >7 day periods (e.g. wave rider buoys, hydrophones, turbidity meters, data-loggers, etc), it should be recognised that their re-use following retrieval does not occur without careful cleaning and dissembly (i.e. for data retrieval, power-pack replacement, recalibration, etc), while the mooring line and associated tackle is often completely renewed with the exception of the steel or concrete anchoring weights and buoyancy floats, if fitted. In the case of the streamer lines, vanes and floats that support the airgun arrays and hydrophones towed at slow speed by seismic survey vessels, their rate of fouling by entangled weed (and associated biota) and settlement by sessile species depends on location (rates are higher in inshore and inner shelf waters than in remote deepwater regions beyond the shelf break). However the streamed gear is not allowed to develop inordinate fouling due to the increased noisy flow and drag, causing poorer signal processing and increased fuel consumption respectively.

5.2.2.2 NIMS Survival during Equipment Mobilisation

The ability of fouling organisms to survive equipment mobilisation requires two factors, firstly the lack of cleaning or replacement of fouled parts prior to the journey, and then storage of these uncleaned, and thus potentially infected, items in a damp or moist compartment, box or container, or on a shaded open deck area regularly subjected to sea-spray wetting. In the case of the long streamer cables carried by seismic survey vessels, these are wound onto large drums so the inner layers can remain moist if journey times are short.

In summary, survey equipment items associated with the Maxima 3D MSS with any realistic potential to cause a fouling-mediated transfer of NIMS of concern may include the streamer gear of the seismic survey vessel, uncleaned 'second-hand' mooring tackle stored in damp conditions, or other item recovered from a temporary abandonment but also carried uncleaned and in a moist state. For each item of concern, the following factors should be scored using the ERASS, after (a) obtaining its deployment history since its last overhaul or thorough cleaning, and confirming (b) its maximum deployment time and (c) its post-recovery cleaning, storage and transport regime:

- Region of use since last overhaul, thorough cleaning or prolonged (>28 day) non-use: This factor scores as a high risk [3] if the location is tropical (i.e. north of Carnarvon or Brisbane), a moderate risk [2] if subtropical (Fremantle to Carnarvon / Sydney to Bundaberg), and a low risk [1] if temperate or cooler (south of Fremantle or Sydney).
- Deployment locations in the regions identified above: This infection risk score is high [3] if the locations included inshore coastal waters (<100 m deep, <50 km from coasts), moderate [2] if the sites were only in shelfal waters (100-200 m, 50-100 km from coasts), and low [1] if they were only in deeper and remote offshore areas (>200 m and >100 km200 from coasts).
- Maximum duration of deployment, since last overhaul or thorough cleaning: A risk reduction factor of [0.1] is applied if no duration exceeds 24 hr, and this value returns to neutral [1] if the maximum period of uninterrupted immersion is always less than 3 days. For immersion periods up to 7 days the risk factor increases to [2], and [3] if one or more immersion periods exceed 7 days.
- Post-retrieval cleaning/maintenance regime: The ERASS sheet applies two risk reduction factors. Firstly a reduction by [0.3] if the equipment item of interest is routinely washed, cleaned, checked and/or dissembled between project sites, and a further [0.2] if the item is packed up dry, and/or stored in dry, airy conditions, between jobs.

Application of the above equipment infection and transfer factors is shown in the *Equipment Risk Assessment Scoring Sheet* (ERASS) in Appendix C. The ERASS should be used to assess the biofouling risk posed by immersible equipment items of concern associated with the Maxima 3D MSS, and to help identify the most convenient inspection and management actions.

5.3 Vessel and Equipment Risk Reduction Management Measures

As has been noted in parts of the preceding sections, there are a number of effective risk reduction measures that can be applied during vessel or equipment pre-mobilisation and mobilisation phases that will clearly reduce the chances of infection and/or survival of unwanted biota via the biofouling or ballast/trim tank vectors.

The most effective measures comprise specific inspections for biofouling (by suitably experienced personnel for vessel hull inspections) at appropriate times and locations before, during or after any planned vessel checks, cleaning and/or maintenance needs. If the risk reduction measures are planned and their outcomes formally documented under this plan, then the results of the inspections and associated field evidence can be used to back up and justify the risk reduction scores and outcomes, as determined by the VRASS and ERASS scoring sheet system shown in Appendix C and Appendix D respectively.

6 Management and Mitigation Procedures

6.1 Maxima 3D MSS Vessel and Immersible Equipment Audit Checks and Inspections

6.1.1 Maxima 3D MSS Vessels

The risk reduction and mitigation procedures for vessels will use the following response criteria;

1) **For vessels assessed as a LOW RISK and mobilising from an Australian or overseas port:**

   Vessel information will be submitted to a WEL representative at least seven (7) days prior to vessels final departure to Scott Reef to confirm that all vessel information and supporting documents provide an accurate and reliable description of the vessel's operational history, fouling control coating and ballasting/trim water details (as used by the VRASS).

2) **For vessels assessed as a MODERATE RISK and mobilising from an Australian port:**

   One haul-out or one in-water vessel inspection shall be undertaken in accordance with **Section 6.2**, at a domestic port nominated by the vessel operator, and with this inspection occurring within seven (7) days prior to the vessel's final departure to Scott Reef, either directly or via supply port(s).

3) **For vessels assessed as a HIGH RISK and mobilising from an Australian port:**

One haul-out or two in-water vessel inspections (on separate occasions) shall be undertaken in accordance with Section 6.2, at domestic port/s nominated by the vessel operator, and with the haul-out inspection or last in-water inspection occurring within seven (7) days prior to its final departure to Scott Reef, either directly or via supply port(s).

4) **For vessels assessed as a HIGH or MODERATE RISK and mobilising from outside Australia:**

   The vessel shall either:

   a) Complete two in-water inspections in accordance with **Section 6.2**;

      - An initial inspection that must occur at the departure port nominated by the vessel operator and within seven (7) days prior to departure for Australia, and
      - The final inspection must occur within 48 hours of arrival to an Australian port nominated by the vessel operator.

   b) Undergo inspection in accordance with **Section 6.2** within seven (7) days prior to its departure for Australia at a departure port haul-out site nominated by the vessel operator.

6.1.2 Maxima 3D MSS Immersible Equipment

The risk reduction and mitigation procedures for immersible equipment will use the following response criteria:

1) **For immersible equipment assessed as a LOW RISK and mobilising from an Australian or overseas port:**

   Immersible equipment information will be submitted to a WEL representative to confirm that all immersible equipment and supporting documents provide an accurate and reliable description of the immersible equipment's operational history and fouling control coating (as used by the ERASS).

2) **For immersible equipment assessed as a HIGH or MODERATE RISK and mobilising from an Australian port:**

   An out-of-water inspection shall be undertaken in accordance with **Section 6.2**, at a domestic port or other location nominated by the immersible equipment operator, and with this inspection occurring after completion of previous operations and within seven (7) days prior to the immersible equipment's final departure to Scott Reef, either directly or via supply port(s).

3) **For immersible equipment assessed as a HIGH OR MODERATE RISK and mobilising from outside Australia:**

   The immersible equipment inspection shall be carried out in accordance with **Section 6.2** at a departure port or other site nominated by the immersible equipment operator and within seven (7) days prior to its departure for Australia.

6.2 Inspection Procedure

The NIMSMP will require an appropriately-qualified marine scientist with experience in in-water and dockyard biofouling inspections to lead all vessel and immersible equipment inspections. The inspections will specifically examine for fouling biota with a known or suspected pest component (Appendix B) and muddy sediments. Video and /or still shots will be taken of external and internal niche areas of the vessel and immersible equipment.

As outlined in **Section 3**, a list has been developed identifying the NIMS specific for the Maxima 3D MSS. These are the species that are believed to pose a potential risk of establishment on Scott Reef (if introduced). Consequently hull inspection will concentrate on these NIMS.

Vessel hull inspections will include a general inspection of the entire hull as well as inspections of the specific niches. Inspection of vessel internal niches will include:

- Status, extent and level of damage to the fouling control coating
- General inspection of deck area and associated equipment.
- Specific inspection of all deck-borne tenders.
- Bilge spaces.
- Anchor cable lockers.
- Strainers and strainer boxes.
- Chief Engineers Log (to identify any reported blockages, reduced seawater pressures or elevated cooling temperatures that imply biofouling build-up).
- At the completion of the vessel inspection, The Vessel Inspection Checklist and Inspection Form (Appendix E) must be completed, signed by the Inspection Team Leader and faxed / emailed to WEL.

  Immersible equipment to be inspected will include the vanes, floats and cable components of the seismic airgun arrays and hydrophone streamers, pre-used mooring tackle, weights, floats, and any other equipment item of concern, as identified by the ERASS. **All immersible equipment must be made ready and good in the condition to be deployed by the contractor prior to inspection**.
- At the completion of immersible equipment inspection (i.e. seismic streamers, airguns and accompanying ropes / chains), The Immersible Equipment Inspection Checklist and Inspection Form (Appendix F) must be completed, signed by the Inspection Team Leader and faxed / emailed to WEL.

  Where vessel hulls or immersible equipment cannot be adequately inspected due to a high level of fouling growth that significantly compromises the ability to identify species of concern, the vessel shall be either hauled out for inspect/ cleaning or an alternate vessel identified.

6.3 Reporting Requirements and Timing

WEL will ensure that all vessels and associated immersible equipment contracted to the Maxima 3D MSS will undergo the NIMS risk assessment as described in Section 5, prior to mobilisation. At the conclusion of the risk assessment process (including any response and reinspection actions), copies of completed assessment sheets, inspection forms and associated relevant documentation will be provided to DoF at least one (1) business days prior to the vessel of interest entering the Scott Reef survey area. The documents will include:

- A copy of the completed Risk Assessment Scoring Sheet for each vessel and immersible equipment item signed by the Lead NIMS inspector.
- Description of associated actions undertaken following the initial risk assessment.
- Copy of the completed Vessel and Equipment Inspection Checklist and Inspection Form(s)
- Description of Vessel History (post last antifouling treatment) including Ballast Water Management and Antifouling certification.

6.4 Management measures for Maxima 3D MSS Vessels or Immersible Equipment of Concern Identified during Pre-Mobilisation Inspections.

1) If sediment or biofouling containing known or suspected marine pests are detected on the hull or on any in-water equipment during the pre-mobilisation inspections, the inspection team shall:
   a) Photograph / video the unclean area(s) ensuring the organisms present are clearly seen.
   b) Collect and preserve a sample of the fouling organism to permit expert taxonomic identification to the satisfaction of DoF (Australian Waters Only).
   c) Immediately alert the Vessel Master and on-site contractor representative / coordinator as to the presence of the uncleaned area(s).
   d) Immediately contact WEL head office with summary details.
   e) Fax/email to WEL an inspection report describing the offending areas of hull or equipment that require attention and the proposed actions.
   f) Assist in providing advice on cleaning requirements and potential cleaning options (see Section 6.2.2) .
   g) Remain at the inspection area until further advice from WEL.
2) If sediment or biofouling containing known or suspected marine pests is detected during the pre-mobilisation inspection of the vessel or immersible equipment item of concern, then WEL will:
   a) Notify DoF (Senior Management Officer, BioSecurity; 0409 370 135) within 24hrs as soon as practical;
   b) With advice from DoF, implement appropriate response actions commiserate to the risk;
   c) Primary actions may include :

      Vessels located in water – vessels that have been identified with NIMS and are in water will move offshore to a water depth of not less than 200m depth until suitable management options have been identified through consultation with DoF and relevant Port Authority;

Vessels located in dry dock – vessels that have been identified with NIMS and are in dry dock will remain in dry dock until NIMS have been removed and a NIMS inspection has found no further NIMS.

Cleaning of External niches – hull or equipment item to be cleaned according to local regulatory requirements and advice from DoF, and then re-inspected as per **Section 6.2**. Material removed during hull or equipment cleaning shall not be discarded to sea, but disposed in an appropriate manner under local jurisdictional rules (e.g. licensed landfill).

Internal niches – niche to be cleaned according to local regulatory requirements and advice from DoF and then reinspected as per **Section 6.2**. For failed internal seawater system (i.e. scored was >0; **Section 5**], the required risk reduction measure is destruction of the suspected living biofouling via treatment/s using suitable commercial preparations (e.g. Rydlime, Conquest or acid products), plus replacement of any remaining blocked components.

d) Following resolution of any hull or equipment cleaning requirement, WEL will provide the inspection and remediation report and any other relevant details of outcomes to DoF.

6.5 Vessels Mobilised from outside Australian Waters

In addition to the requirements and actions identified from the Risk Assessment process **Section 5**, the following shall apply to all vessels mobilised from outside Australian waters:

- Be contractually obliged to undertake the exchange of any ballast water in accordance with the current version of AQIS notice 92/2 *"Controls on the Discharge of Ballast Water and Sediments from Ships entering Australia from Overseas"* (Appendix B). See www.aqis.gov.au/shipping for current version; and

6.6 Management measures for Maxima 3D MSS Vessels or Immersible Equipment of Concern Identified at Scott Reef.

The intention of this NIMSMP is to identify and remove all NIMS from vessels and immersible equipment prior to mobilisation. As such, this NIMSMP describes the risk assessment process and subsequent management procedures that all Maxima 3D MSS vessels and immersible equipment will undergo prior to departure to Scott Reef. No NIMS inspections will be undertaken at Scott Reef

However, if NIMS are identified in the location of Scott Reef during Maxima 3D MSS normal work activities, the following management measures will be implemented.

6.6.1 Vessel fouling

- Vessels fouled with NIMS of concern (**Section 3.3**) will immediately stop work and mobilise out of the Scott Reef area to a depth of greater than 200m;
- DoF (Senior Management Officer, BioSecurity; 0409 370 135) will be notified within 24 hours or as soon as practical;
- On advice from DoF, implement appropriate response actions commensurate with the risk;
- Primary actions may include either:

  a) appropriate cleaning at a suitable haul-out location, or

  b) mobilisation out of Australian waters.
- Vessels for which either a) or b) has been applied will not return to operate as a part of the Maxima 3D MSS until appropriate cleaning has been undertaken and subsequent inspections have identified no NIMS.
- Immersible equipment will be cleaned as described in **Section 6.4** (2).
- Following resolution of any hull or equipment cleaning requirement, WEL will provide the inspection and remediation report and any other relevant details of outcomes to DoF.

6.6.2 Habitat Fouling

Divers will be deployed during the Maxima 3D MSS Field Verification Monitoring Phase. It is possible that during normal work activities the divers may discover NIMS in the environment of Scott Reef. The following response will occur on discovery of NIMS at Scott Reef;

- DoF will be notified of the discovery of the NIMS within 24 hours of discovery or as soon as practical.
- Samples may be collected and provided to Fisheries only if resources are available and the activities are within the overarching OH&S Maxima 3D MSS Plan.

Figure 6-1 Maxima 3D MSS Operational Procedure Flow Chart

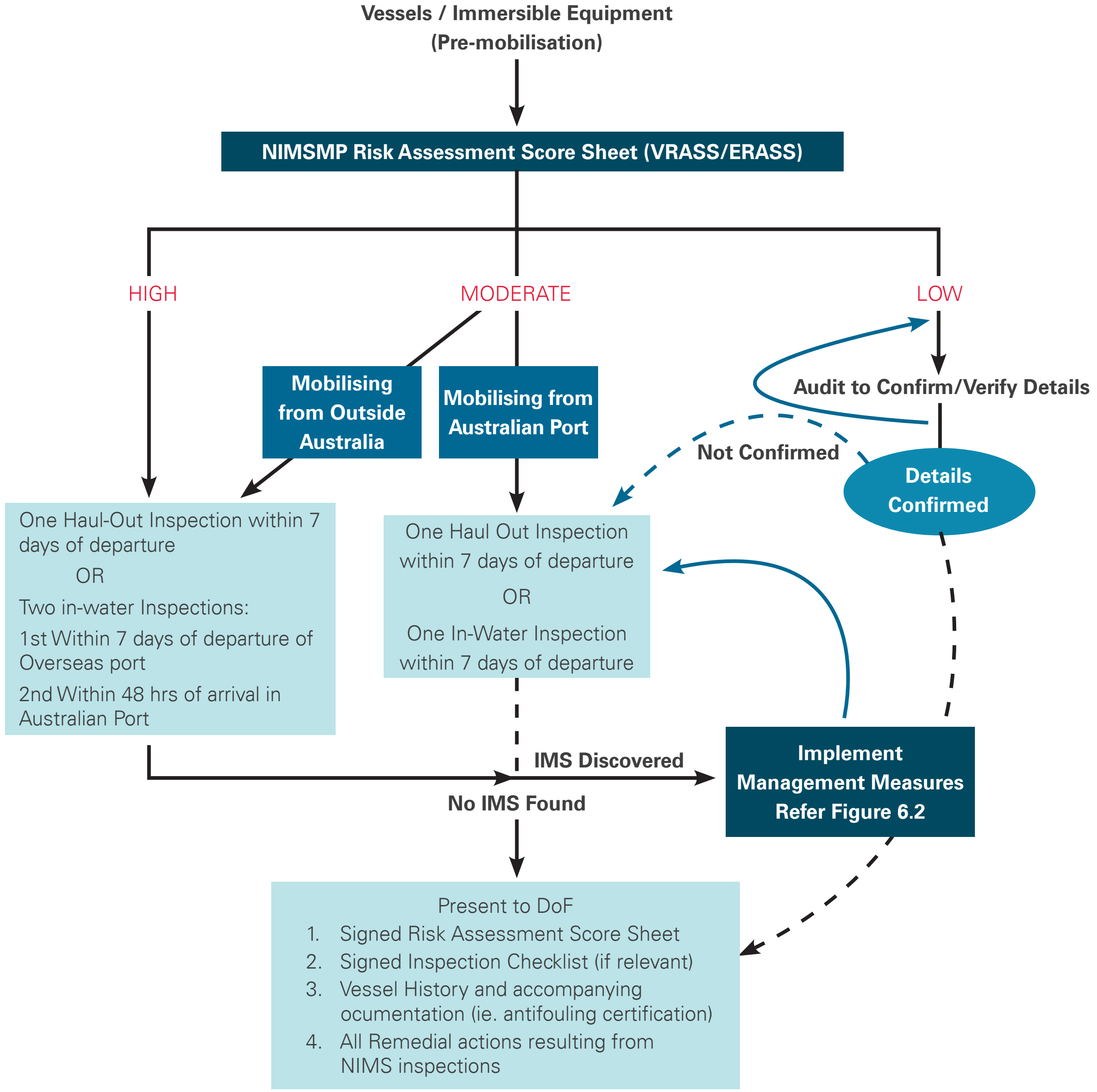
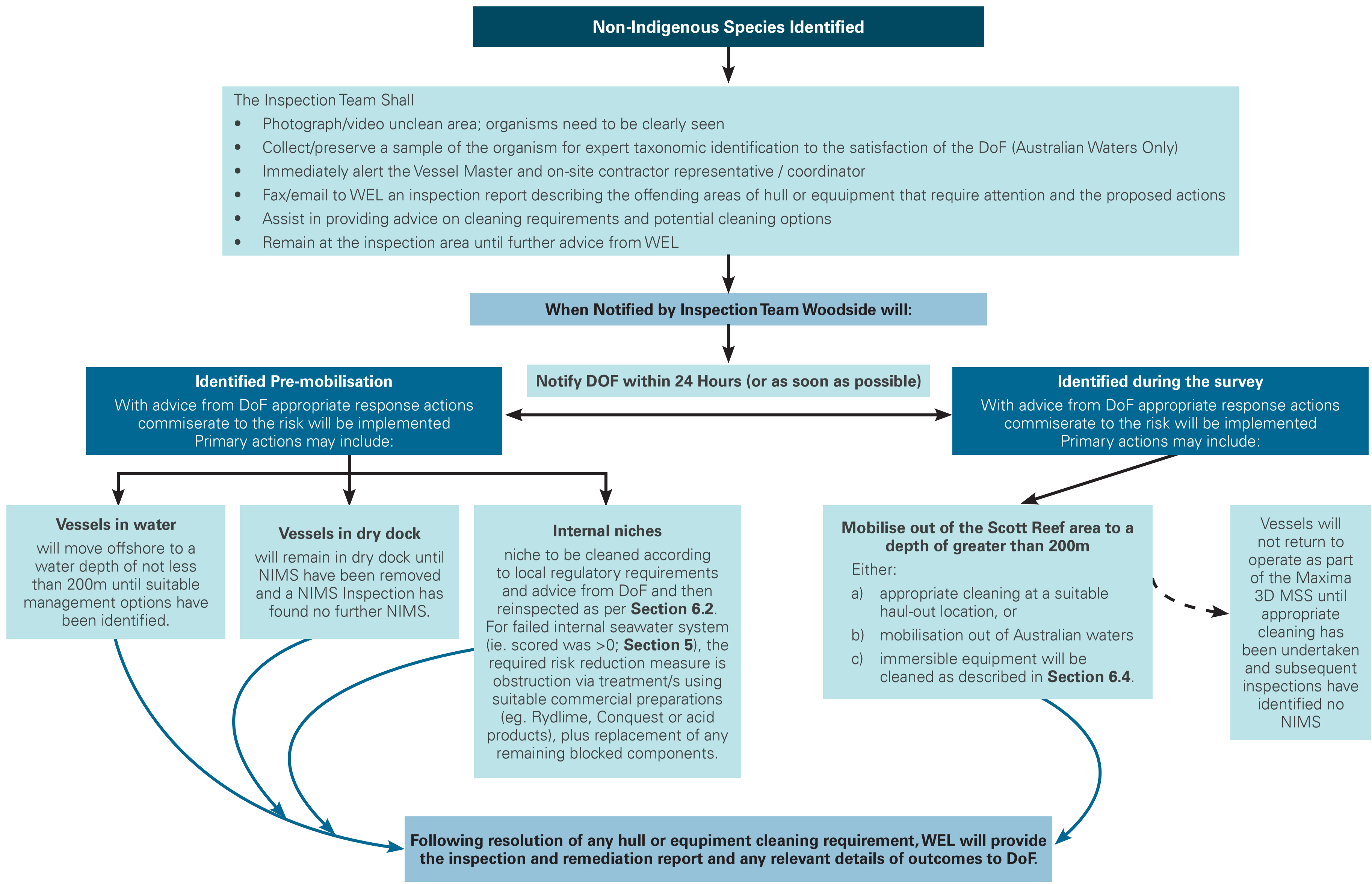


Figure 6-2 Maxima 3DMSS Mitigation Procedures



6.7 Roles and Responsibilities

A breakdown of the roles and responsibilities for personnel are detailed in **Table 6-1**.

Table 6-1 Accountability Matrix for Personnel Involved with the Maxima 3D MSS NIMSMP

Role	Responsibility
Inspection Team Leader	Ensure NIMS inspections are conducted according to this Plan
WEL Environment Advisor	Ensure vessel audits are completed.
Vessel Master	Ensure AQIS Ballast Water Management Requirements are adhered.
Vessel Master	Prepare immersible gear to 'deployment condition' prior to immersible equipment inspection

7 Summary of NISMP Commitments and Actions

The following table lists the activities that WEL will undertake under this NISMP.

No.	Topic / Objective	Commitments/Criteria	Responsibility	Timing
1.	Non-Indigenous Marine Species	An approved Non-indigenous Marine Species Management Plan will be implemented and made publicly available.	WEL Environment Advisor	At least 10 business days prior to mobilisation
2.	Risk Assessment Process	All vessels and immersible equipment will undergo the approved Risk Assessment process.	WEL Environment Advisor	Prior to mobilisation
3.	Inspections (Low Risk vessels / immersible gear)	Information from Low Risk vessels and immersible equipment will be supplied to WEL and checked.	WEL Environment Advisor	At least 5 business days prior to mobilisation
4.	Inspections (Medium Risk vessels / immersible gear) mobilised from an Australian Port	Domestic Medium Risk vessels and immersible equipment will be inspected by either one in-water inspection or one haul-out inspection.	WEL Environment Advisor	Within 7 days of final departure to Scott Reef, either directly or via a supply port(s)
5.	Inspections High Risk vessels/ immersible gear) from an Australian Port	Domestic High Risk vessels and immersible equipment will be inspected by either two in-water inspections or one haul-out inspection.	WEL Environment Advisor	Haul-out or final in-water inspection to be completed within 7 days of final departure to Scott Reef, either directly or via a supply port(s)
6.	Inspections High or Medium Risk vessels / immersible gear mobilised outside Australia	1) High and medium risk vessels and immersible equipment mobilised from outside Australia will undergo either one in-water inspection or one haul-out inspection at the nominated departure port within 7 days of departure to Australia. 2) If an in-water inspection was undertaken at the overseas departure port, a second in-water inspection is required in the period no greater than 48 hours after arrival at the Australian arrival port	WEL Environment Advisor	1) Haul-out or in-water inspection to be completed within 7 days of departure to Australia 2) Second in-water inspection within 48hrs of arrival at Australian Port
7.	Vessel mobilisation to Scott Reef	Vessel history information, Risk assessment score sheet, Inspection report, description of all associated activities and other relevant documentation provided to DoF	WEL Environment Advisor	1 business day prior to vessel arrival at Scott Reef

No.	Topic / Objective	Commitments/Criteria	Responsibility	Timing
8.	Mitigating Procedures for Identified NIMS during vessel / immersible gear inspections	Photograph / video the unclean area(s) ensuring the organisms present are clearly seen (1). Collect and preserve a sample of the fouling organism to permit expert taxonomic identification to the satisfaction of DoF (Australian Waters Only) (1). Immediately alert the Vessel Master and on-site contractor representative / coordinator as to the presence of the uncleaned area(s) (1). Immediately contact WEL head office with summary details (1). Assist in providing advice on cleaning requirements and potential cleaning options and remain at the inspection area until further advice from WEL (1). DoF will be notified as soon as practical (Senior Management Officer, BioSecurity 0409 370 135) (2); On advice from DoF, implement appropriate response actions commiserate to the risk (2) Primary mitigation measures may include: • In-water vessels will move offshore to a depth of greater than 200m. • External niches – Hull and immersible equipment will be cleaned as per local regulatory requirements. • Internal Niches – Treated using suitable commercial preparations	(1) Inspection Team Leader (2) WEL Environmental Advisor	As soon as possible after identification
9.	Mitigating Procedures for Identified NIMS on vessel / immersible gear at Scott Reef	DoF will be notified as soon as practical (Senior Management Officer, BioSecurity 0409 370 135) (2); On advice from DoF, implement appropriate response actions commiserate to the risk (2) Primary mitigation measures may include: • Vessels containing NIMS will immediately mobilise out of the Scott Reef area to a depth of greater than 200m and either: • appropriately cleaned at a suitable haul-out location, or • mobilised out of Australian waters. Vessels for which either a) or b) has been applied will not return to operate as a part of the Maxima 3D MSS until appropriate cleaning has been undertaken and subsequent inspections have identified no NIMS. Immersible Equipment containing NIMS must be immediately removed from the water and cleaned in using appropriate methods. Material removed during equipment cleaning shall not be discarded to sea, but disposed in an appropriate manner under local jurisdictional rules.	(1) Vessel Master (2) WEL Environmental Advisor	Immediately on identification of NIMS

No.	Topic / Objective	Commitments/Criteria	Responsibility	Timing
10.	Ballast Water Management	All vessels will adhere to *Australian Ballast Water Management Requirements (AQIS, 2005)* In addition, it is the intent of WEL that all vessels will follow the proposed National System *Ballast Water Exchange Methods* as described in NIMSMP Section 2.3.1.	Vessel Master	During Survey
11.	Risk Assessment and associated inspection reports	Risk assessment and subsequent actions for all vessels and immersible equipment provided to DoF.	WEL Environment Advisor	At completion of inspections but prior to mobilisation

8 Glossary of Terms

As-New' surface	A surface which has been cleaned then coated or touched-up so that it is free of marine fouling material (dead or alive) and, by the nature of its surface and lack of roughness, is capable of preventing a rapid build-up of primary and secondary fouling.
Advection	Horizontal and vertical dispersal of organisms, propagules, particles or heat by the movement of oceanic,coastal, tidal or riverine currents.
Anthropogenic	Directly or indirectly caused by a human activity.
Antifouling Coating (AFC)	A fouling control coating (FCC) containing active biocidal ingredients, that has been applied to a hull under supervised, licensed dockyard conditions in accordance with the manufacturer's instructions and advice.
Aquatic nuisance species	Defined in the US NANSPC Act 1990 as: "…a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters". Has same meaning as Harmful marine species and Marine pest.
Aquatic species	Any organism which spends all or significant parts of its lifecycle in fresh, brackish or marine waters. Baseline port survey A biological survey aimed at finding and identifying all introduced marine species that may be present in a port (cf. Targeted port survey).
Benthic	Relating to, or inhabiting, the seabed.
Bilge / Bilge Spaces	The lowest internal parts of a vessel where water and waste liquids accumulate.
Bilge water	Any water and other liquids that accumulate in a bilge space.
Bilges, bilge spaces	The lowest and typically dampest internal spaces of a hull where water can accumulate.
Biodiversity	Biodiversity (biological diversity) is the sum total of the variety of life and its interactions. Can be subdivided into genetic diversity, species diversity and ecological (= ecosystem / habitat) diversity.
Biofouling	Any organism attached to or nestling in a vessel hull, including the internal seawater pipe work, anchor well, cable locker, cargo spaces, bilges, etc.
Bioinvasion	A broad term that includes natural range expansions as well as the spread of an invasive species.
Biological diversity	Same as Biodiversity.
Border	Any entry point into a recognised jurisdiction, such as a National, State or Economic border or other political boundary.
Cleaned by exposure	A hull, tender or piece equipment is considered free of viable marine species if it has been stored in a dry (non-splash zone) location for at least one month (a guideline used by agencies such as the WA Department of Fisheries and AQIS for determining the infection status of work boats, dredging equipment, mooring assembly or survey equipment).

Commensal organism	A plant or animal that lives as a 'tenant' of other organisms but not at their expense (cf. Parasite). Commensals that provide mild or essential benefits to their 'partner' organism form a Symbiotic relationship.
Corridor	The specific, physical route of a pathway, such as a particular sea lane.
Cosmopolitan species	A wide-ranging species found in at least two ocean basins, often displaying a broad temperature tolerance. Often Cryptogenic in parts of its range.
Cryptogenic species	A species which is neither demonstratively native nor introduced in one or more regions. Includes many Cosmopolitan species.
Disease	A clinical or sub-clinical infection by an aetiological agent (see Pathogen).
Domestic route (shipping)	Intra-national route (coastal or river) between domestic ports.
Dry docking support strips (DDSS)	Square patches along the keel and hull sides that are recoated by AFC only at alternate dry docking intervals owing to the presence of the dockyard support blocks.
Endemic species	A species with a native distribution restricted to the bioregion/s of interest as a result of one of several biogeographical speciation mechanisms.
Entrainment	Uptake of a species by a vector such as hull fouling.
Eradicate	To remove entirely, completely destroy, extirpate, get rid of.
Established introduction	A non-native species that has established at least one self-sustaining viable population in the region of its introduction (see Introduced species).
Exotic species	Ambiguous term for describing a Non-native species. Can invoke misunderstandings by implying rareness or beauty. Originally used for tropical/subtropical spices, foods and plants that have a striking smell, taste or coloration (Exotica: excitingly different). See Ornamental.
Foreign routes (shipping)	International routes (voyages) between countries (see Border).
Fouling Control Coating (FCC)	A coating system designed to reduce the attachment and growth of fouling organisms. Includes biocidal coatings (with biocides - anti-fouling coatings), non-active coatings (with silicon or teflon - fouling release coatings) and surface-deterrent coatings (with microtopographic patterns).
Fouling organism	Any plant or animal that attaches to natural and artificial substrates such as piers, navigation buoys, pilings or hulls. Includes crawling and nestling forms as well as sessile seaweeds, hydroids, barnacles, mussels, bryozoans, etc. (see Biofouling).
Harmful marine species	Defined in the IMO Ballast Water Convention as: "Aquatic organisms or pathogens which, if introduced into the sea including estuaries, or into fresh water courses, may create hazards to the environment, human health, property or resources, impair biological diversity or interfere with other legitimate uses of such areas". See Aquatic Nuisance Species; Marine pest.
Hazard	A situation or activity that under certain conditions will cause harm. The likelihood of these conditions and the type and magnitude of the harm produce a level of Risk.
Hub / hub port	A strategically located port where international shipping meets domestic shipping and other vectors (see Node).
Hull	The wetted surfaces of a vessel, including its propulsion and steering gear, internal cooling circuits, sea strainers, bow thrusters, transducers, log probes, anchors, anchor chains, anchor lockers and bilge spaces.

Incursion	Unauthorised entrance or movement of a non-native species into a region or country where it is not already established. See Interception.
Indigenous (native) species	Naturally distributed within the region of interest, with a long term presence extending into the pre-historic record. See Introduced and Non-native species.
Infection	When the hull of a vessel becomes fouled, or its trim tank/s are filled with untreated seawater.
Inoculation	A translocation of fouled material or ballast water that contains organisms not native to the receiving environment.
Intentional introduction	Purposeful transfer or deliberate release of a non-indigenous species into a natural or semi-natural habitat located beyond its native range.
Interception	Detection of a non-native organism at a pre-border or border inspection point, quarantine facility or other type of biosecurity control location.
Introduced species	Any species whose movement into a region beyond its native range was directly or indirectly assisted by human activity, intentionally or otherwise. (includes species which make a self-mediated range expansion because of a new canal, waterway or anthropogenic climate change).
Invasive species	Any introduced species which spreads throughout a range of non-native natural or semi-natural habitats and ecosystems by its own and/or human-assisted means. Policy definitions and casual use of this term to describe virtually any introduction has diluted its meaning.
Mariculture	A type of aquaculture involving estuary or coastal water farming of any brackish or marine species.
Marine pest	Used frequently in Australian and NZ government publications and other literature to describe a noxious invasive marine species that threatens environmental, economic or social values (see Aquatic Nuisance Species; Harmful Marine Species).
Mitigate (/mitigation)	To reduce, lessen, ameliorate or compensate negative effects and impacts.
Mutualism	see Symbiotic Relationship; Commensal organism.
Niche	Any location on a hull that facilitates the accumulation and growth of sessile or mobile fouling organisms by the absence of an intact fouling control coating or lack of turbulent flow. Includes nooks and crannies that are difficult to access, clean and coat, even when dry-docked.
Node	Any point in a network where vectors and their routes intersect or branch. Includes ports, harbours, marinas, slipways and boat ramps (i.e. any point where a vector begins, ends or intersects the route of other vectors). Nodes are where vectors become infected by and/or release pests, and are thus an integral part of both the primary and secondary invasion process.
Non-invasive species	An Introduced species that remains localised within a new environment and shows little propensity to spread despite several decades of opportunity.
Non-Indigenous Marine Species	A marine organism that may be introduced via vessels and immersible equipment associated with the Maxima 3D MSS and are likely to have the ability to survive and reproduce in the environments associated with the Maxima 3D MSS survey. These species are identified in Appendix C.
Noxious species	A term sometimes used in government legislation for describing or listing unwanted species which are subject to import or translocation regulations.

Ornamental species	Decorative plants and animals with unusual or eye-catching features that are imported, selectively bred and/or genetically modified for display in aquaria, ponds or lakes.
Parasite	Any fungus, plant, protozoan or metazoan animal that lives within (endoparasite) or on (ectoparasite) a living organism (host) and draws its nutriments directly from it. Typically reduces its host's fitness, growth, or fertility (cf. Commensal organism).
Pathogen	Any protozoan, bacteria, virus, particle or other aetiological agent causing illness or Disease.
Pathway	The route taken by one or more vectors from point A to point B.
Pelagic	Relating to, or inhabiting, the water column of open coastal waters or seas.
Pest	Any troublesome, noxious or destructive organism; a bane, 'curse' or 'plague' species (see Aquatic Nuisance Species; Harmful marine species; Marine Pest; Noxious species).
Primary fouling	A discernible layer or patch of biofilm, with or without green filamentous algae ('beard', 'grass', 'weed') (cf. secondary fouling).
Primary invasion	Initial establishment of an invasive marine species in a disjunct region (i.e. located beyond a land, ocean or temperature/salinity barrier).
Propagules	Dispersal agents of organisms, including spores, zygotes, cysts, seeds, larvae and self-regenerative tissue fragments.
Risk	The likelihood and magnitude of a harmful event (see Hazard).
Risk analysis	Evaluating a risk to determine what type and level of actions are worth taking to reduce the risk (often termed the 'Risk assessment' in the US).
Risk assessment	Undertaking the various tasks required to determine the level of risk (often termed the 'Risk analysis' in the US).
Risk management	The culture, organisational framework and activities which are directed towards identifying, evaluating and reducing risks.
Risk species	A species known or suspected to become a harmful species if introduced, based on documented outcomes or inductive evaluation of available evidence respectively.
Route	A geographic track or corridor taken or formed by a vector (see Pathway).
Sea chest	A substantial recess built into a vessel's hull, often paired Typically covered by a coarse grill, containing one or several intakes and designed to minimise cavitation and maximise pumping efficiency to internal vessel cooling and ballasting circuits. Located well below the waterline, typically below the front bulkhead of the engine room.
Seawater circuit cleaning	Plugged and flushed with freshwater for at least 48 hours or, if bivalve molluscs are present, for at least 5 days with addition of approved agent/s such as CO2, copper sulphate, hypochlorite, weak hydrochloric acid [e.g. Rydlime descaling agent], disinfectant [e.g. Lavendola], etc.
Secondary fouling	The sessile and mobile biota that settles, grasps, nestles or is otherwise attracted to primary fouling or niches that provide protection from an intact fouling control coating and/or turbulent flow.
Secondary invasion	Subsequent spread within a new region by the progeny of the initial founder population (see Primary Invasion).

Surfactant	Any substance or preparation that lowers the surface tension of water, including detergents, dispersants, emulsifiers, wetting and foaming agents.
Symbiotic relationship	When a Commensal organism provides mild or essential benefits to its 'partner' organism (Mutualism; e.g. zooxanthellae in reef-building corals).
Targeted port survey	Port survey where sampling is aimed at detecting the presence of one or more specific marine pests (cf. Baseline port survey).
Taxon/Taxa	Any taxonomic group/s (class, family, genus, species, sub-species, etc.).
TBT Tributyltin	the organotin component of AFCs that are not permitted on vessels <25 m in length and are currently being phased out for all vessels by end of 2008, in accordance with the IMO international convention and national legislation.
Translocate/Translocation	Deliberate or unintentional transfer of an organism or its propagules between disjunct sites. The ICES 1994 Code of Practice on the Introductions and Transfers of Species restricts 'Transfer' and 'Transplant' to a species translocation "within its present range" (i.e. both native and introduced ranges). This usage is not common.
Transplant	A deliberate transfer or translocation.
Unintentional introduction	An accidental, unwitting and often unknowing introduction, directly or indirectly caused by a human activity.
Vector	The physical means, agent or mechanism which facilitates the transfer of organisms or their propagules from one place to another (see Pathway).
Vessel	Any type of ship, barge, drilling unit, work boat, fishing vessel, yacht, launch, recreational boat, personal watercraft, dinghy, submersible, etc.

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Appendix A - Summary of the International Convention for the Control and Management of Ships Ballast (Trim) Water & Sediments

As adopted by consensus at a Diplomatic Conference at IMO in London on Friday 13 February 2004 (http://globallast.imo.org/index.asp?page=mepc.htm).

Summary of Convention requirements

The *International Convention for the Control and Management of Ships' Ballast Water and Sediments* is divided into Articles; and an Annex which includes technical standards and requirements in the Regulations for the control and management of ships' ballast water and sediments.

The main features of the Convention are outlined below.

Entry into force

The Convention will enter into force 12 months after ratification by 30 States, representing 35 per cent of world merchant shipping tonnage (Article 18 *Entry into force*).

General Obligations

Under Article 2 *General Obligations* Parties undertake to give full and complete effect to the provisions of the Convention and the Annex in order to prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments.

Parties are given the right to take, individually or jointly with other Parties, more stringent measures with respect to the prevention, reduction or elimination of the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments, consistent with international law. Parties should ensure that ballast water management practices do not cause greater harm than they prevent to their environment, human health, property or resources, or those of other States.

Reception facilities

Under Article 5 *Sediment Reception Facilities* Parties undertake to ensure that ports and terminals where cleaning or repair of ballast tanks occurs, have adequate reception facilities for the reception of sediments.

Research and monitoring

Article 6 *Scientific and Technical Research and Monitoring* calls for Parties individually or jointly to promote and facilitate scientific and technical research on ballast water management; and monitor the effects of ballast water management in waters under their jurisdiction.

Survey, certification and inspection

Ships are required to be surveyed and certified (Article 7 *Survey and certification*) and may be inspected by port State control officers (Article 9 *Inspection of Ships*) who can verify that the ship has a valid certificate; inspect the Ballast Water Record Book; and/or sample the ballast water. If there are concerns, then a detailed inspection may be carried out and "the Party carrying out the inspection shall take such steps as will ensure that the ship shall not discharge Ballast Water until it can do so without presenting a threat of harm to the environment, human health, property or resources."

All possible efforts shall be made to avoid a ship being unduly detained or delayed (Article 12 *Undue Delay to Ships*).

Technical assistance

Under Article 13 *Technical Assistance, Co-operation and Regional Co-operation*, Parties undertake, directly or through the Organization and other international bodies, as appropriate, in respect of the control and management of ships' ballast water and sediments, to provide support for those Parties which request technical assistance to train personnel; to ensure the availability of relevant technology, equipment and facilities; to initiate joint research and development programmes; and to undertake other action aimed at the effective implementation of this Convention and of guidance developed by the Organization related thereto.

Annex – Section A General Provisions

This includes definitions, application and exemptions. Under Regulation A-2 General Applicability: "Except where expressly provided otherwise, the discharge of Ballast Water shall only be conducted through Ballast Water Management, in accordance with the provisions of this Annex."

Annex – Section B Management and Control Requirements for Ships

Ships are required to have on board and implement a Ballast Water Management Plan approved by the Administration (Regulation B-1). The Ballast Water Management Plan is specific to each ship and includes a detailed description of the actions to be taken to implement the Ballast Water Management requirements and supplemental Ballast Water Management practices.

Ships must have a Ballast Water Record Book (Regulation B-2) to record when ballast water is taken on board; circulated or treated for Ballast Water Management purposes; and discharged into the sea. It should also record when Ballast Water is discharged to a reception facility and accidental or other exceptional discharges of Ballast Water

The specific requirements for ballast water management are contained in regulation B-3 *Ballast Water Management for Ships*:

- Ships constructed before 2009 with a ballast water capacity of between 1500 and 5000 cubic metres must conduct ballast water management that at least meets the ballast water exchange standards or the ballast water performance standards until 2014, after which time it shall at least meet the ballast water performance standard.
- Ships constructed before 2009 with a ballast water capacity of less than 1500 or greater than 5000 cubic metres must conduct ballast water management that at least meets the ballast water exchange standards or the ballast water performance standards until 2016, after which time it shall at least meet the ballast water performance standard.
- Ships constructed in or after 2009 with a ballast water capacity of less than 5000 cubic metres must conduct ballast water management that at least meets the ballast water performance standard.
- Ships constructed in or after 2009 but before 2012, with a ballast water capacity of 5000 cubic metres or more shall conduct ballast water management that at least meets the ballast water performance standard.
- Ships constructed in or after 2012, with a ballast water capacity of 5000 cubic metres or more shall conduct ballast water management that at least meets the ballast water performance standard.

Other methods of ballast water management may also be accepted as alternatives to the ballast water exchange standard and ballast water performance standard, provided that such methods ensure at least the same level of protection to the environment, human health, property or resources, and are approved in principle by IMO's Marine Environment Protection Committee (MEPC).

Under Regulation B-4 *Ballast Water Exchange*, all ships using ballast water exchange should:

- Whenever possible, conduct ballast water exchange at least 200 nautical miles from the nearest land and in water at least 200 metres in depth, taking into account Guidelines developed by IMO;
- In cases where the ship is unable to conduct ballast water exchange as above, this should be as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 200 metres in depth.

When these requirements cannot be met areas may be designated where ships can conduct ballast water exchange. All ships shall remove and dispose of sediments from spaces designated to carry ballast water in accordance with the provisions of the ships' ballast water management plan (Regulation B-4).

Annex - Section C Additional measures

A Party, individually or jointly with other Parties, may impose on ships additional measures to prevent, reduce, or eliminate the transfer of Harmful Aquatic Organisms and Pathogens through ships' Ballast Water and Sediments.

In these cases, the Party or Parties should consult with adjoining or nearby States that may be affected by such standards or requirements and should communicate their intention to establish additional measure(s) to the Organization at least 6 months, except in emergency or epidemic situations, prior to the projected date of implementation of the measure(s). When appropriate, Parties will have to obtain the approval of IMO.

Annex – Section D Standards for Ballast Water Management

There is a ballast water exchange standard and a ballast water performance standard. Ballast water exchange could be used to meet the performance standard:

Regulation D-1 *Ballast Water Exchange Standard* - Ships performing Ballast Water exchange shall do so with an efficiency of 95 per cent volumetric exchange of Ballast Water. For ships exchanging ballast water by the pumping-through method, pumping through three times the volume of each ballast water tank shall be considered to meet the standard described. Pumping through less than three times the volume may be accepted provided the ship can demonstrate that at least 95 percent volumetric exchange is met.

Regulation D-2 *Ballast Water Performance Standard* - Ships conducting ballast water management shall discharge less than 10 viable organisms per cubic metre greater than or equal to 50 micrometers in minimum dimension and less than 10 viable organisms per milliliter less than 50 micrometres in minimum dimension and greater than or equal to 10 micrometers in minimum dimension; and discharge of the indicator microbes shall not exceed the specified concentrations.

The indicator microbes, as a human health standard, include, but are not be limited to:

a) Toxicogenic *Vibrio cholerae* (O1 and O139) with less than 1 colony forming unit (cfu) per 100 milliliters or less than 1 cfu per 1 gram (wet weight) zooplankton samples;

b) *Escherichia coli* less than 250 cfu per 100 milliliters;

c) Intestinal Enterococci less than 100 cfu per 100 milliliters.

Ballast Water Management systems must be approved by the Administration in accordance with IMO Guidelines (Regulation D-3 *Approval requirements for Ballast Water Management systems*). These include systems which make use of chemicals or biocides; make use of organisms or biological mechanisms; or which alter the chemical or physical characteristics of the Ballast Water.

Annex - Section E Survey and Certification Requirements for Ballast Water Management

Gives requirements for initial renewal, annual, intermediate and renewal surveys and certification requirements. Appendices give form of Ballast Water Management Certificate and Form of Ballast Water Record Book.

Appendix B - Recent Target Species Lists

(1) Revised CCIMPE Trigger List (2006)

Species still exotic to Australia		
	Species Name	Common Name
1*	Eriocheir spp.	Chinese Mitten Crab
2	Hemigrapsus sanguineus	Japanese/Asian Shore Crab
3	Crpeidula fornicate	American Slipper Limpet
4*	Mytilopsis sallei	Black Striped Mussel
5	Perna viridid	Asian Green Mussel
6	Perna perna	Brown Mussel
7*	Corbula (Potamocorbula) amurensis	Asian Clam, Brackish-Water Corbula
8*	Rapana venosa (syn Rapana thomasiana)	Rapa Whelk
9*	Mnemiopsis leidyi	Comb Jelly
10*	Caulerpa taxifolia (exotic strains only)	Green Macroalgae
11	Didemnum spp. (Exotic invasive strains only)	Colonial Sea Squirt
12*	Sargassum muticum	Asian Seaweed
13	Neogobius melanostomus (marine / estuarine incursions only)	Round Goby
14	Marenzelleria spp. (invasive species and marine/estuarine incursion only)	Red Gilled Mudworm
15	Balanus improvisus	Barnacle
16	Siganus rivulatus	Marbled Spinefoot, Rabbit Fish
17	Mya arenaria	Soft Shell Clam
18	Ensis directus	Jack-knife Clam
19	Hemigrapsus takanoi/penicillatus	Pacific Crab
20	Charybdis japonica	Lady Crab

Species established in Australia, but not widespread		
	Species Name	Common Name
21*	Asterias amurensis	Northern Pacific Seastar
22	Carcinus maenas	European Green Crab
23	Varicorbula gibba	European Clam
24*	Musculista senhousia	Asian Bag Mussel, Asian Date Mussel
25	Sabella spallanzanii	European Fan Worm
26*	Undaria pinnatifida	Japanese Seaweed
27*	Codium fragile spp. tomentosoides	Green Macroalga
28	Grateloupia turuturu	Red Macroalga
29	Maoricolpus roseus	New Zealand Screwshell
Holoplankton Alert Species		
30*	Pfiesteria piscicida	Toxic Dinoflagellate
31	Pseudo-nitzshia seriata	Pennate Diatom
32	Dinophysis norvegica	Toxic Dinoflagellate
33	Alexandrium monilatum	Toxic Dinoflagellate
34	Chaetoceros concavicornis	Centric Diatom
35	Chaetoceros convolutes	Centric Diatom

* Species on Interim CCIMPE Trigger List

Watching List		
	Species Name	Common Name
1	Styela clava	Clubbed Tunicate
2	Euchone limnicola	Sabellid Polychaete Worm
3	Theora lubrica	Asian Semelid Bivalve
4	Polydora websteri	Mudworm
5	Polydora cornuta	Spionid Polychaete
6	Boccardia proboscidea	Spionid Polychaete
7	Alitta succinea	Pile Worm
8	Petrolisthes longatus	New Zealand Half Shell Crab
9	Ciona intestinalis	Sea Vase

Notification / More Information List		
	Species Name	Common Name
1	Womersleyella setacea	Red MacroAlga
2	Bonnemaisonia hamifera	Red MacroAlga
3	Balanus eburneus	Ivory Barnacle
4	Hydroides dianthus	Limy Tubeworm
5	Tortanus dextrilobatus	Asian Copepod
6	Tridentiger barbatus	Shokihazy Goby
7	Siganus luridus	Dusky Spinefoot
8	Pseudodiaptomus marinus	Asian Copepod
9	Acartia tonsa	Asian Copepod
10	Rhithropanopeus harrisii	Harris Mud Crab
11	Callinectes sapidus	Blue Crab
12	Beroe ovata	Ctenophore
13	Blackfordia virginica	Ctenophore
14	Caulerpa racemosa**	Green Marcoalga

** Caulerpa racemosa was nominated due to concern about an 'invasive strain' in the Mediterranean and it is unclear whether this strain originates from Australia. Recent evidence suggests that the 'invasive strain' occurs naturally in Australia therefore likely to be removed from CCIMPE lists during the annual review.

(2) NIMPCG's Draft National Monitoring Target Species List (August 2006)

#	Common Name	Species Name	Previous List / Source
1	Toxic dinoflagellate	*Alexandrium catenalla*	DSS, CCIMPE (P)
2	Toxic dinoflagellate	*Alexandrium minutum*	DSS, CCIMPE (P), PPR (D)
3	Toxic dinoflagellate	*Alexandrium tamarense*	DSS, CCIMPE (P)
4	Toxic dinoflagellate	*Dinophysis norvegica*	CCIMPE (P), PPR (I)
5	Toxic dinoflagellate	*Gymnodinium catenatum*	DSS, CCIMPE (P), PPR (D)
6	Dinoflagellate	*Pfiesteria piscicida*	CCIMPE (P)
7	Centric diatom	*Chaetoceros concavicornis*	CCIMPE (P)
8	Centric diatom	*Chaetoceros convolutus*	CCIMPE (P)
9	Pennate diatom	*Pseudo-nitzschia seriata*	CCIMPE (P), PPR (I)
10	Green alga	*Caulerpa racemosa* (native query)	CCIMPE (N)
11	Aquarium strain death weed	*Caulerpa taxifolia* (exotic strains)	CCIMPE (T)
12	Deadman's fingers	*Codium fragile spp. tomentosoides*	CCIMPE (T), PPR (D)
13	Red alga	*Bonnemaisonia hamifera*	CCIMPE (N)
14	Red alga	*Grateloupia turuturu*	CCIMPE (T)
15	Red alga	*Womersleyella setacea*	CCIMPE (N)
16	Asian seaweed	*Sargassum muticum*	CCIMPE (T)
17	Japanese seaweed	*Undaria pinnatifida*	DSS, CCIMPE (T), PPR (D)
18	Comb jelly	*Beroe ovata*	CCIMPE (N)
19	Black sea jelly	*Blackfordia virginica*	CCIMPE (N), PPR (I)
20	Comb jelly	*Mnemiopsis leidyi*	CCIMPE (T)
21	Serpulid polychaete worm	*Hydroides dianthus*	CCIMPE (N)
22	Serpulid polychaete worm	*Hydroides sanctaecrucis*	PPR (D)
23	Red-gilled mud worm	*Marenzelleria sp.* (invasive form)	CCIMPE (T)
24	Spionid polychaete	*Polydora cornuta*	PPR (D)
25	Spionid polychaete	*Polydora websteri*	PPR (D)
26	Spionid polychaete	*Pseudopolydora paucibranchiata*	PPR (D)
27	Mediterranean fan worm	*Sabella spallanzanii*	DSS, CCIMPE (T), PPR (D)
28	Calanoid copepod	*Acartia tonsa*	CCIMPE (N)
29	Asian copepod	*Pseudodiaptomus marinus*	CCIMPE (N), PPR (I)
30	Asian copepod	*Tortanus dextrilobatus*	CCIMPE (N)
31	Ivory barnacle	*Balanus eberneus*	CCIMPE (N), PPR (I)
32	Barnacle	*Balanus improvisus*	CCIMPE (T)
33	Barnacle	*Balanus reticulatus*	PPR (D)
34	Rose barnacle	*Megabalanus rosa*	PPR (D)
35	Giant barnacle	*Megabalanus tintinnabulum*	PPR (D)
36	NW Atlantic blue crab	*Callinectes sapidus*	CCIMPE (N)
37	European shore crab	*Carcinus maenus*	DSS, CCIMPE (T), PPR (D)
38	Asian lady crab	*Charybdis japonica*	CCIMPE (T), PPR (I)
40	Chinese mitten crab	*Eriocheir spp.*	CCIMPE (T), PPR (I)
41	Japanese shore crab	*Hemigrapsus sanguineus*	CCIMPE (T), PPR (I)
42	Pacific crab	*Hemigrapsus takanoi (penicillatus)*	CCIMPE (T)
43	Harris mud crab	*Rhithropanopeus harrisii*	CCIMPE (N)
44	Brackish clam	*Corbula (Potamocorbula) amurensis*	CCIMPE (T), PPR (I)
45	Asian clam	*Varicorbula gibba*	DSS, CCIMPE (T)
46	Soft shell clam	*Mya arenaria*	CCIMPE (T)
47	Jack-knife clam	*Ensis directus*	CCIMPE (T)

#	Common Name	Species Name	Previous List / Source
48	Asian date mussel	*Musculista senhousia*	DSS, CCIMPE (T), PPR (D)
49	Golden mussel	*Limnoperna fortunei*	PPR (I)
50	Black-striped mussel	*Mytilopsis sallei*	DSS, CCIMPE (T), PPR (I)
51	South African brown mussel	*Perna Perna*	CCIMPE (T), PPR (I)
52	Asian green mussel	*Perna viridis*	CCIMPE (T), PPR (I)
53	Pacific oyster	*Crassostrea gigas*	DSS, PPR (D)
54	American slipper limpet	*Crepidula fornicate*	CCIMPE (T)
55	Asian veined whelk	*Rapana venosa*	CCIMPE (T)
56	Northern Pacific seastar	*Asterias amurensis*	DSS, CCIMPE (T), PPR (D)
57	Sea moss (bryozoan)	*Bugula flabellate*	PPR (D)
58	Sea moss (bryozoan)	*Bugula neritina*	PPR (D)
59	Sea moss (bryozoan)	*Schizoporella errata*	PPR (D)
60	Sea moss (bryozoan)	*Tricellaria occidentalis*	PPR(D)
61	Sea moss (bryozoan)	*Watersipora arcuata*	PPR (D)
62	Sea moss (bryozoan)	*Watersipora subtorquata*	PPR (D)
63	Sea vase (sea squirt)	*Ciona intestinalis*	PPR (D)
64	Colonial sea squirt	*Didemnum invasive spp.*	CCIMPE (T)
65	Club or leathery sea squirt	*Styela clava*	PPR (D)
66	Dusky spinefoot	*Siganus luridus*	CCIMPE (N)
67	Marbled spine foot	*Siganus rivulatus*	CCIMPE (T)
68	Round goby	*Neogobius melanostomus*	CCIMPE (T), PPR (I)
69	Shokohazi goby	*Tridentiger barbatus*	CCIMPE (N)
70	Shimofuri goby	*Tridentiger bifasciatus*	PPR (I)

Table Notes:

DSS: Used in the AQIS Seaports Programme Ballast Water Decision Support System established in 2001

CCIMPE (T): Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) interim trigger list

CCIMPE (P): CCIMPE Phytoplankton (or Plankton) alert species list

CCIMPE (N): CCIMPE Notification species list

PPR (D): 2005 CSIRO Priority Pest Report – the Priority Pest (domestic) list

PPR (I): 2005 CSIRO Priority Pest Report – the Next Pest (international) list

Appendix C - Vessel Risk Assessment Score Sheet

Vessel Risk Assessment Score Sheet (VRASS) for NIMS species of concern

Type of Fouling Control Coating (FCC)		Score
	FCC type is known, suited to vessel activity + speed and is <2 years old = 0.0 FCC type is unknown, unsuited, absent or >2 years at mobilisation = 3.0	VALUE
Age of Fouling Control Coating (FCC) at mobilisation date		+
Documented age of FCC will be: Documented date of FCC renewal: / /	>1 year old, absent or unknown = 3.0 between 6-12 months = 2.0 3-6 months = 1.0 1-3 months = 0.5 <1 month = 0.1 <14 days = 0.0	VALUE
NIMS infection risk - Location of 'home' ports/main supply base since last FCC		x
Region/s of the home ports or long term supply bases since last FCC renewal have included: *(Insert highest scoring region only)*	Tropical region = 3.0 Subtropical region = 2.0 Only temperate = 1.0	VALUE
NIMS infection risk - number of stationary/slow speed periods over 7 days		x
No of weeks of rest or <6 knots in port or coastal waters (<100 m) since last-haul out for cleaning	No. of 7 day periods divided by 2 =	VALUE
NIMS infection risk - region of the stationary/slow speed periods		x
Region/s of the ports or coastal waters where above stationary or slow speed periods occurred included: *(Insert highest scoring region only)*	Tropical = 3.0 Subtropical = 2.0 Temperate = 1.0	VALUE
NIMS biofouling survival risk		x
No hall-out cleaning and inspection prior to Survey	= 1.0	VALUE
One independent in-water inspection prior to the 7 day premobilisation inspection period	= 0.5	
Two independent in-water inspections prior to the 7 day premobilisation inspection period	= 0.3	
One independent haul-out inspection prior to the 7 day premobilisation inspection period	= 0.3	
Infection risk - internal niches (ie seawater pipework, anchor, bilge)		x
Above checks will include seawater system flushing, check strainers, anchor cable locker, other niches	Yes = 0.5 No = 1.0	VALUE
		x
Subsequent mobilisation by deck cargo, hard stand, or road freight will provide a continuous total hauled-out period that is:	<7 days = 1.0 7-13 days = 0.8 14-27 days = 0.3 >28 days = 0.1	VALUE
NIMS infection risk - from ballasted / trim tank seawater		x
Seawater onboard of tropical or subtropical origin:	None/no discharge = 0.0 Seawater of subtropical origin may need discharge = 2.0 Seawater of tropical origin may need discharge = 3.0	VALUE
		x
Freshwater replacement, or an *en route* >95% tank volume exchange is:	Intended = 0.0 Not possible = 3.0	VALUE
Vessel Risk Score	**Total Score**	
If score >80 = High risk: premoblisation inspection actions required		
If score 20-80 = Moderate risk: Confirmatory independent inspection and/or potential actioning required		
If score <20 = Low risk: Vessel details require checks/confirmation only		

Appendix D - Immersible Equipment Risk Assessment Score Sheet

Equipment Risk Assessment Score Sheet (ERA SS) for NIMS species of concern

Use this sheet for immersible equiment items with potential to be biofouled.

NIMS infection risk - region of deployments since last thorough clean		Score
Region/s of deployments since last thorough clean have included a: *(insert the highest scoring region only)*	Tropical region = 3.0 Subtropical region = 2.0 Only temperate = 1.0	VALUE
NIMS infection risk - coastal location of deployments since last thorough clean		**x**
Locations of deployments since last thorough clean have included: *(insert the highest scoring region only)*	Inshore (<100 m; <50 km) = 3.0 Shelfal (<200 m; <100 km) = 2.0 Offshore remote (>200 m; >100 km) = 1.0	VALUE
NIMS infection risk - duration of deployments		**x**
Duration of deployments is:	Always less than 24 hours = 0.1 Always less than 72 hours = 1.0 Always less than 7 days = 2.0 Has exceeded 7 days = 3.0	VALUE
NIMS survival risk during mobilisation - post-retrieval maintenance regime		**x**
Post-retrieval maintenance includes:	Routine washing and cleaning = 0.3 No routine cleaning = 1.0	VALUE
NIMS survival risk during mobilisation - transport conditions		**x**
Equipment is packed dry and/or stored in dry, well-ventilated space with low humidity.	Packed and/or stored dry = 0.2 Stored in damp conditions = 1.0	VALUE
Vessel Risk Score		
Total Score	*Result*	

If score >10 =	High risk:	Premobilisation cleaning and independent inspection required
If score 5-10 =	Moderate risk:	Confirmatory independent inspection and/or potential actioning required
If score <5 =	Low risk:	Equipment may be subject to audit check to confirm condition/document

Appendix E - Checklist and Inspection Form for Offshore Survey Vessel

Checklist and Inspection Form for Offshore Survey Vessel			
Ref:		Inspected by (name): Location:	
Date:		Vessel name or number:	
Item	Hull Region	Description	Verified Clean [Yes, No, n/a]
1	Anchoring gear	Anchors, chain and lockers free of biofouling & sediment	
2	Hull surface	Bow stem free of biofouling	
		% of hull surface with primary fouling	
		% of hull surface with secondary fouling	
		% of absent or damaged Fouling Control Coating	
		Stern plating / Transom lip free of biofouling	
3	Keel, Bilge Keels and skeg	Keel free of biofouling	
		Bilge keels free of biofouling	
		Skeg free of biofouling	
4	Seawater inlets and outlets	Starboard inlets and gratings free of biofouling	
		Starboard outlets free of biofouling	
		Port inlets and gratings free of biofouling	
		Port outlets free of biofouling	
7	Sacrificial anodes / IC blocks / earthing plates	Starboard-side anodes/IC blocks free of biofouling	
		Portside anodes/IC blocks free of biofouling	
		Propellers/steering gear anodes/IC blocks clean	
		Earth plate/s free of biofouling	
8	Sounder and speed log	Echo sounder transducers free of biofouling	
		Speed log fairing/s free of biofouling	
9	Propulsion units	A-bracket/rope guard/Azimuth housing free of biofouling	
		Propeller shaft/Azimuth centre free of biofouling	
		Propeller blades free of biofouling	
		Propeller boss/s free of biofouling	
		Bow / Stern Thrusters free of biofouling	
10	Rudder, rudder stock, post	Rudder free of biofouling	
		Rudder stock free of biofouling	
		Rudder post free of biofouling	
11	Internal seawater systems and bilge spaces	Strainer/s for starboard engine cooling free of biofouling	
		Strainer/s for port engine cooling free of biofouling	
		Strainer/s for auxiliary / generators free of biofouling	
		Strainer/s for fire main free of biofouling	
		Strainer/s for deck services free of biofouling,	
		Date of last pipework flushing / chemical treatment	
		Date of bilge space cleanup for Topsides quarantine	
12	Other wetside features or items (e.g. legs, spud cans)		

Appendix F - Immersible Equipment Checklist and Inspection Form

Immersible Equipment Checklist and Inspection Form (ICIF)			
Ref:		Inspected by (name): Location:	
Date:		Operator / Contractor:	
Item	Hull Region	Description	Verified Clean [Yes, No, n/a]
1			
2			
3			
4			
5			
6			
7			
8			
9			