



PORT OF THURSDAY ISLAND – BASELINE SURVEYS FOR INTRODUCED MARINE PESTS

Preliminary Report of the March 2004
Port-Wide Field Survey

Prepared for



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The Queensland Department of Primary Industries and Fisheries has taken all reasonable steps to ensure the information contained in this report is accurate at the time of the surveys. Benthic habitat and benthic assemblage distribution and abundance can change seasonally and between years, and readers should ensure they make appropriate enquires to determine whether new information is available.

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1. Introduction

The introduction and establishment of invasive marine species causes fundamental, and typically deleterious, impacts on fisheries and ecosystem resources, industrial development and infrastructure and human welfare (Carlton, 2002). Over 200 exotic marine species have been identified in Australian waters and most are believed to have been unintentional introductions associated with shipping and mariculture activities (Thresher, 1999). The Torres Strait region supports a number of critical fisheries habitats and ecosystem resources, which sustain much of the local economy. Due to the high level of vessel traffic through the Torres Strait areas, and their economic and ecological value, are at high risk from invasive marine taxa.

Fundamental to controlling and managing the introduction and spread of introduced marine species is a knowledge of their present distribution and abundance. To determine the presence of introduced marine species within the Torres Strait, information on the present status of marine assemblages was collected during a port-wide baseline pest survey. Sampling was undertaken 18th-26th March 2004 and targeted areas within the port likely to harbour marine pests.

Port of Thursday Island facilities (wharves, pontoons and moorings) are present on both Horn and Thursday Island. Navigational buoys, mooring buoys and other infrastructure that may support marine pests are also present through the Torres Strait region. A number of locations within the Torres Strait are also used for safe anchorage by vessels. In addition to vessels that actually visit the area, the Torres Strait is also a thoroughfare for a large number of both recreational and commercial vessels that do not stop but transit through the region. The shipping channel that passes through the Torres Strait is shallow and vessels may need to dump ballast to provide safe draught into the harbour. Areas within the Torres Strait region that are, therefore, at high risk from marine pest introduction, and were the focus of sampling during the survey, include:

- The anchorage and export and import berths of the Port of Thursday Island present on Horn and Thursday Islands;
- The jetties, moorings, navigational buoys, landing ramps and mixed international and domestic yacht anchorage areas within the Thursday Island Harbour and surrounding Island areas; and
- The shipping channels.

2. Project Sampling Design and Methods

The sampling regime implemented during the survey adopted a targeted approach focussing on habitats likely to house introduced marine pest species. It was proposed that 149 samples be collected from a range of habitats during the baseline survey using 14 different sampling techniques. The locations proposed for sampling, the justification for sampling these areas and the type of sampling proposed to be undertaken in each area is detailed in Table 1 and 2. The sampling regime was developed in accordance with the national standard protocols for detecting marine pests in ports, developed by CRIMP (Hewitt & Martin, 1996 & 2001) and protocols for sampling for marine pests in tropical ports, developed by CRC Reef (Hoedt *et al.*, 2001). Variations to the suggested sampling provided in the protocols are outlined below. The sampling regime was critically reviewed by the CSIRO, and subsequently ratified by NIMPCG, prior to the survey and was noted to have met the national standards for port baseline surveys for marine pests.

2.1 Variations from the suggested sampling protocols

A number of sampling tools suggested for use in Hewitt and Martin (1996, 2001) during a port baseline survey for marine pests were not utilised during the Thursday Island baseline survey. These, and the justifications for not using them, are outlined below.

Fish poison stations. In the high flow environment of the Port of Thursday Island currents will carry the poison away from the area targeted prior to it taking effect. As such, this method will not prove effective for collection of small fish and will not be used. It is anticipated that beach seines and trapping will provide a reference collection of mobile fishes. Benthic fishes associated with piles are often collected during scrape samples.

Underwater visual searches/sediment cores. Dangerous marine creatures including crocodiles, sharks and stinging coelenterates are common within the Thursday Island area. To minimise risks to staff underwater visual searches for taxa will not be conducted and benthic infaunal cores will not be collected. Samples of benthic taxa will, instead, be collected via trawl, sled and grab.

Organic content of sediment (optional). Sediment granulometry will be carried out, however, the organic content of sediments will not be analysed due to funding restrictions.

Table 1: Sampling plan for the Port of Thursday Island Introduced Species Survey

Site Description	Site Code	Priority Ranking (Hewitt & Martin 2001)	Ranking for Sampling (1=High, 3 = Low)	Justification	Activities
Main Cargo Wharf* (~ 30 piles, concrete and steel)	TI-MCW	1	2	Domestic traffic between Horn and Thursday Island and some from Cairns. Close proximity to Customs wharf.	Pile Scrapes: 3 piles (-0.5m, -3m & -7m ea pile) Visual record of piles: video/still camera Benthic grabs: 3 near base of piles = infauna, 1 = sediment analysis Settlement Plates: check for mussels Environmental data (temperature, salinity etc.)
Customs Wharf* (~ concrete 12 piles)	TI-CW	1	1	Contact with international traffic including FFV	Pile Scrapes: 3 piles (-0.5m, -3m & -7m ea pile) Visual record of piles: video/still camera Benthic grabs: 3 near base of piles = infauna, 1 = sediment analysis. Benthic sled: 2 x 100 m tows, -2m and -10m depth (if avail.) Benthic trawl: 2 x 100 m tows, -2m and -10m depth (if avail.) Crab/shrimp pots: 6 pots, 2 sizes Plankton samples: 20µm & 100 µm mesh, horizontal tow & vertical drop for both
Navy Wharf* (approx 20 concrete piles)	TI-NW	1	2	Contact with international traffic but potential difficulty in sampling due to clearance restrictions. Close proximity to Customs wharf.	If agreed to by Navy: Pile Scrapes: 3 piles (-0.5m, -3m & -7m ea pile) Visual record of piles: video/still camera Benthic grabs: 3 near base of piles = infauna, 1 = sediment analysis.
Old Fuel Wharf Head (~ 16 steel piles)	TI-OFWH	1	1	Wharf in poor condition. Potentially heavy fouling area. May be a reference site for main wharf structure. May be attractive to invasive taxa.	Pile Scrapes: 3 piles (-0.5m, -3m & -7m ea pile) Visual record of piles: video/still camera Benthic grabs: 3 near base of piles = infauna, 1 = sediment analysis. Benthic sled: 2 x 100 m tows, -2m and -10m depth (if avail.) Benthic trawl: 2 x 100 m tows, -2m and -10m depth (if avail.) Crab/shrimp pots: 6 pots, 2 sizes Plankton samples: 20µm & 100 µm mesh, horizontal tow & vertical drop for both Environmental data (temperature, salinity etc.)

Table 1 continued:

Horn Island Wharf	TI-HIW	1	3	Domestic/recreational traffic only which is being accounted for by sampling Main Cargo Wharf. High risk of crocodile presence.	Benthic grabs: 3 near wharf structure, 1 = sediment analysis Visual survey: of piles/pontoons via remote camera Settlement Plates: check for mussels Benthic sled: 2 x 100 m tows, 2 depths Benthic trawl: 2 x 100 m tows, 2 depths Crab/shrimp pots: 6 pots, 2 sizes Plankton samples: 20µm & 100 µm mesh, horizontal tow & vertical drop for both Environmental data (temperature, salinity etc.)
Public mooring pontoons*	TI-PM	1	3	Domestic traffic between islands only.	Visual surveys. Opportunistic collection only if necessary.
Floating buoys/channel markers (~ 20 through the port)	TI-BX TI-CHMX (X=#)	1	1	Artificial substrate available for settlement throughout the port.	Visual surveys: 10. Sample collection: opportunistic, quantitative if possible.
Ellis Channel East	TI-ECHE	3	2	Channel for vessel traffic and high current flow. Potential reference site for settlement of soft substrate taxa.	Benthic sled: 2 x 100 m tows, -2m and -10m depth (if avail.) Benthic trawl: 2 x 100 m tows, -2m and -10m depth (if avail.)
Ellis Channel West	TI-ECHW	3	2	Channel for vessel traffic and high current flow. Anchorage for confiscated vessels. Potential for settlement of soft substrate taxa.	Benthic sled: 2 x 100 m tows, -2m and -10m depth (if avail.) Benthic trawl: 2 x 100 m tows, -2m and -10m depth (if avail.)
Boat Channel (just off Smith Point, Horn Isl)	TI-BCH	3	2	Channel for vessel traffic and high current flow. Potential for settlement of soft substrate taxa.	Benthic sled: 2 x 100 m tows, -2m and -10m depth (if avail.) Benthic trawl: 2 x 100 m tows, -2m and -10m depth (if avail.)
Kiwain (Heath) Point, Prince of Wales Island	TI-KP	2	3	Rocky shore, sandy beach habitat. Current deposition area. Recreational vessel anchorage.	Beach wrack: 1 x 100m transect Rocky shore survey: 1 x 100m transect Beach seine: 1 x 100m transect
Thursday Island Sth W Point	TI-TISWP	2	3	Rocky shore, sandy/Muddy beach habitat. Current deposition area. Recreational vessel anchorage.	Beach wrack: 1 x 100m transect Rocky shore survey: 1 x 100m transect Beach seine: 1 x 100m transect
Thursday Island Nth E Point	TI-TINEP	2	3	Rocky shore, sandy/Muddy beach habitat. Current deposition area	Beach wrack: 1 x 100m transect Rocky shore survey: 1 x 100m transect Beach seine: 1 x 100m transect
Appropriate Substrate for Dinoflagellate cyst samples	TI-ZZZ (Z = to be decided)	1	1	Sediment likely to house dino. cysts will be sourced upon site inspection.	Dinoflagellate cyst sediment samples: 3 x samples per site. 2 sites minimum if appropriate sediment is available.

* All part of one wharf structure. Barge ramp immediately adjacent to public moorings and main wharf. Sled/trawls in this area (listed under Customs Wharf) are expected to sample any taxa that may have been brought in as a result of usage of the Public moorings and/or barge ramp.

Table 2: Summary of the sampling plan for the Port of Thursday Island Introduced Species Survey

Site \ Sampling type	PS	S	T	IG	SG	CP	PT	V	Env	BS	BW	RS	SP	DC	Total
TI-MCW	9			3	1			1	*				*		16
TI-CW	9	2	2	3	1	6	4	1							28
TI-NW	9			3	1			1							14
TI-OFWH	9	2	2	3	1	6	4	1	*						29
TI-HIW		2	2	3	1	6	4	1	*				*		21
TI-B	X							X							5
TI-CHM	X							X							5
TI-PM								1							1
TI-ECHE		2	2												4
TI-ECHW		2	2											3	7
TI-BCH		2	2											3	7
TI-KP								1		1	1	1			4
TI-TISWP								1		1	1	1			4
TI-TINEP								1		1	1	1			4
Total	36	12	12	15	5	18	12	19	3	3	3	3	2	6	149

For Site Codes refer to Table 1

PS = Pile scrape (X = opportunistic)

S = Benthic sled

T = Benthic trawl

IG = Benthic infaunal grab

SG = Sediment grab

CP = Crab and shrimp pots

PT = Plankton tow (zoo and phyto)

V = visual surveys (X= opportunistic)

Env = Environmental data

BS = Beach seine

BW = Beach wrack

RS = Rock Shore survey

SP = settlement plate check

DC = Dinoflagellate cyst sediment samples - opportunistic collection where appropriate sediment available. Indications of potential sampling sites provided

3. Results

Areas identified above as being at risk from marine species introduction were sampled from 18th-26th March 2004 using techniques that included, but were not restricted to, grabs, pylon scrapes, beam trawls and benthic sledge-dredges. A total of 138 samples were collected from wharves, piles, moorings, anchorage areas and shipping channels. The exact locations from where samples were collected can be seen from Figure 1.

Eleven samples originally proposed were not collected during the survey for the following reasons. Only one half-meter pile scrape (not three) was collected from two of the wharf areas noted for sampling (ie four half – meter scrapes were not collected). Visual inspection demonstrated that taxa present at a half-meter were sparsely distributed and sites were similar in their taxonomic composition. As such, four scrapes were not taken as they would not have contributed to the number of taxa collected, only the biomass, and then only marginally (i.e. by three or four barnacles per scrape).

A number of trawls (6) and one sled were not collected during the survey. In a number of locations coral/rocky substrate hindered the collection of benthic trawls, which trailed a fine mesh net and on several occasions poor weather (presence of two cyclones in northern Queensland waters) also hindered late afternoon sampling efforts. In one location the collection of benthic sleds and trawls was hindered with only one sled collected (north-eastern channel off Thursday Island) as the presence of underwater cables/pipes restricted the ability to drag gear across the substrate. In locations where trawls were not collected additional grab samples (17 additional grabs in total) were taken to contribute to the benthic infauna and epifauna information collected. It is anticipated that this additional sampling in combination with information collected from the sled samples should be sufficient to detect any marine invasive taxa in the areas sampled, if they are present.

Crab and shrimp pot sampling was attempted on two separate occasions. On both occasions the sampling gear was removed (potentially stolen) prior to the catch being checked by field staff. Crab and shrimp sampling was therefore abandoned. It is hoped that other sampling tools will provide information regarding the crustacean fauna that should have been sampled using the pots.

The survey sampling regime has yielded comprehensive, semi-quantitative, collections of marine plants, invertebrates, plankton, dinoflagellates and vertebrates that inhabit the various soft and hard substrata in and near the Port of Thursday Island

at risk of marine pest introduction. Many of the samples collected from hard structures, particularly from the mooring buoys and channel markers, had a high proportion of encrusting calcareous taxa including corals, bivalves and bryozoa. In addition, sponges and ascidians were common. Samples collected from soft sediment habitats typically reflected the type of sediment sampled, for instance those collected from fine sediment areas were frequently dominated by seagrasses and their associated biota (polychaetes, shrimps and crabs), where as samples collected in areas where shell rubble was common were typically dominated by crustaceans and molluscs.

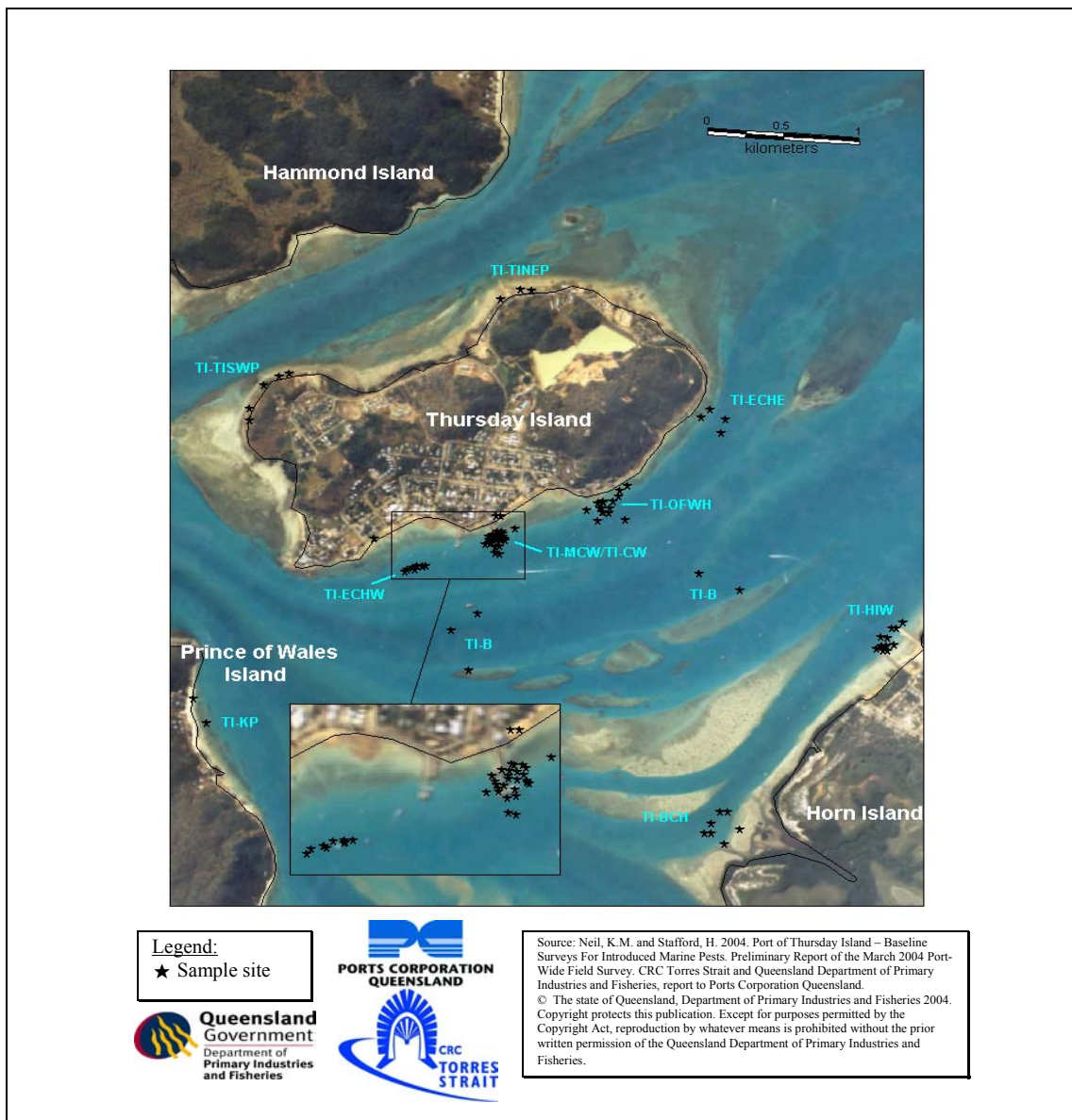


Figure 1: Location of sample sites in and adjacent to the Port of Thursday Island.

4. Presence of Target species

Logistical and cost constraints limit both the spatial and taxonomic scope of any survey of a port's marine species. Recognition of these constraints lead the Centre for Research on Introduced Marine Pests (CRIMP) and Australian Association of Port and Marine Authorities (AAPMA) to adopt a targeted approach which concentrates on determining whether a group of known, listed species are present in any one habitat.

The species listed on the Australian Ballast Water Management Advisory Council's (ABWMAC) schedule of introduced pests (listed in Hewitt and Martin (1996, 2001) and other potentially invasive taxa are listed in Table 3. Detection of many of these can be achieved by simple visual recognition. The field team leader, divers and other personnel involved in the Port of Thursday Island survey are familiar with their appearance to the extent they could readily recognise/identify the target taxa within the field, and ensure samples were taken of target and/or suspected taxa for confirmatory expert analysis.

None of the larger ABWMAC target species were found during the survey, however, in some cases small and cryptic taxa (such as the Asian green mussel) would have been difficult to detect visually due to poor visibility in the area at the time of sampling. As such, comment on the presence/ absence of these taxa from the samples should be left until samples can be examined thoroughly in the laboratory. In the case of the microscopic dinoflagellate cysts and the plankton samples, no comment can be provided until these samples have been processed and examined in the laboratory.

Table 3: Likely occurrence ('x') of ABWMAC target species: black-striped mussels, Asian Green Lipped Mussels and Caribbean tube worms in different port habitats.

Target species	Habitat				
	Soft substrata	Hard substrata	Seagrass/ algal bed	Plankton/ nekton	Beach wrack (strand line)
Mediterranean Fan Worm <i>Savella spallanzanii</i>	X	X	X		X
European Green Crab <i>Carcinus maenas</i>	X	X	X	X	X
NW Pacific Sea Star <i>Asterias amurensis</i>	X	X			X
Japanese Oyster (feral) <i>Crassostrea gigas</i>		X			
Asian Clam <i>Corbula gibba</i>	X		X		X
Senhouse's Date Mussel <i>Musculista senhousia</i>	X	X	X		X
Black-striped mussel <i>Mytilopsis sallei</i>		X			X
Asian Green Mussel <i>Perna viridis</i>		X			
Caribbean Tube Worm <i>Hydroides sanctacrucis</i>		X			
Toxic Dinoflagellates <i>Alexandrium catenella</i>	X				
<i>Alexandrium minutum</i>	X			X	
<i>Alexandrium tamarense</i>	X			X	
<i>Gymnodinium catenatum</i>	X			X	
Japanese Kelp <i>Undaria pinnatifida</i>		X	X		X

(Adapted from Hewitt and Martin, 2001)

5. Summary

The surveys conducted in and around the Port of Thursday Island employed a large range of sampling methods that yielded a large collection of marine organisms associated with the hard substrata and benthic environments. The ABWMAC target pest species, listed in Hewitt and Martin (1996, 2001), were not identified during visual diver surveys or when preserving samples in the field. However, until all specimens are properly examined no conclusion can be drawn regarding these species as many of them can be cryptic and difficult to detect during field surveys. Distinctly different taxa were sampled by each method employed during the survey and the samples that were taken appear to be representative of the range of biota inhabiting the port environment.

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