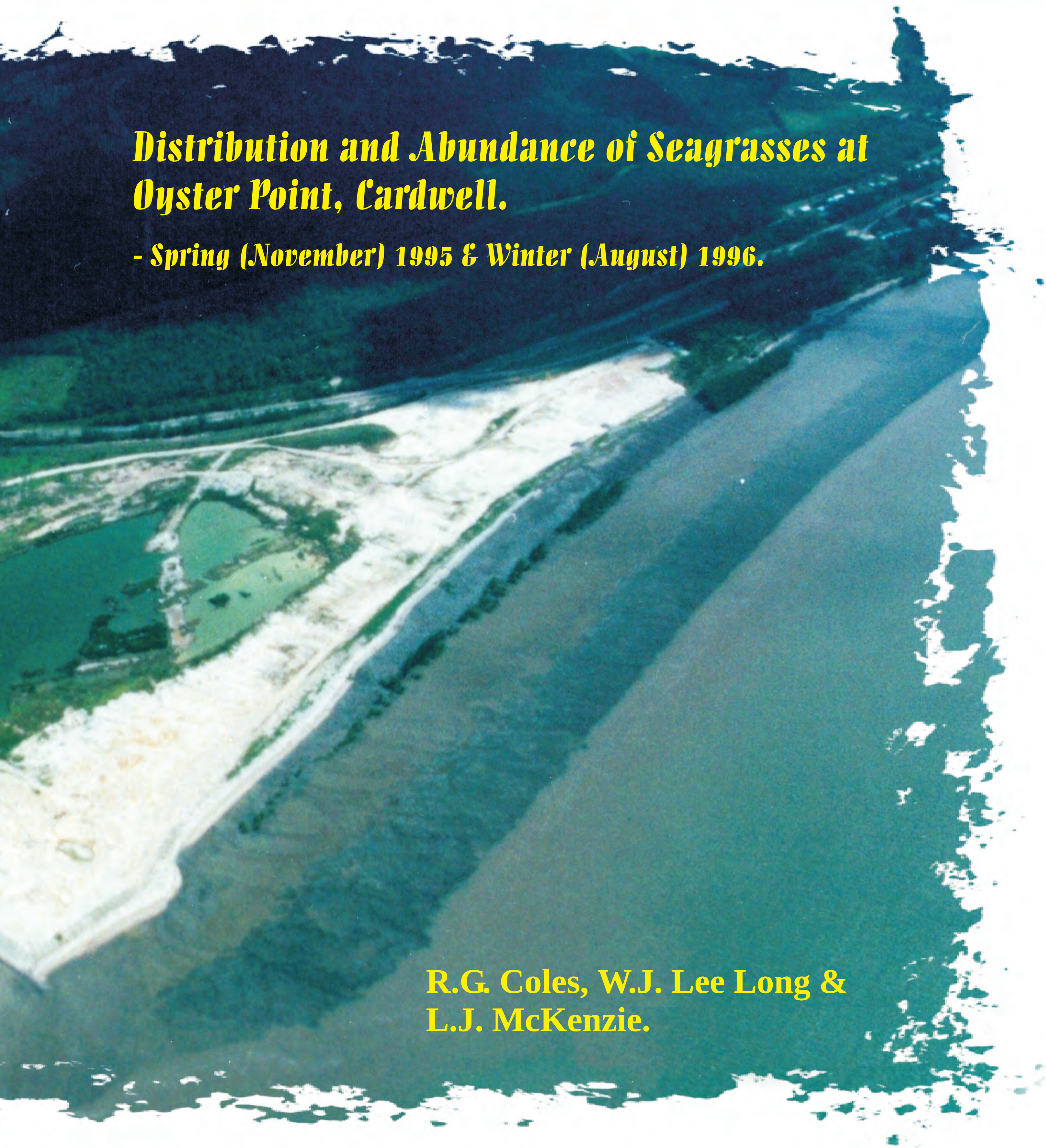
Distribution and Abundance of Seagrasses at Oyster Point, Cardwell.

- Spring (November) 1995 & Winter (August) 1996.



R.G. Coles, W.J. Lee Long & L.J. McKenzie.

QUEENSLAND GOVERNMENT
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Distribution and Abundance of Seagrasses at Oyster Point, Cardwell

Spring (November) 1995 & Winter (August) 1996

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↳EXECUTIVE SUMMARY

KEY RESULTS

1. 285 ±16 ha of seagrass habitat was mapped in late-spring (November) 1995 and 243 ±13 ha in winter (August) 1996, in surveys of the intertidal and subtidal areas surrounding Oyster Point, at the northern end of the Hinchinbrook Channel.
2. 6 seagrass species were found in the survey area. *Halophila ovalis* was the most commonly encountered species (70 % of the total seagrass habitat). Other species were *Halodule pinifolia, Halodule uninervis, Halophila decipiens, Halophila tricostata* and *Halophila spinulosa* (*H. spinulosa* absent in winter (August) 1996).
3. Above-ground seagrass biomass within the Oyster Point survey area ranged from 0.01 to 24.47 g dry wt. m^{-2} in late-spring (November) 1995. Seagrass biomasses were significantly lower in winter (August) 1996 ranging from 0.01 to 9.20 g dry wt. m^{-2}.
4. Seagrasses at Oyster Point were restricted to shallow depths, probably because of high turbidities and reduced light penetration with depth. *Halophila ovalis* had the largest depth range, occurring at the shallowest (0.1 m below Mean Sea Level) and the deepest (4.3 m below MSL) sites where seagrass was found. Mean depths of occurrence for individual species were generally between 0.3 m and 3.8 m below MSL. *Halodule uninervis* dominated the inshore seagrass habitat and *Halophila decipiens* and *Halophila tricostata* had the deepest mean depths of occurrence.
5. The change in seagrass abundance and distribution between the spring and the following winter survey was within the expected range of natural population variation.
6. The seagrass *Halophila tricostata*, which is recorded only from Queensland, was less common in the present surveys than in previous surveys (ie. 1987 & 1994).

KEY ISSUES:

1. Seagrasses in the Oyster Point survey area are pioneering species and are likely to vary naturally in abundance and distribution from year-to-year.
2. Seagrasses were located on intertidal mud banks. Alterations to the mud bank topography could change the distribution and result in habitat loss of certain species.
3. Coastal seagrass habitats such as those at Oyster Point are important to the marine ecology. These habitats may only be a small part of the total coastal zone, but due to their high importance any losses need to be minimised.
4. The baseline surveys are data sets on which monitoring programs can measure changes in seagrass abundance and distribution at Oyster Point.

↳INTRODUCTION

Consultancy Brief

The Queensland Department of Primary Industries, Northern Fisheries Centre, was asked by the Department of Economic Development and Trade (DEDT) to establish a baseline of seagrass data 1.5 km either side of Stony Creek, Oyster Point, at the northern end of Hinchinbrook Channel where the proposed Port Hinchinbrook development is located. The aim being to provide data against which future change in the seagrass habitat could be estimated. To meet this aim the Northern Fisheries Centre have:

❶ Conducted a pre-dry (winter) and pre-wet (late-spring/early-summer) season baseline surveys of seagrass distribution and abundance at Oyster Point in a area extending 1.5 km to the north and south of Stony Creek.

❷ Established a database on the biomass and species composition of seagrass meadows in the area, suitable as a baseline for a pre-dry and pre-wet season monitoring program.

❸ Developed a Geographic Information System (GIS) for map and data display and interpretation.

General Seagrass Ecology

The importance of seagrass meadows as structural components of coastal ecosystems has been recognised during the past twenty years. This has resulted in more interest in the environment being focused on the biology and ecology of seagrasses. These marine angiosperms are important for stabilising coastal sediments; providing food and shelter for diverse organisms; as a nursery ground for many prawn and fish of commercial importance; and for nutrient trapping and recycling (Larkum *et al.* 1989; Edgar and Kirkman 1989).

Seagrasses are unique amongst flowering plants in that they can live entirely immersed in seawater. Several species are found at depths of down to fifty metres (den Hartog 1977; Coles *et al.* 1995b) but tropical species are most common in less than ten metres below mean sea level (MSL) (Lee Long *et al.* 1993). Adaptation to a marine environment imposes major constraints on morphology and structure. The restriction to seawater may have also influenced their geographic distribution and speciation.

Seagrass meadows in northern Queensland play a critical ecological role as a support for commercial species of penaeid prawns and fish (Coles and Lee Long 1985; Coles *et al*. 1993; Watson *et al*. 1993). Seagrasses are also essential food for dugong, *Dugong dugon* (Miller), and green sea turtles, *Chelonia mydas* (Linnaeus) (Lanyon *et al.* 1989). Coastal seagrasses are also important nutrient and sediment sinks (Short 1987), and play important roles in maintaining sediment stability and water clarity.

The growth of seagrasses depends on several factors including the availability of light (Dennison 1987; Williams and Dennison 1990), nutrients (Orth 1977; Erftemeijer 1994) and water temperature (Bulthuis 1987). Activities that lead to a change in these factors such as turbidity from dredging or runoff from agriculture, could potentially have a negative impact on seagrass growth and distribution. Seagrasses show measurable growth responses to changes in ambient water quality conditions and can therefore be used as effective ecological indicators of environmental impact (Dennison *et al*. 1993).

Tropical seagrass meadows vary seasonally and between years (Mellors *et al*. 1993; McKenzie 1994). The potential for widespread seagrass loss has been well documented. The causes of loss can be natural such as cyclones and floods (Poiner *et al.* 1989), or due to human influences such as dredging (Onuf 1994), agricultural runoff (Preen *et al*. 1995), industrial runoff (Shepherd *et al*. 1989) or oil spills (Jackson *et al.* 1989).

Destruction or loss of seagrasses has been reported from most parts of the world, often from natural causes, eg "wasting disease" (den Hartog 1987), or high energy storms (Patriquin 1975; Poiner *et al.* 1989). More commonly destruction has resulted from human activities, eg. as a consequence of eutrophication (Bulthuis 1983; Orth and Moore 1983; Cambridge and McComb 1984) or land reclamation and changes in land use (Kemp *et al.* 1983). Anthropogenic impacts on seagrass meadows are continuing to destroy or degrade coastal ecosystems and decrease their yield of natural resources (Walker 1989).

It is important to document seagrass species diversity and distribution and to identify areas requiring conservation measures to prevent significant areas and species being lost.

Hinchinbrook Channel & Oyster Pt Seagrasses

In 1987 Coles *et al.* (1992) surveyed substantial seagrass meadows in the Hinchinbrook Channel and identified 6 different species. Seagrass meadows in the entire channel (Lucinda Point - George Point in the south, to Meunga Creek - Hectare Point in the north) were estimated to cover 14.57 km^2 (Lee Long *et al.* 1993). They supported high densities of juvenile penaeid prawns and were considered important in sustaining fisheries stocks in the region (Coles *et al.* 1992).

In 1993 an aerial survey (altitude 400 ft) was conducted between Mission Beach and Bowen (including Hinchinbrook Channel) by Jane Mellors (Department of Tropical Environmental Studies and Geography, James Cook University) to determine the presence and extent of seagrass meadows in the region. Mellors (pers. comm.) reported extensive meadows along the banks of Cardwell and Hinchinbrook Channel. She reported extensive feeding by dugongs. The survey provided an index of the relative importance of intertidal meadows as dugong feeding grounds, based on density of feeding trails, with Cardwell - Hinchinbrook rating as the most important within the region extending from Mission Beach in the north to Edgecumbe Bay (Bowen) in the south. Feeding trails in the vicinity of Cardwell jetty were seen in August 1996 (Graeme Inglis, TESAG, JCU, pers. comm.)

On the 11th of March 1994, Tony Preen (TESAG, JCU, pers. comm.) surveyed 9 transects (a total of 23 sites) in Hinchinbrook Channel. Transects were perpendicular to Oyster Point, Cardwell and Meunga Creek, and were approximately 200 to 300 m in length. Preen reported that seagrass covered approximately two thirds of the transects, and that *Halophila ovalis* and *Halodule uninervis* were the predominant species.

The Queensland Department of Primary Industries conducted a reconnaissance survey of seagrass habitats along approximately 6 km of shore, centred on the access channel of the proposed Port Hinchinbrook development, Oyster Point, on the 27 - 29 September 1994 (Coles *et al.* 1995a). The regional importance of seagrasses in the area was confirmed. The report also recommended that the taxonomy of the plant specimens identified as *Halophila tricostata* required further investigation. Results of that survey established the extent of seagrasses in the area.

The present study addresses a need for quantitative data on the seagrasses at this site. The 1994 survey provided only information on presence/absence and not on biomass. It was intended to demonstrate whether or not seagrass distribution in the region were extensive enough to warrant further investigation. The maps presented were only of seagrass area with a qualitative percent cover estimate. The ecological importance of the seagrass is dependent on both the area and the abundance or biomass. An area of seagrass may remain the same between years with vastly different biomasses and species ,effecting its value as a food source and its contribution as habitat for other plants and animals.

The present study provides the required baseline data set from which measurements can be made to determine the extent of changes in area and biomass of the seagrasses. It is a study (one spring; one winter) designed to measure seagrass in an environment where seagrass distribution and abundance are likely to be naturally variable.

METHODS

Site description

The Oyster Point site is at the northern end of the Hinchinbrook Channel, between Hinchinbrook Island and the mainland coast (Figure 1). The Hinchinbrook region includes Hinchinbrook Channel, all coastal lands, islands and State waters within the Cardwell and Hinchinbrook shires. Two catchments drain into this region. The Tully and Herbert Rivers drain agricultural catchments (predominantly sugar cane and pasture) into the northern and southern Hinchinbrook Channel, respectively.

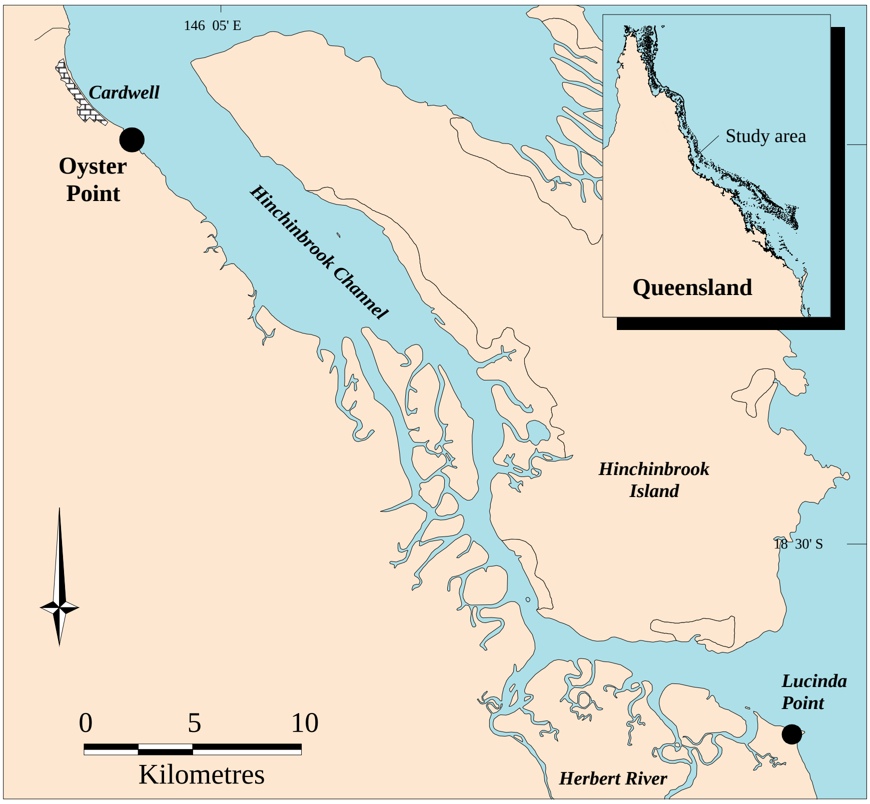

Figure 1. Location of Oyster Point study area.

Hinchinbrook Channel is approximately 4 km wide and up to 20 m deep near Oyster Point. Mangrove and *Melaleuca* wetlands and dry sclerophyll woodlands form a major part of the vegetation of the landward margin of the channel. Average annual rainfall for the Cardwell area is 2129 mm, of which 1450 mm falls from January to March (Director of Survey, Department of Defence, Canberra). The only urban coastal developments adjacent to the channel are Cardwell and a small township at Dungeness. There is a prawn farm (>20 ha) and a barramundi farm operating south of Oyster Point. Other aquaculture developments are planned further south in the Channel.

The Port Hinchinbrook development is proposed at Oyster Point. It is a resort complex involving construction of a marina, access channel, and associated dredging. This proposed development is adjacent to the survey site.

Survey Methods

The sampling approach was based on the need to monitor changes in the abundance of the major seagrass species. We obtained an estimate of the population mean and variance of seagrass biomass for each species on which to base tests for change. The survey area extended 2 km either side of Stony Creek. Survey sites were sampled at least every 20 m along transects. Transects were at least 100 m apart, within an area extending 1 km either side of Stony Creek, and then every 500 m. Transects were marked on the shoreward edge by fixed markers (Map 1). Sampling density was greatest in the vicinity of Oyster Point. Sampling was conducted during late spring (13 - 15 November 1995) and winter (4 - 7 August 1996). Estimates of above-ground seagrass biomass (3 replicates of a 0.25 m^2 quadrat), seagrass species composition, % cover of algae and sediment characteristics were recorded at each survey site. The relative proportion of each seagrass species within each survey quadrat was also recorded.

Above-ground biomass was determined by a "visual estimates of biomass" technique described by Mellors (1991). At each site, divers recorded an estimated rank of seagrass biomass. At times of low visibility an illuminated underwater seagrass viewer was used to aid divers (Appendix 1, Figure 4). To calculate above-ground biomass estimates, each diver's rank of seagrass biomass was calibrated against a set of quadrats which were harvested and the above-ground dry biomass per metre measured (g dry wt. m^{-2}).

Seagrass species were identified according to Kuo and McComb (1989). Specimens of seagrass were collected for later taxonomic verification where necessary.

Sediment characteristics were described using visual estimates of grain size: shell grit, rock gravel, coarse sand, sand, fine sand and mud.

A differential Global Positioning System (GPS) was used to accurately determine geographic location of survey sites (±1.5 m). The inner boundaries of some meadows were accurately mapped at low tide with a GPS. Depths of survey sites were recorded with a depth sounder standardised to depth below Mean Sea Level (MSL), corrected to tidal plane datum (Queensland Department of Transport 1995).

Geographic Information System

All data from each survey were entered onto a Geographic Information System (GIS). A GIS base map using aerial photographic images (courtesy Beach Protection Authority, 1/8/91, altitude 1830 m) was rectified to AMG zone 55 co-ordinates.

Boundaries of seagrass meadows were determined based on the GPS fix at each survey site, and where available on information from aerial photograph interpretation. Errors which should be considered when interpreting GIS maps include those associated with digitising and rectifying aerial photographs onto basemaps and GPS fixes for survey sites. The error in determining the area of seagrass was set at ±10 m either side of the meadow edge and was based on the distance between survey sites. Other errors associated with mapping, such as GPS and position of diver under the vessel, were assumed to be embedded within this range.

Analysis

Standard parametric tests were used for analysis of data (Sokal and Rohlf 1987). All divers had significant linear regressions and r^2 >0.85 when calibrating above-ground biomass estimates against a set of harvested quadrats (Appendix 1). We used a measure of precision to test that the seagrass biomass data was adequate as a baseline from which a monitoring program could be established to measure change. Precision is a function of the Standard Error (SE) of a sample and the measure of precision used in this study was the ratio of the standard error to the mean ($SE/\bar{x}$). The level of precision which field programs usually aim for is 0.1 to no more then 0.2 (Downing and Anderson 1985; Thresher and Gunn 1986).

MAP 1.

Location of Oyster Point survey area and sampling sites - November 1995.

Legend

- *Seagrass*
- *No seagrass*
- *Transect origins*
- *Depth below MSL (m)*

Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

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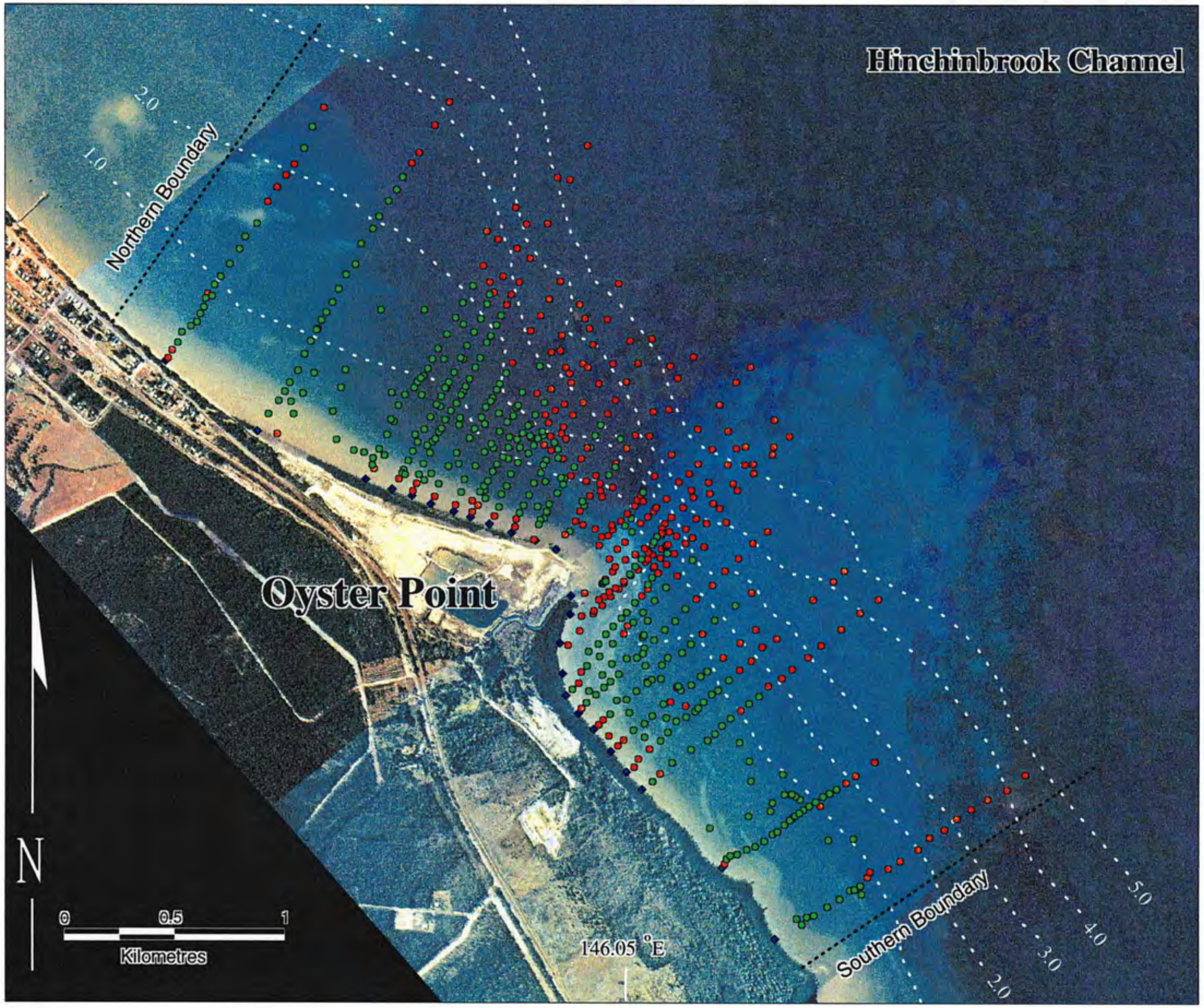

MAP 2.

Location of Oyster Point survey area and sampling sites - August 1996.

Legend

- *Seagrass*
- *No seagrass*
- *Transect origins*
- *Depth below MSL (m)*

Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 4 - 7th August 1996.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

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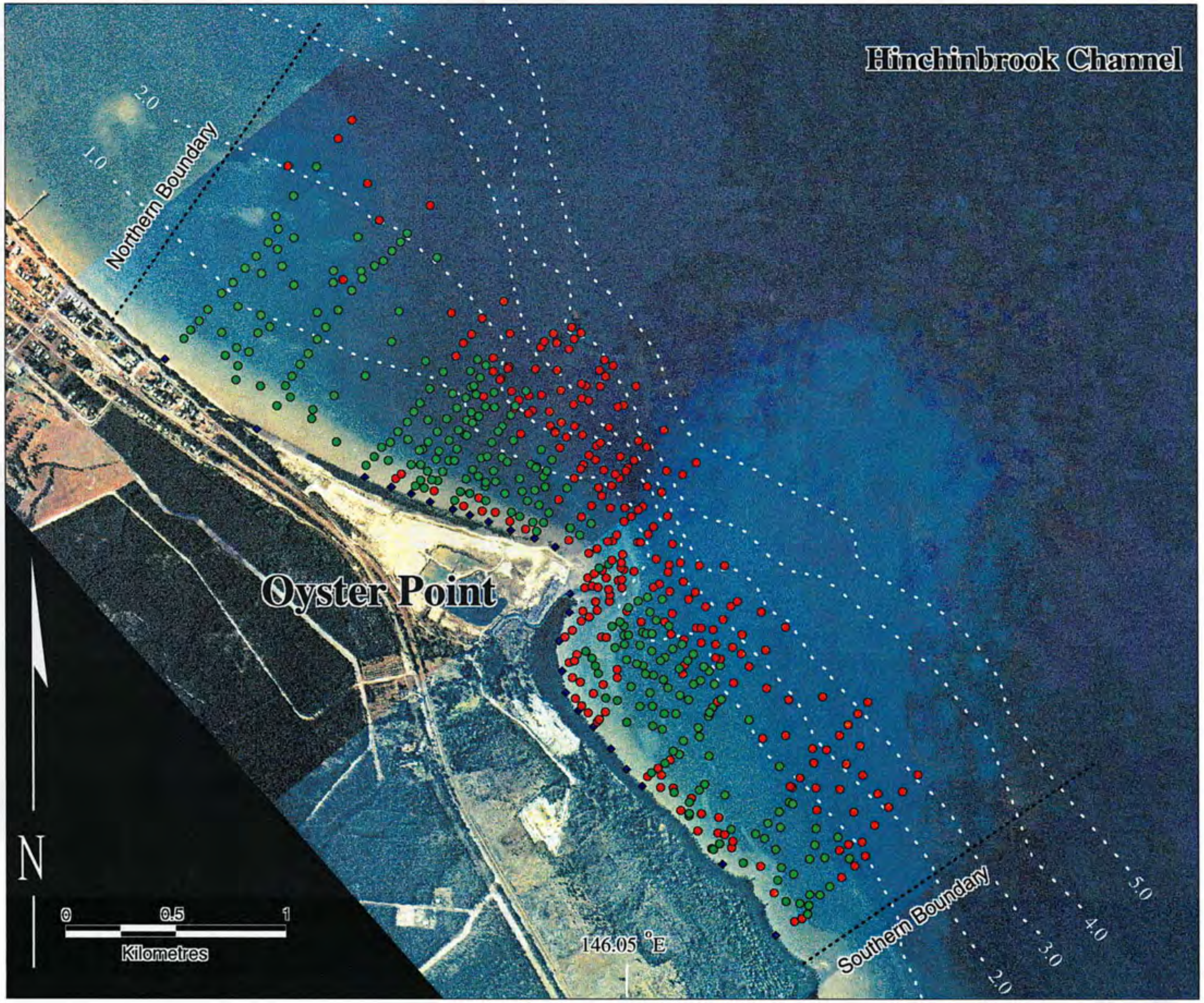

RESULTS

Seagrass species, distribution and abundance

Six species of seagrasses (from two families) were identified in the survey area. *Halophila spinulosa* was absent in winter (August) 1996:

Family HYDROCHARITACEAE Jussieu:
Halophila ovalis (Br.) D.J. Hook
Halophila decipiens Ostenfeld
Halophila tricostata Greenway
Halophila spinulosa (R.Br.) Aschers. In Neumayer

Family CYMODOCEACEAE Taylor
Halodule uninervis (wide & thin leaf) (Forsk.) Aschers*
Halodule pinifolia (Miki) den Hartog

* *wide leaf morph present only in late-spring (November)1995.*

Seagrass was present at 349 (56%) of the 626 sites surveyed in November 1995 (Map 1), and 269 (51%) of the 522 sites in August 1996 (Map 2). Seagrass habitats at Oyster Point decreased in area by approximately 17% from 285 ±16 ha in November 1995 (Map 3) to 243 ±13 ha in August 1996 (Map 4).

Mean above-ground biomass of the Oyster Point seagrass habitat (all species and meadows pooled) decreased by more than fourfold, from 5.46 ±0.13 g DW m^{-2} in November 1995 to 1.21 ±0.04 g DW m^{-2} in August 1996.

Oyster Point seagrass habitats were dominated mainly by *Halophila ovalis.* Other seagrass species (eg. *Halophila tricostata*) were only patchily distributed within the survey area (Maps 5 to 16). *Halophila ovalis* was present in approximately 70 % of the total area of seagrass mapped in November and 87 % in August (Table 1, Maps 11 & 12). *Halophila ovalis* also had one of the highest above-ground seagrass biomass on average, second to *Halodule pinifolia* (Table 1). *Halodule uninervis* (wide), *Halophila tricostata* and *Halophila decipiens* had the lowest mean biomasses (Figure 2).

Halophila ovalis *Halodule uninervis* (thin) - habitat

A reduction in both abundance and distribution of *Halodule pinifolia* and *Halophila decipiens* since spring 1995 was observed (Table 1, Maps 5, 6, 9 & 10). Above-ground biomasses for all other species were significantly lower in August 1996 than November 1995 (Figure 2). As no biomass measures were taken in the 1994 reconnaissance survey, quantitative comparisons are not possible for above-ground biomass (Coles *et al* 1995a).

Table 1. Frequency of occurrence and mean above-ground biomass of each species within their respective areas of distribution at Oyster Point during November 1995 and August 1996.

Species	November 1995				August 1996			
	# sites present	Mean (±SE) (g DW m)	Precision	Distribution (ha)	# sites present	Mean (±SE) (g DW m)	Precision	Distribution (ha)
Halodule pinifolia	26	5.39 ±0.67	0.12	8 ±3.3	1	1.48 ±0.16	0.11	0.09 ±0.14
Halodule uninervis (thin)	52	3.56 ±0.20	0.06	20.3 ±5.1	73	1.41 ±0.10	0.07	42.2 ±8.86
Halodule uninervis (wide)	4	0.79 ±0.19	0.24	1.0 ±0.6	-	-	-	
Halophila decipiens	79	3.95 ±0.28	0.07	73.8 ±8.8	7	0.34 ± 0.06	0.17	11.1 ±1.94
Halophila ovalis	267	4.73 ±0.14	0.03	199.3 ±14.4	224	2.07 ±0.10	0.05	210.9 ±11.5
Halophila spinulosa	1	0.32 ±0.16	0.5	0.20 ±0.02	-	-	-	
Halophila tricostata	11	2.76 ±0.71	0.25	3.2 ±1.4	3	0.35 ±0.01	0.03	3.05 ±1.16

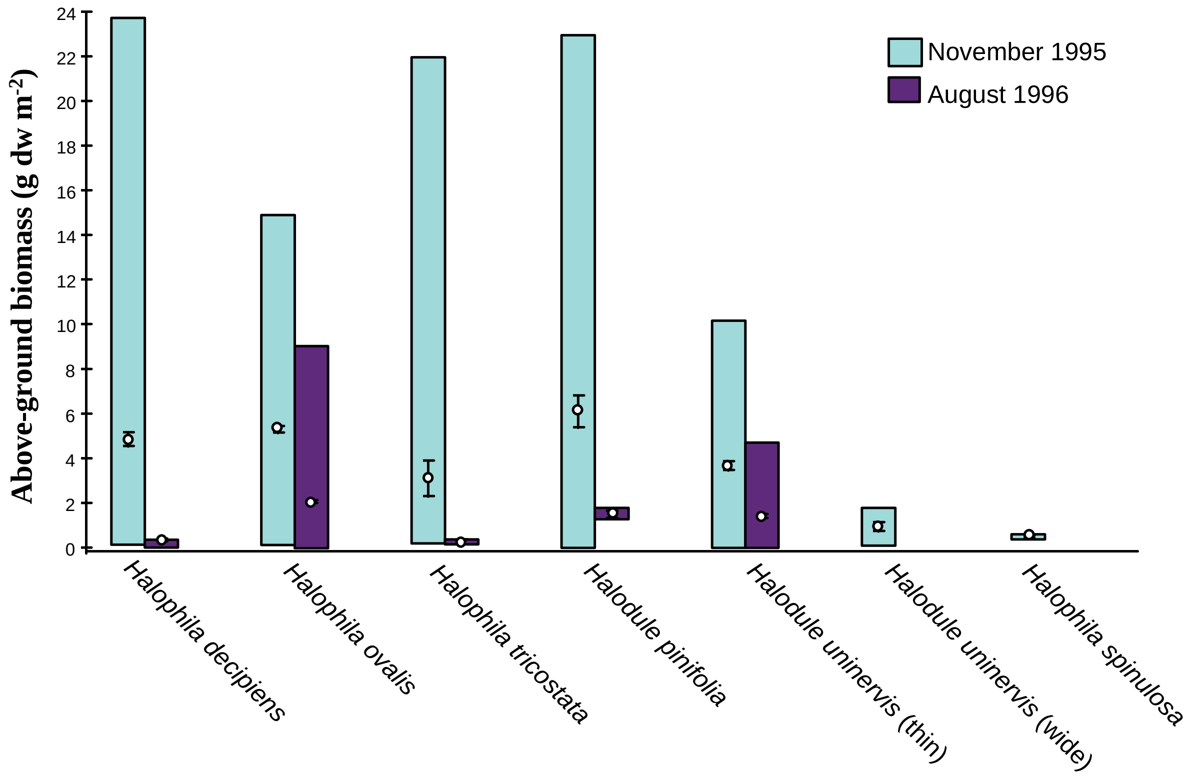

Figure 2. Mean and range of above-ground biomass for each seagrass species (when present in a quadrat) in the survey area (all sites pooled) in late-spring (November) 1995 and winter (August) 1996.

Seagrass depth distribution

Most seagrass species found during the surveys were not restricted to distinct depth zones (Figure 3). In November 1995 and August 1996, bands (approximately 100 and 170 m wide, respectively) of predominantly *Halodule uninervis* (thin) were located on the shoreward margin of intertidal mud banks, up to 0.1 m below MSL. A feature of the topography of the inshore region at this location is these shallow mud banks, approximately 100-200 m wide, exposed at only very low tides. Immediately deeper and seaward of this was a wide (750 m on the north side of Oyster Point and 450 m on the south) zone of mainly *Halophila ovalis*. *Halophila ovalis* had the widest depth distribution range of all species found with a maximum depth of 4.3 m in both surveys and a minimum of 0.5 m and 0.1 m below MSL in November 1995 and August 1996, respectively. *Halophila decipiens* and *Halophila tricostata*, (Maps 9, 10, 13 & 14) were found mainly at the deeper sites during both surveys (Figure 3). No seagrass was found deeper than 4.3 m below MSL during either survey, a distribution probably related to turbidity inhibiting light for growth during winter and spring. *Halodule pinifolia* had the most restricted depth distribution in August 1996, however in spring 1995 *Halophila spinulosa* and *H. tricostata* were the most restricted.

Seagrass occurred in fine-mud or mud/sand/shell substrates. Adjacent to and seaward of the seagrass, in deeper water, was a zone of sea-pens. Beyond this zone was bare mud/coarse sand with shell.

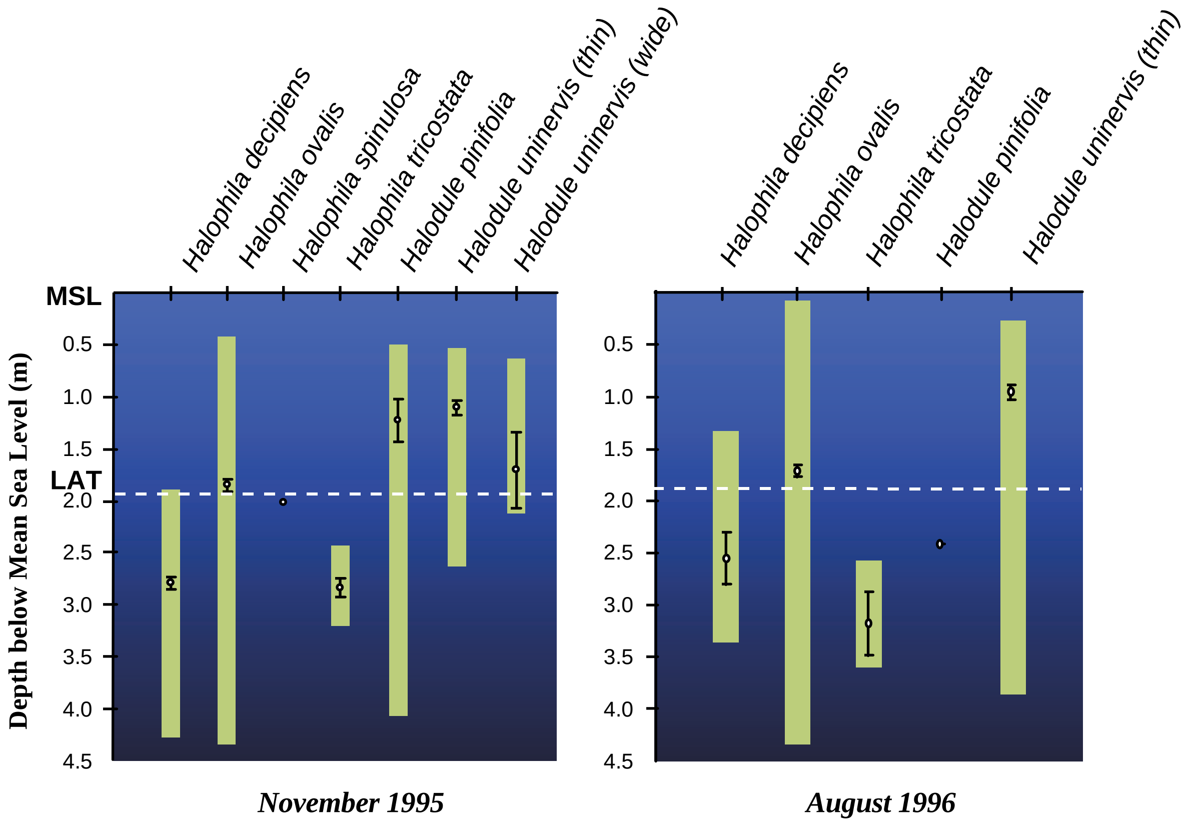

Figure 3 Means, standard errors and ranges of depth of occurrence for each seagrass species of Oyster Point (MSL = Mean Sea Level, LAT = Lowest Astronomical Tide).

Baseline data and future monitoring

The fine resolution of the survey allows us to develop baseline data sets for biomass and presence for each seagrass species where it occurs in the survey area. Measures of precision (above-ground biomass) for the common seagrass species, within their areas of distribution, were all <0.2 (Table 1). This resolution will allow future monitoring to focus on particular species, rather than at the coarser community or meadow level.

MAP 3.

Oyster Point seagrass distribution
- November 1995.

Legend

Seagrass

Depth below MSL (m)

Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrasses at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

Funded by the Department of Economic Development & Trade and the Queensland Department of Primary Industries.

Produced by the Seagrass Ecology Group, QDPI, Northern Fisheries Centre, Cairns, 1997.

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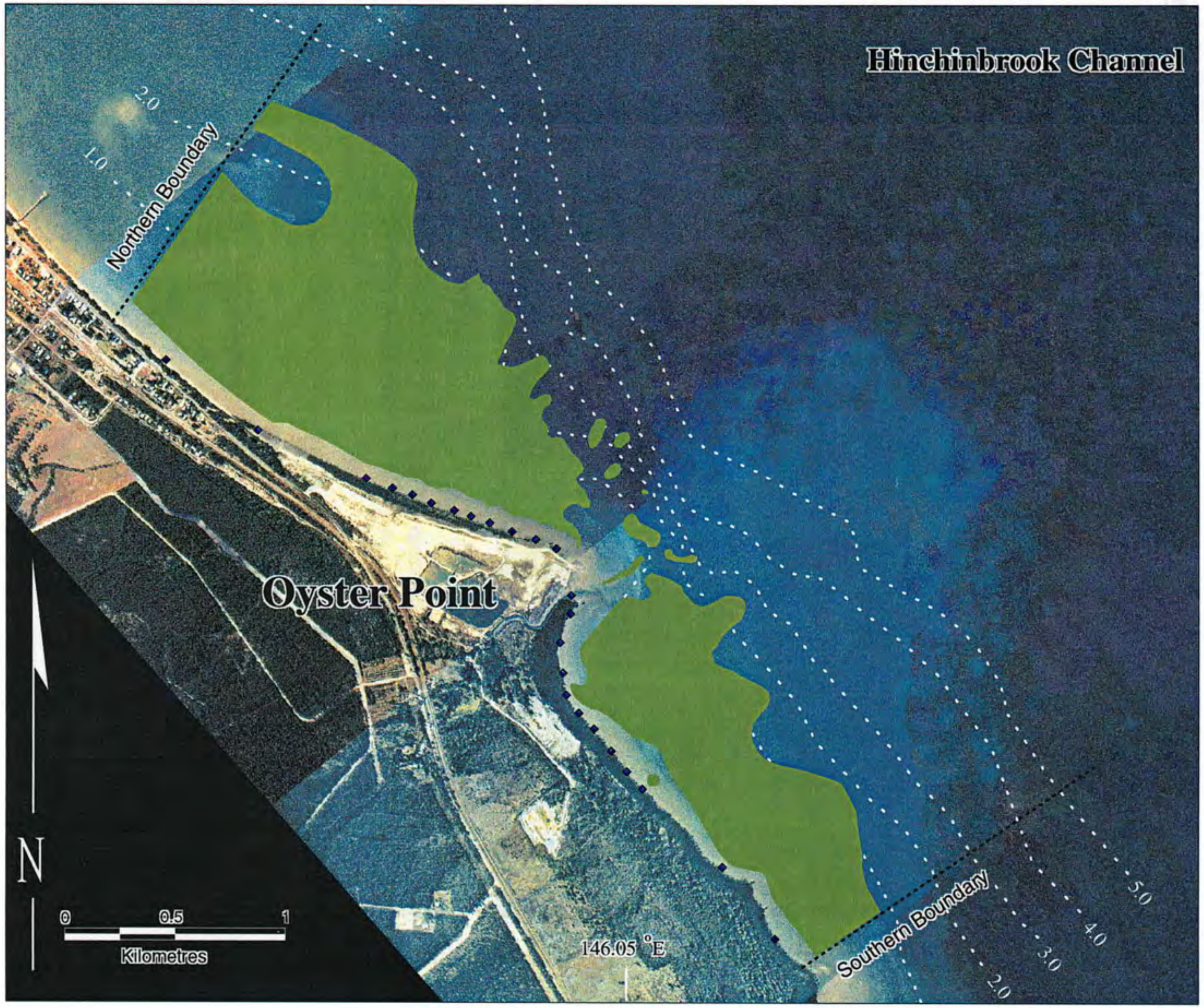


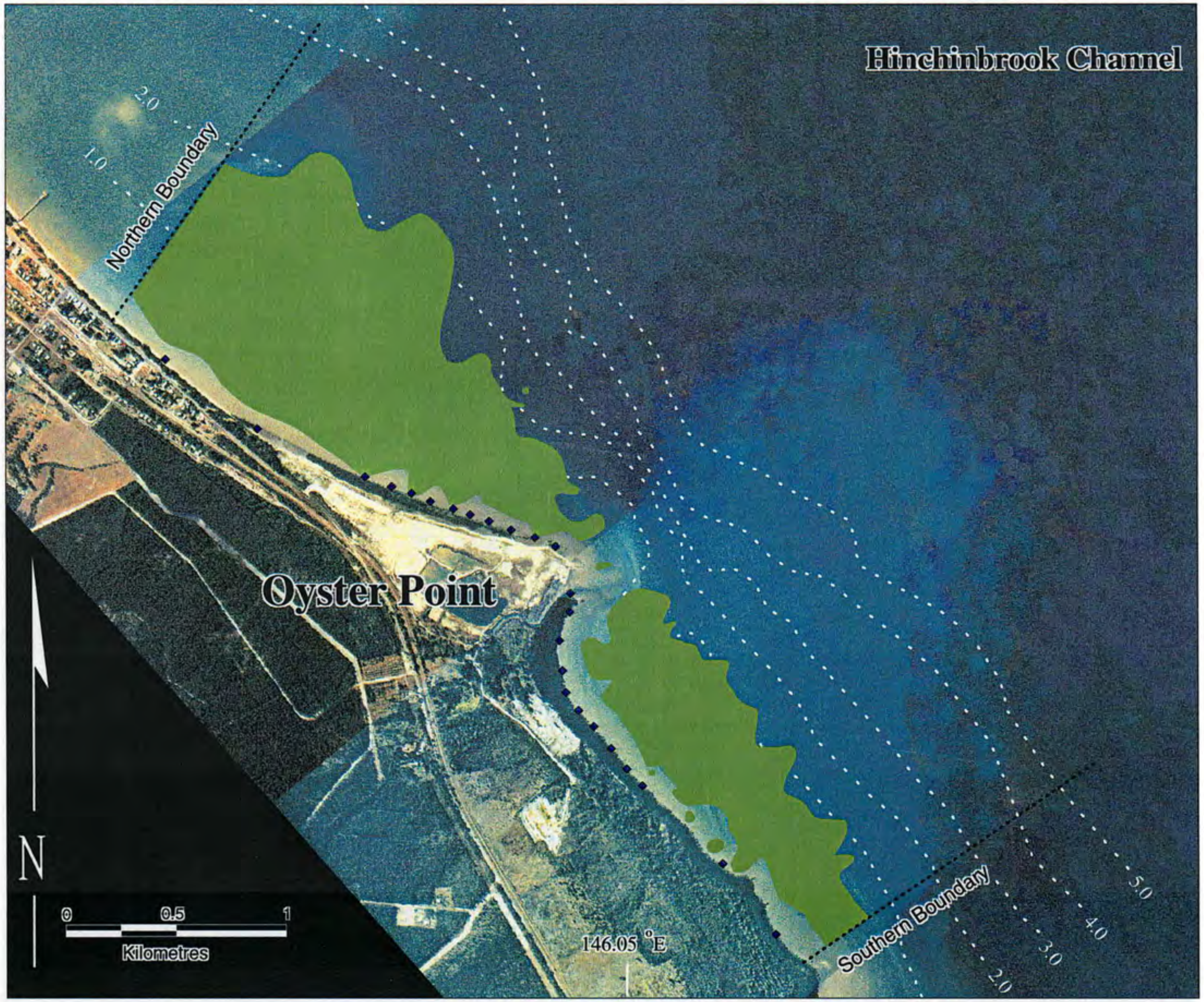
MAP 4.

Oyster Point seagrass distribution - August 1996.

Legend

Seagrass

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrasses at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 4 - 7th August 1996.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

Funded by the Department of Economic Development & Trade and the Queensland Department of Primary Industries.

Produced by the Seagrass Ecology Group, QDPI, Northern Fisheries Centre, Cairns, 1997.

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MAP 5.

Distribution of *Halodule pinifolia*
Oyster Point - November 1995.

Legend

Halodule pinifolia

Depth below MSL (m)

Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrasses at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

Funded by the Department of Economic Development & Trade and the Queensland Department of Primary Industries.

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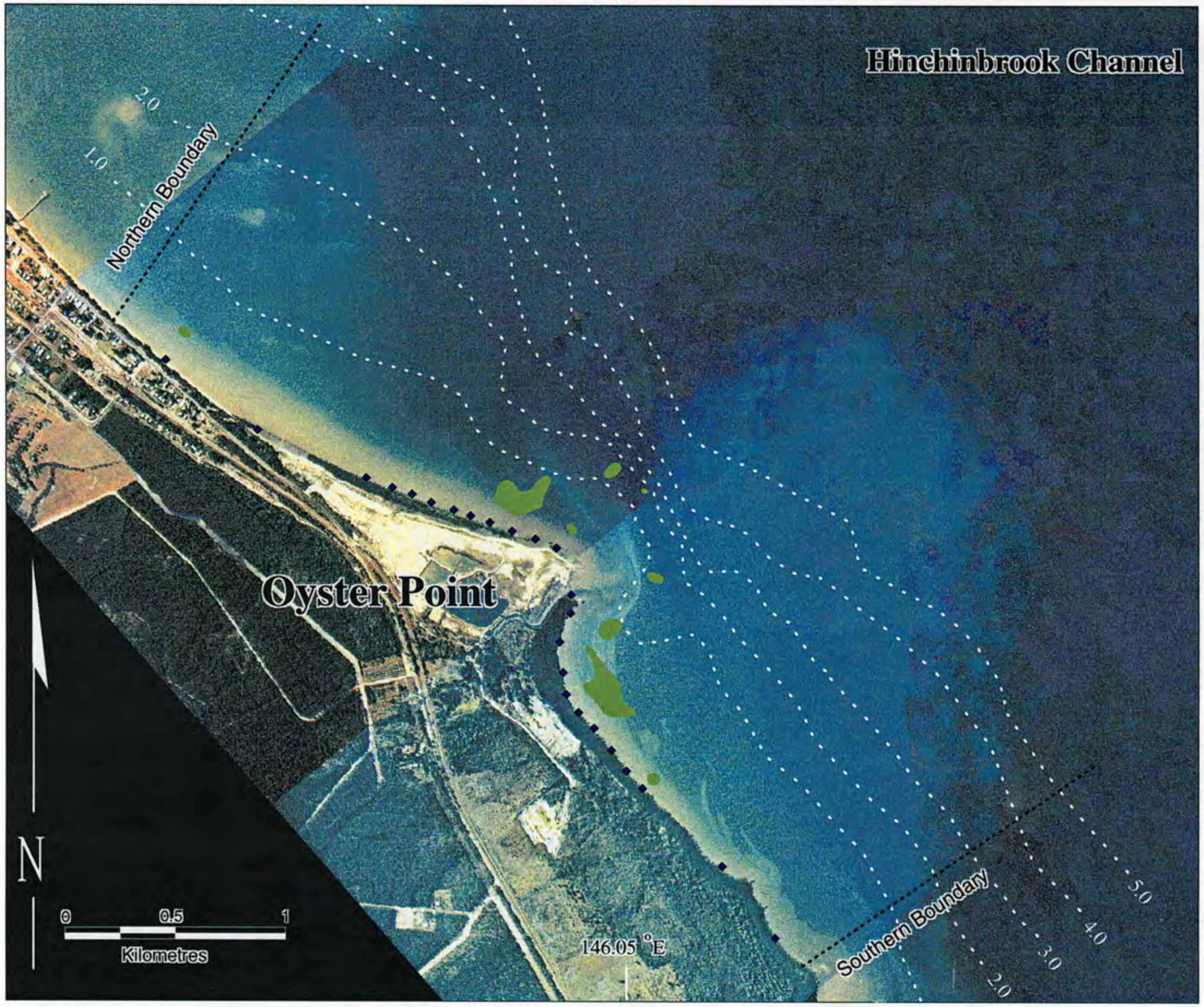


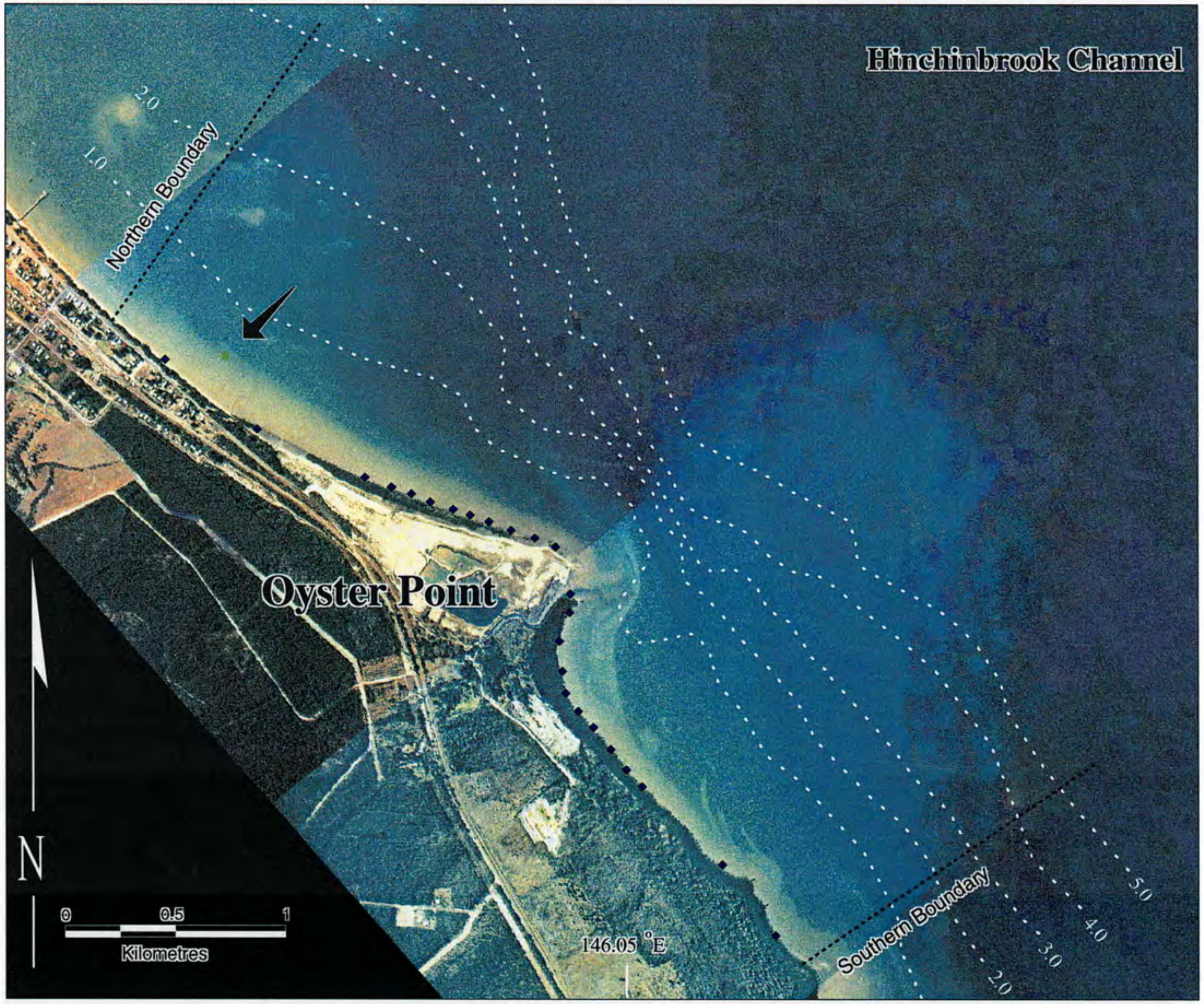
MAP 6.

Distribution of *Halodule pinifolia* Oyster Point - August 1996.

Legend

Halodule pinifolia

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrasses at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 4 - 7th August 1996.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

Funded by the Department of Economic Development & Trade and the Queensland Department of Primary Industries.

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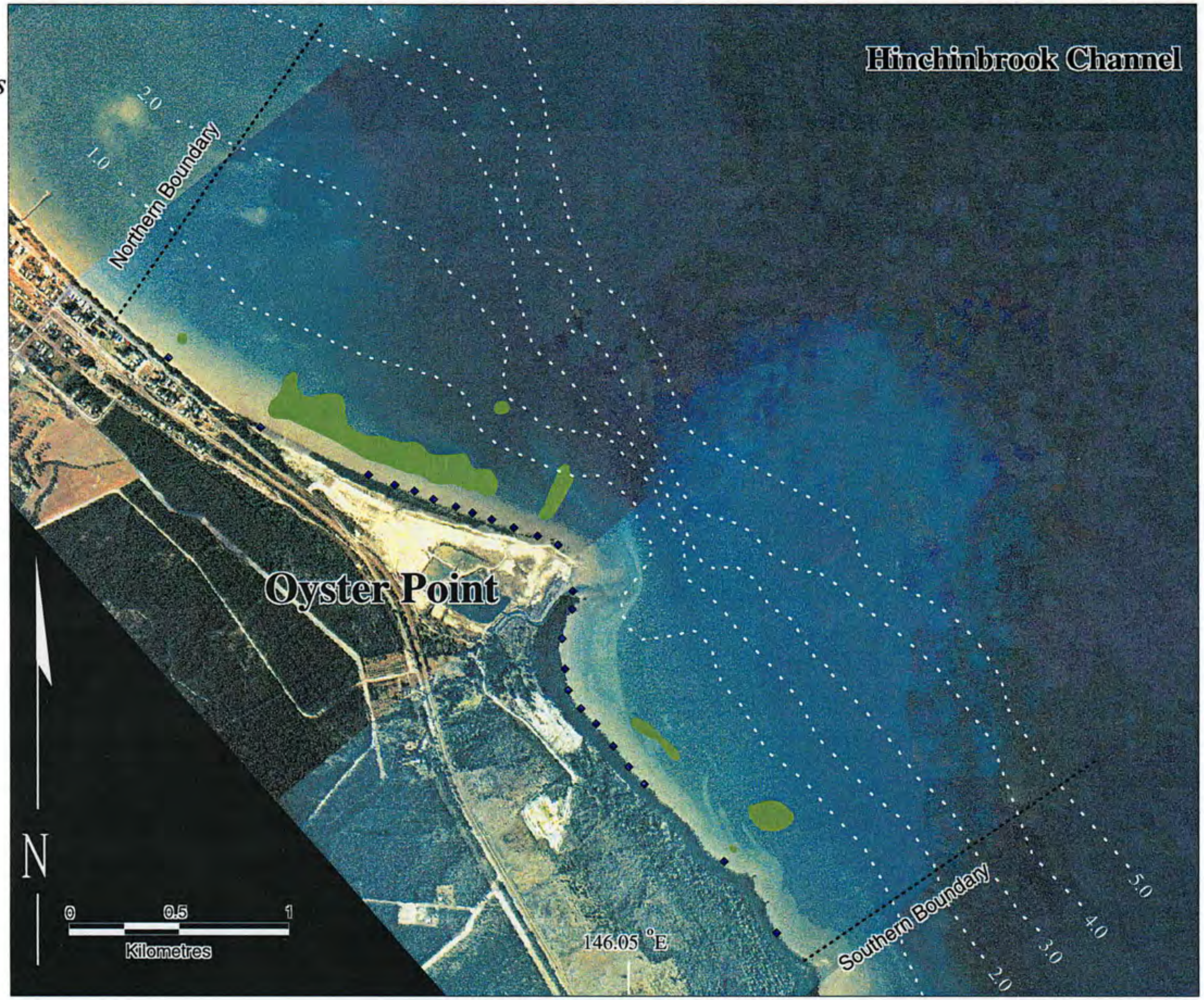
MAP 7.

Distribution of *Halodule uninervis* (thin), Oyster Point - November 1995.

Legend

Halodule uninervis (thin)

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrasses at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

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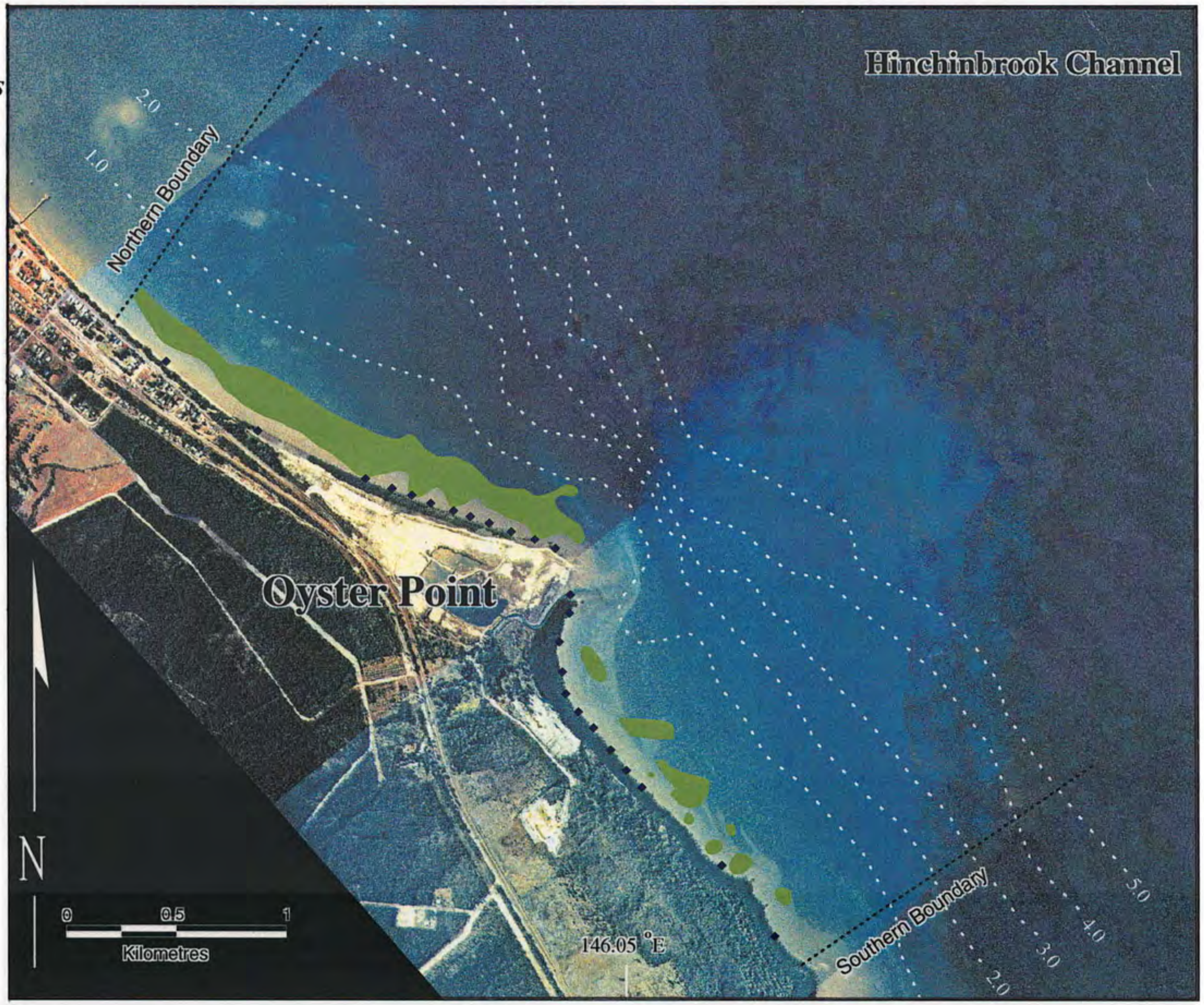
MAP 8.

Distribution of *Halodule uninervis* (thin), Oyster Point - August 1996.

Legend

Halodule uninervis (thin)

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 4 - 7th August 1996.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

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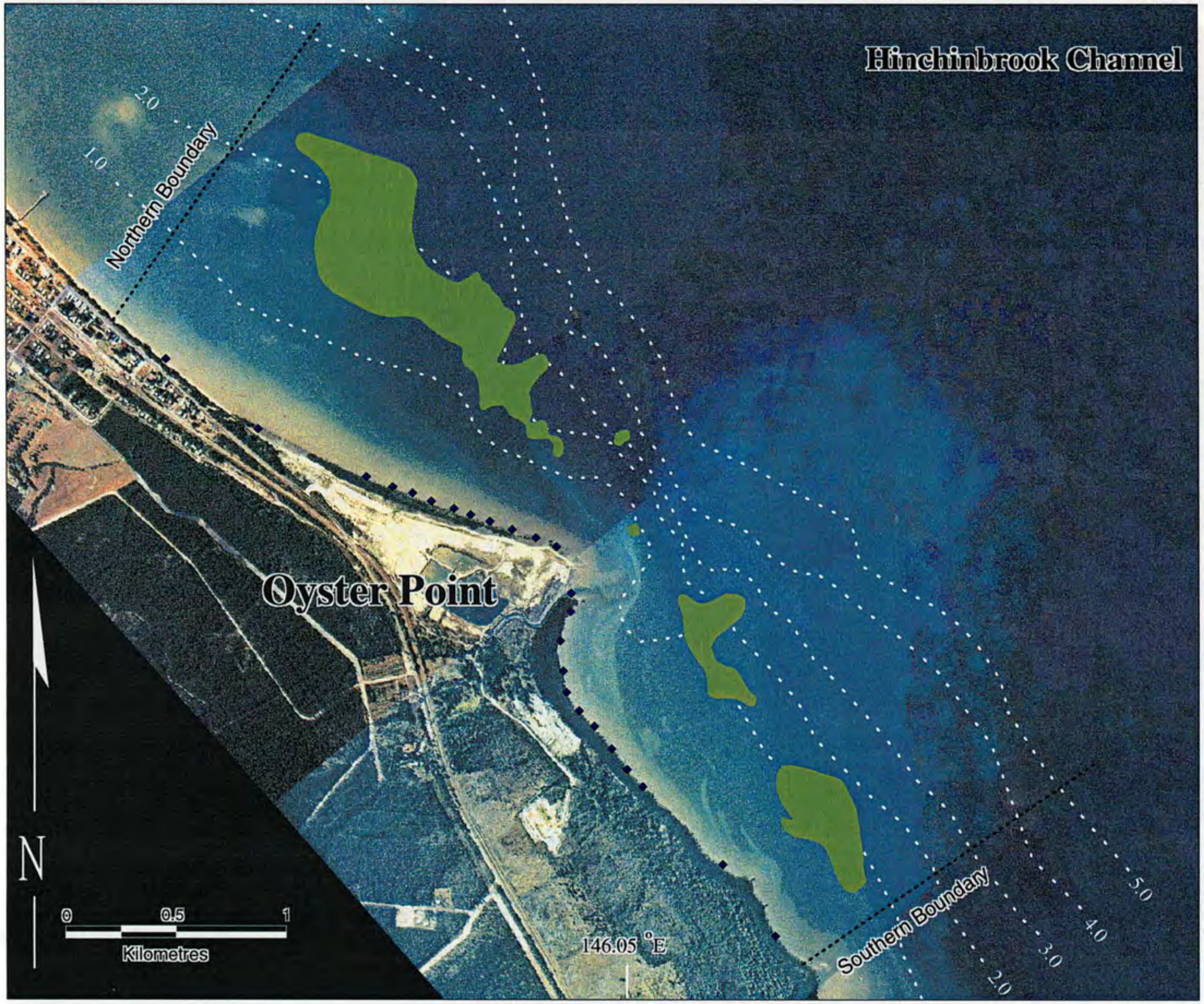
MAP 9.

Distribution of *Halophila decipiens*
Oyster Point - November 1995.

Legend

Halophila decipiens

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

Funded by the Department of Economic Development & Trade and the Queensland Department of Primary Industries.

Produced by the Seagrass Ecology Group, QDPI, Northern Fisheries Centre, Cairns, 1997.

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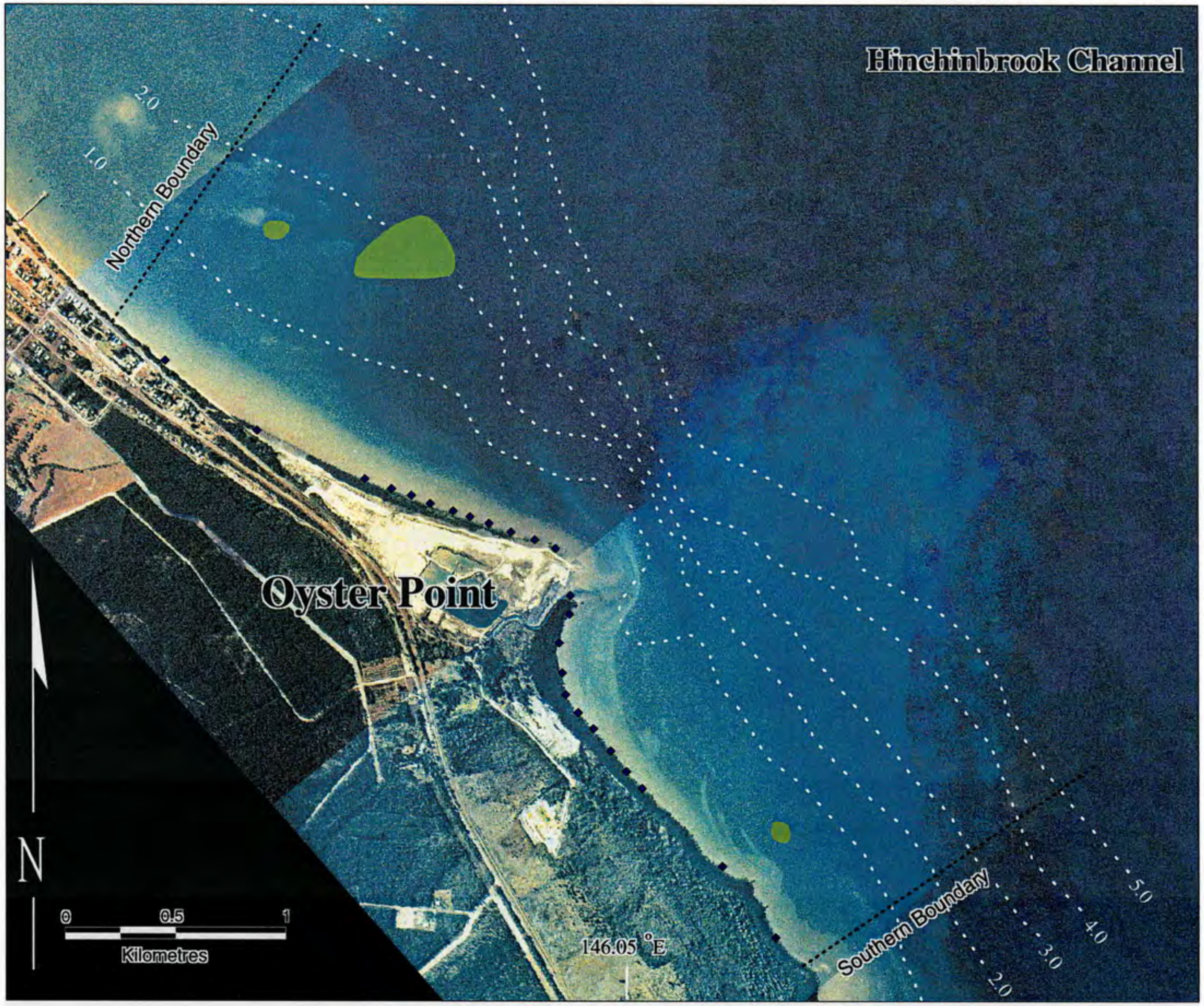
MAP 10.

Distribution of *Halophila decipiens*
Oyster Point - August 1996.

Legend

Halophila decipiens

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 4 - 7th August 1996.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

Funded by the Department of Economic Development & Trade and the Queensland Department of Primary Industries.

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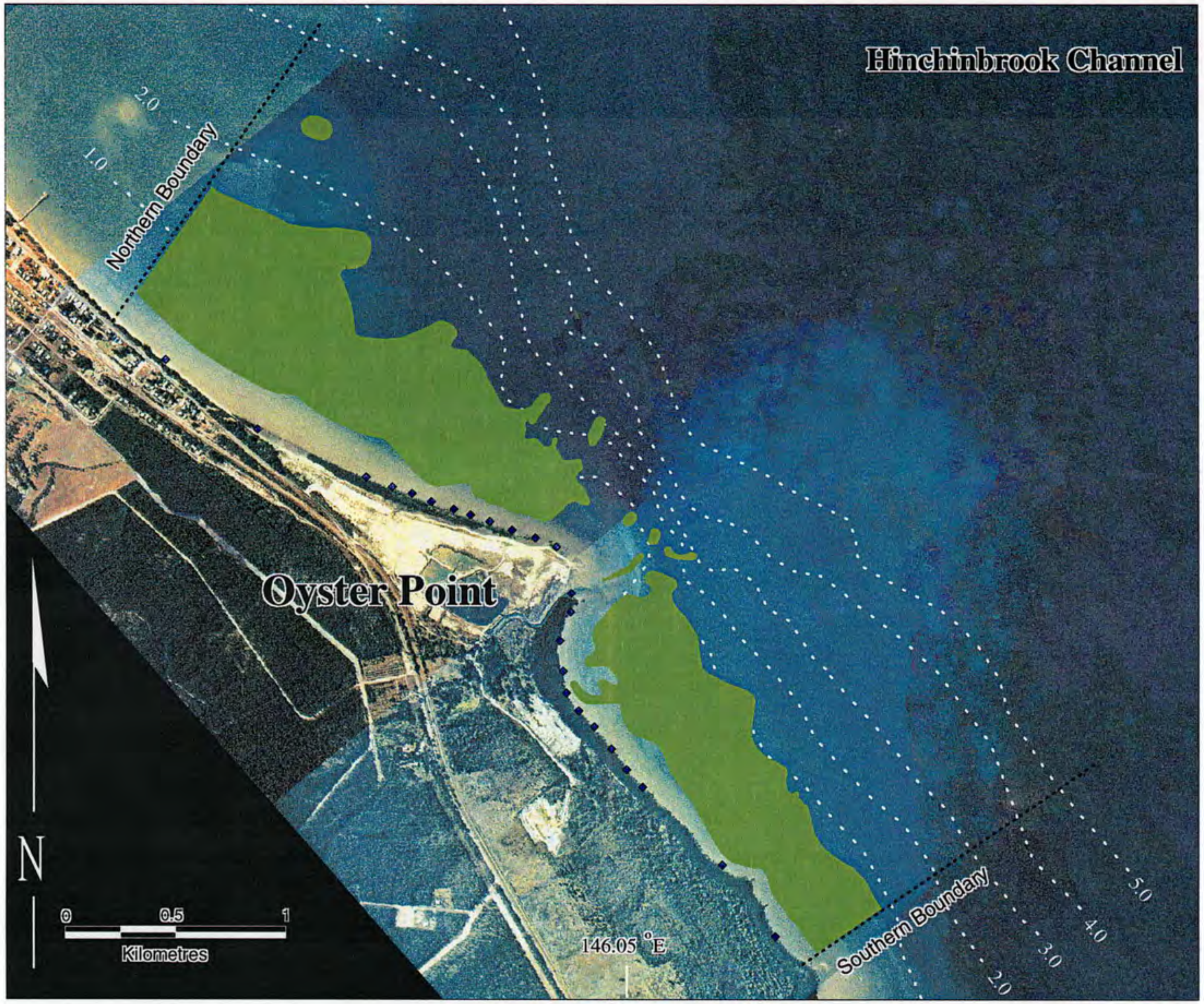
MAP 11.

Distribution of *Halophila ovalis*
Oyster Point - November 1995.

Legend

Halophila ovalis

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

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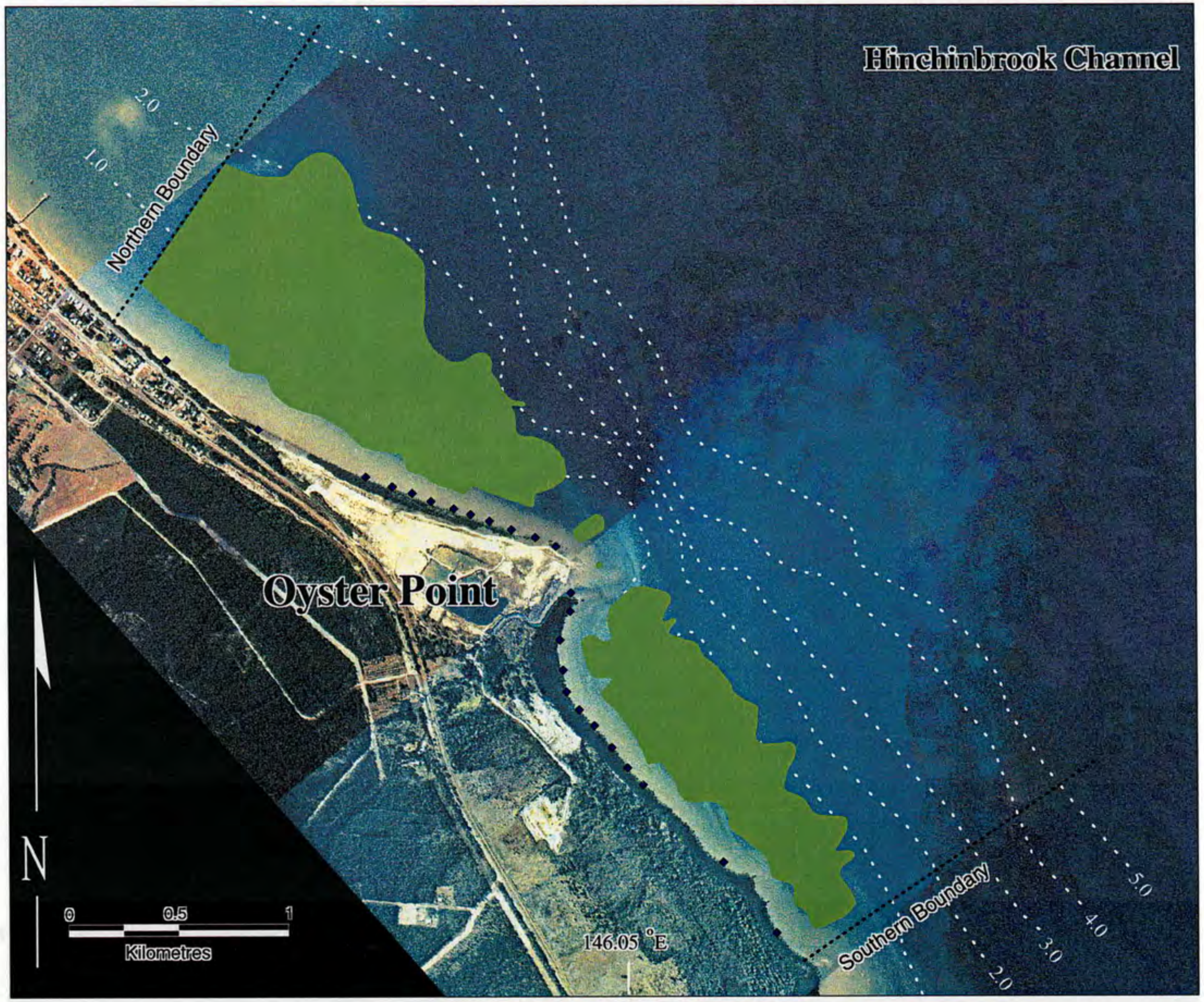
MAP 12.

Distribution of *Halophila ovalis*
Oyster Point - August 1996.

Legend

Halophila ovalis

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

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MAP 13.

Distribution of *Halophila tricostata*
Oyster Point - November 1995.

Legend

Halophila tricostata

Depth below MSL (m)

Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

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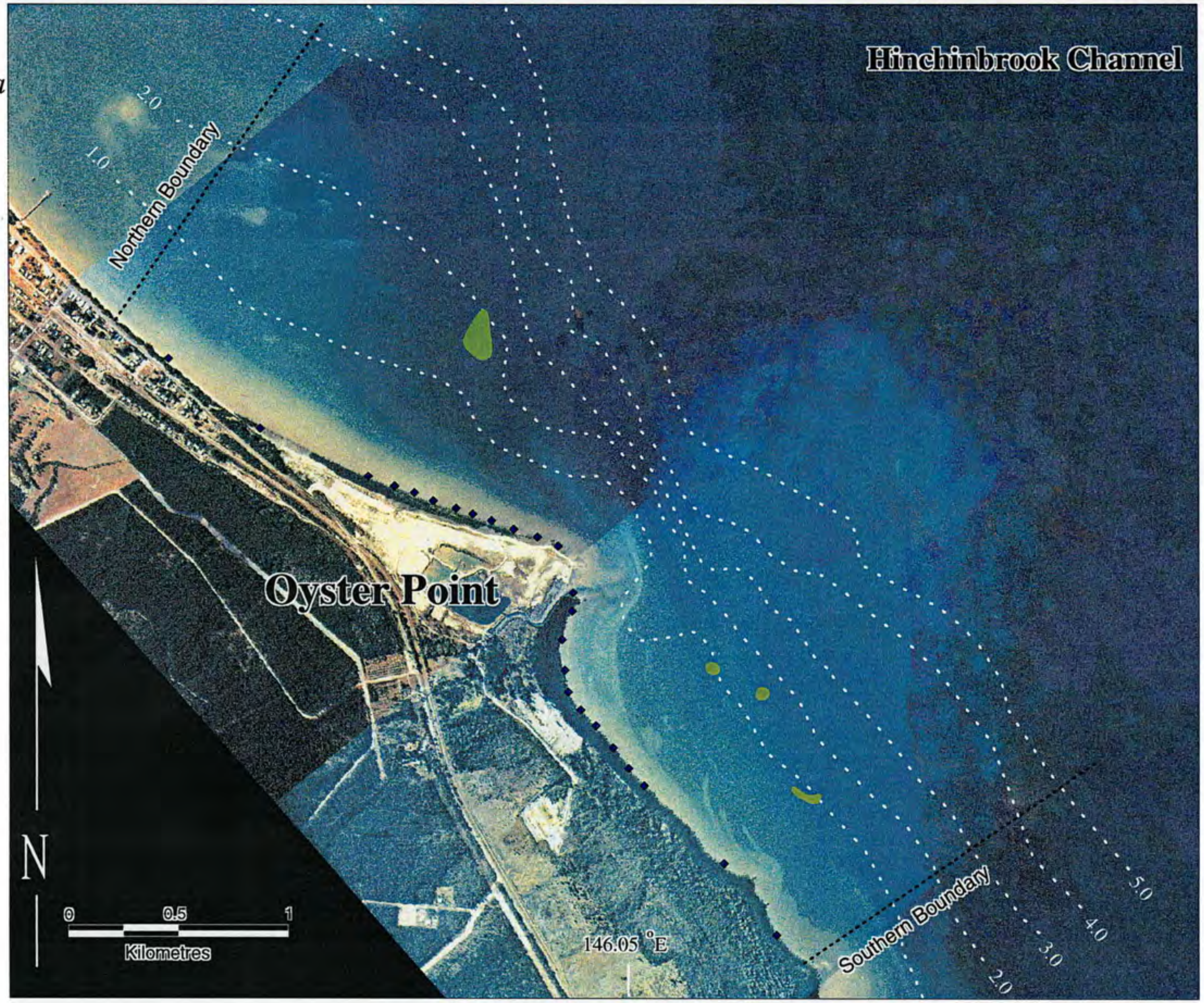

MAP 14.

Distribution of *Halophila tricostata*
Oyster Point - August 1996.

Legend

Halophila tricostata

Depth below MSL (m)

Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 4 - 7th August 1996.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

Funded by the Department of Economic Development & Trade and the Queensland Department of Primary Industries.

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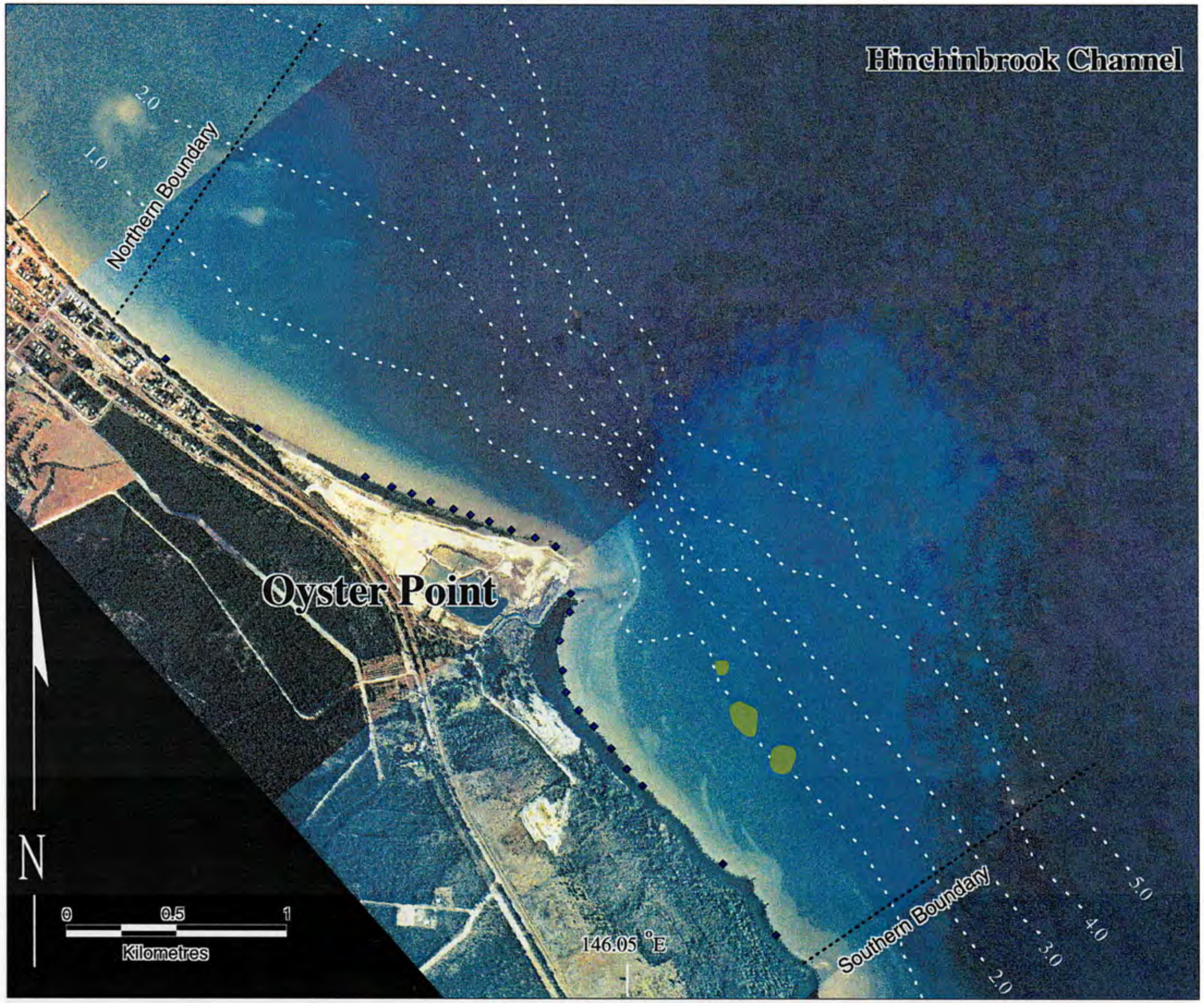


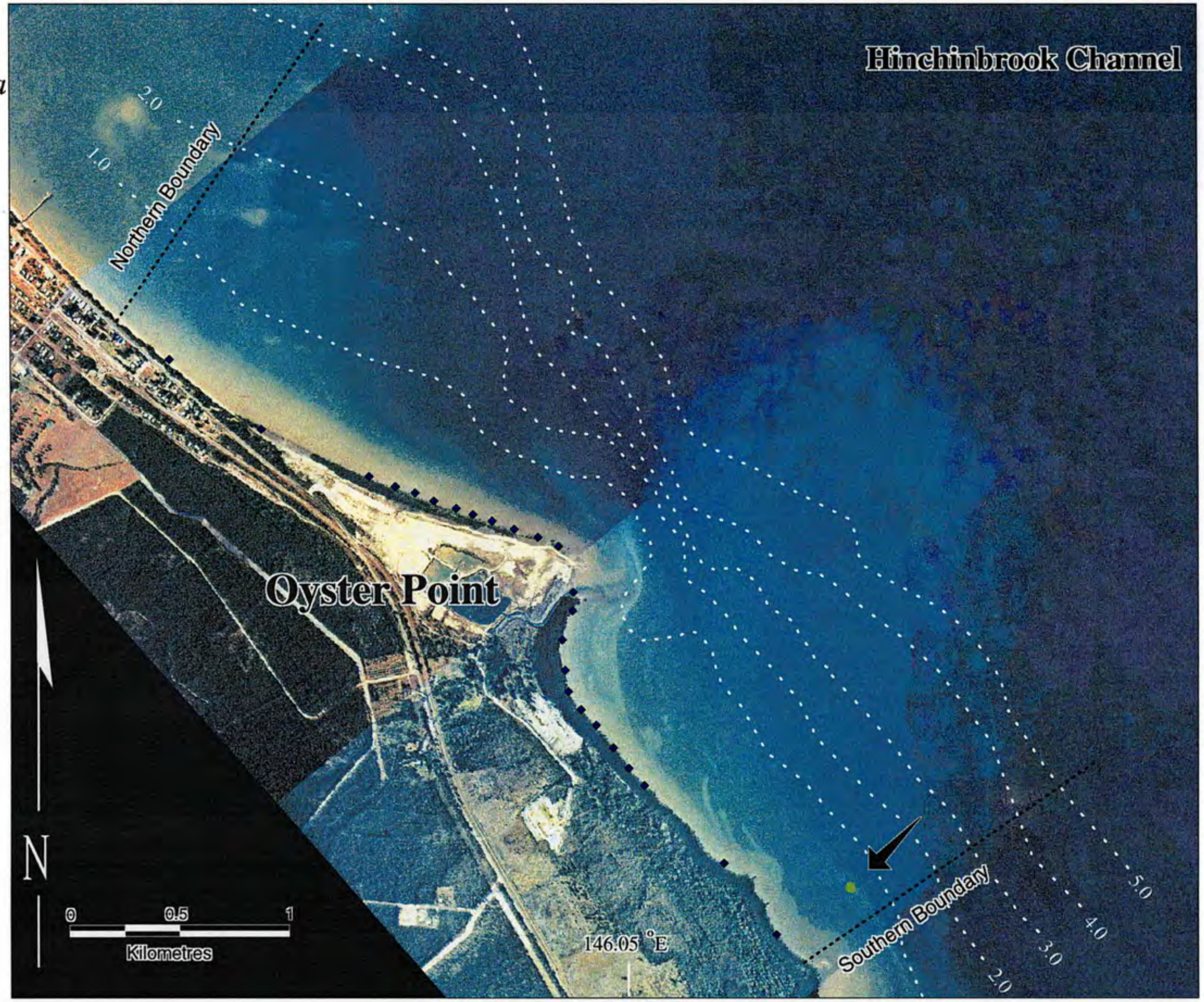
MAP 15.

Distribution of *Halophila spinulosa*
Oyster Point - November 1995.

Legend

Halophila spinulosa

Depth below MSL (m)



Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

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Produced by the Seagrass Ecology Group, QDPI, Northern Fisheries Centre, Cairns, 1997.

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MAP 16.

Distribution of *Halodule uninervis* (wide), Oyster Point - November 1995.

Legend

Halodule uninervis (wide)

Depth below MSL (m)

Source: R.G. Coles, W.J. Lee Long and L.J. Mckenzie (1997) Distribution and Abundance of Seagrass at Oyster Point, Cardwell - Spring (November) 1995 & Winter (August) 1996. QDPI Information Series QI97055 (QDPI: NFC, Cairns) 33 pp.

Survey Date: 13 - 15th November 1995.

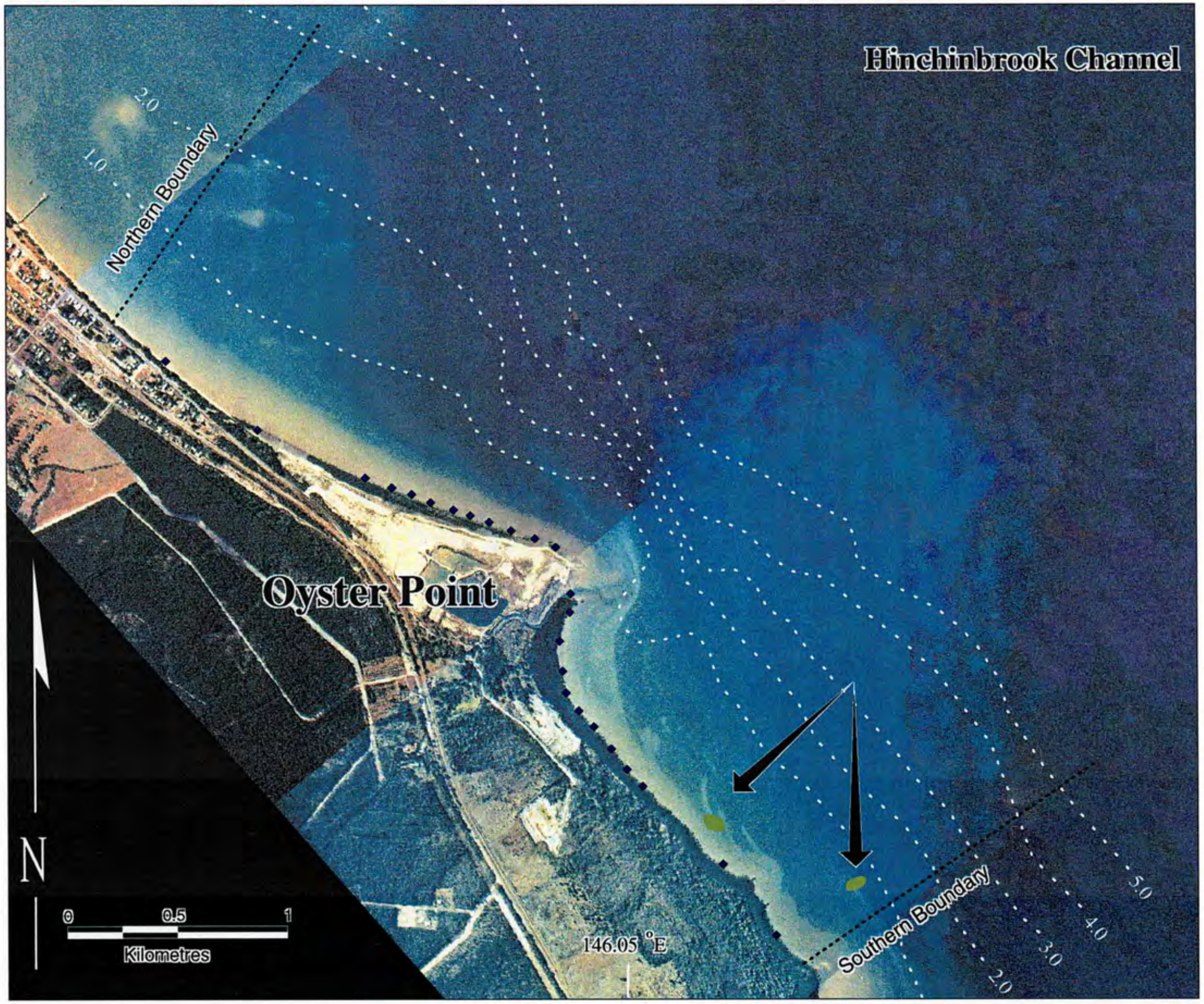
Aerial photo: coutesy QDoE Beach Protection Authority; 1 August 1991, altitude 1830m.

Funded by the Department of Economic Development & Trade and the Queensland Department of Primary Industries.

Produced by the Seagrass Ecology Group, QDPI, Northern Fisheries Centre, Cairns, 1997.

Department of Economic Development and Trade

DPI QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES FISHERIES



↳ DISCUSSION

Distribution and abundance of Oyster Point seagrasses

The meadows at Oyster Point were composed of mixed-species. Seagrass species composition during spring (November) 1995 and winter (August) 1996 surveys were similar, although *Halophila spinulosa* and *Halodule uninervis* (wide) were absent in August 1996. *Halophila ovalis* continued to dominate the survey area and changed little in distribution between surveys. *Halophila tricostata* was distributed over approximately 41 ha in the reconnaissance survey (Coles *et al*. 1995a), but only occurred in small, isolated patches between 3-11 ha in the present surveys. The distribution of this species at this site appears to be highly variable and subject to seasonal change. Kuo *et al* (1993) found that *H. tricostata* is most abundant from September to January where it germinates from seed, grows and produces flowers and fruits, then dies. With this type of life-cycle a variable distribution (area and biomass) is likely.

North Queensland seagrass communities vary seasonally and between years (Mellors *et al*. 1993, McKenzie 1994). Seagrasses at Oyster Point also have seasonal variations in abundance, with a spring/summer maximum decreasing by fourfold to an autumn/winter minimum. The decrease in above-ground biomass (78%) at Oyster Point since November 1995 is considered to be within the scale of natural population variation (Lee Long *et al.* 1996).

The survey site is shallow and exposed. The seagrass species are colonising species and we would expect their biomass and area to be highly variable at this site. Comparisons with previous maps, although difficult because of different sampling intensities, suggests that the area of seagrass near Oyster Point has not greatly changed since 1994. However, it is an exposed site and it is our view that large natural variations could occur particularly the result of cyclonic activity or storms. The species of seagrass found are likely to be resilient to these natural events, but could be threatened by prolonged changes such as long term elevated turbidity or changes to bottom topography.

Coastal seagrass meadows such as those at Oyster Point are important nursery habitat for juveniles of commercially important prawn species. Juveniles *Penaeus esculentus* and *Metapenaeus endeavouri* were common in beam trawl samples from the Hinchinbrook Channel during a broad-scale survey of seagrasses between Cairns and Bowen (Coles *et al.* 1992). Nearshore seagrass meadows of approximately 900 ha in Cairns Harbour, contributed an estimated $1.2M per year to commercial prawn fisheries, and also supported approximately 9,000 small fish per hectare (Coles *et al*. 1993). We would expect Hinchinbrook Channel seagrasses to have a similar value per hectare to fisheries productivity and be regionally important to fisheries.

Seagrass Depth Distribution

Seagrasses in the survey area occurred between 0.1 and 4.3 m below MSL. The deepest species found in Hinchinbrook Channel, *Halophila ovalis* and *Halophila decipiens*, can be found as deep as 50 m at other locations in the Great Barrier Reef lagoon (Coles *et al.* 1995b). Seagrasses like flowering plants on land, require light for photosynthesis and growth. The highly turbid waters of Hinchinbrook Channel reduce light penetration which limit seagrasses to shallow depths. Seagrasses above LAT may be able to photosynthesize enough to allow growth at times when exposed or the water is very shallow. Because of this, seagrasses at these locations may be able to survive and grow and not be unduly effected by water turbidity. A large proportion of seagrass (51% total seagrass area) in the study area was above LAT. Both genera in Hinchinbrook Channel, *Halodule* and *Halophila*, include common pioneering species that are mostly found in other shallow tropical turbid estuaries.

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↳APPENDIX 1

Figure 4. Illuminated underwater seagrass viewer used for conducting visual estimates of seagrass biomass in highly turbid waters.

Table 2. Results of linear regressions of each diver's seagrass biomass estimation with harvested above-ground biomass (g dry wt. m^{-2}).

Diver	November 1995			August 1996		
	r^2	*F*	*p*	r^2	*F*	*p*
G. Chisholm	0.97	117.54	0.001			
R. G. Coles	0.92	48.56	0.002			
W.J. Lee Long	0.99	411.43	«0.001	0.92	73.30	«0.001
L. Makey	0.88	29.32	0.006	0.96	141.31	«0.001
L. J. McKenzie	0.97	191.02	«0.001	0.94	97.10	«0.001
A.J. Roelofs	0.97	156.84	«0.001	0.94	86.75	«0.001

Notes

Seagrass Ecology Group
Queensland Department of Primary Industries
Northern Fisheries Centre, Cairns

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