SEAGRASS HABITATS IN COASTAL, MID SHELF AND REEF WATERS FROM LOOKOUT POINT TO BARROW POINT IN NORTH-EASTERN QUEENSLAND

A REPORT TO THE GREAT BARRIER REEF MARINE PARK AUTHORITY

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INTRODUCTION

Coastal seagrass habitats between Lookout Point and Barrow Point were surveyed in October and November 1984 as part of a study from Cairns to Cape York (Coles *et al.* 1987a). Key seagrass areas along the same coastal region were re-surveyed in the following winter (July 1985).

Information from these surveys was part of the database used by the Great Barrier Reef Marine Park Authority (GBRMPA) in zoning the Cairns and Northern Sections of the Great Barrier Reef Marine Park. Seagrass beds in this region support populations of juvenile commercial penaeid prawns (Coles *et al.* 1987a) and are important feeding areas for a large population of dugongs (Marsh 1989). Large numbers of sea turtles also feed in the area.

Results of aerial surveys (Marsh 1989) suggested that the dugong population of the Lookout Point to Barrow Point region (Fig. 1) was large and required an area of seagrass for feeding much larger than that estimated in the 1984 seagrass survey. Dugong sightings in the region (Marsh 1989) have been recorded near mid-shelf reefs and often beyond the seaward limit of the distribution of seagrass beds recorded by Coles *et al.* (1985). Areas shallow enough to allow seagrass growth (less than 30 m depths) extend out to the outer barrier reefs in this region. Management of the dugong population of this area requires more complete information on the areas of seagrass habitat which are used by dugong. In preparation for the 1989 Great Barrier Reef draft zone plan review the Great Barrier Reef Marine Park Authority commissioned the Queensland Department of Primary Industries (QDPI) to survey seagrass habitats in the coastal, reefal and mid-shelf barrier reef lagoon waters from Lookout Point to Barrow Point, including reef platforms and water depths greater than 15 m that were not surveyed in previous studies. The present survey provides maps of seagrass habitat in this region from the mainland out to barrier reef waters.

METHODS

The Survey Region

The survey region from Lookout Point, to Barrow Point and out to Lizard Island and Howick Group, is a large area of continental shelf waters less than 30 m depth and sheltered from the South Pacific Ocean by a line of ribbon reefs on the outer barrier (Fig. 1). Lizard Island, a continental island, and Martin and Eyrie Reefs also shelter this region from the predominantly south-east winds. Within the Howick Group of islands, Mid Reef and Combe Reef have large sandy reef platforms with active coral growth only at their margins. Nearshore areas are sheltered by headlands such as Lookout Point, and by Murdoch Island and a number of small reefs and islets. Two large rivers, the Starcke and Jeannie, drain a narrow, dry coastal plain.

Bottom sediments are mainly mud-sand with high carbonate content (Maxwell 1968). In the nearshore zone there is a moderate (10-20%) mud distribution (Maxwell 1968). In the shipping channel and mid-shelf zones there is a high (20-40%) mud distribution and on the outer shelf sediment distribution is mainly (40-60%) mud.

Sampling Method

The area from Lookout Point to Barrow Point and out to 28 m deep was surveyed for seagrasses between the 17 and 22 September 1989. The survey method, based on previous Queensland Department of Primary Industries surveys (Coles *et al.* 1987b), used divers to record bottom vegetation at regular spatial intervals. Two Queensland Department of Primary Industries research vessels were employed: the "Tiger Star", a 7 m aluminium, high speed vessel for coastal and shallow waters, and the 19 m "FRV Gwendoline May" for offshore surveys, sample storage and diver accommodation. Both vessels were equipped with radar for navigation and for location of dive sites.

The survey pattern over coastal and continental shelf waters included a total of 160 dives where bottom type was recorded (Figs 2 and 3). In coastal areas less than 15 m deep, bottom vegetation was examined by divers every 250 m along selected transects which were perpendicular to shore. Transects were placed between five and ten kilometres apart. Between transects the bottom was examined at least at every one nautical mile at varied depths and distances from shore to check for continuity of bottom vegetation (Figs 2 and 3). In shallow, clear water areas the distribution of bottom vegetation was also recorded from surface

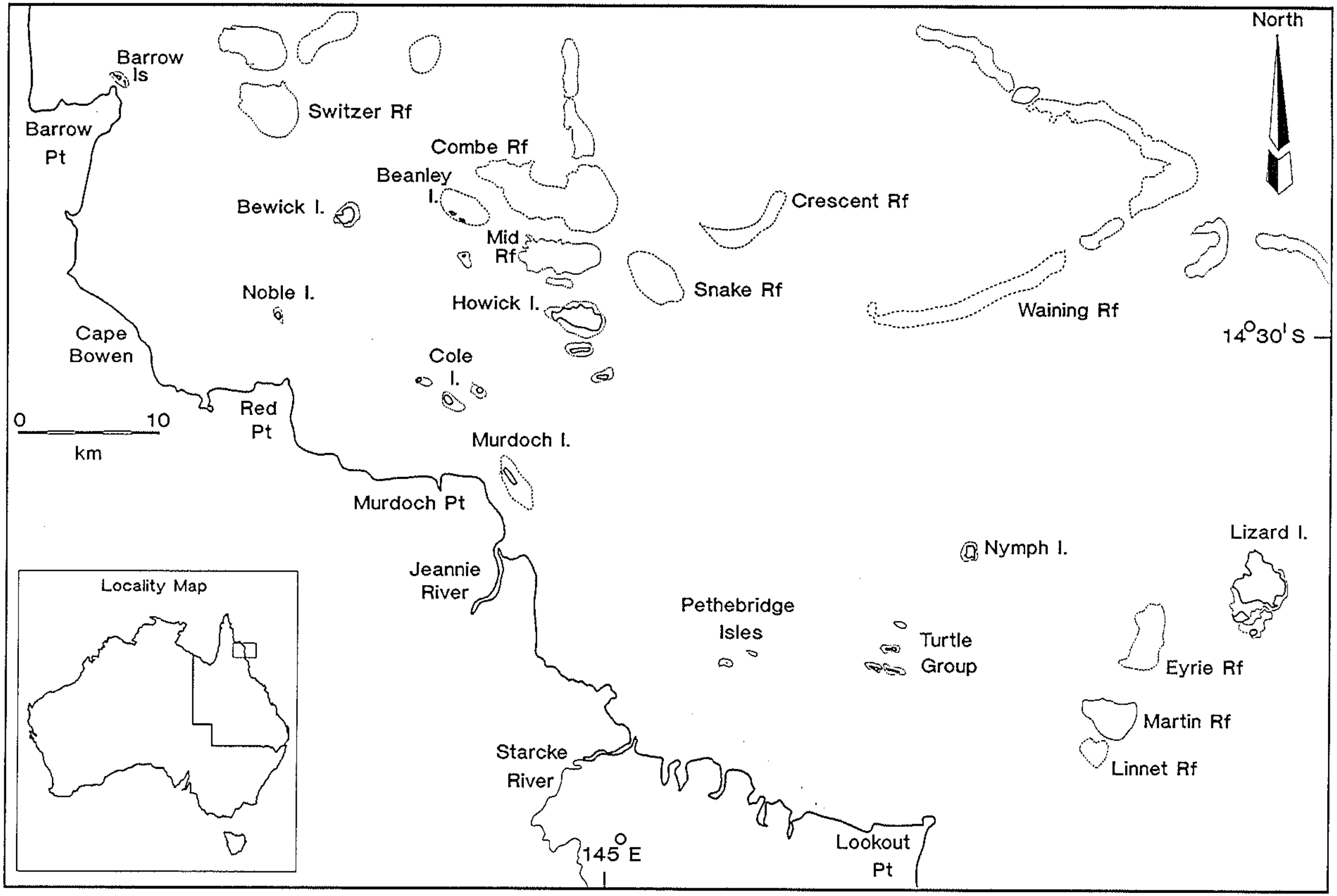

Figure 1. The survey region.

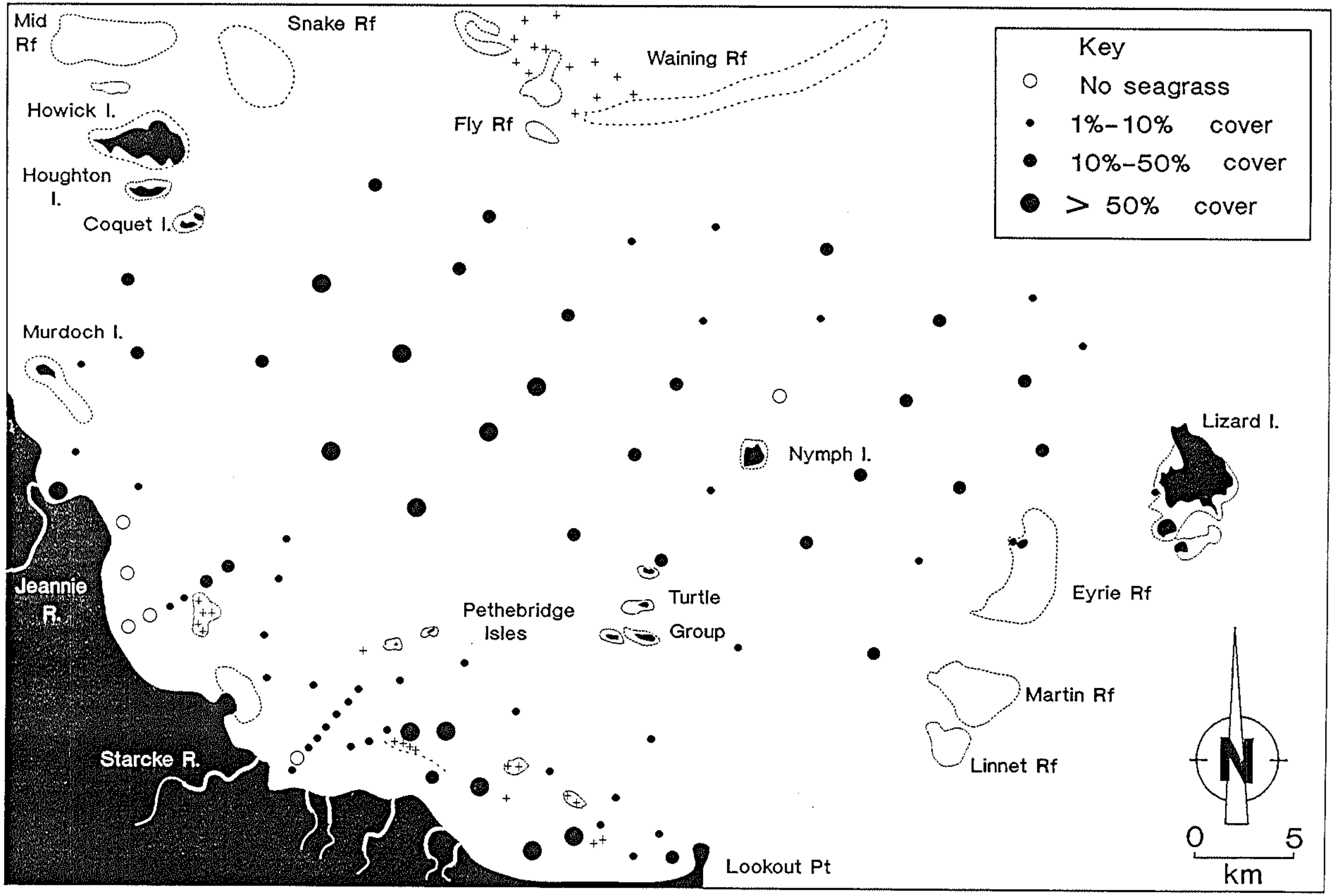

Figure 2. Estimated seagrass bottom cover at each dive site (●) from Lookout Point to Murdoch Island, to 30m deep.

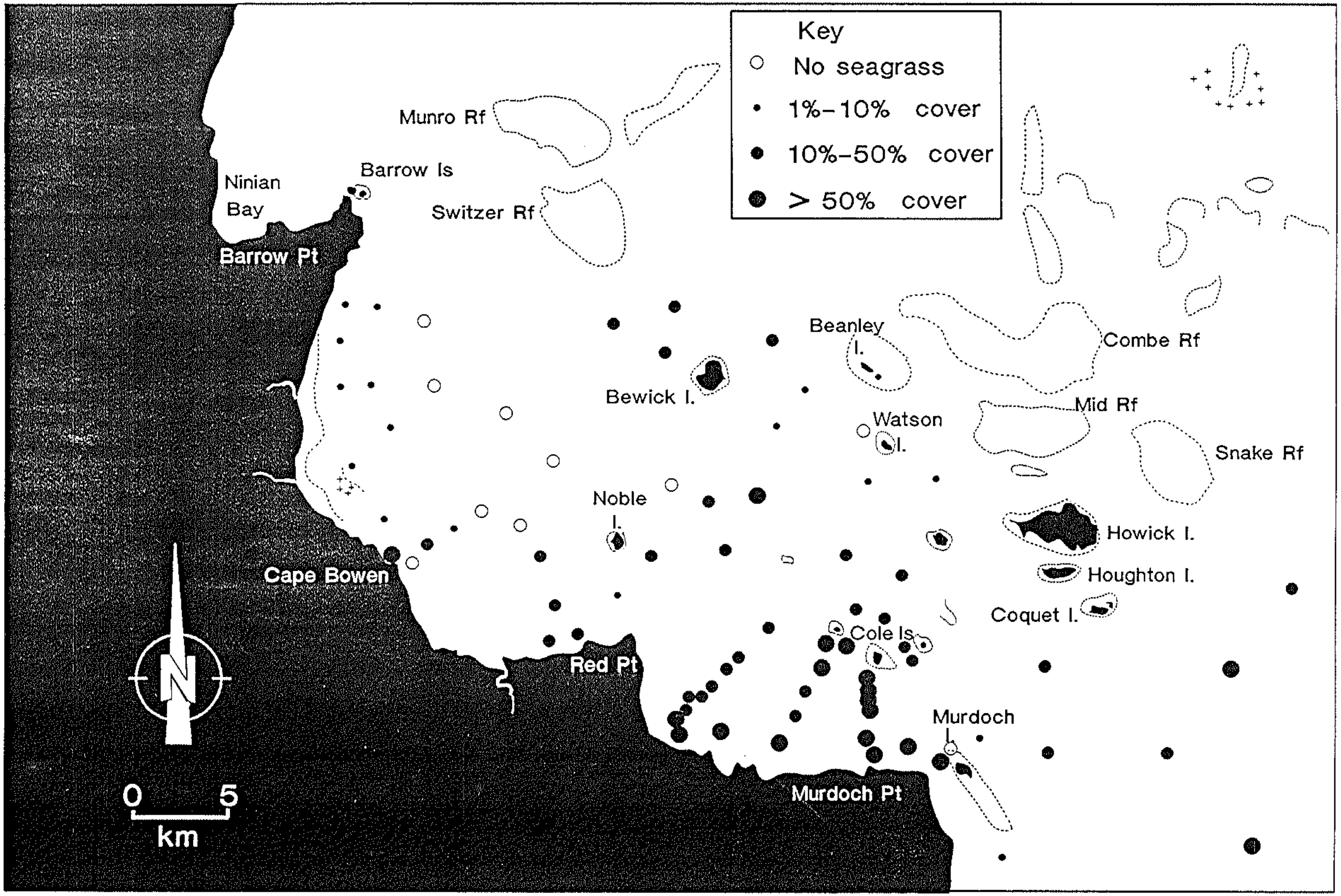

Figure 3. Estimated seagrass bottom cover at each dive site (•) from Murdoch Island to Barrow Point, to 30m deep.

observation. Reef platforms at Lizard I, Martin, Eyrie, Mid, Combe, Snake and two un-named reefs in the Howick Group were systematically surveyed by surface observation, swimming transects and spot dives.

Offshore sampling sites were chosen on selected transects running seaward from the 12 m contouto represent the range of depths between 12 m and 30 m. Dive sites on the transect were selected randomly within pre-set depth ranges: 10-15 m, 15-20 m, 20-25 m and 25-30 m. Operational considerations such as presence of reefs, large ship movements in the shipping channel and limits of dive time on compressed air diving, influenced the final sampling pattern and site selection. Observations of bottom type at depths less than 15 m were made during snorkel dives. On these dives at least 5 m^2 of bottom was examined for seagrass. Sites at depth greater than 15 m were investigated during compressed air dives. Water visibility at deep sites was usually greater than 5 m, and over a three minute drift-speed tow, bottom type was observed in an area of at least 30 m^2.

On all dives, records were made of depth, bottom sediment, seagrass species, seagrass cover and algal cover. Visual estimates of seagrass bottom cover were to the nearest 10%. Standardization of these estimates was made between divers to minimize error of estimation. Two teams of two divers were used and idvers were moved between teams regularly to maintain standards for bottom cover estimates. When seagrass was found, hand-collected samples of each species were kept for later identification. The presence of dugong feeding trails was recorded and at some sites video-taped and/or photographed.

Diver estimates of bottom vegetation cover at each site and observations of seagrass distribution from the surface were used to generate maps of the distribution of seagrass habitat. Seagrass habitat was mapped into three classifications based on estimates of bottom cover, which were: less than 10% cover, 10 to 50% cover, and greater than 50% cover.

RESULTS

Seagrass was found on every reef platform examined and at 90% of all other sites. In coastal waters of less than 10 m depth seagrass was observed at 92% of sites, and in areas between 10 m and 30 m depth seagrass was recorded at 87% of sites. Maps of seagrass beds generated from this survey record approximately one thousand and five hundred (1 500) square kilometres of seagrass habitat area.

Eleven species of seagrass were found during the survey:

Family Potamogetonaceae:

Cymodocea rotundata Ehrenb. et Hempr. ex Aschers.

Cymodocea serrulata (R.Br.) Aschers. and Magnus.

Halodule uninervis (Forsk.) Aschers.

Syringodium isoetifolium (Aschers.) Dandy.

Family Hydrocharitaceaea:

Halophila decipiens Ostenfeld

Halophila ovalis (R.Br.) Hook.F.

Halophila ovata Gaud.

Halophila spinulosa (R.Br.) Aschers.

Halophila tricostata Greenway

Halophila sp. (identification uncertain).

Thalassia hemprichii (Ehrenb.) Aschers.

Some specimens within the genus Halophila could not easily be identified to species level using keys of Lanyon (1986) and den Hartog (1970). For the purposes of this survey and pending revision of the genus *Halophila,* we have labelled these specimens as either *H. ovalis, H. ovata* or *H. tricostata.*

There was a continuous seagrass bed extending from the coast between Lookout Point to Murdoch Point and seaward to at least 28 m depth near Lizard Island and Waning Reef (Fig. 4). From Murdoch Point and Cape Bowen to the Howick Group seagrass was found from the shore seaward to 20 m depth (Fig. 5). Seagrass cover was generally greatest, reaching 100% cover, in sheltered, shallow areas of the nearshore zone. At depths greater than 10 m in the mid-shelf zone seagrass bottom cover was generally less than 50%. At some deep water sites, green algae which appeared similar in shape to the resident seagrasses were found at densities between 0% and 60%. These include algae species belonging to the genus *Caulerpa* which resemble *H. spinulosa*. An algae which was similar in appearance to *H. ovalis* has not yet been identified.

Lookout Point to Murdoch Point nearshore zone less than 10 m depths

From the lee (west) side of Lookout Point, a bed of *H. ovalis* and *H. spinulosa* on a sandy bottom extended along the shore, becoming a wide, nearshore bed of *H. spinulosa,* with 80-100% cover on a mud bottom (Fig. 6). This seagrass bed continued until three to four nautical miles south-east of the Starcke River. Between the Starcke River and Murdoch Point seagrass was sparse (Fig. 6).

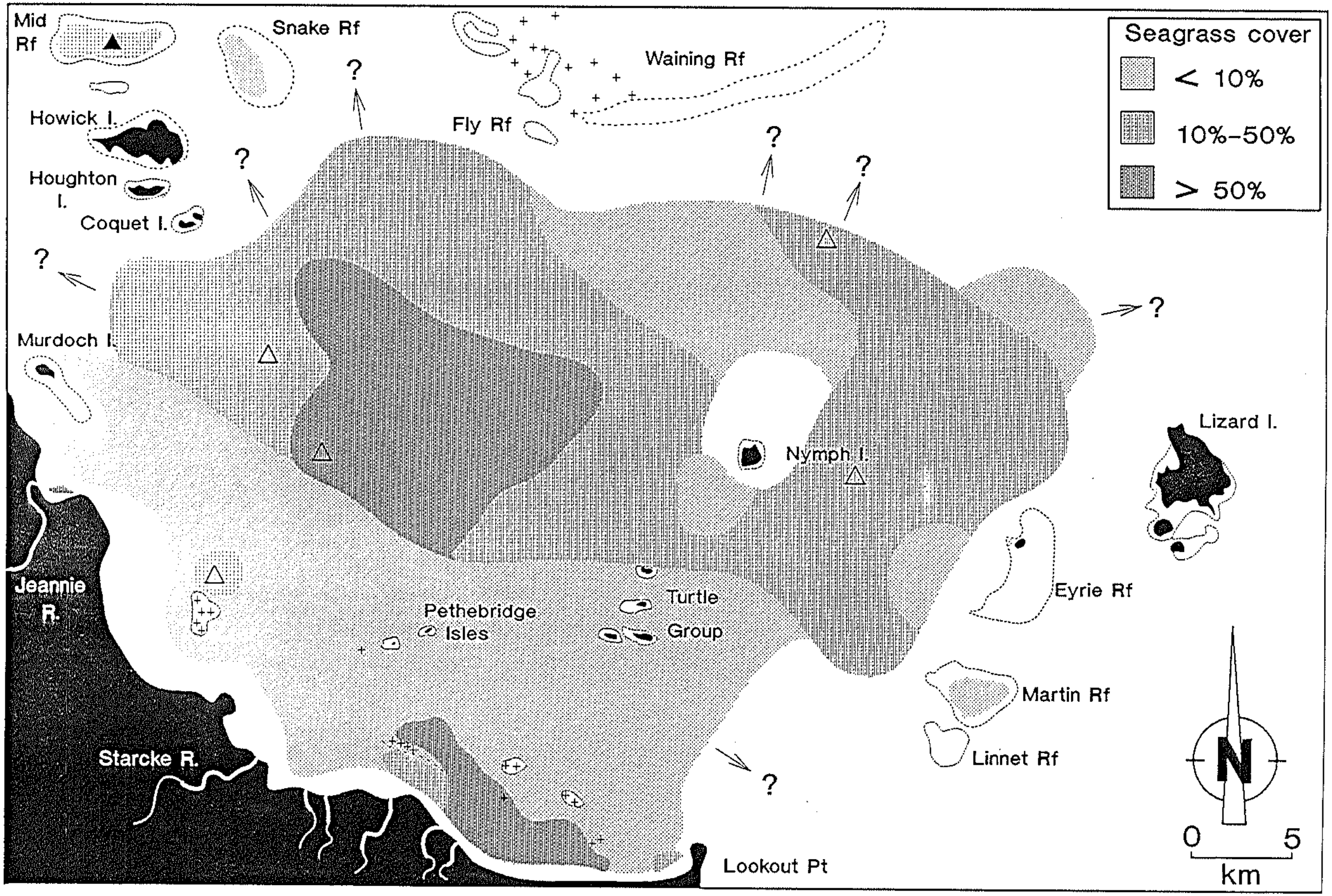

Figure 4. Distribution of three seagrass cover categories from Lookout Point to Murdoch Island, to 30m deep. Sites where dugongs (▲) or dugong feeding trails (△) were seen are marked.

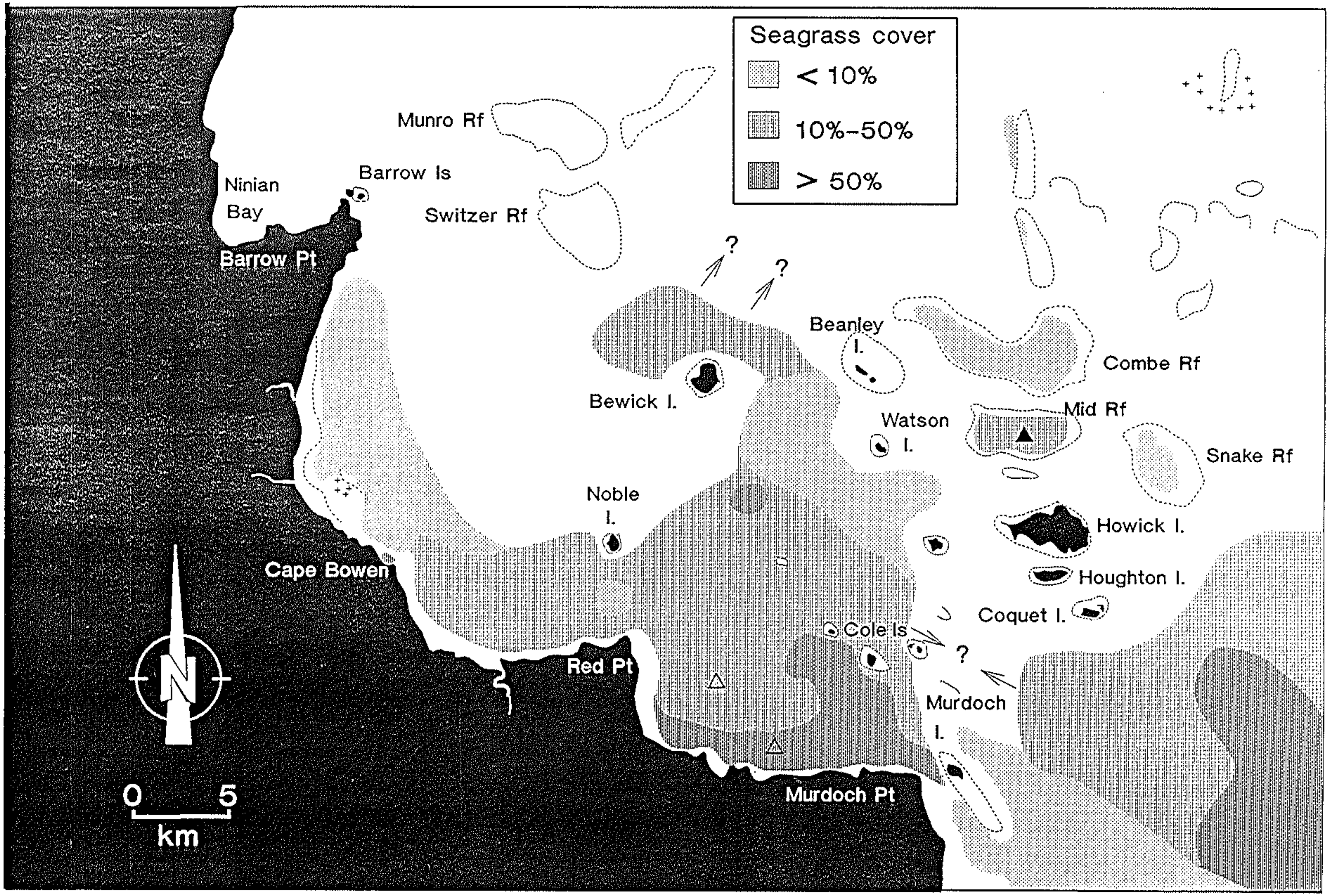

Figure 5. Distribution of three seagrass cover categories from Murdoch Point to Barrow Point, to 30m deep. Sites where dugongs (▲) or dugong feeding trails (△) were seen are marked.

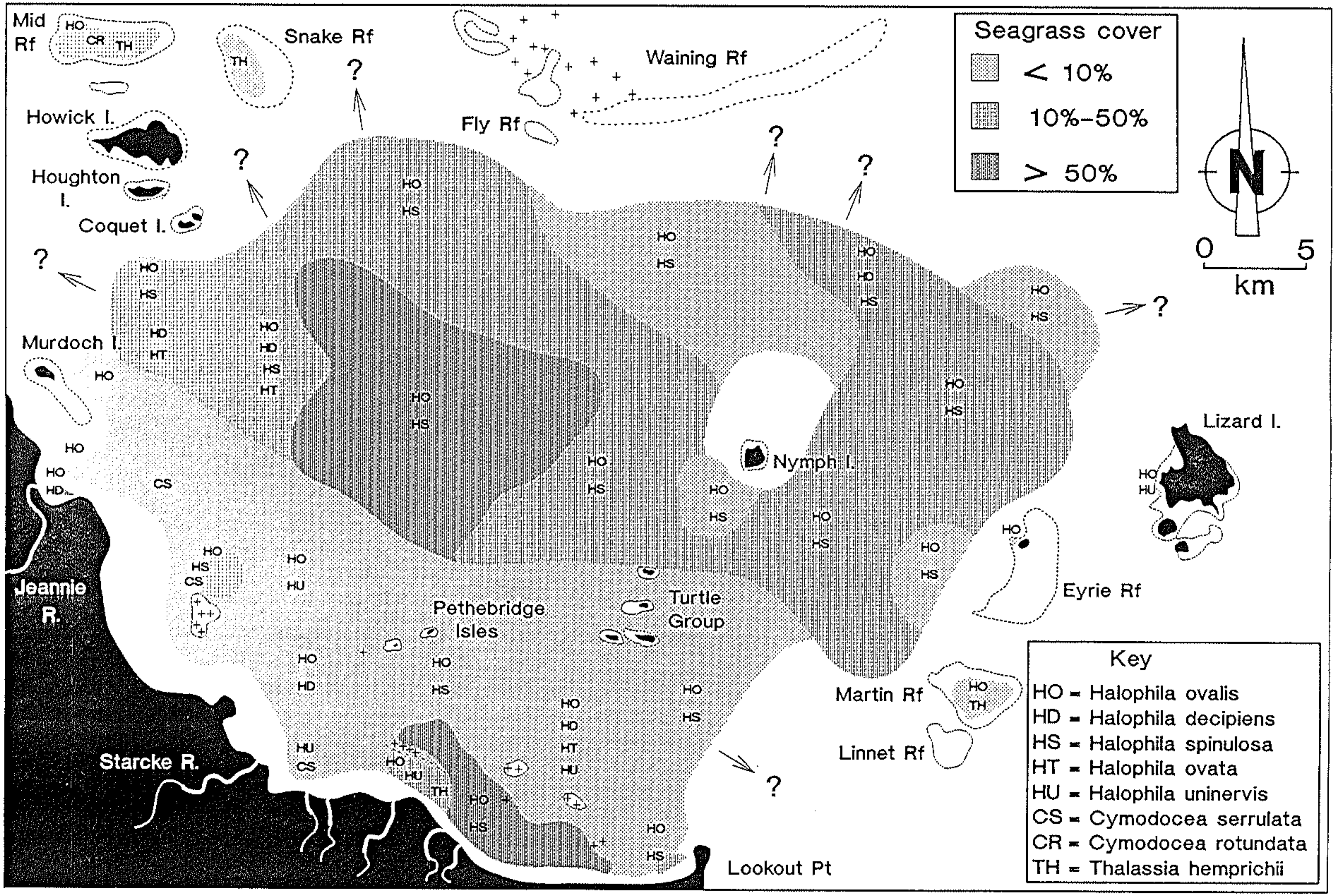

Figure 6. Distribution of three seagrass bottom cover categories from Lookout Point to Murdoch Island showing species of seagrass observed in different areas.

Murdoch Point to Barrow Point nearshore zone to 10 m depth

A dense (greater than 50% cover) and sometimes patchy seagrass bed of mostly *H. spinulosa,* on sand and shell grit extended from near the shore at Murdoch Point to the Cole Islets. Water visibility here during this and previous surveys was exceptionally good. Between the Cole Islets and Cape Bowen there was a patchy bed of mostly *H. ovalis* and *H. uninervis* with 10 to 50% cover on a sand and mud substrate. Seagrass cover in this area was most dense in sheltered shallow water close to shore. North of Cape Bowen to Barrow Point there was a light (less than 1%) cover of *H. ovalis* and *H. decipiens* on fine mud (Fig. 7).

Cole Islets to Barrow Point 10 to 20 m depths

Halophila ovalis and *H. spinulosa* were the dominant seagrass species in the 10-20 m depth range from the Cole Islets to Noble Island and almost out to the Howick Group (Fig. 7). These species were also predominant at sites north of Bewick Island. Seagrass bottom cover in these areas was generally less than 50 percent on mud and shell grit substrate.

Howicks to Lizard Island 10 m to 30 m depths

In the depth range 10-15 m *H. ovalis* and *H. spinulosa* were the most common species and bottom cover between 10% and 60% occurred in extensive patches (Fig. 6). Seagrass cover was most dense in an area halfway between Howick Islands and the Turtle Group. At depths between 15 and 28 m *H. ovalis* was more common than *H. spinulosa* and bottom cover was generally less than 20% in deeper water. Algal species which appear similar in shape to *H. ovalis* and *H. spinulosa* occurred almost throughout this area and in densities up to 30% bottom cover.

Reef Platforms

Almost the whole of Mid Reef had a bed of *H. ovalis, T. hemprichii* and *C. rotundata* in large patches with between 10 and 30% cover on sand (Fig. 7). Combe Reef platform was also covered by patches of *T. hemprichii, C. rotundata* and *H. ovalis* but only up to 10% cover on the sand and amongst coral rubble (Fig. 7). Snake Reef had only light cover (less than 10%) of *T. hemprichii* on sandy patches amongst the coral and algae. Reef platforms on the two un-named reefs north of Combe Reef had mostly bare sand and coral rubble platforms but small patches of *H. ovalis* with 10% bottom cover were found on soft, coarse sand on the back reef areas. Martin Reef had very light cover of *T. hemprichii* on sandy patches amongst coral rubble

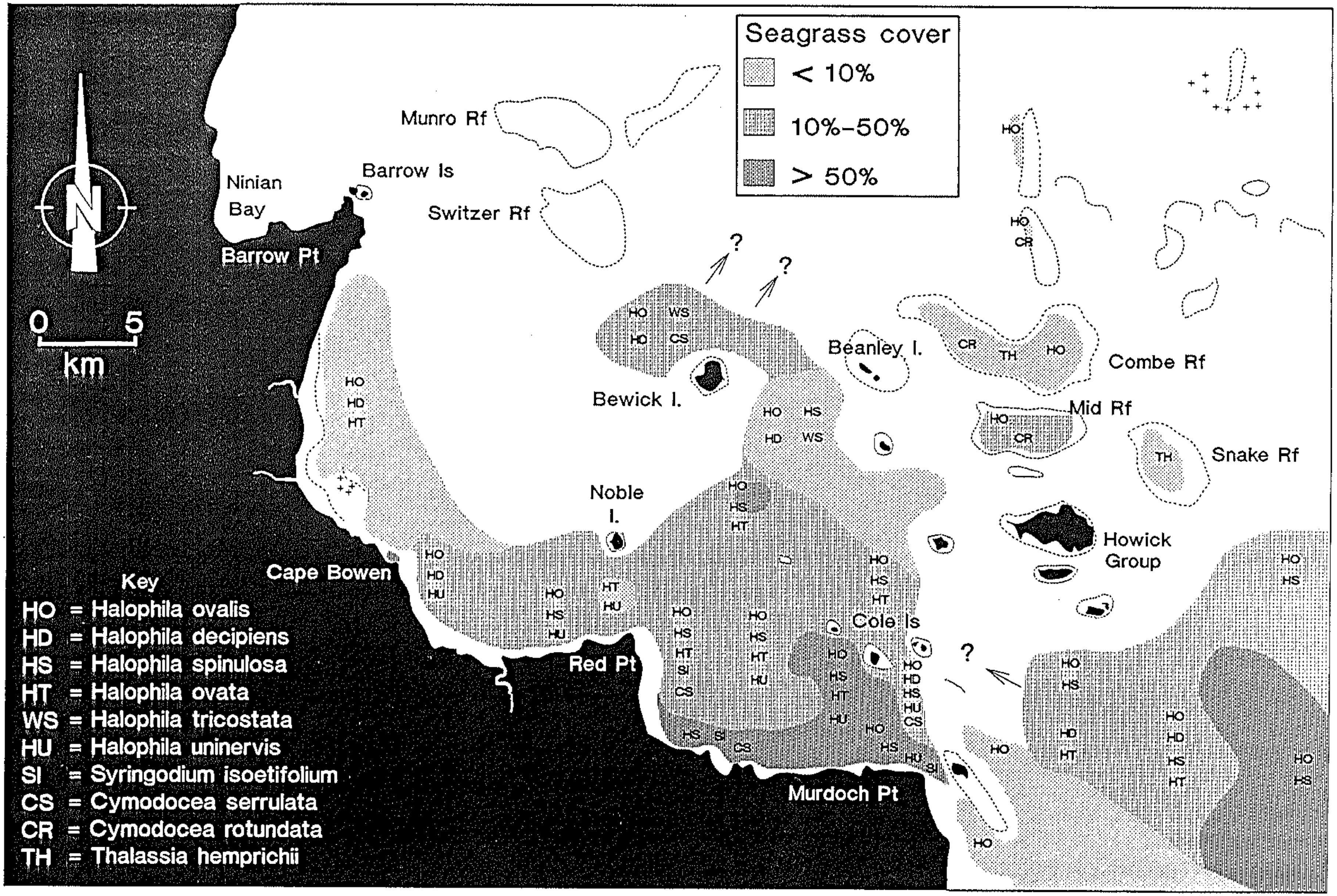

Figure 7. Distribution of three seagrass bottom cover categories from Murdoch Point to Barrow Point showing species of seagrass observed in different areas.

and algae (Fig. 6). On Eyrie Reef, a small area of light cover of *H. ovalis* was found in the lee of Eagle Island (Fig. 6). Sandy areas inside the fringing reef on the lee side of Lizard Island had patches of thin-leaf *H. uninervis* at 10-20% bottom cover (Fig. 6).

No seagrasses were found in water shallower than 0.8 m below mean sea level (MSL) (Fig. 8). *Halophila ovalis* and *H. spinulosa* had the greatest depth ranges and were found to 28 m depth. *Halophila decipiens* was found to 24 m deep and *H. tricostata,* in this survey, was only found at depths between 18 and 22 m. *Halophila ovata* and *C. serrulata* were found to 15 and 18 m, but their average depth of occurrence was less than 10 m. *Syringodium isoetifolium, C. rotundata,* thin-leaf *H. uninervis* and *T. hemprichii* were all seen only at depths less than 5 m.

A single dugong was sighted on Mid Reef platform and dugong feeding trails were observed at seven sites in the survey (Table 1, Appendix 1). In coastal water less than 10 m deep dugong feeding trails were observed at three (3.0%) of all survey dives. Feeding trails were observed at four (6.6%) of the dives in waters deeper than 10 m. Dugong feeding trails were recorded on video at one 18 m site and were photographed at various depths to 23.7 m (Appendix 1).

DISCUSSION

Seagrasses were found from nearshore to depths of 28 m and formed an almost continuous meadow. Seagrass cover ranged from dense in shallow water to a patchy and light cover of *Halophila* species in deeper water. Beyond the survey area towards the outer barrier reefs, water depth ranges between 20 and 30 m. Shelter by the outer barrier reef in these areas may be sufficient to allow seagrass growth and seagrasses may extend further than the area surveyed for this report.

In Queensland, the only other extensive seagrass beds recorded in areas deeper than 15 m are in the Torres Strait at 10°S, and Hervey Bay at 25°S (Queensland Department of Primary Industries, unpublished data). In these areas, *H. spinulosa* and *H. ovalis* were also the most common species found. In Hervey Bay *H. spinulosa* was the predominant species found in 15 to 25 m depths and bottom cover was estimated at up to 90%. In the present survey *H. spinulosa* was the most common species at 10 to 15 m depths and *H. ovalis* was the most common species at depths from 15 to 28 m. In the Torres Strait *H. spinulosa* and *H.*

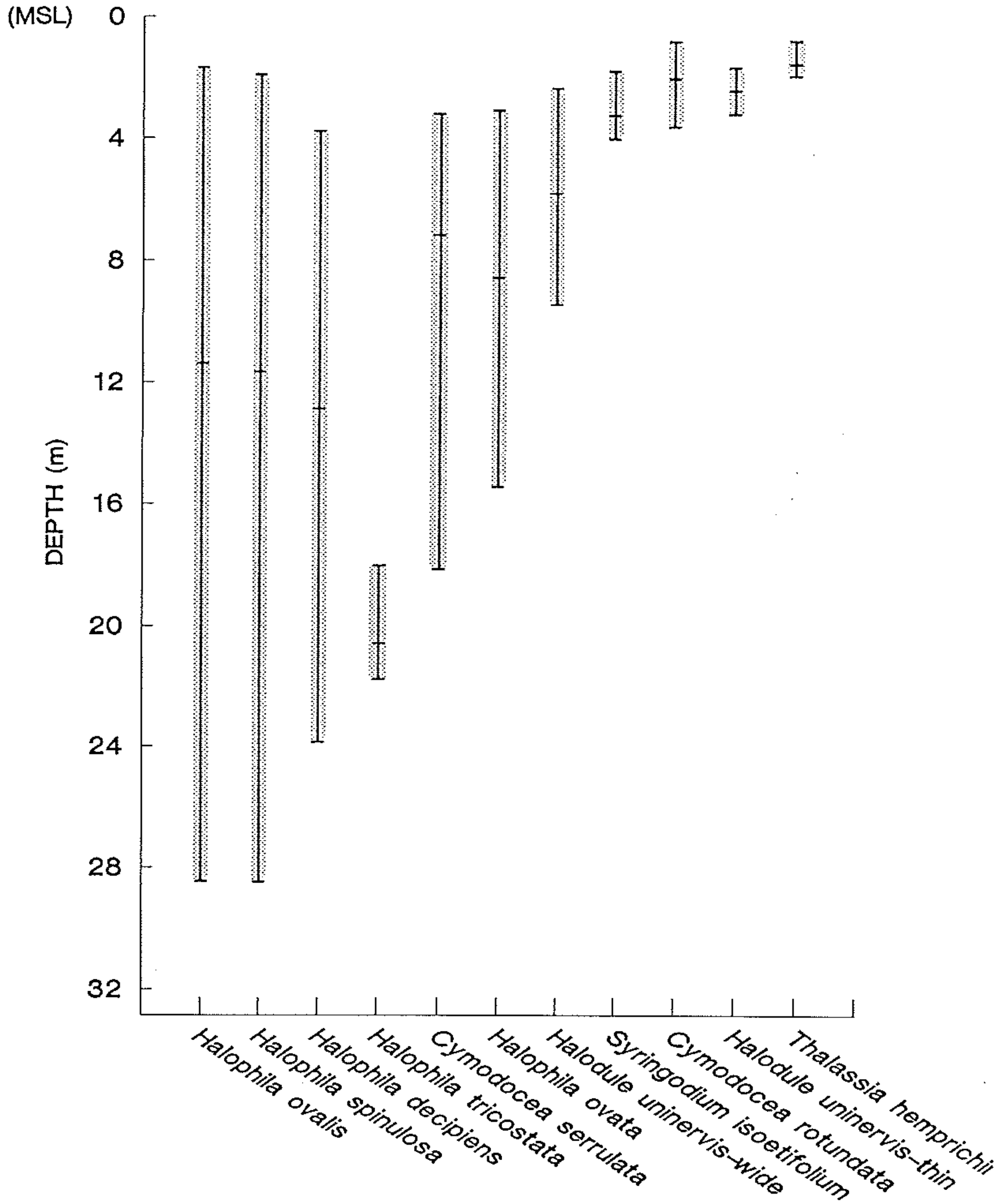

Figure 8. Average and range of depths below mean sea level at which seagrasses were found between Lookout Point and Barrow Point.

ovalis were most abundant, but *Syringodium iseotifolium* and *C. serrulata* were also common. Estimated seagrass cover at sites deeper than 15 m in the Torres Strait and in the present survey were much less than in Hervey Bay. The reasons for these regional differences in deep water seagrass communities are not well understood, but are likely to include factors such as water clarity, water movement, sediment type and latitude.

Since 1985 (Coles *et al.* 1985) this survey recorded a large increase in area of seagrass in the shallow sheltered waters (less than 10 m) between Murdoch Point and Cape Bowen. Marked seasonal changes in seagrass standing crops, from early summer 1984 to winter 1985, have been recorded on major seagrass beds between Cape York and Cairns (QDPI unpublished data). The seagrass cover observed in the present survey may change seasonally. Species composition of bottom vegetation, including the algal species, may also change over time. Seasonal and inter-annual changes in seagrass habitats also have important consequences on populations of seagrass associated fauna (Iverson and Bittaker 1986).

The seagrass distribution varies on different reef platforms probably as the result of differences in shelter and substrate type. The high energy, unsheltered reefs surveyed, including Martin, Eyrie, Snake and the un-named reefs, were covered mostly by coral rubble and algae. Reefs with more shelter, for example Mid Reef and Combe Reef, had much more sand cover and supported a more dense cover of seagrass. Although no dugong feeding trails were sighted, animals such as the one sighted on Mid Reef may feed on these reef platforms. Dugong feeding trails have been recorded for reef platforms in the Cairns region and Clack Reef near Princess Charlotte Bay (Queensland Department of Primary Industries, unpublished data).

Algal species which resemble the external appearance of co-habitant seagrasses *H. ovalis* and *H. spinulosa,* in this survey were present at densities equal to or greater than the seagrasses. The ecological role of these algae is not clearly understood. They were present near dugong feeding trails, and may be ingested by dugong along with the seagrasses which they resemble.

Records of dugong feeding trails in this survey at depths to 23 m indicate that these extensive seagrass beds are important feeding areas for the large dugong population in the region. Sightings of dugong feeding trails have not previously been recorded for depths greater than 20 m in north-eastern Queensland and the maximum depth at which dugongs can feed has not been established.

CONCLUSIONS

The present survey examined seagrass beds in coastal areas which were previously surveyed, and investigated for the first time, reef platforms and deep water mid-shelf areas between Lookout Point and Barrow Point. Maps and other information provided will aid in management for dugong conservation and coastal fisheries.

Seagrass beds in the Lookout Point to Barrow Point region were extensive (approximately 1 500 km^2 of seagrass habitat area was recorded). Seagrasses were continuous from shallow areas re-surveyed in this study out into deeper waters surveyed for the first time. It is very likely that seagrasses occur beyond the deeper limits of the surveyed area. This survey recorded generally high density seagrass bottom cover close to shore and low density cover at deeper sites off shore.

Of the fourteen seagrass species recorded in Queensland, ten were found in this survey. *Halophila spinulosa* was the dominant species in shallow water, whilst *H. spinulosa* and *H. ovalis* were both dominant species in deep water.

The area of seagrass beds in shallow nearshore areas (less than 10 m depths) was larger in this survey than when previously surveyed (Coles and Lee Long 1985). Long-term and seasonal changes in seagrass abundance are not well documented or understood. These and associated changes in faunal populations involve complex interactions of species composition, abundance and life cycle timing which are beyond the scope of this study, but should be considered in the management of these communities.

Records of dugong feeding trails from sites to 23 m depths confirm for the first time on the east Queensland coast that dugongs have been feeding on these extensive deep-water seagrass beds.

Algae with an external appearance much like *H. ovalis* and *H. spinulosa* were seen in densities similar to or greater than the co-habitant seagrasses. Their role in the seagrass bottom community is not well understood.

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Table 1. **Records of dugong and dugong feed trail sightings in the seagrass survey of the Lookout Point to Barrow Point region.**

Date	Location	Survey Site	Depth (m) Below MSL	Seagrass Cover (%)	Seagrass Species Present	Sediment	Dugong Feeding Trails	Dugongs Sighted
18.9.89	North of Starcke R. 14°42'S 145°00'E	18.1.2	5.8	50	*H. ovalis* *C. serrulata*	Sand	Numerous trails sighted	
	NNW of Lizard I. 14°39'S 144°03'E	GM 18.9	13.8	60	*H. ovalis* *H. spinulosa*	Sand-mud	Photographed	
	E of Murdoch I. 14°36'S 145°01'E	GM 18.12	15.3	40	*H. ovalis* *H. spinulosa*	Sand-mud, shell grit	Photographed	
19.9.89	N. of Murdoch Pt 14°36'S 144°50'E	19.5	3.2	80	*H. ovalis* *H. spinulosa* *H. uninervis*	Sand and shell	Photographed	
	S. of Red Pt 14°34'S 144°49'E	19.1.5	4.7	40	*H. ovalis* *H. spinulosa* *H. uninervis*	Fine sand	Photographed	
20.9.89	Mid Reef 14°27'S 144°58'E	20.1	1.8	10	*H. ovalis* *C. rotundata* *T. hemprichii*	Sand	-	One dugong
21.9.89	NNW of Lizard I. 14°34'S 145°17'E	21.5	23.7	20	*H. ovalis* *H. spinulosa* *H. decipiens*	Mud and shell grit	Photographed	
	NW of Lizard I. 14°40'S 145°18'E	GM 21.7	19.3	20	*H. ovalis* *H. spinulosa*	Mud-sand	Photographed and video taped	