

Information Summary Central Section of the Great Barrier Reef Marine Park

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THE GREAT BARRIER REEF MARINE PARK
CENTRAL SECTION
INFORMATION SUMMARY

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A summary of information collected by the Great Barrier Reef Marine Park Authority prior to preparation of a zoning plan for the Central Section.

CENTRAL SECTION INFORMATION SUMMARY

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THIS BOOKLET

Basic to any discussions of a zoning plan for the Central Section is the Reef itself, its resources and their distribution within the Section. As part of the planning process the Authority has prepared a summary of information regarding Reef resources and user demands for those resources.

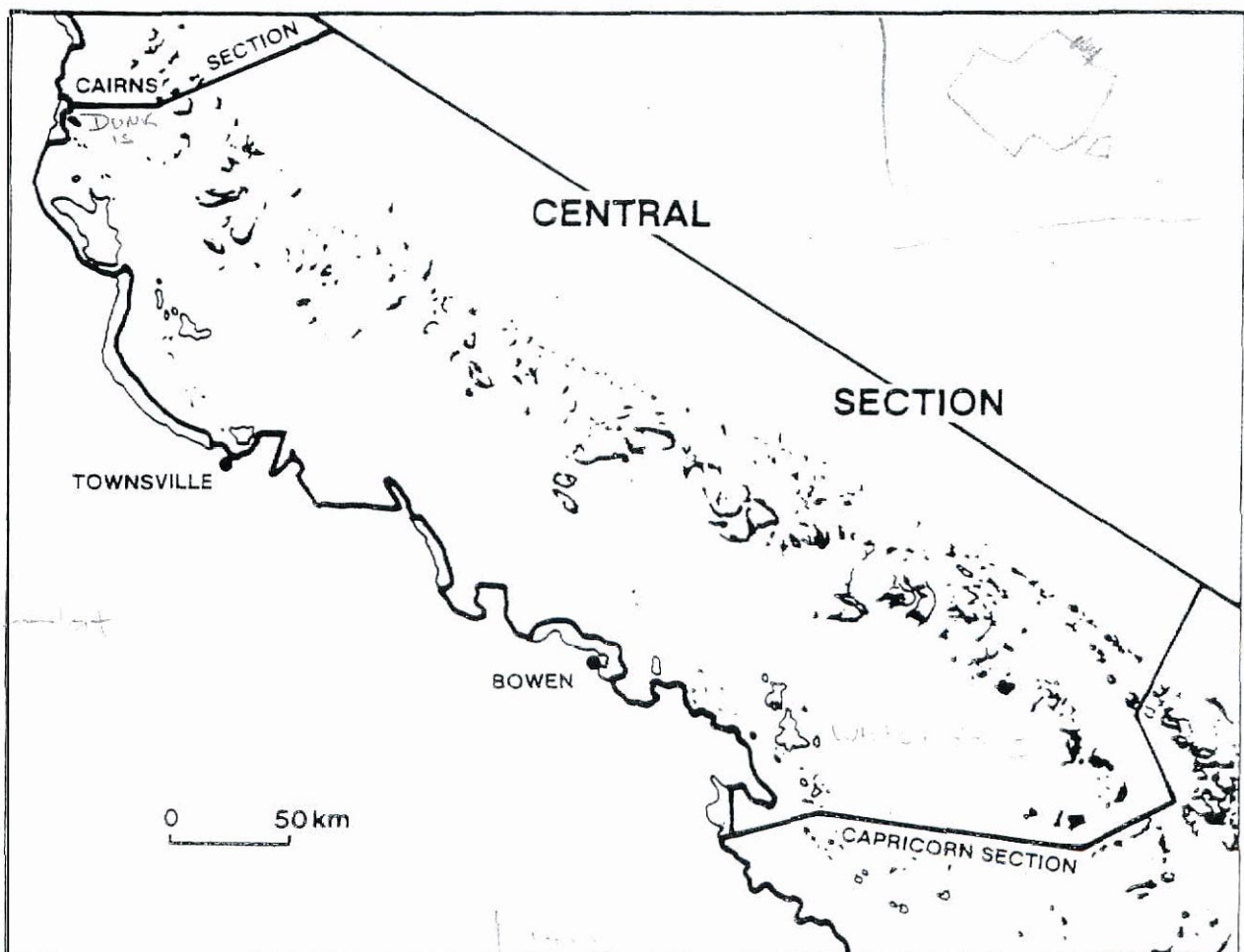
This summary has been developed to help you to comment on the content for a zoning plan in the most effective way. By providing a summary of the factors and information that will be considered in making zoning decisions, it is intended that you will be better able to understand the complex issues involved and to provide corrections or additions to the information base.

This booklet is intended for use in conjunction with the brochure "Help Zone the Central Section". We appreciate that it may be difficult to answer the questions in the brochure without knowing why the questions are asked. It is hoped that this booklet will be of assistance in this regard.

Definition of the Central Section

The Central Section of the Great Barrier Reef Marine Park was recently proclaimed, amalgamating the original Central and Townsville Sections with the northern portions of the Southern and Inshore Southern Sections which were proclaimed in 1983.

The boundary of the Central Section is indicated on the map below.



Great Barrier Reef Marine Park Central Section

~~Theoretical~~
Resource Maps

Thematic maps are used to illustrate

The term 'resources' is used broadly in relation to the maps and includes features such as navigation aids, anchorages and shipping channels, adjacent mainland land uses and the location of seagrass and mangrove areas.

The information displayed on the Resource Maps is from data collected by GBRMPA staff with assistance from other government agencies and researchers. Your assistance in updating or correcting the information will be valuable.

2. INTRODUCTION

The Great Barrier Reef is the largest system of coral reefs and associated life forms anywhere in the world. As a beautiful, natural environment on a uniquely grand scale it is an irreplaceable part of the world's heritage and is, already inscribed in the World Heritage list.

In recent times, tourism and its associated industries, combined with a large and diverse fishing industry, have increased the economic significance of the Great Barrier Reef to Queensland and Australia. The future of these industries depends significantly on the conservation of the whole Great Barrier Reef as a viable living system.

The unopposed passing by the Commonwealth Parliament in 1975 of the Great Barrier Reef Marine Park Act was the consequence of recognition by all political parties that one of our great natural heritages should be conserved for future generations. The Act established the Great Barrier Reef Marine Park Authority which is a resource planning and management body with the object of providing for conservation and reasonable use of the resources of the Great Barrier Reef.

In the Great Barrier Reef Region, planning is based on the analysis and synthesis of information on the character, resources and use of the Region as a whole, and of Sections of the Marine Park in particular. Information is obtained from technical literature, specialist reports prepared by consultants, staff and other public instrumentalities, and from representations made by the public.

Zoning plans are the main end product of the planning process for the Great Barrier Reef Marine Park and provide a framework for managing a Section by separating incompatible activities into different areas as far as possible. The Authority is also required to reserve some areas of the Great Barrier Reef for public appreciation and enjoyment and to set aside areas to be undisturbed by man, except for the purpose of scientific research. The overall objective is to promote both conservation and reasonable use of the Marine Park's resources.

Public Participation

As provided in the Act, the public is encouraged to participate in each of the major planning stages. From November 1984 to March 1985 the public is invited to provide information on the uses and characteristics of the Section, to express any related concerns and interests and to make recommendations for zoning and management.

With the aid of this information, as well as discussions with Queensland and Commonwealth Government departments, and recommendations offered at public meetings, a zoning plan will be prepared for the Section in mid 1985. The public will then be asked to comment on the proposed Zoning Plan - probably beginning in August 1985.

3. GEOMORPHOLOGICAL FEATURES

Reefal structures are comprised of limestone originating from the skeletons of corals and other reefal organisms. Often such structures are growing on geologic platforms which are remains of reefs from an earlier geological era which were subsequently exposed and weathered during the last period of low sea levels. The growth of present reefal structures began about 10,000 years ago as sea levels rose inundating the coastal plain and the old reefal platforms.

Reefal structures may take a number of forms. A reef is generally a large entity that is described as ribbon, planar, lagoonal or crescentic depending on its physical characteristics and orientation due to the prevailing wind pattern. Incipient fringing reefs are mainly rock platforms, or occasionally sand shoals with only scattered corals attached to or closely adjacent to high continental islands or the mainland. Fringing reefs are clearly identifiable reefs with recognisable reef flat development attached to a high continental island or the mainland. A shoal or submerged reef is one which has not grown up to modern sea surface.

Within the boundaries of the Central Section, there are approximately 596 reefal structures, 13 sand or shingle cays of reefal origin and 194 high continental islands (183 with fringing reefs).

4. BIOLOGICAL FEATURES

Distribution of Fish and Benthic Reef Communities

The Central Section supports a highly diverse and abundant fauna of fish and invertebrate marine animals.

Despite the fact that this Section is the most heavily researched of the Sections of the Great Barrier Reef Marine Park there are relatively few reefs for which detailed knowledge of the geomorphological structure or biological communities exist. The majority of these reefs are in the northern part of the Section and fall within the Australian Institute of Marine Science (AIMS) study area. Extensive coral collecting and fish

species studies have been made throughout the Section and additional information on coral cover has been derived from crown of thorns surveys between 1973 and 1984. It is possible on the basis of the results of these expeditions to provide a general typification of reefs in the Section but the degree of data available is not sufficient to provide a comprehensive classification of all reefs at this stage.

The Central Section can be divided into five distinct sub-areas on the basis of proximity to the mainland, distance between reefs, the strength of tidal and other currents and the level of interchange between coastal and oceanic waters. While there are some similarities between sub-areas, recent research has indicated that each area has its own distinctive biological community characteristics (reflected in terms of coral and fish species diversity and numbers, for example).

Inshore Reef Communities

Inshore within five kilometres of the low water mark on the mainland coast is an area subject to wave generated resuspension of sediments and high levels of sediment runoff from river systems. The typical reefs of this area have a community dominated by large massive corals and silt tolerant species, algal beds and soft coral.

Island Fringing Reefs and Inner Reef Communities

The next area which includes the inner inshore fringing reefs of the islands and the inner reefs to landward of the main outer structure of the Great Barrier shares a considerable proportion of the same fish and invertebrate species with the inshore areas. Waters may be quite turbid particularly during the wet season.

Northern Mid Shelf Reef Communities

The mid shelf reefs north of approximately the latitude of Townsville are characterised by widely separated relatively small patch reef systems. It appears that because of the relatively large distance between reefs and the lack of a hard line or outer barrier there is a high level of interchange in this area between coastal and oceanic waters and that tidal and other currents are generally low. These reefs are characterised by a high diversity of coral and fish species and show more oceanic characteristics; namely the absence of extensive macro algae beds, a lesser predominance of large massive coral and a greater abundance of faster growing coral forms. These northern mid shelf reef communities snare many of the fish species characteristic of both the inshore and outer shelf reef communities.

Southern Mid-Shelf Reef Communities

Mid shelf reefs in the southern part of the Central Section are characterised by larger and more tightly packed reef masses subject to strong tidal currents and rips.

Generally the eastward facing sides of the continental islands of the Whitsunday and Lindeman Groups together with the mid shelf reefs of this southern sub-area, like their northern counterparts, are characterised by a high diversity of coral and fish species, however, the variation in community structures are such that the northern and southern mid-shelf reefs can be identified as separate units for this classification.

Outer Shelf Reef Communities

The outer reefs of the Central Section are represented by a line of small reefs often several kilometres away from the main reef mass which stand nearer the edge of the continental shelf and accept the force of the coral sea waters. As such, there are components of these communities which appear to be distinctive.

By dividing the Section into even these broad sub-areas the Authority is better able to consider the distribution of the reef resources throughout the Section and, to some extent, the ability of reefs within these sub-areas to withstand the various demands and pressures placed on them. Assessment of the relative capabilities of each sub-area is integral to meeting the objective of providing for the conservation and reasonable use of the resources of the Great Barrier Reef.

The uniqueness or representativeness of certain biological communities needs to be considered in zoning, not just for recreational, commercial, harvest and aesthetic values but also for their research potential and for conservation.

See Resource Map 1.

Cetaceans (Whales & Dolphins)

The most frequently reported whales in the Central Section are humpback, minke and killer whales.

The humpback whale (Megaptera novaengliae) is considered to be an endangered species due to twentieth century whaling activities. Humpback whales seen in the Central Section spend the summer feeding in Antarctic waters but migrate north each winter to calve and mate. In the Central Section, most sightings have been reported from July through October. Humpbacks have been seen around Magnetic Island, the Palm group, and along inner mid-shelf reefs such as Rib, Trunk, Charity, North, Wheeler and Little Broadhurst Reefs. They have been sighted around the Whitsunday area including Hardy and Little Reef. A birth was recorded north of the Palm Island Group at Little Trunk Reef in 1982 and in the Whitsunday area near Teague Island a female with a young calf were sighted (Paterson, 1984). As the reported sightings tend to reflect human usage of the Central Section it is likely that humpbacks are more widely dispersed in the area than these records indicate. Commercial whaling in east Australian waters ceased in 1962 and recovery of the areas humpback population now appears to be occurring.

The status of the minke whale (Balaenoptera acutorostrata) is not a cause for concern. Scientists believe that minkes seen in the GBR area from May to October may belong to a warm-water race (Reader's Digest, 1984). Minke whales have been reported in the Central Section around the Whitsunday islands and the Hook and Hardy Reefs area.

Killer whales (Orcinus orca) have occasionally been sighted in the Central Section between Hook Reef and Hayman Island and near Hook Island at Langford Reef (Bowen Independent, 1983).

The species of dolphins usually seen in coastal areas of the Central Section are the bottlenose dolphin (Tursiops truncatus), Irrawaddy River dolphin (Orcaella breuirostris), and the Indo-pacific humpback dolphin (Sousa chinensis). An oceanic species, the spinner dolphin (Stenella longirostris) is generally seen some distance from shore.

Generally the pelagic nature of cetaceans means that their conservation requires measures that extend beyond the boundaries of the Great Barrier Reef Marine park. As such the Australian Government has enacted the Whale Protection Act 1980 which seeks to provide the required conservation measures. However, all cetaceans, whales and dolphins, have value for tourism and conservation and as such they are declared species under the Great Barrier Reef Marine Park Regulations. Additional measures such as protection of feeding or breeding areas on migratory pathways may be considered in a zoning plan.

See Resource Map 2.

Dugong

Large numbers of dugong (Dugong dugon) have been sighted during aerial surveys in Rockingham Bay, Missionary Bay at Hinchinbrook Island, Hinchinbrook Channel and Cleveland Bay. Dugong are also known to frequent Halifax Bay and the lee shores of Magnetic Island. Calving has been reported on tidal flats in Halifax Bay. Comparison of dugong sightings in the Far Northern and Central Sections of the Great Barrier Reef Marine Park seems to indicate that dugong populations in the Central Section are of less significance on a national scale than those in the Far Northern Section, however, the numbers present in the Central Section are probably higher than in most parts of the dugong's range outside the Australian region.

The dugong is considered a vulnerable species of world significance, as such Australia has an international commitment to protect dugong and its habitat. Zoning plans can play an integral role in fulfilling that commitment.

Turtles

The most frequently sighted turtles in the Central Section are flatback (Chelonia depressa), green (Chelonia), hawksbill (Erennochelys imbricata) loggerhead (Caretta caretta), an olive ridley (Lepidochelys olivacea) turtles. Four species of turtles have been recorded as nesting adjacent to the Central Section: flatback, green and more rarely, loggerhead and hawksbill. The flatback is the only one that is predictable in its nesting in this area, with very low density nesting on almost every beach, and with greater frequency to the south. Three small flatback rookeries on mainland beaches are the largest for the Section: Burdekin delta, Cape Bowling Green, and Cape Cleveland promontory. As they are the only mainland turtle nesting aggregations between Princess Charlotte Bay and the Whitsunday Islands, they have regional significance and high interpretive value.

Green and hawksbill turtles generally seek sandy cays and beaches for nesting. These are limited as there are only thirteen single or sand cays adjacent to the Central Section.

All of the above mentioned turtles feed in the Central Section, on reefs, rocky areas, and inter-reefal habitat. There are however no major high density feeding aggregations known in the area. Small hawksbills and small greens tend to be associated with the rocky coastlines and reefs. Research done in co-operation with prawn trawlers in the Central Section indicate that flatbacks and ridleys are the main species caught in inshore prawning areas. Mortality is low at present but this could change as fishing practices change (e.g. changes in shot times).

Because of their population dynamics, such as their slow maturity rate, all marine turtles are considered vulnerable.

Feeding and nesting sites need to be identified and considered in the zoning process, as apart from their conservation value they have a high value for interpretation.

See Resource Map 2.

Crocodiles

Crocodylus porosus, otherwise known as the saltwater crocodile, has as its prime habitat coastal mangrove swamps and freshwater lagoons. Australia is generally considered to be a marginal habitat for Crocodylus porosus on world standards (L. Taplin, pers.comm., 1984). However saltwater crocodiles have been so depleted in most other countries that Australia should now be considered as a potential source of stock for the species.

The east coast adjacent to the Central Section does not provide a large habitat for crocodiles as most of the river systems are fairly short. Crocodiles are known to nest in very low numbers on the Johnstone, Murray, Herbert and Burdekin Rivers, and Hinchinbrook

Channel. As saltwater crocodiles tend to avoid areas of strong wave action and to prefer freshwater and brackish lagoons, there are few seen in reefal areas. Because of destruction of much of the habitat and the fact that any large crocodiles are usually removed from the more populated areas, considerable pressure is placed on crocodile populations adjacent to the Section. Between Princess Charlotte Bay and Shoalwater Bay, the only protected habitat with large mangroves associated with freshwater swamps is Hinchinbrook Channel and hinterland. Areas such as this may require consideration in zoning.

Birds

Records of bird occurrences in the Central Section are incomplete due to the lack of regular and comprehensive surveys. Also some records make reference to a specific island in a group, while others refer to the group of islands, and not all the records identify numbers of breeding birds or pairs, or the numbers sighted. These circumstances make it difficult to identify the importance of individual islands. The importance of islands as breeding or roosting sites may vary over time as habitat or human impacts change (B. King pers com. 1984).

There have been 22 species of seabirds from 8 families recorded from islands and reefs within or adjacent to the Section. Of these, 9 species have been found breeding. These records cover 16 islands and groups of islands of which the most important for breeding are Eshelby Island and the Brook Group of islands, Dunk Island, Sandy Cay and Eva Island are also recognised breeding sites and Hinchinbrook Island is an important roosting site.

There have been at least 156 species of land and water birds from 45 families recorded from islands within or adjacent to the Section. Of these, 85 species have been found breeding. These records cover 44 islands and groups of islands, of which the most important are Dunk Island, the Family, Brook, Palm and Whitsunday Groups of Islands, Magnetic Island and Hinchinbrook Island. There may be other important islands for land and water birds.

The Japan-Australia Migratory Birds Agreement provides for the protection of the migratory birds and birds in danger of extinction and their environment. Of the 66 birds listed in the Agreement, 26 species have been recorded in the Central Section, and of these, 6 have been found breeding, the Brown Booby and 5 species of terns and noddies.

Some migratory species may affect aircraft operations at certain times. Some islands and groups of islands are important land and water bird sites because of the numbers and diversity of birds, others are of local significance, not only as breeding or roosting sites but because of their appeal for tourism and to local naturalists. The Marine Park does not include areas above low water mark which are part of Queensland and not owned by the Commonwealth. Therefore it is not possible under the Great Barrier Reef Marine Park Act to protect islands or cays for the

benefit of breeding birds, except those which are owned by the Commonwealth. Zoning plans developed in conjunction with other management agencies can help to conserve the natural attractions of these sites.

See Resource Map 3

Mangroves and Seagrass Communities

Both of these are very important plant communities. Mangroves are believed to be some of the most productive ecosystems in the world. They are nursery areas for larval and juvenile stages of many species of fish and prawns and feeding grounds for a variety of marine fauna including young green and hawksbill turtles.

Seagrass areas are also important nursery and feeding grounds for marine fauna, such as certain species of prawns and large green turtles and are particularly important habitat for dugong.

See Resource Map 4.

5. HUMAN USAGE

Fishing

The Central Section has a diverse fish and invertebrate fauna, some of which constitute an important commercial and recreational resource.

The Great Barrier Reef Marine Park Act specifies that one objective of zoning plans is to regulate the use of the Marine Park so as to protect the Great Barrier Reef while allowing the reasonable use of the Great Barrier Reef Region. Generally commercial and recreational fishing is considered to be a reasonable use of the Reef's resources. However, at some level or in some areas of intensive use, fishing may become un-reasonable.

There has been considerable discussion recently in which both commercial and amateur fishermen have identified the need to regulate the catch of reef fish. Apart from information on current fishing activity, it is necessary to obtain further information on the resource. Through public participation, the Authority hopes to draw on the knowledge accumulated by Reef users to provide adequate conservation measures, and at the same time ensure that the needs of the fishing industry are adequately considered. Fishermen, who spend much of their life observing the habits of their catch, are able to provide important information, for example, where and when certain species of fish and crustacea aggregate to breed. The Authority would appreciate a response from Reef users on these topics.

In order that all objectives of the Act are met the Authority needs to have detailed knowledge of commercial and recreational fishing activities. Your assistance is sought in updating the information presented.

(i) Commercial Fishing

The major commercial fisheries occurring in the Section are trawling, netting, trolling and line fishing. The extent of these activities is described in Table 5.1 and illustrated on Resource Maps 5 and 6

(ii) Recreational Fishing

Line fishing, light tackle game fishing, net fishing and spearfishing are all popular activities occurring throughout the Section. Coastal locations and fringing reefs associated with urban or tourist developments are the most intensively used areas.

Apart from shore based net and line fishing, access to the Section is generally by privately owned small boats. The large distances required to travel to the reefs of the Central Section mean that most small boats are not adequate to reach these reefs. However, alternative access is provided by a number of charter boats which operate in the Section; some primarily conducting fishing trips.

Species sought by recreational fishermen include a variety of reef fish such as coral trout, emperor and sweetlip, and pelagic species including mackerel, blue fin tuna, queenfish, trevally, black marlin and sailfish. A number of crustacea including crabs, crayfish and prawns are also taken in nets, traps, or are caught by hand or spear.

See Resource Map 7.

TABLE 5.1: COMMERCIAL FISHERIES - CENTRAL SECTION

FISHERY	TRAWLING	NETTING	TROLLING	LINE FISHING
<u>Area Fished</u>				
	generally between coast and reefs, less intensive in outer reef areas. (Resource Map 5)	generally in bays and estuaries generally throughout and around continental islands (no specific locational information available)	section (Spanish Mackerel - entire Section, and bait fishing around continental islands). (Resource Map 6)	reefs. throughout Section. (no specific locational information available)
<u>Vessels*</u> - as primary activity end with home ports on adjacent coast	170	116	28	13
<u>Fishing Method</u>	otter trawling mostly 2 nets	60% set or drift net*. 38% beach seine. mesh net. or minor tunnel netting.	trolling, usually from one boat	handline from vessel and dories
<u>Seasonality</u>	All year, peaking in* winter Way-July	barramundi closed season I November to 31 January		
<u>Species Caught</u>	Prams - tiger, king (blue leg, red spot) banana, coral. Bycatch-hugs. scallops (off Townsville/Lucinda), squid	king salmon. barramundi	mackerel	coral trout, emperor, sweetlip
<u>Mobility*</u>	high mobility into and out of Section (evidence of many "southern" vessels fishing Central Section 1983 winter)	low	Generally moderate but may fish outside the section	as for trolling
* Reference	Williams, H. 1980 Survey of Fishing Operations in Queensland 1980.			Queensland Fisheries Service Technical Report No. 2

TABLE 5.1 continued

FISHERY	TRAWLING	NETTING	TROLLING	LINE FISHING
Value of Catch** (Bowen to Cardwell)	\$4M (1980) equals \$5.3M (1984) (probably under estimate due to black market.)	Other than trawling: \$1.6M (1980) equals \$2.3M (1984) (probably under estimate due to black market.)		
value of Vessels** (Bowen to Cardwell)	\$11.5M (1980) equals \$15M (1984)	Other than trawling: \$2.3M (1980) equals \$2.9M (1984)		
People employed**	340 (based on an average of 2 per vessel)	185	40	
Comments*	In economic terms and numbers employed trawling is the most important fishery in the GBR. 28% of vessels with home ports adjacent to GBR are in Central Section 50% of trawl fishermen also participate in another fishery. Trawling is not a secondary fishery.	Met fishing is the second most important fishery in Qld. in terms of participation and probably landings. 36% of GBR primary net fishermen have home ports in Central Section. Trawl fishing is also a secondary fishery and most troll fishermen participate in other fisheries (netting, line fishing, crabbing).	Almost 40% of GBR troll fishermen have home ports in Central Section. Line fishing is also a secondary fishery and most line fishermen participate in other fisheries (netting, line fishing, crabbing).	14% of GBR line fishermen have home ports in the Central Section. Line fishing is also a secondary fishery and most line fishermen participate in other fisheries (netting, line fishing, crabbing).

Other Fisheries: Mud crabbing is the only other fishery in the Section (other than collecting) with only 4 primary fishermen. It is a secondary activity for some.

References: * Williams 1980

** Driml et al 1982. Econ : Characteristics of Fishing in the Great Barrier Reef Region. Report to the Great Barrier Reef Marine Park Authority.

Collecting

Collecting is generally considered a reasonable activity in the Marine Park, however, in some instances intensive collection may conflict with other activities. One aim of zoning is to mediate between conflicting uses to ensure that the requirements of all users can be met as far as possible. In order to achieve this aim a detailed account of collecting activities presently being undertaken, or proposed to be undertaken in the Section must be obtained.

(i) Shell Collecting

Shell collecting is a popular activity carried out by private collectors, individually or in groups, and by charter operators, commercial collectors and researchers.

Amateur shelling occurs at easily accessible coastal locations, islands and reefs and particularly on drying reefs which provide greater opportunities because of their accessibility. There is no specific information on the extent of amateur shell collecting throughout the Section.

There is apparently very little commercial shell collecting carried out in the Section. Some trochus collecting occurred in the past to a limited extent. Trochus are known to occur on the seaward side of reefs and are collected to about 10 metres. They are patchy on and between reefs in the Section (Nash, pers. comm.).

Trawlers infrequently retain shells brought up in their nets for sale to collectors and local shops, however, generally the shells are thrown back because of the difficulty of cleaning for small return.

Southgate (no date) reports that the main shell families collected in the Townsville area are Cowries (Family Cypræidae), Volutes (Family Volutidae), Mitres (Family Mitridae) and Cones (Family Conidae).

(ii) Aquarium Fish Collecting

The distance required to travel from populated areas on the mainland to the reefs of the Central Section has meant that aquarium fish collection has not developed to any great extent in the Section.

Under existing legislation commercial aquarium fish collectors require a licence or permit from the responsible agencies. The few commercial collectors operating in the Section are generally associated with local tourist or display aquariums. A wide range of species of fish and invertebrate fauna are collected and available figures indicate that the interest and expertise required for keeping a greater variety of species is developing rapidly.

Amateur collectors undoubtedly operate in the Section but there is no information currently available on the extent of the amateur collection. No licence or permit is currently required for amateur collectors in this Section.

Resource Map 8 indicates known areas of collection.

(iii) Corai Collecting

Approximately 33% of all coral collected from the Great Barrier Reef comes from the Central Section. Table 5.2 shows the amount of each species of coral collected during a twelve month period (1982-1983).

Coral collected from the Central Section supplies two main sources:

- (a) The curio industry - selling various coloured or bleached coral pieces or ornaments to the tourist industry locally and interstate and, infrequently, for export.
- (b) The aquarium industry - requires both live and bleached coral pieces for display. This coral is destined for southern Queensland and interstate distribution with a small proportion sold locally.

Under existing legislation collection of coral from the Great Barrier Reef is only permitted with a Licence from the responsible agencies. Resource Map 8 shows the location of licenced collection areas in the Central Section.

Research

Because of the proximity of two major marine research centres (Australian Institute of Marine Science and James Cook University) to the Central Section, this Section is a major focus for marine research.

There is one research station in the Section - at Orpheus Island. The station is run by James Cook University. The Australian Institute of Marine Science has designated a "central study transect" in order to concentrate research into a defined cross-shelf area. (See Resource Map 9).

Tourism

The most apparent feature of coastal tourism in north and central Queensland is that it is currently undergoing marked change. In particular, there has been a significant growth in tourist facilities over recent years (Table 5.3), as indicated by increases in numbers of guest rooms and bed spaces and an accompanying 16.9% increase, in real terms, in takings from accommodation during the period December 1979 to December 1983.

Table 5.2 Amounts of coral collected from the Central Section by commercial collectors during a twelve month period (1982-1983)

Home Port	Amount (kg/yr)						TOTAL	
	Brown Stem	Staghorn	Mushroom	Xmas	Needle	Hibiscus		Other
Townsville	5,124	24	736	455	-	248	736	7,323
Airlie Beach	455	909	400	682	450	41	150	3,087
TOTAL	5,519	933	1,136	1,137	450	289	886	10,410

Source: J. Oliver (1983) - unpublished data.

Brown stem	=	<u>Pocillopora damicornis</u>	Needle	=	<u>Seriatopora</u> sp.
Staghorn	=	<u>Acropora</u> spp.	Hibiscus	=	<u>Pectinia</u> spp.
Mushroom	=	<u>Fungia</u> spp.			
Xmas	=	<u>Acropora elseyi</u> (A. vaughni)			

Table 5.3 Rates of increase of facilities associated with tourism on Islands in the Central Section - 1979/1983

	<u>Dec. 1979</u>	<u>Dec. 1983</u>	<u>% Increase</u>
Number of Developments	20	23	15%
Guest Rooms	1019	1328	30%
Bed Spaces	3043	4005	32%
Takings from Accan. Real Term (\$83/84)	\$3,461,300	\$4,047,000	16.9%

Source: ABS Tourist Accommodation Statistics - Queensland

Impacts from tourist facilities are basically as a result of locally intensifying recreational and associated impacts. Table 5.4 indicates major tourist developments immediately adjacent to the Marine Park and their associated marine based activities (see Resource Map 10).

Table 5.4 Activities associated with major tourist developments adjacent to the Central Section.

	Fishing Trips	Game Fishing	Cruises	Reef Walking	Scuba Tank Fills	Scuba Gear	Snorkel etc.	Motor Boats	Sailing	Glass Bottomed Boats	Tours	Observatory	Coral Display	Accommodation
Dunk Is.	X		X				X	X	X	X				X
Bedarra Is.	X		X					X	X					X
Hinchinbrook Is.	X		X				X							X
Orpheus Is.	X	X	X	X			X	X	X	X				X
Magnetic Is.	X	X	X				X	X	X		X			X
Hayman Is.	X	X	X	X	X	X	X	X	X	X				X
Daydream Is.	X		X			X	X		X	X				X
South Molle Is.	X	X	X	X	X	X	X	X	X	X	X			X
Whitsunday 100 (Long Is.)	X		X	X			X	X	X		X			X
Lindeman Is.	X		X	X			X	X	X	X	X			X
Hamilton Is.	X	X	X	X	X	X	X	X	X	X	X	X		X
Hook Is.												X		
Dent Is.													X	

Source QITC (1982) Queensland Travel Agents Manual

Amongst proposed developments adjacent to the Section of which the Authority is aware are:

- a resort at Shute Harbour
- a marina at Airlie Beach;
- new resorts and marinas at Magnetic Island.
- the casino at Townsville which is proposing to include a hotel and marina.

Off-shore developments

Tourist industry interest in providing access to mid-shelf and outer reefs of the Section is increasing rapidly. There has been a marked increase in proposals for the development of off-shore tourist facilities. These range from simple, individually moored pontoons to large scale structures providing accommodation.

Currently further developments are proposed for John Brewer Reef, Broadhurst Reef, the Slashers Group, Hardy Reef, Square Reef, Little Bugatti Reef, Magnetic Island and Daydream Island.

Consideration of off-shore developments is complex in that the Authority must balance the requirements for tourism with the requirements of other reef users. The impact on the Reef itself is a major consideration.

Non-extractive Recreational Activities

Apart from recreational activities associated with tourist resorts which have previously been discussed; snorkelling, diving, sailing, boating and photography are popular recreational activities at the more accessible reefs.

The greater clarity of the outer waters of the Great Barrier Reef makes the offshore reefs attractive for diving, although for much of the year the roughness of large stretches of water between the reefs makes access difficult and uncomfortable. Though the inner waters are often turbid, due to the proximity to land, there are a number of good popular diving sites accessible from continental islands and the mainland which receive regular use.

Camping on islands is an increasingly popular pastime. Indications are that considerable pressure is placed on the fringing reefs associated with island destinations.

Charter/Cruise Vessels and Aircraft

The Central Section generally, and particularly the Whitsunday Islands, provide a major focus for charter and cruise vessel activity in the Great Barrier Reef Region.

Like other aspects of tourism, the most apparent feature of the charter/cruise vessel industry over the past 5 to 10 years is its rapid growth and change. This period has seen the advent of the bare-boat charters, particularly in the Whitsunday Islands. The large high-speed aluminium catamarans have greatly increased the accessibility of more outer reefs to the general public. The availability of sea planes, conventional aircraft, jet and helicopter services on a regular basis and for charter has considerably reduced travelling time to the Reef. And, more recently, the development of floating platforms and the "semi submersed" reef viewing vessels have added a new facet to the industry.

Activities offered by charter operators are equally diverse. The major activities are fishing, snorkelling, scuba diving, cruising, coral viewing, reef walking and island drop-offs.

Experience with zoning plans for other Sections of the Marine Park indicates that charter and cruise vessels and aircraft have particular requirements for use of the Reef's resources. Because of the great changes that have occurred in this industry the Great Barrier Reef Marine Park Authority has commissioned a survey to provide up-to-date information on charter and cruise vessel activities. The survey will provide essential information on nearly all aspects of the industry for the entire Reef Region and it is expected that preliminary results will be available for the Central Section late in 1984.

Information currently available on the location of regular services has been included on Resource Map 11.

Sheltered Anchorages

The locations of commonly used anchorages in the Central Section have been plotted on Resource Map 12.

Experience with zoning plans for other Sections of the Marine Park has indicated that access to all weather anchorages is an important consideration in developing a zoning plan.

Shipping and Navigation Aids

The Commonwealth Department of Transport maintains a series of lights and channel markers along the major "inner route" shipping lane which passes between the coast and the inner barrier reef. In 1981/82, 1,300 vessels were piloted along the inner route. This figure has remained fairly stable over the past few years.

Shipping channels have been plotted on resource map 12 along with details of channel lights and markers.

Channels are characterised by a minimum draft of approximately 10 metres, a minimum width of 1700 metres and a minimum clearance from reefs of 550 metres.

In the Central Section only Rib Reef is located within the snipping channel. Passage within the reef, as opposed to east of the outer reefs, is a necessity both economically speaking and in terms of safety in the event of a shipboard emergency or rough weather. The majority of "through-reef" transits occur through Grafton Passage in the Cairns Section. However, Palm Passage in the Central Section is also commonly used. The development of Hydrographers Passage will provide an alternative route through the Reef in the near future. It is expected that use of Hydrographers Passage will reach 730 transits per annum in the 1990's.

International obligations require the Authority to provide for shipping along traditional and current routes.

Defence Areas

The restricted Defence Areas wholly or partly within the Central Section are:

- R771 Halifax Bay - Surface and Air limits - used for bombing and gunnery practice. Vertical limits and hours of activities are notified by Notice to Mariners and NOTAM.
- R780 Townsville - used for air to air firing. Vertical Limits and hours of activity are notified by Notice to Mariners and NOTAM.
- R784B Cowley Beach - used for test firing of Army guns and ammunition. Vertical limits and hours of activity are notified by Notice to Mariners and NOTAM.
- R776 Ingham - lies adjacent to the Section near Hinchinbrook Channel and is administered by the Department of Aviation for flying training.

The Authority is required to consider the use of Defence areas when preparing zoning plans.

Educational Programs and Facilities

Queensland Department of Education operates two field study centres on the mainland adjacent to the Central Section; they are the Vincent State School and the Paluma Field Study Centre. Neither concentrates on marine activities. An additional centre is proposed for Cape Pallarenda which, if developed, will have a major marine studies component.

James Cook University runs educational programs which are generally associated with their research study reefs. The university has its own research vessel and a fleet of small boats as well as extensive research and educational equipment and facilities. A research station is also established at Orpheus Island.

Currently there is no information available with regard to private educational programs or facilities.

The location and activities associated with educational programs and facilities must be considered in terms of potential conflicts with other activities and with the Reef ecosystem, and also in terms of their potential for educating Reef users.

Historic Shipwrecks

Under the provisions of the Commonwealth Government's Historic Shipwrecks Act (1976) and subsequent amendments, the Commonwealth Minister for Home Affairs and Environment can declare a wreck or relic(s) to be an "Historic Shipwreck" or "Historic Relic".

The Central Section contains 100 or more shipwrecks that can be considered "historic" in terms of the period in which they were wrecked, from 1825 (earliest recorded wreck) to 1941. The exact positions of many of the wrecks is not known. Although all of these shipwrecks can be considered "historic" in terms of the year in which each went down, their actual "historical significance" depends on many other factors, such as:

- (a) Significance of a wreck in the discovery, early exploration, settlement or early development of Australia;
- (b) Relevance of a wreck to the opening up or development of parts of Australia;
- (c) Relevance of a wreck to a particular person or event of historical importance;
- (d) A source of relics of historical or cultural significance;
- (e) The wreck is representative of a particular maritime design or development;
- (f) Naval wrecks other than those deliberately scrapped or sunk;

(g) Wrecks having educational and recreational value.

At present only three wrecks in the Section have "Historic Shipwrecks" status under the Act.

They are:

- The Schooner "Foam" a blackbirder (kanaka carrier) which was wrecked on Myrmidon Reef in 1893

The 3663 ton steam ship "Yongala" which sank during a cyclone in 1901 just south east of Cape Bowling Green

The 741 ton barque rigged steam ship "Gothenburg" which was wrecked during a heavy gale on Old Reef in 1875

The status of "Historic Shipwreck" provides several levels of protection for the wrecks, relics and marine life associated with them. Under the provisions of the Act and regulations the wrecks and/or relic(s) and/or marine life associated with them cannot be removed, damaged or interfered with, without a permit from the Minister for Home Affairs and Environment or a State Authority (such as the Queensland Museum) authorised under the Act. The provision for a "protected zone" around a wreck provides further protection for the wreck. Permits may also be required for diving and other underwater activities in the restricted areas.

The "protected zone" around the Yongala protects the marine life associated with the wreck (one of the reasons the wreck is so famous and interesting) as well as protecting the wreck from boats anchoring at the site. The Yongala is the only location in the Central Section where aggregations of sea snakes and large loggerhead turtles can reliably be viewed. As such it has high value for marine environment interpretation.

It is very likely further wrecks within the Section will be declared as "Historic Shipwrecks" in the future as exact locations are discovered, identities proven, and historical significance assessed.

When preparing zoning plans for other Sections of the Marine Park, the Authority considered that the existing legislation provided adequate protection for historic shipwrecks. This may require further consideration in the light of information available for the Central Section.

6. ADJACENT LAND USE

Harbours, Ports, Marinas and Boat Ramps

The Commonwealth Government believes that, unless there are over-riding conservation reasons, the involvement of the Authority in port administration might divert it from its principal functions. For this reason, large harbour and port areas have not been included in the

Marine Park. Even so, information on adjacent port developments, including snipping intensity and types of cargoes is important. Provision for access to the port and associated dredging activities must also be taken into account.

The principal ports adjoining the Central Section are Lucinda, Townsville, Abbot Point, and Bowen.

The Port of Lucinda has a 5.76km long jetty which is primarily a sugar terminal. The volume of trade for 1981 was 40 vessels (37 piloted) with exports of 326,367 tonnes of raw sugar and 53,081 tonnes of molasses with imports of 21,000 tonnes of aqua-ammonia.

The Port of Townsville consists mainly of a bulk sugar terminal at the entrance to Ross Creek, and an outlet for Mt Isa Mines mineral products and Greenvale Nickel products. It has a slipway for vessels up to 1500 tons and 67m. The volume of trade for the Port in 1980-81 was 385 ships (298 piloted) with exports of minerals and sugar totalling 2,105,162 tonnes. A fish processing plant (KFV Fisheries) is located at Ross River which employs 60-70 people locally and maintains 27 vessels which work mainly in the Gulf of Carpentaria. All trawlers have been relocated from Ross Creek to new facilities in Ross River.

Abbot Point is a coal loading port for export from Collinsville and Newlands mines. The L-shaped jetty is 2.8km long. The swing basin was dredged in 1981.

The main items of trade through the Port of Bowen are coal and meat. Total exports during 1981 amounted to 171,960 tonnes of coal. No imports were recorded for the port. The number of snips entering the port during the year was 13, all piloted.

Dredging occurs in the Port of Townsville and Platypus Channel which provides access to the Port, and in the Port of Bowen, its small boat harbour and their access channels. There are no designated spoil grounds identified in association with either of these ports. At Townsville the dredged material is dumped in the eastern part of Cleveland Bay.

There is no dredging activity identified with the Ports of Abbot Point and Lucinda and no dredging will take place in Hydrographer's Passage.

Small ports and marinas provide shelter and facilities for smaller boats, many of which are used primarily for recreation. Small boat facilities on the mainland are located at Cardwell, Dungeness, Ross River Creek in Townsville, Bowen and Shute Harbour; and are proposed for Airlie Beach, Shute Harbour, Tam O'Shanter Point, Cardwell and Magnetic Island.

Public boat ramps provide focal points for marine-related activity and access to the Marine Park particularly for recreational users. Public boat ramps are located at:

Mission Beach	Hull River Heads
South Mission Beach	Tully Heads
Cardwell-Northern Esplanade	Oungeness
Taylor's Beach (via Halifax)	Forrest Beach (via Ingham)
Saunders Beach	Balgol Beach/Rollingstone Creek
Ross Creek (2)(Townsville)	Railway Estate (Townsville)
Pallarenda (Townsville)	Barrata Creek (2)
Barramundi Creek (local name)	Morris Creek
Cromarty Creek (via Giru)	Groper Creek (2)
Ocean Creek	Plantation Creek
Wallace Landing	Bowen BH No 1 - (Eastern Side)
Bowen BH No 2 (Magazine Island)	
Grays Bay (Airlie Beach)	
Proserpine River (Towards Wilsons Beach)	
Shingley Beach (Cannonvale)	Shute Harbour (Near Lloyd Robert Jetty)

(Source: Official Tide tables for Queensland with notes on boating 1984).

Local Authorities

There are 7 Local Authorities in coastal areas adjacent to the Central Section: the Shires of Cardwell, Hinchinbrook, Thuringowa, Burdekin, Bowen and Proserpine and the City of Townsville.

In 1981 the total population of the Local Authorities in coastal areas adjacent to the Section was approximately 161,720.

Table 6.1 indicates that over-all there has been substantial population growth in the adjacent shires, particularly in Thuringowa Shire with an average annual population increase of 10.2% in the period 1976-1981.

Table 6.1
1981 Population - Local Authorities adjacent to Central Section

Local Authority	1981 Population	Average Annual Growth Rate 1976-1981 %
Cardwell	7 030	2.1
Bowen	13 000	2.6
Burdekin	18 780	- 0.5
Hinchinbrook	U 940	- 0.9
Thuringowa	18 390	10.2
Townsville City	82 760	0.1
Proserpine	7 820	- 4.6
Total	161 720	

Increasing populations adjacent to the proposed Section will add to the impact on Reef resources.

Local Authorities exercise a wide range of powers through By-laws and Town Plans for the adjacent mainland and islands. Compatibility between town plans and zoning plans developed for these adjacent areas is desirable.

Effluents and Pipes

The extent to which land-based discharges affect the Great Barrier Reef lagoon is not known. There is a need to research and monitor the effects of discharges from major rivers on the marine environment.

The Water Quality Council of Queensland is responsible for administration of the Clean Waters Act 1971-1979 and there is a regional office at Townsville. Licences may be issued subject to appropriate conditions in respect of discharges to the waters of the State including those from the mainland and islands to ocean waters. There is continual monitoring of water quality. Such monitoring is the responsibility of the relevant State Government agency, although the Commonwealth contributes to water quality and quantity monitoring on major Queensland rivers through the National Water Resources Assessment Program.

The Authority would generally prefer to refrain from becoming involved in the regulation of activities outside the Marine Park except when they occur in areas which are integral to the Marine Park. S.66(2)(e) of the Great Barrier Reef Marine Park Act 1975, does however provide that the Governor-General may make regulations to "regulate and prohibit acts (whether in the Marine Park or elsewhere) that may pollute water in a manner harmful to animals and plants in the Marine Park". It is expected that generally such activities would be controlled through Queensland legislation.

Under the Great Barrier Reef Marine Park Regulations and in zoning plans prepared for other Sections of the Marine Park discharge of wastes from islands or fixed structures can be permitted subject to appropriate conditions.

Aboriginal Resources

Of the Palm Island Group, Great Palm, Curacoa, Esk, Falcon, Eclipse, Brisk and Havannah Islands are Aboriginal Trust Areas. A reserve was established at Great Palm Island in 1913. In 1980 a population of 1454 lived on Great Palm Island with an established "traditional" and commercial association with the marine resources of the area.

The most important areas in or adjacent to the Central Section containing material evidence of past Aboriginal history include middens, fish traps, and fishermen ponds on Hinchinbrook and Dunk Islands.

The Commonwealth Government has a stated commitment to the upholding of traditional rights including protection to sites of special significance.

See Resource Map 13.

National Parks and Environmental Reserves

Camping and tourism associated with Queensland National Parks and Environmental Parks, both island and mainland, provide a focus for human interaction with the Section. The great number of island and mainland Queensland National Parks within the outer boundaries of, or adjacent to the Central Section provides a unique opportunity for complementary management of significant environmental features.

Fringing reefs and/or shallow water marine areas occur adjacent to the following National Parks, Environmental Parks and Reserves (see Resource Map 13):

i) Island National Parks

Dunk Island	Hinchinbrook Island
Kumboola Island	Orpheus Island
Mungum-Gnackum Island	Magnetic Island (part only)
Purtaboi Island (Mound Is.)	Gloucester Island
Family Group (5 islands)	Saddleback Island
Goold Island	Middle Island
Brook Islands Group (3 islands)	Double Cone Island
Border Island	Thomas Island
Arkhurst Island	Keyser Island
Langford Island	Volskow Island (Pine Is.)
Bird Island	Black Island
Triangle Island	Hook Island (Part only)
Comston Island	Whitsunday Island
Baynham Island	Tancred Island
Gaibirra Island	Repair Island
Mansell Island	Shute Island
Shaw Island	Molle Island (Part only)
Maher Island	Goat Island (Part only)
Seaforth Island (Scenic Area)	North Molle Island
Lindeman Island (Part only)	Mid Molle Island
Little Lindeman Island (by vinculum to Lindeman Island)	Planton Island
Pentecost Island	Denman Island
Dungurra Island	Nunga Island
Surprise Rock	Teague Island
Perseverance Island	Gungwiya Island
Pine Island 20°23'S, 148°54'E	Yerumbinna Island
Cid Island	Haslewood Island
Long Island (Part only)	Lupton Island
Henning Island	Nicolson Island (Pine Island 20°18'S, 149°06'E)
Deloraine Island	Workington Island
Dumbell Island	Wirrainbeia Island

Esk Island
Harold Island
Sillago Island
Edward Island
Yiundalla Island
Armit Island
Gumbrell Island
Grassy Island
Olden Island

Ireby Island
Cockermouth Island
Repulse Group (3 islands)
Buddi Buddi Island

Hayman Island (Part only)
Low Islet
Edwin Rock
Unnamed island (between Grassy
Island and Edwin Rock)
Pelican Island

ii) Mainland National Parks

Hull River N.P.
Edmund Kennedy N.P.
Hinchinbrook Channel N.P.
Nypa Palms N.P.
Cape Cleveland N.P.

Bowling Green Bay N.P.
Mt Burrumbush N.P.
Cape Upstart N.P.
Conway N.P.

iii) Environmental Parks

Insulator Creek Environmental
Park

Townsville Town Common Environ-
mental Park

iv) Other Reserves

Hinchinbrook Channel Fish Habitat
Reserve

Hock Island Fish Sanctuary

Local Authority Recreation Areas
- Balgal Beach
- Bluewater Beach
Beach Erosion Control Districts
- Upstart Bay
- Cape Upstart to Cape
Edgecombe

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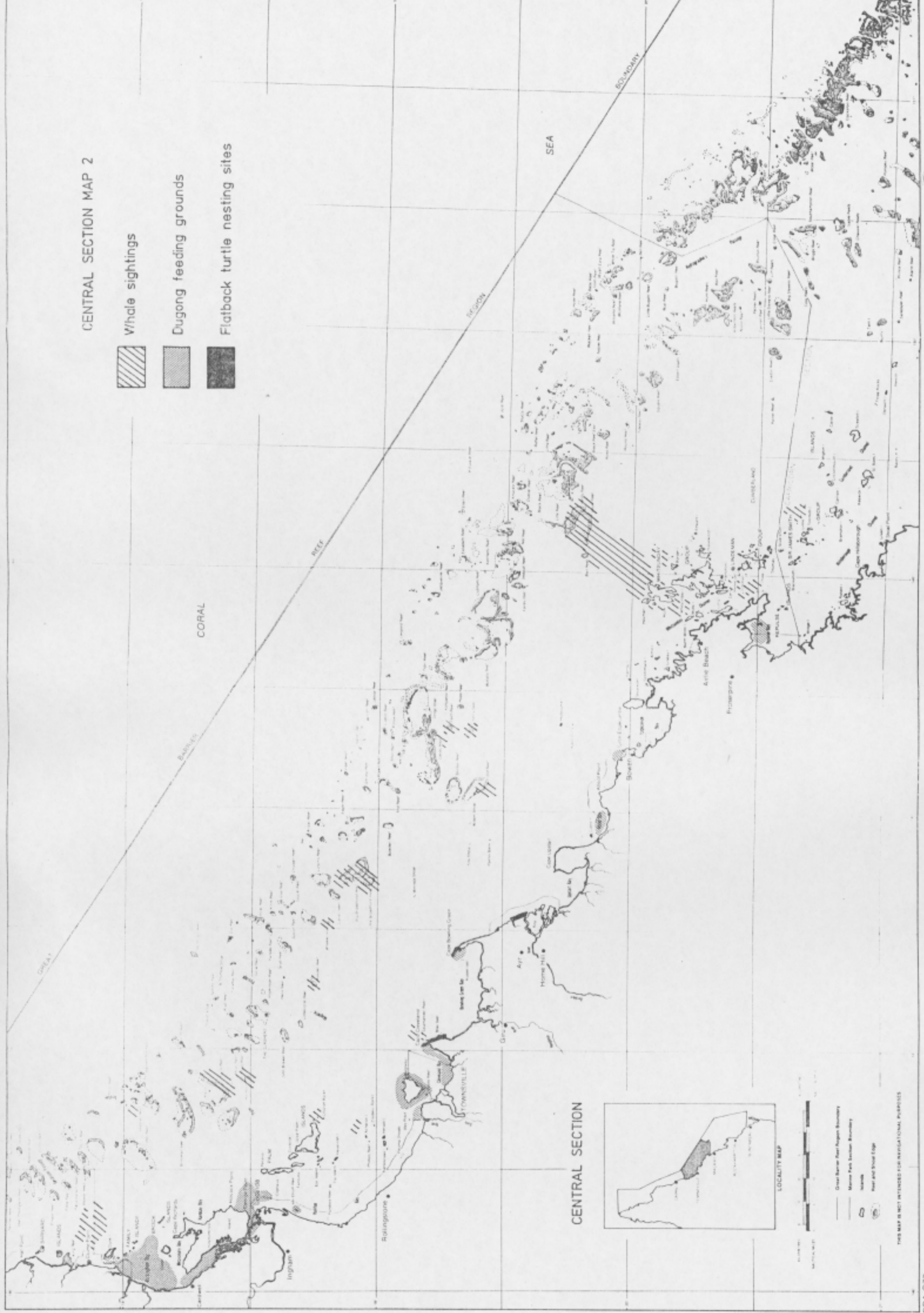
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


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Attachment 1 - Resource Maps

CENTRAL SECTION MAP 2

-  Whale sightings
-  Dugong feeding grounds
-  Flatback turtle nesting sites



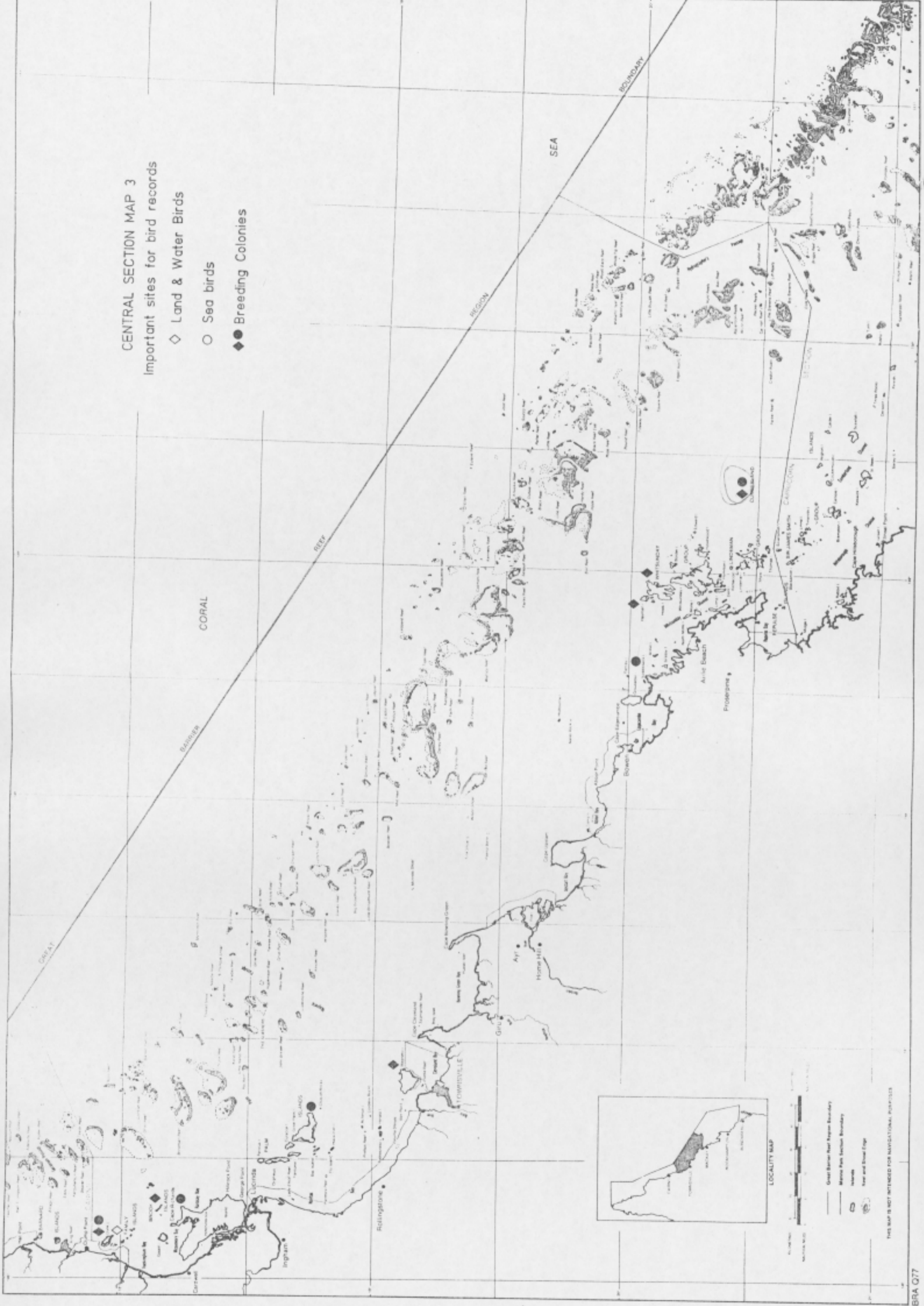
- LOCALITY MAP
-  Great Barrier Reef Dugong Boundary
 -  Marine Park Dugong Boundary
 -  Island
 -  Reef and Shoal Edge

THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

CENTRAL SECTION MAP 3



Important sites for bird records

- ◇ Land & Water Birds
- Sea birds
- ◆ Breeding Colonies



THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

CENTRAL SECTION MAP 4

-  Major Mangrove Communities
-  Seagrass Communities

CORAL

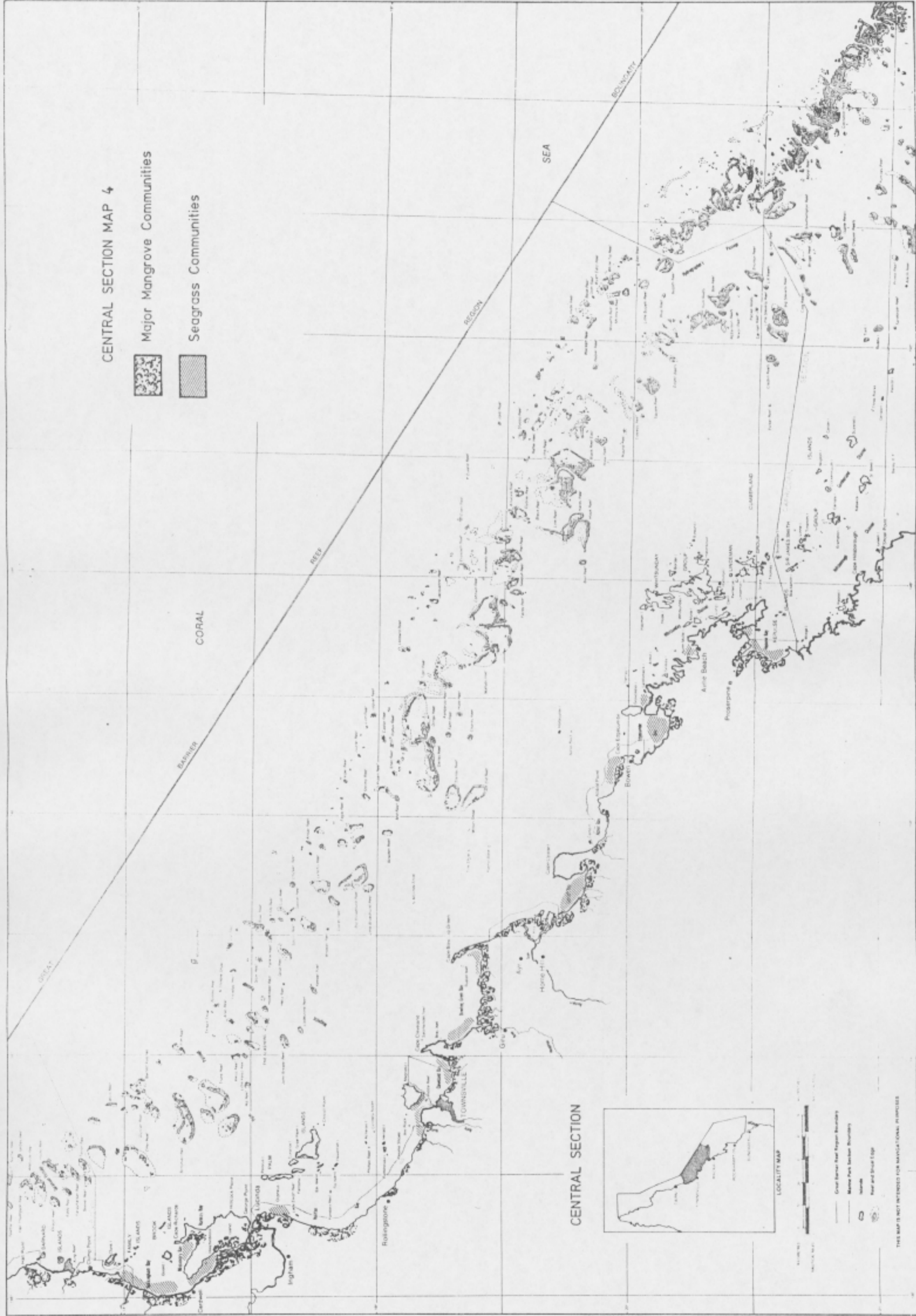
BARRIER

REEF

REGION

SEA





BOUNDARY



CENTRAL SECTION

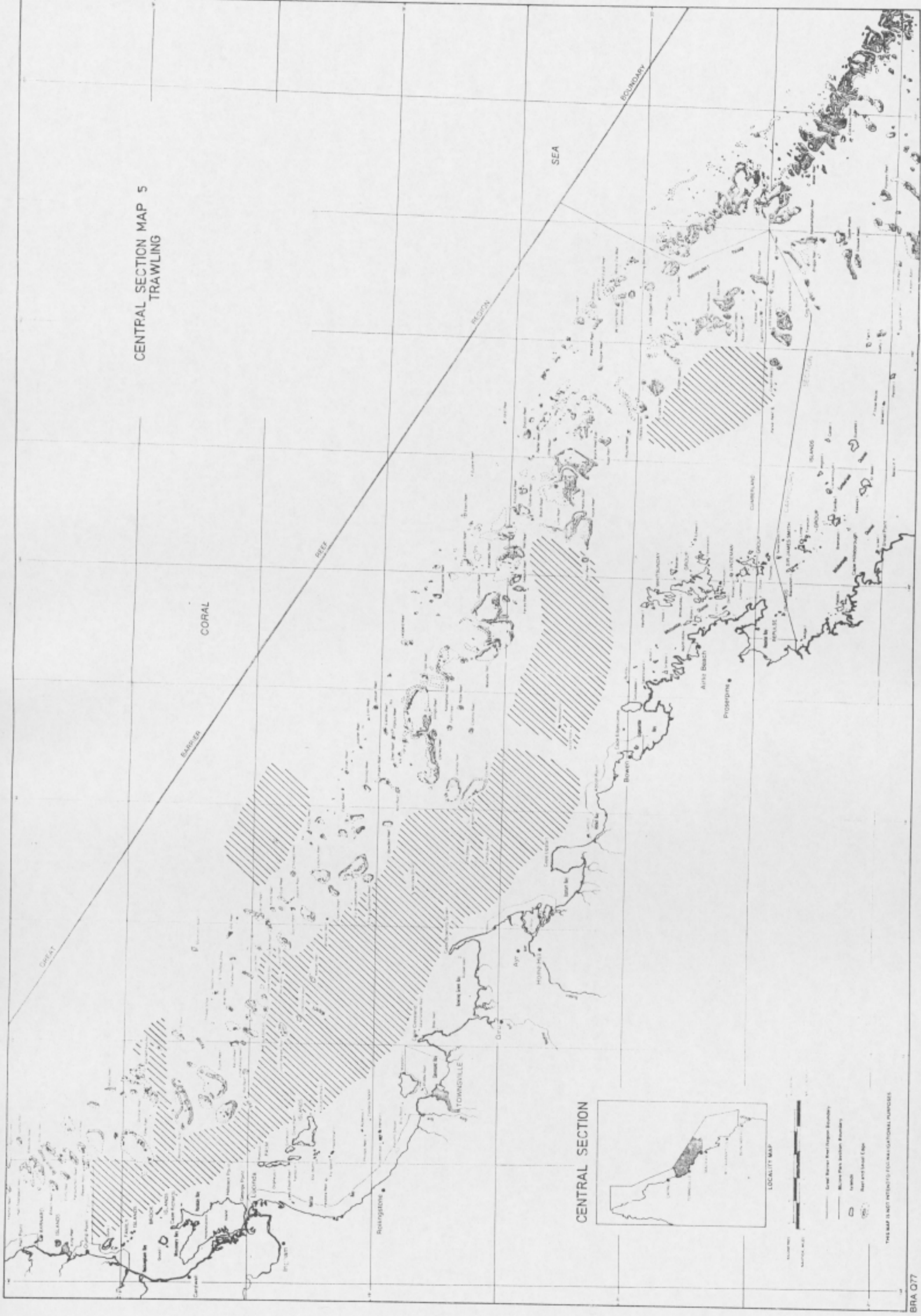


LOCALITY MAP

-  Great Barrier Reef Region Boundary
-  Marine Park Section Boundary
-  Island
-  Reef and Shoal Edge

THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

CENTRAL SECTION MAP 5 TRAWLING



CENTRAL SECTION

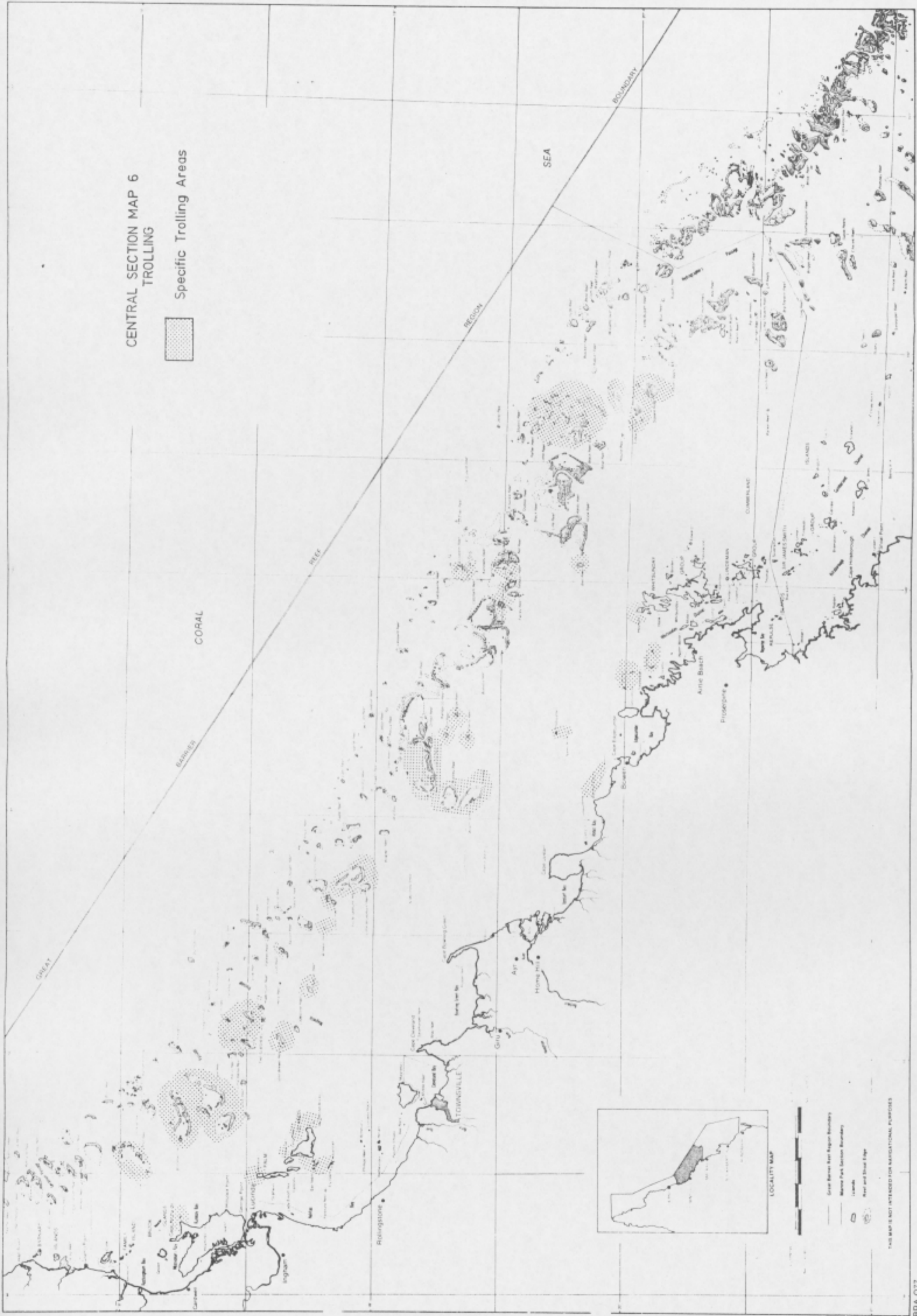


- Scale: 1:50,000
- Great Barrier Reef Marine Park Boundary
 - Marine Park Section Boundary
 - Island
 - ⊖ Reef and Lagoon Edge

THIS MAP IS NOT INTENDED FOR NAUTICAL PURPOSES

CENTRAL SECTION MAP 6
TROLLING




Specific Trolling Areas

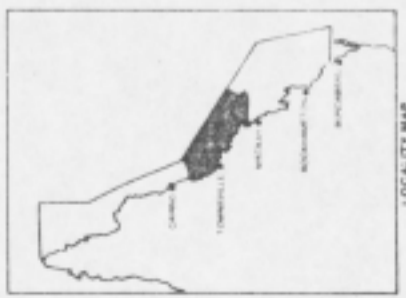
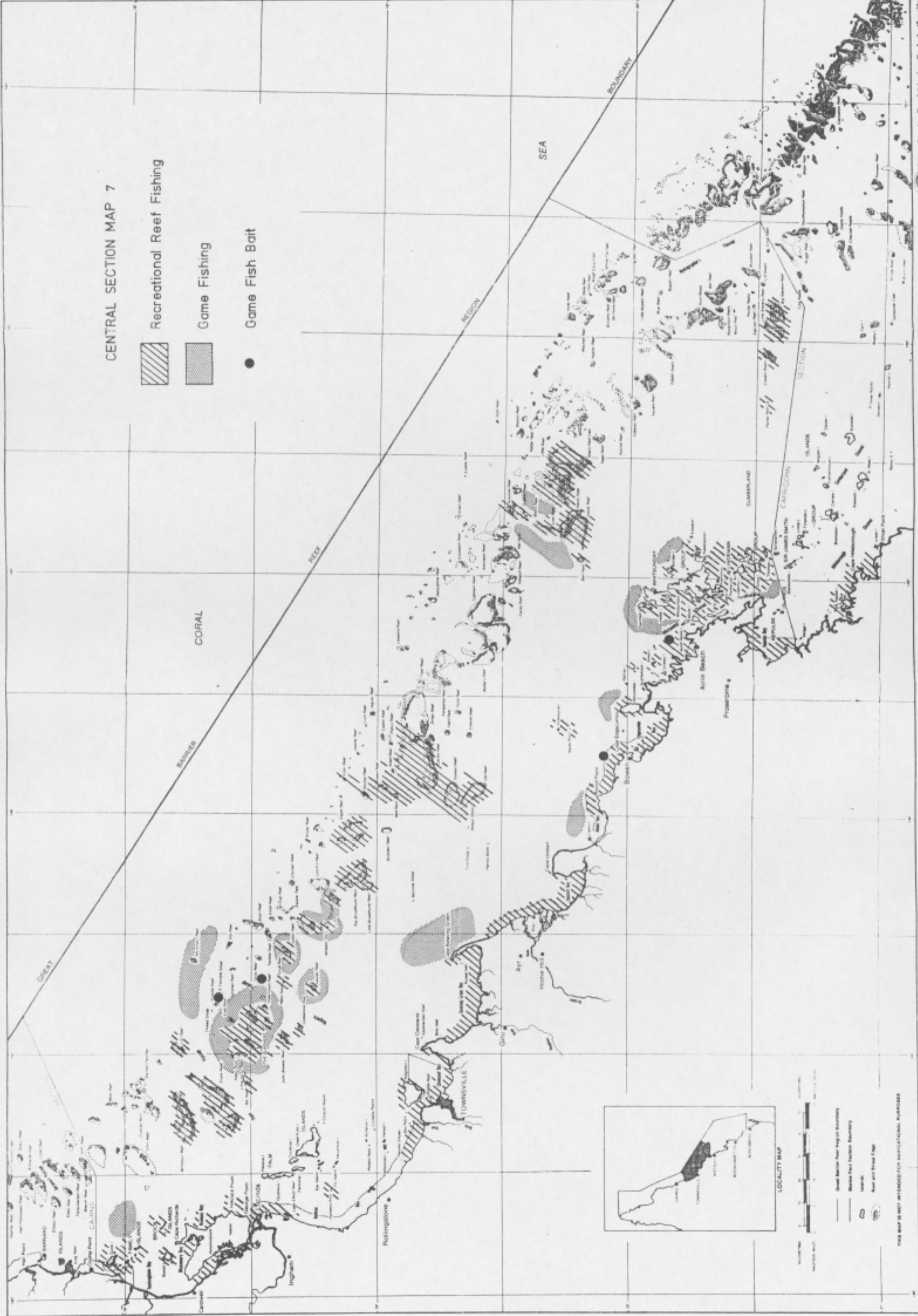






- Great Barrier Reef Region Boundary
- Marine Park Section Boundary
- Island
- Reef and Shoal Edge

THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

CENTRAL SECTION MAP 7

-  Recreational Reef Fishing
-  Game Fishing
-  Game Fish Bait



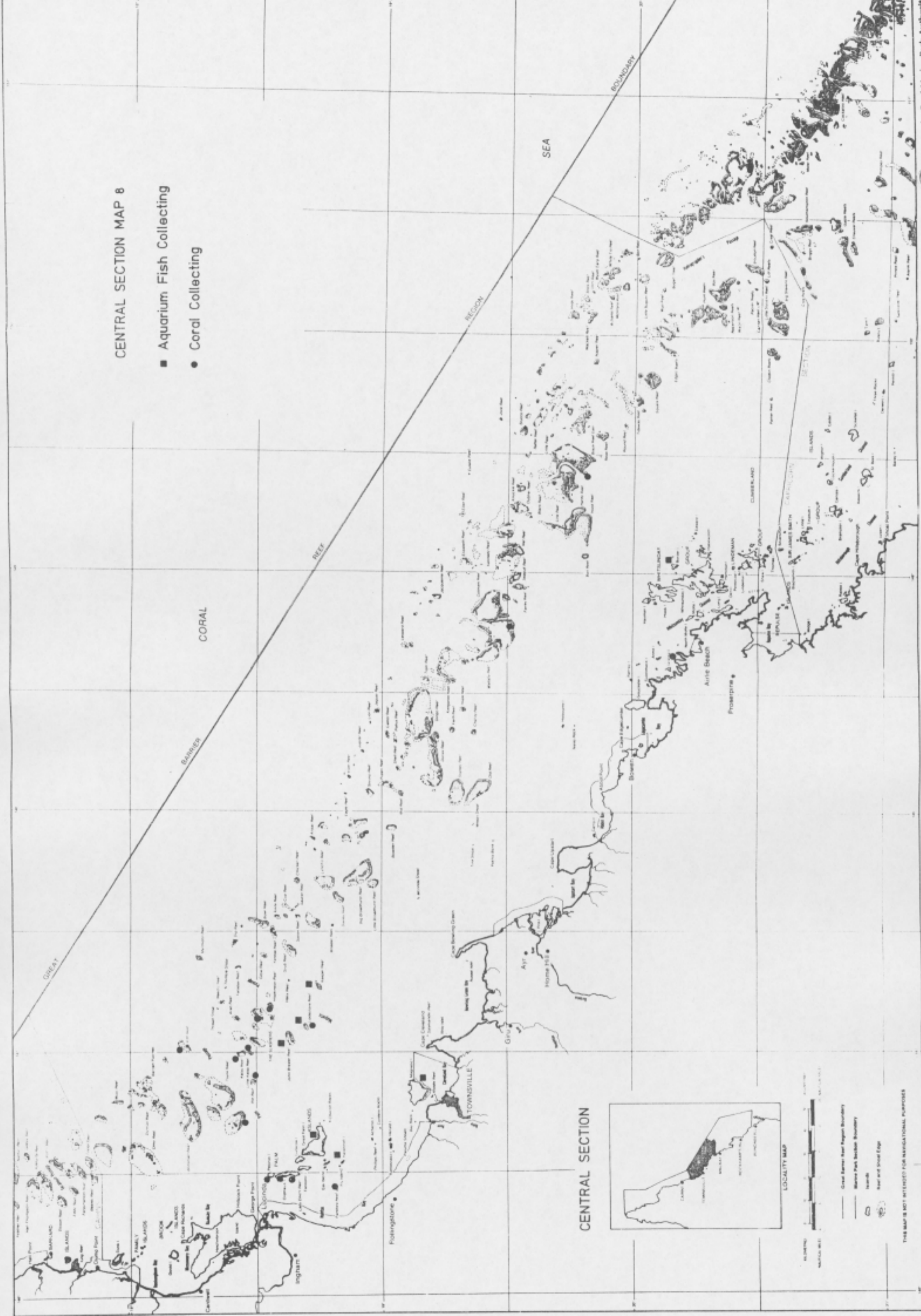
- SCALE: 1:50,000
-  Great Barrier Reef Region Boundary
 -  Marine Park Inshore Boundary
 -  Island
 -  Reef and Shoal Top

THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

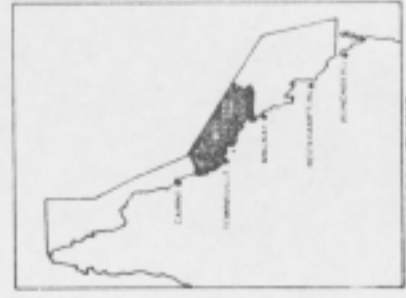
CENTRAL SECTION MAP 8

- Aquarium Fish Collecting
- Coral Collecting

CORAL



CENTRAL SECTION

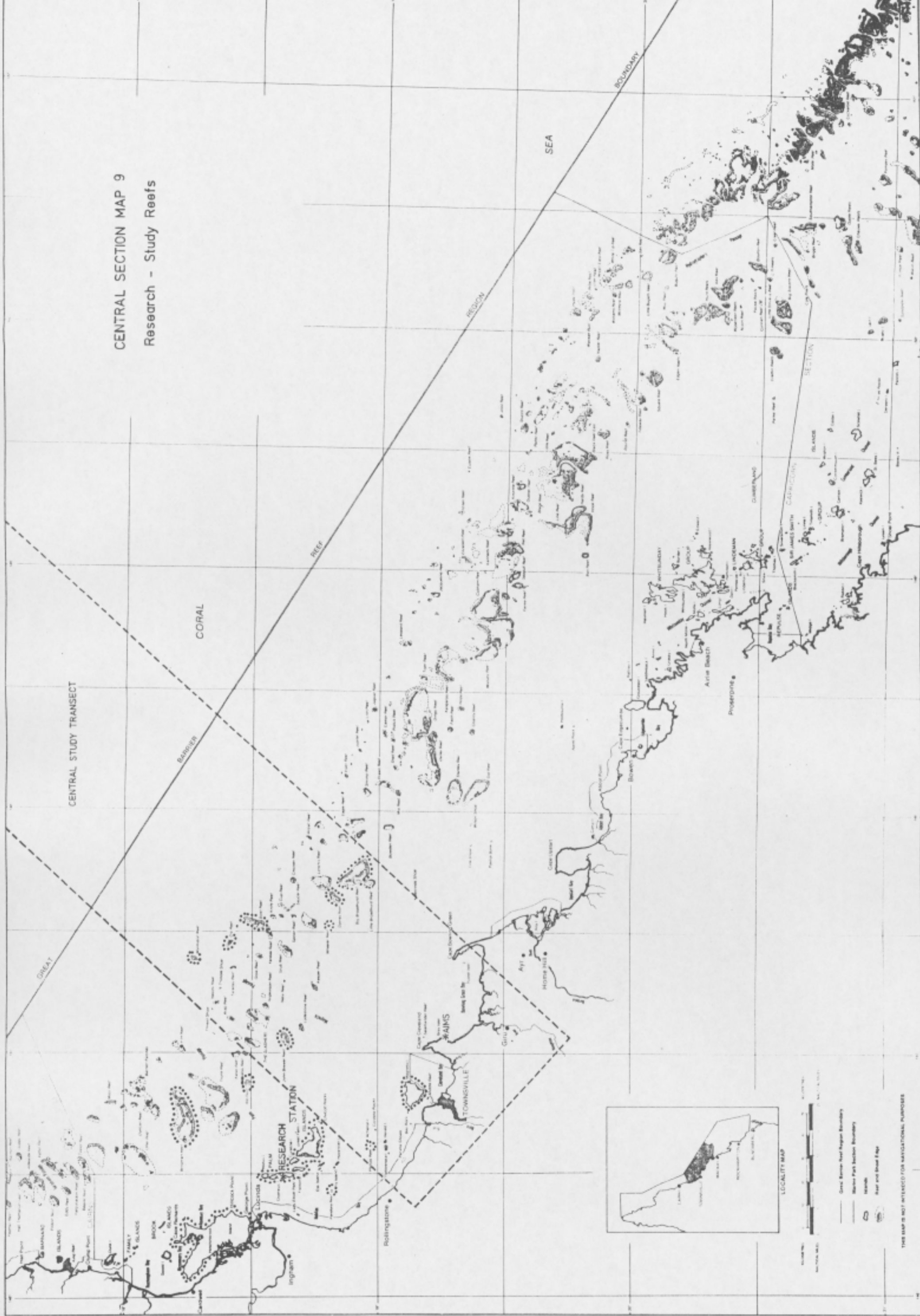


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- Great Barrier Reef Region Boundary
 - Marine Park Section Boundary
 - Islands
 - Reef and Island Edge

THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

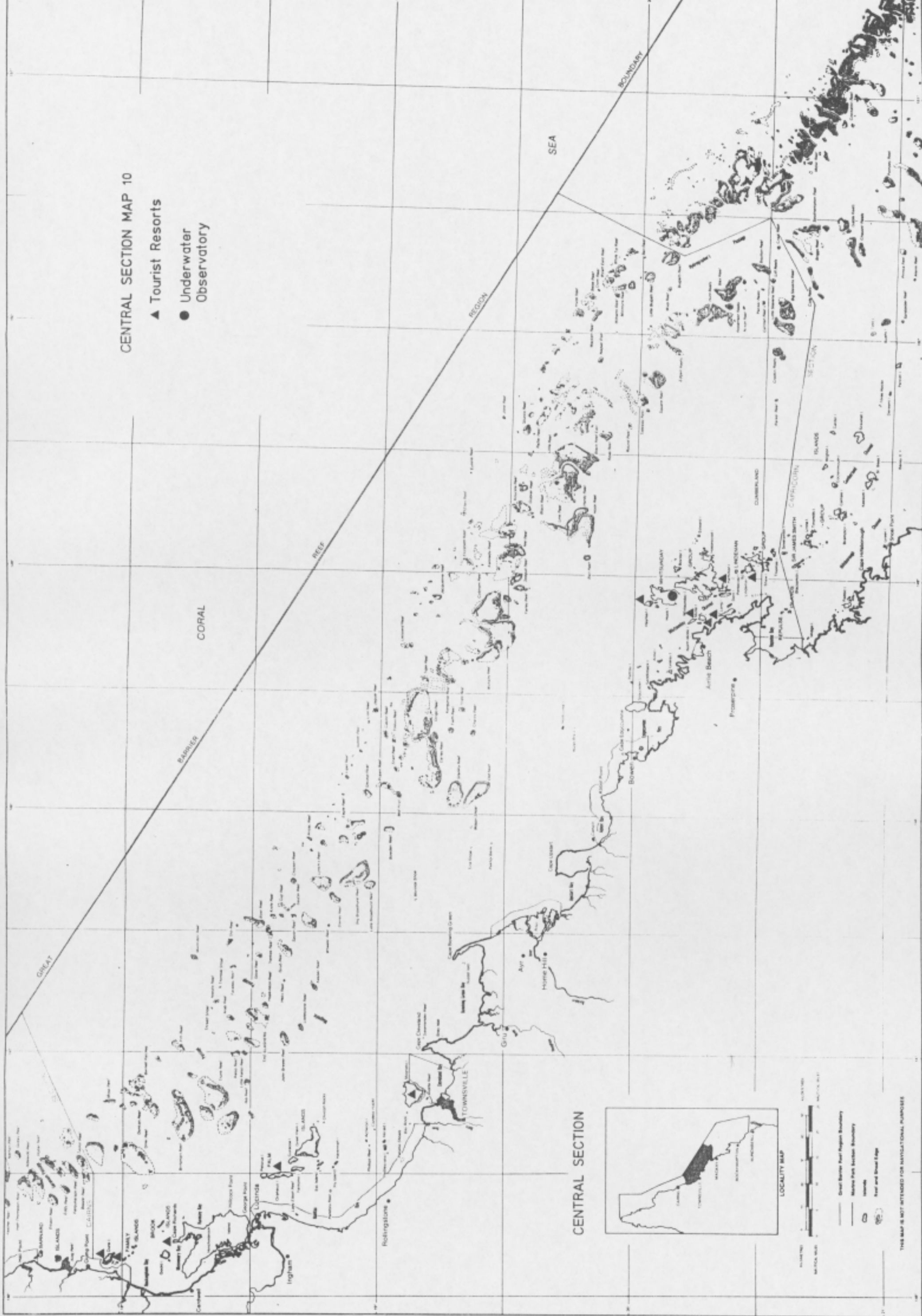
CENTRAL SECTION MAP 9

Research - Study Reefs

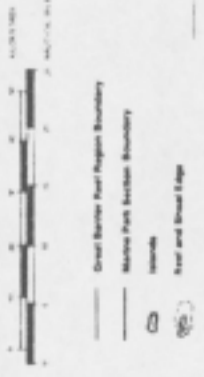
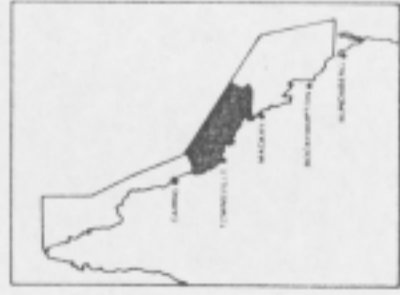


CENTRAL SECTION MAP 10

- ▲ Tourist Resorts
- Underwater Observatory



CENTRAL SECTION



THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

CENTRAL SECTION MAP 11

- Charter / Cruise Vessels
- ▲ Aircraft Landing Strip
- ◆ Seaplane Landing Site
- Helicopter Landing Site



CENTRAL SECTION



- LOCALITY MAP
- Great Barrier Reef Region Boundary
 - Marine Park Subarea Boundary
 - Island
 - Reef and Shoal Edge

THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

CENTRAL SECTION MAP 12

- Navigation Aids
- Shipping Channels
- Anchorages






CENTRAL SECTION

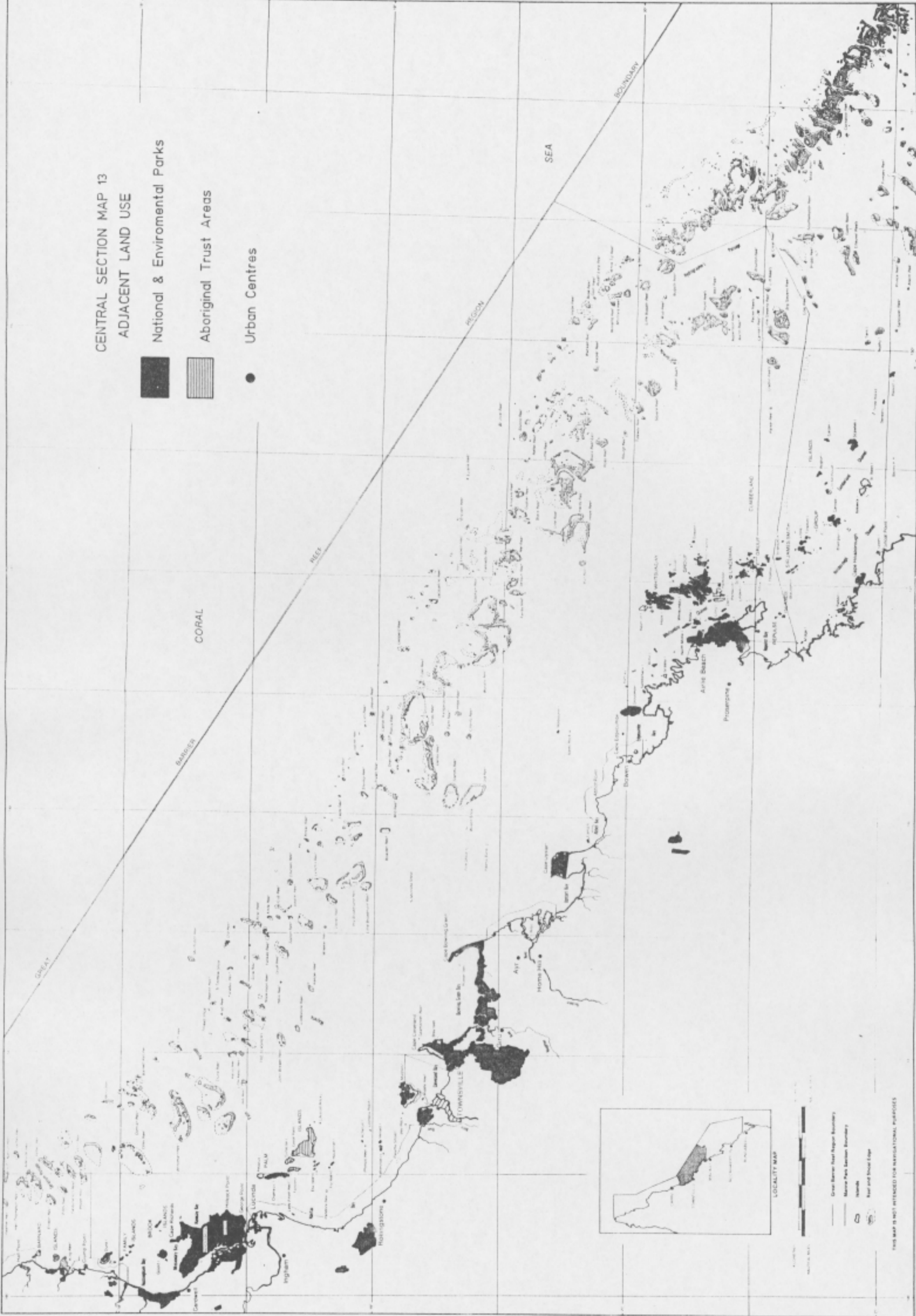






- LOCALITY MAP
- Great Barrier Reef Region Boundary
 - Marine Park Section Boundary
 - Island
 - Reef and Island Edge

THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES

CENTRAL SECTION MAP 13
ADJACENT LAND USE

-  National & Environmental Parks
-  Aboriginal Trust Areas
-  Urban Centres



-  Great Barrier Reef Region Boundary
-  Marine Park Section Boundary
-  Island
-  Reef and Shoal Edge

THIS MAP IS NOT INTENDED FOR NAVIGATIONAL PURPOSES