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THE FISHERMAN ISLANDS

BAIT WORM FISHERY

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Port of Brisbane Authority

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Date: December 1991

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EXECUTIVE SUMMARY

The Port of Brisbane Authority (PBA) has identified a longer term need to expand the capacity of the port to accommodate a future increase in port usage. This may require disturbance of intertidal and subtidal lands on and near Fisherman Islands.

The PBA, as part of port management/development strategies, has commissioned WBM Oceanics to undertake studies of the commercial bait worm fishery which operates on intertidal flats adjacent to Fisherman Islands.

The bait worm fishery provides a major bait supply for local anglers targeting estuarine fish such as bream, whiting and flathead. Worms are dug by hand (using a modified garden fork) on low tides amongst seagrass beds.

Fishermen construct bunds around the perimeter of a digging area (generally 8 m x 8 m) to prolong the period before flooding tides inundate the area. This process gives digging grounds a "checker board" appearance from the air. Commercial bait diggers are licensed and are required to replace seagrass removed from the bunded area in an upright position.

The area adjacent to Fisherman Islands is the largest (370 ha) and most productive bait worming area in Moreton Bay. Most digging operations are by commercial fishermen as amateurs generally dig closer to Wynnum where access is easier. Thirty to forty commercial bait collectors regularly work in the Fisherman Islands area. Estimates of the annual value of landed product from the fishery range from $500,000 to $700,000.

The ecological effects of bait digging are largely unknown. Seagrass, if correctly replaced, regenerates after 3 - 5 years although raised areas (bund walls or spoil piles) may take longer to be revegetated. Results from studies examining digging impacts to intertidal fauna vary depending upon the species being considered. Estuarine benthic animals are resilient to changing environmental conditions and it is probable that bait worm digging results in mainly short term adverse impacts.

Bait worm digging occurs in areas used by net fishermen. Digging holes and construction of bunds creates an uneven substrate. When nets are set over such areas, the holes and ridges result in gaps being left under the net leadline which allow fish to escape thus reducing the catches of net fishermen. Conflicts between the two fishing groups are generally minor although occasional

disputes occur. Some prawn trawl operators believe digging in seagrass areas destroys juvenile prawn habitat and thereby ultimately affects their catches. Conflicts arise between bait diggers generally due to disputes over digging techniques and "ownership" of digging areas.

The bait worm fishery is a viable fishery which appears to have a stable long term future. Management of digging operations (number of fishermen and techniques), the presence of large areas of seagrass and absence of major pollutant inputs are crucial to the productivity of the fishery.

1.0 INTRODUCTION

The Port of Brisbane Authority (PBA) has developed Whyte and Fisherman Islands as a major port facility at the mouth of the Brisbane River. The PBA has identified a longer term need to expand the capacity of the port to accommodate a future increase in port usage. Further expansion of port related facilities on the southern side of the mouth of the Brisbane River (north east of Fisherman Islands) is proposed by the Port of Brisbane Authority. This may require disturbance of intertidal and subtidal lands on and near Fisherman Islands.

The draft Moreton Bay Strategic Plan, designed to ensure appropriate land use within Moreton Bay, confirms the future usage of lands adjacent to Fisherman Islands as port related activities (see Figure 1.1).

The Port of Brisbane Authority, as part of port management strategies, has commissioned WBM - Oceanics to undertake several studies in relation to the ecological/fisheries importance of regions surrounding Fisherman Islands.

Some intertidal areas adjacent to Fisherman Islands are utilised by commercial and recreational bait worm diggers. The bait worm fishery provides a major bait supply for local anglers targeting estuarine fish such as bream, whiting and flathead.

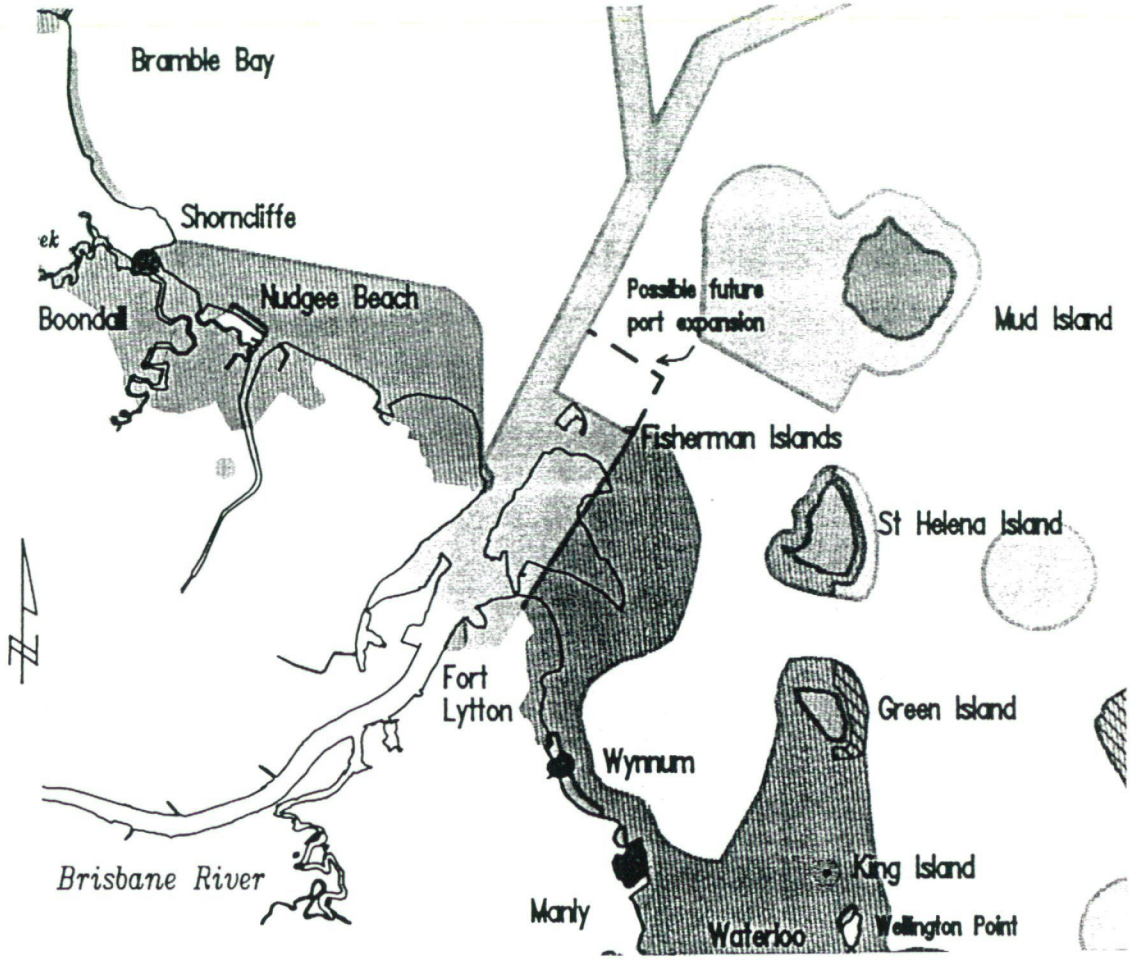
The present study was undertaken to provide the PBA with information on bait worm digging operations to be incorporated into port management and development strategies.

2.0 SCOPE OF THE STUDIES

The PBA has commissioned WBM - Oceanics Pty Ltd to;

- map the major worm collecting areas in the region near Fisherman Islands.

- describe the characteristics of the bait worm fishery operating near Fisherman Islands.



Preservation — to ensure outstanding biological communities are preserved.

Habitat protection — identifies important biological habitats.

General use — allows a wide range of uses with minimal environmental impact.

Port and industrial — for Port of Brisbane operations and other water-based industrial activities.

Marinas and harbours — for recreational boating, commercial water transport and associated onshore facilities.

Island residential — for low density, low impact residential and ancillary development.

Foreshore recreation — for public access and enjoyment of the the foreshore and adjacent waters.

Special management — where specific issues, uses or activities can be examined and controls applied.

0 2 4 6 8 10 Km

EXTRACT FROM DRAFT MORETON BAY STRATEGIC PLAN

FIGURE 1.1

WBM

- comment on the impact (short and long term) of present worm digging operations on seagrass beds and other areas of ecological importance.

- assess the sustainability of existing collecting operations in the Fisherman Islands region.

3.0 FISHERIES REGULATIONS

A permit, issued by the Queensland Department of Primary Industries, is required to legally collect worms in Queensland. The permit system was initiated in 1987 in response to requests from the "better" commercial diggers for management of the fishery.

The permits are valid for one year and require that worms are dug by fork or by hand and that seagrass is replaced in an upright position. Digging is prohibited from occurring in Fish Habitat Reserves.

To obtain new permits to collect worms on a commercial basis, it is required that new collectors work under the supervision of an established permit-holder for one year prior to receiving an open collecting permit. This is to ensure that a new operator is adequately trained in digging methods which minimise disturbance to worm banks and seagrass.

4.0 SOURCES OF INFORMATION

In contrast to most other commercial fisheries in Moreton Bay which are managed by the Queensland Fish Management Authority, the bait worm fishery is managed by the Queensland Department of Primary Industries (QDPI).

A meeting was held with bait worm fishery managers from the QDPI who supplied some general information and bait worm operators to be contacted.

Mr B. Johnson, one of the major bait worm suppliers and employer of baitworm diggers in Moreton Bay, provided information on the fishery characteristics and viability.

Only one study (Forbes 1984) has been published on Moreton Bay bait worm fishery. The QDPI are presently involved in a long term study directed at assessing the impact of bait worm digging on seagrass beds (see Luck 1989). It is uncertain when the results of the study will be publically available.

5.0 THE BAIT WORM FISHERY

5.1 THE WORM SPECIES

The commercial bait worm fishery adjacent to Fisherman Islands depends almost entirely on the eunicid polychaete *Marphysa sanguinea* (Montagu). The worm is most commonly known as the "mud worm", "Cribb Island worm" or "bloodworm". It may attain a length of 40 - 50 cm (extended) and weigh up to 10 g. This species occurs in a wide variety of habitats from intertidal to waters 100 m deep (Pettibone 1963) and is globally widespread throughout warm oceanic waters (Fauchauld 1970). In Moreton Bay, it is most commonly found in seagrass beds at a sediment depth of 0.3 - 0.5m.

Mud worms are probably one of the most important regularly used baits for anglers in Moreton Bay. Anglers seeking bream, whiting and flathead (to a lesser extent) generally buy live worms, although "serious" or competition anglers often collect their own bait. In 1986, Moreton Bay was estimated to be used by 300,000 fishermen who spent 1.5 million fishing days per year in the Bay and spent an estimated $160 million each year on fishing activities (Neumann and Hundloe, 1986).

Other species of worms (beach, rock, wriggler) are commercially/ recreationally collected for bait although such collecting activities do not occur to a significant degree in the Fisherman Islands area.

5.2 NUMBER OF FISHERMEN

Information supplied by the QDPI indicate that 70 commercial bait worm diggers (mud worm only) operate in Moreton Bay, although the number varies annually from 60 to 80. Discussions with commercial fishermen indicate that 30 to 40 fishermen regularly work the area adjacent to Fisherman Islands which is considered to be the most heavily

utilised area in Moreton Bay. On some occasions, many unlicensed commercial operators are present in the area. Forbes (1984) recorded up to 33 diggers at Fisherman Island and concluded that about 15 was a typical number.

Fishermen form crews ranging in size from 2 - 20 fishermen to extend the period available for digging (see below).

Commercial fishermen report that relatively few amateur fishermen dig in their areas presumably because access is restricted (by boat only). Most amateur operations occur in more landward areas near Wynnum where access is easier (see Section 4.4).

5.3 TECHNIQUES

Digging operations are conducted using a four-pronged gardening type fork. The fork is modified in that the prongs are angled upwards and the tips are flattened to aid digging.

Digging occurs on intertidal banks and thus the period when digging can occur is dependent upon tidal conditions. To reduce this dependence, fishermen form bunds (dykes) around the perimeter of a digging area. Diggers generally start forming a bund on the last stages of an ebbing tide.

Initially, the seagrass and top layer of substrate is removed from outside the proposed digging area and used to build the bund, leaving a trench around the bund. After the bund is complete, the fringing inner portions of the enclosed area are excavated to form a trench, with the spoil (seagrass and substrate) being added to the bund wall to further raise its height. Water that drains into the inner fringing trench is bailed out and the bunded area is thus drained and suitable for digging. Diggers then work as a team, excavating areas, bailing, placing the spoil in previously dug areas, and slowly spiralling towards the centre of the bunded area. Each forkful of spoil is carefully checked for worms which are placed in a collecting bucket. Digging continues until the tide overtops the bund and floods the enclosed area.

The site of the area bunded varies depending upon tidal conditions and the number of fishermen in the area. However, on average, bunds are 8m square.

Digging is an extremely labour intensive task and thus fishermen form teams (2 - 20 diggers) to enable a large area to be bunded and dug prior to incoming tides overtopping the bund. The amount of time available for catching worms is dependent upon the tidal conditions, seepage of water into the trench and endurance of diggers.

Some diggers take particular care with the seagrass because they believe it is important for the long-term maintenance of worm populations. These diggers remove the seagrass as a sod which is replaced after deeper layers are searched for worms. This is not possible for bund wall construction but may occur when inner drained portions are dug.

The worms are generally sorted into broken and unbroken individuals and delivered to a bait supplier. The worms may be held for up to 14 days in shallow water filled trays although the demand for worms is generally high and holding periods are rarely that long. Water within the trays is frequently replaced and some supplies use additional treatments to ensure worm survivorship (eg. air conditioning, bactericides).

Digging generally occurs during the day although some diggers are equipped to work during the night (lights etc.) if the demand for bait is high.

5.4 DIGGING AREAS

Discussions held with QDPI staff and commercial bait diggers indicate that the Fisherman Island area is the main worm digging area in Moreton Bay. Other commercial digging operations occur in Deception Bay although this is of lesser importance compared to Fisherman Islands.

Amateur diggers collect mud worms in many areas of Moreton Bay although the Wynnum - Lota foreshores are probably the most utilised area. Commercial diggers

also operate in this area on occasions. Other significant amateur grounds occur in Deception Bay, along the Nundah and Redland Bay foreshores.

Fishermen generally only dig in seagrass areas to the low water spring tide mark. Although mud worms occur in unvegetated areas, worm abundance is greatest in seagrass areas and hence almost all digging occurs in such areas.

The main digging areas at Fisherman Islands cover approximately 370 ha and are shown on Figure 5.1. This area was determined on the basis of the regions in which seagrass has been disturbed by digging activities (CSIRO Cleveland supplied data) and WBM Oceanics field surveys.

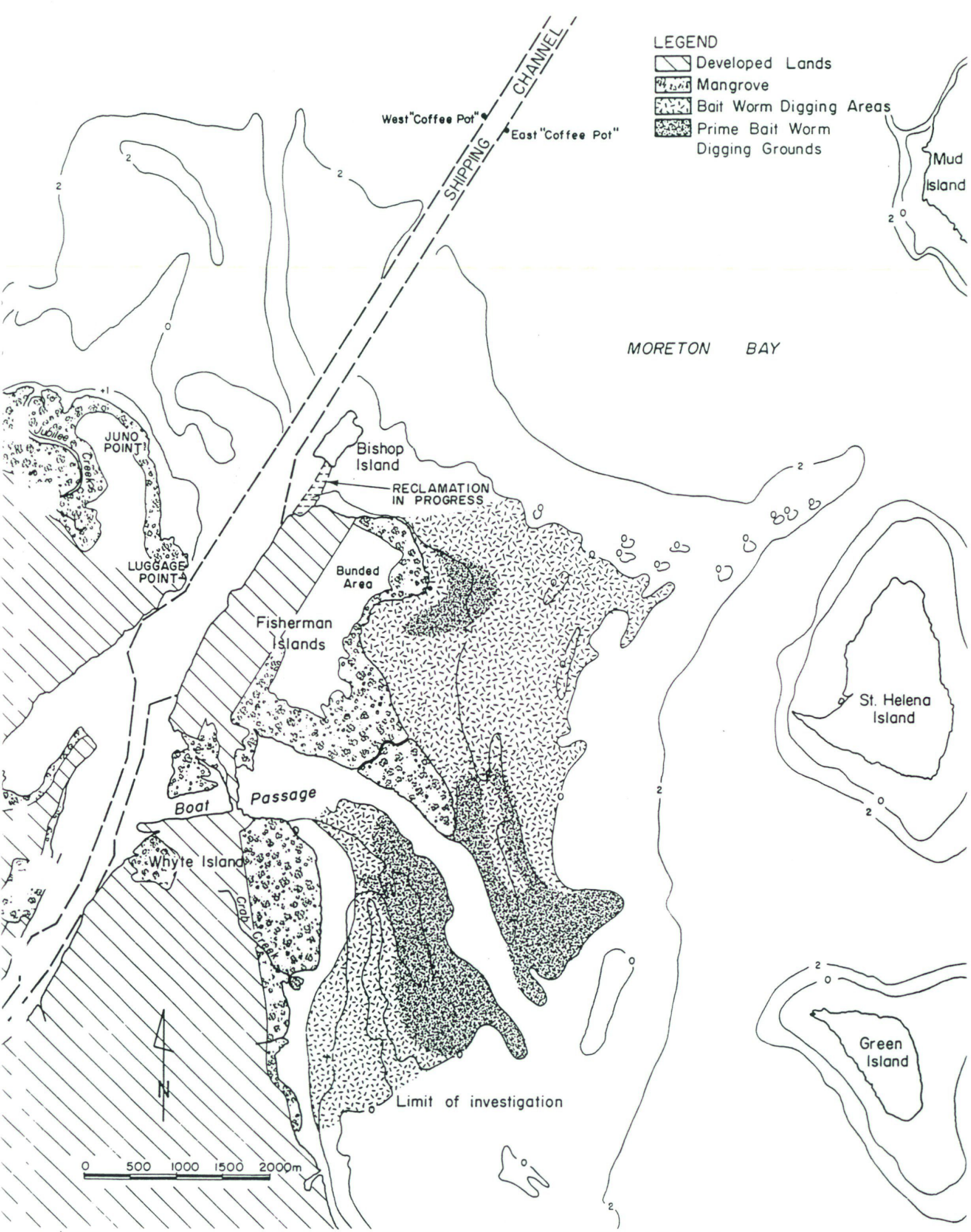
Selection of a particular digging area is dependent upon individual digger preference, predicted tidal conditions and the number of fishermen in the crew. The repeated construction of bunds results in digging areas having a checkerboard appearance on aerial photography.

Forbes (1984) concluded that the Fisherman Islands digging area covered 1024 ha. Unfortunately he did not provide a map of digging areas. It appears that this value represented the total area of seagrass beds in the region at the time of his study and he assumed that all seagrass beds are (or potentially may be) dug.

5.5 SEASONALITY OF LANDINGS

Because baitworm digging occurs on intertidal flats, the tidal regime significantly affects the time available for digging.

Tides in Moreton Bay are unequal semidiurnal with greatest tidal ranges occurring in summer and winter. The higher of the high tides occurs during the day in summer and night in winter. Conversely, lower low tides occur during day in winter and night in



FIGURE

COMMERCIAL BAIT WORM DIGGING AREAS 5.1

WBM OCEANICS AUSTRALIA

summer. In spring and autumn, tidal ranges are less and day/night tides are approximately equal in magnitude.

Catches of worms are therefore greatest in winter because the lower low tides enable a larger time available for digging. Additionally, as worms tend to avoid high temperatures by burrowing deep into the mud, the cooler weather results in worms being close to the surface and therefore less digging is required.

The January to March period is considered to provide the poorest catches and many bait diggers cease operations. Some diggers continue to work during this period to maintain supplies to regular customers.

5.6 CATCH VALUE

Enquiries at several bait shops indicated that retail prices of worms in 1991 range from $0.50 to $1.75 per worm depending upon size. Some retail outlets sell worms on a weight basis.

No data on the total catch value of the mudworm fishery in Moreton Bay are available from the QDPI.

Forbes (1984) conducted a detailed study of worm collecting operations at Fisherman Islands extending over several seasons and concluded that:

- the annual number of man days spent collecting worms was estimated to be 10,950. This was determined on the basis of the average number of diggers being 15 and 730 low tides being suitable for collecting operations. This estimate assumes diggers are present on every low tide and is probably an overestimate.

- catch rates vary from 8.5 to 20.0 worms m^{-2} with an overall mean of 10.5 worms m^{-2}.

- 2,312,400 worms are taken from the Fisherman Islands area each year.

Commercial diggers presently receive $30/100 worms on a wholesale basis. Using Forbes (1984) catch estimates the landed value of the bait worm fishery would be approximately $700,000.

Discussions with bait worm diggers in association with the present study, suggest that the Fisherman Islands region produces approximately $500,000 of worms taking into account the average number of diggers and their average income.

6.0 IMPACTS RESULTING FROM BAIT WORM COLLECTING

Bait worm collecting adjacent to Fisherman Islands is almost exclusively carried out in seagrass areas because fishermen report that worm populations are greatest in seagrass beds. Digging and construction of bunds physically damages seagrass beds.

Some bait worm diggers carefully remove and replace seagrass from within bunded areas (see Section 5.3) in an attempt to minimise damage. QDPI permits require this procedure although not all diggers comply with the permit condition. Seagrass covered in the construction of bunds is smothered and dies.

Forbes (1984) qualitatively monitored recovery of seagrass at Fisherman Island in 1980 and concluded that:

- raised spoil heaps and bunds are slowly eroded
- recovery was more rapid in areas where seagrass had been replaced
- regrowth was slower in raised areas (spoil piles and bunds) than in hollows
- consolidation of the sediment in hollows had not occurred after two years

Ongoing QDPI research notes that previous indiscriminant mud worm digging (mainly due to amateurs) has had a major affect in some areas between Sandgate and the Brisbane River mouth. Failure to replace seagrass sods has led to erosion and little, if any, seagrass regrowth. Replaced sods enhance recovery of dug areas and it is

estimated that recovery generally occurs within three years (Luck 1989). QDPI monitoring programmes are underway to confirm this estimate.

The ecological effect of bait worm digging on benthic epifauna and infauna is largely unknown. Surface fauna (epifauna) is disturbed and buried under spoil piles or bund walls. It is probable that some buried epifauna would die. Burrowing fauna (infauna) would be affected to a lesser degree.

Casual observations of amateur baitworm digging operations by WBM Oceanics staff at Amity (North Stradbroke Island) over several years indicate the following short to long term impacts to benthic communities within baitworm digging grounds:

- Much of the impact to fauna, particularly epifauna, on the flats results from direct smothering and trampling during digging and bunding. The physical elevation and tidal drainage of worked areas is altered for many months or years. This results in more prolonged drying or inundation than previously experienced and for sedentary species such as bivalve molluscs apparently often results in death.

- Other epibenthic species such as soft corals, sea pens and anemones do not tolerate the disturbance of sediments at all well. Semi-mobile species such as anemones have been observed to relocate with the flooding tide following disturbance by digging.

- Often the freshly dug sediments bought to the surface by baitworm digging contain a significant quantity of organic detritus which has previously undergone anaerobic decay. Where this sulphurous material is deposited on the flats it appears to be avoided and is perhaps toxic to some forms of surface detrital feeders such as holothuroids (sea cucumbers).

- In the short-medium term, baitworm digging disturbs or removes the camouflage cover and food resources afforded by seagrass to benthic molluscs, crustaceans and polychaetes. These areas instantly become food foraging areas for the larger predators such as fish and seabirds.

- On the first flood tide following digging, fish such as bream, whiting and occasionally flathead move onto the diggings to actively feed upon exposed crustaceans, molluscs and polychaetes. Fish often school where the sediments have been heaped to form bunds and where wave/tide action actively erodes these mounds to expose new food sources.

Forbes (1984) examined the impacts of digging upon the most abundant burrowing fauna (an unidentified bivalve and the polychaete *Cirriformia tentaculata*) at Deception Bay (Moreton Bay) worm grounds and concluded that digging did not have a significant adverse impact on these organisms. Research in England demonstrated that digging for lugworms (*Arenicola marina*) and ragworms (*Nereis diversildor*) adversely affected catches of the edible cockle (*Cerastoderma edule*) as a result of burial (Jackson and James 1979). In contrast, McLusky *et al.* (1983) concluded that commercial digging for lugworms had little effect on two epibenthic species (*Hydrobia ulvae* and *Macoma balthica*). They suggested that many estuarine benthic animals are highly adaptable, able to cope with the variable ecological situations found in estuaries, and that this ecological resilience appears to render them largely unaffected by bait digging. A similar situation may occur on the Fisherman Islands digging areas.

Overall, it is probable that bait worm digging, if properly undertaken (eg. replacement of sods), results in mainly short term ecological impacts. Recovery of dug areas apparently occurs over several years (< 5 years).

7.0 CONFLICTS WITH OTHER FISHING OPERATIONS

Bait worm operations are conducted in areas used by net fishermen. The disturbance of the intertidal flats as a result of digging operations apparently provides both beneficial and detrimental impacts to net fishing operations.

Some net fishermen believe that bait worm digging in seagrass areas attracts fish because benthic invertebrates (eg. shells, crabs) are exposed and available for fish to feed upon. However, digging holes and construction of bunds produces an uneven substrate. When nets are set over such areas, the holes and ridges result in gaps being left under the net leadline which allow fish to escape. Conflicts mainly occur when

diggers operate in a favoured netting location. Disputes are generally infrequent and minor although some instances have occurred where nets have been purposely damaged.

Some prawn trawl operators believe digging in seagrass areas destroys juvenile prawn habitat, ultimately affecting their catches. The prawn fishermen state that disturbance/destruction of seagrass is an offence under -the Fisheries Act and that Government authorities are "turning a blind eye" to the damage done by bait worm fishermen (see Section 6.0 for impacts to seagrass).

Conflicts within the bait worm fishery are mainly between bait worm diggers themselves. Most problems arise because diggers that have a long term commitment to the fishery try to manage their operations by:

- replacing seagrass (as a sod) that has been disturbed to aid regeneration. QDPI bait worm permits require replacement of seagrass although the degree to which this is observed varies between diggers.

- not digging upper (ie. landward) intertidal areas when lower areas are available.

- leaving disturbed areas for a period before resuming digging.

Diggers who fail to effectively replace seagrass or work in "recovering" areas because it is easier to dig, are considered by long-term operators to delay the rehabilitation of disturbed areas to the ultimate detriment of the fishery.

Fishermen who operate year round manage their digging areas to try to leave upper intertidal areas for digging when low tides are large and few intertidal banks are exposed (eg. day low tides in summer). Although diggers could dig these upper areas for an extended time period when low tides are small, this procedure would not leave any undisturbed digging areas for periods when the low tides are large. Conflicts occur when infrequent or short-term diggers work in areas that have been "reserved" for digging in the summer by the longer term operators.

The present system where bait worm collectors are able to dig areas on an unrestricted basis inhibits efficient use of the bait worm grounds.

8.0 VIABILITY OF THE FISHERY

No information is available on the long term future of the bait worm collecting fishery. The main concern expressed by bait worm fishermen in relation to port activities, involve possible loss of bait worm digging areas as a result of reclamation or pollutant inputs.

Opinions expressed by QDPI and fishermen suggest that, providing the worm digging areas are not disturbed (eg. loss of seagrass, pollutant inputs, alterations to sediment characteristics) and the number of licensed worm diggers and digging techniques remain regulated, the fishery should be able to continue as a viable operation for the foreseeable future.

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FISHERIES ADJACENT TO

FISHERMAN ISLANDS

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EXECUTIVE SUMMARY

The Port of Brisbane Authority (PBA) has developed Whyte and Fisherman Islands as a major port facility at the mouth of the Brisbane River. Further expansion of port related facilities on the southern side of the mouth of the Brisbane River (north east of Fisherman Islands) is proposed by the Port of Brisbane Authority which may require disturbance of intertidal and subtidal lands on and near Fisherman Islands.

The PBA has commissioned WBM Oceanics to undertake the present study which provides information on commercial fishing operations and the fisheries importance of aquatic habitats present in the Fisherman Islands region. Elements of this report are to be incorporated into a port management and development strategy.

This report has been prepared taking into account information supplied by the Queensland Fish Management Authority (QFMA), Queensland Department of Primary Industries (QDPI; Fisheries Branch), Queensland Commercial Fishermen's Organisation (QCFO) and several commercial fishermen who regularly operate adjacent to Fisherman Islands.

Some of the information supplied by commercial fishermen would be useful to other fishermen and the confidential nature of this information should be considered when referring to this report given the competitive nature of fishing operations.

Three main types of commercial fishing operations (excluding bait worm digging) occur in the study area; beam trawling, mesh (gill) netting and tunnel netting. Commercial bait worm collecting, undertaken on intertidal flats adjacent to Fisherman Islands on a substantial basis, is addressed in a separate report (WBM Oceanics 1991b). Each fishery is subject to regulations prescribing permitted fishing areas and techniques.

Net Fishing

Net fishing is the main fishery which occurs adjacent to Fisherman Islands and involves both tunnel netting (predominantly) and mesh netting. The study area is reported by commercial fishermen to be regularly fished by seven netting crews, each of which generally consist of one

to four fishermen. When fish catches are large, or weather conditions are unsuitable in other areas of Moreton Bay, up to 14 crews may operate in the study area.

Virtually all of the study region is fished at some time by net fishermen. Fishing operations are conducted all year although fishing mainly occurs in the period November-August. The dominant species, whiting, butterfish, flathead, mullet and bream are taken year round with differing seasonal peak landing periods. Areas within mangrovie forests are rarely fished and most fishing takes place on seagrass covered intertidal flats or areas fringing mangrove forests.

Areas to the north of Boat Passage are fished more frequently than areas towards Wynnum. The northern area, between the Boat Passage and Brisbane River shipping channel, produces significant mullet and flathead catches for most of the year. As a result, these two types of fish form the bulk of annual landings. Prime fishing locations occur along a ridge that runs eastward from northern Fisherman Islands towards St Helena Island and areas fringing the Boat Passage.

The intertidal flats and mangrove forests south of the Boat Passage are netted primarily for mullet, bream, flathead and butterfish. The relative importance of fish species differs from areas north of the Boat Passage in that less mullet and far more butterfish are taken. Areas adjacent to Crab Creek are reported by fishermen to be some of the most productive butterfish netting grounds in Moreton Bay and most netting south of the Boat Passage targets this species.

The areas fringing Fisherman Islands are of importance to Moreton Bay fisheries. No net catch statistics specific to the Fisherman Islands region are held by government agencies (QDPI, QFMA) or the QCFO. However, on the basis of information provided by fishermen, the annual value of the netting catch from the study area can be conservatively estimated to be $560,000. This represents approximately 10% of the gross annual value of finfish caught in Moreton Bay ($6,000,000; Anon. 1989).

It is difficult to estimate total landings for the study area given the varying interannual frequency of fishing effort, catch composition, total landings and market factors. Nevertheless, on the basis of information supplied by fishermen, it can be assumed that the study area roughly produces 100-150 tonne of fish per year and that most fish are mullet, flathead, whiting, butterfish and tailor. Information on total finfish landings in Moreton Bay, provided by the QFMA indicates that 1300-1400 tonnes of fish are landed each year. This indicates that an estimate of the Fisherman

Island/Whyte Island region contribution to Moreton Bay finfish landings would be in the range of 8% - 12%.

Net fishermen report that existing reclamation and other port related activities have adversely influenced their catches only to a minor degree. Some short-term (< 3 years) decreases in catches reportedly occurred as a result of silt laden water flowing eastwards onto the intertidal flats from bunded areas on Fisherman Islands approximately five years ago. With the exception of works on the northern tip of Fisherman Islands (which fishermen claim significantly affected bream, mullet and jewfish catches in that area), no regularly used fishing grounds have been disturbed and no major long term adverse effects from port operations are reported. No data are available to quantify the adverse effects described by fishermen.

CRAB FISHING

Net fishermen indicate that no commercial mud crabbers use the Fisherman Islands region on a regular basis although mud crabs (*Scylla serrata*) are taken as by-catch in netting operations. Sand crabs *(Portunus pelagicus*) are frequently taken by commercial fishermen. Net fishermen catch the crabs as by-catch in mesh/tunnel nets and occasionally set traps when crab abundance is high. One commercial sand crabber reportedly frequently fishes this area.

BEAM TRAWL

Beam trawl operations cannot legally occur on the intertidal flats south of the Brisbane River shipping entrance channel and are restricted to a small portion of the study area (the Brisbane River and northern fringes of the shipping channel).

Commercial fishermen advise that approximately 30 beam trawlers involving 40 fishermen (some fishermen have an assistant) work in the study area at least 50% of their fishing time. Of these, 17 beam trawlers are reported to be moored within and work exclusively in the Brisbane River, particularly the river mouth. The remaining 13 beam trawlers are moored elsewhere but rely heavily on the lower Brisbane River as a fishing ground.

The Brisbane River greasyback prawn fishery is one of the major suppliers of bait prawns in Australia. The lower reaches of the river, including those within the study area are the most productive. Larger greasyback prawns are sold for human consumption, although the majority

of the catch is for bait. Bait prawns are sold throughout Queensland and exported mainly to N.S.W. and Western Australia. Banana prawns, taken in winter, are commonly large and are sold to the restaurant trade.

The abundance of prawns, and hence fishing operations, in various locations varies depending upon tidal state, water clarity/salinity, river flow and time of the year. In general, fishermen advise that the prime fishing grounds within the lower Brisbane River occur along the edges of the entrance channel to the Brisbane River, along the old bar cutting, and within the mouth of the Brisbane River (ie. within the study area).

Prawn species taken in the study area include greasyback, king, tiger and banana prawns. Greasyback prawns form the bulk of catches and are taken mainly from November to May. King and tiger prawns are taken in winter in some years, although considerable interannual variation occurs.

As for the net fisheries, no catch data specific to the Fisherman Islands region are held by Government authorities or the QCFO. Beam trawl fishermen conservatively estimate that the annual value of beam trawled prawn landings from the mouth of the Brisbane River, which includes the study area, is $962,500.

Beam trawlers report only minor concerns with PBA operations, generally in association with maintenance dredging. Maintenance dredging operations which leave the bottom in an uneven condition, render dredged areas unsuitable for beam trawling until natural processes level the seabed. The PBA bed levelling operations reduce this problem although fishermen believe levelling to a greater degree would significantly improve their catches. Maintenance dredging also creates turbidity plumes. Although not adversely affecting catches, the plumes are reported by fishermen to affect prawn distribution hence altering fishing areas but apparently not adversely affecting landings to a substantial degree.

RECREATIONAL FISHING

Most recreational fishermen do not use the extensive intertidal flats adjacent to Fisherman Islands for angling or crabbing for fear of their boats stranding/grounding. Shore based activities are limited to Wynnum and the verges of the Port of Brisbane Road at the Boat Passage as a result of the thick mangrove fringe and restricted road access.

The intertidal flats are mainly used by recreational fishermen seeking bait. Bait worm digging generally occurs near Wynnum and flats between the D'arcy light and Fisherman Island where access is easier. As noted previously, a separate report has been completed on bait worm collecting (WBM Oceanics 1991b).

Angling within the study area occurs mainly on the fringes of the main shipping channel, and areas within and adjacent to Boat Passage. Whiting fishermen consider the area south of the shipping channel (ie. east of Bishop Island) to be a prime fishing ground in spring months. Tailor, mackerel and other pelagic fish are also taken on a seasonal basis in the same area. Sand crabs are taken in reportedly large numbers from the area north east of Bishop Island (along the shipping channel).

The level of recreational fishing in Moreton Bay is increasing rapidly and is anticipated to double in the next decade. This will result in greater utilisation of areas near Fisherman Islands for angling and bait collecting.

FISHERIES IMPORTANCE OF WETLAND HABITATS ADJACENT TO FISHERMAN ISLANDS

The wetland areas adjacent to Fisherman Islands contain mangrove forests, seagrass beds and saltmarshes. Contrary to a generally held public perception, these habitats are not used as spawning grounds by species of fisheries value but provide valuable nursery and feeding habitat.

Mangroves produce large amounts of particulate organic material (detritus) derived from the decomposition of mangrove forest litter (ie. leaves, twigs, flowers) which forms the basis of most estuarine food chains. Mangroves provide food and shelter for juvenile fish and are important feeding grounds for many species of fisheries value.

One study of fish utilisation of mangrove areas in Moreton Bay (Morton 1990) concluded that the value of marketable fish within mangrove areas was \$8380 ha^{-1}. This value only accounted for marketable species and did not include prawns or commercially important juvenile fish.

Seagrasses, which occur on intertidal and subtidal mudflats in the study area (see CSIRO seagrass report prepared for PBA), are important feeding areas for a variety of organisms. Turtles,

dugong and some fishes (eg. garfish) feed directly on seagrasses whilst most other animals feed upon epiphytes, detritus, microfauna and the benthos associated with seagrass areas.

Research by the Queensland Department of Primary Industries on seagrass beds adjacent to Fisherman Islands indicate that seagrass beds are of substantial importance for fish and prawns. Post-larval and juvenile greasyback, tiger and king prawns are abundant in seagrass beds which serve as nursery areas. Larval tiger prawns are unlikely to survive if they do not settle in seagrass areas. Many commercial fish species (eg. flathead, whiting) use seagrass beds as nursery areas. Seagrass beds also provide habitat for worms which form the basis of a major baitworm fishery in the study area.

OVERVIEW

The study region encompasses some of the more productive netting grounds in Moreton Bay and supplies a significant proportion of the mullet, flathead and butterfish market. Beam trawl operations at the mouth of the Brisbane River supply a major baitprawn market. Bait prawns are both used locally and exported throughout Australia.

Additionally, areas fringing Fisherman and Whyte Islands contain large areas of mangroves and seagrasses. In common with other wetlands in Moreton Bay, these areas provide valuable nursery and feeding habitat for fish and prawn species of direct fisheries importance which are taken throughout Moreton Bay. The wetlands are of considerable regional significance as described in the Wetlands Report (WBM-Oceanics 1991a).

1.0 INTRODUCTION

The Port of Brisbane Authority (PBA) has developed Whyte and Fisherman Islands as a major port facility at the mouth of the Brisbane River. The PBA has identified a long term need to expand the capacity of the port to accommodate a future increase in port traffic. Further expansion of port related facilities on the southern side of the mouth of the Brisbane River (north east of Fisherman Islands) is proposed by the Port of Brisbane Authority. This may require disturbance of intertidal and subtidal lands on and near Fisherman Islands.

The draft Moreton Bay Strategic Plan, designed to ensure appropriate land use within Moreton Bay, confirms the future usage of lands adjacent to Fisherman Islands for port related activities (see Figure 1.1).

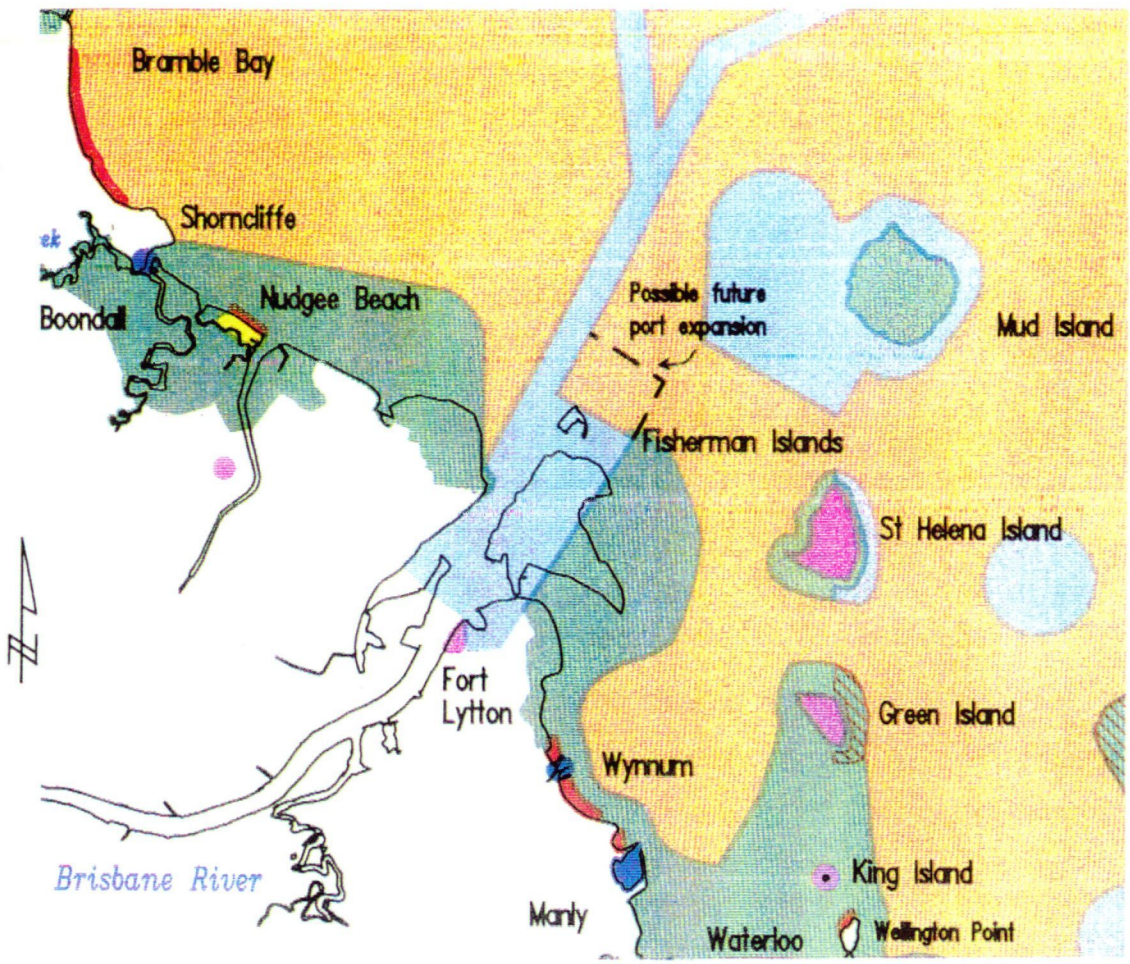
The present studies were to provide the PBA with information on commercial fishing operations and the fisheries importance of aquatic habitats present in the Fisherman Islands region for incorporation into a port management and development strategy.

Other separate studies have been completed (in conjunction with this report) which describe the wetlands and commercial bait worm digging operations (WBM Oceanics 1991 a,b) associated with the Fisherman Islands region.

2.0 SOURCES OF INFORMATION AND TERMINOLOGY

This report has been prepared on the basis of information supplied from a variety of sources.

The Queensland Department of Primary Industries (Fisheries Branch) provided information on fishing techniques. The Department maintains a logbook system where fishermen are required to complete daily records detailing catches and areas fished. The grid system used to identify areas fished divides Moreton Bay into two grid elements. It is impossible to identify catch locations within a grid and therefore no data is available that relates specifically to the Fisherman Islands area.



EXTRACT FROM DRAFT MORETON BAY STRATEGIC PLAN

FIGURE 1.1

As a result, the catch information presented in this report is based upon interviews and records held by fishermen.

The Queensland Commercial Fishermen's Organisation (QCFO) was requested (see Appendix A) to supply a statement on the importance of the Fishermans Island area. The QCFO provided a list of fishermen to contact who operate in the area however no written response has been received from the organisation to date.

The Queensland Fish Management Authority provided information on legislative aspects of the fishery (eg. number of licensed fishermen, closures etc.) and finfish landings in Moreton Bay.

Several commercial fishermen who regularly operate in the area were interviewed and provided information on fishery attributes. Mr J. Page (net fisherman), Mr G. Murphy and Mr M. Fennesy (beam trawl operators) were particularly helpful.
Some of the information provided would be useful to other fishermen and the confidential nature of the information should be considered when referring to the findings of this report given the competitive nature of fishing operations.

The study region (study area) is shown on Figure 2.1. Emphasis was placed on those areas adjacent to Fisherman Islands and fishing activities on Mud Island and St Helena foreshores are not included in this report.

3.0 FISHERIES REGULATIONS

Commercial fishing operations are legislated under the Fisheries Act 1976-1984 and are administered by the Queensland Fish Management Authority. The Act prescribes gear types and permitted fishing grounds for various fishing techniques.

Three main types of commercial fishing operations (excluding bait worm digging) occur in the study area; tunnel netting, mesh (gill) netting and beam trawling. Regulations relevant to these operations are described below.

FIGURE 2.1

STUDY AREA

WBM OCEANICS AUSTRALIA

All commercial fishing operations are prohibited in Moreton Bay during weekends to minimise conflict with recreational fishermen.

It should be recognised that fisheries regulations (eg. closure boundaries) often change and that the regulations described in this report may need to be re-examined in the future.

Beam Trawling

Beam trawling is permitted within the Main and West (or Old Bar Cutting) channels leading into the Brisbane River, and an area upstream of Juno Point bounded by the second green beacon in the West Channel, the western Coffee Pot beacon, the western Inner Bar beacon and the northern end of Bishop Island (see Figure 3.1). Operations may extend upstream (approx. 28 km) to the Victoria Bridge.

Beam trawls may not be towed by a vessel exceeding 9 m in length, have a net longer than 5 m, or a net mesh less than 25 mm.

Beam trawlers may extend their operations further offshore than the Coffee Pots (see Figure 3.1) although other trawl net regulations apply and fishermen must fit different mesh size nets. In other trawl areas, nets may not have a mesh smaller than 38 mm.

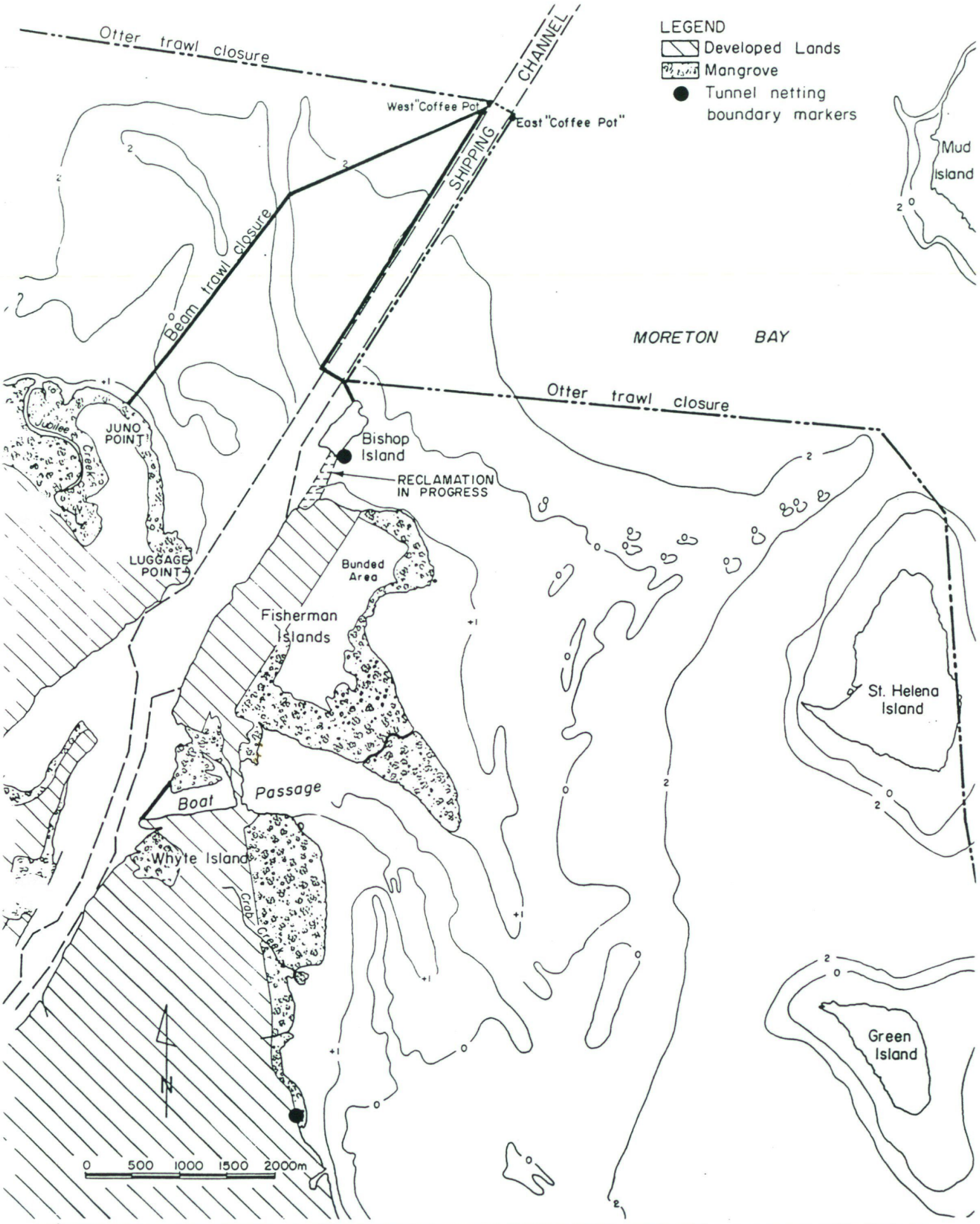
Regulations regarding permitted beam trawl operations near the Port of Brisbane are presently being reviewed by the QFMA and it is probable that beam trawling within major navigation channels will be restricted in the future.

Mesh nets

Mesh netting is permitted on all foreshores within the study area.

Mesh nets cannot be longer than 800 m or have a mesh size less than 50 mm. A licensed fisherman must be at the net the whole time that it is in the water.

Tunnel netting



CLOSURE LINES/MARKERS FOR COMMERCIAL FISHING

FIGURE 3.1

WBM OCEANICS AUSTRALIA

Tunnel netting may occur on foreshores between a marker (a board marked F↑B) located on the southernmost end of Bishop Island and a marker located 800 m north of Wynnum Creek (see Figure 3.1). The foreshores of the Boat Passage may be tunnel netted although the Brisbane River foreshores are closed to netting.

Tunnel nets may not:

- be longer than 1700 m (excluding the tunnel section).
- have a net mesh less than 50 mm.
- have a tunnel section more than 200 m.
- have a tunnel entrance less than 1.5 m or greater than 4.0 m.
- have a mesh of the tunnel section greater than 50 mm.
- have a tunnel, while containing fish, less than 30 m of its length in water at least 300 mm deep.
- be attended by less than two licensed fisherman. These fishermen must be present during the entire netting operation.

4.0 NET FISHING

Net fishing is the main fishery which occurs adjacent to Fisherman Islands and involves both tunnel netting and mesh netting. Fish species are described in this report using names commonly employed by commercial fishermen. Table 4.1 presents the common and scientific name of the most frequently captured commercial fish.

4.3 FISHING AREAS AND SPECIES TAKEN

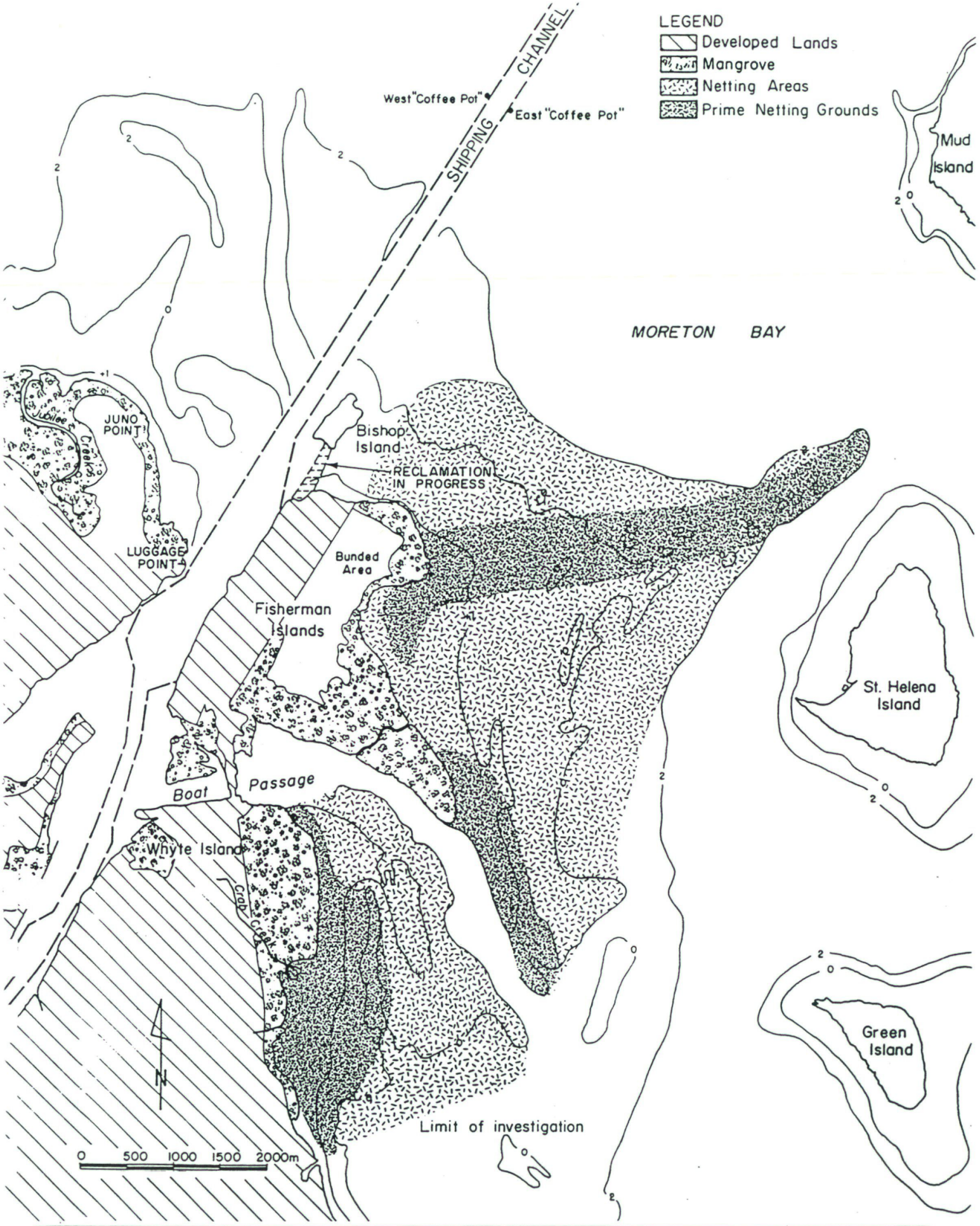
Virtually all of the study region is fished at some time by net fishermen (Figure 4.1). Fishing occurs for most of the year with netting occurring both day and night (60:40 ratio). Most netting occurs on the intertidal foreshores although limited netting occurs in Boat Passage. The only areas rarely fished are the northern mangrove fringe along Boat Passage (although a site on the northern bank near the bridge used to be fished prior to dredging works) and within the creek that crosses Fisherman Islands.

The location and frequency of fishing operations within the Fisherman Islands area is determined by a variety of factors including tidal phase, weather conditions, market prices for different species, and the number of other fishermen working in the area.

Areas within mangrove forests are rarely fished and most fishing takes place on seagrass covered intertidal flats or areas fringing mangrove forests. Seagrass flats are considered to support the largest populations of marketable fish.

4.3.1 Areas North of the Boat Passage

Areas to the north of Boat Passage are fished more frequently than areas towards Wynnum (see Section 4.3.2). The northern area, between the Boat Passage and main shipping channel, produces significant mullet and flathead catches for most of the year. As a result, these two types of fish form the bulk of annual landings



FISHERMAN ISLANDS COMMERCIAL NETTING AREAS

FIGURE 4.1

WBM OCEANICS AUSTRALIA

Whiting are mainly taken in spring whilst tailor are most common in autumn catches. Bream, butterfish, and black bream are rarely targeted but are taken frequently, generally as by-catch. Shark nets are occasionally set although catches are comparatively small.

Most fish reportedly travel on flooding tides into the fishing grounds from the northeast. A shallow sand ridge (with deeper water either side) extends eastwards from northern Fisherman Islands (see Figure 4.1). Fishermen report that fish move along this spit with the tide either feeding on benthos associated with the ridge or preying on bait fish that congregate along the sides of the ridge. In this regard, fishermen consider that the ridge attracts fish and makes it one of the better fishing locations (especially for tailor and whiting) near Fisherman Islands. They report that alterations to the ridge could affect their catches, not only from the ridge, but also in other areas, as fish supposedly use the spit as a "run" to move into intertidal areas near the mangroves on Fisherman Islands. Fishermen are concerned that modifications to the ridge could affect fish prey abundance and/or current directions, possibly adversely affecting the distribution of commercially targeted fish (eg. reduced fish utilisation of the Fisherman Islands area or fish congregating in areas unsuitable for netting).

A second ridge extends from the south-east corner of Fisherman Islands to D'Arcy Light (Figure 4.1) and is also an important fishing area. Mullet dominate catches although flathead and bream form a significant component of landings (Figure 4.2). Fishermen report that mullet move from the Brisbane River via the Boat Passage to congregate along the ridge. Fish distribution is commonly influenced by current strength and direction and fishermen believe that any alterations to current flows/directions that exist in the Boat Passage could alter mullet movement patterns and affect their catches. Such detrimental affects have reportedly occurred previously (see Section 4.6). Little information is available on the relationship between current flows

and estuarine fish movements and thus quantifying the effects of man-induced current alterations is difficult.

4.3.2 Areas South of the Boat Passage

The intertidal flats and mangrove forests south of the Boat Passage are netted primarily for mullet, bream, flathead and butterfish. The relative importance of fish species (Table 4.3) differs from areas north of the Boat Passage in that less mullet and far more butterfish are taken (compare Figures 4.2 and 4.3).

Areas adjacent to Crab Creek support extensive areas of macroalgae (mainly *Ulva*) which provide food for large populations of butterfish. The discharge of treated sewage into Crab Creek presumably results in elevated nutrient levels in waters and sediments near the creek providing conditions conducive to rapid algae growth. These areas are reported by Mr Page to be the most productive butterfish netting grounds in Moreton Bay and most netting south of the Boat Passage targets this species. Catches of up to 800 kg/fishing crew/day are reported.

4.4 CATCH VALUE AND REGIONAL CONTRIBUTION

TABLE 4.4
TOTAL 1989 FINFISH LANDINGS FOR MORETON BAY
(EXCLUDES OCEAN BEACH FISHERY) PROVIDED BY THE QFMA

FISH	TONNES
Mullet	765
Bream	161*
Black Bream	48
Dart	7
Flathead	30
School Mackerel	5
Other Mackerel	20
Shark	8
Tailor	138
Whiting	160*
TOTAL	1342

* Considered by QFMA to be an underestimate

4.5 SEASONALITY OF LANDINGS

Fishing operations are conducted all year in the study area although fishing mainly occurs in the period November-August.

Peak catches of various species differ seasonally. Butterfish, flathead, mullet and bream are taken year round with differing seasonal peak landing periods. Whiting and tailor are taken mainly from June to September whilst black bream (luderick) are captured principally from October to March. This periodicity varies slightly from year to year.

4.6 RECENT HISTORICAL CHANGES TO FISHING OPERATIONS

Fishermen report that catch rates and the species composition of catches has remained unchanged over the past 20 years for undisturbed regions of the study area. However, fishermen claim that recent works (< 10 yrs) in some areas of the Fisherman Islands region have changed the nature of fishing operations and reportedly decreased landings from some areas. The comments made by fishermen are presented below to demonstrate the importance of particular fishing grounds and effects of modifying works.

No data are available to support these statements, however they indicate the concerns of local fishermen in relation to port activities.

Boat Passage

The reclamation of lands over the last 10 years on the south-west side of the Passage (Queensland Tugs and PBA depots) has reportedly affected mullet catches in areas near the eastern entrance of the Boat Passage. Prior to these works, mullet moving downstream in the Brisbane River used to enter the Boat Passage and moved eastwards through the passage onto the intertidal flats where they were susceptible to netting. Fishermen consider that the reclamation works have apparently formed an obstruction to the "normal" mullet movements and resulted in less fish entering the Boat Passage. Mullet reportedly remain in the Brisbane River to a greater extent than in the past, and consequently are less able to be netted thereby reducing commercial fish landings from the study area.

No data are available to confirm whether there has been a reduction in the number of mullet entering the Boat Passage or, if there has been a reduction, that this resulted from these reclamation activities.

Fisherman Islands Reclamation

Reclamation of Fisherman Islands has involved construction of bunds into which dredge spoil has been pumped. Approximately five years ago tailwaters from bunds located in central regions of Fisherman Islands (the Divide) overflowed onto the eastern intertidal flats. Fishermen claim that these waters contained very high levels of silt which smothered seagrass beds adjacent to mangroves and apparently raised the level of the flats. They believe that this markedly reduced fish catches in the affected area over a three year period until most seagrass beds recovered.

No information is available to confirm these reports although historical aerial photography indicate some silt input occurred. Photographic detail is insufficient to ascertain seagrass loss.

Fisherman Islands/Bishop Island Connection

The reclamation of subtidal lands between Fisherman Islands and Bishop Island filled in an area reputed to be an extremely productive fishing ground. This area consisted of undulating substrates and several wrecks (used to construct Bishop Island) which provided shelter and food (eg. oysters on the wrecks) for bream and jewfish. The area is now mostly reclaimed. As a result of these works and associated habitat loss, commercial catches of these species have decreased from the northern Fisherman Islands region. Recreational fishermen also state that the reclaimed area was a productive fishing ground and that bream and jewfish catches near Bishop Island are less than they were prior to reclamation works.

Reclamation of the subtidal lands between Fisherman Islands and Bishop Island also reportedly affected the movement of mullet from the river onto fishing grounds. Prior to the reclamation, mullet travelling downstream swam between the islands and reportedly congregated in shallow water near the northern tip of Fisherman Islands, where fishermen netted them. Fishermen believe that filling of the waterway between

Fisherman Islands and Bishop Island has prevented fish from congregating near northern Fisherman Islands and mullet have since tended to remain within the main shipping channel before moving to other areas of the bay or onto the ocean surf beaches.

Commercial/recreational fishing organisations and State Government authorities do not hold site specific catch records and therefore the extent of decreased landings for the area cannot be quantified.

Overview

Overall, net fishermen consider that reclamation and other port related activities have adversely influenced their catches only to a minor degree.

Fishermen claim that approximately five years ago some localised short-term decreases in catches occurred because silt laden water flowed eastwards onto the intertidal flats from bunded areas on Fisherman Islands, leading to a short term loss of seagrass beds.

Fisherman advise that, with the exception of works on the northern tip of Fisherman Islands, no regularly used fishing grounds have been disturbed and no major long term adverse effects from port operations are experienced.

The general consensus amongst fishermen interviewed is that port related and fishing activities can be compatible in the long-term, providing port expansion strategies and techniques avoid disturbance of important fishing grounds.

4.7 OVERVIEW

There are 95 licensed netting operations in Moreton Bay. In 1989 Moreton Bay net fishermen landed 1342 tonnes of fish.

The study region near Fisherman Islands is considered by fishermen to encompass some of the more productive commercial netting grounds in Moreton Bay. Some fishermen regard the area as the best flathead ground in Queensland.

On average, approximately 7 netting crews regularly operate in the study area catching 100-150 tonne of fish per year. Most fish taken are mullet, flathead, bream and butterfish. The landing value of the finfish catch is reportedly at least $560,000 per year which roughly approximates to 8-12% of Moreton Bay finfish landings.

Fishermen advise that works by the Port of Brisbane Authority in the Fisherman Islands region have had relatively minor adverse effects on nearby commercial netting operations, other than in the area on the northern tip of Fisherman Islands.

5.0 CRAB FISHING

Net fishermen indicate that no commercial mud crabbers use the Fisherman Islands region on a regular basis. Mud crabs (*Scylla serrata*) are taken as by-catch in netting operations although landings are low relative to other areas of Moreton Bay. Most crabs sold are particularly large crabs destined for the restaurant trade.

Sand crabs *(Portunus pelagicus*) are frequently taken by commercial fishermen. Net fishermen catch the crabs as by-catch in mesh/tunnel nets and occasionally set traps when crab abundance is high. The principal sand crabbing ground is the ridge running eastwards from northern Fisherman Islands (described in Section 4.3.1) presumably because the ridge provides an attractive feeding for crabs. One commercial sand crabber reportedly frequently fishes this area. Attempts to locate this fisherman have proved unsuccessful.

6.0 BEAM TRAWL FISHING

Beam trawl operations cannot legally occur on the intertidal flats east of Fisherman Islands and are restricted to a small portion of the study area (the Brisbane River and northern fringes, see Section 3.0).

6.1 TRAWLING TECHNIQUES

Beam trawling involves towing a trawl net behind boat (generally 5-9 m in length), the mouth of the net being held open by a beam (maximum permitted width 5 m). This differs from otter trawling where the net is held open by otter boards or doors which act as spreading devices for the mouth of the net.

The beam trawl net is lowered over the stern of the vessel while it steams away, paying out the towing warp. The height of the skids and point of attachment of the warp to the beam is usually governed by the type of grounds and species of prawns which are being fished. Trawl time can vary from a few minutes to half an hour depending upon conditions.

6.2 NUMBER OF FISHERMEN

The QFMA advise that 77 commercial fishermen have an endorsement which permits beam trawling in the region between the N.S.W./QLD border and Double Island Point. Not all of these endorsements are used and in 1990, only 59 beam trawling operations were reported to the QFMA.

Approximately 30 beam trawlers involving 40 fishermen (some fishermen have an assistant) work in the study area at least 50% of their total fishing time (approximately 150 fishing days per year). Of these, 17 beam trawlers are moored within and work exclusively in the Brisbane River, particularly the river mouth. The remaining 13 beam trawlers are moored elsewhere but rely heavily on the Brisbane River as a fishing ground.

6.3 FISHING AREAS AND SPECIES TAKEN

The legally permitted beam trawl areas within the study region are shown in Figure 3.1. All grounds within the legal area are beam trawled. The abundance of prawns, and hence fishing operations, in various locations varies depending upon tidal state, water clarity/salinity river flow and time of the year.

Fishermen advise that fishing operations within the mouth of the Brisbane River, on any one fishing day, generally involve trawling in several areas throughout the region shown in Figure 6.1, which includes the study area. Prime fishing grounds generally occur within the study area along the edges of the entrance channel (Figure 6.1) along the old bar cutting, and within the mouth of the Brisbane River.

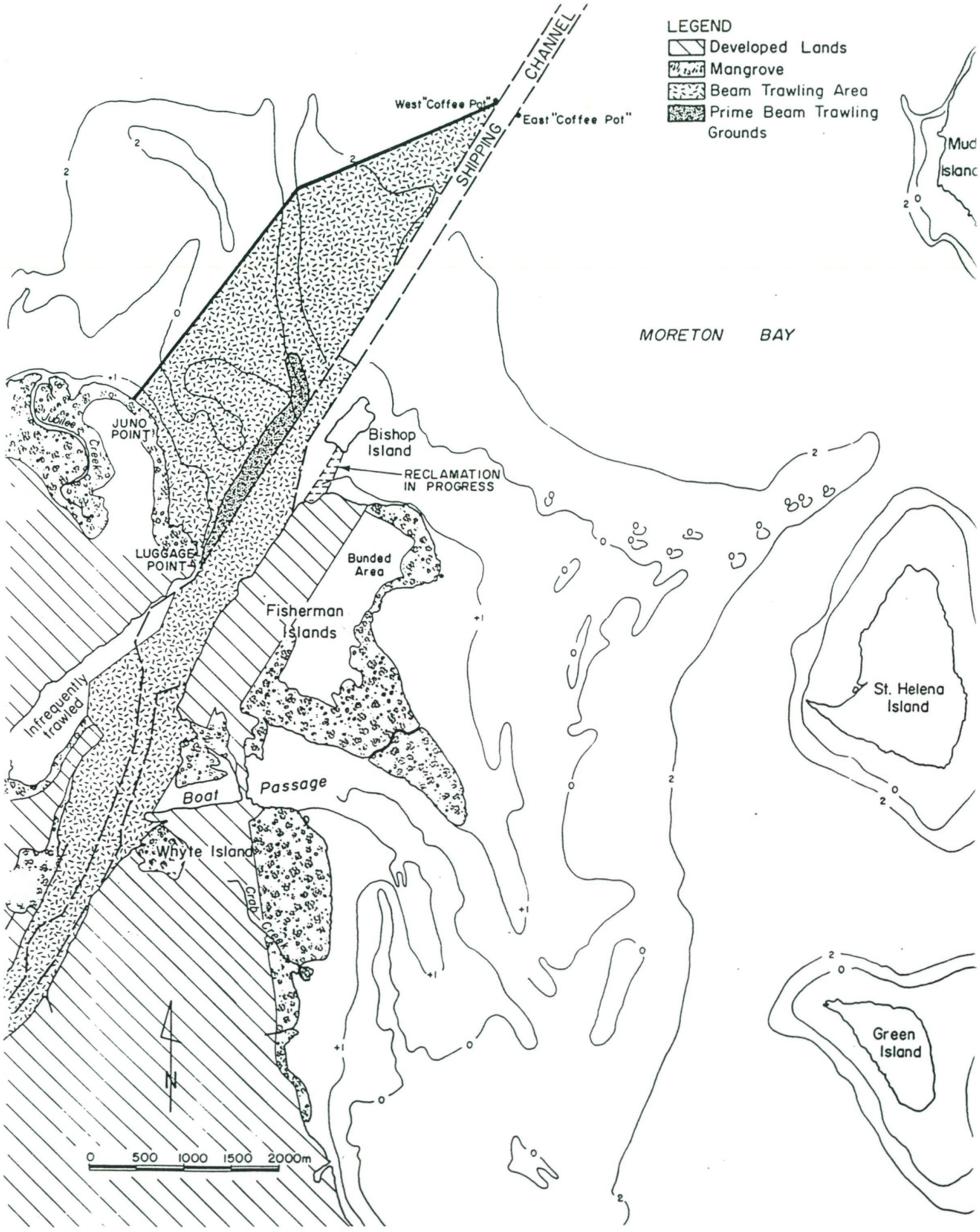
Prawn species taken in the study area include greasyback *(Metapenaeus bennettae)*, king *(Penaea plebjus)*, tiger *(Penaeus esculentus)* and banana *(Penaeus merguiensis)* prawns. Greasyback prawns form the bulk of catches and are taken mainly from November to May. King and tiger prawns form an important by-catch. Banana prawns are taken in winter in some years, although considerable interannual variation occurs.

6.4 CATCH VALUE

The Brisbane River greasyback prawn fishery is one of the major suppliers of bait prawns in Australia. The lower reaches of the river, including those within the study area are the most productive. Bait prawns are sold throughout Queensland and exported mainly to N.S.W. and Western Australia. Larger greasyback prawns are sold for human consumption, although the majority of the catch is for bait.

Banana prawns, taken in winter, are commonly large and are sold to the restaurant trade.

As for the net fisheries, no catch data specific to the Fisherman Islands are collected by Government authorities or the QCFO.



FIGURE

MAIN BEAM TRAWLING AREAS

6.1

WBM OCEANICS AUSTRALIA

Beam trawl fishermen estimate that the beam trawl fishery operating within the study area involves (on average) 17 fishermen who work within the Brisbane River mouth, including the study area, 75-100% of their operating time. Thirteen fishermen reportedly operate in the area for half of their fishing time. An "average" beam trawler is considered to earn $50,000 each year and thus a conservative estimate of the annual value of beam trawled prawn landings from the mouth of the Brisbane River is $962,500 (17 x 0.75 x $50,000 + 13 x 0.5 x $50,000 = $962,500)

6.5 SEASONALITY OF LANDINGS

Greasyback prawns, the most commonly captured prawn in the study region, are generally taken in greatest numbers from November to May with peaks occurring in summer months. Banana prawns are taken in winter months although catches in some years are almost nil.

6.6 INFLUENCE OF PORT OPERATIONS ON BEAM TRAWLING OPERATIONS

Beam trawlers report only minor concerns with PBA operations, generally in association with maintenance dredging.

Beam trawling requires a level seabed to work efficiently and prevent the skids/beam from "hooking up". Maintenance dredging operations which leave the bottom in an uneven condition render dredged areas unsuitable for beam trawling until natural processes level the seabed. The PBA bed levelling operations reduce this problem although fishermen believe levelling to a greater degree would significantly improve their catches.

Maintenance dredging also creates turbidity plumes. Although not adversely affecting catches, the plumes affect prawn distribution. Prawns move into shallower waters when conditions are turbid as a result of dredge plumes, perhaps because greater predator protection afforded by low clarity waters enables prawns to feed in otherwise "unavailable" shallow areas. In contrast, when waters are of high clarity, prawns tend to occur in deeper waters, including dredged areas such as main navigation channels.

The influence of dredge plumes is reported by fishermen to alter fishing areas but not reduce landings to a substantial degree.

Dredging operations also provide benefits to beam trawling operations. The deepening of some areas of the river has created additional habitat favoured by greasyback prawns. These deep areas have low light intensity, which may reduce prawn predation, and they serve to accumulate detritus which is used as a food resource by prawns.

Fishermen advise that the time of year when dredging is conducted is of little concern. However, on the basis of the seasonal nature of prawn landings (see Section 6.5), it would appear that the September/October period when catches are low would be the most preferable period for major dredging works. This would allow a greater time for dredged substrates to naturally level.

7.0 RECREATIONAL FISHING

No data are available on recreational catches or fishing levels for specific areas of Moreton Bay. The following information is based upon interviews with anglers that use the area.

Shore based angling locations are limited as a result of the thick mangrove fringe, muddy foreshores and restricted road access. However, those sites which are available are particularly popular with recreational fisherman because of their close proximity to residential centres of Brisbane. The most popular locations are the road bridge crossing at the Boat Passage for the Port of Brisbane Road, reclaimed foreshores along the Boat Passage and along the Wynnum North esplanade (at high water only). One boat ramp has recently been constructed in the Boat Passage. Other nearby boat ramps occur at Wynnum (Wynnum Creek) and Pinkenba.

Most recreational fishermen do not use the extensive offshore intertidal flats for angling or crabbing for fear of their boats stranding/grounding. The intertidal flats are mainly used by recreational fishermen seeking bait. Bait worm digging generally occurs near Wynnum and the flats between the D'arcy light and Fisherman Islands where access is

easier. Bait worms are predominantly taken from areas close to the shore or from banks close to navigation channels (eg. Boat Passage).

Amateur bait worm digging also occurs amongst mangroves near Wynnum. These digging operations have extensively disturbed mangrove pneumatophores/seedlings and affected areas are visually unattractive (see Wetlands Study Report, WBM 1991a).

Angling within the study area occurs mainly on the fringes of the main shipping channel, and areas within and adjacent to Boat Passage. Bream, jewfish, and luderick are captured mainly from shallow water adjacent to revetment walls near the tanker/cargo terminal and Bishop Island. More favoured fishing locations for these fish occur outside the study area at Luggage Point and the upstream BP river training wall.

Bream, whiting and flathead are commonly taken on the shallow flats south of the shipping channel and from the flats fringing the Boat Passage. Whiting fishermen consider the area south of the shipping channel (ie. east of Bishop Island) to be a prime fishing ground in spring months. On the opposing bank, the flats surrounding the seaward edge of the Old Bar cutting are also popular areas for anglers seeking whiting. Tailor, mackerel and other pelagic fish are also taken on a seasonal basis in these areas.

Crabbing is mostly restricted to sand crab trapping. Sand crabs are taken in reportedly large numbers from the area north east of Bishop Island (along the shipping channel), and the area west of St. Helena Island using pots and dillies.

The level of recreational fishing in Moreton Bay is increasing rapidly and is anticipated to double in the next decade. This will result in greater utilisation of areas near Fisherman Islands for angling and bait collecting.

8.0 FISHERIES IMPORTANCE OF WETLAND HABITATS ADJACENT TO FISHERMAN ISLANDS

The wetland areas adjacent to Fisherman Islands contain mangrove forests, seagrass beds and saltmarshes. Contrary to a generally held public perception, these habitats are

not used as spawning grounds by species of fisheries value but provide valuable nursery and feeding habitat.

8.1 MANGROVES

Mangroves are highly productive ecosystems. The primary food source for aquatic organisms in most mangrove dominated estuaries occurs in the form of particulate organic material (detritus) derived from the decomposition of mangrove forest litter (ie. leaves, twigs, flowers). Estimates of litter fall (the most commonly measured component of net primary production) for *Avicennia marina*, the dominant species in the study area, range from 1.94 t/ha/yr to 6.42 t/ha/yr (Davie 1984) which were recorded at Mud Island. WBM Oceanics are presently undertaking leaf litter estimates at Fisherman Islands for the PBA (WBM Oceanics 1991a).

During decomposition, mangrove litter becomes a food source for a wide variety of filter, particulate, and deposit feeders such as molluscs, crabs, and polychaete worms. These primary consumers, which include representatives of most phyla, in turn form the food of a secondary consumer level which is usually dominated by small forage fish species and by the juveniles of the larger predatory species that form the third consumer level (Odum and Heald, 1972). In addition, there are important fishery species, which occupy both primary and secondary consumer levels. They feed directly on particulate organic detritus and also upon primary consumers.

Numerous studies have noted that fishes (particularly juveniles) are more abundant in mangrove dominated areas than in other nearshore habitats (Robertson and Duke 1987, Morton 1990). Possible explanations for this increase in fish abundance near mangroves include high availability of foods (Blaber and Blaber 1980, Morton 1990) and a high degree of structural heterogeneity (ie. shelter) in the form of prop roots, pneumatophores etc. (Robertson and Duke 1987). Many of the fishes present near mangrove areas of subtropical Queensland are of direct fisheries value (Morton, 1990).

Economic value

Morton (1990) concluded that mangrove forests at the mouth of Tingalpa Creek, (Moreton Bay) which are similar in structure to areas fringing Fisherman/Whyte

Islands, provide important nursery and feeding habitat for fish of direct fisheries value. Study results indicated that:

- 46% of the fish species, 75% of the number of fishes and 94% of the biomass taken from mangrove forests and fringing waters were of direct importance to regional fisheries.

- the value of marketable fish taken from the mangrove study area was \$8380 ha^{-1}. This value only accounted for marketable species and does not include commercially important juveniles, fish or prawns.

8.2 SEAGRASSES

Seagrasses, which occur on intertidal and subtidal mudflats in the study area (see CSIRO seagrass report prepared for PBA), are important feeding areas for a variety of organisms. Turtles, dugongs and some fishes (eg. garfish) feed directly on seagrasses whilst most other animals feed upon epiphytes, detritus, microfauna and the benthos associated with seagrass areas. Harlin (1980) reported that seagrass provides extensive surface area for large numbers of epiphytes which are grazed extensively by amphipods, gastropods etc. These animals are in turn eaten by larger animals.

Fish

Very few studies have been conducted specifically with regard to the fishes associated with seagrass beds in Queensland. Studies in N.S.W. have shown that seagrass beds support a large variety of fishes many of which are important to fisheries. Small epibenthic crustaceans were noted as a main part of the diet of juvenile fish in seagrass (Pollard 1984).

Recent studies by QDPI have involved beam trawling over seagrass beds fringing the northern banks of the Boat Passage monthly for a 15 month period. QDPI officers involved in the project have provided a list of fish species taken at Fisherman Islands which is reproduced in Appendix B. The detailed results of the QDPI studies, which

are unavailable at present, are anticipated to be released in December 1991/January 1992.

The QDPI data indicate that the seagrass beds support a wide variety of small fish (40 species), many (approximately 16) of which are of fisheries importance. Beam trawling techniques are designed to capture prawns and principally catch only small, slow moving fish. Fast-swimming and pelagic fish (most of which are of direct fisheries importance) are generally under-represented in beam trawls. For this reason, the abundance of fish of direct economic importance (eg. mullet, whiting, flathead) contained in the beam trawl catches shown in Appendix B is low and does not reflect the nursery value of seagrass beds to fisheries.

Other research (ongoing) by the QDPI using different netting techniques (eg. stake netting) indicate that seagrass beds are valuable nursery habitat for flathead, whiting, mullet and bream (D. Cameron pers. comm.) whilst studies in N.S.W. have shown that patchy *Zostera* beds are an important feeding/shelter habitat for juvenile summer whiting, the most commercially important whiting species (Burchmore *et al.* 1988). Undoubtedly more detailed fish studies would reveal the dependence of many other fisheries species upon seagrass beds.

Seagrass beds also provide habitat for worms which form the basis of a major bait worm fishery in the study area. As described in the Bait Worm Report (WBM Oceanics 1991b), large populations of bait worms are only associated with seagrass beds.

Prawns

Seagrass also provide an important settlement area for the post-larval stage of several species of penaeid prawns (Young 1978). The post-larval stage is the stage which leaves the plankton to adopt a bottom dwelling (or demersal) lifestyle. Seagrass beds are considered valuable prawn nursery grounds, especially for the tiger prawn, *Penaeus esculentus* (Young 1978, Staples *et al.* 1985, Coles and Lee Long 1985) and endeavour prawns, *Metapenaeus endeavouri*, (Coles *et al.* 1987). Post larval and juvenile stages

are found almost exclusively in seagrass beds. Within seagrass beds, tiger prawns (*Penaeus esculentus*) fed on polychaetes, gastropods, algae and seagrass (*Zostera capricorni*) seedcases (Wassenberg and Hill 1987). It is probable that if larval tiger or endeavour prawns do not settle in an area of seagrass they will be unlikely to survive and will be lost to the fishery.

Greasyback prawns, the dominant prawn species caught in the study area (and Moreton Bay), spawn from October to May within Moreton Bay, no further than 16 km from river mouths (Dall 1958). Post-larval recruitment occurs mostly from March and June (Young and Carpenter 1977). Epibenthic post-larvae occur on a variety of substrates but are more abundant on seagrass beds than bare substrate and are more abundant in shallow than deeper water (Young and Carpenter 1977).

Beam trawl studies by QDPI (see Fish section above) at Fisherman Islands indicate that these seagrass beds:

(i) mainly support large populations of juvenile greasyback prawns, the dominant prawn taken in Brisbane River/Moreton Bay trawl (otter and beam) fisheries (see Section 6.0).

(ii) also support tiger and king prawns but in lesser numbers.

(iii) contain greater abundances of juvenile prawns than in adjacent shallow subtidal areas.

(iv) have a comparable abundance of greasyback prawns to another sample site located over seagrass beds at Deception Bay but contain greater numbers of king and tiger prawns.

Economic Value

Unfortunately no data are available that can place an accurate estimate on the value to fisheries of specific seagrass areas such as those within the study area. Difficulties arise because:

(a) Prawns, fishes, etc. often move substantial distances between the juvenile and adult phase thus, at least on a local scale, attempts to locate nursery grounds for a particular stock are difficult. Tagging programs are useful in this context but require a large research input.

(b) Seagrass beds vary annually in terms of distribution and density of substrate cover.

(c) The "carrying capacity" of seagrass beds and fish/prawn recruitment levels to seagrass beds are likely to vary annually and between sites.

(d) Relatively little is known about the ecology of seagrass areas in Australia.

Whilst being extremely difficult to place a quantitative figure on the economic value of associated seagrass areas it is prudent to assume that large areas are of substantial importance to the fisheries of an area. Impacts due to the loss of small areas are difficult to assess given the often wide interannual variability in seagrass extent.

8.3 SALTMARSHES

Saltmarsh areas are limited in extent within the study area occurring only as small isolated patches (individually < 0.1 ha) in central Fisherman Islands (adjacent to the southern bund) and landward of Whyte Island mangroves.

Saltmarshes occur in upper littoral regions. In Moreton Bay, approximately 15% of the high tides inundate this habitat annually. Studies of the fisheries value of saltmarshes in Moreton Bay (Morton *et al.* 1987, 1988) concluded that:

- fish species important to commercial fisheries do not directly utilise saltmarsh to a large extent. Of those that do, mullet and bream use tidal inlets to saltmarshes as feeding areas.

- the value of small areas of saltmarsh for maintenance of commercial fish populations is not critical however when considered in total, saltmarshes in Moreton Bay provide rich feeding grounds for certain types of fish.

8.4 OVERVIEW

The study region encompasses large areas of mangroves and seagrasses. In common with other wetlands in Moreton Bay, these areas provide valuable habitat for fish and prawn species of direct fisheries importance which are taken throughout Moreton Bay. The wetlands are of considerable regional significance as described in the Wetlands Report (WBM Oceanics 1991a).

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APPENDIX A
CORRESPONDENCE TO QUEENSLAND COMMERCIAL FISHERMEN'S ORGANISATION

APPENDIX B
RESULTS FROM QDPI BEAM TRAWL STUDY AT FISHERMAN ISLANDS

TABLE 1
SCIENTIFIC AND COMMON NAMES OF THE FISH SPECIES CAUGHT ON FISHERMAN ISLANDS *ZOSTERA CAPRICORNI* SEAGRASS BEDS BY QDPI (1989-1990)

Apogonidae	
Adenapogon roseigaster	Rose-bellied siphon-fish
Apogon fasicata	Cardinal fish
Atherinidae	
Atherinomorus ogilbyi	Common hardyhead
Balistidae	
Monacanthus chinensis	Fan-bellied leather-jacket
Paramonacanthus sp.	
Blenniidae	
Bothidae	
Pseudorhombus arsius	Large-toothed flounder
Pseudorhombus jenynsii	Small-toothed flounder
Centropomidae	
Ambassis marianus	Yellow perchlet
Chaetodontidae	
Parachaetodon ocellatus	Six-spined butterfly fish
Congridae	
Conger labiatus	Australian conger eel
Diodontidae	
Dicotylichthys myersi	Myers' porcupine-fish
Engraulidae	
Stolephorus carpentariae	Carpentaria anchovy
Gerridae	
Gerres subfasciatus	Silver-belly
Gobiidae	
Pseudogobius?	
Hemiramphidae	
Arrhamphus sclerolepis	Snub-nosed garfish
Hyporhamphus regularis	Needle-gar
Mugilidae	
Mugil cephalus	Sea mullet
Muraenesocidae	
Muraenesox cinereus	Pike eel
Platycephalidae	
Cymbacephalus nematophthalmus	Fringe-eyed flathead
Platycephalus fuscus	Dusky/mud flathead
Platycephalus indicus	Bar-tailed flathead

Plotosidae	
Euristhmus lepturus	Long-tailed catfish
Plotosus anguillaris	Striped catfish
Scorpaenidae	
Bathyaploactis curtisensis	Port Curtis mossback
Centropogon marmoratus	Marbled fortesque
Sillaginidae	
Sillago analis	Golden-lined whiting
Sillago ciliata	Sand/summer whiting
Sillago maculata	Winter/diver whiting
Soleidae	
Euryglossa orientalis	Black sole
Sparidae	
Acanthopagrus australis	Yellowfin bream
Rhabdosargus sarba	Tarwhine
Syngnathidae	
Campichthys tryoni	Tryon's pipe-fish
Syngnathoides biaculeatus	Horned pipe-fish
Urocampus carinirostris	?
Tetraodontidae	
Spheroides hamiltoni	Common toado
Spheroides pleurostictus	Banded toado
Tetraodon hispidus	Stars and Stripes toado
Torquigener squamicauda	Scaly-tailed toado
Theraponidae	
Pelates quadrilineatus	Trumpeter perch

TABLE 2
ABUNDANCE AND BIOMASS OF FISH SPECIES CAUGHT ON FISHERMEN ISLANDS SEAGRASS BEDS BY QDPI
(1989-1990)

FAMILY	ABUNDANCE	BIOMASS (g)
Balistidae	98	162.1
Blenniidae	28	8.5
Bothidae	4	53.0
Centropomidae	4	22.1
Gobiidae	174	232.2
Hemiramphidae	3	84.3
Mugilidae	1	206.8
Platycephalidae	9	375.9
Plotosidae	53	1014.0
Scorpaenidae	1426	3091.7
Sillaginidae	8	51.4
Solidae	2	270.6
Sparidae	68	750.9
Syngnathidae	182	43.5
Tetraodontidae	89	891.8
Theraponidae	1159	2162.1
Other fish +	39	390.4

\+ Apogonidae
Atherinidae
Chaetodontidae
Congridae
Diodontidae
Engraulidae
Gerridae
Muraenesocidae
Unidentified larvae