ABBOT POINT GROWTH GATEWAY PROJECT

Fisheries Technical Report

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EXECUTIVE SUMMARY

This report assesses the potential impacts to commercial and charter fishing operations associated with the Abbot Point Growth Gateway project. A review of available commercial logbook information was undertaken and this review included the logbook reporting grid that contains Abbot Point (logbook grid M22) as well as the grids surrounding it (logbook grids L21, L22, M21, N21 and N22). Commercial fishing logbook data is the official ongoing source of commercial catch and effort information for all Queensland commercial fisheries. This study also used a number of other published and unpublished studies that are of relevance to the study region, including:

- Fenton and Marshall (2001) which documented the social and economic structure and linkages of the Bowen commercial fishing fleet prior to the Representative Areas Program (RAP);
- Lédée et al. (2012) which collected empirical information from commercial fishers on their spatial patterns of effort pre and post RAP and their adaptations to the RAP;
- Ludescher (1997) which collected information and analysed commercial fishing logbook information in the region between Bowen and Tully between 1988 and 1995; and,
- The *Bowen Fisheries Decline Report 2009* which included logbook analysis and vessel monitoring system data (VMS) for the trawl fishery as well as fisheries independent trawl survey work in the Bowen region.

Investigations into recreational fishing in the area indicated that the spatial scale of the catch data was too coarse to link it to specific locations, however it was demonstrated that recreational fishing in the Bowen region is important for residents and tourists. Recreational fishing participation rates in the Mackay Statistical Division which includes Bowen were shown to be increasing and this is the opposite of the trend in the state-wide participation rate. Boat ownership showed a clear and consistent increasing trend over the period examined (2001-2012).

Available information for the charter fishing industry indicated there was no reported activity within grid M22. The key area in the Bowen region for charter fishing is grid N23 which includes the northern part of the Whitsunday area.

The report focuses on commercial fisheries, particularly those based out of Bowen. Commercial logbook information for the six grids surrounding the Port of Abbot Point were analysed and the major findings were:

- The total annual catch (tonnes) and the annual gross value of production (GVP) from logbook grid M22, for all commercial fisheries combined, peaked in 2003-04 at 219 tonnes and $1.37 million and was lowest in 2007-08 at 75 tonnes and $408,000;
- The key suite of target and by-product species in logbook grid M22 included Spanish mackerel (*Scomberomorus commerson*), grey mackerel (*Scomberomorus semifasciatus*), spotted mackerel (*Scomberomorus munroi*), Australian blacktip shark (*Carcharhinus tilstoni*), Moreton Bay bugs (*Thenus orientalis* and *Thenus indicus*), red spot king prawn (*Melicertus longistylus*), tiger prawns (*Penaeus esculentus* and *Penaeus semisulcatus*), mud crabs (*Scylla serrata*) and mud scallop (*Amusium pleuronectes australiae*).

For the net fishery specifically;

- Although variability is clearly evident, catch generally increased between 1990 and 2000 and has generally declined following the rezoning of the Great Barrier Reef (GBR) in 2004;

- Effort in the region has principally focussed on sites one and six in logbook grid L22 which is the south end of Upstart Bay. Sites one and six include the mouth of the Burdekin River which is a focal point of inshore fishing activities for commercial fishers based in the Ayr and Home Hill region; and
- Net fishing is recorded from sites 22 and 23, in Grid M22. These two sites make an important contribution to the income of net fishers based in Bowen. However, due to the “five boat rule” which limits public access to data when less than five boats have accessed an area, the publicly available catch of fish (sharks in particular) by net fishing in more offshore sites is underestimated in the Abbot Point region. That is, catch can be recorded in the database, but is not publicly available. Permission to access individual licence holders logbook history was obtained in a number of instances, and this verified that underestimation of catch and effort data in the public domain was evident. Confidentiality requirements prevent the placement of individual logbook history obtained into the public domain.

For the trawl fishery specifically;

- A significant and sustained decline in both catch and effort occurred following the rezoning of the GBR in 2004. This trend is evident across the fishery as a whole; and
- Within grid M22, only sites one and two had consistent trawl catches recorded, and the magnitude of these catches were not high in the context of the other sites in other grids examined. Of the six logbook grids examined, grids L21, L22 and M21 were the most important for the trawl fishery.
- Individual logbook information did demonstrate that some fishing operators did have substantial catches in sites within logbook sites at and directly adjacent to Abbot Point. These substantial catches were not visible in the publically available data to confidentiality constraints.

For the line fishery specifically;

- Effort in the line fishery generally showed less variation than the other fisheries examined, with a peak evident between 1997 and 1999. Clear peaks in catch were also evident in 1997 and 1999;
- Commercial logbook data very clearly identified that the grids M21 and N21 were the most important for the line fishery with a clear focus on the capture of coral trout in those grids and not within M22; and
- Some line fishing catch and effort is recorded in site 16 of logbook grid M22.

For the crab fishery specifically;

- Effort in the region examined has principally focussed on sites one, six and 18 in logbook grid L22.

For the tiger prawn and mud scallop components of the trawl fishery, commercial logbook information was augmented with published vessel monitoring system (VMS) data and a published fisheries independent survey which documented the distribution and abundance of the mud scallops in the vicinity of Abbot Point. This additional information identified that the area of Abbot Point was important for the harvesting of both these species, although clear inter-annual variation in importance was evident. Recreational and commercial fishing routinely occurs within operational port limits, although port authorities have the power to declare exclusion zones for safety and security reasons. The review of available data and consultation with commercial fishers indicated that the assessment of impacts of the project on commercial fishing should focus on:

- Plumes associated with dredging:
- Plume associated with return water discharge; and,

- Previously trawlable ground becoming untrawlable as a result of changes to the seabed from dredging.

  The potential for impacts to fishing access (particularly for the trawl fishery) from the presence of pipelines was considered as a potential impact. However, given the location of the pipelines adjacent to the existing wharf structures, along with the temporary nature of the pipeline deployment (anticipated to be up to 14 weeks), this potential impact was considered to be highly unlikely to be realised, or if it were, highly unlikely to be significant. The potential for impacts to nursery areas for fished species was also considered but it was concluded that in this instance they were unlikely to be relevant. The discharge of return water was also considered as a potential impact. The proposed indicative location of the discharge means that it is highly unlikely to be on grounds that are fished, particularly by the trawl fishery. Modelling of the discharge plume identified a limited spatial impact (up to a maximum of the 500 metres to the north) of elevated TSS but of low concentration.

  Modelling of the likely dredge plume identified that the plume (2 - 5 mg/L TSS) would extend along a general north-west to south-east axis, but predominantly to the north-west. For context the median TSS in the Abbot Point region is estimated at 3.3 mg/L. There is uncertainty as to whether fished species will respond to a plume of this concentration during the dry season, and if so how. Notwithstanding the uncertainties regarding larval responses to turbidity gradients; the scale, intensity and duration of the predicted plume are unlikely to result in changes to the distribution or abundance of larvae of fished species to the extent that catches at the local or regional scale are significantly influenced. Available information suggests the modelled plume associated with dredging activities does not appear to overlap substantially with trawl fishing.

After the construction of T0 there will be additional shipping activity (and potentially additional anchoring requirements). The potential consequential impacts may be:

- Additional anchorage areas, and associated vessel exclusion zones; and,
- Increased vessel movements.

Shipping activity associated with the future development may impact commercial fisheries, particularly the trawl fishery, through loss or modification of access to areas used for anchoring and as a result of unevenness on the seafloor as a result of anchoring activity. In the net fishery, there is potential for ships to entangle nets if fishing and shipping activities overlapped and the subsequent loss of seasonally important fishing ground (e.g. for the shark fishery) due to practical limitations to access. Commercial fishers in the Bowen area have consistently raised concerns regarding the impacts of anchoring, and these concerns are being worked through by the North East Water Space Management Group. Currently, anchoring predominately occurs within commercial fishing logbook grid M22, but at times also extends into logbook grid L22.

1. INTRODUCTION

Ports have been operating along the coast of Queensland for more than a century and continue to provide essential transport infrastructure to support current and future import and export trade across a range of economic sectors important to regional areas, Queensland and Australia. A number of Queensland's ports are located along the Great Barrier Reef coast, within defined port areas external to the Great Barrier Reef Marine Park (GBRMP). Their ongoing development is directed by Land Use Plans approved by Government under the *Transport Infrastructure Act 1994*, taking into consideration environmental, social and economic constraints and opportunities. While development is typically contained within defined port areas, elements of development and operation may necessarily extend beyond these limits. In the case of ports along the Great Barrier Reef coast, these occur within a multiple-use context according to the marine park zonings and designated areas.

Over the long history of port development and operation along the Queensland Coast, ports and fishing have co-existed and have continued to develop and operate within the multiple-use environment of the GBRMP established more than 30 years ago. Each of the ports is developed to varying degrees and similarly have different levels of planned development. The existing port operations form a baseline from which future development is considered within the wider port master planning process and form an important baseline context beyond which impacts and offsets are to be considered. Within the GBRMP, there is a focus on the expansion of existing ports, rather than the creation of new ports at greenfield locations.

Port developments have the potential to directly and/or indirectly impact fisheries. Direct impacts can arise as a result of loss of access through the reclamation of fishing grounds, the exclusion of fishing around port infrastructure and changes to the marine environment that make some forms of fishing impractical. Indirect impacts may result from changes to habitat and/or water quality that could potentially affect the local or regional standing stock of harvested species.

The Port of Abbot Point is one of three existing major coal export ports on the Queensland east coast (Figure 1) and has been operating since 1984. The Port is located approximately 20km north-north west of Bowen and is well positioned in terms of providing ready access to deep water, existing rail linkages and without nearby residents. The Port is managed by North Queensland Bulk Ports (NQBP) as the port authority. The strategic location of Abbot Point for future industrial and port development was recognised in June 2008 by the declaration of the Abbot Point State Development Area (APSDA). The purpose of the APSDA was to facilitate the establishment of large scale industrial development of regional, state and national significance, while recognising and protecting environmental, community and cultural values. The further development of Abbot Point has been identified by the Queensland Government as critical to economic growth in north and central Queensland. Accordingly, land adjacent to the port has been designated as a State Development Area and port allocations have been granted by the Port Authority (NQBP) to a number of companies.

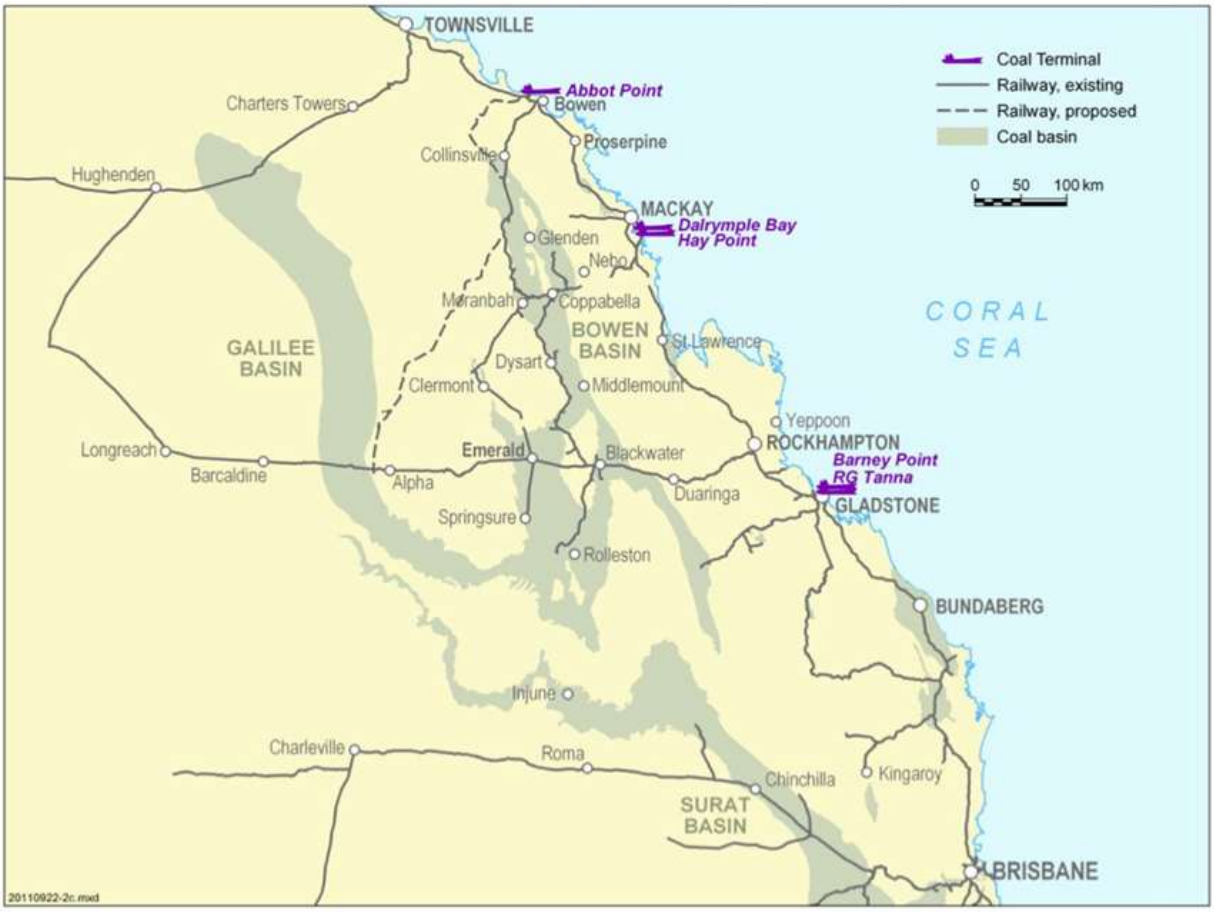


Figure 1 - Map showing central Queensland Coal Ports.

This assessment covers the Abbot Point Growth Gateway Project. It builds on and modifies previous development proposals at Abbot Point which were substantially larger in size and also included at-sea spoil disposal.

The Abbot Point Growth Gateway Project (the Project) is proposed by the Queensland Government Department of State Development (DSD) to support the development of the already approved Terminal 0 (T0) Project at the Port of Abbot Point through undertaking capital dredging to provide sea access for this terminal (Figure 2). The Project includes:

- Construction of onshore dredged material containment ponds (DMCPs) within the area previously allocated for the development of Terminal 2 (T2) and adjoining industrial land
- Capital dredging of approximately 1.1 million m3 in-situ (Mm3) of previously undisturbed seabed for new berth pockets and ship apron areas required to support the development of T0
- Relocation of the dredged material to the DMCPs and offshore discharge of return water
- Ongoing management of the dredged material including its removal, treatment and beneficial reuse within the port area and the Abbot Point State Development Area, where appropriate.

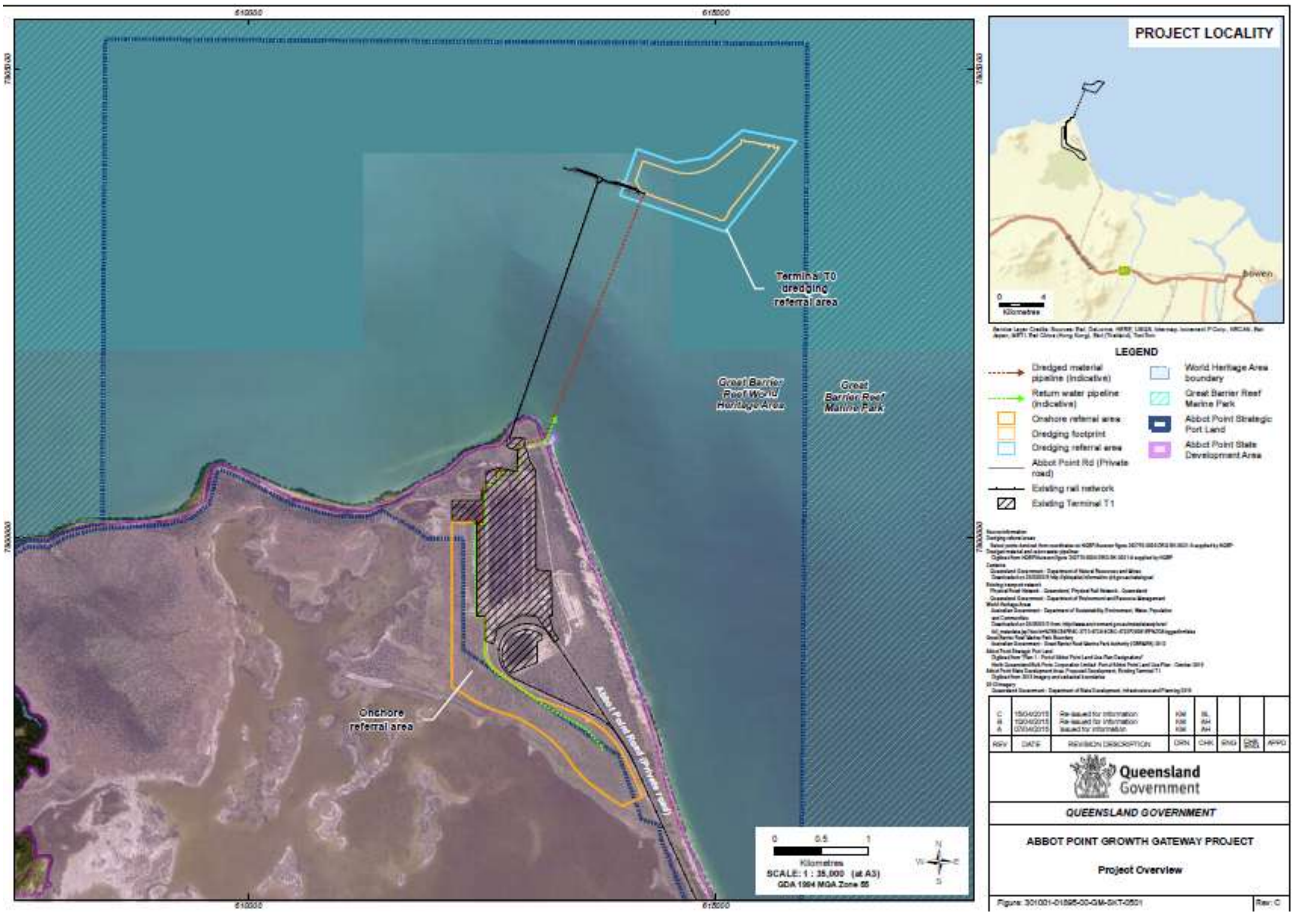


Figure 2 Overview of proposed project at Abbot Point.

2. METHODOLOGY

The primary source of information on catch and effort in Queensland commercial fisheries is from compulsory logbooks which are filled out by commercial fishermen and returned to the state fisheries agency for database entry. For most commercial fisheries, the spatial scale of the existing catch and effort information is coarse (30 minute grids) and makes unambiguous interpretation of direct impacts at a specific location difficult. A proportion of commercial fisheries information is available at a finer scale - at the scale of 'sites' (6 minute) - although the historical recording of this information by commercial fishers is highly variable. Further and importantly, if less than five boats fish in a specific grid, the state fisheries agency does not routinely allow third party access to that data and does not allow publication of such data in any public forum. Table 1 provides an assessment of the level of completeness of the available data by identifying how many instances of "zero catch and effort provided" at the scale of 30 minute grids. When zero catch and effort data are provided it is either because no catch has been entered as a result of the fishery not operating in the grid, or less than five boats have been active in a grid in a given year. Permission was given by a number of operators to provide access to their individual logbook data by the author through the appropriate process, and such data was reviewed and analysed. It is however not permissible to reproduce such data in a public forum as it would be a breach of state government confidentiality requirements. In this report the individual data is used contextually to support (or refute) anecdotal information provided directly by fishers without revealing any confidential details regarding the activities of any specific licence holders.

Table 1 Assessment of the Coverage of Commercial Logbook Data for Key Fisheries Between the Period 1990 and 2010 in the 30 Minute Grids Surrounding Abbot Point.

Grid	Fishery			
	Trawl	**Net**	**Line**	**Crab**
M22	All years provided	All years provided	All years provided	11 out of 20 years provided
M21	All years provided	None provided	All years provided	None provided
L21	All years provided	12 out of 20 years provided	All years provided	18 out of 20 years provided.
L22	All years provided	All years provided	17 out of 20 years provided	All years provided
N21	10 out of 20 years provided	None provided	All years provided	None provided
N22	18 out of 20 years provided	None provided	All years provided	None provided

It is important to clearly recognise that **commercial fishing logbook data is the official ongoing source of commercial catch and effort information**. This compulsory information is used for fisheries management functions including quota allocation, determining whether a licence holder has maintained a sufficient level of fishing activity in order to be allowed to continue accessing a specific fishery. It is also used in stock assessments of target species. Additionally it has also been used as an input into marine park planning process and an important component of structural adjustment to address marine park impacts on commercial fishing.

Commercial logbook data and VMS data are the only sources of information that provide a spatial component to commercial fishing catch and effort. That is, the ability to link catch and effort to a location, albeit very broadly in the case of commercial logbook data. It is pertinent to point out that it is the responsibility of each individual commercial fisher to maintain complete and accurate logbooks and forward this information to DAFF. It is an offence under the *Fisheries Act 1994* to provide false, misleading or incomplete documents to DAFF. Any inaccuracies that result from such actions should not be factored into environmental assessments or fisheries management. However, information provided directly by commercial fishers can also make an important contribution and can provide a direct avenue of capturing local commercial fishing knowledge.

Commercial fishing and charter fishing logbook information for relevant grids was provided by Fisheries Queensland in March and August 2012. Abbot Point is contained within the 30 minute grid logbook reporting grid – "M22" (Figure 3). As well as logbook grid M22, a further five logbook grids in the Bowen region that surround logbook grid M22 were analysed: M21, L21, L22, N21 and N22. To determine trends in the spatial pattern of commercial fishing catch and effort, the following analyses were undertaken for each of the identified logbook grids:

- An analysis of catch and effort for the net, line, crab and trawl fisheries for the period 1990-2010;
- The relative importance of the six grids for each fishery examined for a period of 2000 to 2010;
- Finer spatial scale analysis (sites) for the fisheries (otter trawl, net, crab and line) where data was available for the period 2000 to 2010; and
- Identification of key target species and an analysis of the trend in catch, effort and catch per unit effort (CPUE) for these species in the period 2003-04 to 2010-11.

In addition to logbook information, additional information on catch and effort and its spatial pattern was obtained from relevant publications, and requested directly from commercial fishers through the Bowen Fishing Group.

Where data was available, specific analysis of sites within logbook grids was undertaken. For this analysis, sites were classified into "primary" and "secondary" harvesting sites within a grid. Primary sites were classified as sites that had catch and effort recorded in at least five years with one of these years being after 2006, and catch volumes which were significant in terms of the overall production in the specific grid. Secondary sites were those that had catch and effort recorded, but which did not meet the criteria of being a primary site. Discussion of the importance of various sites also considered that fishing in a number of sites that were historically accessed no longer occurs due to the rezoning of the GBR. The ChrisWEB database contains estimates of gross value of production (GVP). These estimates are widely used for a variety of purposes and are considered the "official" estimates of GVP. Commercial fishers frequently question the veracity of these estimates, and indeed these estimates represent a statewide average and do not take into account various factors, including regional differences which may be significant (Sen, 2011; Hundloe et al., 2003). For individual species, if commercial fishers are able to provide information on the value they obtain for them, it is possible to determine a more locally appropriate price per kilo for the calculation of GVP for an individual species. This price per kilo can be higher or lower than those contained in the ChrisWEB database.

From previous work (Hundloe, et al. 2003) it was identified that for coral trout in particular, the information in ChrisWEB can be a significant underestimate of the actual GVP that fishers obtain for this species. This is because of the price differential obtained for live fish as opposed to dead fish. Price estimates of live and dead coral trout were obtained from Bowen fishing operators and it was assumed that 90% of the trout caught are live and this proportion of live fish is supported by available information (see Sen, 2011). Individual commercial fishers and seafood processors in Bowen provided the author with advice on local prices of key seafood products. For key species where information was provided, the local price per kilo compared to the price per kilo extracted from logbook information is contained in Table 2. Estimates of GVP used later in this report utilise both logbook prices and the local prices obtained.

Table 2 - Comparison of logbook price estimates and local price estimates for key species.The local prices were obtained in August 2012

Species	Logbook Price Estimate (per kg)	Local Price Estimate (per kg)
Coral trout	$32.71	$43.65
Red throat emperor	$6.74	$8.50
Spanish mackerel	$7.00	$10.00
Stripeys	$4.00	$5.20
Spangled emperor	$6.00	$3.90
Mud crabs	$16.00	$30.00
Grey mackerel	$5.55	$10.00
Moreton Bay bugs	$20.60	$21.00
Red spot king prawns	$12.80	$19.00
Tiger prawns	$15.30	$18.00
Shark (barrels only)	$3.00	$6.00
Banana prawns	$8.19	$10.00
Mud scallops (meat weight)	$14.05	$24.00

Charter fishing information was also obtained. Recreational catch was also extracted from the ChrisWEB database but this information was only available at the scale of statistical division as defined by the Australian Bureau of Statistics (ABS).

3. FISHERIES OF THE ABBOT POINT REGION

3.1 Commercial Fishery Overview

Queensland commercial fisheries are broadly divided into: trawl, mesh net, line, crab and collection fisheries. Queensland commercial fisheries are characterised by a significant diversity of target species and operations. Contributing factors to this diversity include the highly variable biophysical environment and the historic development of the various fisheries which have resulted in many traditional local and regional practices being codified in regulation.

Commercial fishers in Queensland require appropriate licences to operate and specific endorsements (symbols) are required to operate in specific fisheries. Endorsements can be focussed on the catching of a select group of species, the operation of specific apparatus, or more usually, a combination of both. Queensland commercial fisheries are multi-endorsed which means that a commercial fisher can possess a number of endorsements and operate in several different fisheries; however except for the crab fisheries, fishers cannot utilise multiple symbols at the same time. All commercial fisheries have a suite of input controls and a number (e.g. Coral Reef Finfish Fishery) also have output controls in the form of total allowable catches which for some species are divided into individual transferable quotas. The biology and ecology of the key target species in the commercial and recreational fisheries in the Bowen region is included in Appendix 1.

The key fishing endorsements relevant to the study area are listed in Table 3. In Queensland, some endorsements may be linked to a permissible specific area to fish, while others can be used throughout Queensland waters. An example of the former is the M2 endorsement which limits a trawl vessel to fishing in Moreton Bay only while an example of the latter is the N1 endorsement which can be used along the entire Queensland East Coast.

Lédée *et al.* (2012) presents a coarse scale regional summary from empirical face to face survey data collected directly from commercial fishers, on spatial changes to the pattern of fishing effort before and after the GBR rezoning. Lédée *et al.* (2012) considered trawl, crab and line fisheries only and their study is significant in terms of understanding changes in the fishing effort, including the spatial pattern of that effort. The information relevant to the Abbot Point region is shown in Figure 5. Lédée *et al.* (2012) shows that there was some displacement of fishing effort from the GBR rezoning into the inshore area south of Abbot Point, but that overall effort in this area was still low.

Ludescher (1997) presents catch information from commercial fishing logbooks for the region between Bowen and Tully between 1988 and 1995 and some qualitative disaggregation of this data can be undertaken to identify target species in the Abbot Point region during those years. As well as pre-dating the rezoning of the GBR, this data period also pre-dates other major reforms in Queensland fisheries. These reforms include the creation of Dugong Protection Areas and the associated structural adjustment of the net fishery; and the introduction of new management plans and associated effort reductions and quota implementation in the East Coast Trawl and Coral Reef Fin Fish Fishery (reviewed in McPhee, 2008).

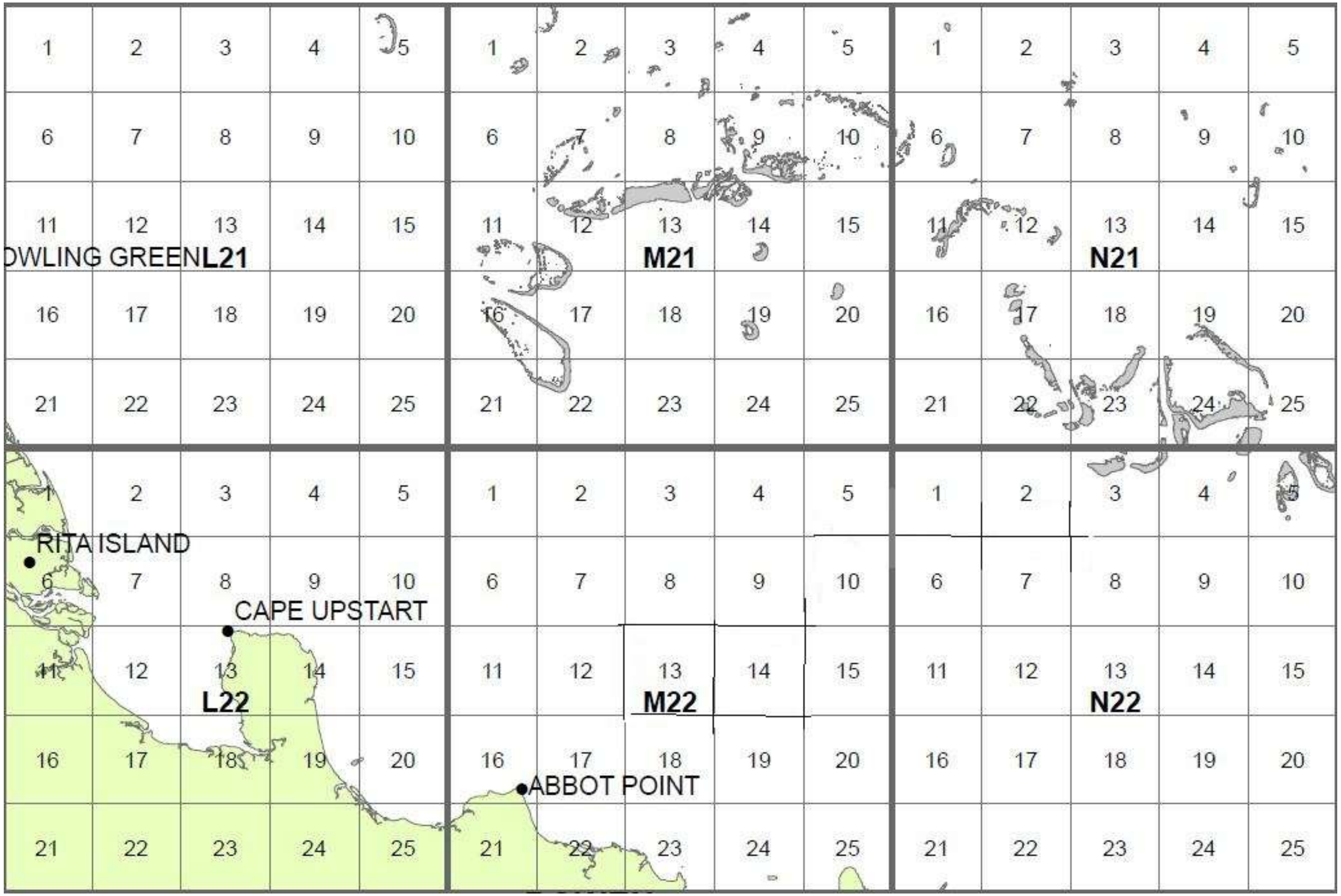


Figure 3 - Commercial Logbook Grids Relative to the Location of Abbot Point

Table 3 - List of Key Fishery Symbols Relevant to the Study Region.

Fishery Symbol	Description
N1	The symbol for the mesh net fishery that targets finfish species other than barramundi.
N2	The symbol for the set mesh net fishery (foreshore and river) for the targeting of barramundi and other species.
T1	Otter trawl fishery that is permitted to harvest various prawn species, scallops, and selected by-product species.
S	The symbol that allows the taking of shark (and rays) by line or net.
SM	The Spanish mackerel fishery which permits the taking of Spanish mackerel by line in any waters in which the fisher is endorsed to fish through possession of valid 'L' symbols.
RQ	The symbol that allows the targeting of key demersal coral reef species including coral trout.
L2 and L3	The demersal line fishery for the targeting of species other than Spanish mackerel and species covered under the RQ symbol.
C1	The symbol that allows the targeting of mud and sand crabs by pot.

In the period examined by Ludescher (1997), the inshore area north of the Abbot Point region was an area of significant targeting of banana prawns (*Fenneropenaeus indicus*) (particularly in 1991). Annual variation in regional banana prawn catch was high; however this is typical for that particular species (e.g. Vance *et al.*, 1985). Catches of tiger prawns (*Penaeus esculentus* and *Penaeus semisulcatus*) were also high in the same region. King prawn catches are recorded well offshore of Abbot Point and this contains both red spot king prawns (*Melicertus longistylus*) and blue legged prawns (*Melicertus latisulcatus*), which prior to 2003, were not differentiated in commercial fishing logbooks (DEEDI, 2011). Very little Spanish mackerel (*Scomberomorus commerson*) catch was recorded from the Abbot Point region and surrounding areas with the nearest largest catch in the region being offshore of Hinchinbrook Island (Ludescher, 1997).

Consistent with other tropical and sub-tropical coastal fisheries in Australia, the abundance of target species in the Bowen region is known to have high inter-annual variability. This variation in the abundance of target species drives, in part, variability in the operations of commercial fisheries. Cost of production, competition and market demand are also obviously other important factors. As an example, DEEDI (2011) highlights that since 2010, a high foreign currency exchange rate has reduced export demand for tiger prawns. Tiger prawns sourced from the Gulf of Carpentaria, that would normally be exported, are being sold on the domestic market in competition with east coast product, reducing returns to east coast trawl fishermen and providing a disincentive for the targeting of tiger prawns. Sen (2011) also identifies that across the GBR fisheries as a whole, fishing businesses dependent on export markets had experienced a strong negative impact on their businesses as a result of the strong Australian dollar. In the case of East Coast Trawl Fishery there has been in decline in catch and effort across the fishery as a whole (Figure 4). This decline has been driven by a number of factors including: the introduction of new management arrangements for the fishery between 1999 and 2001 and associated structural adjustment scheme, the rezoning of the GBR, higher cost of operation (e.g. fuel) and increased competition with imported product.

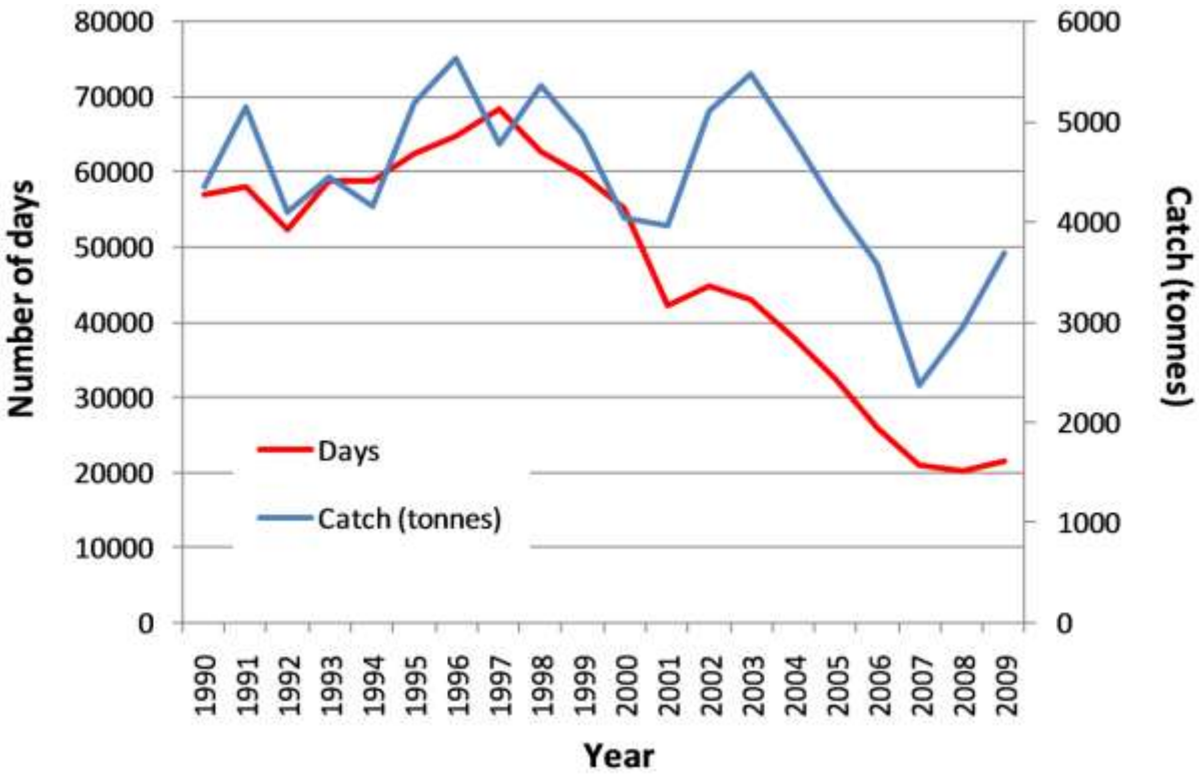


Figure 4 - Catch and Effort (days fished) in the East Coast Trawl Fishery over the Whole Spatial Area of the Fishery (From Grech and Coles, 2011).

Most commercial fishing effort in the Abbot Point region is from boats based out of Bowen (Fenton and Marshall, 2001). In addition to the use of Bowen as a homeport, numerous fishing businesses used the port of Bowen when travelling to or from fishing areas. Fenton and Marshall (2001) used a resource cluster analysis approach to examine the economic and social characteristics of Queensland fisheries on a regional basis, and it represents a salient summary of the commercial fisheries prior to the rezoning of the GBR. Fenton and Marshall (2001) identified that line fishing was the primary fishing activity from Bowen, followed by netting, trawling and crabbing. While the report from Fenton and Marshall (2001) is now dated, it still represents the most comprehensive data set available. More contemporary commercial logbook history still supports the relative importance of these fishing sectors for the Bowen region. As is common for Queensland commercial fishing in general, many fishing businesses in Bowen participate in more than one fishery.

The peak period of activity for the commercial line fishery was identified as September through to November (though more recently peak seasons may be aligned to periods of high demand/price such as Chinese New Year); while for net fishing it was June through to September. Both trawling and crabbing showed a less clear pattern of seasonal effort, although both these fisheries are recognised as having seasonal components in general. The majority of businesses within peak and off-peak seasons had between one and three full-time employees (which would include the owner and/or operator). There is little part-time or casual employment by these businesses. The average number of employees per business during the peak season was 3.1 employees per business and in the off-peak season it was 2.5 in total. It is estimated that during the peak season there were 217 full-time equivalent employees while during the off-peak season there were an estimated 175 full-time equivalent employees. 73% of the income generated is expended in the Bowen region. A caveat to these figures is again that they are quite dated, but no comprehensive updated figures are available.

Appendix 2 includes detailed analysis and interpretation of commercial fishing logbook information and available VMS information.

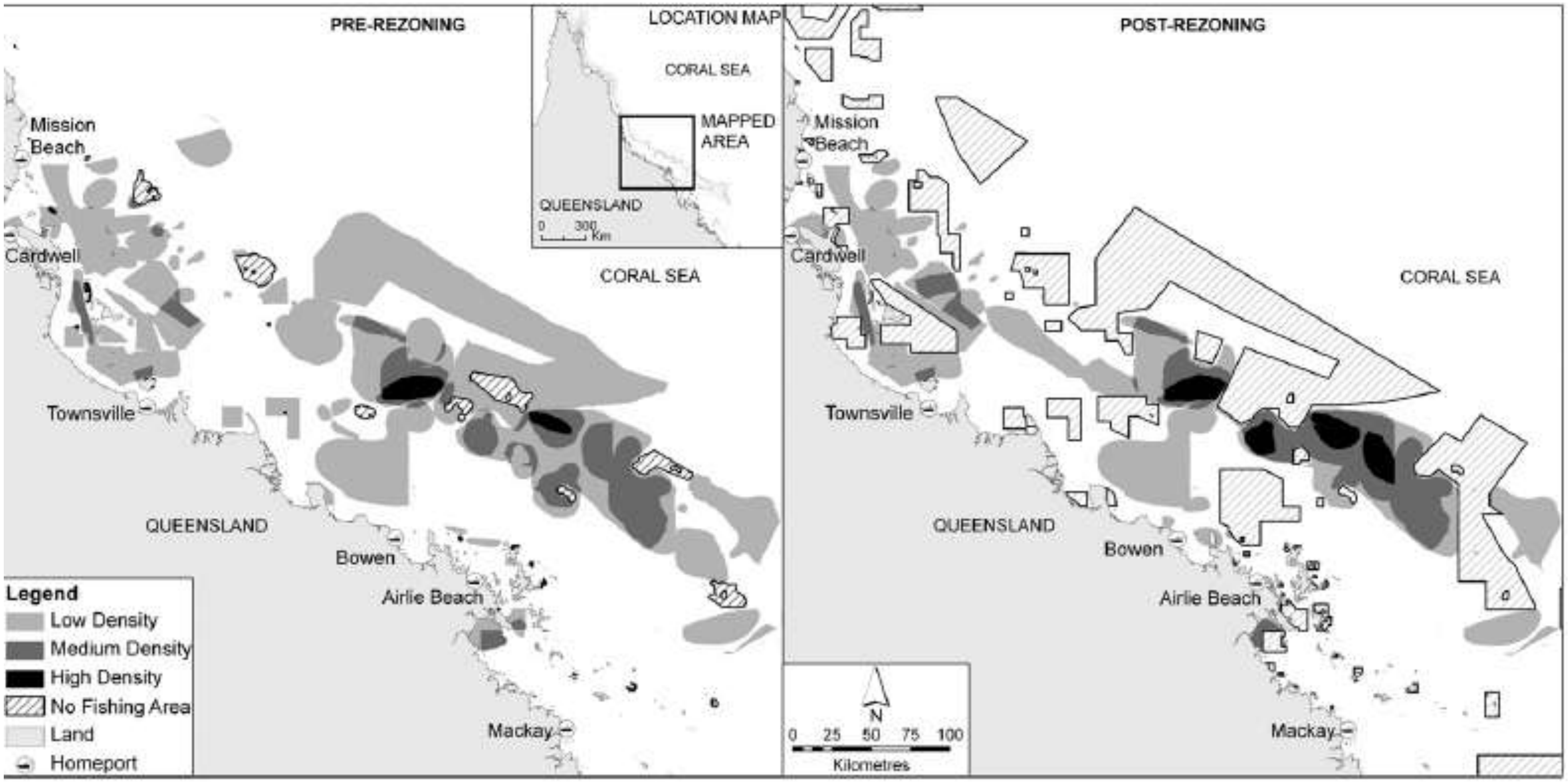


Figure 5 - Distribution of high density (> 12 fishers), medium density (6-12 fishers) and low density (< 6 fishers) fishing locations pre and post rezoning in the Central section of the GBRMP (From Lédée et al. 2011)

3.2 Bowen Seafood Processing and Seafood Reliant Businesses

The catching sector of the seafood industry has a number of forward and backward linkages with other types of businesses in the economy. Some of these types of businesses are more reliant on commercial fishing activity than others. For example a seafood unloading/processing business is frequently highly reliant on local commercial fishing activity, while a supermarket may be less so. With respect to the latter, a commercial fishing business may individually spend what is considered to be a significant amount for supplies to go to sea on extended trips, but the contribution of this individual expenditure is small compared to the overall level of revenue obtained by the supermarket, and can be potentially substituted for by an increase in economic activity elsewhere in the local economy. A generic diagram of forward and backward linkages of the commercial fishing catching sector is shown in Figure 6.

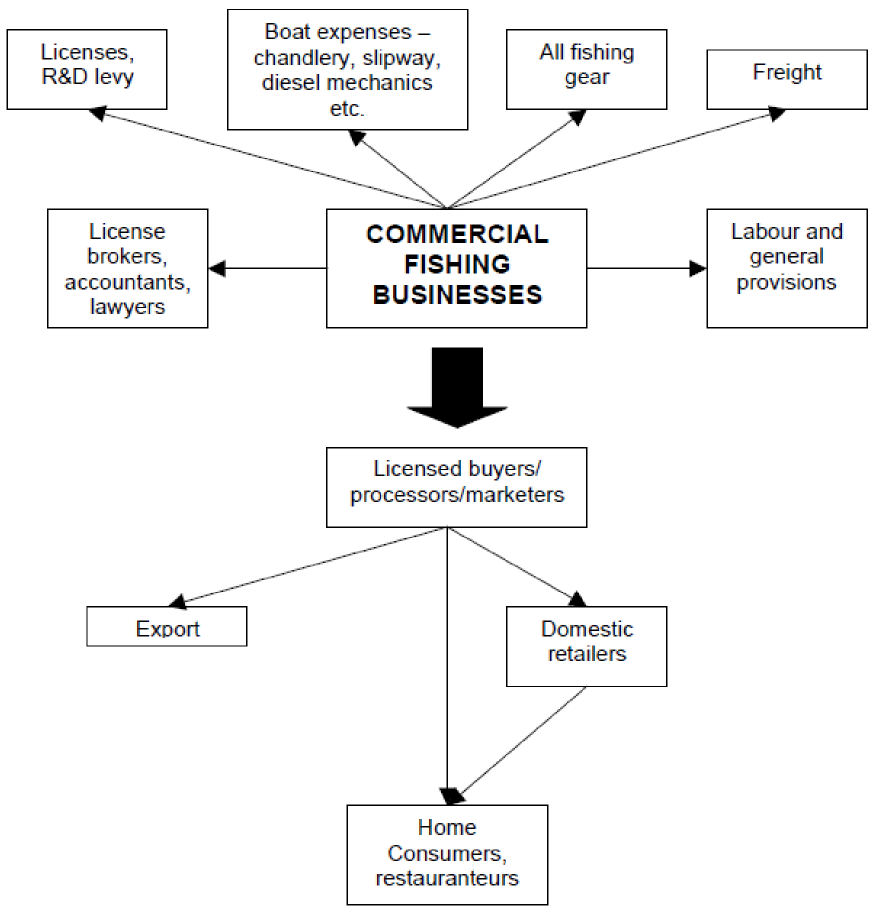


Figure 6 - Schematic Diagram of Generic Forward and Backward Linkages of Commercial Fishing Businesses

There are two major vertically integrated seafood businesses in the Bowen region that operate fishing vessels, providing unloading, holding and processing facilities for seafood businesses in general, as well as retail facilities. Anecdotal information from commercial fishers interviewed indicated that the vast majority of fisheries products landed in Bowen were unloaded through these two facilities. There is also an additional dedicated “Fish Bar” which provides retail sales. These businesses have a clear focus on locally sourced product and thus, a high reliance on local commercial fishing activity. Due to the variable nature of local fisheries production, the number of employees in the processing side of the seafood businesses can vary. For two of the businesses, the estimates of staff employed vary between 6 and 12 for one, and 8 to 22 for the other annually. Other businesses identified by commercial fishers as being at least partially reliant on fishing included marine mechanics, engineers and fibreglassers.

3.3 Recreational Fishery Overview

Recreational fishing is an "as of right activity" for citizens, although bound by certain regulations. If recreational fishing is permitted in an area, then all citizens have a theoretical right to access that area. This of course does not happen in practice. Bowen is well known as a focus of recreational fishing. The reasons that people go recreational fishing are diverse and include both catch and non-catch related motivations (McPhee, 2008 and references therein). Recreational fishing generally involves angling but can also include the use of apparatus such as crab pots and spear fishing. The product of recreational fishing is not fish per se but the fishing experience of which catching fish is a component in influencing the overall level of satisfaction obtained from the activity. Within the recreational fishery a number of sub-sectors can be identified and these sub-groups can differ with respect to the specific recreational fishing methods used by the commercial fishers, the relative importance of catch and non-catch related motivations, investment in fishing equipment, the frequency of fishing (avidity) and the spatial distribution of fishing activity (Arlinghaus, et al., 2008; McPhee, 2008). Further broad analysis of recreational fishing can be found in McPhee (2008; 2011).

Currently, there is little available information to determine the fine-scale pattern of recreational fishing catch and effort in the Bowen and Abbot Point region. Previously, information collected as part of the 2005 Queensland-wide phone and diary surveys is presented at the level of "statistical division", with the Mackay Statistical Division being the one that includes Bowen. As such, it is not possible to determine recreational catches in the specific region of interest from this information. Further, but not surprisingly, the taxonomic resolution of the catch is extremely coarse (e.g. "cod"). However, for completeness, the available information has been included as Table 4. Despite a regional focus, Ludescher (1997) presents little in the way of recreational catch and effort information. Cameron and Begg (2002) undertook a number of survey approaches to assess recreational fishing effort directed at small mackerels[1] in the mid-1990s. This study identified that small mackerels were an important target species for north Queensland residents, but also intrastate and interstate visitors. The Bowen region is well recognised as one of the focal points of the recreational small mackerel fishery. Anecdotal evidence suggests that the area around Abbot Point is an important fishing area for small mackerels and also the larger Spanish mackerel. Anecdotal evidence also suggests that the small areas of rocky reef scattered throughout the Abbot Point region (especially east of Abbot Beach) are also fished by recreational fishers for a variety of demersal reef fish and mackerels.

[1] This includes spotted, school and grey mackerel.

Table 4 - Key Recreational Species in the Mackay Statistical Division (greater than 20,000 fish caught) recorded in 2005

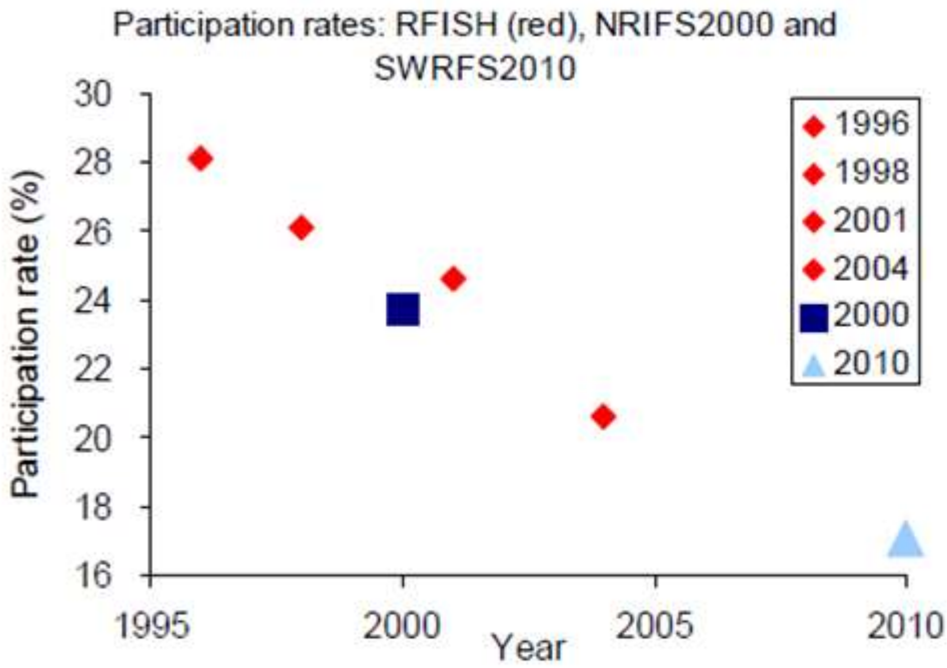
Species	Number Caught	Number Harvested	Number Released
Cod	365309	74032	291277
Whiting - total	334920	176757	158162
Crab - total	274656	106002	168655
Whiting - unspecified	271199	142979	128220
Tropical Snappers	249912	74770	175142
Mullet	237730	216101	21629
Sweetlip	217471	93426	124045
Bream	204143	77538	126605
Crab - mud	176033	57941	118091
Grassy sweetlip	111187	44082	67105
Coral Trout	102887	45533	57355
Trevally	96112	33765	62348
Crab - unspecified	84941	41788	43152
Mackerel - total	82534	49012	33522
Sweetlip unspecified	78369	39485	38884
Grunter	68482	27287	41195
Parrot	67353	24835	42518
Stripeys	66250	29104	37147
whiting - summer	60871	32609	28262
Threadfins	56147	42595	13552
Flathead	54628	25419	29209
Red Emperor	44268	7229	37039
Mackerel - Spotted	37441	18369	19072
Prawn	37331	34956	2375
Shark	34724	1763	32961
Fingermark	31699	8518	23180
Nannygai	30220	7952	22268

Species	Number Caught	Number Harvested	Number Released
Barramundi	28159	8765	19394
Red throat emperor	25212	7882	17329

In terms of assessing participation rates of recreational fishers, two approaches can be used. The first is direct measure of participation through various survey techniques. In the case of the surveys undertaken such as the Queensland wide surveys, participation is defined as a respondent having fished more than once in the twelve months prior to the survey. Taylor et al (2012) identified that in Queensland, approximately 23% of the male and 11% of the female population went recreational fishing in the 12 month period assessed. The greatest numbers of recreational fishers were between 30 and 44 years of age. In coastal waters of Mackay there were 104,729 (s.e. 14,309) “fisher days”[2] recorded, which ranks it sixth in the state in terms of fishing effort as measured by fisher days. The average number of days fished per angler was four. With respect to the latter point, data on days fished is often “left-skewed – most anglers fish very infrequently (e.g. once a year), while a small minority fish very frequently (McPhee, 2008). Taylor et al. (2012) calculated the number if fish of key species released or harvested by recreational anglers in Mackay coastal waters and found that demersal reef fish of various taxa, mud crabs, various whiting and pikey bream were key parts of the catch by number. Mackerels did not feature as key species in the data of Taylor et al. (2012) for Mackay coastal waters as a whole; however, as discussed in this report Cameron and Begg (2002) clearly identified their significance for the Bowen region.

Despite a rapid growth in the Queensland population, a feature of recreational fishing in Queensland has been a decline in participation rates (Taylor et al., 2012) (Figure 7). The reasons for this decline are complex and include a number of factors including a lack of time, loss of interest, and a perception of poor fishing opportunities (Sutton et al., 2009). Similar trends in declining participation rate of recreational fishing have been recorded in the Northern Territory (West et al., 2012), South Australia (Jones, 2009) and to a lesser extent in Tasmania (Lyle et al., 2009). Similar trends are also evident in a number of overseas locations and have been an overall cause of concern for the recreational fishing industry. However, the Mackay statistical division has not experienced a statistically significant decline in recreational fishing participation. As such it has bucked the statewide trend (Figure 7).

[2] Fisher day is common measure of fishing effort applied to recreational fisheries.



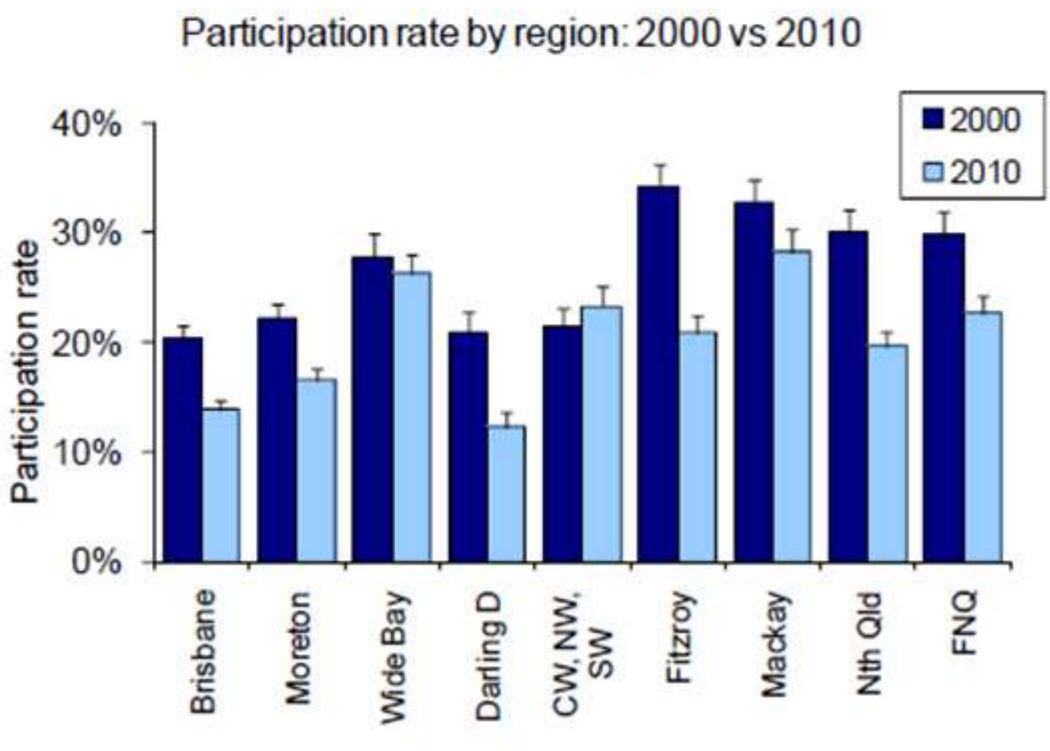


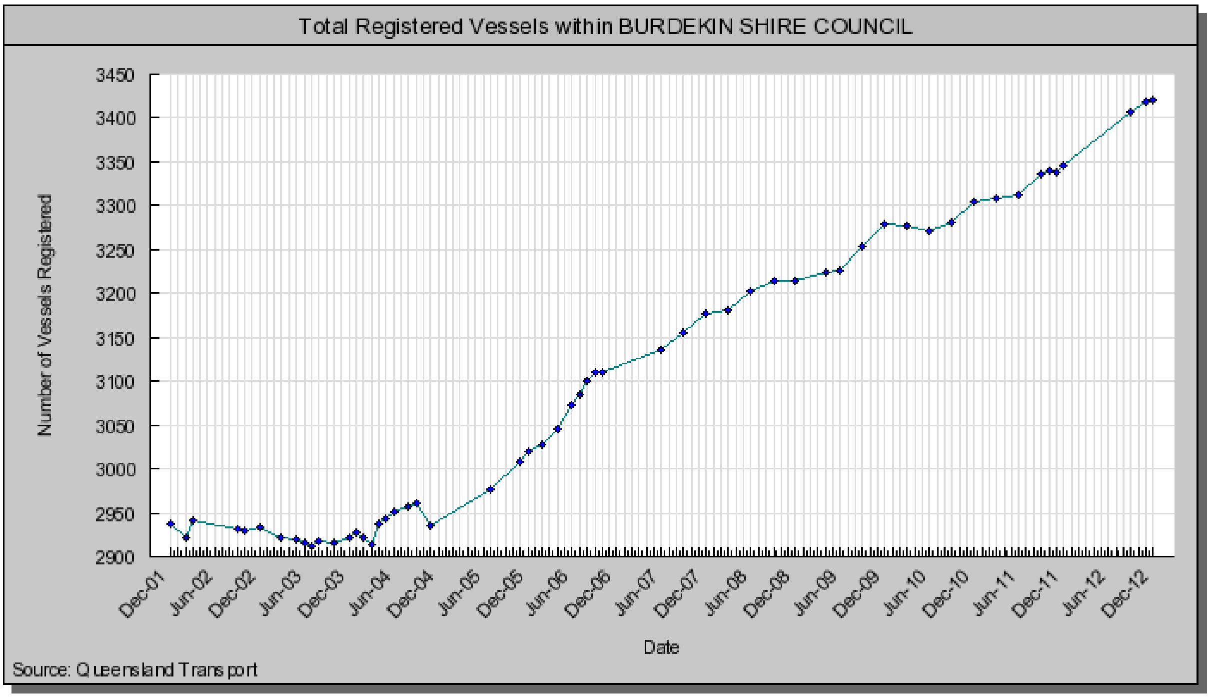
Figure 7 Trend in participation rates across all state-wide surveys conducted (1995-2010) (top) and comparative regional participation rates in 2000 and 2010 (bottom).

An alternative way to assess recreational fishing participation is to examine trends in boat registration. Boat registrations are a useful but not necessarily a perfect proxy for recreational fishing participation. Trends in boat registration as a proxy for recreational fishing participation may be confounded to a degree by: existing land-based fishers purchasing a boat; recreational fishers who have a registered boat but do not use it for fishing over the time period examined; and a recreational fisher may own more than one boat.

In the Mackay region approximately 60% of recreational fishing households own a boat which is a higher percentage in comparison to the state as a whole (45%) (Taylor et al., 2012).Additionally and important in an area such as Bowen, boat-based recreational fishing tourists fish in the area but the boat is not necessarily registered in the area where they have fished. While it is clearly possible to be a registered boat owner and not at any time recreational fisher, a minority only fall in to this category – only approximately 10% in the Mackay statistical division (Taylor et al., 2012). Despite the caveats discussed, boat registration information is useful in the context of trends in recreational fishing and is discussed in this report.

In the Mackay statistical division, growth in recreational boat registrations was stronger than elsewhere in Queensland in terms of overall boat numbers and for boats greater than eight metres for the period examined. Both the Burdekin and Whitsunday shires have shown consistent and significant growth in vessel registrations over a decade.

Overall, available information on recreational fishing demonstrates that it is an important activity in the Bowen region. The Mackay statistical division as a whole has not experienced the decline in recreational fishing participation which have occurred elsewhere in Queensland and other states and countries. Boat registration in both the Whitsunday and Burdekin shires also shows a consistent increasing trend over an extended period of time. Lacking is objective information on the spatial distribution of recreational fishing in the Bowen region.



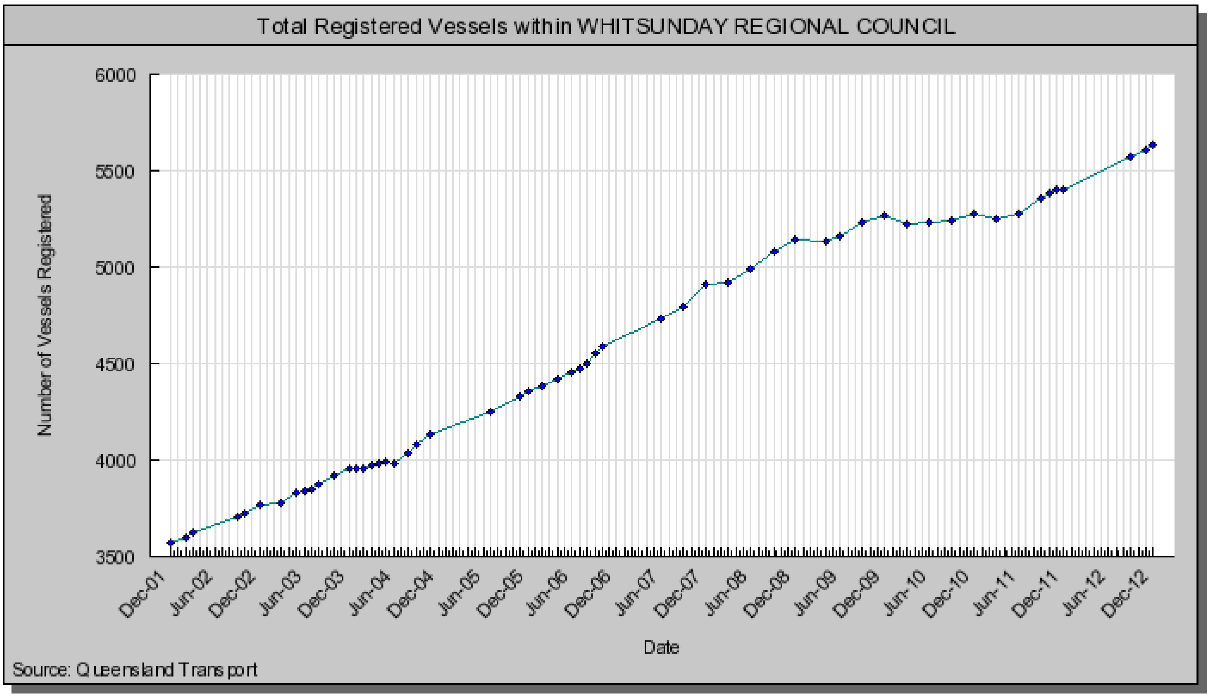


Figure 8 Total registered vessels in the Whitsunday and Burdekin shires between December 2001 and December 2012.

3.4 The Charter Fishery Overview

The charter vessel fishing sector is an important marine tourism sector that can provide access to a quality recreational fishing experience to those who are unwilling or unable to obtain such an experience by themselves, or who want additional diversity in their angling experience. A review of the charter fishing logbook information identified that no charter fishing was recorded in logbook grid M22. It is plausible that catch was obtained in that grid, but as less than five boats were in operation, the data is not publicly available.

Pooled across the Bowen region, the charter fishing logbook information allows identification of the key species targeted and retained. The key species include: coral trout (principally *Plectropomus leopardus*), Spanish mackerel (*Scomeberomorus commersoni*), unspecified sweetlip (Family Lethrinidae and most probably principally red throat emperor *Lethrinus miniatus*), unspecified trevally (Family Carangidae), unspecified nannygai (Family Lutjanidae), unspecified cod (Family Serranidae) and unspecified tuskfish (Family Labridae).

The clear focus of charter fishing effort in the region is grid N23 which is focussed on the Whitsundays area.

4. FISHERIES IMPACTS FROM THE ABBOT POINT GROWTH GATEWAY PROJECT

This section identifies potential impacts from the proposed project. In terms of the current proposal the relevant impacts considered include: activities which may limit fishing access from current levels and the potential for the displacement of fishing effort when this occurs; loss or modification of nursery habitats; and local impacts from return water from the Dredge Material Containment Ponds (DMCP).

4.1 Loss or Significant Modification of Access

Commercial and recreational fishing activities have historically occurred within port limits at Abbot Point and at other Queensland ports. NQBP and other port authorities do have the power to prevent fishing activities within port limits for safety and security reason, and to protect port infrastructure. Land use plans also take into account maritime safety and port security issues. In the case of the proposed port development at Abbot Point, loss or significant modification of commercial fishing access can potentially arise through:

- The deployment of pipelines to and from the T0 dredged location to the shore during the construction phase of the project which makes trawl fishing unsafe;
- Dredging activities, the results of which may make the use of mobile gears such as trawl impractical;

4.1.1 Pipelines

The APGG project aims to co-locate the pipelines for the delivery of dredged material from the seabed to the onshore dredged material placement ponds, and the tailwater return as close as possible to reduce the footprint of this component of the project. It is anticipated that the delivery pipeline will be in place for a period of up to 14 weeks and will then be removed. The duration could be longer if the dredging program is delayed due to weather or other potential delays. Currently the exact route of the pipeline is not finalised, however within operational constraints, the pipeline will be located as such to minimise disturbance of important terrestrial and marine habitats. In addition, the potential for altering commercial fishing access (in particular for the trawl fishery) should also be factored into the final location for the pipeline. The indicative placement of the pipelines is such that any impacts to access by the trawl fishery are unlikely.

4.1.2 Dredging

Dredging activities can impact commercial fisheries by creating deeper areas where mobile fishing gear such as trawl gear is impractical to use. Depending on the location, the spatial impacts of a dredged area can be larger than the dredging footprint itself as it may potentially dissect a trawl ‘shot’ which creates potential disruption to the fishery. The area to be dredged for the most part is in relative close proximity to the existing infrastructure and the majority of the dredging is for berth pockets only, rather than for a channel like a number of other port projects in Queensland. It should be noted that onshore spoil placement, and not ocean disposal of dredged material is proposed and as such it was not necessary to consider potential impacts from at sea spoil disposal.

The available VMS data included in this report identifies that the proposed area to be dredged does not appear to overlap with the trawl fishery.

Modelling of the likely dredge plume identified that the plume (2 - 5 mg TSS) would extend along a general north-west to south-east axis, but predominantly to the north-west. For context the median TSS in the Abbot Point region is estimated at 3.3 mg/L. There is uncertainty as to whether fished species will respond to a plume of this concentration during the dry season, and if so how. Notwithstanding the uncertainties regarding larval responses to turbidity gradients; the scale, intensity and duration of the predicted plume is unlikely to result in changes to the distribution or abundance of larvae of fished species to the extent that catches at the local or regional scale are significantly influenced.

4.2 Consequential Impacts: Anchorages and Shipping Movements

After the construction of T0 there will be additional shipping activity (and potentially additional anchoring requirements). Shipping anchorages and shipping movements can potentially impact fishing operations and travelling to and from fishing grounds. Anchorage areas in particular can have an impact on trawl fisheries. When vessels are at anchor, the vessel and the associated exclusion zone can interrupt trawl shots. Even when a vessel is not at anchor and in the absence of any anchoring structures, the vessel anchors themselves can create a depression in an otherwise flat seabed which can be a hazard to trawl fishing. For the offshore net fishery, given the length of the net (up to 1,200 metres for some licences) there is potential for nets to be snagged by ships should offshore net fishing overlap spatially with shipping activities. Anchorage impacts and in particular the potential impacts on fishing access have been a consistent high priority issue for Bowen based fishermen.

Currently vessels anchor over a wide area adjacent to Abbot Point and this includes a substantial part of commercial logbook grid M22 as well as at times L22. With increased shipping activities, the spatial scale of anchoring impacts will increase. The Bowen Fishing Group are currently working through with the North East Water Space Management Group and Marine Safety Queensland (MSQ) anchorage arrangements in order to minimise the disruption to fishing activities. A conservative estimate of the area impacted by anchoring at Abbot Point derived from Geoscience Australia maps produced by MSQ is 30,931 hectares. An additional transit area across fishing grounds was estimated at 26,899 hectares. This area overlaps in part with areas accessed by the trawl fishery. In terms of the latter, it should be stressed that fishing activities have co-existed with shipping movements at Abbot Point and other ports in Queensland. Maritime Safety Queensland “Anchor Movement Records” would be an important tool to help quantify and verify the spatial scale of anchoring impacts. These records were not able to be accessed for the current report, however the North East Water Space Management Group provides an appropriate forum for their use to address the issue.

There is scope for a Code of Practice to be developed to aid continued security of access to fisheries within port limits as the port develops to its full potential over time, without compromising marine safety and port security. Key stakeholders in the potential development of a Code of Practice include local commercial and recreational fishers, NQBP, MSQ and port clients. This assessment was not able to determine the exact impact on trawl fishing access as a result of consequential impacts. The exact area and alignment of anchoring areas relative to trawl grounds were not able to be determined at the time of preparing this report.

4.3 Loss or Modification of Nursery Habitat

In terms of estimating the value of production for a fishery from a habitat, it is a function of both the density in which fished species occur there and the proportion of those that reach a fished size and enter the fishery. For example, an area may have a high concentration of juvenile fish, but may not contribute significantly to fisheries production if mortality of those animals is disproportionately high (and vice versa). In the case of Abbot Point, the data collected by Unsworth *et al.* (2010) demonstrates that the area is not important as a nursery area for fished species. While vegetated habitats such as seagrass are correctly identified as important nursery areas for many fished species, shallow habitats (vegetated or unvegetated) that have a high level of turbidity are generally recognised as more critical areas for juveniles of key species (e.g. Blaber and Blaber, 1980). A paucity of species of commercial or recreational significance were recorded by Unsworth *et al.* (2010). As coral habitat will not be lost or modified, it is predicted that impacts on key species in the commercial coral reef finfish fishery (e.g. coral trout and red throat emperor) will not occur.

Overall, it is well acknowledged that the value per area of vegetated habitats such as seagrass for both fisheries and marine biodiversity is not equal (e.g. Barnes et al., 2012). Even in the circumstance where the habitats are more or less physically similar, some areas contribute disproportionally more to production than others (e.g. McNeill, 1992; Barnes et al., 2012).

Unsworth *et al.* (2010) mapped the seagrass resource of the Abbot Point region. Like tropical seagrass beds in general, those at Abbot Point show significant temporal and spatial variability at several different scales. There is a high degree of habitat heterogeneity even within an area that is classified as being of the same broad habitat type. The seagrass species present were typical of tropical and subtropical regions. The La Niňa event of 2010/11 combined with severe tropical cyclone Yasi and the subsequent flooding contributed significantly to losses of seagrass since November 2010 at Abbot Point, and similar declines were also detected at other monitoring locations in central Queensland (McKenna and Rasheed, 2011).The total extent of all seagrass meadows in the broader Abbot Point area declined by 60% between the 2008 and 2013 wet season surveys. While some recovery was recorded, seagrass biomass at the offshore monitoring sites again declined from the January 2013 survey onwards (McKenna and Rasheed, 2014). These declines may have been a result of the impacts of high winds and flooding associated with Tropical Cyclones Oswald, Dylan and Ita that crossed the coast near Abbot Point between January 2013 and April 2014. Since January 2013, seagrass at the offshore monitoring sites have remained at very low densities (McKenna and Rasheed, 2014).

The fisheries value of seagrass habitat at Abbot Point has been directly assessed by Unsworth *et al.* (2010) using methods that have been identified as being sufficient to adequately sample the representative fauna (e.g. Coles *et al.*, 1993). A total of 45 beam trawl samples were undertaken between August 2008 and August 2009. The fish fauna of the seagrass in the Abbot Point region was dominated by families and species which are not of fisheries significance in the Bowen region (or more generally in Queensland). Fish assemblages at Abbot Point contained species from 22 fish families, the most abundant of which were the Apogonidae (cardinal fish), Bothidae (flounder/sole), Pinguididae (sandperch) and the Platycephalidae (flatheads). While flathead can be an important component of Queensland recreational fisheries in particular, the dominant species recorded from Abbot Point was the fringe-eyed flathead (*Papilloculiceps nematopthalmus*), which is a small species of relatively little fisheries significance. Unsworth et al. (2010) did not identify any fish species of fisheries significance in the seagrass beds at Abbot Point.

Unsworth *et al*. (2010) also assessed the use of the Abbot Point seagrass beds as habitat for penaeid prawns and largely found species of minor or no commercial significance (e.g. *Trachypenaeus* spp. and *Metapenaeopsis* sp). Only three tiger prawns were captured in the surveys. The seasonal coverage of the survey was such that it covered periods when juvenile tiger prawns would normally have been abundant. Coles et al. (1992) examined the abundance of various juvenile prawn species in a number of locations between Cairns and Bowen. Overall, Coles et al. (1993) identified that Abbot Bay had the lowest abundance of juvenile prawns of all locations sampled, with Upstart Bay having the highest (Table 5). Juvenile prawns (particularly tiger prawns) in Upstart Bay were much more abundant in high biomass beds of *Zostera* in comparison to lower biomass beds of *Halophila*/*Halodule* (Rasheed and Thomas, 2002). Significant *Zostera* seagrass beds were not recorded around Abbot Point or Bowen with beds of *Halophila*/*Halodule* dominant. .

The importance of Abbot Point seagrass as habitat for juvenile fish and invertebrates of fisheries significance appears significantly less than other areas in central and northern Queensland assessed in a number of studies including studies by Blaber (1980), Coles *et al*. (1992) and Kwak and Klump (2004). The seagrass beds at Abbot Point do not occur in water with a high level of prevailing turbidity (refer GHD 2012) and turbidity is identified as a key determinant in the importance of nursery areas for many coastal fish and invertebrate species (Blaber, 1980; Blaber and Blaber 1980). However, there are uncertainties regarding the preferred habitat of new recruits and juveniles of a number of species – spotted mackerel in particular.

Table 5 - Comparison of abundance of juvenile commercially harvested penaeid prawn species at a number of locations between Cairns and Bowen (Source: Coles et al, 1992).

Location	*P. exculentus*	*M. endeavouri*	*P. latisulcatus*	*M. ensis*	*P. semisulcatus*	Total
Upstart Bay	86	152	154	4	-	396
Magnetic Island	100	116	-	2	4	222
Hinchinbrook Island	63	62	-	-	-	125
Bowling Green Bay	32	28	-	2	4	86
Mourliyan Harbour	38	24	-	-	-	62
Mission Bay	-	-	51	6	-	57
Cleveland Bay	8	18	4	1	-	31
Abbot Bay	3	3	3	-	-	9

Unsworth *et al*. (2010) identified that the fisheries productivity of the Abbot Point seagrass beds were high; however the empirical data they presented in that report do not support their conclusion. While Unsworth *et al*. (2010) does discuss the limitation of beam trawl sampling to catch more mobile species such as trevallies and mackerel, the representation of species of fisheries importance is less than similar studies in other locations in Queensland using the same or similar sampling apparatus (e.g. Coles and Lee Long, 1985; Coles et al., 1987; 1992; 1993; Watson et al., 1993). In effect, the methods used by Unsworth *et al.* (2010) and others is an index of prawn abundance. The review of the empirical data contained in Unsworth *et al.* (2010) does not support the conclusion of high fisheries production. Watson *et al.* (1993) modelled the contribution per hectare of seagrass beds to the prawn fishery in the Cairns region. For the Mission Bay site, which represents the only embayment site assessed, the value per hectare of the habitat for prawn production was $183 per hectare per year in 1992. Given that the Abbot Point region appears to be less important as a nursery habitat for prawns than less exposed, more turbid waters, then the value per hectare is likely to be less. Further discussion of the value of habitat for prawn production is contained elsewhere in this report.

Unvegetated sub-tidal habitats can make a significant contribution to fisheries production for a number of species. Unvegetated habitats have received much less attention in terms of fisheries habitat than vegetated areas and this is generally due such areas having relatively less diversity and density of animals (Coles *et al.*, 1993). For example, Coles *et al.* (1993) identified the relative density of tiger and endeavour prawns (*Metapenaeus endeavouri*) in vegetated (seagrass) and unvegetated habitats in Cairns (Table 6). Based on this information, the ratio of densities of tiger prawns in seagrass and unvegetated habitat is approximately 11:1. However, while production per unit area of such areas may be lower than vegetated habitats, the often large areas of such habitat means that they can still make a contribution to fisheries production.

Table 6 - The relative abundance of juveniles of various species of commercially harvested penaeid prawn species in seagrass and unvegetated habitats in the Cairns region (From Coles et al *1993).*

Species	Species Habitat	Unvegetated Habitat
Penaeus esculentus	117	1
Penaeus semisulcatus	453	50
Metapenaeus endeavouri	148	10

Overall, while the loss or modification of nursery habitat is an important consideration for port developments, the available information supports the conclusion that the impacts from the proposed project are negligible and will not impact fisheries production in any measurable or meaningful way. Port infrastructure itself can play a role as fisheries habitat and this is explained in Appendix 3.

4.4 Return Water from the Dredge Material Containment Ponds

Dredged material is to be placed on land with return water pumped via a pipeline to a discharge location over a limited time period (up to an estimated 14 weeks). The discharge location is expected to be near the Abbot Point Headland in a depth between -4 and -10m (lowest astronomical tide (LAT)). The discharge will be continuous. The discharge water will under most circumstances be elevated in turbidity above ambient levels. The discharge water will be subject to licencing requirements.

The proposed indicative location of the discharge is adjacent to existing port infrastructure meaning that it is highly unlikely to be on grounds that are fished, particularly by the trawl fishery. The VMS data contained in this report supports that conclusion. Modelling of the discharge plume identified a limited spatial impact (up to a maximum of the 500 metres to the north-west) of elevated TSS but of low concentration. From the modelling information, meaningful and measurable fisheries impacts are highly unlikely as the low concentration plume will not extend onto fishing grounds.

5. SUMMARY OF IMPACTS AND RECOMMENDED MITIGATION MEASURES

For the proposed development, loss or modification of fishing access can occur as a result of:

- Plumes associated with dredging of T0;
- Plumes associated with the discharge of return water; and
- Previously trawlable ground becoming untrawlable as a result of changes to the seabed from dredging and the presence of pipelines.

There are consequential impacts from the proposed project as a result of additional shipping movements and the need for additional anchorages. Local commercial fishermen consider the issue of the expansion of the extent of anchoring areas as a priority issue. Currently vessel anchoring is reported to occur extensively in logbook grid M22, but also extends into important fishing grounds in logbook grid L22. In the net fishery, there is potential for ships to entangle nets if fishing and shipping activities overlap and the subsequent loss of seasonally important fishing ground (e.g. for the shark fishery) due to practical limitations to access. Further port expansions will almost certainly see the area required for anchoring being extended and anchoring areas used more frequently. Local commercial fishermen are currently working through anchoring arrangements with North East Water Space Management Group and Marine Safety Queensland (MSQ) with the aim to minimise disruption to fishing activities.

The potential for the proposed project to impact nursery habitats that substantially support fished species was investigated and it was concluded that such impacts would not occur. The potential for the discharge of the return water from the Dredge Material Containment Ponds to result in impacts to fisheries was also considered. It was concluded that given the indicative location of the discharge and relevant plume modelling, together with the likely very low levels of elevated TSS that fisheries impacts are highly unlikely to occur. The discharge would be subject to licensing conditions.

Overall, port activities and commercial and recreational fishing at Abbot Point have co-existed. There is no reason why they cannot continue to co-exist.

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Appendix One: **Biology and Ecology of Key Fished Species**

This appendix describes the known biology and ecology of key fished species in the Abbot Point region including their distribution and habitat use throughout their life history.

Spanish mackerel (*Scomberomorus commerson*)

The Spanish mackerel is a pelagic fish that occurs throughout tropical and sub-tropical Australian waters and are found with reefs and other structures such as headlands. Adult Spanish mackerel remain resident within specific home ranges (Newman et al., 2009); although the exact spatial scale of these home ranges is likely to be highly variable.

A reproductive peak for Spanish mackerel occurs in October and November in Queensland east coast waters (McPherson, 1993). The bulk of spawning in this species occurs along the inner reef matrix. Larvae of Spanish mackerel are found in the inner and middle lagoon regions of the GBR (Jenkins et al., 1985; Thorrold, 1993). These studies indicated that within the central region of the GBR, larvae of all scombrid species were relatively abundant in surveyed areas 16-24km from the coast. This corresponded to the position of a coastal boundary layer in the area. The significance of this boundary layer to the distributions of small scombrids is unknown (Thorrold, 1993). Along the Queensland East Coast, juvenile (15-40cm) Spanish mackerel occur in shallow inshore waters, while individuals larger than 40cm are generally encountered in coral and rocky reef waters (Kailola et al. 1993). There is no specific information on the exact habitat requirements of juvenile Spanish mackerel. In general, anecdotal information suggests Spanish mackerel prefer water with low turbidity.

On the Queensland east coast, the Spanish mackerel is considered sustainably fished (DEEDI, 2011).

Grey mackerel (*Scomberomorus semifasciatus*)

The grey mackerel is pelagic fish that are widely distributed throughout tropical and subtropical Australian waters ranging from Moreton Bay northwards to Shark Bay in Western Australia (Collette and Nauen, 1983). From a genetic perspective, grey mackerel are considered to be a single stock on the Queensland east coast (Broderick et al., 2011), although stable isotope analysis suggests subdivision on the east coast into a northern (including Bowen) and a southern Queensland stock (Newman et al., 2009).

Adult grey mackerel are known to occur in turbid tropical and sub-tropical waters of approximately 3–30m depth, usually in the vicinity of bottom structure, where pelagic baitfish (e.g., tropical sardines and herrings) are concentrated or on otherwise sandy-mud and muddy-sand substrates (e.g. Newman et al., 2010). Grey mackerel are identified as using inshore areas more than the other species of scombrids that occur in Australia, including using mangrove areas as adults in Western Australia (Blaber, 1986). The region between Townsville and Mackay is considered to be an important spawning location for the species (Cameron and Begg, 2002). Larval and juvenile life history stages of grey mackerel are found inshore, often in estuarine environments. The larvae of this species inhabit coastal bays and nearshore areas that are typically influenced by freshwater runoff and low salinity surface waters (Jenkins et al. 1985).

On the Queensland east coast, the stock status of the grey mackerel is uncertain (DEEDI, 2011). There are however significant community concerns regarding the regional depletion of grey mackerel through commercial net fishing[3].

Spotted Mackerel (*Scomberomorus munroi*)

Spotted mackerel are highly migratory. Tagged spotted mackerel moved large distances, with approximately 39% of recaptured fish being over 100km from their release sites and the largest movement observed for a spotted mackerel was 1100km (Begg et al., 1997). The spawning period extends from August to October in northern Queensland waters with a peak in September; and spawning occurs between Mackay and waters south of Townsville (Begg, 1998). Electrophoretic analysis of spotted mackerel caught at several sites between Bowen and Iluka (northern New South Wales) found no significant differences in allele frequencies, indicating that spotted mackerel throughout this geographic range form a common gene pool or unit stock (Begg et al. 1997; Begg and Sellin, 1998). The diet of spotted mackerel throughout the year consisted almost exclusively of pelagic prey, including pilchards, anchovies and herring (*Herklotsichthys castelnaui*) (Begg and Hopper, 1998).

Spotted mackerel are caught by both commercial and recreational fishers mainly around Bowen and Innisfail during winter and early spring (July-September) and from Hervey Bay and Moreton Bay during late spring and summer (November-February). Significant declines in the spotted mackerel stock occurred during the mid-1990s to early- 2000s which were attributed to overfishing including in part the targeting by net of spawning aggregations in the Bowen region. Management measures were introduced to mitigate this, including preventing the targeting of the species by net fishers through a netting trip limit and a commercial total allowable catch.

On the Queensland east coast, the spotted mackerel is considered sustainably fished (DEEDI, 2011).

Australian Blacktip Shark (*Carcharhinus tilstoni*)

The Australian blacktip shark is found from Thevenard Island (Western Australia) around northern Australia and south to Sydney. This species occurs in the coastal zone but its range also extends offshore to approximate depths of 150m (Pillans and Stevens, 2003). Breeding occurs in shallow coastal area (e.g. Cleveland Bay), although breeding locations are considered to be very widespread (Simpendorfer and Milward, 1993). Genetic data suggest Australian blacktip sharks across northern Australia are all members of a single population (Lavery and Shaklee, 1989).

Due to the difficulties of accurately identifying whaler sharks, it is plausible that the recorded catch of Australian blacktip sharks also includes other species, in particular the common blacktip shark (Carch*arhinus limbatus*) which is nearly morphologically identical.

DEEDI (2011) do not make an assessment as to whether Australian blacktip sharks are overfished or otherwise. A challenge with assessment of shark populations in Queensland is the lack of consistent and accurate species identification in the commercial logbook program.

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3 http://www.ffc.org.au/FFCWEBSITE_images/Grey%20Mackerel%20Qld/A%20Case%20Study_The%20possible%20collapse%20of%20a%20grey%20mackerel%20population.pdf

Moreton Bay Bugs (*Thenus australiensis* and *Thenus pardincus*)

The spatial extent of the populations of the mud bug (*Thenus pardincus*) and the reef bug (*T. australiensis*) was estimated to be approximately 12,000 and 9,000km respectively (Jones, 1993). Jones (1993) identified that *T. australiensis* in the Townsville region inhabited relatively shallow waters between 10 and 30m in fine soft sediments, while *T. pardincus* was typically more abundant in depths of between 30 and 60m in areas characterised by coarser sandy sediments.

On the Queensland east coast, Moreton Bay bugs are considered sustainably fished (DEEDI, 2011).

Red Spot King Prawn (*Melicertus longistylus*)

The red spot king prawn is a widely distributed species, having been recorded from Lord Howe Island, the northern Australian coast, the Arafura Sea and from the coastal fringe of the eastern Indian Ocean to the South China Sea.

In the northern GBR, the red spot king prawn appears to associate with small pockets of terrigenous silica sand, close to the shoreline and coarser inter-reef sediments (Gribble et al., 2007 and references therein). While red spot king prawns move from coral reef lagoon nursery habitats to deeper water, there is no evidence of migratory behaviour after this.

DEEDI (2011) do not make an assessment as to whether red spot king prawns are overfished or otherwise.

Tiger prawns (*Penaeus esculentus* and *Penaeus semisulcatus*)

The commercial catch of tiger prawns consists of two species – the brown tiger prawn (*Penaeus esculentus*) and the grooved tiger prawn (*P. semisulcatus*). The brown tiger prawn is generally the more abundant of the two species in shallower waters (<35m) (Somers, 1994). Aquatic vegetation provides the critical nursery habitat for tiger prawns although they do occur in unvegetated habitats. Small juvenile tiger prawns do not discriminate between different types of seagrass (Kenyon et al., 1995). Intertidal and shallow subtidal seagrasses (<2.5m) are the critical settlement and juvenile habitat for tiger prawns; with few large postlarvae and juveniles found on deeper seagrasses. Adult grooved tiger prawns have been found to prefer habitats that are comprised of >70% fine mud, whereas brown tiger prawns are more common in areas with less of a mud fraction (Ludescher, 1997). A number of crustaceans including tiger prawns that utilise seagrass are considered to settle from the plankton as soon as they find seagrass, rather than discriminating between different types of seagrass when they settle (e.g. Bell and Westoby, 1986a and b).

On the Queensland east coast, tiger prawns are considered sustainably fished (DEEDI, 2011).

Mud crabs (*Scylla serrata*)

Mud crabs (*Scylla serrata*) are dependent on and closely associated with mangroves throughout the majority of their life cycle (Hill et al., 1982; Manson et al., 2005). Juvenile mud crabs (20 to 99mm carapace width) are resident in the mangrove zone, remaining there during low tide. The majority of sub-adult crabs (100 to 149mm) migrated into the intertidal zone to feed at high tide and retreated to sub-tidal waters at low tide. Adults (150mm and larger) are found mainly subtidally with only small numbers found intertidally at high tide (Hill et al., 1982). However, females on the east coast of Queensland are known to migrate offshore (often at the sea surface for periods of time) for spawning (Hyland et al., 1984; Hill, 1994).

Although there is no evidence to suggest any chronic or incremental changes, which would indicate sustainability concerns for mud crabs, the sustainability of the east coast stock is considered 'uncertain' given the high catches and fishing pressure on the east coast and unreliable index of abundance due to poor effort reporting in logbooks (DEEDI, 2011).

Mud scallop (*Amusium pleuronectes australiae*)

Significantly less is known about the biology of the mud scallop in Queensland in comparison to the more commercially important saucer scallop (*Amusium balloti*). However, the species is widely distributed through much of Asia and is the subject of important fisheries and some research in that region. Like many bivalve species including harvested species, the populations of mud scallops exhibit significant annual variations. They are considered to range in depth from 10 to 80m (Poutiers, 1998) and the limited available information in Queensland suggests peak abundances in waters 20 to 40m (Watson et al., 1990). Once scallops settle onto the substrata, they generally form large aggregations. This aggregating behaviour can make them highly susceptible to serial depletion as a result of fishing activities (DEEDI, 2009).

DEEDI (2011) do not make an assessment as to whether mud scallops on the east coast are overfished or otherwise.

Barramundi (*Lates calcarifer*)

Barramundi have a complex life-history which includes hermaphroditism. The lifecycle is tied to estuaries, with access to floodplain habitat a critical driver of year class strength (Moore, 1979; Davis, 1982). Larvae and juveniles enter coastal wetlands during the wet season and juveniles migrate into freshwater areas at the end of the wet season. In freshwater areas they grow to maturity as males in three to four years, and migrate downstream at the start of the wet season for spawning. Spawning generally occurs at the mouth of the estuary or in adjacent coastal waters. Males become females after six to eight years. The hermaphroditism in this species is thought to allow the larger and more "successful" fish to maximise their contribution to the gene pool (Moore, 1979).

The importance of environmental flows for the maintenance of barramundi populations is highlighted by the work of Staunton-Smith *et al.* (2004). A positive correlation in the Fitzroy River was found between the abundance of barramundi year classes and the quantity of fresh water flowing into the estuary during spring and summer, when barramundi spawn and recruits enter nursery habitats. The most likely mechanism responsible for this correlation is that the quantity of freshwater influences the recruitment and survival of juveniles by altering accessibility, productivity and or carrying capacity of nursery habitats. Further, Robins *et al.* (2006) provides quantitative evidence to support the hypothesis that freshwater flows also improve the growth rates of barramundi.

On the Queensland east coast, barramundi are considered sustainably fished (DEEDI, 2011).

Coral trout (*Plectrompomus leopardus*)

The coral trout is an obligate coral reef fish, and across the state it is the dominant component of the reef line fishery. It is site attached, but does undergo larger movements to form spawning aggregations. The life history of coral trout is relatively well understood and is summarised in Doherty (1996). At the end of the pelagic phase, coral trout select rubble habitats at the base of the reef as settlement sites and they may be aggregated at reef-wide scales by the availability of suitable habitat, as well as by differential larval supply. Home range increases as the fish grow. They become less cryptic and eat more fish instead of crustaceans. Increased mobility may result in ontogenetic shifts in habitat as fish move out of their settlement sites and the older year-classes are more homogeneously distributed at reef-wide scales.

Coral trout species are protogynous hermaphrodites, changing from female to male as their size increases. Individual coral trout have the capacity to spawn on multiple occasions, with lunar periodicity. However, evidence suggests that early bouts of reproduction may be more important in terms of reproductive investment than subsequent bouts later in the same season (Frisch et al., 2007).

On the Queensland east coast, coral trout are considered sustainably fished (DEEDI, 2011). However, large tracts of reef habitat important to coral trout were damaged by Cyclone Hamish and Cyclone Yasi and the impacts of these extreme weather events, and this is believed to be contributing to a reduction in biomass of the species (DEEDI, 2011).

Redthroat Emperor (*Lethrinus miniatus*)

Red throat emperor is the second most important species in the coral reef finfish fishery. However, compared to the coral trout, there is relatively little detailed knowledge of the life history and habitat use of the species.

Adult red-throat emperor are usually found associated with coral reefs and surrounding shoal areas to depths of over 100m. It is unclear whether adult red-throat emperor move between reefs, however they are often caught in rubble areas between reefs, suggesting at least the potential for such movement. The preferred juvenile habitat is not known with certainty, but it is considered that it is most likely in deeper waters adjacent to reefs. This is based on their absence in any of the studies that have examined the shallow and coastal areas of the GBR.

On the east coast, red throat emperor is considered by DEEDI (2011) to be underutilised. In 2009-10, only 43% of the available commercial quota was fished.

Appendix Two: Commercial Logbook Catch Data Analysis

The commercial fisheries catch data is assessed and analysed for all the grids surrounding Abbot Point. As previously identified in this report, Abbot Point itself is in logbook grid M22. In interpreting aggregate logbook information within a grid, it is important to consider that overall trends in catch and effort may not reflect trends in individual activity for a fishing business. For example, a catch which appears small overall, may still make a significant economic contribution to an individual fishing business. Catch and effort over time is also significantly impacted by Commonwealth and Queensland Government management decisions, which can alter the amount of fishing effort, the spatial and temporal pattern of fishing effort, and total or individual allowable catch volumes of specific species (or suites of species). These management decisions relate to maintaining the sustainability of the fishery, biodiversity conservation, and the sharing of fisheries resources between fishing sectors.

Logbook Grid M22

The total catch (tonnes) and the GVP from logbook grid M22 (all commercial fisheries combined) peaked in 2003-04 at 219 tonnes and $1.37 million and was lowest in 2007-08 at 75 tonnes and $408,000. Figure 9 and Figure 10 summarise the catch (weight in tonnes) and effort (number of days fished) for net, trawl, line and crab fishers in logbook grid M22 between 1990 and 2010.

For the net fishery, effort declined following the rezoning of the GBR. Although variability is clearly evident, catch generally increased between 1990 and 2000, but then declined in 2003-04. Catch tended to rise in the net fishery between 2007 and 2010. For the trawl fishery, a significant and sustained decline in both catch and effort occurred following the rezoning of the GBR. Effort in the line fishery generally showed less variation than the other fisheries examined, with a peak evident between 1997 and 1999. Clear peaks in catch were also evident in 1997 and 1999. Unlike the trawl and net fisheries, a clear impact from the rezoning of the GBR was not evident for the line fishery in grid M22. Catches in 2009 and 2010 represented the third and fourth highest catches for the line fishery during the 20 year period examined. For the crab fishery, overall catch and effort was highly variable, but low overall.

Table 7 summarises the dominant species by weight caught in logbook grid M22 in each financial year between 2003-04 and 2010-11. Annual trends in the catch and CPUE for the key fished species are presented in Table 8 through to Table 16. In a number of instances, no catch or effort is recorded for a number of species in a number of years. For example, only two years of data is available for the Australian blacktip whaler and in each year of those years, their catch made a major contribution to the overall catch in the grid (Table 11). The most likely explanation for the lack of recorded catch in other years is that less than five boats operated and therefore catch and effort records are not publicly available. Individual logbook data provided to the author by operators clearly demonstrated that significant catches of blacktip shark did occur in most years. No catch and effort data was recorded for the collection fisheries (e.g. Beche de Mer and aquarium fish fisheries) from the M22 grid during the years examined. This could be because no catch was taken from this grid or again it could be due to less than five boats from the relevant fisheries accessing this grid. No individual logbook information from commercial operators in the collection fisheries was provided, so it cannot be confirmed that the "five boat rule" is the reason for the lack of publicly available catch and effort information.

Catch and effort for Spanish mackerel has been variable over the period investigated (Table 8). There is no trend in the catch volume, but some evidence of declining effort (boats and days fished). The lowest catch was recorded in 2010-2011; however that period also corresponds to the highest recorded annual GVP.

A significant decline in catch, effort and CPUE for tiger prawns is evident in the logbook data for grid M22 (Table 5). Regional declines in the catch of tiger prawns were assessed by Department of Agriculture, Fisheries and Forestry (DAFF) (DEEDI, 2009). That report concluded that decline in effort off Bowen is due to a reduction in the number of boats in the fleet, generally lower CPUE off Bowen compared with Townsville and further north, increasing fuel costs and low prawn prices resulting in the remaining fleet focussing on areas of the coast that have higher catch rates. Additional anecdotal information strongly suggests that tiger prawn catches during the 2013/14 season were substantial.

Although variable, there is a general decline in catch and effort for red spot king prawns over the period investigated (Table 10). There has been an increase in catch in the years 2009-10 and 2010-11 for both grey and spotted mackerel (Table 12 and Table 13 respectively). In particular, catches of grey mackerel were high in 2010-11. Catches for some years are unknown at this stage due to data access restrictions. While there are declines in the number of boats recording catch of Moreton Bay bugs, the CPUE (t/boat) has risen (Table 14). Catches of barramundi have generally been variable although relatively low (Table 11). While mud scallops have traditionally made a significant contribution to the Bowen fishery, no logbook catches were recorded after 2005-06, based on information publicly available (Table 16). The highest catch and effort levels in the mud scallop fishery occurred between 1993 and 2003 (DEEDI, 2009). The fisheries independent trawl sampling conducted as part of the DEEDI (2009) report did identify that mud scallop catch rates were variable but “reasonable”. Locations directly offshore from Abbot Point had higher than average CPUE for the region as a whole. Interviews with local fishers suggested they thought the recent absence of mud scallop catches was reflective of natural variability and part of the cyclical nature of the fishery.

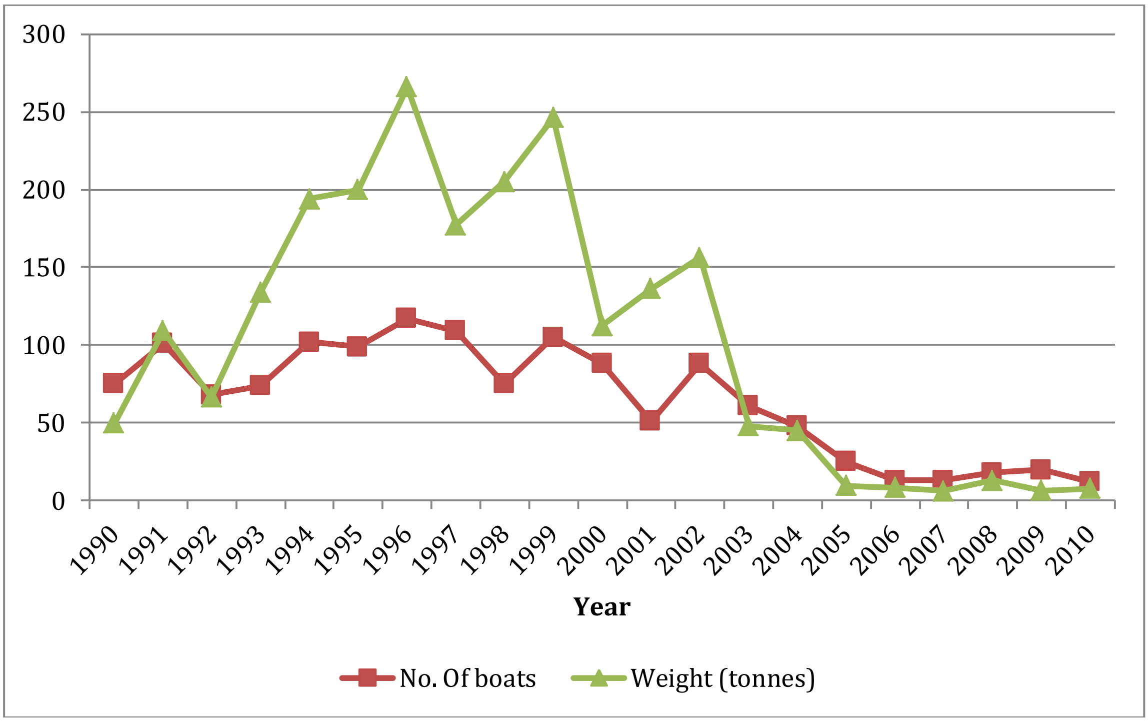
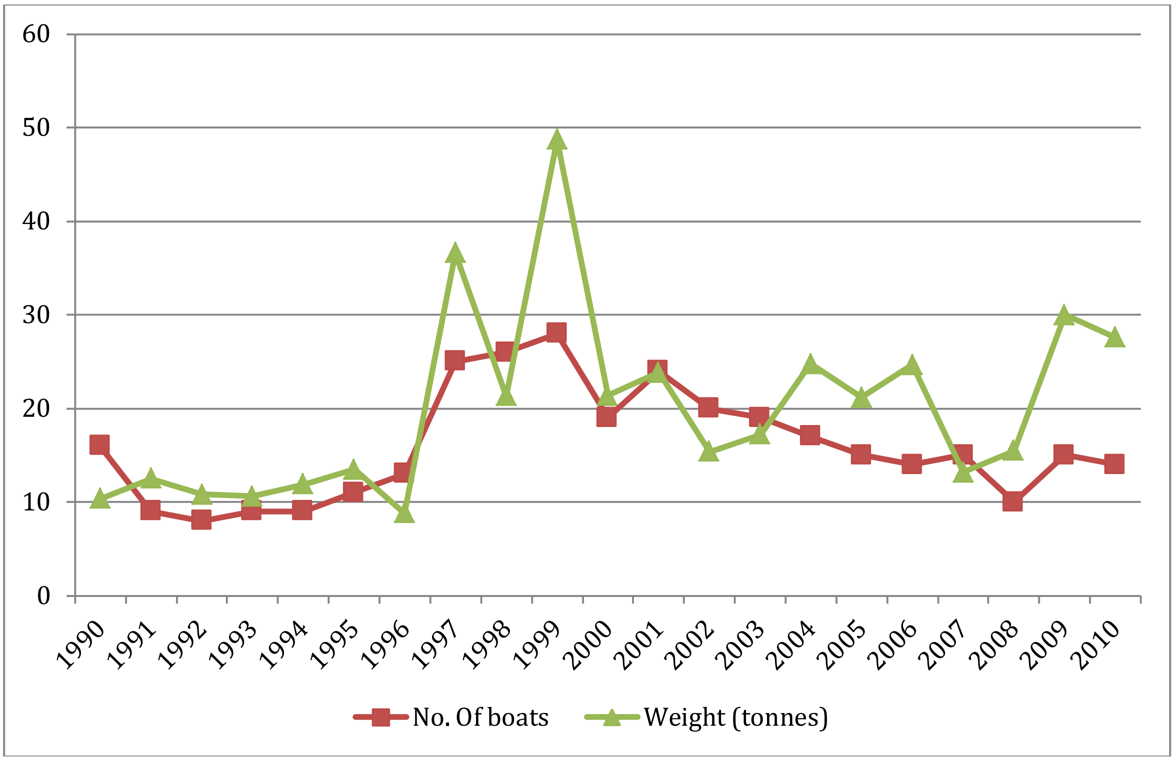


Figure 9 - Annual catch (tonnes) and effort (no. of boats) in logbook grid M22 for the net fishery (top) and trawl fishery (bottom) between 1990 - 2010.



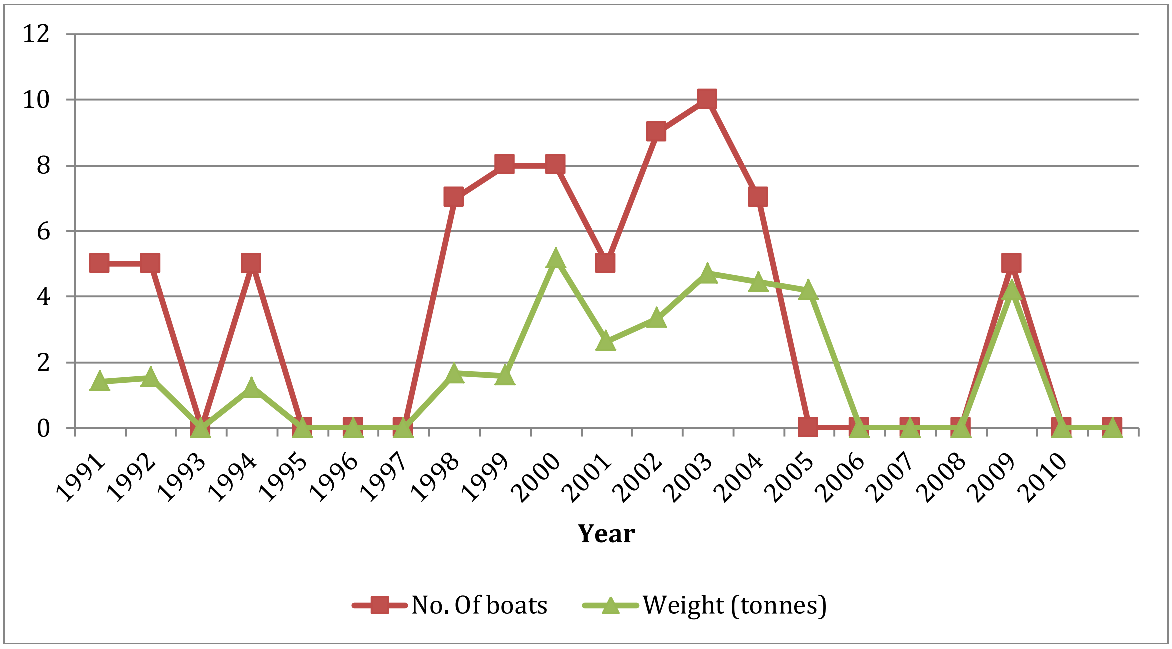


Figure 10 - Annual catch (tonnes) and effort (no. of boats) in logbook grid M22 for the line fishery (top) and crab fishery (bottom) between 1990 - 2010

Table 7 - Dominant Species (by Weight) Caught in Logbook Grid M22 between 2003-04 and 2010-11.

Year	First	Second	Third	Fourth	Fifth
2003-04	Tiger prawns	Spanish mackerel	Red spot king prawn	Garfish	Moreton bay bugs
2004-05	Australian blacktip shark	Tiger prawns	Spanish mackerel	Hammerhead shark	Whaler shark
2005-06	Spanish mackerel	Red spot king prawn	Spotted mackerel	Tiger prawns	Moreton bay bugs
2006-07	Spanish mackerel	Red spot king prawn	Moreton bay bugs	Spotted mackerel	School mackerel
2007-08	Australian blacktip shark	Spanish mackerel	Grey mackerel	Barramundi	Spotted mackerel
2008-09	Spanish mackerel	Red spot king prawn	Moreton bay bugs	Spotted mackerel	Grey mackerel
2009-10	Spanish mackerel	Grey mackerel	Spotted mackerel	Moreton bay bugs	Red spot king prawn
2010-11	Grey mackerel	Spanish mackerel	Spotted mackerel	Barramundi	School mackerel

Table 8 - Trend in the Recorded Catch and CPUE of Spanish Mackerel from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	15	115	11.07	$77,458.22	$110,700.00	0.73	0.09
2004-05	13	176	17.26	$120,850.80	$172,600.00	1.32	0.10
2005-06	9	149	12.15	$85,041.60	$121,500.00	1.34	0.08
2006-07	9	158	19.19	$134,349.25	$191,900.00	2.13	0.12
2007-08	9	107	7.53	$52,728.62	$75,300.00	0.83	0.07
2008-09	7	112	13.31	$93,155.72	$133,100.00	1.90	0.12
2009-10	9	117	15.00	$105,009.10	$150,000.00	1.66	0.13
2010-11	6	57	11.66	$81,592.70	$116,600.00	1.94	0.20

Table 9 - Trend in the Recorded Catch and CPUE of Tiger Prawns from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	40	319	24.14	$369,281.62	$434,520.00	0.60	0.07
2004-05	37	220	15.89	$243,112.06	$286,020.00	0.43	0.07
2005-06	7	41	2.98	$45,531.01	$53,640.00	0.42	0.07
2006-07	-	-	-	-	-	-	-
2007-08	-	-	-	-	-	-	-
2008-09	5	5	0.09	$1,346.35	$1,620.00	0.01	0.01
2009-10	5	13	0.29	$4,468.95	$5,220.00	0.05	0.02
2010-11	5	14	1.15	$17,640.21	$20,700.00	0.23	0.08

Table 10 - Trend in the Recorded Catch and CPUE of Red Spot King Prawns from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	33	118	10.15	$129,859.04	$192,850.00	0.30	0.08
2004-05	17	45	3.76	$48,090.73	$71,400.00	0.22	0.08
2005-06	12	48	4.50	$57,601.35	$85,500.00	0.38	0.09
2006-07	13	43	2.93	$37,543.28	$55,670.00	0.23	0.06
2007-08	10	26	1.16	$14,809.95	$22,040.00	0.12	0.04
2008-09	13	78	4.95	$63,361.49	$94,050.00	0.38	0.06
2009-10	14	48	2.36	$30,221.51	$44,840.00	0.17	0.05
2010-11	9	28	1.86	$23,821.36	$35,340.00	0.21	0.06

Table 11 - Trend in the Recorded Catch and CPUE of Australian Blacktip Shark from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	-	-	-	-	-	-	-
2004-05	5	303	60.44	$181,334.70	$362,640.00	12.08	0.19
2005-06	-	-	-	-	-	-	-
2006-07	-	-	-	-	-	-	-
2007-08	5	65	18.71	$56,144.64	$112,260.00	3.74	0.29
2008-09	-	-	-	-	-	-	-
2009-10	-	-	-	-	-	-	-
2010-11	-	-	-	-	-	-	-

Table 12 - Trend in the Recorded Catch and CPUE of Grey Mackerel from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	-	-	-	-	-	-	-
2004-05	6	42	1.32	$7,326.47	$13,200.00	0.22	0.03
2005-06	-	-	-	-	-	-	-
2006-07	-	-	-	-	-	-	-
2007-08	5	40	3.49	$19,347.30	$34,900.00	0.70	0.09
2008-09	5	33	2.22	$12,328.77	$22,200.00	0.44	0.07
2009-10	7	62	12.44	$69,026.46	$124,400.00	1.78	0.20
2010-11	8	124	66.02	$366,386.03	$660,200.00	8.25	0.53

Table 13 - Trend in the Recorded Catch and CPUE of Spotted Mackerel from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	7	31	0.89	$6,205.50	0.13	0.03
2004-05	10	77	4.92	$34,461.70	0.49	0.06
2005-06	11	140	3.35	$23,450.70	0.30	0.02
2006-07	7	57	1.87	$13,080.62	0.27	0.03
2007-08	10	60	2.03	$14,194.81	0.20	0.03
2008-09	5	40	2.55	$17,836.00	0.51	0.06
2009-10	8	68	6.42	$44,951.90	0.80	0.09
2010-11	6	74	7.84	$54,905.90	1.57	0.11

Table 14 - Trend in the Recorded Catch and CPUE of Moreton Bay Bugs from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	50	260	4.45	$91,579.52	$93,450.00	0.09	0.02
2004-05	30	180	2.11	$43,467.06	$44,310.00	0.07	0.01
2005-06	13	66	2.18	$44,806.09	$45,780.00	0.17	0.03
2006-07	13	44	2.08	$42,766.64	$43,680.00	0.16	0.05
2007-08	10	26	0.95	$19,632.28	$19,950.00	0.10	0.04
2008-09	14	78	3.68	$75,830.44	$72,280.00	0.26	0.05
2009-10	17	57	3.39	$69,753.29	$71,190.00	0.20	0.06
2010-11	10	42	2.16	$44,445.58	$46,360.00	0.22	0.05

Table 15 - Trend in the Recorded Catch and CPUE of Barramundi from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	6	66	2.50	$22,903.32	$25,000.00	0.42	0.04
2004-05	-	-	-	-	-	-	-
2005-06	-	-	-	-	-	-	-
2006-07	-	-	-	-	-	-	-
2007-08	5	52	3.12	$28,630.07	$31,200.00	0.62	0.06
2008-09	-	-	-	-	-	-	-
2009-10	5	33	1.84	$16,913.35	$18,400.00	0.37	0.06
2010-11	9	61	5.78	$53,015.52	$57,800.00	0.64	0.09

Table 16 - Trend in the Recorded Catch and CPUE of Mud Scallop from the M22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	5	34	3.0	$42,176.22	$72,000.00	0.60	0.08
2004-05	7	38	2.4	$33,613.10	$57,600.00	0.34	0.06
2005-06	-	-	-	-	-	-	-
2006-07	-	-	-	-	-	-	-
2007-08	-	-	-	-	-	-	-
2008-09	-	-	-	-	-	-	-
2009-10	-	-	-	-	-	-	-
2010-11	-	-	-	-	-	-	-

Catch and effort information at a finer spatial scale - sites[4] within grid M22 - are presented for the major fisheries. In sites that are not listed, no catch occurred, or less than five boats reported catch in the specified period. Similar to the information on logbook grids, a caveat for the information is that it only includes sites where more than five boats recorded effort in the specific fishery. For the otter trawl fishery, sites 1 and 2 are those that have consistently recorded catch over the period reviewed (Table 17). Site 1 is clearly the most consistently used site in grid M22. All other sites, including site 24 which had the highest average annual GVP, had no recorded information after 2005. The most likely explanation for this is changes in the fishery which occurred

[4] It is not compulsory for commercial fishers to report catch at the finer spatial scale.

as a result of the rezoning of the GBR. No catch or effort has been recorded (or fewer than five boats have reported catch) at those two sites since 2004.

Table 17 - Otter Trawl Catch and Effort in the Sites within Grid M22 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
1	10	2010	19	92	7.05	$103,754	$68,811
2	8	2009	15	55	6.16	$86,304	$35,215
3	2	2002	6	23	2.43	$35,875	$4,848
4	3	2003	8	40	2.26	$33,404	$7,063
6	2	2002	8	29	2.64	$36,028	$4,499
11	5	2004	23	133	16.48	$240,545	$44,042
12	4	2004	15	64	10.35	$150,082	$31,277
13	3	2004	13	46	4.30	$60,967	$14,239
14	2	2004	5	19	1.55	$22,590	$2,800
16	4	2003	16	61	8.28	$119,263	$27,789
17	5	2004	18	85	10.85	$155,194	$54,160
18	4	2004	21	119	19.04	$276,755	$39,279
19	4	2003	15	74	11.38	$156,699	$35,275
23	5	2005	18	98	11.64	$159,143	$43,711
24	6	2005	34	375	34.07	$508,720	$140,821

For the line fishery, site 14 in grid M22 was the only site where catch was consistently recorded (Table 18). Catch was only recorded from three other sites within grid M22. For the net fishery, sites 22 and 23 were the only two where catch and effort were recorded (Table 19). Overall, catch and effort in M22 is consistent with a theme of declining catch and effort as a result of the rezoning of the GBR and the subsequent structural adjustment package. For species targeted by trawl fisheries, effort in particular has declined.

Table 18 - Line Catch and Effort in the Sites within Grid M22 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
14	10	2010	10	104	16.32	$97,059	$70146

Table 19 - Net Catch and Effort in the Sites within Grid M22 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
22	6	2010	10	76	16.32	$87,047	$27,455
23	6	2010	7	85	39.33	$219,818	$46,196

Logbook Grid L21

Catches in logbook grid L21 areas dominated by the line and trawl fisheries, with only limited sporadic catch and effort recorded in the net fishery (Figure 11 and Figure 12). After increasing between 1991 and 1997, effort in the trawl fishery generally trended down over the remaining period analysed. Catch in the trawl fishery showed greater variation than effort, but still showed a similar trend. Catch and effort in the line fishery was generally steady between 1990 and 1995 before rising sharply and peaking in 1998. From 2002, effort in the fishery has generally declined although catch showed more variation. By weight, catch in the logbook grid was dominated by trawl caught species – Moreton Bay bugs, red spot king prawns, banana prawns, blue leg king prawns, and saucer scallops (Table 20). Moreton Bay bugs and red spot king prawns were of particular importance. Catch and effort (number of boats and days fished) of Moreton Bay bugs has shown a decline, however catch per unit effort has been variable, but with a general trend of increasing catch per boat (Table 21). A similar trend is evident across the entire fishery (DEEDI, 2011). The catch of Moreton Bay bugs in grid L21 is considerable and represents approximately 10% of the state wide catch of this species. The number of boats catching red spot king prawns has declined, although days fished were more variable (Table 22). There were no clear trends in catch or catch per unit effort, although both of these parameters were much lower in 2010-2011 than recorded in the other years assessed. Banana prawn catch and effort showed high inter-annual variability and this is consistent with the dynamics of this component of the fishery overall.

Examination of the finer scale information on the distribution of trawl fishing catch and effort (sites within grids) identifies that this logbook grid is extensively trawled with sites 2, 8, 9, 10, 11 and 25 of particular importance (Table 24).

Catch and effort in the net fishery was generally low with the exception of 1999, 2004 and 2005. Given the location of this grid, these three large annual catches are likely to consist principally of shark and grey mackerel that are caught in the offshore component of the net fishery.

Catches of more than 5 vessels were recorded in the crab fishery for only two of the 20 years examined – 1999 and 2003 and comprised only a relatively small volume, 0.87 and 1.64 tonnes.

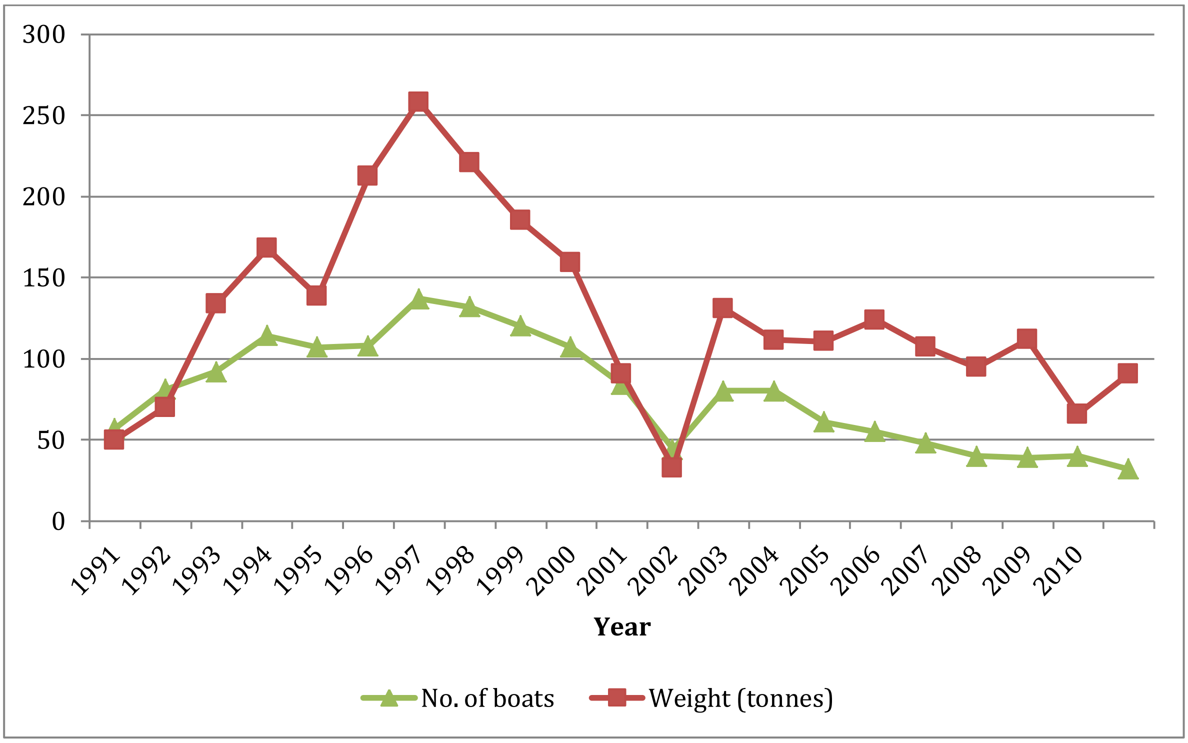


Figure 11 - Annual catch (tonnes) and effort (no. of boats) in logbook grid L21 for the trawl fishery between 1990 - 2010.

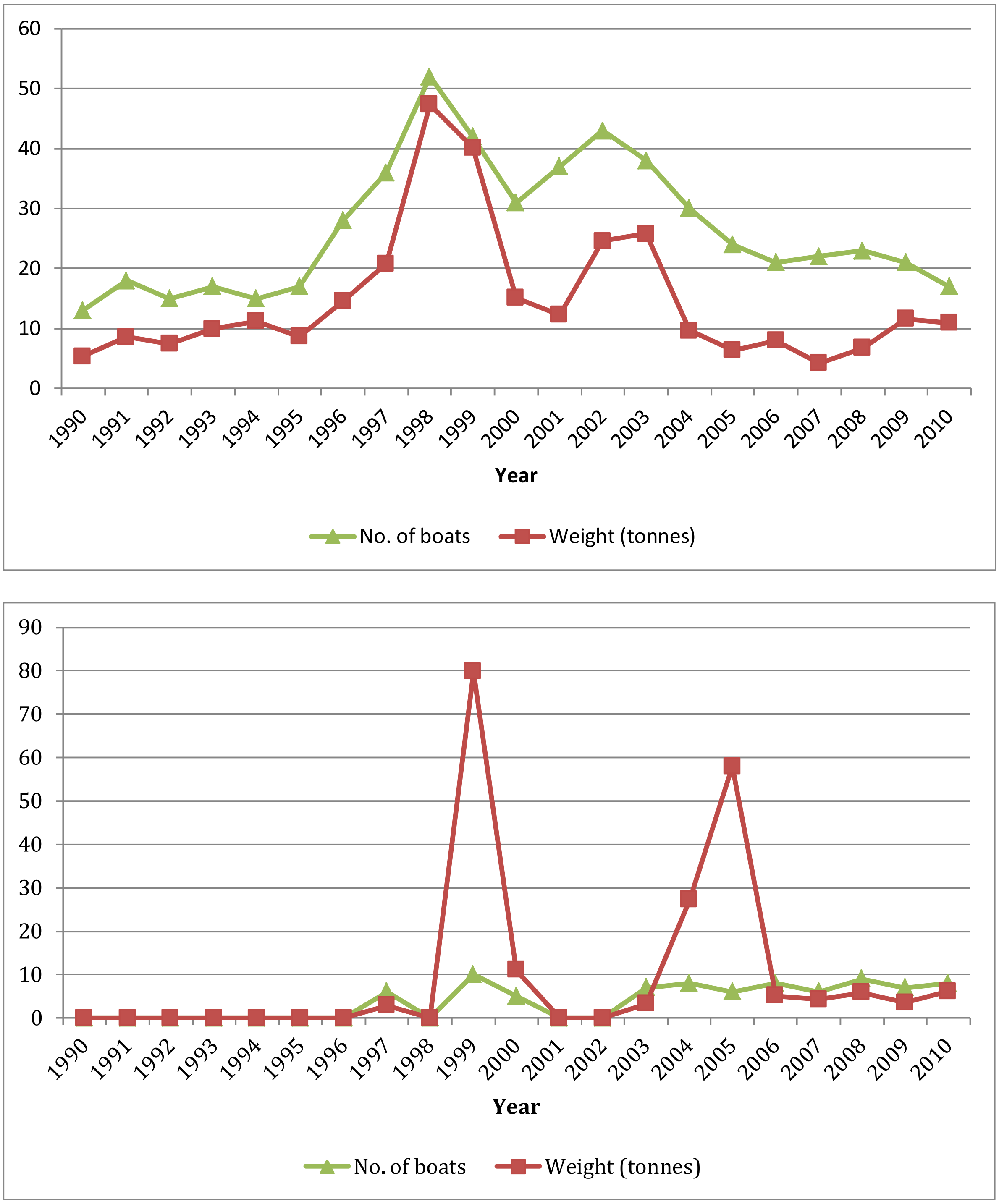


Figure 12 - Annual catch (tonnes) and effort (no. of boats) in logbook grid L21 for the line fishery (top) and the net fishery (below) between 1990 - 2010.

Table 20 - Dominant Species (by Weight) Caught in Logbook Grid L21 between 2003-04 and 2010-11.

Year	First	Second	Third	Fourth	Fifth
2003-04	Moreton Bay Bugs	Red spot king prawns	Banana prawns	Blue leg king prawns	Tiger prawns
2004-05	Moreton Bay Bugs	Red spot king prawns	Banana prawns	Saucer scallop	Tiger prawns
2005-06	Moreton Bay Bugs	Red spot king prawns	Saucer scallop	Balmain Bugs	Blue leg king prawns
2006-07	Moreton Bay Bugs	Red spot king prawns	Banana prawns	Blue leg king prawns	Tiger prawns
2007-08	Banana Prawns	Moreton Bay Bugs	Red spot king prawns	Blue leg king prawns	Tiger prawns
2008-09	Moreton Bay Bugs	Red spot king prawns	Banana prawns	Blue leg king prawns	Tiger prawns
2009-10	Moreton Bay Bugs	Red spot king prawns	Banana prawns	Saucer scallop	Spanish mackerel
2010-11	Moreton Bay Bugs	Red spot king prawns	Banana prawns	Spanish mackerel	Coral Trout

Table 21 - Trend in the Recorded Catch and CPUE of Moreton Bay Bugs from the L21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	72	711	33.9	$698,810.16	$711,900.00	0.471139	0.04771
2004-05	50	718	36.2	$744,481.47	$760,200.00	0.72278	0.050333
2005-06	48	755	46.2	$951,454.69	$970,200.00	0.962208	0.061174
2006-07	47	806	47.4	$977,246.52	$995,400.00	1.009319	0.058856
2007-08	33	431	21.5	$443,569.97	$451,500.00	0.652485	0.049958
2008-09	34	551	30.12	$620,466.46	$632,520.00	0.885853	0.054662
2009-10	34	435	34.1	$702,518.25	$716,100.00	1.003	0.078395
2010-11	22	236	17.1	$352,495.16	$359,100.00	0.777773	0.072504

Table 22 - Trend in the Recorded Catch and CPUE of Red spot king prawns from the L21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	61	494	23.92	$306,215.18	$454,480.00	0.392172	0.488214
2004-05	49	621	25.57	$327,329.27	$485,830.00	0.521878	0.53275
2005-06	48	724	31.58	$404,195.07	$600,020.00	0.657854	0.671851
2006-07	47	759	29.81	$381,564.14	$566,390.00	0.634234	0.851686
2007-08	35	363	13.37	$171,101.61	$254,030.00	0.381914	0.381914
2008-09	35	558	28.47	$364,411.74	$540,930.00	0.8134	0.837324
2009-10	34	407	30.42	$389,397.93	$577,980.00	0.894735	1.382773
2010-11	22	222	8.70	$111,337.01	$165,300.00	0.395364	0.241611

Table 23 - Trend in the Recorded Catch and CPUE of banana prawns from the L21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	15	60	14.14	$115,737.61	$141,400.00	0.9426	0.23565
2004-05	16	74	23.70	$193,984.72	$237,000.00	1.481125	0.320243
2005-06	-	-	-	-	-	-	-
2006-07	10	45	9.43	$77,207.52	$94,300.00	0.9432	0.2096
2007-08	17	121	46.12	$377,540.86	$461,200.00	2.713059	0.381174
2008-09	12	48	13.94	$114,141.40	$139,400.00	1.162	0.2905
2009-10	-	-	-	-	-	-	-
2010-11	18	18	4.27	$34,912.01	$42,700.00	0.853	0.236944

Table 24 - Trawl Catch and Effort in the Sites within Grid L21 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
1	10	2010	14	23	7.76	$105.049	$42,436
2	11	2010	27	105	13.64	$216,472	$70,976
3	8	2008	13	37	5.5	$83,891	$33,836
4	4	2010	8	41	7.58	$126,670	$53,865
6	8	2009	15	48	6.78	$104,910	$57,275
7	11	2010	19	47	6.85	$110.072	$55,546
8	11	2010	20	88	11.41	$204,201	$83,305
9	11	2010	22	154	16.01	$246,668	$99,911
10	10	2010	19	106	11.69	$178,865	$125,357
11	7	2007	20	74	10.22	$145,693	$74,901
12	5	2007	11	39	4.49	$35,995	$26,113
13	11	2010	15	49	4.79	$82,803	$58,283
14	6	2005	12	48	6.64	$79,116	$31,700
15	6	2008	15	36	8.76	$98,702	$48,631
16	3	2005	8	35	4.28	$110.904	$65,031
17	2	2003	6	17	2.81	$38,148	$22,625
18	10	2010	15	76	14.29	$212,465	$98,361
19	8	2010	9	62	5.76	$80,580	$47,406
20	2	2002	6	13	1.16	$20,065	$13,664
21	8	2009	16	90	31.52	$281,400	$89,886
22	2	2003	9	33	4.33	$66,608	$47,291
23	9	2010	14	53	7.39	$108,148	$82,574
24	11	2010	18	55	10.32	$139,434	$82,994
25	11	2010	21	90	19.12	$257,214	$128,677

Logbook Grid L22

Logbook grid L22 is utilised by all four major fisheries. Catch and effort in the trawl fishery has generally declined across the period examined (Figure 13 and Figure 14). The major trawl caught species in logbook grid L21 are banana prawns. Banana prawn catch and effort showed high inter-annual variability and this is consistent with the dynamics of this component of the fishery overall. Only two sites within the grid (2 and 7) have consistently recorded trawl catch across the period examined, these sites being near the mouth of the Burdekin River, although sites 5 and 8 have recorded catch in most years (Table 25).

The number of boats participating in the (mud) crab fishery has shown no clear or consistent trend. The catch declined between 1990 and 1992 before exhibiting a considerable increase in 1999 and remained at these high levels (approximately 50 tonnes) until 2002 before exhibiting a decline, but persisting around 30 tonnes (Table 27). Catch, effort, and catch per unit effort in the fishery for mud crabs has been consistent over the eight recent financial years analysed. Site 6 was clearly the most consistently important site in the grid for catching mud crabs (Table 31).

Catch and effort in the line fishery was highly variable with no consistent trend (Figure 14). The number of boats participating in the net fishery was consistent across the period examined, although catch was variable but with generally lower catches between 1990 and 1996 (Figure 14). By weight, barramundi, sharks, blue and king threadfin and grunter bream were important components of the net catch (Table 25). Catch, effort and catch per unit effort of barramundi has been consistent over the eight recent financial years analysed (Table 28). Sites 1 and 6 are the key sites within the grid for the net fishery (Table 30).

Figure 13 - Annual catch (tonnes) and effort (no. of boats) in logbook grid L22 for the trawl fishery (top) and the crab fishery (below) between 1990 - 2010.

Figure 14 - Annual catch (tonnes) and effort (no. of boats) in logbook grid L22 for the line fishery (top) and the net fishery (below) between 1990 - 2010.

Table 25 - Dominant Species (by Weight) Caught in Logbook Grid L22 between 2003-04 and 2010-11.

Year	First	Second	Third	Fourth	Fifth
2003-04	Banana prawn	Tiger prawn	Mud crab	Unspecified shark	Barramundi
2004-05	Banana prawn	Mud crab	Unspecified whaler shark	Barramundi	Australian blacktip shark
2005-06	Mud crab	Barramundi	Banana prawn	King threadfin	Tiger prawn
2006-07	Banana prawn	Mud crab	Barramundi	Unspecified whaler shark	King threadfin
2007-08	Hammerhead shark	Mud crab	Banana prawn	Barramundi	Unspecified whaler shark
2008-09	Banana prawn	Mud crab	Unspecified whaler shark	Barramundi	Tiger prawns
2009-10	Mud crab	Barramundi	Banana prawn	Blue threadfin	Grunter bream
2010-11	Mud crab	Barramundi	Banana prawn	Blue threadfin	Tiger prawn

Table 26 - Trend in the Recorded Catch and CPUE of banana prawns from the L22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	35	278	85.05	$696,152.86	$850,500.00	2.429857	0.305917
2004-05	35	270	62.71	$513,304.78	$627,100.00	1.791643	0.23225
2005-06	11	82	17.49	$143,167.89	$174,900.00	1.59	0.213293
2006-07	28	138	35.02	$286,655.03	$350,200.00	1.250679	0.253761
2007-08	20	134	30.11	$246,463.24	$301,100.00	1.50545	0.224694
2008-09	24	117	39.74	$325,324.28	$397,400.00	1.655958	0.339684
2009-10	9	42	7.99	$65,420.11	$79,900.00	0.888	0.190286
2010-11	19	75	10.79	$88,323.70	$107,900.00	0.567895	0.143867

Table 27 - Trend in the Recorded Catch and CPUE of mud crabs from the L22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	24	1,631	28.16	$450,606.40	$844,800.00	1.173454	0.017267
2004-05	16	1,394	25.98	$415,652.80	$779,400.00	1.623644	0.018636
2005-06	14	1,389	31.89	$510,280.00	$956,700.00	2.278036	0.022961
2006-07	19	1,758	33.23	$531,699.20	$996,900.00	1.749011	0.018903
2007-08	20	1,933	36.12	$577,953.60	$1,083,600.00	1.806105	0.018687
2008-09	21	1,493	32.20	$515,204.80	$966,000.00	1.533348	0.021568
2009-10	19	1,215	28.55	$456,736.00	$856,500.00	1.502421	0.023495
2010-11	20	1,105	24.86	$397,833.60	$745,800.00	1.24323	0.022502

Table 28 - Trend in the Recorded Catch and CPUE of barramundi from the L22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	22	405	16.46	$150,950.87	$164,600.00	0.748114	0.040638
2004-05	20	330	18.98	$174,065.60	$189,800.00	0.948938	0.057511
2005-06	17	293	18.94	$173,696.16	$189,400.00	1.114028	0.064636
2006-07	19	297	21.12	$193,710.34	$211,200.00	1.111614	0.071113
2007-08	18	327	24.60	$225,613.66	$246,000.00	1.36662	0.075227
2008-09	16	376	22.22	$203,817.07	$222,200.00	1.388914	0.059103
2009-10	18	370	17.56	$161,067.51	$175,600.00	0.975642	0.047464
2010-11	20	400	23.96	$219,725.31	$239,600.00	1.197857	0.059893

Table 29 - Trawl Catch and Effort in the Sites within Grid L22 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
1	5	2007	10	36	13.45	$113,635	$80,546
2	11	2010	22	132	35.22	$320,043	$131,718
3	3	2004	15	76	14.01	$239,060	$113,708
4	5	2007	13	51	6.05	$85,569	$57,576
5	9	2008	24	118	17.66	$236,890	$97,477
7	11	2010	26	105	35.06	$299,106	$112,363
8	8	2009	35	199	22.38	$324,278	$123,438
9	7	2007	18	105	9.53	$136,943	$59,446
10	2	2002	8	27	2.83	$38,344	$37,153
14	3	2003	10	39	10.09	$144,268	$65,938
15	4	2003	17	63	7.57	$111,828	$66,153
20	3	2002	13	51	5.5	$81,142	$54,436

Table 30 - Net Catch and Effort in the Sites within Grid L22 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
1	10	2010	12	150	10.17	$107,306	$52,425
6	11	2010	11	270	21.71	$115,942	$86,287
11	3	2008	6	38	6.86	$33.746	$21,933
12	3	2009	8	61	6.76	$29,902	$21,967
18	6	2008	7	89	16.22	$88,385	$30,575
20	6	2010	7	32	3.26	$16,485	$11,255

Table 31 - Pot Catch and Effort in the Sites within Grid L22 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
1	8	2010	8	469	8.33	$133,256	$71,862
6	11	2010	11	987	27.70	$443,222	$220,402
12	2	2001	7	163	5.8	$92,736	$67,963
18	8	2010	7	422	7.67	$122,736	$65,653
20	2	2002	6	42	0.79	$12,736	$9,936

Logbook Grid M21

Logbook grid M21 was dominated by effort and catch in the line and trawl fisheries. The number of trawl boats utilising the logbook grid has been variable overall, but was generally consistently low between 2006 and 2010; and catch has been highly variable with no clear trend (Figure 15). By weight, red spot king prawns are the most important trawl species, followed by Moreton Bay bugs (Table 25) Sites 17, 18, 22 and 23 were the key sites for the trawl fishery within logbook grid M21, while a smaller volume of catch was also consistently recorded in site 21 (Table 29).

The number of line fishing boats utilising the grid generally rose steadily until 2003 before a decline between 2004 and 2005 (Figure 15). Catch volumes in this fishery showed a general increasing trend before a sharper rise in 2001 which continued until 2003 before a decline became evident. However, catch in 2009 was also relatively large. The dominant species captured in this fishery are coral trout and red throat emperor (Table 32), and these two species represent the principal target species in the coral reef finfish fishery overall. Spanish mackerel also made a contribution. For coral trout the number of boats and the total number of days fished was relatively high in 2003-04. Catch was also high in that financial year but CPUE was the lowest in the period examined. Catch was also high in 2008-09 which represents the financial year with the highest CPUE. Catch and effort in the line fishery was distributed throughout most sites within the grid although sites 4, 8, 9 and 10 were the most significant locations for production (Table 38). A similar general trend in catch and effort was also evident for red throat emperor, although CPUE was high in both 2003-04 and 2008-09. Catch and effort of Spanish mackerel was also high in 2003-04, but CPUE showed no clear trend.

Figure 15 - Annual catch (tonnes) and effort (no. of boats) in logbook grid M21 for the trawl fishery (top) and the line fishery (below) between 1990 - 2010.

Table 32 - Dominant Species (by Weight) Caught in Logbook Grid M21 between 2003-04 and 2010-11.

Year	First	Second	Third	Fourth	Fifth
2003-04	Coral trout	Red spot king prawn	Red throat emperor	Spanish mackerel	Moreton Bay Bugs
2004-05	Coral trout	Red spot king prawn	Moreton Bay Bugs	Red throat emperor	Spanish mackerel
2005-06	Coral trout	Red spot king prawn	Red throat emperor	Moreton Bay Bugs	Spanish mackerel
2006-07	Coral trout	Red spot king prawn	Red throat emperor	Moreton Bay Bugs	Spanish mackerel
2007-08	Coral trout	Red spot king prawn	Red throat emperor	Spanish mackerel	Moreton Bay Bugs
2008-09	Coral trout	Red spot king prawn	Red throat emperor	Moreton Bay Bugs	Spanish mackerel
2009-10	Coral trout	Red spot king prawn	Red throat emperor	Moreton Bay Bugs	Spanish mackerel
2010-11	Coral trout	Red spot king prawn	Red throat emperor	Moreton Bay Bugs	Spanish mackerel

Table 33 - Trend in the Recorded Catch and CPUE of coral trout from the M21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	89	2,070	136.77	$4,473,556.78	$5,970,010.50	1.536686	0.06607
2004-05	55	1,186	102.51	$3,353,058.70	$4,474,561.50	1.863805	0.086433
2005-06	46	989	78.62	$2,571,516.91	$3,431,763.00	1.709046	0.07949
2006-07	35	963	70.56	$2,308,081.99	$3,079,944.00	2.016069	0.073274
2007-08	41	844	71.89	$2,351,648.17	$3,137,998.50	1.75352	0.085183
2008-09	44	1,070	120.29	$3,934,668.38	$5,250,658.50	2.733868	0.112421
2009-10	42	1,264	97.08	$3,175,558.97	$4,237,542.00	2.311495	0.076806
2010-11	31	583	45.69	$1,494,478.05	$1,994,368.50	1.473839	0.078369

Table 34 - Trend in the Recorded Catch and CPUE of red spot king prawns from the M21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	76	1,013	99.30	$1,271,056.99	$1,886,700.00	1.306566	0.098025
2004-05	60	1,004	78.47	$1,004,381.94	$1,490,930.0	1.307758	0.078153
2005-06	36	366	28.43	$363,925.33	$540,170.00	0.78975	0.07768
2006-07	33	367	29.79	$381,269.74	$566,010.00	0.902606	0.081161
2007-08	28	335	26.44	$338,427.13	$502,360.00	0.94425	0.078922
2008-09	26	595	60.98	$780,530.29	$1,158,620.00	2.345288	0.102483
2009-10	37	597	65.16	$834,003.55	$1,238,040.00	1.760946	0.109137
2010-11	17	310	31.34	$401,174.20	$595,460.00	1.843588	0.1011

Table 35 - Trend in the Recorded Catch and CPUE of red throat emperor from the M21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	85	1,906	62.63	$421,999.26	$532,355.00	0.736821	0.032859
2004-05	53	1,104	23.94	$161,294.58	$203,490.00	0.451661	0.021683
2005-06	45	909	16.36	$110,231.66	$139,060.00	0.363549	0.017997
2006-07	35	876	19.60	$132,090.40	$166,600.00	0.560109	0.022379
2007-08	39	743	13.95	$94,009.59	$118,575.00	0.357747	0.018778
2008-09	44	1,004	28.68	$193,261.00	$243,780.00	0.651869	0.028568
2009-10	42	1,204	33.15	$223,345.83	$281,775.00	0.789219	0.027531
2010-11	31	572	18.45	$124,309.36	$156,825.00	0.595129	0.032253

Table 36 - Trend in the Recorded Catch and CPUE of Moreton Bay bugs from the M21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	69	954	22.44	$462,192.82	$471,240.00	0.325159	0.023518
2004-05	58	1,004	24.01	$494,515.00	$504,210.00	0.413879	0.023909
2005-06	36	357	10.01	$206,190.40	$210,210.00	0.278028	0.028036
2006-07	32	382	16.56	$341,123.68	$347,760.00	0.517469	0.043348
2007-08	26	314	9.49	$195,581.15	$199,290.00	0.365154	0.030236
2008-09	24	533	16.22	$334,201.91	$340,620.00	0.675958	0.030437
2009-10	34	584	24.24	$499,273.72	$509,040.00	0.712824	0.0415
2010-11	15	301	12.29	$253,118.34	$258,090.00	0.819133	0.040821

Table 37 - Trend in the Recorded Catch and CPUE of Spanish mackerel from the M21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	68	626	29.36	$205,540.24	$293,600.00	0.431807	0.046906
2004-05	31	249	14.84	$103,845.25	$148,400.00	0.47855	0.059578
2005-06	27	214	9.49	$66,432.02	$94,900.00	0.351492	0.044347
2006-07	24	212	8.30	$58,125.76	$83,000.00	0.345987	0.039168
2007-08	27	237	13.15	$92,061.79	$131,500.00	0.487099	0.055492
2008-09	29	246	15.27	$106,881.22	$152,700.00	0.526508	0.062068
2009-10	30	214	10.90	$76,297.24	$109,000.00	0.36332	0.050933
2010-11	19	125	7.07	$49,497.14	$70,700.00	0.372159	0.056568

Table 38 - Line Catch and Effort in the Sites within Grid M21 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
1	11	2010	29	121	17.9	$358,357	$125,205
2	11	2010	32	119	17.3	$367,479	$239,041
3	11	2010	23	66	10.81	$207,496	$112,845
4	11	2010	31	150	25.39	$615,086	$342,047
5	9	2009	19	62	11.09	$220,397	$100,217
6	4	2004	8	35	7.2	$117,890	$52,613
7	11	2010	35	123	16.90	$408,029	$256,892
8	11	2010	36	189	28.00	$586,360	$342,964
9	11	2010	46	354	61.45	$1,427,938	$776,684
10	11	2010	37	261	42.66	$890,484	$532,626
12	11	2010	37	123	17.61	$323,586	$246,247
13	11	2010	24	114	13.87	$259,781	$131,816
14	11	2010	25	78	8.38	$132,474	$80,232
15	3	2004	9	28	5.16	$118,542	$83,180
16	9	2009	26	106	12.18	$183,716	$76,684
17	4	2003	10	35	3.88	$45,234	$25,803
18	3	2002	7	33	2.98	$62,224	$34,901
19	10	2009	13	57	11.26	$136,193	$65,456
20	10	2009	14	48	4.04	$58,284	$34,569
21	11	2010	23	85	9.76	$145,258	$60,647
22	5	2008	18	67	5.47	$78,850	$35,248

Table 39 - Trawl Catch and Effort in the Sites within Grid M21 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
6	3	2006	6	40	4.09	$72,361	$33,709
12	6	2005	8	54	9.47	$133,422	$63,431
13	5	2004	13	56	5.73	$79,277	$48,508
15	2	2004	8	40	6.21	$84,253	$60,915
17	11	2010	54	434	65.03	$884,707	$357,516
18	11	2010	38	186	23.04	$309,955	$157,055
19	4	2004	8	24	2.66	$32,749	$17,002
20	4	2004	7	65	8.80	$134,156	$87,322
21	10	2010	20	93	15.2	$218,217	$60,747
22	11	2010	43	289	39.4	$565,413	$147,358
23	11	2010	31	216	14.25	$208,050	$133,260
24	2	2004	7	36	2.96	$41,077	$34,587

Logbook Grid N21

Logbook grid N21 was dominated by effort and catch in the line fishery. The number of line fishing boats utilising the grid generally rose steadily until 2002 before declining (Figure 16). Catch was relatively steady until a significant increase in 2002 and 2003, and then a sharp decline and a levelling out. The dominant species captured in this fishery are coral trout and red throat emperor, although a variety of other species also made a contribution). Effort and catch of coral trout and red throat emperor were highest in 2003-04 (Table 41 and Table 42). Catch and effort of Spanish mackerel has been increasing, but the overall volumes are low (Table 43). The line catch in the grid was consistently centred in sites 18, 19, 22, 23 and 24. While a variable but low level of catch and effort in the trawl fishery was evident, no catch or effort were recorded after 2005 (Table 44).

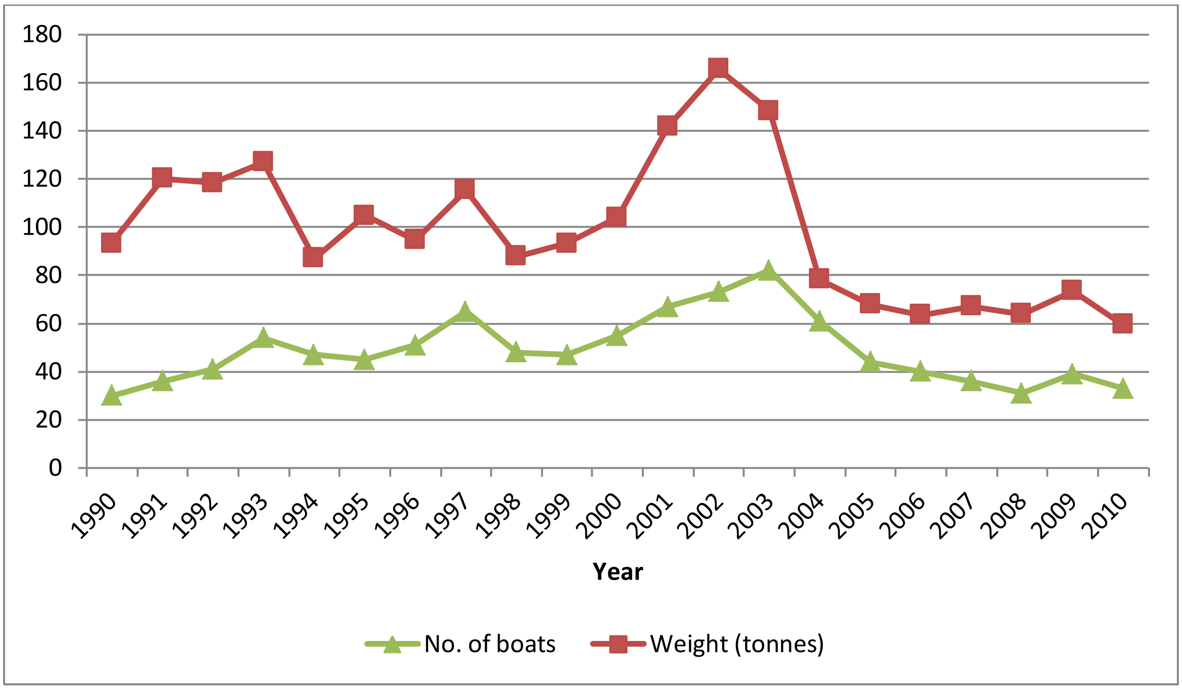


Figure 16 - Annual catch (tonnes) and effort (no. of boats) in logbook grid N21 for the trawl fishery (top) and the line fishery (below) between 1990 - 2010.

Table 40 - Dominant Species (by Weight) Caught in Logbook Grid N21 between 2003-04 and 2010-11.

Year	First	Second	Third	Fourth	Fifth
2003-04	Coral trout	Red throat emperor	Spanish mackerel	Mixed reef fish	Unspecified "fish"
2004-05	Coral trout	Red throat emperor	Red spot king prawn	Stripey	Spanish mackerel
2005-06	Coral trout	Red throat emperor	Stripey	Spanish mackerel	Unspecified sweetlip
2006-07	Coral trout	Red throat emperor	Mixed reef fish	Stripey	Unspecified sweetlip
2007-08	Coral trout	Red throat emperor	Stripey	Spangled emperor	Unspecified sweetlep
2008-09	Coral trout	Red throat emperor	Spangled emperor	Stripey	Spanish mackerel
2009-10	Coral trout	Red throat emperor	Stripey	Spangled emperor	Spanish mackerel
2010-11	Coral trout	Red throat emperor	Spangled emperor	Spanish mackerel	Stripey

Table 41 - Trend in the Recorded Catch and CPUE of coral trout from the N21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	73	990	57.99	$1,896,720.60	$2,531,263.50	0.794333	0.058572
2004-05	44	461	35.03	$1,145,713.08	$1,529,059.50	0.796059	0.07598
2005-06	41	583	42.35	$1,385,410.49	$1,848,577.50	1.033039	0.072649
2006-07	32	602	36.06	$1,179,638.05	$1,574,019.00	1.126992	0.059907
2007-08	32	490	37.91	$1,239,997.44	$1,654,771.50	1.184658	0.077365
2008-09	32	451	40.13	$1,312,549.42	$1,751,674.50	1.253972	0.088974
2009-10	33	530	37.43	$1,224,357.25	$1,633,819.50	1.13427	0.070624
2010-11	28	220	13.91	$454,927.90	$607,171.50	0.496714	0.063218

Table 42 - Trend in the Recorded Catch and CPUE of red throat emperor from the N21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	72	927	27.41	$184,718.56	$232,985.00	0.380756	0.029573
2004-05	43	438	11.17	$75,231.79	$94.945.00	0.259658	0.025492
2005-06	40	557	15.03	$101,277.53	$127,755.00	0.37577	0.026985
2006-07	32	572	13.22	$89,058.84	$112,370.00	0.413044	0.023107
2007-08	32	466	13.79	$92,885.35	$117,215.00	0.430791	0.029582
2008-09	31	436	16.50	$111,190.48	$140,250.00	0.532323	0.037849
2009-10	33	517	20.51	$138,211.88	$174,335.00	0.621585	0.039676
2010-11	30	233	9.95	$67,073.42	$84,575.00	0.331817	0.042723

Table 43 - Trend in the Recorded Catch and CPUE of Spanish mackerel from the N21 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	12	79	1.34	$8,043.90	$13,400.00	0.111721	0.01697
2004-05	17	94	1.14	$6,820.80	$11,400.00	0.066871	0.012094
2005-06	14	103	1.15	$6,913.20	$11,500.00	0.0823	0.011186
2006-07	14	78	1.57	$9,412.20	$15,700.00	0.11205	0.020112
2007-08	29	229	3.22	$19,325.40	$32,200.00	0.111066	0.014065
2008-09	24	226	3.95	$23,694.00	$39,500.00	0.164542	0.017473
2009-10	25	275	3.86	$23,136.00	$38,600.00	0.15424	0.014022
2010-11	23	132	2.93	$17,595.00	$29,300.00	0.1275	0.022216

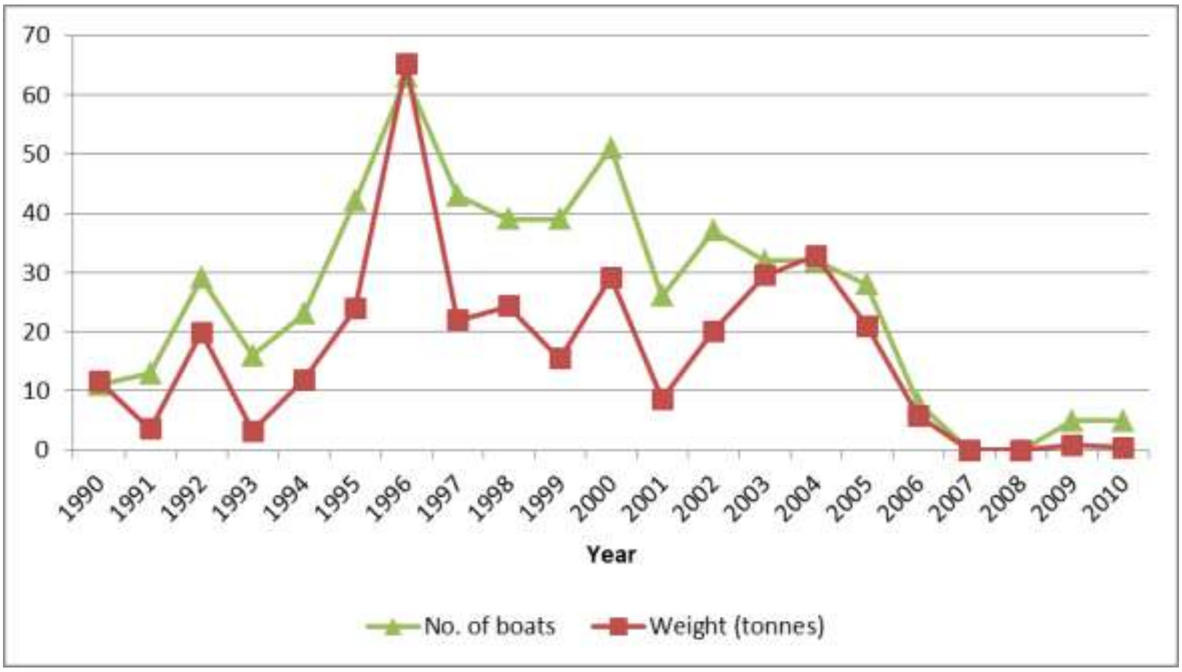
Table 44 - Line Catch and Effort in the Sites within Grid N21 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
6	7	2007	22	98	15.00	$318,095	$165,974
11	4	2003	13	47	5.27	$110,892	$65,790
12	4	2003	8	36	6.98	$146,892	$68,322
14	2	2005	7	19	4.37	$76,000	$58,556
15	5	2010	5	15	2.06	$50,645	$42,617
16	4	2006	9	23	2.93	$52,713	$37,360
17	11	2010	16	57	5.02	$101,328	$63,301
18	11	2010	31	118	13.61	$287,128	$211,069
19	11	2010	26	115	14.34	$308,416	$150,326
22	11	2010	40	138	17.82	$374,135	$228,669
23	11	2010	39	244	27.79	$558,422	$390,929
24	11	2010	36	171	22.77	$447,930	$208,079
25	4	2005	13	32	2.94	$58,725	$41,375

Logbook Grid N22

Logbook grid N22 was dominated by effort and catch in the line and trawl fisheries. Since 2007 however, the trawl catch and effort has been low (Figure 17). Red spot king prawns were the dominant component of the trawl catch, and between 2003-04 and 2006-07 they were also the most important species by weight captured in the logbook grid (Table 47). However, there was no catch of red spot king prawns after 2007-08. Site 10 was the most important site within the grid for trawl effort, although no effort has been recorded since 2005 (Table 47).

The catch in the line fishery peaked in 2003 and was also high between 2000 and 2002 (Figure 17). Coral trout, red throat emperor and Spanish mackerel are the dominant species captured. In the years examined, the catch and effort of coral trout was highest in 2003-04 (Table 45). Catch and effort of coral trout declined sharply in the years after 2003-04, but catch and effort was variable. While Spanish mackerel were a relatively important component of the line catch in the grid, the overall volume of the catch was relatively low (Table 45). The important sites within the grid for line fishing were 3 and 5 (Table 49).



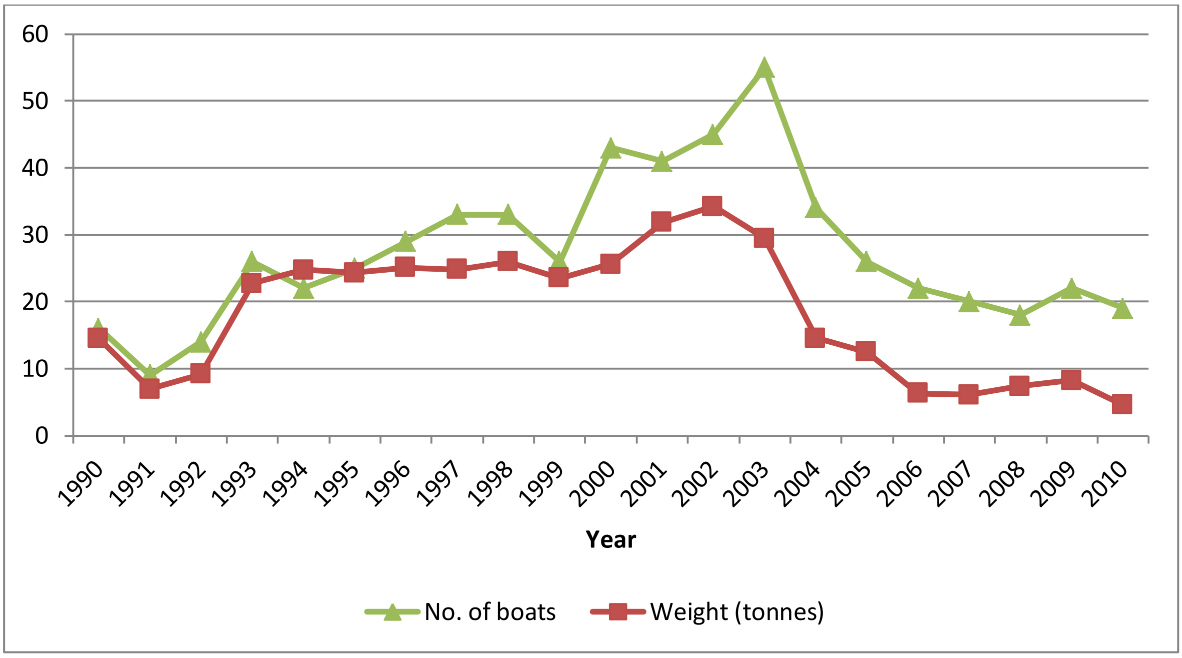


Figure 17 - Annual catch (tonnes) and effort (no. of boats) in logbook grid N22 for the trawl fishery (top) and the line fishery (below) between 1990 - 2010.

Table 45 - Dominant Species (by Weight) Caught in Logbook Grid N22 between 2003-04 and 2010-11.

Year	First	Second	Third	Fourth	Fifth
2003-04	Red spot king prawn	Coral trout	Unspecified shark	Moreton Bay bugs	Red throat emperor
2004-05	Red spot king prawn	Moreton Bay bugs	Coral trout	Saucer scallop	Spanish mackerel
2005-06	Red spot king prawn	Coral trout	Moreton Bay bugs	Red throat emperor	Spanish mackerel
2006-07	Red spot king prawn	Coral trout	Red throat emperor	Spanish mackerel	Moreton Bay bugs
2007-08	Coral trout	Red throat emperor	Spanish mackerel	Spangled emperor	Red spot king prawn
2008-09	Coral trout	Red throat emperor	Spanish mackerel	Shark mackerel	Stripey
2009-10	Coral trout	Red throat emperor	Spangled emperor	Shark mackerel	Stripey
2010-11	Spanish mackerel	Coral trout	Red throat emperor	Spangled emperor	Shark mackerel

Table 46 - Trend in the Recorded Catch and CPUE of coral trout from the N22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	44	216	10.24	$335,092.93	$446,976.00	0.232828	0.047428
2004-05	19	74	5.40	$176,567.50	$23,571.00	0.284105	0.072946
2005-06	21	87	5.36	$175,246.02	$233,964.00	0.255124	0.061582
2006-07	19	67	2.88	$94,364.50	$125,712.00	0.151837	0.043058
2007-08	16	54	4.35	$142,199.31	$189,877.50	0.271706	0.080506
2008-09	18	52	3.33	$108,926.91	$145,354.50	0.185006	0.06404
2009-10	23	56	2.18	$71,441.47	$95,157.00	0.094961	0.039002
2010-11	12	34	0.88	$28,784.62	$38,412.00	0.073333	0.025882

Table 47 - Trend in the Recorded Catch and CPUE of red spot king prawn from the N22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP (Logbook Value)	GVP (Local Value)	CPUE (t/boat)	CPUE (t/day)
2003-04	30	258	21.43	$274,272.03	$407,170.00	0.714233	0.08305
2004-05	30	265	20.40	$261,087.72	$387,600.00	0.6799	0.07697
2005-06	19	117	8.37	$107,138.51	$159,030.00	0.440526	0.071538
2006-07	8	49	2.96	$37,914.49	$56,240.00	0.37025	0.060449
2007-08	5	7	0.53	$6,771.36	$10,070.00	0.1058	0.075571
2008-09	-	-	-	-	-	-	-
2009-10	-	-	-	-	-	-	-
2010-11	-	-	-	-	-	-	-

Table 48 - Trend in the Recorded Catch and CPUE of Spanish mackerel from the N22 Grid between 2003-04 and 2010-11.

Year	Boats	Days	Weight (t)	GVP	CPUE (t/boat)	CPUE (t/day)
2003-04	19	57	3.18	$22,247.30	0.167273	0.055758
2004-05	8	25	1.98	$13,834.80	0.24705	0.079056
2005-06	8	16	1.01	$7,050.54	0.125903	0.062951
2006-07	8	12	0.77	$5,370.40	0.0959	0.063933
2007-08	6	22	1.04	$7,270.52	0.173108	0.047211
2008-09	7	9	0.46	$3,216.50	0.065643	0.051056
2009-10	8	22	0.32	$2,228.59	0.039796	0.014471
2010-11	5	23	1.02	$7,147.00	0.2042	0.044391

Table 49 - Line Catch and Effort in the Sites within Grid N22 between 2000 and 2010.

Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
3	11	2010	31	96	11.18	$184,965	$113,975
4	4	2009	10	24	2.17	$35,295	$18,299
5	8	2009	27	82	9.89	$173,513	$82,247

Table 50 - Trawl Catch and Effort in the Sites within Grid N22 between 2000 and 2010.

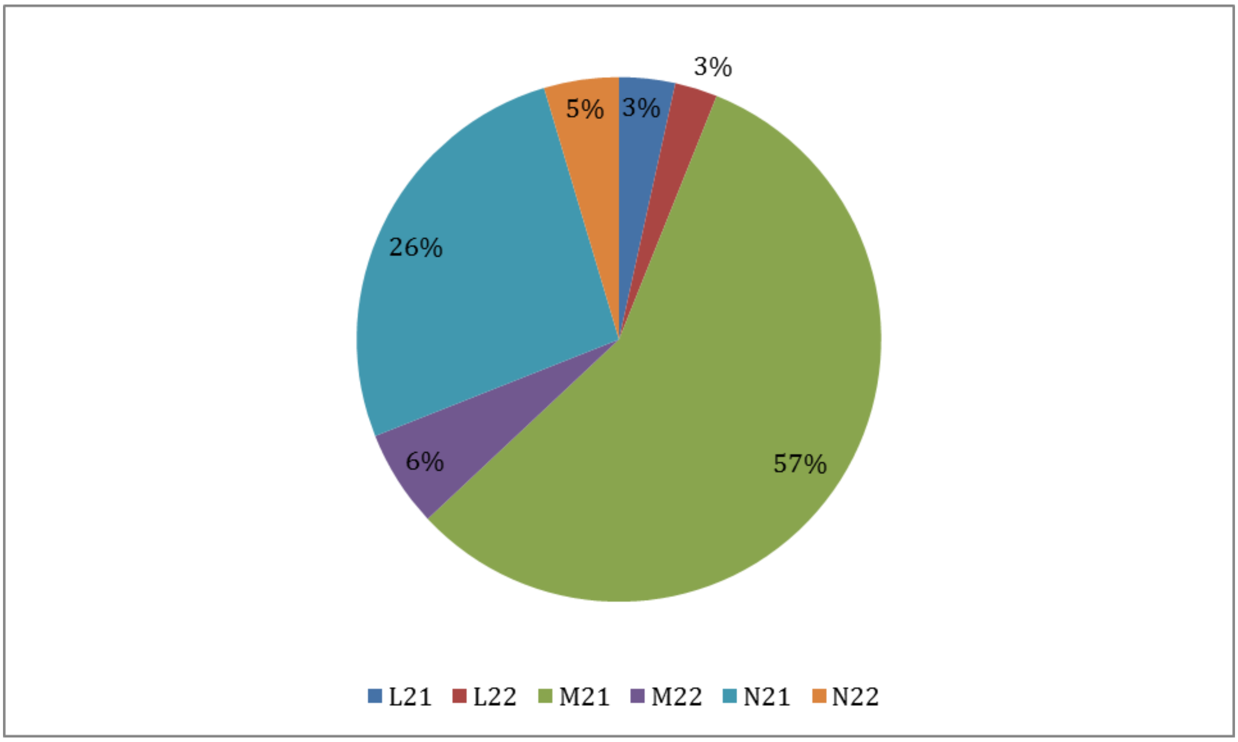
Site	No of Years of Catch Recorded	Years of Last Logbook Entry	Maximum boats	Maximum days	Maximum Weight (t)	Maximum GVP	Average Annual GVP
3	2	2003	7	29	2.37	$33,063	$32,471
9	6	2005	11	40	4.56	$60,983	$38,313
10	5	2005	19	159	18.40	$262,319	$134,926
15	5	2005	12	64	7.38	$87,827	$49,871

Summary of Commercial Fishing Logbook Information

The preceding section analysed catch and effort across six logbook grids – M22 which includes the proposed port expansion and five surrounding grids – M21, L21, L22, N21 and N22. A dominant feature in most fisheries examined in most grids is a change in catch and effort around the 2003 and 2004 period which coincides with the period of implementation of the rezoning of the GBR, and the associated structural adjustment program.

For the line fishery, of the grids examined, M21 and N21 are the key areas of production (Figure 18). This is not surprising given that these grids contain extensive coral reef habitat suitable for the targeting of the two key demersal species – coral trout and red throat emperor. The catch in logbook grid M21 in particular is large. Considerably smaller quantities of line caught fish were also caught in the other grids assessed.

For the trawl fishery, the catch was more dispersed across the grids in comparison to the line fishery, although very little catch was recorded in grids N21 and N22 (Figure 18). For the crab fishery, the catch was completely dominated by the M22 and L22, with a small portion coming from N21 (Figure 19). For the net fishery, the catch was dominated by two grids – L22 and M22 (Figure 19). Figure 20 through to Figure 23 identify the important sites within the grids for the trawl, line, net and crab fisheries.



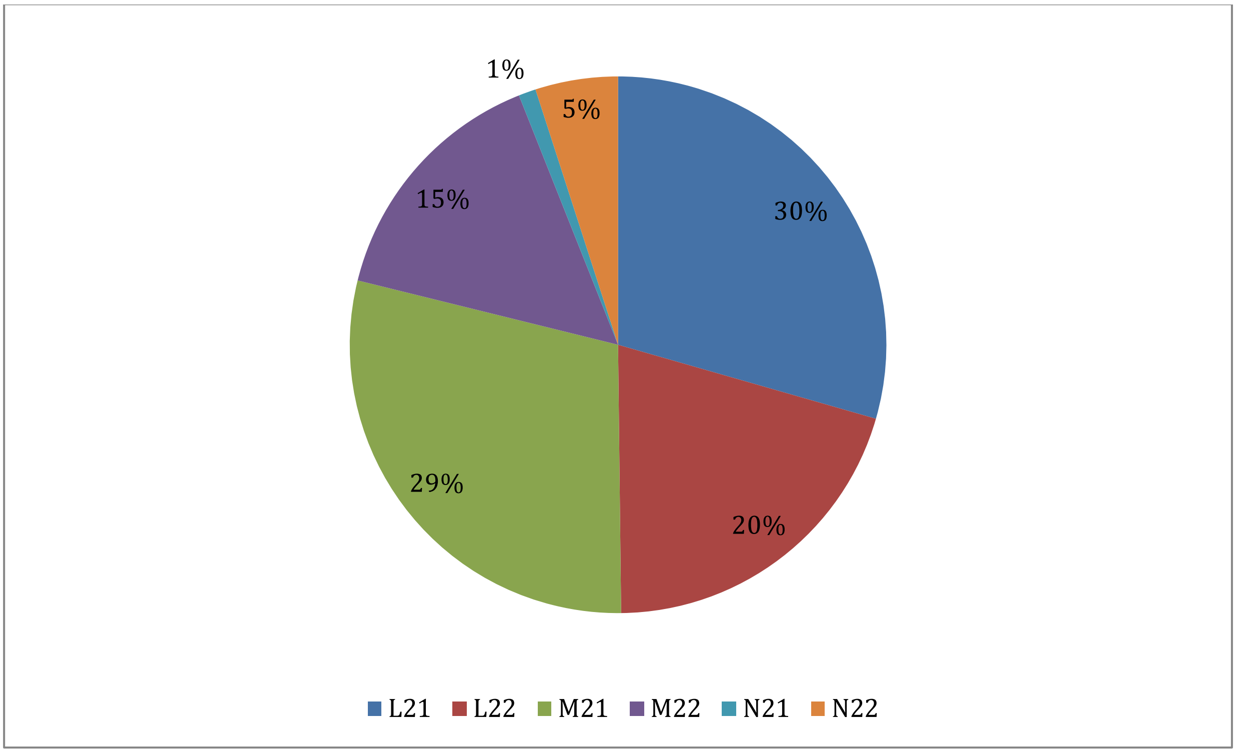
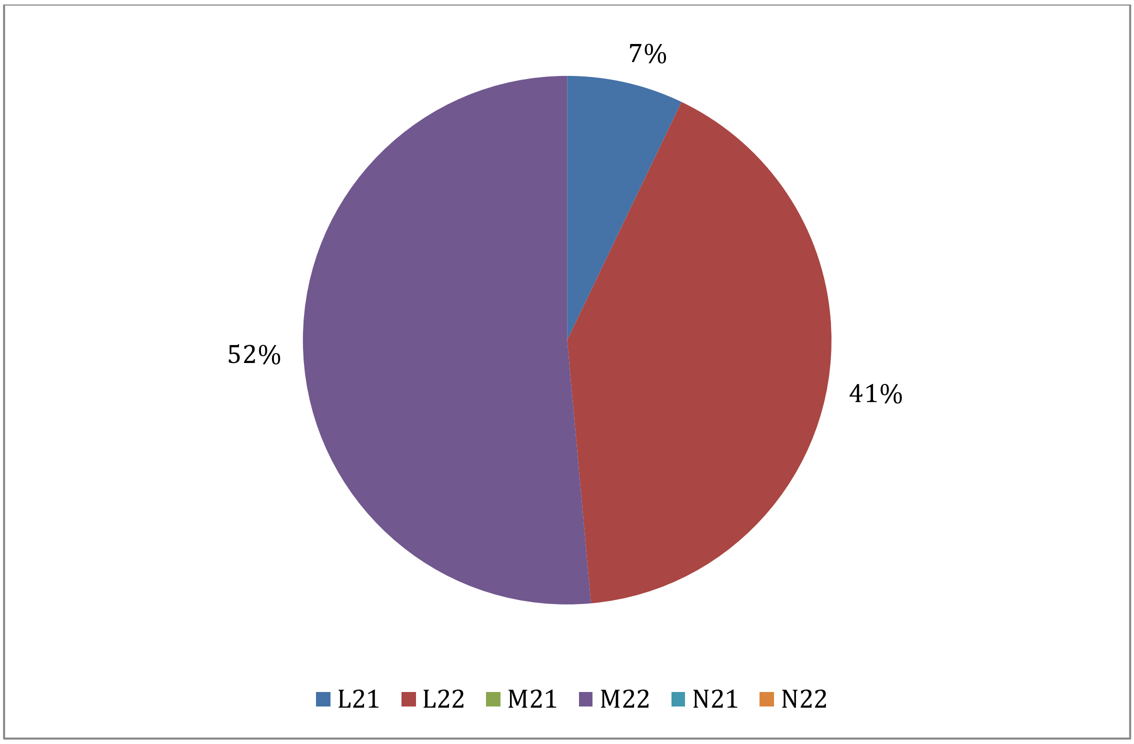


Figure 18 - Relative importance of the various logbook grids in the Bowen region for the line (top) and trawl (bottom) fisheries.



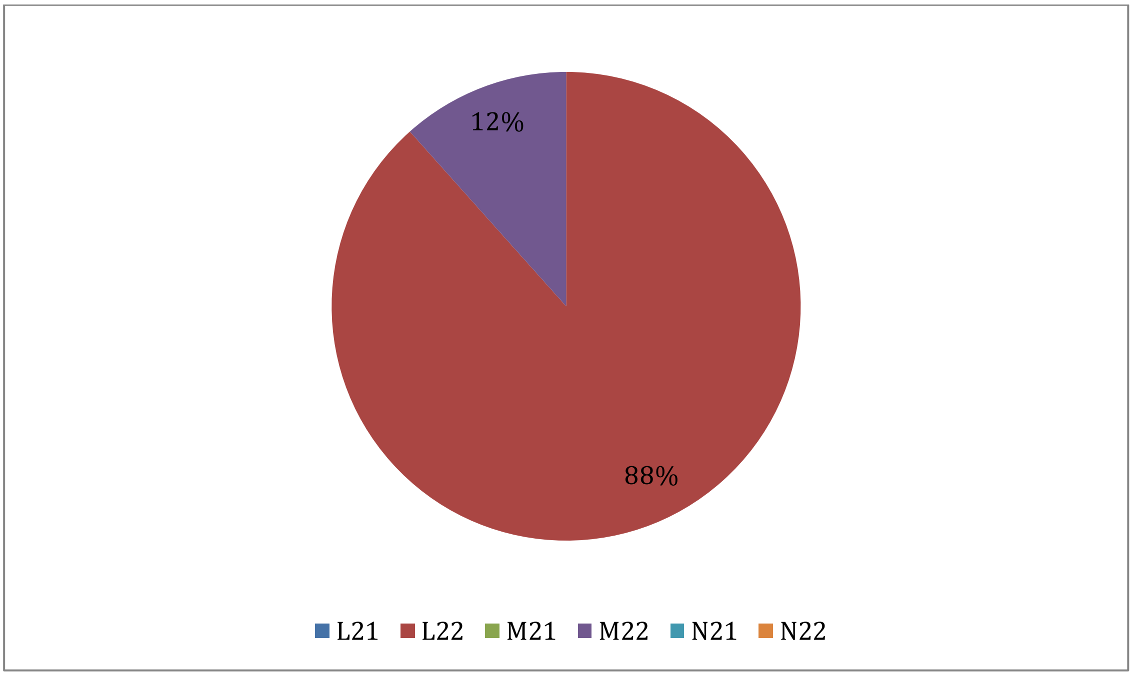


Figure 19 - Relative importance of the various logbook grids in the Bowen region for the crab (top) and net (bottom) fisheries.

Figure 20 - Spatial Pattern of Trawl Fishing as Recorded at the scale of logbook sites. Dark blue are primary fishing locations while light blue are secondary fishing locations. There was no site information available for the trawl fishery in logbook grid N21.

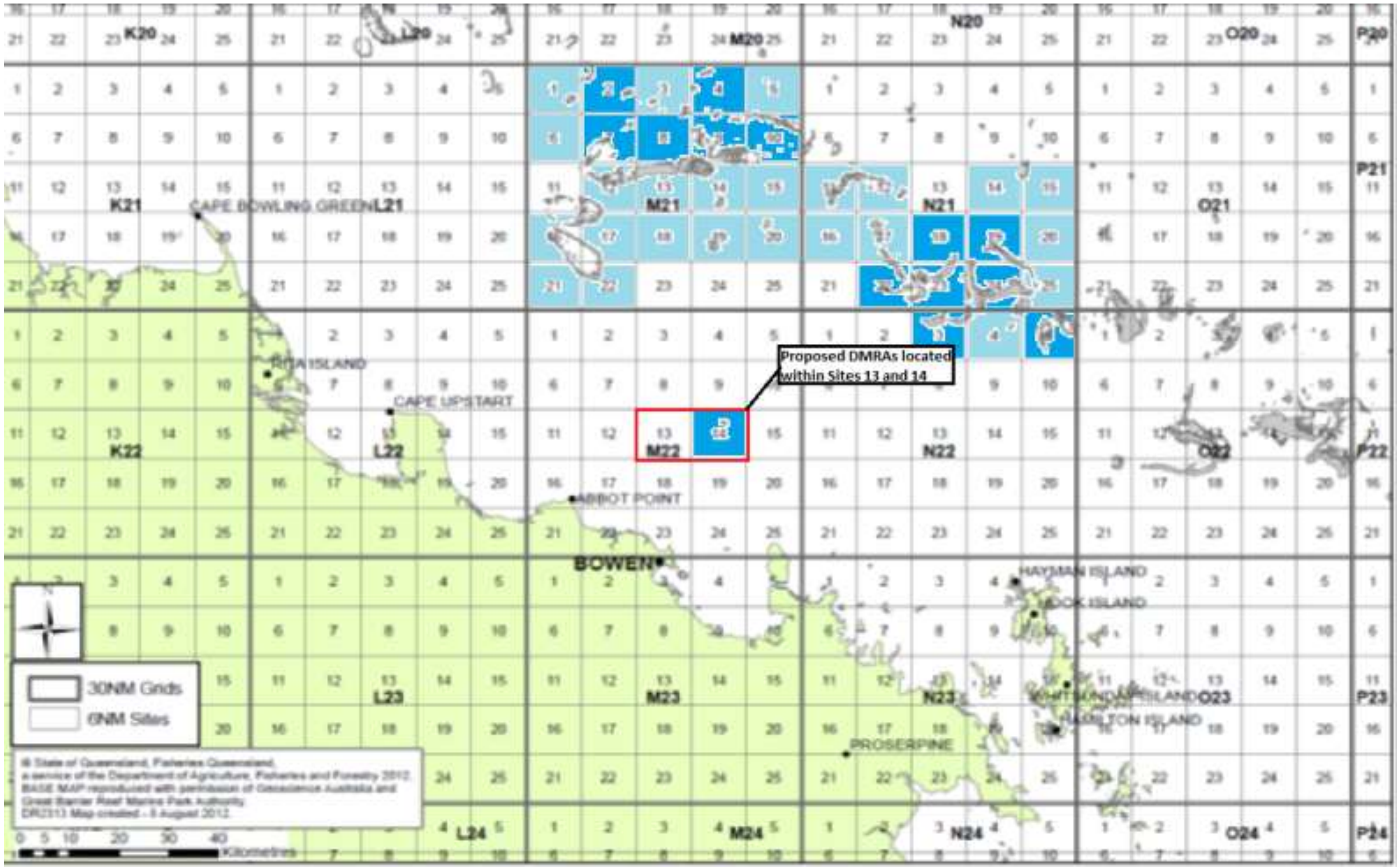


Figure 21 - Spatial Pattern of Line Fishing as Recorded at the scale of logbook sites. Dark blue are primary fishing locations while light blue are secondary fishing locations. There was no site information available for the line fishery in logbook grids L21 or L22.

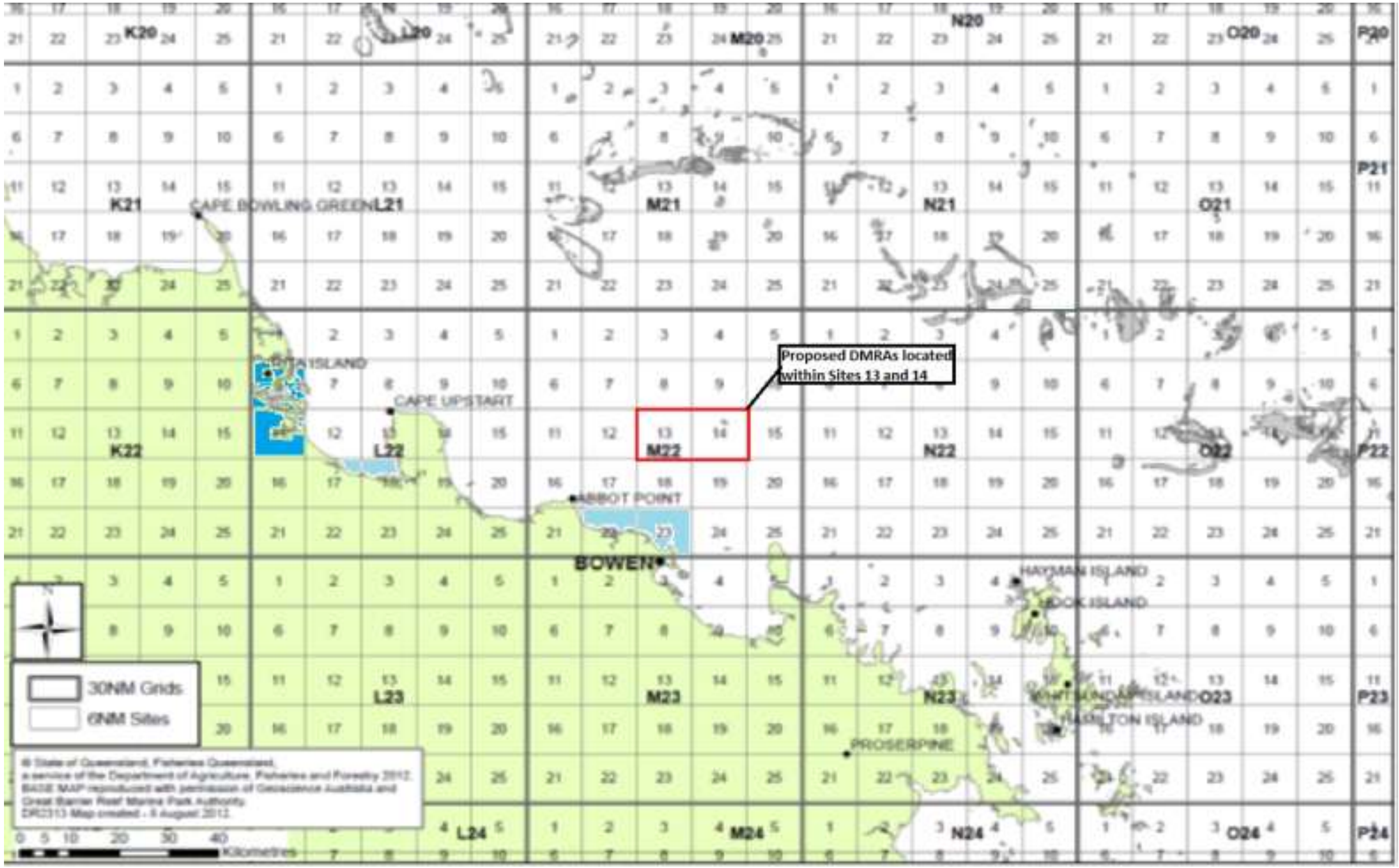


Figure 22 - Spatial Pattern of Net Fishing as Recorded at the scale of logbook sites. Dark blue are primary fishing locations while light blue are secondary fishing locations. There was no site information available for the net fishery in logbook grids L21, M21, N21 or N22.

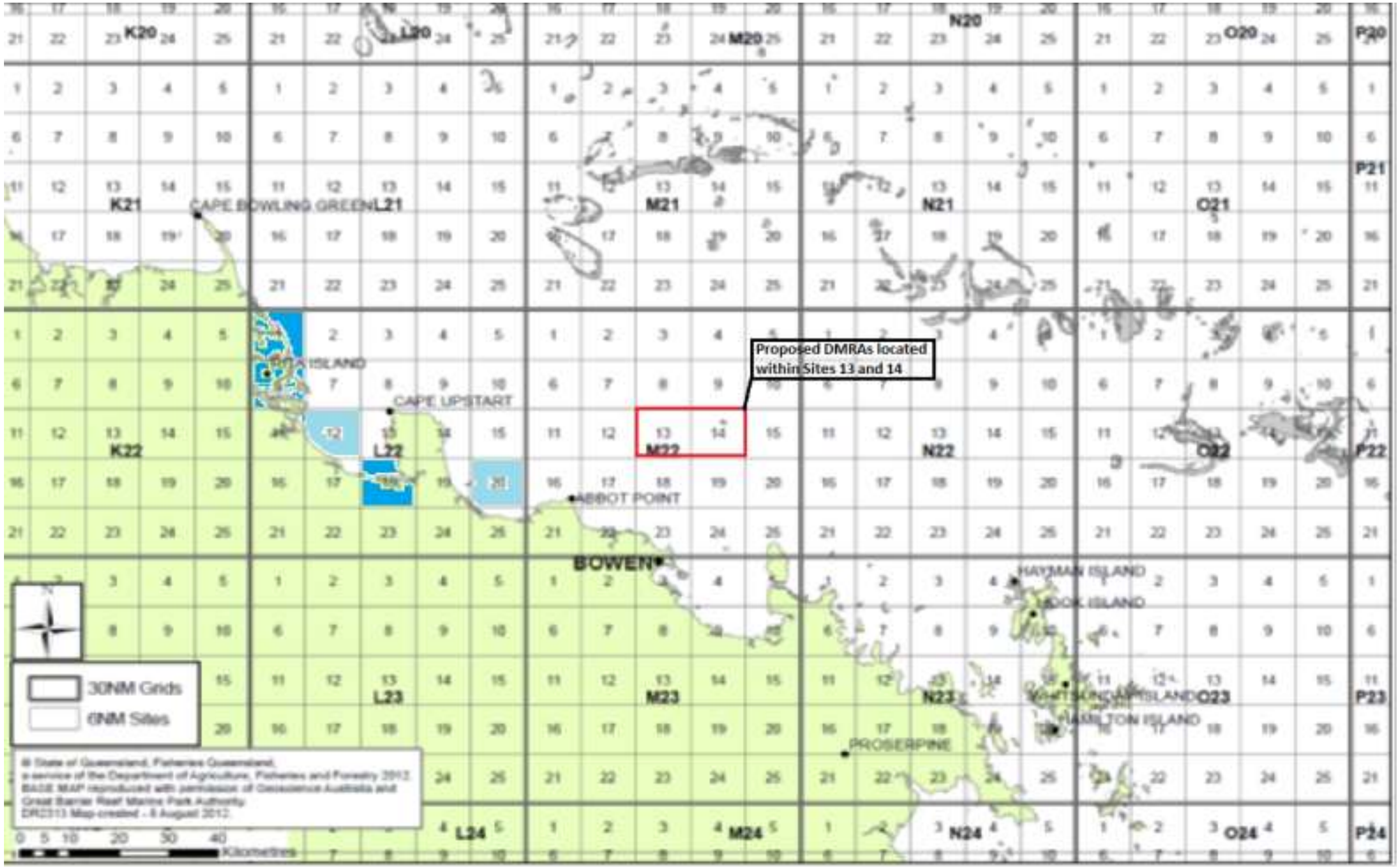


Figure 23 - Spatial Pattern of Crab Fishing as Recorded at the scale of logbook sites. Dark blue are primary fishing locations while light blue are secondary fishing locations. Site information was only available for Grid L22.

Additional Trawl Information – VMS and Fishery Independent Survey

For the tiger prawn and mud scallop components of the trawl fishery, aggregated VMS for the Bowen region is provided in DEEDI (2009). There is clear inter-annual variation evident in the catch of tiger prawns. For the tiger prawn fishery, effort in the years 2001 to 2006 is focussed in a very broad coastal band in the region investigated – from the Gloucester Island area to north of the Burdekin River. Further north, additional tiger prawn fishing grounds are found offshore of Cape Bowling Green (Figure 24 and Figure 25). The area accessed includes areas directly offshore of Abbot Point. Examination of the effort associated with tiger prawns between 2005 and 2007 identified that the area north of Upstart Bay was the focal area of fishing effort, together with much further north offshore of Cape Bowling Green. In the period 2005 and 2007, very little effort associated with tiger prawns was recorded in the area offshore of Abbot Point. Subsequent to 2007, commercial trawl fishers have reported anecdotally high catches of tiger prawns in the Abbot Point region, and a review of individual logbook history generally supports the anecdotal reports.

VMS data identifies that in 2001 and 2002 effort associated with mud scallops occurred in a coastal band much narrower than that associated with tiger prawns and also restricted to between Gloucester Island and Cape Upstart, including offshore of Abbot Point (Figure 24). Later VMS data for the period 2003 to 2007 identifies that the effort associated with the mud scallop fishery is focussed offshore and to the south of Abbot Point (Figure 25). Like many bivalve species including harvested species, the populations of mud scallops exhibit significant annual variations. They are considered to range in depth from 10 to 80m (Poutiers, 1998) and the limited available information in Queensland suggests peak abundances in waters 20 to 40m (Watson et al., 1990). Fisheries independent survey work undertaken by BMT WBM (2012) provides high resolution information on the distribution of mud scallops in the Abbot Point region (Figure 26). The focus of fishing effort associated with mud scallops will correlate strongly with the distribution of the species and shows a distribution similar to that shown in Figure 26.

DEEDI (2009) assessed logbook data with a focus on examining changes in catch and effort to determine whether regional declines were evident for both tiger prawns and mud scallops and combined this information with fisheries independent trawl surveys using otter trawl gear. For tiger prawns, the report concluded that decline in effort off Bowen is due to a reduction in the number of boats in the fleet, generally lower CPUE off Bowen compared with Townsville and further north, increasing fuel costs and low prawn prices resulting in the remaining fleet focussing on areas of the coast that have higher catch rates. The area between Cape Upstart an Gloucester Island was identified as having a low catch per unit effort (CPUE). For mud scallops, catch rates were considered to be “reasonable” at many sites between Abbot Point and Edgecumbe Bay.

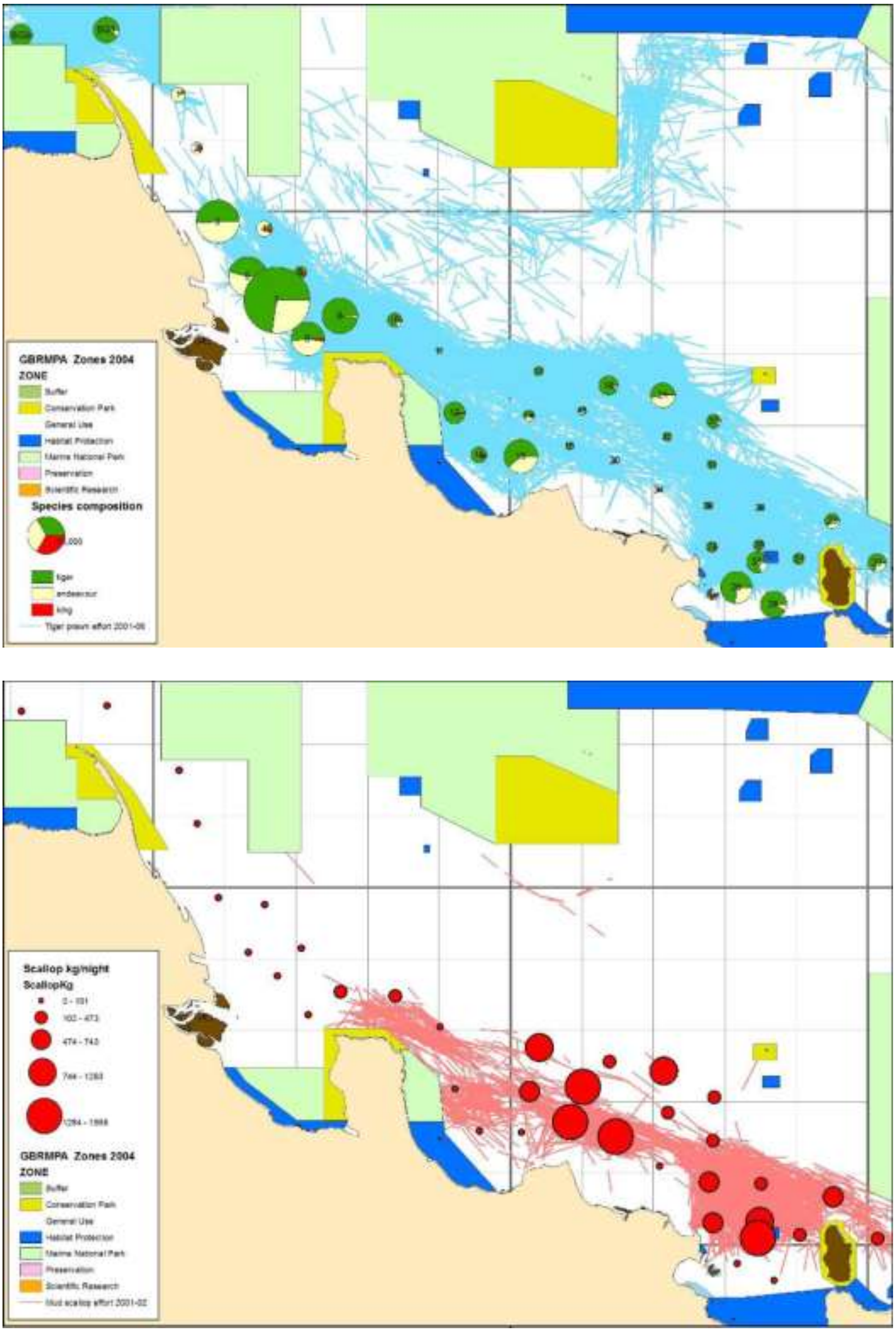


Figure 24 Distribution of trawl fishing effort from vms data for effort associated with tiger prawn catches between 2001 and 06 (top) and mud scallop catches in 2001 and 2002 (bottom) (From DEEDI, 2008).

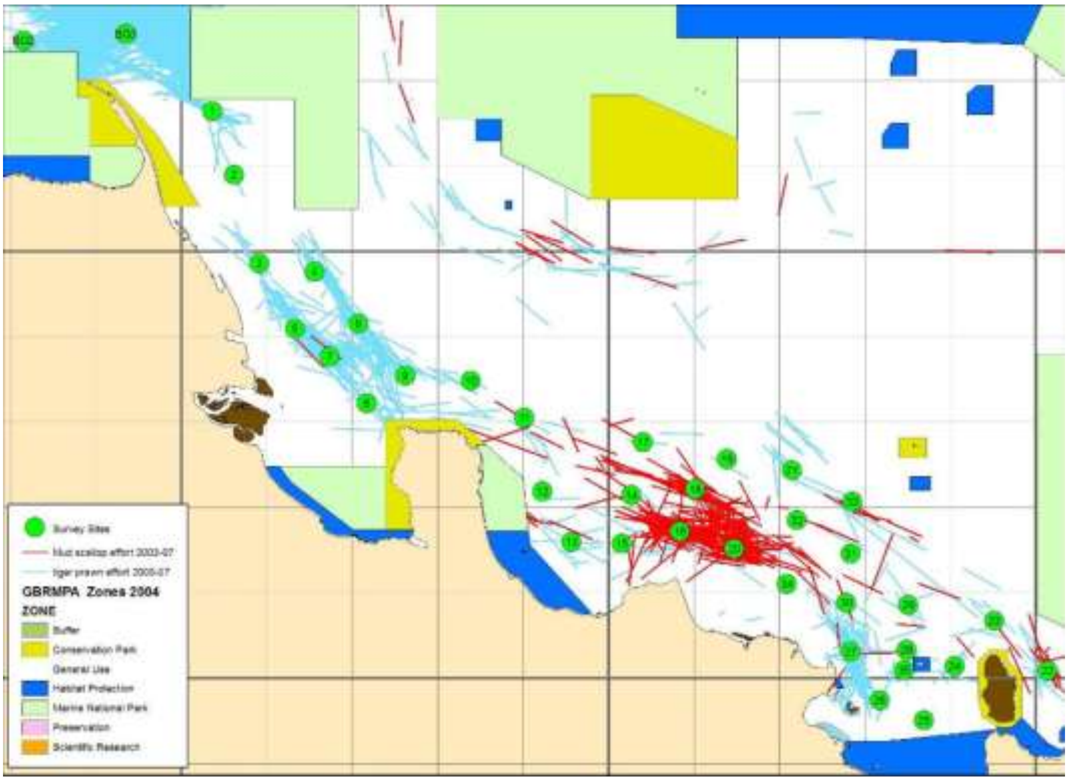


Figure 25 Distribution of trawl fishing effort from vms data for effort associated with tiger prawn catches between 2005 and 2007 (blue lines) and Mud scallop catches between 2003 and 2007 (red Lines) (From DEEDI, 2008).

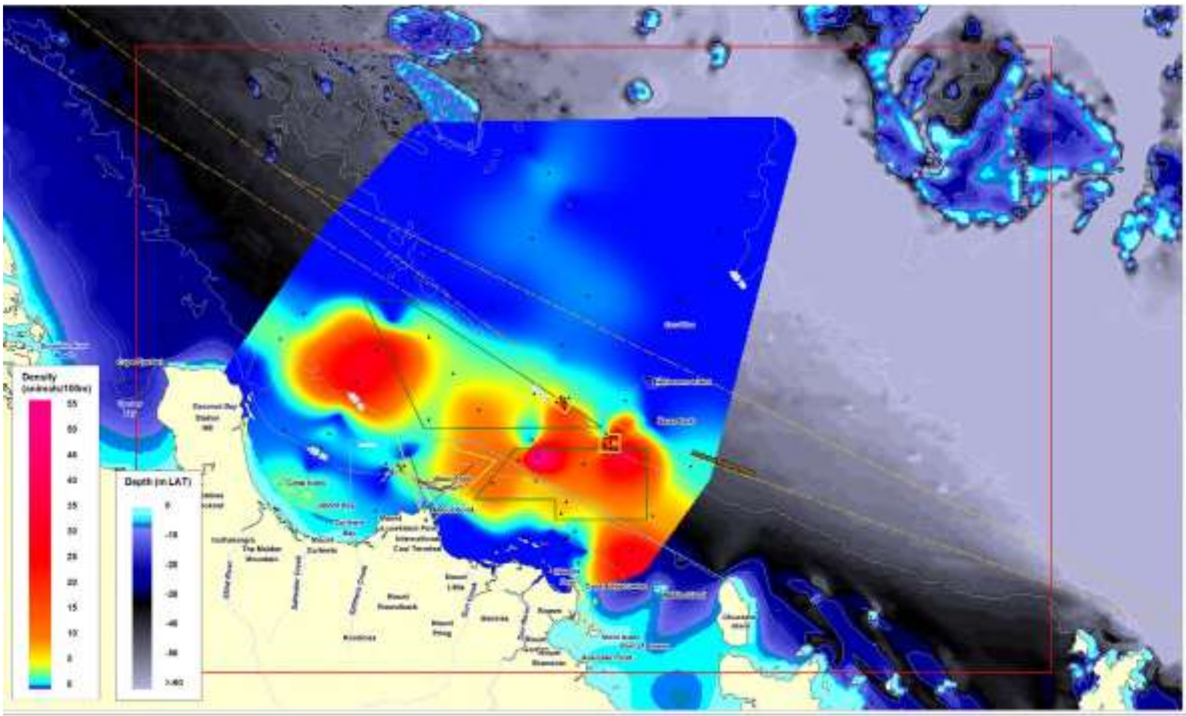


Figure 26 The distribution of mud scallops in the Abbot Point Region as identified in fisheries independent survey work undertaken by BMT WBM (2012)

Appendix Three: Port Infrastructure as Fisheries Habitat

Three-dimensional structures that provide habitat are utilised by structure associated fish species. This is the rationale behind the use of artificial reefs for various purposes including fisheries enhancement. Port infrastructure itself (e.g. rockwalls, trestles, pylons etc.) provides habitat for fish and invertebrate species, although the exact nature of the assemblages will be highly variable and influenced by a number of different factors and scale (Glasby, 1999; Chapman and Bulleri, 2003; Bulleri et al., 2005). Port infrastructure can provide novel habitat for an array of species; however the structure of this assemblage can differ from natural rocky areas. Whether this difference is a positive or a negative impact depends on context and the overall environmental values being considered.

In terms of direct fisheries benefits from the habitat created by port infrastructure, the areas are generally not able to be physically accessed by commercial fishing due to the nature of the habitat itself which is not compatible with the main commercial fishing apparatus (nets and trawls). Further, for safety and security reasons there are typically exclusion zones that prevent access by commercial and recreational fishers defined under the *Transport Infrastructure Act 1994* (Qld), *Transport Operations (Marine Safety) Act 1994* (Qld) and *Maritime Transport Security Act 2003* (Qld). The exact nature of the exclusion zone can vary but in the case of Abbot Point, this exclusion zone normally comprises the designated port boundary. Overall, port infrastructure does not provide a direct fisheries benefit unless the area can be accessed by fishers. The port infrastructure at Abbot Point is inaccessible to commercial and recreational fishers from land. Concerns were raised by commercial fishers that port infrastructure does attract fish to which they cannot gain access to for harvesting.

There is ongoing scientific debate as to whether artificial substrata simply attract and aggregate fish and benthic invertebrates to an area, or whether they increase the productivity of an area (Pickering and Whitmarsh, 1997). The scientific focus has been on the relationship between attraction and productivity in the context of dedicated artificial reefs for fisheries enhancement, but the basic concept is equally as relevant for port infrastructure. Wilson *et al*. (2001) suggest that both attraction and production are likely to interact and that much of the question relates to the role of larval supply and density-dependence driving fish dynamics in general. Osenburg (2002) also considers that attraction and production are not mutually exclusive and can be considered as extremes along a gradient.

Given the lack of fishing effort in close proximity to the port development, port infrastructure can function as a de-facto no-take marine protected area. Spillover of adult and juvenile fish (and larvae) from no-take areas can provide a fisheries benefit, however the nature and scale of these benefits are difficult to predict. There has been considerable empirical research examining the spillover effect from no-take marine protected areas, particularly spillover of adult/juvenile fish. Overall the body of research shows that spillover is highly variable and dependent on a range of factors including adjacent habitat types, the movement patterns of animals, body size, life history stages, hydrodynamic factors, larval ecology, and the nature of the fisheries management regime including the overall pattern of fishing effort (McClanahan and Mangi, 2000; Tewfik and Bene, 2003; Murawski *et al*., 2005; Stelzenmuller *et al*., 2007; Cudney-Bruno *et al*., 2009; Grüss *et al*., 2011).