Annual status report
Mud Crab Fishery

November 2006

Queensland Government
Department of **Primary Industries and Fisheries**

PR06–2561

The Department of Primary Industries and Fisheries (DPI&F) seeks to maximise the economic potential of Queensland's primary industries on a sustainable basis.

Introduction

Mud crabs (*Scylla* spp.) are found in tropical and subtropical areas in association with mangrove-lined estuaries. Fast growth rates, early maturity, wide distribution and high fecundity are all biological characteristics that contribute to the resilience of mud crabs to harvest. Mud crabs are highly desired in both the commercial and recreational sectors. Queensland is unique among Australian states in protecting all female crabs and only allowing males to be harvested.

The Mud Crab Fishery targets the common mud crab, *Scylla serrata*. A second species, *S. olivacea*, is also found in the fishery, but it is smaller, has restricted habitat requirements and is taken in negligible quantities. All references to mud crabs in this report refer to *S. serrata*.

This report covers the 2005 calendar year.

Fishery profile

Total harvest from all sectors in 2005: estimated at approximately 1765–1965 t

Commercial harvest in 2005: approximately 952 t

Recreational harvest in 2002: approximately 800–1000 t

Indigenous harvest in 2000: approximately 12 t

Charter harvest in 2005: approximately 1 t

Commercial Gross Value of Production (GVP): $9.9 million

Number of licences: 858 (including 77 held by the Commonwealth Department of the Environment and Heritage (DEH) under the Great Barrier Reef Marine Park (GBRMP) Structural Adjustment Package) as of August 2006

Commercial boats accessing the fishery: approximately 425

Fishery season: January–December

Description of the fishery

Fishing methods

Commercial operators are permitted to use collapsible traps[1] (Figure 1) and crab pots[2] (Figure 2). In addition to pots and traps, recreational fishers are also permitted to use dillies.[3]

Size and shape of pots vary, but most are cylindrical and have two entrance funnels. Mud crabs are enticed into the pot or trap by bait attached to the inside of the apparatus.

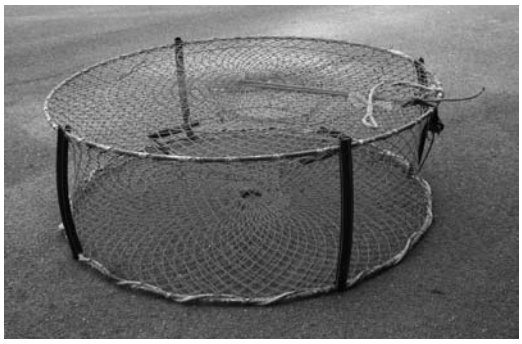

Figure 1: Collapsible manyana trap.

[1]Under the Fisheries Regulation 1995, a collapsible trap is defined as 'a trap made of rigid material, with one or more collapsible sides'.

[2]Under the Fisheries Regulation 1995, a crab pot is defined as 'a fishing apparatus comprising a cage with a round opening top, or an elongated opening (parallel to the base) in the side'.

[3]Under the Fisheries Regulation 1995, a dilly is 'a fishing apparatus comprising a frame and a net that hangs below the frame's horizontal plane when the apparatus is in use'.

Pots and traps are set on the substrate, generally in shallow water estuarine or nearshore coastal areas. Apparatus are checked daily or on each rising tide and the pots or traps are hand-hauled to a dinghy or small boat, checked for mud crabs, rebaited and then reset.

Figure 2: Rigid crab pot.

Fishing area

The Mud Crab Fishery (Figure 3) comprises the following tidal waters:

- east of longitude 142˚31'49″ east
- north of latitude 10˚ south and between longitude 141˚20' east and longitude 142˚31'49″ east
- in the Gulf of Carpentaria between the 25 nautical mile line and the shore, south of latitude 10˚48' south.

This essentially covers all Queensland tidal waters.

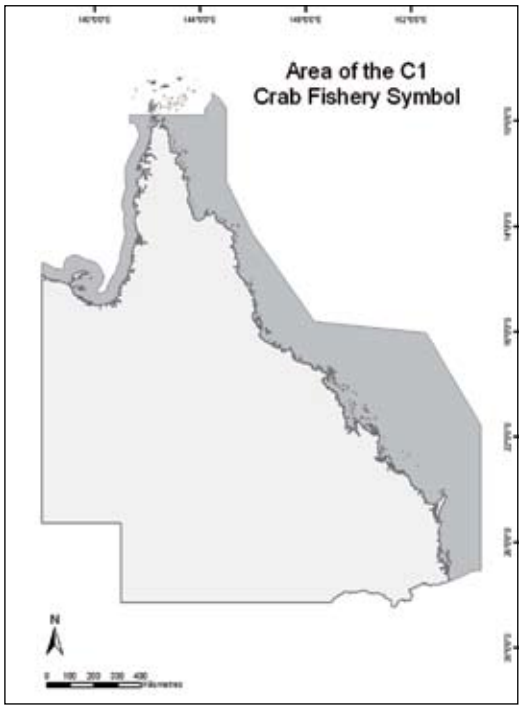

Figure 3: Boundary of the Mud Crab Fishery.

Main management methods used

The Department of Primary Industries and Fisheries (DPI&F), Queensland manages the Mud Crab Fishery in accordance with ecologically sustainable development principles. The Mud Crab Fishery is managed under the Queensland *Fisheries Act 1994* and in accordance with the Queensland Fisheries Regulation 1995. A range of input and output controls are in place to manage the harvest of mud crabs by commercial and recreational fishers, including:

- minimum legal size limit that applies to both commercial and recreational fishers (150 mm carapace width)
- a prohibition on taking female crabs
- apparatus restrictions (50 pots per licence for the commercial fishery and four pots per person for the recreational fishery)
- limited entry to the commercial fishery (C1 endorsement required)
- prescriptions on the size of float that may be used
- closures (Eurimbula Creek and all adjoining waterways are closed to the harvesting of mud crabs, along with closures enforced through marine park zoning established under the Commonwealth *Great Barrier Reef Marine Park Act 1975* and the *Queensland Marine Parks Act 1982*).

Approximate allocation between sectors

Information reported to DPI&F through commercial logbooks and recreational fisher diaries indicates that mud crab resources are shared almost equally between the commercial and recreational sectors, with the recreational sector harvesting slightly less than the commercial sector. Compared to the recreational and commercial sectors, the annual harvest of mud crabs by the Indigenous and charter sectors is considered very low (12 t and 1 t respectively).

Fishery accreditation under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The Mud Crab Fishery was granted a Wildlife Trade Operation approval on 13 August 2004 under Part 13A of the Australian Government EPBC Act. This accreditation acknowledges that the Mud Crab Fishery is being managed in an ecologically sustainable manner and allows the export of catch. The approval expires on 22 September 2007.

Catch statistics

Commercial

Queensland mud crab fishers are required to report commercial catch in a daily logbook, which is maintained by DPI&F. Total reported commercial catch for Queensland has decreased from 1166 t in 2004 to 952 t in 2005 (Figure 4, Table 1). Catch per unit effort (CPUE)—based on kilogram per boat day—remained fairly stable during 2000–05, ranging between approximately 23–26 kg/day (Figure 4, Table 1).

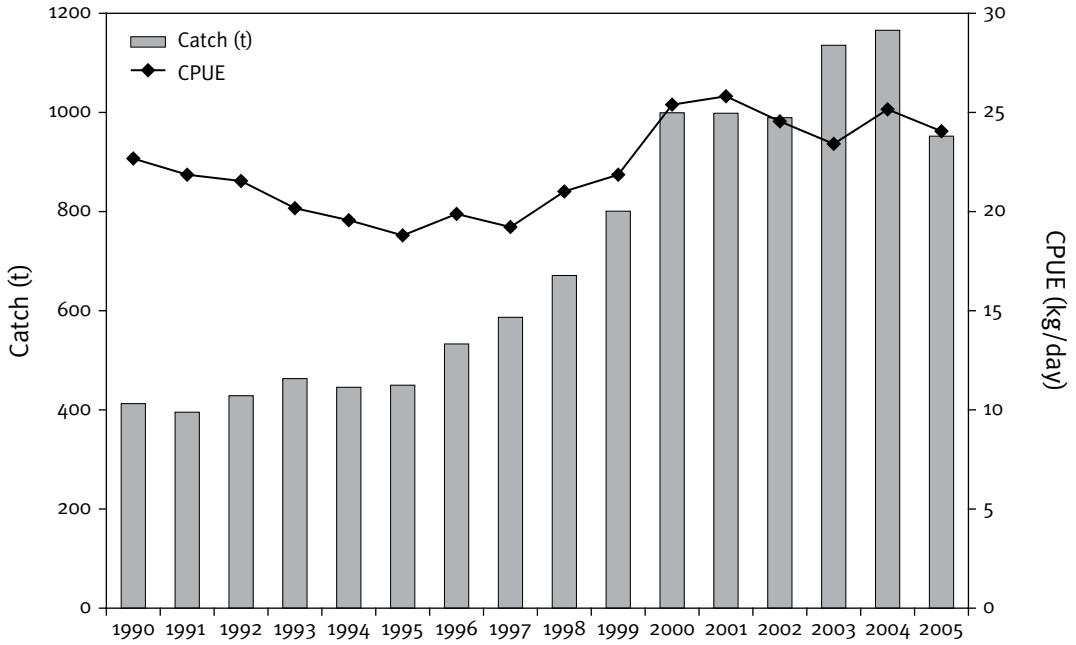

Figure 4: Reported commercial catch and effort in the Mud Crab Fishery, 1990–2005.

Table 1: Commercial details for the Mud Crab Fishery, 2000–05.

	2000	2001	2002	2003	2004	2005
Catch (t)	998	1 000	992	1 139	1 166	952
Days fished	39 856	38 960	40 378	48 817	46 792	39 861
Boats	463	487	480	501	498	424
CPUE kg/day	25	26	25	23	25	24
Days/boat	84	80	84	97	94	94
Catch (t)/boat	2.14	2.06	2.07	2.28	2.34	2.24
GVP $million	10.4	10.5	10.4	11.9	12.2	9.9

Rather than a declining catch rate, the decrease in the commercial mud crab harvest in 2005 is more likely a reflection of the decrease in commercial fishing days; from approximately 45 000 days in 2004 to approximately 38 000 in 2005 (Table 1). It is also a reflection of the lower number of boats accessing the fishery following the licence buyout under the GBRMP Structural Adjustment Package (Figure 5). DEH currently holds 77 C1 crab fishing symbols.

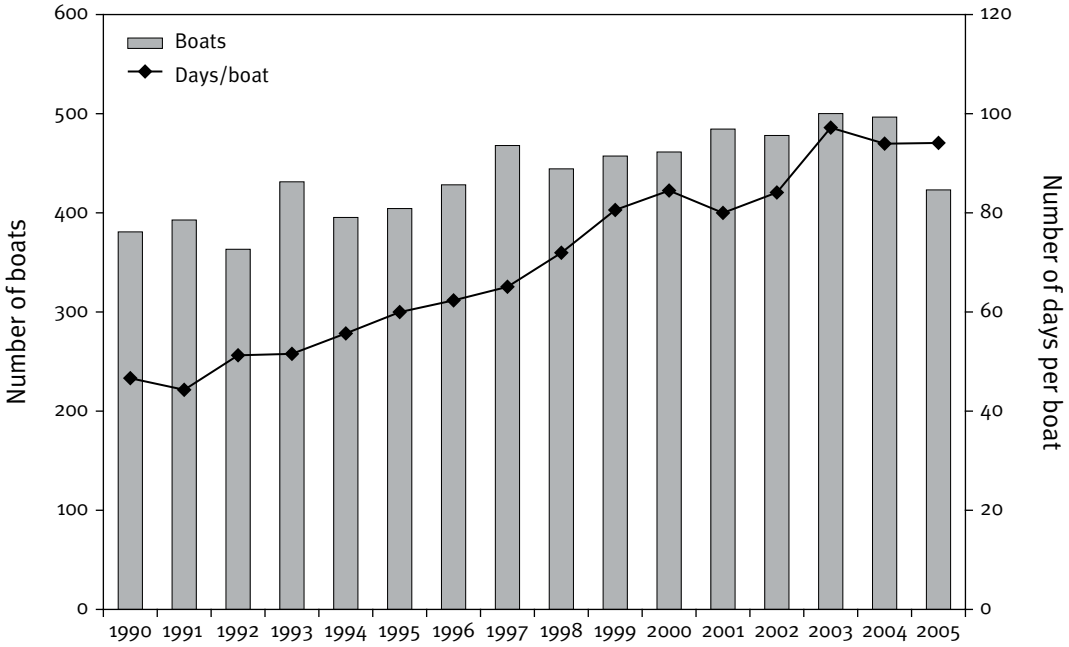

Figure 5: Commercial effort in the Mud Crab Fishery.

Regionally, the commercial sector of the Mud Crab Fishery is concentrated in a number of hot spots, including Moreton Bay, Gladstone, Princess Charlotte Bay, Weipa and Karumba.

Southern Queensland

The southern Queensland region is defined as the intertidal waters from Baffle Creek to the New South Wales border. Catch in the southern region shows a general increasing trend since the logbook program was introduced in 1988, although catch decreased to 229 t in 2005, down from 291 t in the preceding year (Figure 6). This reduction is in line with the observed overall reduction in mud crab catch for 2005. Similar to the total catch trends, CPUE has shown a steady increasing trend since 2000, with a slight decrease in 2005 (Figure 6).

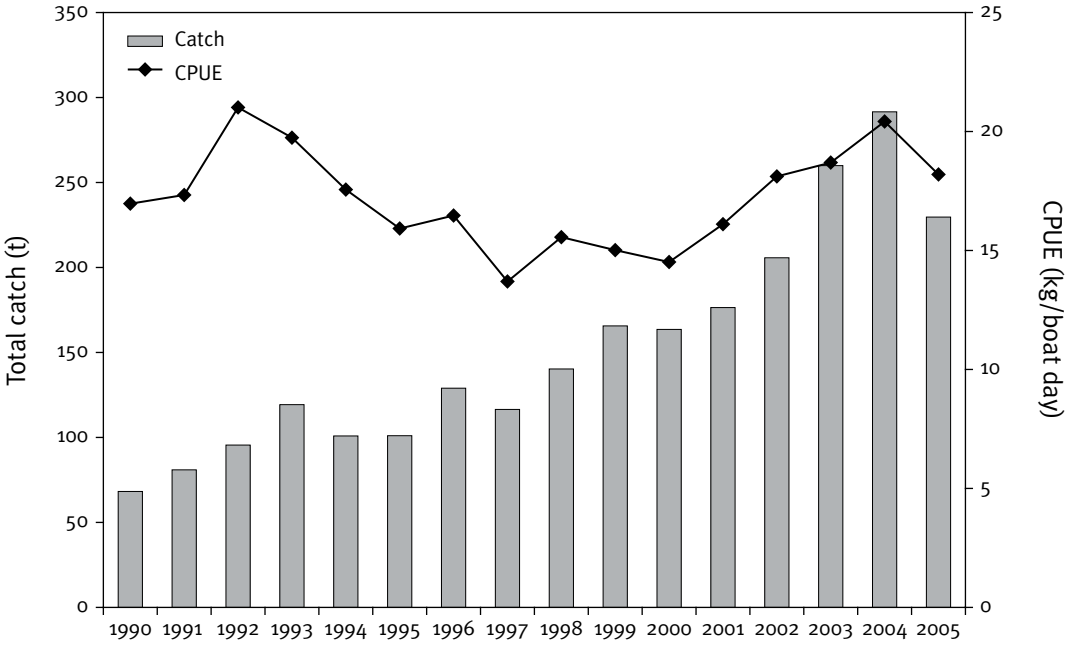

Figure 6: Reported catch and CPUE in the southern Queensland region, 1990–2005.

Great Barrier Reef region

The Great Barrier Reef (GBR) area is defined as intertidal waters from Cape York to Baffle Creek. Following a considerable increase in catch in the GBR region in the late 1990s, catch remained relatively stable during 2000–04. However, this area experienced the greatest reduction in reported catch for the 2005 season, down to 534 t from 736 t in 2004 (Figure 7). It is likely that a large proportion of the reduction in reported catch of mud crab in the GBR region is related to the reduction in effort associated with the licence buyout under the GBRMP Structural Adjustment Package. CPUE has remained relatively stable since 2002 (Figure 7).

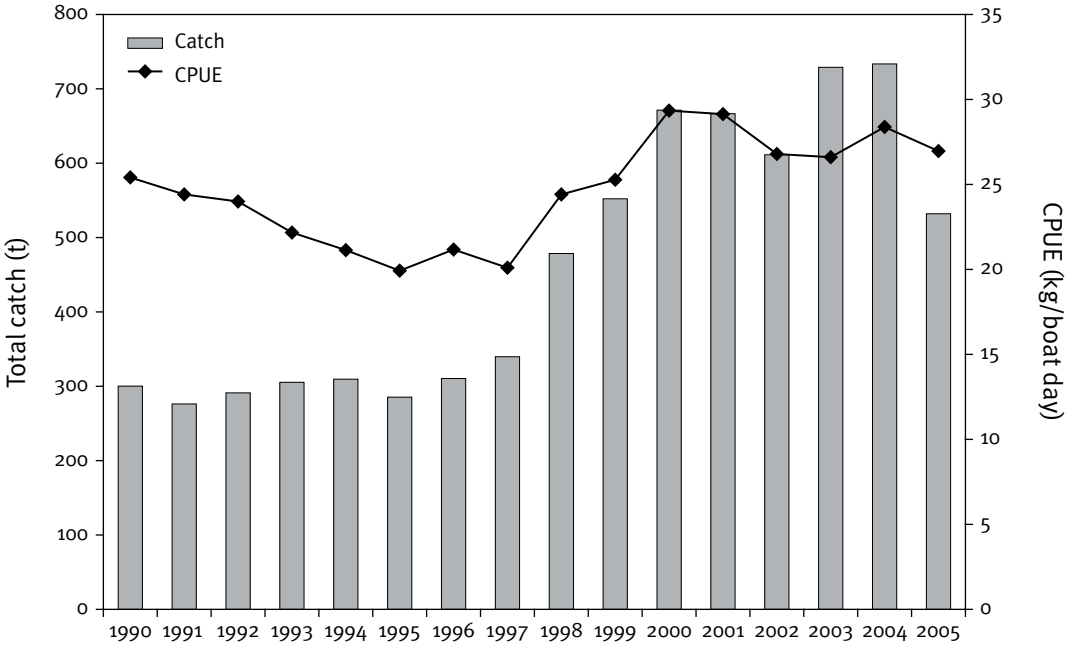

Figure 7: Reported catch and CPUE in the Great Barrier Reef region, 1990–2005.

Gulf of Carpentaria region

The Gulf of Carpentaria region is defined as intertidal waters from the tip of the Cape to the Northern Territory border. Although the area has historically provided only a small amount of product compared to the rest of the state, it is the only one of the three regions to experience a greater reported catch in 2005, increasing to 157 t from 148 t in 2004 (Figure 8). The decline in CPUE observed during 2002–03 in the Gulf region is believed to be associated with one of the worst droughts experienced in the region from 2001 to 2003. The observed increase in CPUE during 2004–05 (Figure 8) suggests that mud crab stocks are healthy in the Gulf of Carpentaria.

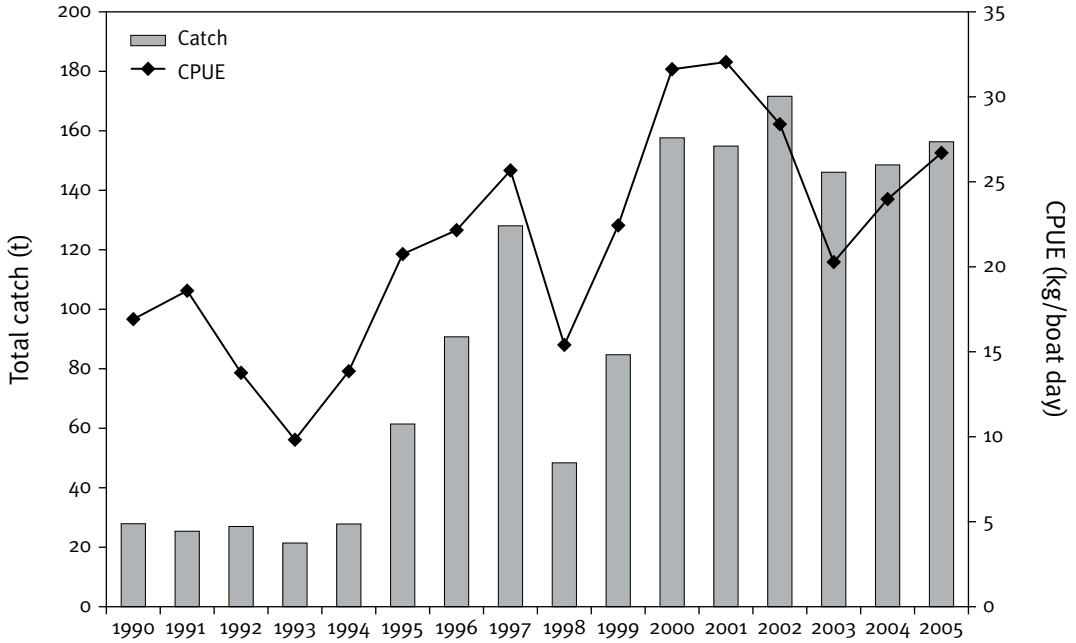

Figure 8: Reported catch and CPUE in the Gulf of Carpentaria region, 1990–2005.

Recreational

The 2002 Recreational Fisheries Information System (RFISH) diary survey indicates that approximately 870 000 mud crabs were harvested in that year and approximately 3 million mud crabs were released. These estimates equate to a recreational harvest of 800–1000 t. The 2001 National Recreational and Indigenous Fishing Survey (NRIFS)[4] indicated that Queensland recreational fishers take the largest proportion of the national mud crab catch (71%). NRIFS also found that pots and traps were the primary fishing method used by recreational fishers to harvest mud crabs.

Charter

The charter sector of the Mud Crab Fishery is the smallest component of the total annual crab harvest and only represents approximately 1% of the commercial catch. The total catch for 2005 has dropped since 2004, which was the greatest reported annual harvest of mud crabs in the charter sector (Table 2).

[4]Henry, GW and Lyle, JM 2003, *The National Recreational and Indigenous Fishing Survey*, FRDC Project No. 99/158, Australian Government Department of Agriculture, Fisheries and Forestry, Canberra, Australia.

Table 2: Charter and catch effort, 2000–05.

Year	Catch (kg)	Number of operators	Number of days fished
2000	717	10	447
2001	784	12	459
2002	1 482	15	563
2003	1 164	14	668
2004	1 537	19	611
2005	1 165	13	487

Indigenous

The Indigenous catch of mud crabs across northern Australia was estimated as part of the NRIFS. In 2001, an estimated 12 000 mud crabs were harvested by Indigenous fishers in north Queensland communities surveyed. These estimates equate to an Indigenous harvest of approximately 12 t. The main fishing methods used by Indigenous fishers were found to be hand (58%) and spear (27%) fishing.[5]

Spatial issues/trends

Historically, there have been differences in the catches and catch rates between the north and south of Queensland, mainly due to mangrove habitat availability and variation in the natural abundance of crabs.

On 1 July 2004, the Great Barrier Reef Marine Park Authority introduced a new zoning plan for the reef through the Representative Areas Program (RAP). The RAP increased the extent of closures to commercial fishing from 4% to 33%[6] in the GBR region. Despite the implementation of the RAP, the greatest proportion of effort in the Mud Crab Fishery is still expended in the GBR region (Figure 9).

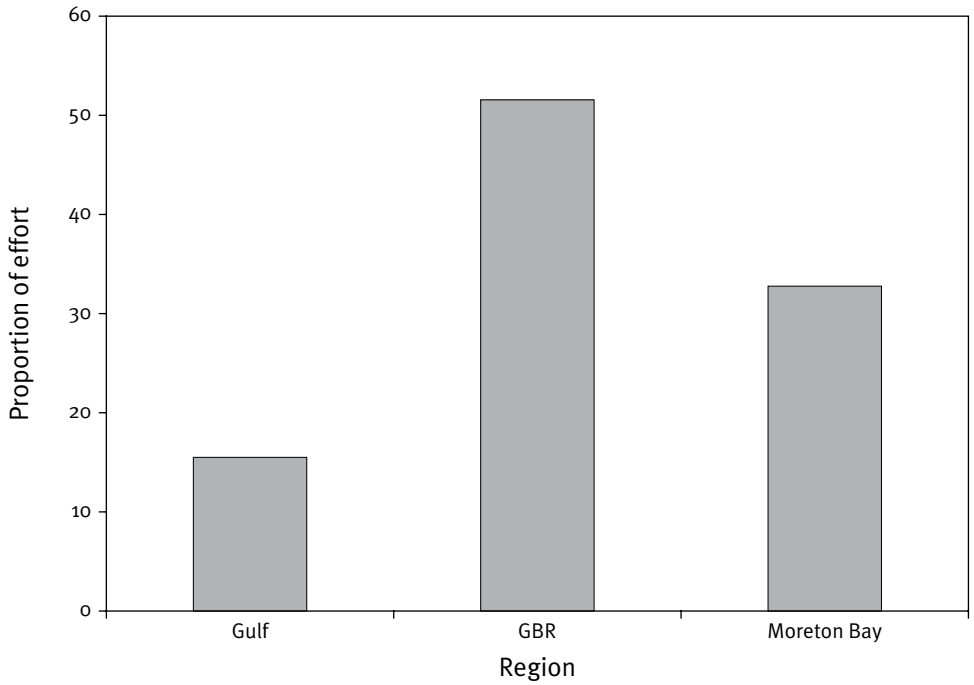

Figure 9: Distribution of effort in the Mud Crab Fishery for 2005.

[5]Ibid.

[6]Taylor-Moore, N 2006, *Great Barrier Grief: A Case Study of the Socio-Economic Impacts of the Representative Areas Program for the Great Barrier Reef Marine Park on the Queensland Seafood Industry*, Sharing the Fish Conference 2006, Perth, Australia.

Socio-economic characteristics and trends

Prices for mud crabs fluctuate between $10/kg to $12/kg, depending on the supply of the product, the time of the year and the product form. There have been no significant upward or downward trends in prices over the last four years[7] beyond increases associated with general inflation.

Figure 10 indicates that incomes for the majority of the mud crab fleet in 2005 were less than $60 000. Approximately 20% of the fleet make less than $2000 a year from the Mud Crab Fishery, suggesting that many fishers operating in the Mud Crab Fishery are endorsed for several fisheries or fishing only accounts for part of their income.

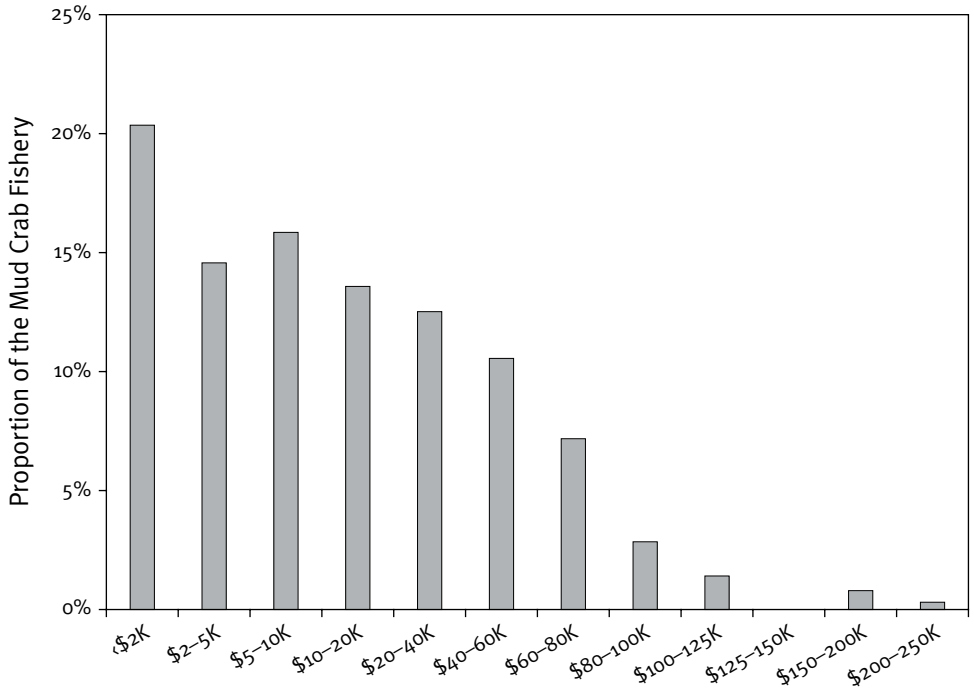

Figure 10: Income distribution in the Mud Crab Fishery (pot) in 2005.

Figure 11 displays the contribution of mud crab harvest to the total fishing income of all licence holders active in the Mud Crab Fishery. Just under half of all licence holders are making more than 95% of their fishing annual income solely from the Mud Crab Fishery. A further 30% of licence holders are also strongly dedicated to the Mud Crab Fishery, deriving between 40–60% of their income from the fishery.

[7]Based on prices obtained from the Sydney Fish Markets (www.sydneyfishmarket.com.au).

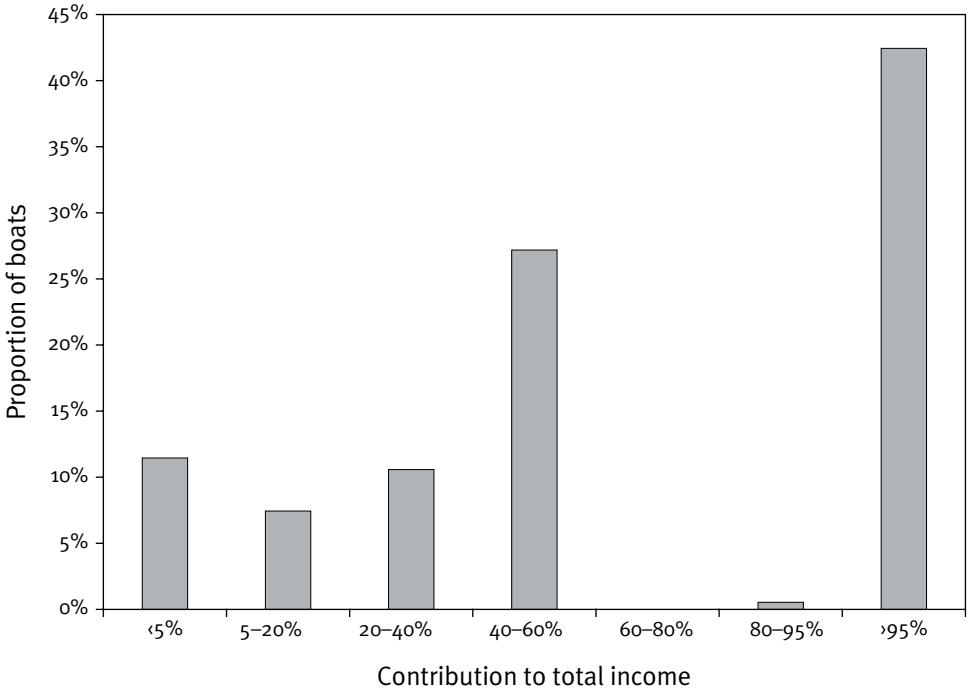

Figure 11: Contribution of mud crab harvest to annual income in 2005.

Fishery performance

Appraisal of fishery in regard to sustainability

Reported logbook data suggests that, although the total catch has decreased, CPUE has remained fairly stable. There were fewer boats operating in the fishery in 2005 and the average number of days fished per boat per year has remained relatively stable (see Catch statistics, Table 1). RFISH surveys conducted in 1999 and 2002 indicate that recreational harvest decreased slightly over this period, but not to an extent that caused concern.

The prohibition on taking female and undersized crabs in Queensland is a precautionary approach to management that protects the spawning capacity of the stock from increases in effort. The Queensland fishery is managed in a more precautionary and sustainable manner than any other Australian mud crab fishery. Despite this, in 2006 an ecological risk assessment (ERA) was undertaken for the fishery, and subsequently a performance measurement system (PMS) developed, to ensure the fishery continues to be managed in an ecologically sustainable manner. The outcomes of the ERA and the PMS will be included in the 2007 annual status report.

Progress in implementing DEH recommendations

Recommendation	Progress
DPI&F to inform DEH of any intended amendments to the management arrangements that may affect sustainability of the target species or negatively impact on bycatch, protected species or the ecosystem.	*Ongoing* Proposal to prescribe a maximum size opening in crab apparatus to minimise interactions with juvenile sea turtles.
DPI&F to continue to actively engage with the Northern Territory and New South Wales in pursuit of collaborative or complementary management and research of shared mud crab stocks.	*Ongoing* DPI&F meets with the New South Wales Department of Primary Industries on an annual basis to pursue opportunities for collaborative or complementary management and research of shared species.
As part of the management planning process, DPI&F to develop fishery-specific objectives linked to performance indicators and performance measures for target, bycatch, protected species and impacts on the ecosystem.	*In progress* PMS will be finalised in late 2006 and will be applied to the fishery thereafter.
DPI&F to monitor the status of the fishery in relation to the performance measures once developed. Within three months of becoming aware of a performance measure not being met, DPI&F to finalise a clear timetable for the implementation of appropriate management responses.	*Ongoing* Performance measures will be regularly assessed and reported against in the timeframes specified within the PMS itself.
DPI&F to develop a compliance strategy for the Mud Crab Fishery. The strategy will explicitly address the following issues and provide for the periodic review of the effectiveness of the strategy: • catch and effort data validation • compliance with commercial pot number restrictions • compliance with restrictions on the take of female and undersize crabs • the potential for Queensland harvested female and undersize crabs to be laundered in other jurisdictions with different management measures • the appropriateness and effectiveness of existing recreational bag and size limits • the 'black market' sale of recreationally caught crabs • the occurrence of crab pot 'drying'/stranding.	*In progress* The Queensland Boating and Fishing Patrol (QBFP) are coordinating compliance risk assessments and strategy development across all Queensland fisheries. A compliance risk assessment for the Mud Crab Fishery is scheduled for early 2007.
From 2005, DPI&F to report publicly on the status of the fishery on an annual basis, including explicit reporting against each performance measure once developed.	*Ongoing* This annual status report is the second to be completed for the Queensland Mud Crab Fishery.
DPI&F to develop a system to ensure that catch data collected in compulsory logbooks is validated on an ongoing basis and to investigate methods for documenting and validating effort in the fishery.	*Ongoing* DPI&F's logbook validation strategy encompasses a range of activities to be undertaken across Queensland's fisheries. Validation of the Mud Crab Fishery logbooks is scheduled for 2007.
DPI&F to develop and implement separate management arrangements for the Gulf of Carpentaria mud crab stock by 30 June 2005.	*In progress* An allocation method using catch history is currently being considered by DPI&F. Allocation is subject to industry and community consultation, with consultation subject to government approval and other management priorities.

Recommendation	Progress
DPI&F to develop a strategy to remove or substantially reduce the amount of latent effort in the fishery, which includes clearly defined management actions linked to specific timeframes, by 31 December 2004. DPI&F to implement the strategy prior to the introduction of the management plan.	*In progress* The new licensing and fees policy introduced as of 1 July 2006 is anticipated to result in a reduction in latent effort. It is expected that the policy will considerably reduce the retention of unused licences.
As part of the management planning process, DPI&F to review existing management measures designed to control mud crab harvest by recreational fishers to ensure that these measures are appropriate, adequately constrain recreational effort and minimise impacts on bycatch and protected species. Should the review indicate that existing measures are not appropriate, DPI&F will develop new measures in a timely manner.	*Not started* It is intended that this recommendation will be progressed through Crab Management Advisory Committee (CrabMAC) proceedings.
DPI&F to identify fishery areas at risk of overfishing within two years. DPI&F to undertake independent surveys in these areas with a view to detecting any significant changes in crab abundance and take appropriate management action to address resource sustainability concerns.	*Ongoing* DPI&F commissioned a review of the Mud Crab Fishery monitoring program in 2005, which identified high effort areas in the fishery. A revised monitoring strategy to better meet resource assessment needs will be developed for implementation in 2007.
DPI&F to develop a system for the collection and monitoring of information on discarded undersize female mud crabs and key bycatch species sufficient to enable identification of long-term trends in bycatch and discards. In the event that catch levels of any bycatch species or discards change, DPI&F will investigate suitable management responses.	*Complete* The continuation of the mud crab Long Term Monitoring Program (LTMP), implemented in 1999, meets this recommendation (see Monitoring programs and results).
Within one year, to support the implementation of the Species of Conservation Interest logbooks, DPI&F to ensure that an education program for fishers, both recreational and commercial, is developed and implemented, to promote the importance of protected species protection and accurate incident reporting.	*Complete* A comprehensive education program was released to commercial and recreational fishers in September 2005. This information is available through DPI&F on 13 25 23.
DPI&F to conduct a risk assessment to determine the likely impact of protected species interactions in the fishery (including the recreational sector) within two years. In the event that a species is found to be at risk, DPI&F will investigate measures to mitigate interaction with the species, to ensure that any risks to protected species can be minimised.	*In progress* An ERA of the Mud Crab Fishery was held in May 2006. Outcomes were presented to CrabMAC for review in July 2006. Once finalised in late 2006, the outcomes from the ERA will be incorporated into ongoing management planning processes.
DPI&F investigate the effects of ghost fishing by lost or discarded mud crab apparatus within two years.	*In progress* This issue was specifically addressed as part of the ERA process. All impacts associated with ghost fishing in the Mud Crab Fishery were assessed as either low (2) or negligible (1). Accordingly, no immediate management action is required.

Management performance

DPI&F held a workshop in early April 2006 to develop performance measures for the Mud Crab Fishery. The PMS is to be finalised in late 2006 and will be applied to the fishery thereafter.

Resource concerns

As a result of the ecological assessment of the fisheries undertaken by DEH in 2004, the amount of latent effort in the blue swimmer and mud crab fisheries was identified as a risk to the long-term sustainability of Queensland's crab stocks. DPI&F considers that the latent effort in the fishery poses minimal risk to the sustainability of mud crabs given the precautionary minimum legal size limit in place and the prohibition on taking females—which in theory effectively caps the proportion of the population that can be harvested to approximately 25%.[8] Despite this, DPI&F has advised DEH that it intends to monitor the effects of the new licensing and fee arrangements, which were implemented on 1 July 2006, to determine if C1 licence holders surrender previously unused fishery symbols. If this does not result in the removal of latent effort, alternative approaches will be investigated. It should be noted that the GBRMP Structural Adjustment Package removed 77 crab licences from the fishery.

There are concerns that the actual numbers of turtle interactions occurring in the Mud Crab Fishery are being underreported. In 2006, DPI&F conducted an ERA for the Mud Crab Fishery, which specifically addressed the issue of protected species interactions with crab fishing gear. Once finalised in late 2006, the outcomes from the ERA will be incorporated into ongoing management planning processes and reported in the annual status report. The DPI&F CrabMAC is investigating alternative gear types, for example modified entrance tunnels on crab pots, to reduce the likelihood of turtle mortality related to interactions with crab fishing gear.

DEH has noted concern regarding recreational harvest on a species that is already affected by pressures from coastal population growth. DPI&F acknowledge that expanding coastal populations may lead to increased recreational fishing pressure on mud crabs, and monitors recreational fishing participation on a regular basis. However, the precautionary management arrangements that protect all female and undersize male mud crabs from harvest ensure that approximately 75% of the population is protected.[9]

There is also concern regarding potential loss of mangrove habitat, damage to burrows and the potential impact this may have on mud crab stocks, particularly as Queensland coastal areas continue to be developed to meet the demands of human population growth. DPI&F has undertaken comprehensive baseline coastal habitat mapping to facilitate long-term monitoring of changes in these habitat areas.[10]

Ecosystem

Non-retained species/bycatch

LTMP has collected information on size, sex ratio and surveyed catch rates of mud crabs since 1999, and has more recently (since 2002) incorporated the collection of information relating to other bycatch species (see Monitoring programs and results). The available fishery independent and dependent data suggests that discards associated with the fishery are predominantly undersize or female mud crabs, with other species only occasionally present in pots.[11] Survival of released crabs is believed to be high.[12]

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[8] M Doohan (Department of Primary Industries and Fisheries), discussion, October 2006.

[9] M Doohan (Department of Primary Industries and Fisheries), discussion, October 2006.

[10] De Vries, C, Danaher, KF and Dunning, MC 2002, 'Assessing and monitoring Queensland's fish habitats using Landsat TM and ETM+ imagery', *Proceedings of the 11th Australasian Remote Sensing and Photogrammetry Conference*, Brisbane, Australia.

[11] McCormack, C 2005, *Post Release Survival in Crab Pot Fisheries—A compilation of historical data*, Department of Primary Industries and Fisheries, Brisbane, Australia.

[12] Ibid.

Interactions with protected species

A total of eight interactions[13] with protected species were recorded for all crab fishers over the 2005 fishery season. Table 3 provides details on the interactions recorded in the Species of Conservation Interest logbooks. Interactions with turtles have reduced from three in 2004 to no reported interactions in 2005.

Table 3: Crab Species of Conservation Interest reported over the 2005 Crab Fishery season.

Common name	Numbers	Condition
Sea snake	2	Released alive
False water mouse	3	Released dead
Humpback whale[14]	1	Alive
Saltwater crocodile	2	Released dead

Fishery impacts on the ecosystem

The fishery's impact on the ecosystem is considered to be negligible. The lightweight and stable structure of crab fishing apparatus is considered to have little, if any, impact on the muddy/ sandy bottom habitats in which the fishery operates.

Other ecosystem impacts

Due to the importance of mangrove habitats on mud crab life cycles, the species can be susceptible to impacts from habitat modification or pollution. Recent research[15] indicates that estuaries throughout the world are increasingly subjected to anthropogenic impacts that result in changes in land cover, including mangrove clearing. These changes can affect organisms at various stages of their life cycles and thus compromise ecosystem functions and services.

DPI&F has completed baseline coastal habitat mapping at a regional scale for all of Queensland.[16] The mud crab LTMP also collects habitat information at all of its sampling sites. These data can be used to explain mud crab habitat usage as well as to monitor changes within these habitat areas (see Monitoring programs and results).

Hydrological drought is associated with periods of low flow of coastal rivers[17] and previous research has found that high river flow into marine environments can have positive effects on productivity of commercial fisheries.[18] It is possible that the drought conditions Queensland has been experiencing in recent years may have an impact on mud crab stocks.

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[13]'Interaction' means any physical contact an individual has with a protected species. This includes all catching (e.g. hooked, netted, entangled) and collisions with a protected species.

[14]It should be noted that the possibility of interaction with a humpback whale being reported by a licence holder targeting mud crabs is negligible. It is likely that this interaction was reported by a licence holder targeting blue swimmer crabs.

[15]Zharikov, Y, Skilleter, GA, Loneragan, NR, Taranto, T, Cameron, BE 2005, 'Mapping and characterising subtropical estuarine landscapes using aerial photography and GIS for potential application in wildlife conservation', *Biological Conservation*, vol. 125, pp. 87–100.

[16]De Vries, C, Danaher, KF and Dunning, MC 2002, 'Assessing and monitoring Queensland's fish habitats using Landsat TM and ETM+ imagery', *Proceedings of the 11th Australasian Remote Sensing and Photogrammetry Conference*, Brisbane, Australia.

[17]Humphries, P and Baldwin, DS 2003, 'Drought and aquatic ecosystems: an introduction', *Freshwater Biology*, vol. 48, pp. 1141–1146.

[18]Loneragan, NR and Bunn, SE 1999, 'River flows and estuarine ecosystems: Implications for coastal fisheries from a review and a case study of the Logan River, southeast Queensland', *Australian Journal of Ecology*, vol. 24, pp. 431–440.

Research and monitoring

Recent research and implications

A project funded by the Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management analysed the links between coastal fisheries production and mangrove extent. The study described the patterns of coastal environments, mangroves and commercial fisheries in Queensland, and investigated whether the distribution of fisheries was related to certain mangrove attributes and environmental characteristics. Results of the research suggested that mangrove characteristics, particularly area and perimeter, were the dominant parameters in explaining the variation in local CPUE for mud crabs, which are known to inhabit mangroves as juveniles.[19]

Recent research into the effects of marine reserve protection on mud crabs[20] found that small marine reserves, such as those found in Moreton Bay, can provide conservation and fisheries benefits for mud crab populations. Marine reserves within Moreton Bay supported higher catch rates and a larger mean size than non-reserve sites.[21]

Monitoring programs and results

Long Term Monitoring Program (LTMP)

The LTMP mud crab survey is designed to obtain:

- fishery independent CPUE data to estimate annual changes in relative abundance
- size frequency data for long-term comparison of population structure
- sex data for population sustainability indicators.[22]

Habitat change and water quality are also monitored to give context to possible changes in mud crab stocks.

A fixed sampling design (where the sites are surveyed each year) was chosen to minimise variation in abundance, due to habitat and season. The fixed design provides data suitable for times series analysis. The monitoring program surveys key river systems throughout the state, helping to provide a better understanding of the resource and more sustainable management practices.

The LTMP fishery independent CPUE data (Figure 12) is indicative of relative abundance of mud crabs in Queensland. The LTMP catch rates for the five different regions also mirror that of the commercial fishery. Catch rates are relatively stable, excluding Moreton Bay, which is the region with the highest variation during 2000–05 (Figure 12).

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[19]Manson, FJ, Loneragan, NR, Harch, BD, Skilleter, GA and Williams, L 2005, 'A broad-scale analysis of links between coastal fisheries production and mangrove extent: A case study for northeastern Australia', *Fisheries Research*, vol. 74, pp. 69–85.

[20]Pillans, S, Pillans, RD, Johnstone, RW, Kraft, PG, Haywood, MDE and Possingham, HP 2005, 'Effects of marine reserve protection on the mud crab *Scylla serrata* in a sex-biased fishery in subtropical Australia', *Marine Ecology Progress Series*, vol. 295, pp. 201–213.

[21]Ibid.

[22]Department of Primary Industries and Fisheries 2005, *Fisheries Long Term Monitoring Program Sampling Protocol—Mud Crab (2000–2005) Section 1*, Department of Primary Industries and Fisheries, Brisbane, Australia.

In 2005, DPI&F undertook a review of the LTMP currently in place for mud crabs in Queensland.[23] The aim of the review was to assess DEH's recommendations concerning monitoring in the fishery. A revised monitoring strategy to better meet resource assessment needs will be developed for implementation in 2007.

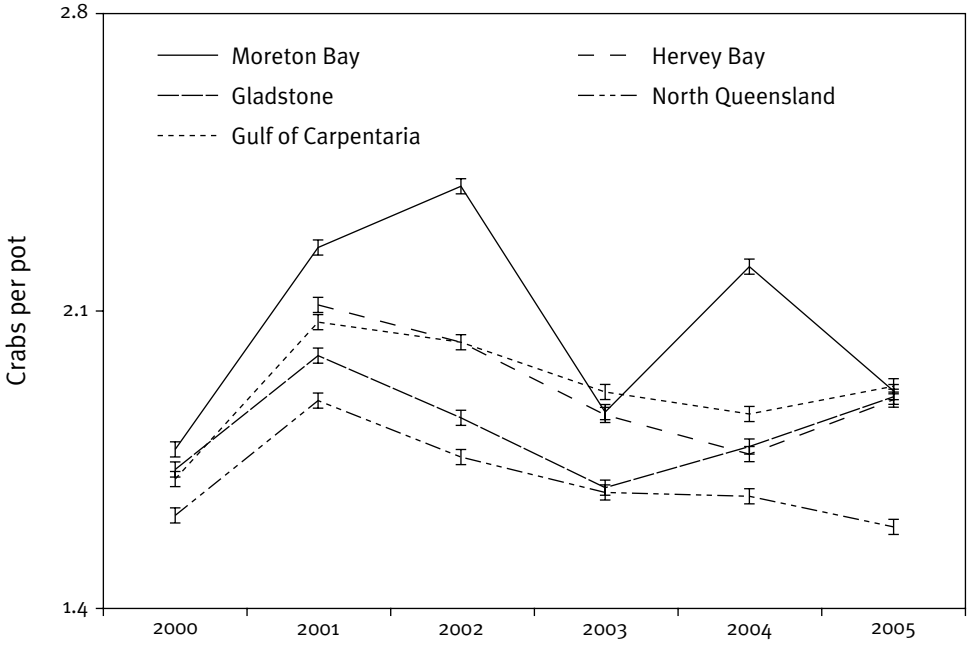

Figure 12: Modelled catch rate of mud crabs (numbers/pot) for each region, 2000–05.

Collaborative research

DPI&F continues to work with the Northern Territory on research projects related to mud crabs. A joint DPI&F and Northern Territory Mud Crab Fishermen's Association research project is currently investigating the survival of mud crabs during post-harvest transportation and subsequently developing procedures to maximise survival. The outcomes of this research will be applicable across all mud crab fisheries.[24]

Fishery management

Compliance report

Compliance and enforcement in the Mud Crab Fishery is the responsibility of the DPI&F Queensland Boating and Fisheries Patrol (QBFP).

During 2005, 1306 commercial and recreational crabbing units (mud crab and blue swimmer crab) were inspected in Queensland.

During this period, 55 fisheries infringement notices (FINs) and several cautions were issued for offences in the Mud Crab Fishery. The majority of FINs were issued for the take or possession of undersized/female mud crabs or exceeding the in-possession limits for mud crabs. In addition, there were several FINs issued for using excess fishing apparatus and failing to mark an apparatus in the prescribed way.

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[23]Webley, J 2005, *Fisheries long term monitoring program: addressing the Department of the Environment and Heritages' recommendations for monitoring Queensland's mud crab and blue swimmer crab fisheries*, Department of Primary Industries and Fisheries, Brisbane, Australia.

[24]S Poole (Department of Primary Industries and Fisheries), telephone conversation, 26 October 2006.

An additional 18 prosecutions are still pending for the year for unlawful interference with crabbing apparatus, and one for a buyer failing to have a docket available for inspection.

In addition to the above inspections, 539 unattended/incorrectly marked pots were seized and several marketer premises were inspected.

A compliance risk assessment will be completed for this fishery in 2006–07 in order to determine compliance priorities and allow the most effective use of QBFP resources.

Changes to management arrangements in the reporting year

CrabMAC has proposed to prescribe a maximum size opening in crab apparatus to minimise interactions with juvenile sea turtles.[25] Industry proposed models are currently being investigated. The implementation of the proposed management changes will be subject to further stakeholder consultation.

Complementary management

DPI&F continues to collaborate with other states and the Commonwealth Government on complementary management arrangements to enable a more complete assessment of Mud Crab Fishery stocks. The Queensland, Northern Territory, Western Australia and Commonwealth governments meet annually at the Northern Australian Fisheries Managers Forum to discuss the management of shared stocks, including those of mud crabs.

Information compiled by

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Image

Mud crab (*Scylla serrata)*

[25] M Doohan (Department of Primary Industries and Fisheries), discussion, October 2006.