



Performance Measurement System  
Mud Crab Fishery  
Version 2 – August 2012

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## Introduction

The Queensland Mud Crab Fishery targets the common mud crab, *Scylla serrata*, using collapsible traps and crab pots. Pots and traps are set on the substrate, generally in shallow water estuarine or nearshore coastal areas. Information reported to Fisheries Queensland indicates that mud resources are utilised predominantly by the commercial sector (65%) compared with the recreational sector (35%). The annual harvest of mud crabs by the Indigenous and charter sectors is considered very low (less than 1%). There is a range of input and output controls in place to manage the harvest of mud crabs by commercial and recreational fishers. This performance measurement system (PMS) covers the Queensland Mud Crab Fishery.

A PMS is a key component of any enhanced management arrangements as it provides a set of transparent and verifiable measures against which Fisheries Queensland can assess and report on the performance of the fishery. The development of a PMS is also a requirement of the Wildlife Trade Operation (WTO) approvals granted under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, and is therefore necessary to maintain export approvals.

This PMS was developed by officers of Fisheries Queensland. Views of stakeholders, fishery managers, researchers and assessment and monitoring staff were sought to ensure that the PMS was meaningful, defensible and precautionary, taking into account data limitations but incorporating the most appropriate information available. This revised PMS (Version 2) involved desktop studies and expert consultation in collaboration with workshops attended by representatives from Fisheries Queensland and Agri-Science.

Performance measures have been developed for:

- Principal species (mud crab)
- Bycatch species
- Protected species
- Social issues.

Fisheries Queensland will report on the performance measures annually. Within three months of becoming aware that a performance measure has been triggered, Fisheries Queensland will finalise a clear timetable for implementation of appropriate management responses in consultation with fishery stakeholders.

The PMS is designed to be a working document and may be reviewed and updated to reflect available data and to address any issues that may arise from monitoring data collection and analysis processes. A complete review of this document will be undertaken every 3–5 years by an expert panel of relevant Departmental staff including fishery managers, stock assessment and fisheries scientists. Fisheries Queensland will provide opportunity for external stakeholders to comment on revised documents as they become available.

# Performance Measurement System Summary Table

## Queensland Mud Crab Fishery

	<b>Objective</b>	<b>Performance indicator</b>	<b>Performance measure</b>
<b>Principal species</b>	To ensure that stocks of mud crab are maintained or improved.	<p>1. Annual commercial standardised pot catch rate<sup>1</sup> for the east coast, Gulf of Carpentaria and specified regional divisions<sup>2</sup>.</p> <p>2. Annual commercial pot total catch<sup>3</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</p>	<p><b>1a. Annual commercial standardised pot catch rate falls outside the upper or lower deciles<sup>4</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</b></p> <p><b>1b. A consecutive increase or decrease in commercial standardised pot catch rate over the preceding five years<sup>5</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</b></p> <p><b>2a. Annual commercial pot total catch falls outside the upper or lower deciles for the east coast, Gulf of Carpentaria and specified regional divisions.</b></p> <p><b>2b. A consecutive increase or decrease in commercial pot total catch over the preceding five years<sup>5</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</b></p>
<b>Bycatch species</b>	Ensure impacts on bycatch species are minimised.	Ecological risk to bycatch categories (as defined in the Ecological Risk Assessment (ERA)) in the Mud Crab Fishery.	<b>The review of the Mud Crab Fishery ERA indicates any bycatch category requires a Level Two Productivity Susceptibility Analysis.</b>
<b>Protected species</b>	Ensure the impact of the Mud Crab Fishery on stocks of protected species,	1. Interactions reported through SOCI logbooks.	<b>1. Percentage of protected species released alive falls below 90%.</b>

<sup>1</sup> Commercial catch rate was standardised using a generalised linear mixed model of log (daily catch rate) in GenStat (2011), which adjusts for the effects of year, month, effort, catch, targeting behaviour and lunar phase. The process also involves removing outliers and incomplete records. This method of calculating catch rate gives the performance measure a more robust baseline from which to measure the fishery.

<sup>2</sup> The boundaries (latitudes and longitudes) for the specified regional divisions are detailed in the target species 'Rationale for inclusion of issue'.

<sup>3</sup> Total catch is the commercial logbook data in its raw unaltered form.

<sup>4</sup> The upper and low deciles (also referred to as 90th and 10th percentiles respectively) were calculated from the mean and standard deviation of the previous ten years of data (2000–2009), using a standard statistical formula.

<sup>5</sup> Preceding five years includes the current data year and the previous four years.

	<b>Objective</b>	<b>Performance indicator</b>	<b>Performance measure</b>
	especially marine turtles, do not increase.	2. Ecological risk to protected species categories (as defined in the Ecological Risk Assessment (ERA)) in the Mud Crab Fishery.	2. <b>The review of the Mud Crab Fishery ERA indicates any protected species category requires a Level Two Productivity Susceptibility Analysis.</b>
<b>Social</b>	To ensure community confidence in management arrangements.	Level of compliance by commercial and recreational fishers.	<b>The rate of compliance falls below 92.5% in the commercial fishery and/or 92.5% in the recreational fishery.</b>

# Versions

## #1 April 2007

## #2 June 2012 – amendments listed below:

- A more robust target species catch rate measure was developed for Version 2. Justification for these measures and their calculation are outlined in Appendix 1.
- A social measure was included to assess community confidence in the current management arrangements.

## References

GenStat (2011). GenStat for Windows, Release 14.1. VSN International Ltd. Oxford.

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## Acknowledgements

Dr David Mayer, Bonnie Holmes, Mick O'Neill, Dr Wayne Sumpton, Dr Ian Brown, Dr Stephen Wesche, Jason McGilvray, Michelle Winning, Megan Leslie, Phil Gaffney, Dr Stephen Taylor, Chad Lunow, Dr Malcolm Dunning and Dr Neil Gribble.

# Appendix 1: Detailed Performance Measurement System

## Target species

<p>Rationale for inclusion of issue</p>	<p>The main purpose of the <i>Fisheries Act 1994</i> (the Act) includes applying and balancing the principles of ecologically sustainable development (ESD). Among the principles of ESD, as defined in the Act are:</p> <ul style="list-style-type: none"> <li>• “enhancing individual and community wellbeing through economic development that safeguards the wellbeing of future generations”;</li> <li>• “protecting biological diversity, ecological processes and life-support systems”; and</li> <li>• “the precautionary principle”, which is defined in the Act as “the principle that , if there is a threat of serious or irreversible environmental damage, lack of scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation, because of the threat”.</li> </ul> <p>Mud crabs (<i>Scylla serrata</i>) are one of the primary target species in the C1 crab pot fishery. Mud crabs are also heavily targeted by recreational fishers. <i>Scylla olivacea</i>, the brown mud crab is also harvested, however due to the geographical limitations of <i>S. olivacea</i> commercial fishers’ typically only harvest small quantities of this species. Management arrangements for the fishery have been set based on biological knowledge where available, and in other instances have been set in a precautionary manner to account for gaps in current knowledge.</p> <p>The locations and regions used in the analysis of the Mud Crab Fishery data are as follows:</p> <ul style="list-style-type: none"> <li>• East coast (<math>\geq 142.5</math>)</li> <li>• Gulf of Carpentaria (<math>&lt; 142.5</math>)</li> <li>• GOC North (<math>\leq -10.5</math> and <math>&gt; -15</math> and <math>\geq 138</math> and <math>&lt; 142.5</math>)</li> <li>• GOC South (<math>\leq -15</math> and <math>\geq -18</math> and <math>\geq 138</math> and <math>&lt; 142.5</math>)</li> <li>• EC Far North (<math>\leq -10.5</math> and <math>&gt; -14.5</math> and <math>\geq 142.5</math> and <math>\leq 155</math>)</li> <li>• EC North (<math>\leq -14.5</math> and <math>&gt; -19</math> and <math>\geq 142.5</math> and <math>\leq 155</math>)</li> <li>• EC North-Central (<math>\leq -19</math> and <math>&gt; -21</math> and <math>\geq 142.5</math> and <math>\leq 155</math>)</li> <li>• EC Central (<math>\leq -21</math> and <math>&gt; -23.5</math> and <math>\geq 142.5</math> and <math>\leq 155</math>)</li> <li>• EC South-Central (<math>\leq -23.5</math> and <math>&gt; -26.5</math> and <math>\geq 142.5</math> and <math>\leq 155</math>) and</li> <li>• EC South (<math>\leq -26.5</math> and <math>&gt; -28.2</math> and <math>\geq 142.5</math> and <math>\leq 155</math>)</li> </ul>
<p><b>Operational objective</b></p>	<p>To ensure that stocks of mud crab are maintained or improved.</p>
<p><b>Performance indicator</b></p>	<p>[1] Annual commercial standardised pot catch rate<sup>6</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</p> <p>[2] Annual commercial pot total catch<sup>7</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</p>

<sup>6</sup> Standardised catch rate is commercial logbook data which has been manipulated in Genstat. A range of catch, effort and environmental factors are tested for significance and incorporated to fine tune the dataset.

The process also involves removing outliers and incomplete records. This method of calculating catch rate gives the performance measure a more robust baseline from which to measure the fishery.

<sup>7</sup> Total catch is the commercial logbook data in its raw unaltered form.



<p><b>Performance measure</b></p>	<p><b>[1a] Annual commercial standardised pot catch rate falls outside the upper or lower deciles<sup>8</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</b></p> <p><b>Justification:</b> Trends in catch rate of the target species may provide an indication of trends in abundance. Previous performance measures (Version 1, MC PMS, April 2007) utilised CFISH data to look at percentage increases and decreases in unstandardised catch rate. The percentages that were chosen were thresholds based on expert opinion at the PMS development workshop in 2007.</p> <p>Following a review in early 2010 catch rate is now standardised by year, month, effort, catch, fisher targeting behaviour and lunar phase. Standardised catch and effort data is analysed by grid within regions and grid within locations (east coast and Gulf of Carpentaria). The adjusted catch rate is compared to upper and lower deciles which are calculated from a ten year historical standardised mean (mean of catch rate). The ten year period was chosen as it represented a relatively stable period of both management arrangements and catches. Under no trend, the random expectation is that one year in ten will be lower than the upper decile (10th percentile) and similarly one year in ten will be higher than upper decile (90th percentile). The purpose of this measure is to identify years where catches are unusually high or low. By looking at this measure over a number of years trends that may indicate changing conditions in a fishery would be more obvious. For example, two years of catches that are lower than the 10th percentile could highlight a concerning trend that may not be due to natural variability alone.</p> <p>Fisheries Queensland has identified the need for spatial monitoring of harvest of target species. Analysis is conducted at a broader scale whole of fishery level as well as regionally allowing Fisheries Queensland to ascertain the status of the stock on multiple levels (broad scale and local). It should be noted that all regions are required to have a minimum number of observations before they are accepted into the standardisation process—a lack of observations (records) in a specified region would exclude the specified region from the catch rate analysis. If and when any of the regions fall under the minimum total percent of observations required for analysis they will simply be left out, with an appropriate explanation.</p> <p>Issues within the Mud Crab Fishery pertaining to the use of excess gear (exceed pot allowances) has been identified as potentially affecting crab catch rate analyses. For this reason DEEDI scientists have modelled additional catch rate trends using an estimated 5% per annum over-potting factor in the analysis. The 5% p.a. over-potting factor is a generous over-estimate and as such will not be measured as part of the formal performance measures; rather it is presented in order to monitor all possible fishery scenarios. For more information on why five percent was chosen to represent effort creep (or ‘efficiency’ increase) please refer to FRDC Report 2009/031 ‘Taking female mud crabs (<i>Scylla serrata</i>): assessment of risks and benefits’.</p> <p><b>[1b] A consecutive increase or decrease in commercial standardised pot catch rate over the preceding five years<sup>5</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</b></p> <p><b>Justification:</b> Fisheries Queensland has identified that incremental increases or decreases in standardised pot catch over consecutive years are also important to monitor, given that long term averages may not trigger where relatively slow consistent changes are occurring.</p> <p><b>[2a] Annual commercial pot total catch falls outside the upper or lower deciles for the east coast, Gulf of Carpentaria and specified regional divisions.</b></p>
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<sup>8</sup> The upper and lower deciles were calculated from the mean and standard deviation of the previous ten years of data (2000–2009), using a standard statistical formula.

	<p><b>Justification:</b> Trends in the catch of blue swimmer crabs may provide a broader indication in trends of abundance and fishing mortality.</p> <p><b>[2b] A consecutive increase or decrease in commercial pot total catch over the preceding five years<sup>5</sup> for the east coast, Gulf of Carpentaria and specified regional divisions.</b></p> <p><b>Justification:</b> Fisheries Queensland is ensuring that blue swimmer crab harvest remains sustainable by monitoring incremental increases and decreases in catch.</p>
<p><b>Management response</b></p>	<p>Fisheries Queensland will report on the PMS annually. Within three months of becoming aware that a performance measure has been triggered, Fisheries Queensland will finalise a clear timetable for implementation of appropriate management responses in consultation with fishery stakeholders.</p>
<p>Data requirements/availability</p>	<p>[1a] &amp; [1b] Commercial catch rate (provided through commercial logbooks) subsequently run through Genstat 12<sup>th</sup> Ed statistical software for standardisation purposes.</p> <p>[2a] &amp; [2b] Commercial catch (provided through commercial logbooks) subsequently run through Genstat 12<sup>th</sup> Ed statistical software.</p>
<p>Evaluation of current fishery performance</p>	<p><b>[1a] Commercial standardised pot catch rate falls outside the upper or lower deciles – East coast and Gulf of Carpentaria</b></p> <p>Standardised commercial catch rate results indicate that the east coast remained within the upper and lower deciles between 2000 and 2008. The Gulf of Carpentaria catch rates fell outside the upper deciles in 2000 but remained within the boundaries of the upper and lower deciles from 2001 through to 2009. In 2010, mud crab catch rates in both locations fell outside the upper decile (Figure 1 and 2)—this can be attributed to above normal and prolonged wet weather, which was experienced in many areas of the state during 2010. This information corresponds directly to anecdotal information provided by fishers—stating that they have experienced one of the best mud crab seasons for many years.</p> <div data-bbox="1332 774 2116 1252" data-label="Figure"> <p>The graph plots 'Adjusted catch rate (kg/day)' on the y-axis (0 to 25) against 'Year' on the x-axis (1988 to 2010). The 'EC adjusted catch rate' (solid line with diamonds) starts at ~13 in 1988, peaks at ~16 in 1990, and then fluctuates between 13 and 20 until 2009, where it reaches ~22. The 'EC average (2000-2009)' is a solid orange horizontal line at ~17. The 'EC upper decile' is a dashed blue horizontal line at ~19.5, and the 'EC lower decile' is a dashed red horizontal line at ~16.5. The '5% p.a. overpotting' (dashed line with diamonds) starts at ~13 in 1988 and declines steadily to ~7 by 2010.</p> </div>

Figure 1: Standardised commercial pot catch rate (kg/day) for mud crabs on the east coast, Queensland 1988–2010.

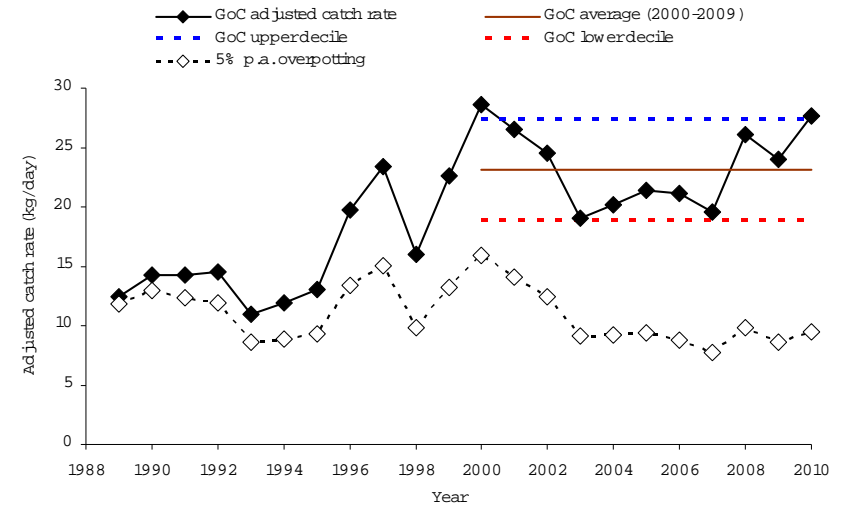
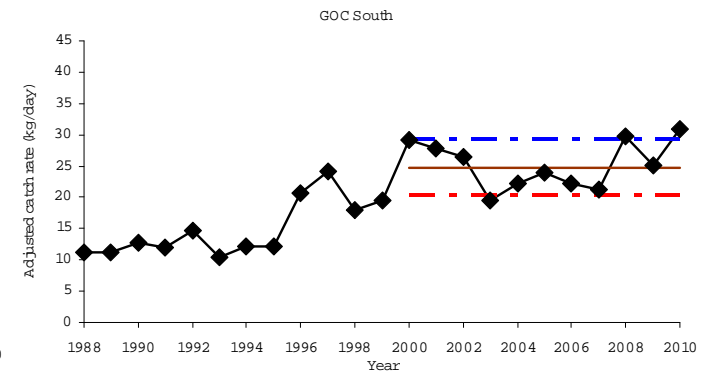
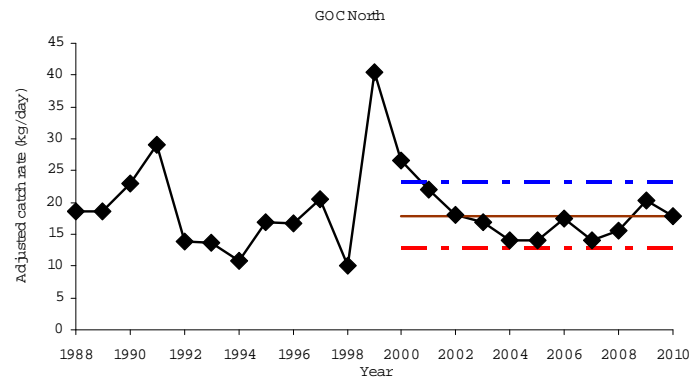


Figure 2: Standardised commercial pot catch rate (kg/day) for mud crabs in the Gulf of Carpentaria, Queensland 1988–2010.

### Regions

An assessment of the regional changes in catch rate (kg/day) for mud crab shows multiple occasions where catch rates have fallen outside the upper and lower deciles. Although fluctuations in catch rate are recorded for each of the regions, the majority of years show figures which sit within the upper and lower deciles. In 2010 catch rates in the GOC South, EC North, EC Central, EC South-Central and EC South fell outside their upper decile.



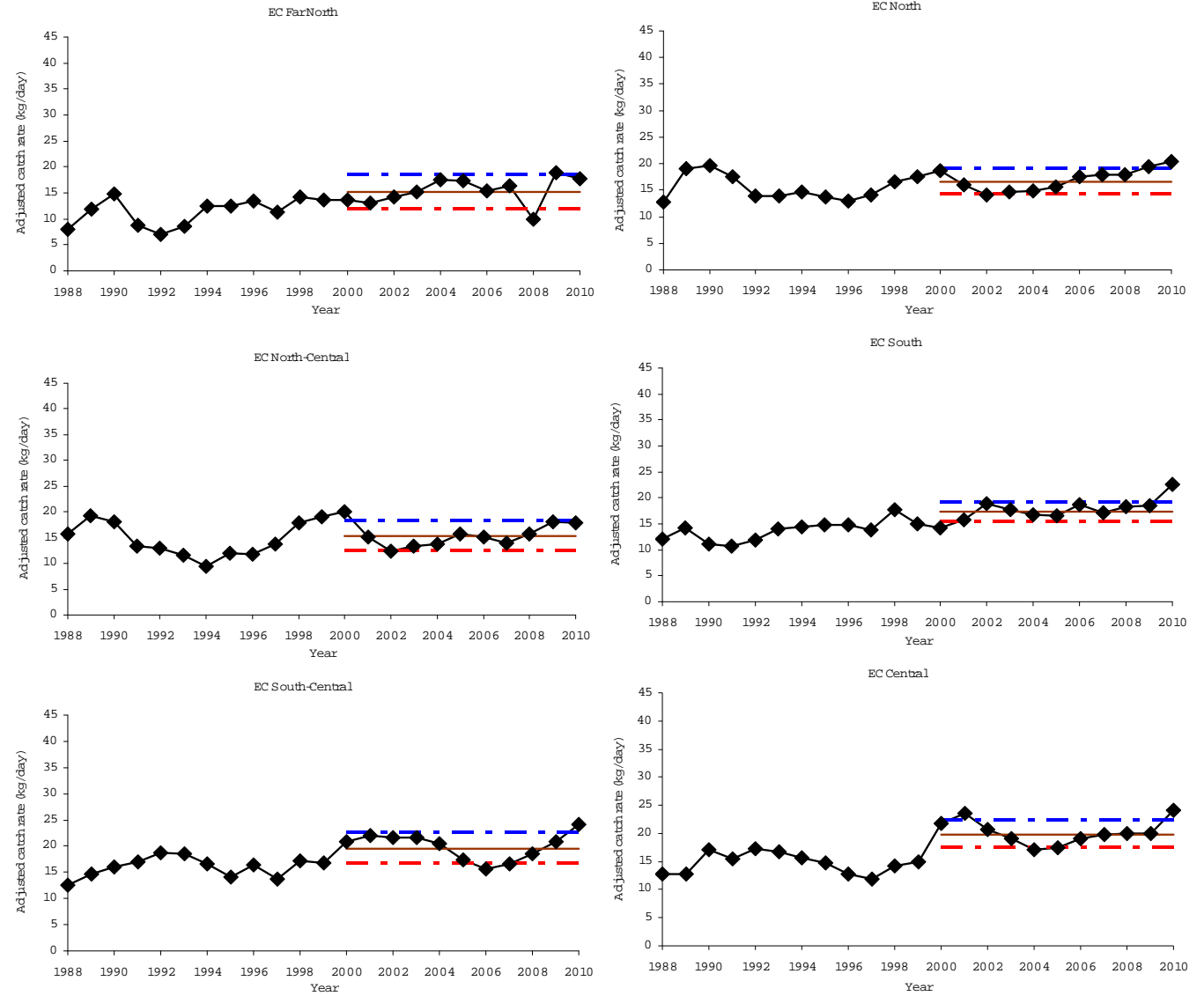


Figure 3: Regional standardised commercial pot catch rate (kg/day) of mud crabs 1988–2010.

**[1b] Consecutive increase or decrease in commercial standardised pot catch rate over the preceding five years<sup>5</sup>**

**East coast and Gulf of Carpentaria**

This can be determined by referring to Figures 1 and 2 above. The east coast mud crab catch rates have been increasing steadily over the preceding five years (2006–2010) which has resulted in this measure triggering for the 2010 analysis. In 2010, catch rate on the east coast reached its highest point in the data set (1988–2010) peaking at 22.29 kg/day. The Gulf of Carpentaria mud crab catch rates continue to fluctuate. There is no consecutive increase or decrease in catch rate over the preceding five years (including the latest data year e.g. 2006–2010) which has resulted in the performance measure not triggering for 2010.

**Regions**

This can be determined by referring to Figure 3 above. The only region which has seen a consecutive increase or decrease in catch rates over the preceding five years and therefore triggering the performance measure is the EC Central region—five years of consecutive increases in catch rate have been recorded. Catch rates in the GOC North, GOC South, EC Far North, EC North-Central, EC South-Central and EC South continue to fluctuate and have not shown any consecutive trends over the preceding five years.

**[2a] Commercial pot total catch falls outside the upper or lower deciles**

**East coast and Gulf of Carpentaria**

Commercial total catch indicates that the east coast has remained between the upper and lower deciles for the previous ten years with the exceptions of 2003, 2005 and most recently 2010. The Gulf of Carpentaria catch rates fell outside the upper decile in 2008 and 2010 but remained within the boundaries of the upper and lower deciles from 2000 through to 2007 and in 2009. In 2010, mud crab catches in both locations fell outside the upper decile (Figure 4)—this can be attributed to above normal and prolonged wet weather, which was experienced in many areas of the State during 2010.

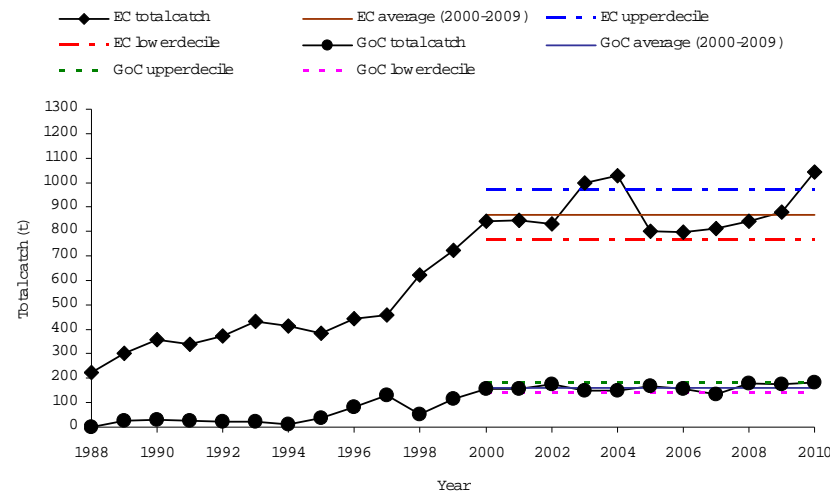
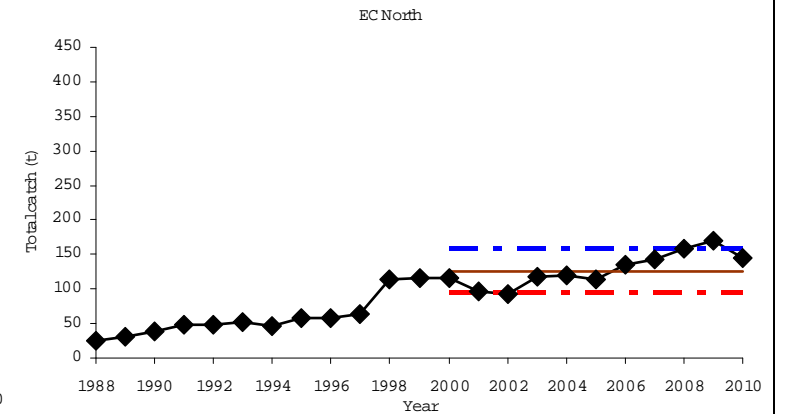
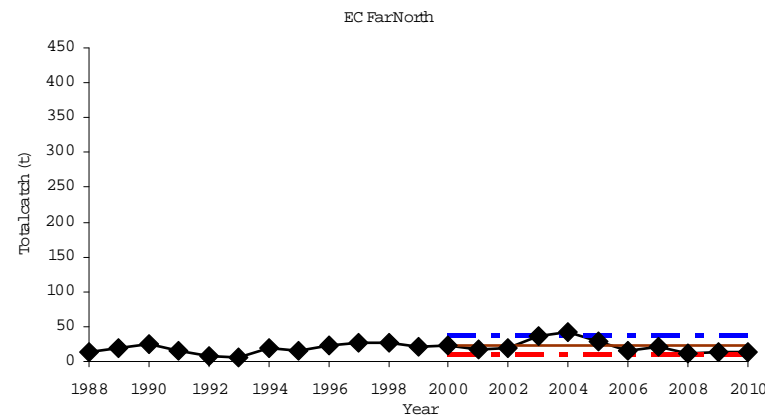
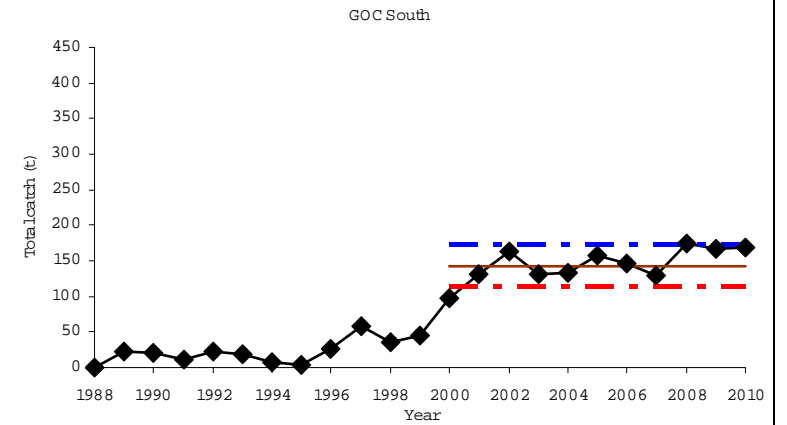
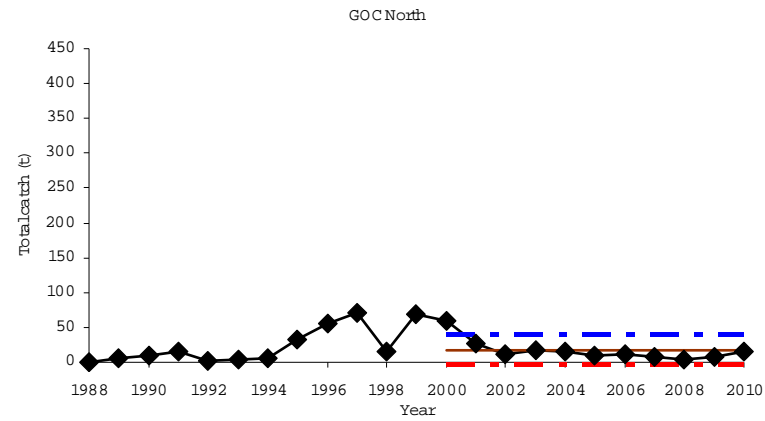


Figure 4: Commercial total pot catch (t) for mud crabs on the east coast and in the Gulf of Carpentaria, Queensland 1988–2010.

## Regions

An assessment of the regional changes in total catch rate (t) for mud crab shows multiple occasions where total catch has fallen outside the upper and lower deciles. Although fluctuations in catch rate are recorded for each of the regions, the majority of years show figures which sit within the upper and lower deciles; very similar to the results for the standardised commercial catch rates. In 2010 total catch in the EC Central and EC South fell outside their upper decile.



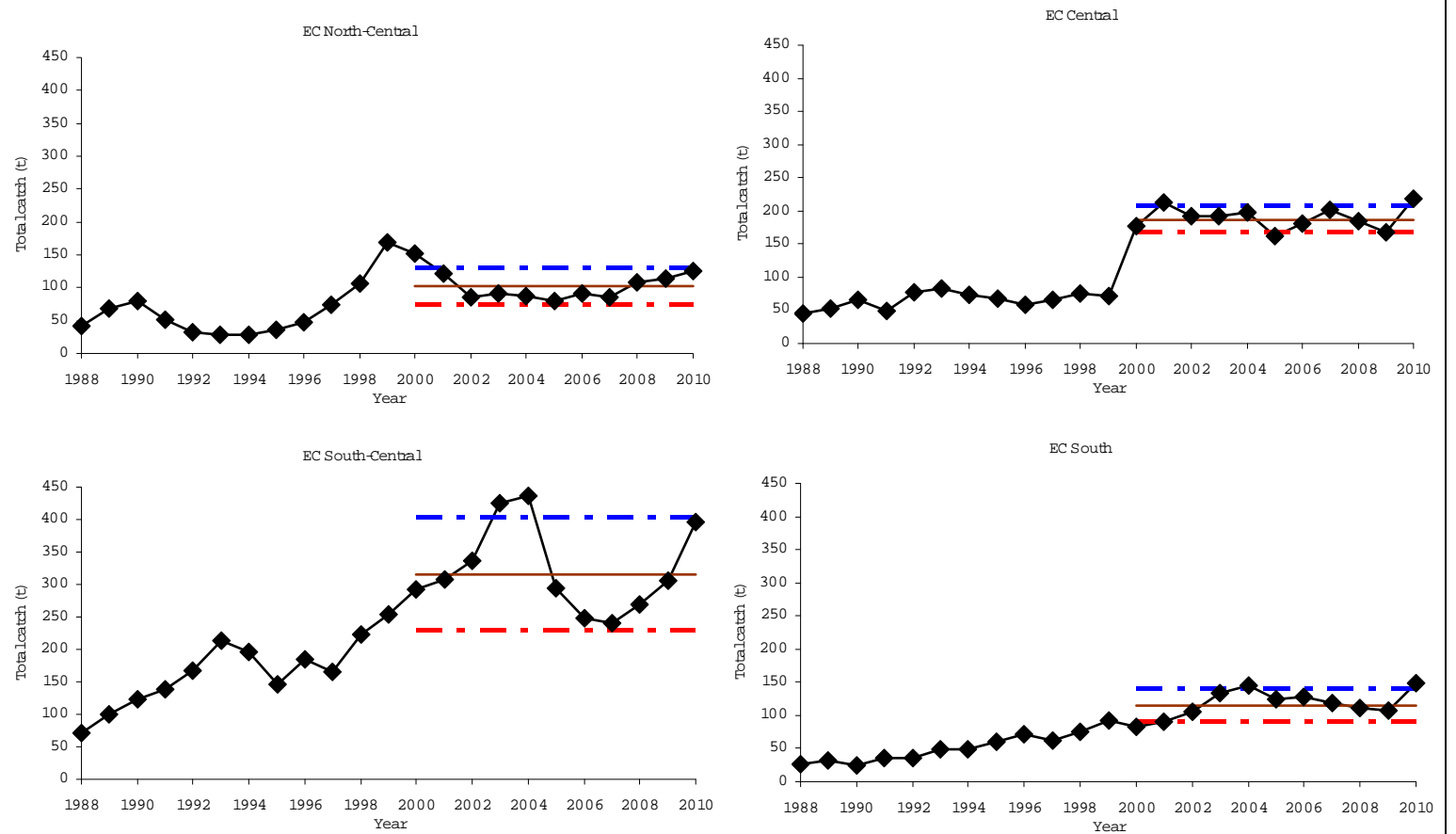


Figure 5: Regional commercial pot total catch (t) of mud crabs 1988–2010.

It should be noted that currently all mud crab regions have enough observations to make it into the standardisation process—a lack of observations (records) in a specified region would exclude the specified region from the catch rate analysis. At which time any of the regions fall under the minimum total percent of observations required for analysis they will simply be left out. Explanation will be provided if this occurs.

**[2b] Consecutive increase or decrease in commercial pot total catch over the preceding five years<sup>5</sup>**

**East coast and Gulf of Carpentaria**

This can be determined by referring to Figure 4 above. The east coast mud crab total catch continues to increase triggering the

	<p>performance measure (2006–2010). In 2010, total catch on the east coast reached its highest point in the data set (1988–2010) peaking at 1045 t. The Gulf of Carpentaria mud crab total catch continues to fluctuate. There is no consecutive increase or decrease in total catch over the preceding five years (2006–2010) which has resulted in the performance measure not triggering for 2010.</p> <p><b>Regions</b> This can be determined by referring to Figure 5 above. No regions were triggered in 2010 due to a lack of consecutive increasing or decreasing trends over the preceding five years. Total catch in all regions continue to fluctuate.</p>
Robustness	<p><b>[1a] &amp; [1b] Standardised commercial catch rate [Medium]</b> Improved standardisation and statistical techniques has improved the robustness of this performance measure from the previous version of this document. However, experts still highlight and recognise the great deficiencies in the quality of the logbook data (particularly relating to effort). Fisheries Queensland will continue to work towards more accurately measuring changes in stock density through improvements to logbook and independent data collection, and compliance of fishers accessing the various sectors of the fishery.</p> <p><b>[2a] &amp; [2b] Commercial total catch [Medium]</b> The Queensland logbook program represents, internationally, one of most advanced systems of compulsory reporting of daily fishing activities and harvest. While there are accuracy and compliance issues with any logbook program, Fisheries Queensland considers that the information still provides a valuable monitoring tool.</p>
Current and future management	<p>As at May 2012 the main management arrangements in place are:</p> <ul style="list-style-type: none"> <li>• Minimum legal size (MLS) of 15 cm across the carapace width (CW) at the widest point</li> <li>• All females protected</li> <li>• Limit of 50 commercial pots or four recreational pots per person in use</li> <li>• Recreational bag limit of 10 in possession</li> <li>• In July 2008, Fisheries Queensland implemented the Policy for the Removal of Excess Fishing Capacity in Queensland's Line, Crab, Beam Trawl and Eel Fisheries. The implementation of this Policy has removed a significant number of Crab Fishery symbols (C1). The effective removal of symbols has now ceased with 337 symbols removed from a total of 770 (approximately 40%).</li> </ul>
Comments and action	N/a
External drivers	N/a
Other issues	N/a



## Bycatch species

Rationale for inclusion of issue	<p>The main purpose of the Act includes applying and balancing the principles of ESD. Among the principles of ESD, as defined in the Act are:</p> <ul style="list-style-type: none"> <li>• “protecting biological diversity, ecological processes and life-support systems”; and</li> <li>• “the precautionary principle”, which is defined in the Act as “the principle that , if there is a threat of serious or irreversible environmental damage, lack of scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation, because of the threat”.</li> </ul> <p>Bycatch information for the Mud Crab Fishery is not currently collected. Fisheries Queensland believes the use of the Ecological Risk Assessment (which includes consolidated quantitative data, expert opinion and various scientific papers) as a performance indicator is deemed precautionary and appropriate.</p> <p>Bycatch in this fishery refers to ‘no take’ species, undersized mud crabs and female mud crabs.</p>
<b>Operational objective</b>	Ensure impacts on bycatch species are minimised.
<b>Performance indicator</b>	Ecological risk to bycatch categories (as defined in the Ecological Risk Assessment (ERA)) in the Mud Crab Fishery.
<b>Performance measure</b>	<p><b>The review of the Mud Crab Fishery ERA indicates any bycatch category requires a Level Two Productivity Susceptibility Analysis.<sup>9</sup></b></p> <p><b>Justification:</b> Bycatch in this fishery is generally low and consists of undersized target or non-permitted species. Fisheries Queensland determined that the low amount of bycatch associated with this fishery would be better represented in a semi-quantitative and semi-qualitative ranking rather than a data orientated figure. This performance measure will be useful in prompting further investigation of fishing activities which are deemed likely to impact bycatch species populations whilst ensuring that impacts on bycatch species do not increase.</p>
<b>Management response</b>	Fisheries Queensland will report on this performance measure after the ERA has been undertaken. Within three months of becoming aware that a measure has been triggered Fisheries Queensland will carry out a process of investigation. If a particular measure requires further investigation and explanation, Fisheries Queensland, in collaboration with a stakeholder based advisory group will finalise clear and appropriate management responses.
Data requirements/availability	<p>The ERA for the MCF applies the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Ecological Risk Assessment for the Effects of Fishing (ERAEF) Framework and was conducted concurrently with the development of the PMS in May 2006.<sup>10</sup> The MCF ERA is a semi-quantitative analysis which only takes into consideration the pot activities/bycatch associated with the fishery. Ecological Risk Assessments are undertaken periodically (generally every three to five years).</p> <p>After a Level One Scale, Intensity and Consequence Analysis (SICA) has been conducted for various fishing activities</p>

<sup>9</sup> For a more detailed description and explanation of the steps required to undertake this analysis please refer to the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Ecological Risk Assessment for the Effects of Fishing (ERAEF) Framework.

<sup>10</sup> To view the summary of results please refer to the Ecological Risk Assessment.

	linked with bycatch, and an overall consequence score has been given, any score of three or above (moderate or above) warrants further investigation through the Level Two Productivity and Susceptibility Analysis. This is when the performance measure would trigger (E.g. If a fishing activity linked with bycatch was given a moderate risk, the fishing activity would need to be analysed using the next level of investigation (the PSA)).
Evaluation of current fishery performance	<p>An ERA looking directly at bycatch issues has not been undertaken at this stage. The ERA for the Mud Crab Fishery will be conducted once the review of the Crab Fisheries ERA's has been finalised.</p> <p>The ghost fishing/ gear loss component of the MCF ERA rated the impact on bycatch species as minor.</p> <p>The GOC ERA revealed that no bycatch species/issues were identified as a moderate risk (score of 3) or higher.</p> <p>Crab Post Release Survival</p> <p>Long term monitoring data indicates that large proportions (up to 80%) of mud crabs were discarded. Field observations and mark-recapture studies indicate that the post release survival of discarded undersized and female mud crabs is high. Fishing gears and methods are relatively benign, inflicting minimal damage on the discarded catch. Pots are checked regularly minimising the incidence of injury relating to interactions with co and con-specifics in the pot. More information on bycatch will be provided through the Fisheries Observer Program.</p>
Robustness	<p><b>ERA [Low–Medium]</b></p> <p>The ERA process, whilst largely qualitative, provides a mechanism to review the risk of pot fishing on bycatch in the fishery.</p>
Current and future management	The previous Crab Management Advisory Committee has discussed and noted bycatch mitigation measures for the fishery. If a concern is identified with regard to bycatch species, a more thorough investigation of bycatch mitigation measures would be warranted.
Comments and action	Fisheries Queensland will conduct the review of the relevant ERA on a three to five year return interval, including the assessment of any changes in the composition and abundance of bycatch species.
External Drivers	<ul style="list-style-type: none"> <li>• Management changes (e.g. new size limits etc)</li> <li>• Catch and release philosophy</li> </ul>
Other issues	N/a

## Protected species

Rationale for inclusion of issue	<p>The Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) has listed marine turtles, dugongs and cetaceans as protected species that occur in the area of the fishery and which appear to have potential to interact with gear utilised by the Mud Crab Fishery.</p> <p>Turtles are the protected species most likely to interact with the fishery based on available information (fishery area/operation, anecdotal reports from fishers and researchers, Species of Conservation Interest (SOCl) logbooks, Stranding and Mortality Database (S&amp;MD) and the ERA).</p> <p>Turtles are a listed marine species protected under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i>.</p>
<b>Operational objective</b>	Ensure the impact of the Mud Crab Fishery pot operations on stocks of protected species, especially marine turtles, do not increase.
<b>Performance indicator</b>	<p>[1] Interaction reported through SOCl logbooks.</p> <p>[2] Ecological risk to protected species categories (as defined in the (ERA)) in the Mud Crab Fishery.</p>
<b>Performance measure</b>	<p><b>[1] Percentage of protected species released alive falls below 90%.</b></p> <p><b>Justification:</b> This performance measure recognises that the level of interaction with protected species in the fishery is extremely low and that the key issue is ensuring that where there is an interaction, the animal is released alive.</p> <p><b>[2] The review of the Mud Crab Fishery ERA indicates any protected species category requires a Level Two Productivity Susceptibility Analysis.<sup>11</sup></b></p> <p><b>Justification:</b> Protected species interactions in this fishery are low. However Fisheries Queensland acknowledges the importance of monitoring protected species interactions, and continues to explore options to reduce impacts of fishing activities on protected species.</p>
<b>Management response</b>	Fisheries Queensland will report on the PMS annually. Within three months of becoming aware that a performance measure has been triggered, Fisheries Queensland will finalise a clear timetable for implementation of appropriate management responses in consultation with fishery stakeholders.
Data requirements/availability	<p>[1] SOCl</p> <p>The SOCl logbook allows Fisheries Queensland to provide annual summaries of protected species interactions with crab fishing apparatus.</p>

<sup>11</sup> For a more detailed description and explanation of the steps required to undertake this analysis please refer to the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Ecological Risk Assessment for the Effects of Fishing (ERA EF) Framework.

	<p>[2] ERA The ERA for the MC Fishery applies the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Ecological Risk Assessment for the Effects of Fishing (ERAEF) Framework and was conducted concurrently with the development of the PMS in May 2006.<sup>12</sup> The Mud Crab Fishery ERA is a semi-quantitative analysis which only takes into consideration the pot activities/protected species interactions associated with the fishery. ERAs are undertaken periodically (generally every three to five years).</p>
Evaluation of current fishery performance	<p>[1] SOCI</p> <ul style="list-style-type: none"> <li>• A SOCI logbook has been implemented in the MCF since 2003.</li> <li>• The SOCI logbook lists 19 interactions with protected species in the Mud Crab Fishery in 2003; of the interactions, 13 were with turtles. In 2004 four interactions were recorded (all with turtles), seven interactions in 2005 (none with turtles), two interactions in 2007 (none with turtles) and three interactions in 2008 (none with turtles) ten interactions were reported as released dead, with the majority released alive (25).</li> </ul> <p>[2] ERA Fishing, gear loss, other capture fishery method and coastal development were the protected species issue that was identified as posing a moderate risk (score of 3) or higher; the remaining protected species issues received a risk ranking of Low (2) or Negligible (1).</p> <ul style="list-style-type: none"> <li>• Fishing rated a moderate risk due to knowledge of turtles aggregating areas and high fishing effort data, possibility of high levels of mortality/interaction in areas such as Moreton Bay, where a change in population size/growth rate may be evident.</li> <li>• Gear loss rated a moderate risk due to a precautionary risk ranking as it is based on the limited data available regarding the extent or scale of gear loss, the relative impact to green turtles and susceptibility to capture.</li> <li>• Other capture fishery method rated a moderate risk due to a precautionary risk ranking based on the potential for turtle interactions to occur with inshore net gear (nets/floats/lines) as part of their normal foraging behaviour.</li> <li>• Coastal development rated a moderate risk due to a precautionary risk ranking as there is a lack of information regarding coastal impacts.</li> </ul>
Robustness	<p>[1] SOCI [Low–Medium] The indicator is a direct measure of the fishery’s impacts on protected species and the fate of any animals for which an interaction has occurred. There are concerns with data accuracy of interactions reported through the SOCI logbook.</p> <p>[2] ERA [Low–Medium] The ERA comprehensively addresses all potential fishery impacts on protected species.</p>
Current and future management	<ul style="list-style-type: none"> <li>• Trotline apparatus use is now permitted within the Moreton Bay area (effectively reducing the total amount of line in the water column).</li> <li>• Protected species education is ongoing. For example, all new master fishermen holding a commercial fisher licence must complete an Endangered Species Awareness course.</li> <li>• Any proposal on alternative pot design or configuration will be assessed on the trade-off between reducing turtle capture and maintaining crab catch.</li> <li>• Funding acquired by OceanWatch Australia has initiated commercial crab pot fishers in Moreton Bay to trial a</li> </ul>

<sup>12</sup> To view the summary of results please refer to the Ecological Risk Assessment.

	modification of an existing crab pot design, which aims to minimise interactions with protected species.
Comments and action	<p>Fisheries Queensland will conduct the review of the relevant ERA on a three to five year interval, including the assessment of any changes in the composition and abundance of protected species.</p> <p>The performance indicator and measure declare that when interactions increase above the highest historical point, this is the point at which the measure will trigger. The reason for this is that populations of protected species are supposedly increasing and thus the number of interactions with protected species will also increase (namely in high effort areas associated with nesting and foraging).</p> <p>Please note the number of protected species interactions which result in the death of the individual (ratio of release alive vs released dead).</p>
External drivers	Protected species populations are impacted by a range of natural and anthropogenic forces (other than commercial fisheries, including Indigenous fishing, coastal development, and habitat modification).
Other issues	<ul style="list-style-type: none"> <li>• Habitat loss or degradation</li> <li>• Ghost fishing</li> <li>• Marine park closures</li> <li>• Climate change</li> <li>• Other human impacts</li> </ul>

## Social issues

Rationale for inclusion of issue	<p>The main purpose of the <i>Fisheries Act 1994</i> (the Act) includes applying and balancing the principles of ecologically sustainable development (ESD). One of the principles of ESD, as defined in the Act is “that decisions and actions should provide for broad community involvement on issues affecting them”.</p> <p>The Fisheries Queensland manages the fishery on behalf of all Queenslanders and has made an explicit commitment, through the objectives of the Act, to involve the community in the decision making process. Ensured through the public release of documentation and consultation processes describing proposals for changes to management arrangements. As long as fishery management arrangements are adequate to ensure sustainability of the target species and any other ecosystem component, ensuring adequate compliance with management arrangements for any fishery will have the flow on effects of strengthening the protection afforded to biological diversity, ecological processes and life-support systems and will also enhance individual and community wellbeing, while involving the community in the decision making process and increasing community confidence that the resource is being harvested sustainably.</p>
<b>Operational objective</b>	To ensure community confidence in management arrangements.
<b>Performance indicator</b>	Level of compliance by commercial and recreational fishers.
<b>Performance measure</b>	<p><b>The rate of compliance falls below 92.5% in the commercial fishery and/or 92.5% in the recreational fishery.</b></p> <p><b>Justification:</b> High compliance is used as a proxy for whether management arrangements are being communicated effectively and whether recreational and commercial fishers are generally satisfied with the management regime. The Queensland Fisheries Strategy 2009–2014 outlines 92.5% as the proxy for the appropriate level of accepted compliance.</p>
<b>Management response</b>	Fisheries Queensland will report on the PMS annually. Within three months of becoming aware that a performance measure has been triggered, Fisheries Queensland will finalise a clear timetable for implementation of appropriate management responses in consultation with fishery stakeholders.
Data requirements/availability	<p>Data from the Compliance Activity System (# breaches per inspections conducted).</p> <p>The compliance information that is required for this part of the performance measure pertains directly to serious offences. Serious offences are those which could be considered to inhibit or reduce the sustainability of the fishery. If all offences were considered (particular administrative) then the trigger would be set off more frequently.</p>
Evaluation of current fishery performance	<p>Compliance Risk Assessment</p> <p>The compliance risk assessment identified the following activities as having the highest level of risk in the Mud Crab Fishery:</p> <ul style="list-style-type: none"> <li>• Interference with fishing apparatus,</li> <li>• Use of unauthorised gear in the recreational fishery</li> <li>• Leaving fish in fishing apparatus out of the water</li> </ul>

	<ul style="list-style-type: none"> <li>• Take/possession of regulated fish (undersized male) by recreational and commercial fishers</li> <li>• Take/possession of regulated fish (female) – recreational</li> <li>• Recreational fishers taking crabs for commercial purposes</li> </ul> <p>Annual compliance reports have identified minimal offences in the Mud Crab Fishery which maintains a compliance rate of at least 90% and above.</p>
Robustness	<p><b>Compliance [Low]</b></p> <p>The compliance information is only a very indirect indicator of fisher satisfaction with management and effective communication.</p>
Current and future management	<p>A compliance risk assessment was completed for this fishery in 2010 to determine compliance priorities. The outcomes of the assessment will be incorporated into QBFP operational plans from 2010 onwards.</p>
Comments and action	N/a
External drivers	N/a
Other issues	N/a