

Sustainable Fisheries Strategy

2017–2027

Mud & Blue Swimmer Crab (C1) Fishery Scoping Study

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Table of contents

Summary (Table)	iv
1 Overview	1
1.1 Commercial Fishery	1
1.2 Non-commercial Fishing.....	1
2 Legislation & Advisory Bodies	3
3 Key Management Controls	3
4 Assessment History	3
5 Licence & Symbol Summary	4
5.1 Commercial Fishing Authorities / Fishery Symbols.....	4
6 Catch & Effort Summary	6
6.1 Effort	6
6.2 Effort Distribution	10
6.3 Catch	10
6.4 Target Species	10
6.5 Byproduct	16
6.6 Bycatch.....	16
6.7 Species of Conservation Interest (SOCI)	16
7 Key References and Links	18
8 Appendix	20

Summary (Table)

Feature	Details
Species targeted	<i>Commercial</i> –Mud crab, blue swimmer crab. <i>Recreational</i> –Mud crab, blue swimmer crab.
Fisheries symbols	<u>Pot fishing</u> –C1, all crab species except spanner crabs. <u>Access symbols</u> –None.
Legislation	<i>Fisheries Act 1994; Fisheries Regulation 2008.</i>
Working group	Yes.
Harvest Strategy	No, scheduled for implementation 2019.
Gear	The following apparatus are currently used within the C1 Fishery: <ul style="list-style-type: none"> – Baited wire-mesh or trawl-mesh crab pots – Pots can be arranged along a trotline – Hoop/dilly (inverted dillies prohibited) <i>A full description of the types of apparatus permitted are outlined in Appendix 1.</i>
Main management methods	<u>All fishers</u> General spatial closures. Minimum size limits–mud crabs, 15 cm carapace width (CW, tip to tip); blue swimmer crabs, 11.5 cm CW. Single sex harvest regulation–no take on female mud and blue swimmers. No take species–Spanner, non-crab species (e.g. fin fish). Gear restrictions –Inverted or ‘witches hat’ dillies prohibited, compliant float and labels must be affixed. <u>Commercial only</u> Licence restrictions–Maximum 50 pots, traps, or dillies per C1 symbol. Gear restrictions–see Appendix 1 for details. <u>Recreational only</u> 4 pots/dillies per person. Mud crabs in-possession limit of 10 per person.
Quota	No quota/TACC limits in place for either species.
Fishing Season	All year round, however 80% of blue swimmer crabs are caught between November and May.
Commercial Fishery licences	Number of C1 symbols: 412 (2017). Total number of licences with access to the fishery: 331 (2017). Number of active licences: 106 (blue swimmer) & 321 (mud) (2017).
Total annual harvest by sectors	Commercial: 994t mud crabs & 323 t blue swimmer crabs (DAF 2016). Charter: less than 1t (Business Queensland, 2017). Aboriginal people’s and Torres Strait Islander people’s harvest: 13t mud crabs (2000-01 data) (Grubert <i>et al.</i> , 2018), unknown for blue swimmer crabs. Recreational: blue swimmers 36t (Johnston <i>et al.</i> , 2018) & mud crabs 332t (Grubert <i>et al.</i> , 2018).
GVP	\$15.9 million for mud crabs (DAF 2017a). \$3 million for blue swimmer crabs (DAF 2017b).

Feature	Details
Stock Status	<p>SAFS reports Queensland east coast & Gulf of Carpentaria mud crabs as 'sustainable' (Grubert <i>et al.</i>, 2018).</p> <p>SAFS reports north eastern Australian blue swimmer crabs as 'sustainable' (Johnston <i>et al.</i>, 2018)</p>
EPBC Act Accreditation	<p>Part 13: Accredited.</p> <p>Part 13A: Accredited (expires 31 May 2019 for both species)</p>

1 Overview

1.1 Commercial Fishery

The commercial (C1) crab fishery is Queensland's third most valuable fishery and it has an estimated Gross Value of Production (GVP) of \$18.9 million (Department of Agriculture and Fisheries, 2018b; a). The management framework for this fishery is relatively simple with operators targeting two key species: mud crabs (*Scylla serrata*) and blue swimmer crabs (*Portunus armatus*). East Coast Trawl Fishery (ECTF) operators are also permitted to retain blue swimmer crabs (45t in 2017; Department of Agriculture and Fisheries, 2019), but unlike the C1 Fishery, trawl caught crabs have in-possession limits. In addition to the trawl fishery, a small amount of mud and blue swimmer crabs (16t total since 2000; Department of Agriculture and Fisheries, 2019) are harvested by net fishers operating on the Queensland east coast.

The fishing area for the C1 symbol includes both the Queensland east coast (EC) and the Gulf of Carpentaria (GoC) (Fig. 1). This allows the licence holder to fish in both regions and provides their operation with a high degree of flexibility. It differs to the majority of Queensland's fishery symbols that restrict operations to a single region *i.e.* can be only used on the Queensland EC or in the GoC. With that said, logistical and economic constraints would limit the number of fishing operations that split their effort between regions. However, the extent of within-region movements (*i.e.* along the Queensland east coast) due to licence transfers or changing fishing behaviours is less certain. At present, the majority of C1 licences operate on the Queensland EC with the greatest concentrations occurring in the South East Queensland. It is therefore not surprising that most of the commercial catch and effort is reported from the southern half of Queensland's EC.

The C1 catch is dominated by mud crabs which are in greater market demand and thus have higher value per kilogram. Mud crab catch is distributed along the Queensland coastline with notable hotspots occurring in south-east Queensland. This contrasts with the blue swimmer crab catch which is largely confined to the south-east corner of the state. While the distribution of mud and blue swimmer crabs overlap, the two species tend to be caught in different habitat and spatial ranges. For example, Mud crabs are targeted in estuary and intertidal waters and are frequently caught in muddy substrates and turbid, brackish waters (Hill *et al.*, 1982; Hill & Garland, 2009; Business Queensland, 2017). In comparison, blue swimmer crabs are caught seasonally between November and May, with operators targeting the species across a smaller spatial range (100 - 500 nautical miles) and in waters 3–60 metres deep (Hill & Garland, 2009; Business Queensland, 2017).

While regulations permit the retention of other crab species (excluding spanner crabs), only moderate amounts of byproduct are retained in this fishery—typically <20t and frequently lower than 10t (Department of Agriculture and Fisheries, 2019).

1.2 Non-commercial Fishing

The *Statewide Recreational Fishing Survey 2013-14* estimated that Queensland had an annual recreational fishing population of more than 640,000, with the sector registering a combined 12-month estimate of 2.5 million fishing days (Department of Agriculture and Fisheries, 2015). Mud and blue swimmer crabs hold significant social importance in Queensland and the recreational sector is responsible for 8 and 22% of the total crab harvest respectively (Grubert *et al.*, 2018; Johnston *et al.*, 2018).

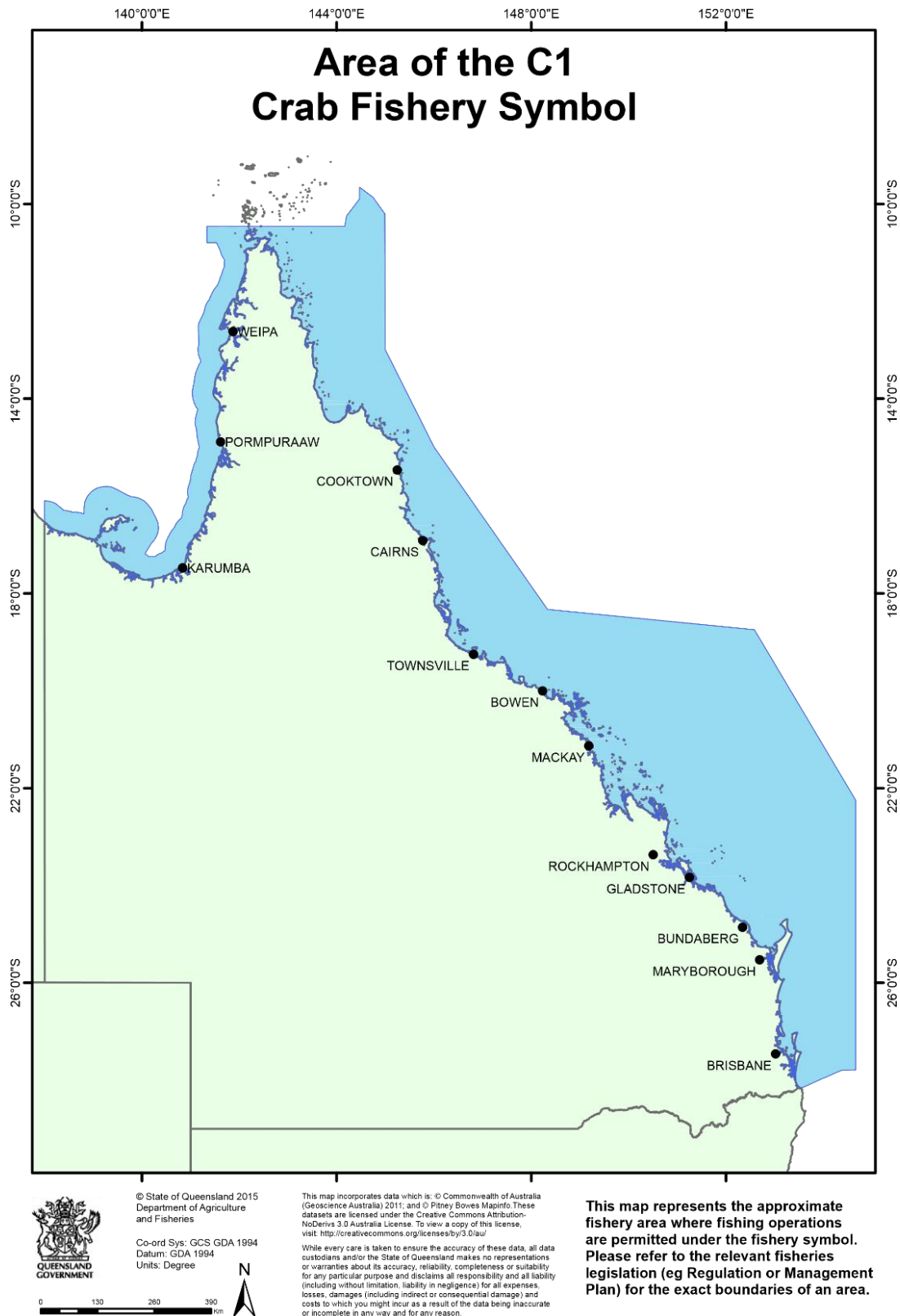


Figure 1. Area permitted to be fished under the C1 fishery symbol which grants access to the mud and blue swimmer crab fishery.

In addition to the recreational and commercial sectors, the C1 Fishery includes a much smaller charter fishing sector. Records show that 1t of (mostly) mud crab catch has been reported since 2007 (Department of Agriculture and Fisheries, 2019); demonstrating that the charter sector makes a very small to negligible contribution to the annual crab harvest.

While catch and effort by Aboriginal peoples and Torres Strait Islander peoples is the least understood, catch and effort in this sector is expected to be comparatively low with fishing activities aligning closely with the recreational fishing sector.

2 Legislation & Advisory Bodies

The C1 Fishery is managed in accordance with the objectives of the *Fisheries Act 1994* and the *Fisheries Regulation 2008*. While it does not operate under a management plan, a harvest strategy is being developed for the fishery as part of the *Queensland Sustainable Fisheries Strategy 2017–2027* (the Strategy). Development of the harvest strategy will be done in consultation with the Crab Fishery Working Group (CFWG).

The CFWG is an advisory group that includes a wide range of stakeholders from the scientific community, management agencies, and commercial and recreational fishing sectors. The CFWG has discussed various management options for the C1 Fishery that support the ecological, socio-economic and management objectives of the crab fishery. Further information on the changes being proposed for the C1 fishery are outlined in the *Government direction of Fisheries reforms–2018* paper (https://www.daf.qld.gov.au/data/assets/pdf_file/0009/1427238/queensland-government-direction-on-fisheries-reform-2018.pdf).

3 Key Management Controls

The C1 Fishery operates under a mixture of input and output controls which are largely based at the whole of fishery level. Commercial fishers are subject to a range of general input controls that include limited entry, spatial closures, pot limits (e.g. 50 apparatus per symbol, trotline limits of 10 pots) and restrictions on the types of pots and traps that can be used. The *Fisheries Regulation 2008* also incorporates two regionally-specific restrictions on use of trotlines in the Moreton Bay and Great Sandy regions (Appendix 1). Output controls for the fishery include a long standing prohibition on the retention of female crabs and minimum legal size limits.

Management of the recreational fishing sector relies principally on the use of spatial closures, gear restrictions, in-possession limits (for mud crabs only), prohibition on the retention of female crabs, and minimum legal size limits.

A more detailed account of the gear restrictions applied to the crab fishery is contained within Appendix 1. Refer to the *Fisheries Regulations 2008* for a full account of the rules governing the use of the C1 fishing symbol (available at: <https://www.legislation.qld.gov.au/>).

4 Assessment History

The blue swimmer crab (C1), mud crab (C1) and spanner crab (C2/C3) fisheries have been the subject of a *Level 1: Scale, Intensity, Consequence, Analysis* (SICA) (Hill & Garland, 2009) which focused on the direct impacts of the fishery on the most vulnerable species. The stock status of blue

swimmer crabs and mud crabs have also been assessed as part of the Status of Australian Fish Stocks (SAFS). These assessments indicate that both species are fished sustainably on the Queensland EC and in the GoC (Grubert *et al.*, 2018; Johnston *et al.*, 2018). More detailed information on the SAFS assessments can be found at <http://fish.gov.au/>

The Queensland blue swimmer crab fishery was quantitatively assessed in 2015 (Sumpton *et al.*, 2015) with the results indicating that the species was not overfished to the point where spawning biomass was significantly reduced. However, this study found that the population of legal sized male crabs combined with the effort levels would not produce catch rates that were suitable for economic profit or angling quality (Sumpton *et al.*, 2015). This means that while blue swimmer crab stocks were not overfished, total biomass was unlikely to increase substantially under the current fishing environment. This finding is important as the *Queensland Sustainable Fisheries Strategy 2017–2027* contains key biomass targets including the establishment of catch limits based on achieving Maximum Economic Yield by 2027 (Department of Agriculture and Fisheries, 2017).

Biomass estimates including sustainability reference points are not currently available for mud crabs. This situation is currently being rectified and a stock assessment for the species on the Queensland EC and GoC is scheduled for completion in 2019.

More broadly, the C1 Fishery undergoes broad-scale sustainability assessments as part of the *Wildlife Trade Operation* (WTO) approvals process. A WTO approval is issued under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is required for all fisheries that export product caught and retained in Australian waters. While more complicated, the WTO approval effectively signifies that a fisheries as a whole is being managed sustainably.

5 Licence & Symbol Summary

5.1 Commercial Fishing Authorities / Fishery Symbols

Access to Queensland's commercial fisheries is managed using fishery symbols. These symbols, in effect, define what gear can be used in each fishery (e.g. N = Net, L = line, T = trawl) and the area of operation. While operators can have multiple fishery symbols attached to their licence (e.g. N1, N2 and L1 or a L1 and T1), they can only use one fishery symbol at a time. The notable exceptions to this are a) the crab (C1) fishery symbol that can be used in conjunction with a line (L) and net (N) fishery symbol; and b) fishing symbols related to quota such as those used in the *Coral Reef Fin Fish Fishery* and the *East Coast Spanish Mackerel Fishery*. In each fishery, the total number of symbols represents the number of fishers that could potentially access the fishery at any one time. This differs from data on the number of 'active' licences which represents the number of operators that have used their symbol to access the fishery over a 12 month period.

Commercial fishers wanting to access the mud crab and blue swimmer crab fishery are required to hold a C1 fishing symbol. This symbol covers all crab fishing operations on the Queensland EC and in the GoC but excludes spanner crabs which are managed under C2 and C3 fishery symbols. Prior to the introduction of the C1 symbol in 1995, all crab catch (spanner, blue swimmer and mud) was reported against an 'R' fishery symbol. As data for the R fishery symbol covers a number of species it cannot be easily separated into mud, blue swimmer and spanner crab fisheries. As a consequence this catch data were not included in Table 1 or the corresponding figures.

Table 1. Overview of the number of C1 fishing symbols and total number of active licences, including the East coast (EC) and Gulf of Carpentaria (GoC). 'Unknown' represents the number of active licences who reported fishing activities where the fishing location was not reported or recorded within the licencing system.

Year	No. symbols	No. active licences			
		Total	EC	GoC	Unknown ¹
1988	–	397	367	3	91
1989	–	413	364	35	53
1990	–	401	360	39	29
1991	–	412	377	35	21
1992	–	393	340	46	44
1993	–	435	385	52	44
1994	–	406	381	25	30
1995	489	404	377	30	35
1996	586	428	386	54	21
1997	745	487	418	82	27
1998	870	473	414	74	13
1999	923	484	428	67	8
2000	913	496	438	76	9
2001	893	525	466	77	2
2002	890	523	460	83	3
2003	886	563	494	85	8
2004	883	547	481	79	2
2005	869	472	408	72	3
2006	799	468	409	78	1
2007	782	468	404	75	–
2008	771	479	417	70	–
2009	504	449	389	75	–
2010	434	408	357	62	–
2011	438	404	353	59	–
2012	437	396	337	66	–
2013	430	397	344	62	–
2014	431	383	337	56	–
2015	420	356	325	39	–
2016	417	336	311	36	–
2017	412	331	305	33	–

¹ Unknown locations are likely the result of submission of incomplete logbooks, administrative errors and / or a proportion of fishers operating in northern Australia / readily accessing both areas. These anomalies have been readdressed through time through a series of internal monitoring and reporting processes. The unknown records still represent an active licence and therefore were included in the analysis.

Data on the total number of C1 symbols reveals four distinct phases: a substantial increase in the number of C1s after its introduction in 1995, a period of relative stability, a sharp decline in 2008-09 followed by another period of stability (Fig. 2a)². This decline can be attributed to the *2008-09 Latent Effort Removal Process* which specifically targeted and removed underutilised C1 symbols. Going forward and without management intervention, the number of fishing symbols available for use in the crab fishery is expected to remain at or around 2017 levels (Table 1, Fig. 2a). The primary reason for this is Queensland's limited licencing entry policy prevents new licences being issued for the fishery. While this does not prevent the re-activation of underutilised licences, it will help prevent licence numbers expanding into the future.

Data on the number of licences operating on the EC and in the GoC (active licences³) are summarised in Table 1 and Fig. 2. This data represents the number of licences that reported catch against a C1 fishing symbol and, when compared to the number of fishing symbols, provides an indicator of the number of unused C1 symbols within a given year (Fig. 2a). This data shows a progressive decline in the number of licences accessing the fishery between 2003 (563 licences) and 2017 (331 licences). The reasons behind this decline are difficult to quantify but could include changing fishing behaviours, the introduction of new management arrangements (e.g. the expansion of the Great Barrier Reef Marine Park Representative Areas Program, expansions of the *Moreton Bay Marine Park* and *Great Sandy Marine Park* zoning plans) and the surrender of licencing packages as part of a non-affiliated buybacks including those associated with the introduction of the net free zones (Department of Agriculture and Fisheries, 2016a; b). As the latent effort review was aimed at unused licences, observed declines in symbol numbers between 2008 and 2009 were not reflected in the active licence data (Fig. 2a).

Regionally, licencing data revealed that over 80% of the active C1 symbols operate on the Queensland EC (Fig. 2b). While showing a small degree of variability, these proportions have remained relatively stable through time (Fig. 2b). This differential will be significant when taking into consideration the risk posed by the fishery to key species within each of the respective regions.

6 Catch & Effort Summary

6.1 Effort

Effort is quantified by the number of days fished by the primary vessel (vs. number of pots) and can be analysed at the whole of fishery level or subdivided into the Queensland EC and GoC regions (Table 2; Fig. 3a). At a whole of fishery level, effort remained relatively stable until around 1996 where it increased progressively to its peak in 2003. At 60,813 days fished, the 2003 peak was more than double the period preceding the rise in effort (pre-1996 average = 24,196 days fished) and approximately double that observed in the pre-2000 period (29,559 days fished) (Table 2; Fig. 3a). After 2004, effort trends become more stable with the fishery fluctuating between 40,000 and 50,000 fishing days (Table 2; Fig. 3a-b).

² The total number of fishing symbols represent the potential number of operators that could operate in the fishery at one time. This differs from data on the number of 'active' licences shows how many fishers are actually operating within the fishery.

³ An 'active' licence is defined by DAF as any licence that reported catch against the C1 fishery symbol, irrespective of the days fished, the frequency of fishing events or the amount of catch reported. As such, this data may include licences that access the fishery infrequently, have small catch quantities or undertake very limited fishing events.

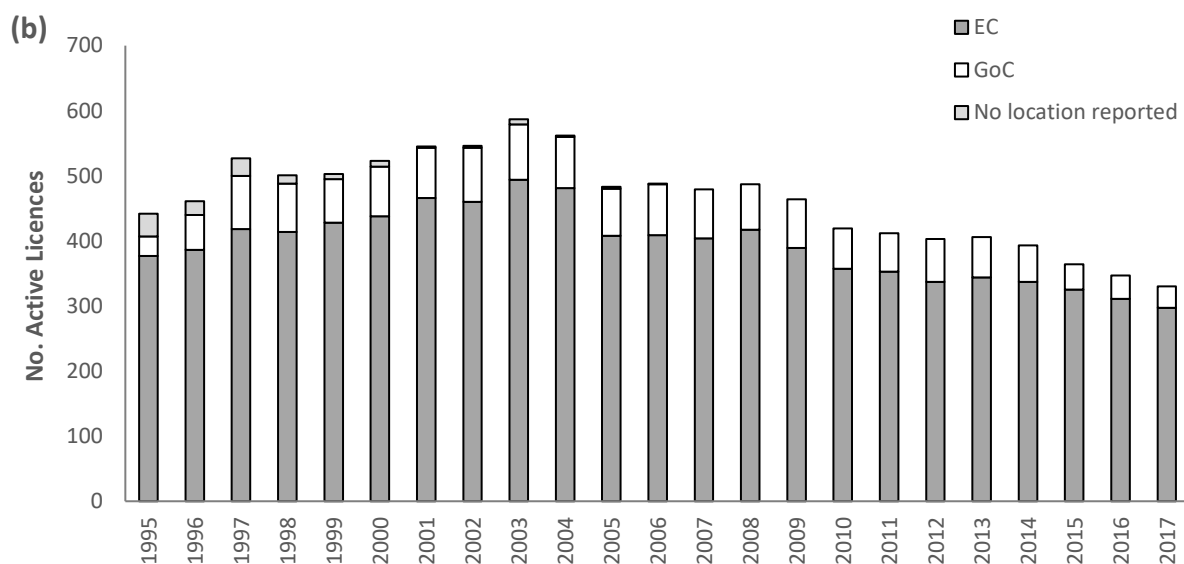
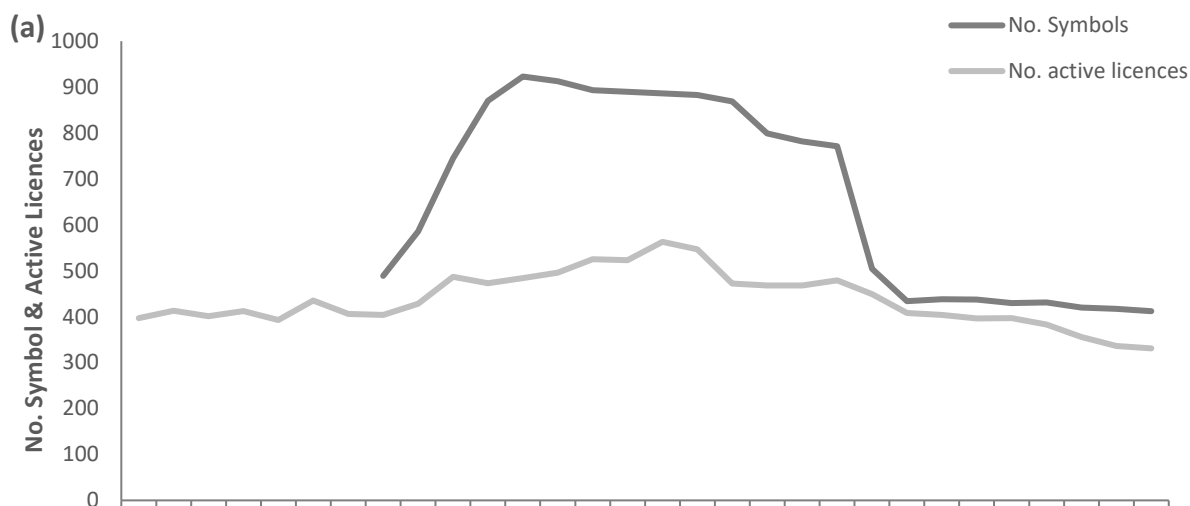


Figure 2. Comparisons between the number of C1 fishing symbols and the number of active licences by region, including a) the number of C1 symbols vs. number of active licences and b) number licences active on the Queensland east coast and in the Gulf of Carpentaria.

Effort in the C1 Fishery underwent an expected increase with the expansion in the number of C1 fishing symbols. The increase in effort accelerated from 2000 onwards and jumped markedly in the 2003 and 2004 period (Fig. 3b). Factors that would have contributed to this increase include increased market demand or value for the two target species and changing fishing behaviours. The peak in 2003-04 also coincided with the release of an investment warning for the fishery which may have resulted in a temporary increase in effort, or over reporting in the fishery. The extent and influence (low, medium, high) of the investment warning though will be difficult to determine

Table 2. Effort data for the entire C1 Fishery, the EC, GoC, and unknown locations. *Discrepancies between total effort and the combined regional data is due to some licences accessing two areas on the same day. At a whole of fishery level this is treated as a single fishing day.

Year	Effort Levels (days fished)			
	Total*	EC	GoC	Unknown
1988	19511	17427	78	2013
1989	22130	18826	1907	1397
1990	22187	19778	1726	685
1991	22290	20361	1364	566
1992	22222	19181	1908	1137
1993	26130	23498	2223	409
1994	25689	24577	797	315
1995	26709	25215	1210	284
1996	30902	27194	3580	128
1997	35722	30564	5028	131
1998	39140	35575	3511	54
1999	44998	40545	4429	24
2000	46638	41611	4902	125
2001	48814	43928	4879	7
2002	49675	43594	6063	18
2003	60813	53240	7535	39
2004	57080	50754	6320	6
2005	47859	41531	6321	7
2006	47457	41811	5641	5
2007	45820	40451	5369	–
2008	46485	40791	5711	–
2009	47025	40534	6491	–
2010	46248	39947	6301	–
2011	46412	40584	5828	–
2012	49028	42790	6238	–
2013	48696	42686	6010	–
2014	47450	42198	5281	–
2015	47322	42504	4818	–
2016	46982	43026	3956	–
2017	45641	41911	3730	–

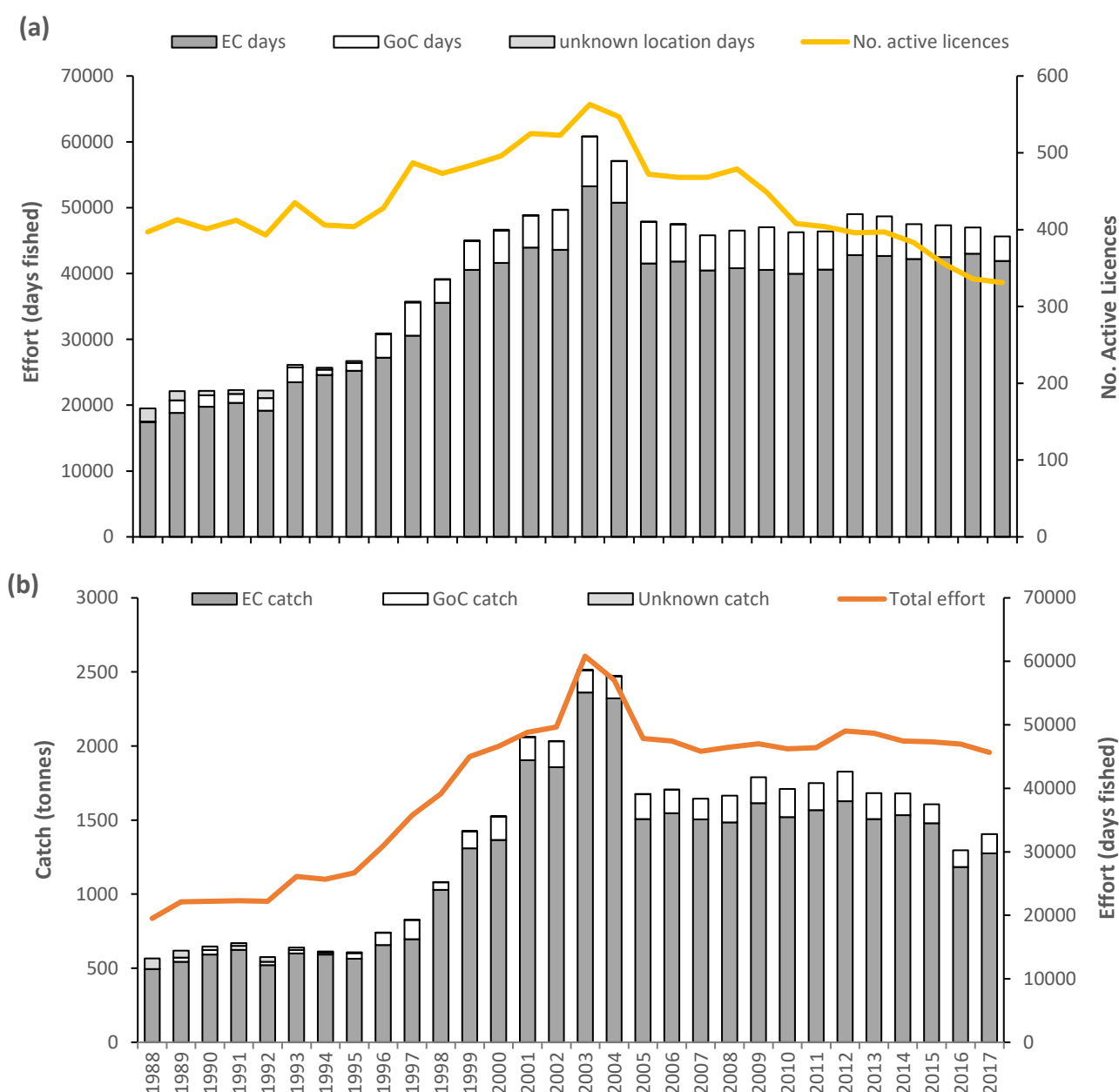


Figure 3. Summary of catch and effort trends for the entire C1 Fishery, including a) a comparison between total effort and number of active licences, and b) total catch compared to total effort.

Declines in both the number of fishing symbols and the number of active licences, appears to have had a limited effect on total effort (Fig. 3b). Between 2005 and 2016 total effort fluctuated between 45,000 and 49,000 fishing days despite a 52% decline in the number of C1 symbols (Table 1) and a 29% decline in the number of active licences (Table 1; Fig. 3b). This suggests the majority of licences that have been removed from the fishery were either latent, underutilised and/or made a lower contribution to total effort levels. This is of particular relevance to the 2008–2010 period (Fig. 3a). In more recent times, the slight decline in active licences numbers reflects a management change that permits operators the use more than the prescribed pot number if they hold more than one C1 fishing symbol. This change, in effect, would have helped consolidate the number of active licences whilst maintaining effort levels

6.2 Effort Distribution

Although mud and blue swimmer crabs are managed at the whole of fishery level, there are notable differences in the effort distribution maps for each species. Operators targeting mud crabs spread their effort over a significant portion of Queensland's coast, including in regional areas such as the eastern coast of the GoC and north of Cooktown (see Appendix 2). Blue swimmer crab effort is more sparsely distributed and fishers primarily operating within and around Moreton Bay. The GoC blue swimmer crab fishery is smaller than the EC with effort concentrated around towns located on the south-eastern coastline (Appendix 2). These differences between species are important when assessing ecological risk, and may support management framework adjustments aimed at dividing mud and blue swimmer crabs into separate management units.

6.3 Catch

Catch data for the C1 Fishery is provided in Table 3 and gives an absolute (non-standardised) value of what is being harvested across Queensland. As this data is compiled from commercial fisher logbooks, it does not account for the proportion of catch that was discarded (e.g. no-take individuals, or target/byproduct species returned to the water for various reasons including commercial desirability/marketability).

Catch data for the C1 Fishery shows strong correlations with fishing effort (days fished); trending upwards from 1994 until its peak in 2003/2004 before stabilising at around 1600 and 1800 t per year (Fig. 3a-b). Early increases in total catch can be attributed to the increased use and prevalence of the C1 fishing symbol.

6.4 Target Species

The C1 Fishery is often examined and assessed in the context of the Queensland's EC and GoC. Whole of fishery comparisons though are considered to be important as they provide a broad overview of how the entire fishery (Fig. 1) is functioning and gives insight into species specific trends. Only catch and effort for the pot fishery is considered here; blue swimmer crabs caught by trawl vessels will be covered in the trawl fishery ERAs. A full breakdown of the catch and effort for the whole C1 Fishery is provided in Appendix 3.

From a regional perspective, catch and effort profiles of the two target species are vastly different (Fig. 4–6). This partly reflects the discrepancy in marketability of the two species, the comparatively high value of mud crabs and the seasonal dynamics of populations, e.g. blue swimmer crabs are caught in greater numbers during summer (Sumpton *et al.*, 2003).

Table 3. Catch data for the C1 Fishery (total), the EC, GoC, and unknown. Unknown represents catch reports where the fishing locations could not be verified by Fisheries Queensland.

Year	Catch (t)			
	Total	EC	GoC	Unknown
1988	566	495	0	71
1989	618	544	27	47
1990	646	593	29	24
1991	669	624	26	19
1992	574	521	24	30
1993	640	600	22	18
1994	614	592	13	9
1995	607	564	37	6
1996	740	657	81	2
1997	828	696	129	3
1998	1081	1029	51	1
1999	1425	1309	115	1
2000	1527	1366	157	3
2001	2061	1904	157	0
2002	2033	1857	175	2
2003	2513	2360	151	2
2004	2472	2322	150	0
2005	1674	1507	167	–
2006	1705	1546	159	–
2007	1644	1505	139	–
2008	1665	1485	180	–
2009	1790	1614	176	–
2010	1710	1521	189	–
2011	1750	1566	184	–
2012	1827	1627	201	–
2013	1682	1507	174	–
2014	1680	1533	146	–
2015	1606	1478	128	–
2016	1296	1184	112	–
2017	1405	1275	130	–

Table 4. Whole of fishery catch and effort for blue swimmer crabs and mud crabs. Data excludes catch and effort with unknown locations. A full account of the catch and effort for the entire C1 Fishery, the Queensland EC, GoC and unknown locations has been provided in Appendix 3.

Year	East Coast				Gulf of Carpentaria			
	Blue swimmer crab		Mud crab		Blue swimmer crab		Mud crab	
	Catch	Effort	Catch	Effort	Catch	Effort	Catch	Effort
1988	269	6914	226	11249	-	-	<1	78
1989	240	6033	304	13151	<1	41	27	1896
1990	234	5544	359	14586	<1	24	29	1702
1991	285	6429	339	14515	<1	3	26	1361
1992	148	5067	372	14724	-	-	24	1908
1993	166	6015	434	18569	<1	10	22	2213
1994	180	6262	412	19275	-	-	13	797
1995	182	6653	382	19985	<1	22	37	1203
1996	214	6745	443	22001	<1	26	81	3557
1997	236	7876	459	24743	<1	20	129	5008
1998	405	9869	624	28455	<1	35	51	3479
1999	586	12015	723	32686	<1	5	115	4424
2000	523	11620	843	33980	-	-	157	4902
2001	1058	14607	845	33905	<1	38	156	4867
2002	1026	14362	831	34297	<1	11	175	6063
2003	1363	19183	998	41414	<1	23	150	7529
2004	1296	17821	1026	40379	<1	72	149	6320
2005	705	13358	802	34098	-	-	167	6321
2006	748	13736	798	33790	1	142	157	5641
2007	710	11936	796	32936	3	256	136	5368
2008	655	12055	829	33104	2	158	178	5711
2009	743	12807	871	33038	2	167	174	6491
2010	485	10082	1035	34342	2	159	187	6296
2011	331	8358	1235	36951	<1	8	184	5828
2012	397	8832	1230	39116	2	184	199	6238
2013	341	8847	1167	39004	<1	196	174	6010
2014	351	8622	1183	37784	<1	5	146	5280
2015	417	8018	1062	38080	<1	95	127	4818
2016	296	7601	888	38858	12	324	100	3931
2017	419	8208	855	36668	<1	45	130	3730

Blue Swimmer Crab

Blue swimmer crab data for the Queensland EC is dominated by a rapid increase (and subsequent decrease) in catch and effort between 2000 and 2003. During this period, total blue swimmer crab catch increased from 523t per year to 1,326t per year with effort increasing from 11,620 days fished to 19,183 days fished (Table 4; Fig. 4a). Blue swimmer crab catch and effort in the GoC is lower with the fishery reporting less than 3t of catch in all but three of the years examined (Table 4; Fig. 4b). While catch of the species increased in 2016, catch (≤ 1 t) and effort (≤ 324 days) remains well below that of the Queensland EC (Table 4; Fig. 4b).

Non-standardised catch per unit effort (CPUE) trends for blue swimmer crabs reflected the oscillative nature of the fishery. On the EC, CPUE (kg/day fished) is above that of mud crabs suggesting that a) the species is caught in higher number / encountered more frequently and b) the value of the species lies in the quantity of the product vs. individual weights of the product (Fig. 6a). This trend did not carry through to the GoC where catches are much lower and have a higher degree of variability (Fig. 6b).

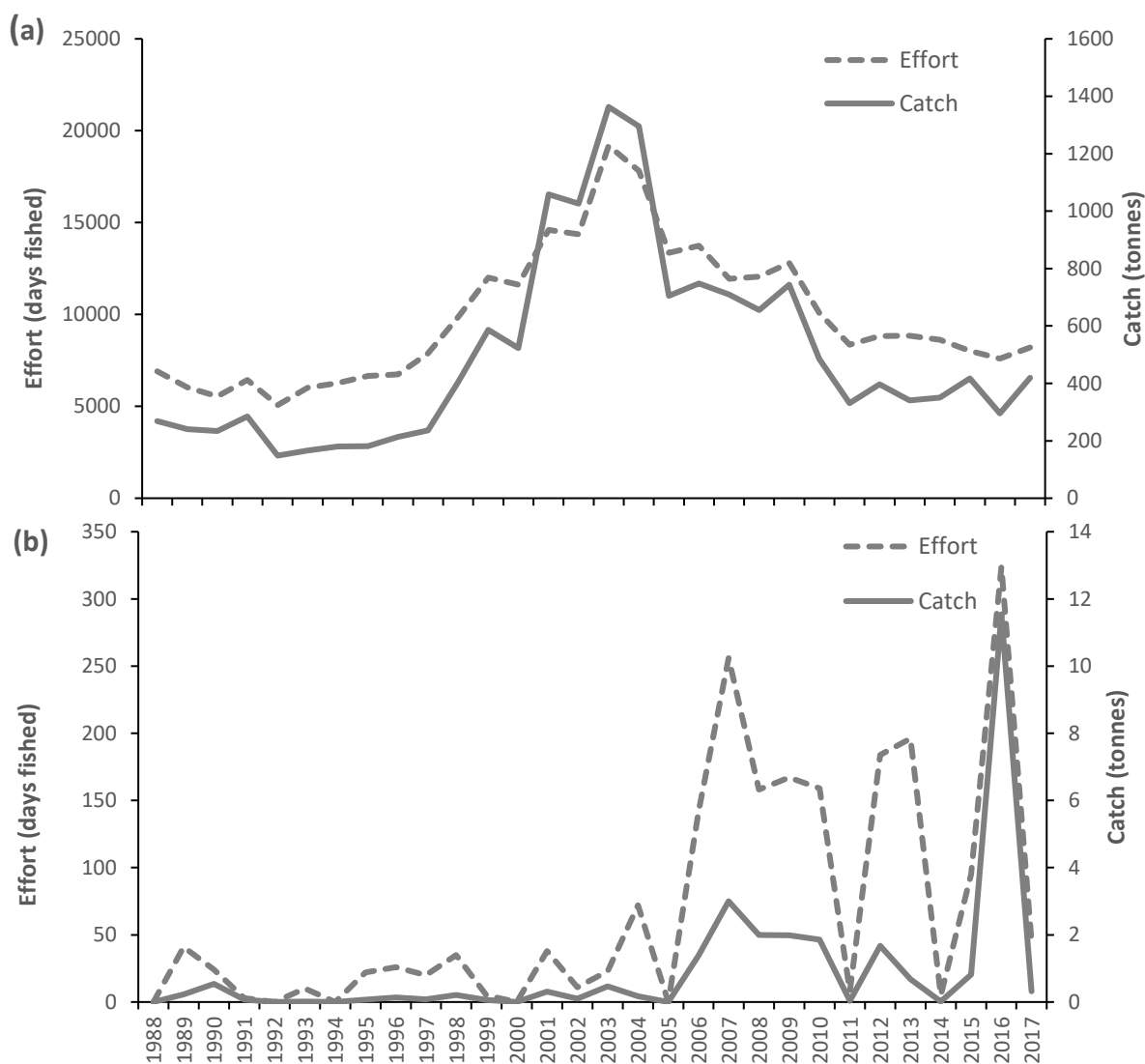


Figure 4. Catch and effort trends for blue swimmer crabs on the (a) EC and in the (b) GoC.

Mud Crabs

The Queensland EC mud crab data shows an extended period of growth (Table 4; Fig. 5a). As with the blue swimmer crabs, mud crab effort peaked in 2003 at 41,414 fishing days (998t); although the maximum reported catch occurred almost 10 years later; 1,235t in 2011 (36,951 days) (Table 4; Fig. 5a). When compared to the fishing data for blue swimmer crabs, mud crab catch and effort in the GoC was more consistent. The data however still showed a degree of between-year variability, (Fig. 5b).

The non-standardised mud crab CPUE for the Queensland EC was more consistent than in the GoC and showed a marginal increases from 1988 to 2011. This trend reversed in the subsequent years (2012–2016) before a correction in 2017 (Fig. 6a). While the mud crab CPUE is higher than blue swimmer crabs in the GoC, this measure remains fairly stochastic, (Fig. 6b).

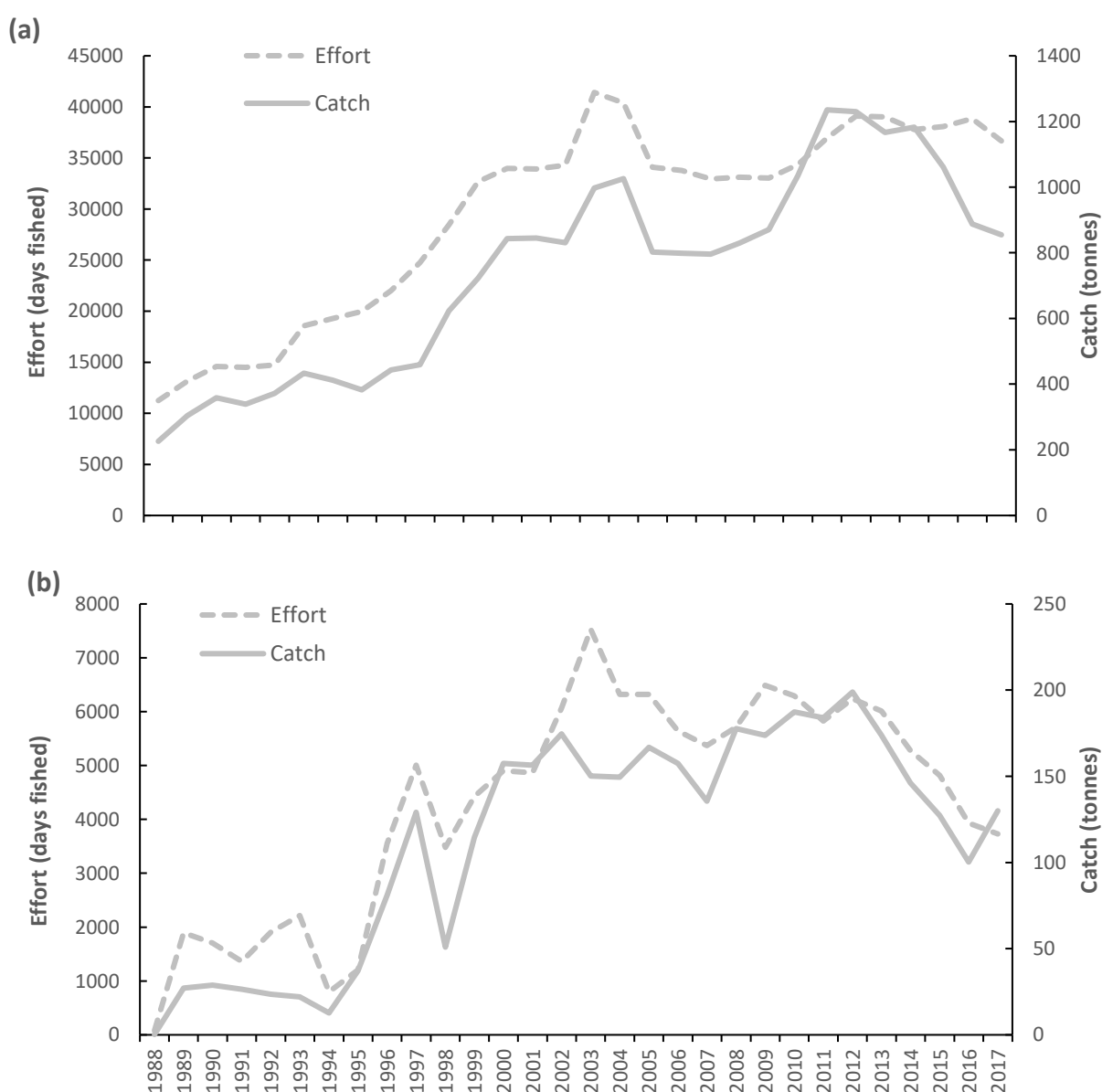


Figure 5. Catch and effort trends for mud crabs on the (a) EC and in the (b) GoC.



Figure 6. Non-standardised catch per unit effort (CPUE) for blue swimmer and mud crabs for the (a) EC and in the (b) GoC.

6.5 Byproduct

While mud crabs and blue swimmer crabs are the primary targets, all other crab species (excluding spanner crabs) are permitted for harvest, including coral swimmer crabs (*Charybdis feriatus*), three-spot crabs (*Portunus sanguinolentus*) and hairyback crabs (*Charybdis natator*). Despite this, only moderate amounts of byproduct are retained in this fishery with data indicating that the average combined catch of non-target crabs is less than 10t of the total catch (Appendix 3) (Department of Agriculture and Fisheries, 2019).

6.6 Bycatch

The majority of non-target bycatch in the C1 Fishery consist of crustaceans, other marine invertebrates and teleosts. Evidence suggests that post release survival rates for most species caught in crab pots are relatively high (Ryan *et al.*, 2003; Sumpton *et al.*, 2003). Modern crab fishing apparatuses may be equipped with turtle exclusion devices and/or 'escape vents' (Fig. 7a-b) so undersized crabs and non-target species are able to extract themselves. However, the use of a bycatch reduction device is not mandatory in the C1 fishery and the extent of their use in this fishery is unknown.

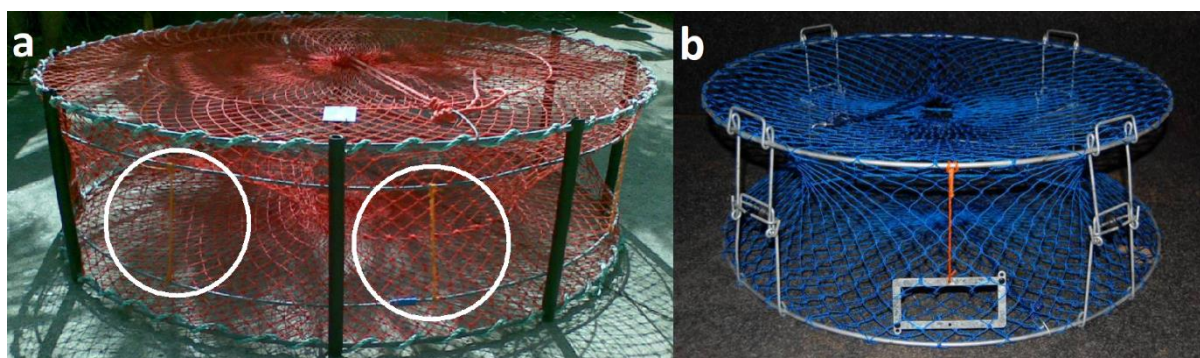


Figure 7. Bycatch reduction devices for crab pots including (a) turtle excluder devices (modified from (Oceanwatch Australia)) and (b) escape vents (Grubert & Lee, 2013).

6.7 Species of Conservation Interest (SOCI)

Species of Conservation Interest (SOCI) that interact with the C1 Fishery include marine turtles, crocodiles, sea snakes, sea birds, sawfishes, groupers, water monitors and water rats (Fig. 8; Appendix 4). Most SOCI are listed as vulnerable, threatened, or endangered under the *Nature Conservation Act 1992* and the *Environment Protection and Biodiversity Conservation Act 1999* and/or protected under *Fisheries Regulation 2008*. These interactions can include direct capture within the crab pot/dilly or indirect interactions e.g. entanglement in float lines.

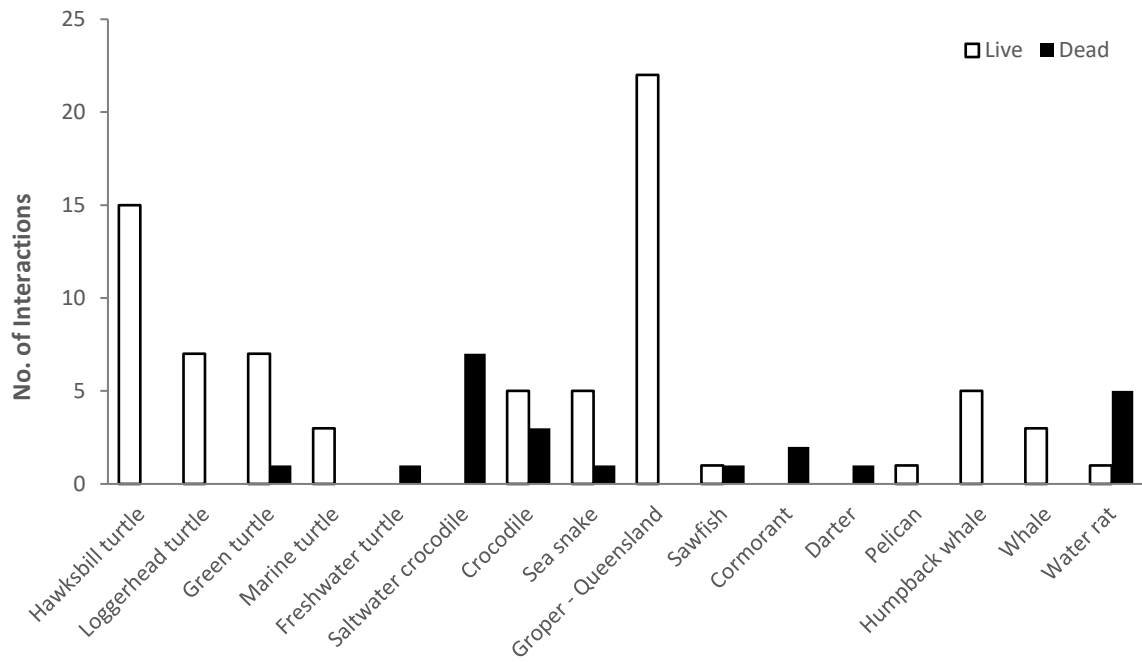


Figure 8. Interactions with Species of Conservation Interest (SOI) recorded from crab fishing activities in the C1 Fishery from 2002 to 2017 (inclusive).

7 Key References and Links

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8 Appendix

- Appendix 1—An overview of the Fisheries Regulations relating to the mud and blue swimmer crab (C1) fishery
- Appendix 2—Effort distribution maps for the 2015, 2016 and 2017.
- Appendix 3—Complete overview of the C1 catch from 1988–2017 inclusive.
- Appendix 4—Detailed overview of the SOCI interactions reported from the ECIFFF.

APPENDIX 1—Summary of the *Fisheries Regulation 2008* provisions relating to the take of mud and blue swimmer crabs in Queensland waters.

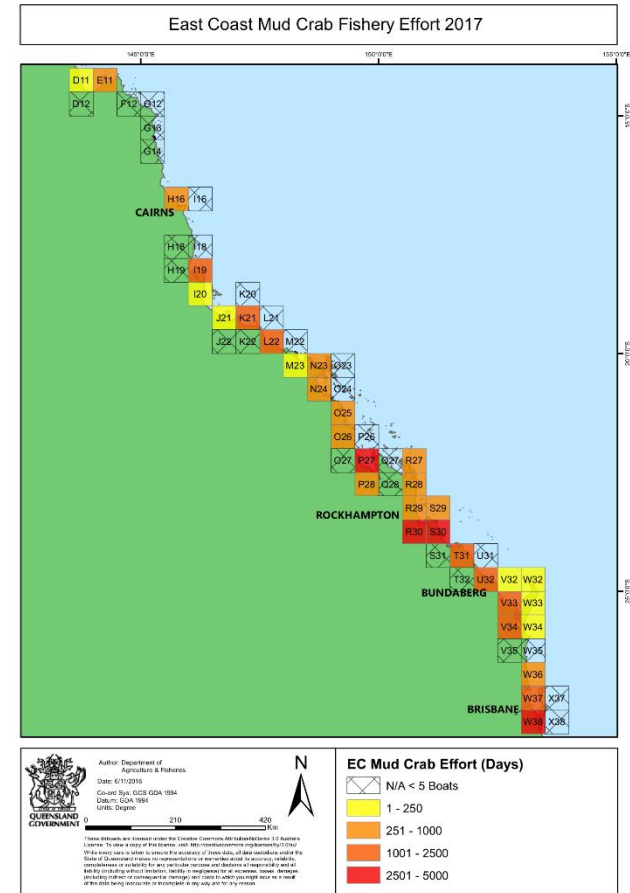
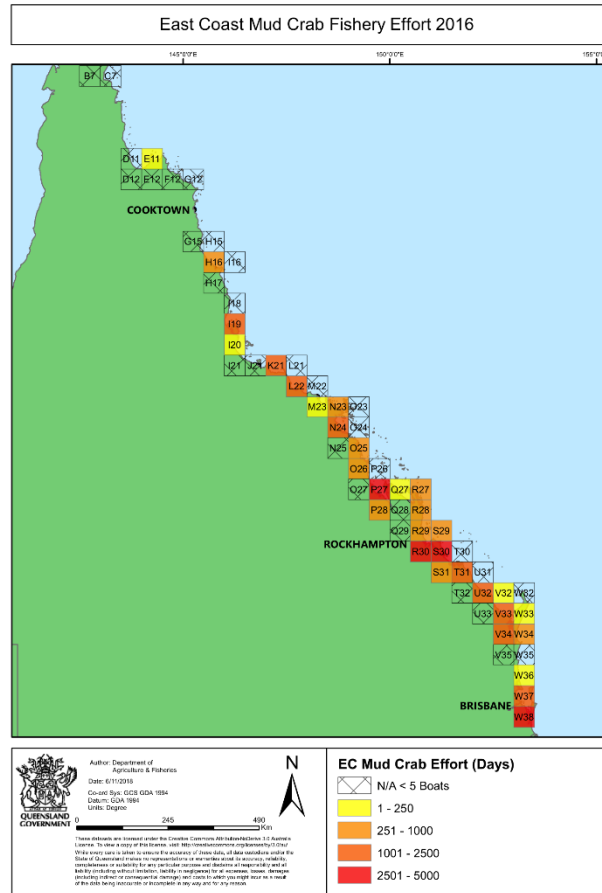
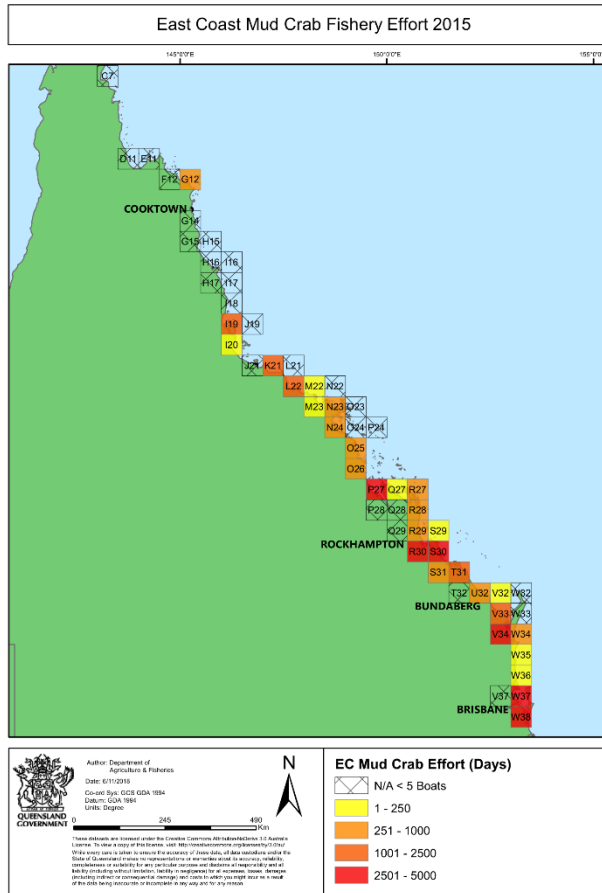
Commercial

Gear regulation	<ul style="list-style-type: none">• Harvesting only by crab pot, collapsible trap or dilly.• Crab apparatus must be attached to a rope, which must be attached to a compliant float, or a fixed object above the high water mark• No more than 50 crab apparatus may be used at a time, or in possession on a boat, including any combination of crab apparatus.• No more than 10 items of crab apparatus attached to a single line or attached to each other in sequence.• If there is more than more than one 'C1' symbol on a commercial fisher's licence, the fisher at any one time may use up to 50 apparatus per C1 symbol, including any combination of apparatus, up to a maximum total of 150 pots for three C1 symbols under a general fisheries permit.
Vessel regulation	<ul style="list-style-type: none">• The primary boat must not exceed 14 m in length• Tender boat may not be used more than 800 m from its primary boat
Spatial regulation	<ul style="list-style-type: none">• Two or more crab apparatus attached to a single line or in a sequence may not be used at the following two locations:<ul style="list-style-type: none">○ Moreton Bay, south of latitude 27°18.430'○ The waters of the Great Sandy Strait; south of a line drawn between Point Vernon (mainland) & Moon Point (Fraser Island).

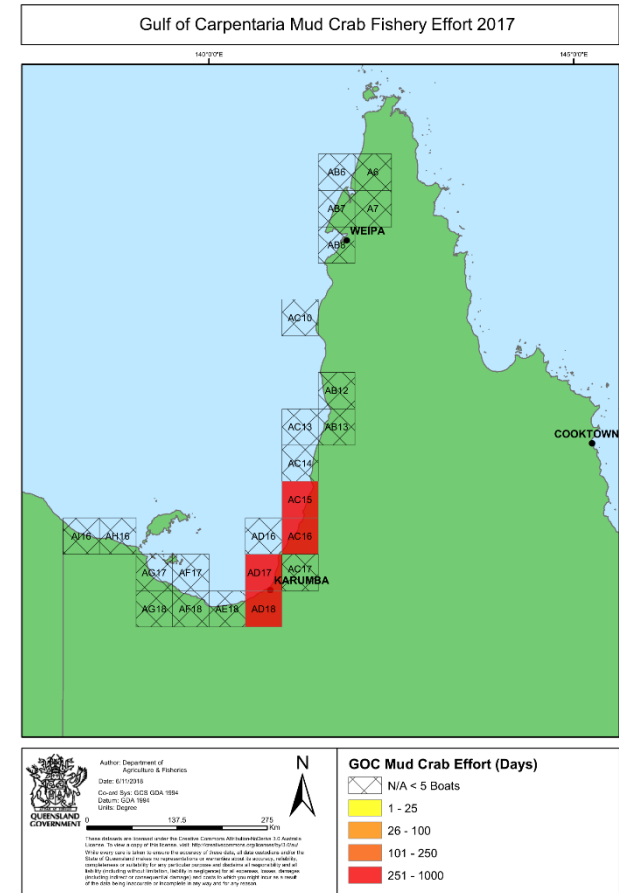
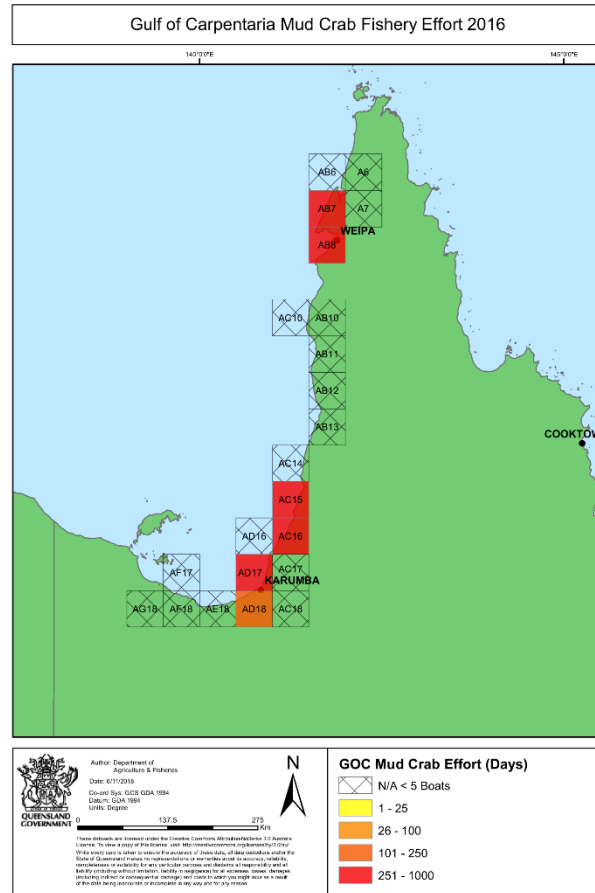
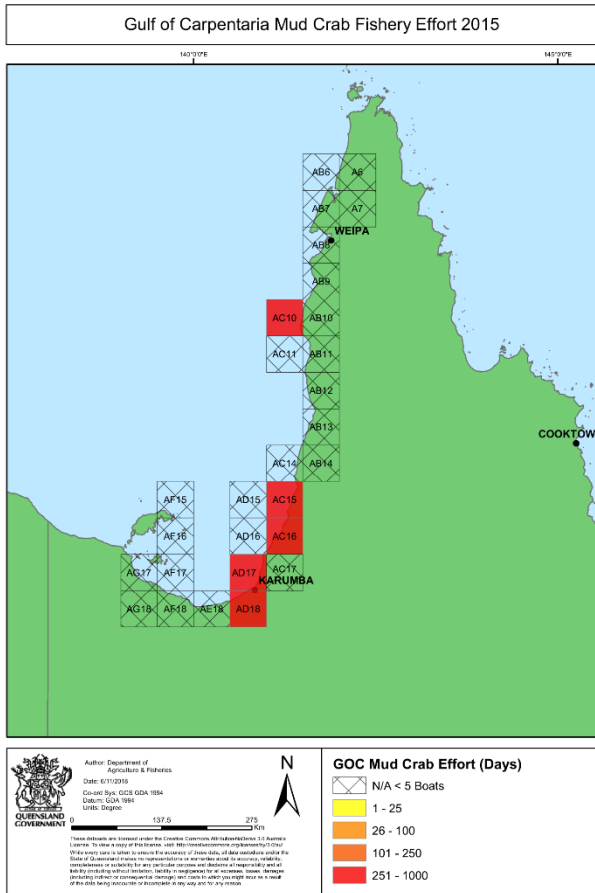
Recreational

Gear regulation	<ul style="list-style-type: none">• Harvesting only by crab pot, collapsible trap, or dilly.• Crab apparatus must be attached to a rope, which must be attached to a compliant float, or a fixed object above the high water mark. Floats and traps must be clearly marked.• No more than 4 items of crab apparatus may be used at a time, in possession of a recreational fisher.• Dillies must not exceed 125 cm in diameter, and mesh size must not exceed 25 mm
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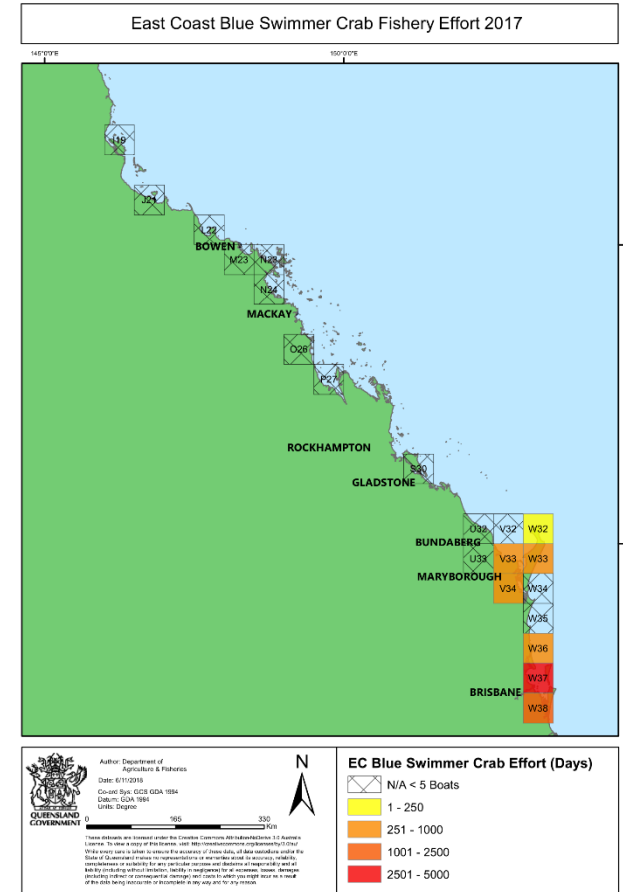
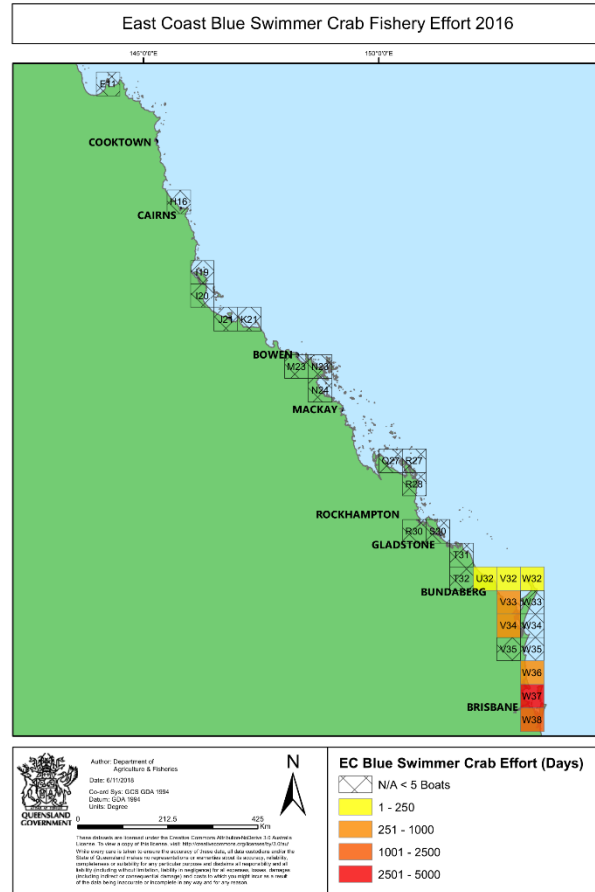
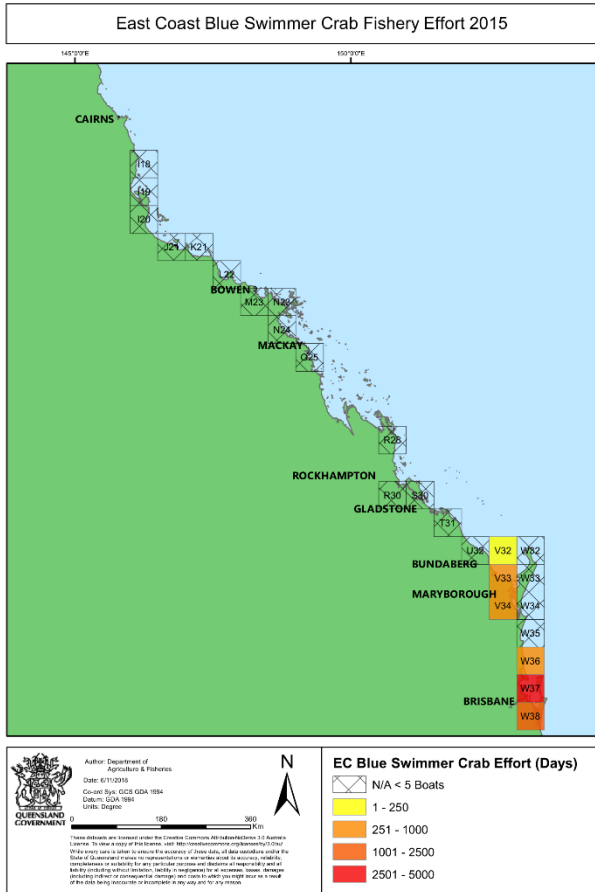
APPENDIX 2–Effort distribution maps for mud crabs and blue swimmer crabs on the Queensland east coast and in the Gulf of Carpentaria (2015-17).



APPENDIX 2 cont.–Effort distribution maps for mud crabs and blue swimmer crabs on the Queensland east coast and in the Gulf of Carpentaria (2015-17).

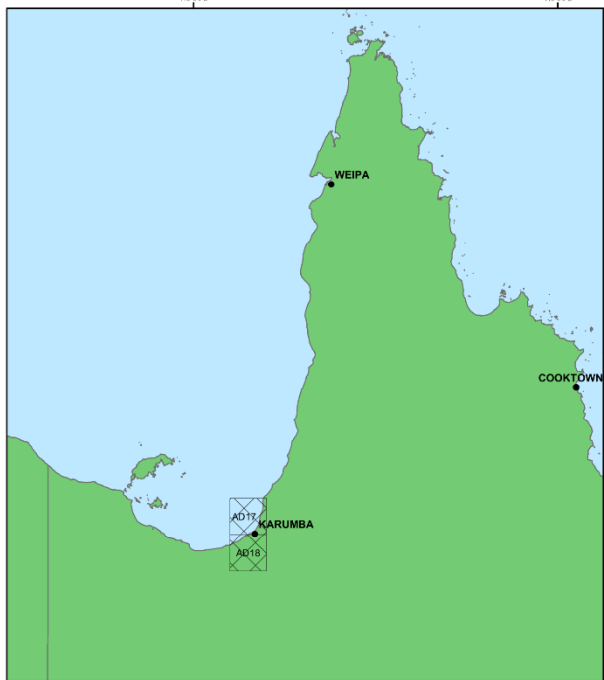


APPENDIX 2 cont.—Effort distribution maps for mud crabs and blue swimmer crabs on the Queensland east coast and in the Gulf of Carpentaria (2015-17).



APPENDIX 2 cont.—Effort distribution maps for mud crabs and blue swimmer crabs on the Queensland east coast and in the Gulf of Carpentaria (2015-17).

Gulf of Carpentaria Blue Swimmer Crab Fishery Effort 2015

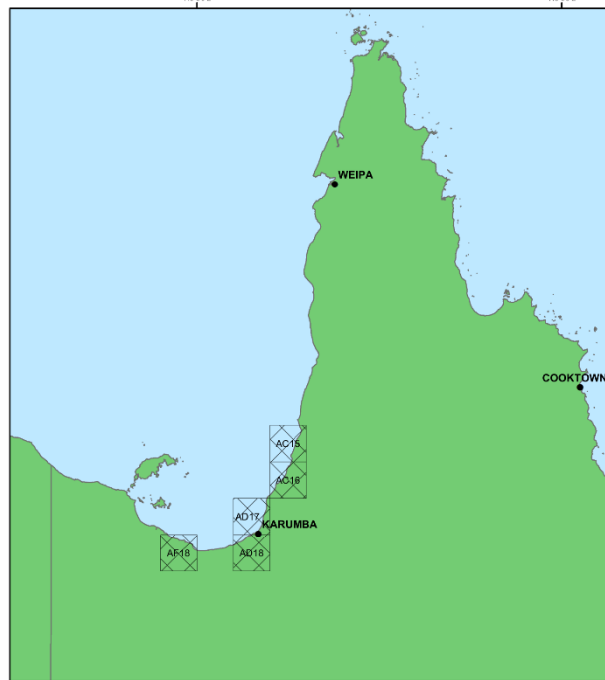


QUEENSLAND GOVERNMENT
 Author: Department of Agriculture & Fisheries
 Date: 6/11/2015
 Coastal Spots: GDA 1984
 Datum: GDA 1984
 Units: Degree

GOC Blue Swimmer Crab Effort (Days)
 ☒ N/A < 5 Boats

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Gulf of Carpentaria Blue Swimmer Crab Fishery Effort 2016

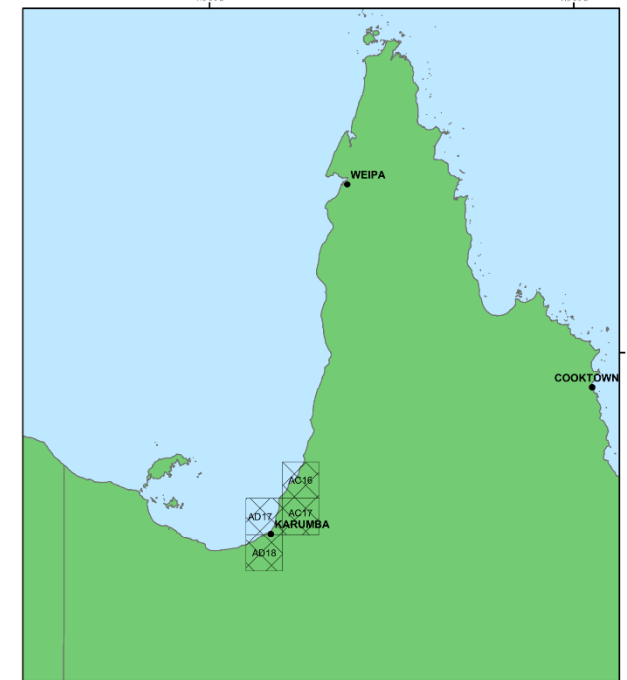


QUEENSLAND GOVERNMENT
 Author: Department of Agriculture & Fisheries
 Date: 6/11/2016
 Coastal Spots: GDA 1984
 Datum: GDA 1984
 Units: Degree

GOC Blue Swimmer Crab Effort (Days)
 ☒ N/A < 5 Boats

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Gulf of Carpentaria Blue Swimmer Crab Fishery Effort 2017



QUEENSLAND GOVERNMENT
 Author: Department of Agriculture & Fisheries
 Date: 6/11/2017
 Coastal Spots: GDA 1984
 Datum: GDA 1984
 Units: Degree

GOC Blue Swimmer Crab Effort (Days)
 ☒ N/A < 5 Boats

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APPENDIX 3—Full account of catch and effort for blue swimmer crabs and mud crabs across the C1 Fishery on the Queensland east coast and in the Gulf of Carpentaria.

Year	Catch (t)								Effort (days fished)							
	Blue swimmer crab				Mud crab				Blue swimmer crab				Mud crab			
	Total	EC	GoC	Unknown	Total	EC	GoC	Unknown	Total	EC	GoC	Unknown	Total	EC	GoC	Unknown
1988	306	269	0	37	260	226	<1	33	7802	6914	0	888	12504	11249	78	1177
1989	261	240	<1	21	357	304	27	26	6484	6033	41	410	16046	13151	1896	999
1990	242	234	<1	8	404	359	29	16	5717	5544	24	149	16824	14586	1702	536
1991	293	285	<1	9	376	339	26	10	6754	6429	3	322	16273	14515	1361	397
1992	162	148	<1	14	412	372	24	17	5616	5067	0	549	17518	14724	1908	886
1993	172	166	<1	6	468	434	22	12	6242	6015	10	217	21142	18569	2213	360
1994	181	180	<1	<1	432	412	13	8	6290	6262	0	28	20360	19275	797	288
1995	182	182	<1	<1	425	382	37	6	6687	6653	22	12	21461	19985	1203	273
1996	215	214	<1	<1	526	443	81	1	6803	6745	26	32	25668	22001	3557	110
1997	237	236	<1	<1	591	459	129	3	7906	7876	20	10	29872	24743	5008	122
1998	406	405	<1	<1	675	624	51	<1	9916	9869	35	12	31982	28455	3479	48
1999	587	586	<1	<1	837	723	115	<1	12027	12015	5	7	37129	32686	4424	19
2000	524	523	<1	<1	1003	843	157	3	11626	11620	0	6	39002	33980	4902	120
2001	1059	1058	<1	<1	1002	845	156	0	14651	14607	38	6	38773	33905	4867	1
2002	1028	1026	<1	2	1005	831	175	0	14391	14362	11	18	40361	34297	6063	1
2003	1365	1363	<1	1	1148	998	150	<1	19216	19183	23	10	48972	41414	7529	30
2004	1296	1296	<1	0	1176	1026	149	<1	17893	17821	72	0	46705	40379	6320	6

Year	Catch (t)								Effort (days fished)							
	Blue swimmer crab				Mud crab				Blue swimmer crab				Mud crab			
	Total	EC	GoC	Unknown	Total	EC	GoC	Unknown	Total	EC	GoC	Unknown	Total	EC	GoC	Unknown
2005	705	705	0	<1	969	802	167	<1	13359	13358	0	1	40425	34098	6321	6
2006	749	748	1	0	956	798	157	<1	13878	13736	142	0	39436	33790	5641	5
2007	713	710	3		931	796	136		12192	11936	256		38304	32936	5368	
2008	657	655	2		1007	829	178		12213	12055	158		38798	33104	5711	
2009	745	743	2		1044	871	174		12974	12807	167		39529	33038	6491	
2010	487	485	2		1223	1035	187		10241	10082	159		40638	34342	6296	
2011	331	331	<1		1419	1235	184		8366	8358	8		42779	36951	5828	
2012	398	397	2		1429	1230	199		9016	8832	184		45354	39116	6238	
2013	341	341	<1		1340	1167	174		9043	8847	196		45014	39004	6010	
2014	351	351	<1		1329	1183	146		8627	8622	5		43035	37784	5280	
2015	418	417	<1		1189	1062	127		8113	8018	95		42898	38080	4818	
2016	308	296	12		988	888	100		7925	7601	324		42789	38858	3931	
2017	369	369	<1		859	735	123		7248	7203	45		35053	31480	3573	

APPENDIX 4—Summary of interactions reported in the Species of Conservation Interest (SOCl) logbook by fishers operating in the C1 Fishery.

Species	Yearly SOCl interactions																Total
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Whales	0	2	1	1	0	1	1	1	1	0	0	0	0	0	0	0	8
Dolphins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marine turtles	1	18	5	1	2	0	0	2	1	0	1	1	0	0	0	1	33
Fresh water turtles	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Sharks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sawfishes & Rays	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
Crocodiles	0	6	0	2	0	0	1	0	0	0	0	0	2	1	0	3	15
Seabirds	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	4
Sea snakes	0	0	3	2	0	0	0	0	0	0	0	0	1	0	0	0	6
Teleosts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	12	22
Dugong	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water rats	0	0	0	3	0	0	0	1	2	0	0	0	0	0	0	0	6
Syngnathids	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-SOCl reports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0