

Yellow chat (Capricorn subspecies) *Epthianura crocea macgregori* recovery plan

Prepared by Wayne Houston and Alistair Melzer



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Photos on cover page: Top right - *Schoenoplectus litoralis* sedge-bed on the right bordered by water couch on the left; Bottom right - Upper marine plain with greater freshwater influence and *Cyperus alopecuroides* lined channels (wet season – March 2005). Note the Capricorn yellow chats in the foreground; Left - yellow chat.

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Executive Summary

Species

The Capricorn subspecies of yellow chat *Epthianura crocea macgregori* is found in Capricornia, a coastal area in central Queensland.

Current species status

The Capricorn yellow chat is currently listed as 'Critically Endangered' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and as 'Endangered' under the Queensland *Nature Conservation Act 1992* (NCA).

Habitat and distribution summary

The Capricorn yellow chat is known to occur at three localities – Curtis Island, Torilla Plain and the Fitzroy Delta and is most abundant at Torilla Plain. Recent surveys indicate that the total adult population is approximately 300 (Houston *et al.* 2004b, unpub. data). Based on current knowledge, habitat critical to the survival of the Capricorn yellow chat is wetlands and associated grasslands on seasonally inundated marine plains. These wetlands have shallow braided channels and depressions with a mosaic of dense sedge-beds, grasslands, tall samphire and areas of mud and/or shallow water (Houston *et al.* 2004a, Jaensch *et al.* 2004a, Houston *et al.* unpub. data). Further studies are required to better understand habitat requirements of the Capricorn yellow chat.

Threats summary

Habitat occupied by the Capricorn yellow chat is threatened by modifications to hydrological regimes through flow reductions (by dams or ponded pastures) into catchments and construction of barriers (i.e. extensive levee banks for ponded pasture development) within tidal areas where the subspecies occurs. High densities of feral pigs and cattle grazing and trampling threatens important breeding and shelter sites on Curtis Island. The potential for industrial expansion may also lead to further habitat loss in the Fitzroy Delta.

Recovery objective

The overall objective of the recovery plan is to improve the conservation status of the Capricorn yellow chat and manage its habitat.

Summary of actions

Actions for the recovery of the Capricorn yellow chat aim to secure existing populations, locate additional populations and increase the area of habitat being managed for recovery. Research into aspects of the subspecies' ecology and habitat, mapping of habitat critical to the survival and monitoring the condition of habitat and population abundance trends will inform and guide management and provide early warning of threats. Government agencies responsible for water management will be informed of the threats posed by reduced surface water in-flows into breeding areas and actions to be taken to reduce the degree of known threats at Curtis Island (pig and cattle damage). The dissemination of information relevant to Capricorn yellow chat conservation issues will increase public awareness and inform land managers of the requirements of Capricorn yellow chats and their habitat.

1. General information

Conservation Status

Epthianura crocea macgregori is currently listed as 'Critically Endangered' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and as 'Endangered' under the Queensland *Nature Conservation Act 1992* (NCA). The subspecies is known by the common name, yellow chat (Capricorn subspecies) (Jaensch *et al.* 2004a; Houston *et al.* 2004b) as well as yellow chat (Dawson subspecies) (Garnett and Crowley 2000).

International obligations

This species is not listed under any international agreements. This recovery plan is consistent with Australia's international responsibilities.

Affected interests

Tenures, where Capricorn yellow chats occur include:

- **Freehold:** most of the Torilla Plain properties and some portions of the Twelve Mile Creek area and Raglan Creek;
- **Lease:** of which there are several types including a small perpetual lease at Torilla Plain, special leases, mineral leases and grazing leases in the Fitzroy Delta area; and
- **Protected area:** at Curtis Island over the marine plain, either conservation or national park, with grazing lease over the conservation park.

Stakeholders were consulted on their interests in recovering the Capricorn yellow chat. This included actions to conserve the species that affect landowners land use and management, the views of conservation groups and specialists in the community. Stakeholders consulted included:

- **Statutory stakeholders:** Environmental Protection Agency (EPA) and the Australian Government Department of the Environment, Water, Heritage and the Arts.
- **Other government agencies:** Queensland Department of Natural Resources and Water (DNR&W) (management of waterways, leases), Department of Primary Industries and Fisheries (DPI&F), Department of Defence (management of the main catchments for Torilla Plain - Wadallah and Coonyan Creek) and local councils (Calliope, Fitzroy and Livingstone).
- **Interested non-government organisations:** Fitzroy Basin Association Natural Resource Management Body (FBA NRM), Sunfish, Birds Australia, Birds Queensland and Wetlands International.
- **Current landholders:** listed in a secure appendix.

Areas with conservation tenure include (i) Curtis Island marine plain (conservation park and national park) and (ii) a camping reserve at Twelve Mile Creek as habitat for barramundi. The land managers of the camping reserve have expressed an interest in stewardship of Capricorn yellow chat habitat at Twelve Mile Creek. Part of the conservation park at Curtis Island is under a 75 year cattle grazing lease. Two salt producers hold leases in the Fitzroy Delta and one of these companies holds leases (and mining leases) over part of the Twelve Mile Creek habitat downstream of the camping reserve. There is another area of lease adjacent to the camping reserve, which is a term grazing lease and may be available for incorporation into a reserve for Capricorn yellow chats in the future.

Consultation with Indigenous people

Elders and representatives of the following local Aboriginal Land Councils were consulted in the development of this recovery plan - Woppaburra, Darumbal, Port Curtis Coral Coast, Fitzroy Basin Elders Committee and Gurang Land Council. Representatives of the Darumbal Aboriginal Land Council have expressed an interest in the implementation of the recovery plan.

Indigenous people will be encouraged to be involved in the recovery process throughout the implementation of the recovery actions.

Benefits to other species or communities

The plan's implementation will contribute to the conservation of other fauna including migratory and Australian waders using similar habitats to Capricorn yellow chats. Several migratory species are common in saltmarsh habitats at Twelve Mile Creek and Torilla Plain including sharp-tailed sandpiper *Calidris acuminata*, marsh sandpiper *Tringa stagnatilis*, common greenshank *Tringa nebularia* and red-necked stint *Calidris ruficollis*. Great knot *Calidris tenuirostris* and long-toed stint *Calidris subminuta* occur occasionally at these sites and Latham's snipe *Gallinago hardwickii* occur in nearby similar habitat. Resident shorebirds in these habitats include red-capped plover *Charadrius ruficapillus*, red-kneed dotterel *Erythronyctes alpinus*, black-fronted dotterel *Elseya melanops* and black-winged stilt *Himantopus himantopus* (Jaensch 2004a, Houston *et al.* unpub. data, Wetlands International unpub. data). Pacific golden plover *Pluvialis fulva* have been found at Curtis Island.

Breeding by Australian painted snipe *Rostratula australis* (vulnerable -EPBC Act, NCA), has been documented at two areas of potential habitat for Capricorn yellow chat on the Torilla Plain (Jaensch *et al.* 2004b, Houston *et al.* unpub. data). Marine plains are also breeding areas for many waterbird species including magpie geese, ducks and terns and, at Torilla, are foraging areas for egrets that breed nearby (Jaensch *et al.* 2003, Jaensch 2004a, Jaensch *et al.* 2005, Houston *et al.* unpub. data). Parties of adult and juvenile broilgas are often seen at both Curtis Island (Arnold *et al.* 1993) and the Torilla Plain (Houston *et al.* unpub. data). Secretive species such as crakes and rails and the zitting cisticola *Cisticola juncidis* (near the southern limit of its range) may also benefit (Jaensch 2004a, Houston *et al.* unpub. data).

Protection and management of the marine plain at Curtis Island (mapped as regional ecosystem 12.1.2 but has associated sedgelands) will contribute to the conservation of a landform that has less than 10 percent representation in the Queensland national park system. Any conservation protection afforded to Capricorn yellow chat habitat will add to the protection estate of sedgelands such as Regional Ecosystem 11.1.3, which is listed as 'Of Concern' under the *Vegetation Management Act 1999*.

Social and economic impacts

Most of the known breeding habitat at Twelve Mile Creek lies within the upper extent of leasehold land with salt operations, well upstream of present industrial operations. However, if expansion of the saltfields into this area was to occur then there may be a substantial impact on this important breeding site.

Known mineral reserves include copper and zinc in small catchments bordering Hollins Bay, and gold within catchments bordering Torilla Plain (both Coonyan and Wadallah Creeks) (Garrad and Withnall 2004). Immediately south of the Torilla Plain are shale oil deposits on Banksia (Boundary Lagoons Creek) and Glen Isla (Block Creek). No known economic deposits of shale oil or magnesite have been found underlying or within catchments of Capricorn yellow chat habitat. Development applications that have the potential to significantly impact Capricorn yellow chat habitat will need to be referred to the Department of the Environment, Water, Heritage and the Arts under the EPBC Act. For further information on the EPBC Act referral process please go to <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>.

Adverse impacts to yellow chats on freehold grazing properties are likely to be minimal provided current grazing practices are continued, monitored and adapted to changing conditions so that habitat for Capricorn yellow chats is conserved. Currently a grazing lease with a 75 year tenure exists over the conservation park at Curtis Island. Maintenance of Capricorn yellow chat habitat in suitable condition will require sympathetic management of grazing pressure and regimes on the marine plain. It is difficult to quantify economic impacts that may result from management changes.

2. Biological information

Species description

The endemic yellow chat *Epthianura crocea* Castelnau and Ramsay (1877) is a small finch sized (approximately 11cm and 9g) insectivorous bird (Higgins *et al.* 2001). Subspecies vary only slightly in plumage and size (Higgins *et al.* 2001). Plumage of breeding males is predominantly yellow (yellow-olive on back) with a brighter golden-yellow head and a diagnostic, usually crescent-shaped blackish band on the centre of the upper chest. Adult females are duller and lack the breast band but have a yellow rump in flight, as do males and young. The black breast band fades in non-breeding males but may be present as a dark smudge. The presence of pale irises is used to distinguish adults in mixed flocks of orange (*E. aurifrons*) and yellow chats (Higgins *et al.* 2001, Jaensch 2004b).

The current known distribution is a coastal area in central Queensland known as Capricornia, hence the common name, yellow chat (Capricorn subspecies) (Jaensch *et al.* 2004a; Houston *et al.* 2004b). The Dawson subspecies is a descriptor applied by Garnett and Crowley (2000) based on Keast (1958) who incorrectly mapped its distribution as associated with the Dawson and McKenzie Rivers in central Queensland.

Life history and ecology

Yellow chats (all subspecies) are predominantly insectivorous (Keast 1958, Blakers *et al.* 1984, Higgins *et al.* 2001). Capricorn yellow chats feed within low vegetation in or near channels and basins. Most foraging by adult birds is seen to be on the ground at the bases of sedges and on bare mud or dry substrates depending on season, but also from low vegetation such as grass tussocks, sedges, samphire vegetation and occasionally shrubs fringing the sedge-beds (Houston *et al.* 2004a, 2004b, Jaensch *et al.* 2004a, Jaensch 2004b). Birds rarely forage in dense para grass swards (Houston *et al.* unpub. data). Adults tending nestlings have been seen to forage mainly around pools and muddy substrates bordering sedge-beds (Houston *et al.* 2004a). In May 2005, large numbers of Capricorn yellow chats were seen feeding within dense stands of *Cyperus alopecuroides* on seedheads and occasionally on the ground (Houston *et al.* unpub. data). Insects were very abundant within these seedheads and it seems likely that *C. alopecuroides* is an important feeding resource for breeding and post-breeding Capricorn yellow chats. In contrast, foraging during the dry season months (June to October based on two years observation on the Torilla Plain) was within dry channels and/or depressions with low annual herbaceous vegetation, associated dried sedges and adjacent grazed para grass swards (Houston *et al.* unpub. data).

Capricorn yellow chats breed in spring and summer (Houston *et al.* 2004a, 2004b) and probably autumn (Jaensch *et al.* 2004a). Nesting sites have been recorded as occurring in sedges and/or grasses from 0.4 to 1.5m in height in a variety of vegetation types including:

- a small patch of *Schoenoplectus litoralis* bordering an extensive densely vegetated sedge-bed;
- an extensive area of moderately dense mixed vegetation comprising *S. litoralis*, marine couch and water couch; and
- dense marine couch on small islands surrounded by water (Houston *et al.* 2004a, 2004b).

Recorded Capricorn yellow chat clutch size ranges from two to three eggs but may be greater, as adults have been seen feeding groups of up to four fledged young (Houston *et al.* 2004a, 2004b, Jaensch *et al.* 2004a). Nesting yellow chats (all subspecies) are territorial with territories established just prior to nest-building (Williams 1979) although adult birds of the Capricorn subspecies range more widely when feeding fledged young (Houston *et al.* 2004a, Jaensch *et al.* 2004a). Territories of the inland subspecies were abandoned following fledging (Williams 1979).

The incubation period of the inland yellow chat is approximately 14 days. Nestlings were found to remain in the nest for a further 14 days (Williams 1979). When the inland yellow chat juveniles emerge from the nest, they remain near it for a further two days (Williams 1979) and then move away with the parents, often linking with other birds to form loose flocks. Parents continue to feed them for an undetermined length of time. This suggests that successful reproduction occupies adult birds for at least five weeks (Williams 1979). Although no confirmed data were available, Williams hypothesized that chats were capable of raising multiple broods within a year, provided conditions were suitable. Experience on the Torilla Plain suggests this is likely for Capricorn yellow chats.

Although data specific to yellow chats is lacking, Williams (1979) found similar life history attributes in the three more intensively studied chat species – *E. albifrons*, *E. tricolor* and *E. aurifrons*. Longevity was at least three years and birds may be capable of breeding at one year of age (Williams 1979). Wetland inundation leading to plant growth and increased insect abundance may be a breeding trigger for this wetland breeding species (Williams 1979, Houston *et al.* 2004a).

Williams (1979) regarded chats as opportunistic breeders after abundant rainfall with adaptations for nomadism that allow them to exploit an unpredictable environment. Of the four species of chats, Williams regarded yellow chats as having the greatest ability to withstand lack of water and the most capable of dispersal to exploit widely separated areas following unpredictable rainfall. Whether this applies to the Capricorn yellow chats is not known.

Information regarding Capricorn yellow chats is summarised in Appendix 2.

Distribution

Keast (1958) described four subspecies of yellow chat, three of which are currently recognised (Higgins *et al.* 2001) (Appendix 1, Figure A). The 'inland' subspecies *E. c. crocea* is widespread in northern Australia including the Kimberley region, Barkly Tableland, the Gulf of Carpentaria and the Lake Eyre Basin. The Alligator Rivers subspecies *E. c. tunneyi* occurs in the Alligator Rivers region and the Capricorn subspecies *E. c. macgregori* (Keast 1958) occurs in the coastal region of central Queensland (Higgins *et al.* 2001, Garnett & Crowley 2000). Ford and Parker (1974) suggested that there be no subspecific division made until more is known about distribution and movements. *E. c. tunneyi* is 'Endangered' under the EPBC Act, while the inland subspecies is not considered to be threatened nationally.

Historically, the Capricorn yellow chat was known from Fitzroy Vale near Rockhampton on the Fitzroy River delta, where it was found in 1859 by McGregor (Mack 1930), and Torilla Plain in the Broad Sound area north of Rockhampton (Campbell 1917) (Figure 1). There were no further published sightings over the next 60 years (Blakers *et al.* 1984) and the species was considered to be either a rare vagrant (Longmore 1978) or possibly extinct (Higgins *et al.* 2001). In 1992 a small sub-population of less than 50 birds was found in the north-east part of Curtis Island to the east of the Fitzroy Delta (Arnold *et al.* 1993). Subsequently, the subspecies has been found at two more localities – the Torilla Plain in July 2003 (Jaensch *et al.* 2004a) and the Fitzroy Delta at Twelve Mile and Raglan Creeks in February 2004 (Houston *et al.* 2004b).

Currently the Capricorn subspecies is known from eight sites including:

- one at Curtis Island;
- four on the Torilla Plain, and
- three within the Fitzroy Delta.

Before the re-discovery of the Torilla Plain and Fitzroy Delta sub-populations, the abundance of the Capricorn yellow chat was thought to be less than 50 at a single location – Curtis Island (Houston *et al.* 2004a). Recent surveys indicate that the adult population is approximately 300 (Houston *et al.* unpub. data).

Using 2005 dry season data, freehold land held 80 percent of the known population and protected areas 20 percent.

Curtis Island lies in the South East Queensland bioregion, and the Torilla Peninsula and Fitzroy Delta sites lie in the Brigalow Belt bioregion (Environmental Protection Agency 2004). All sites are in the Capricorn-Capricorn region (NRM *Vegetation Management Act 1999*). Curtis Island is within the Calliope Shire, Fitzroy Delta within Fitzroy Shire and the Torilla Plain area within the Livingstone Shire.

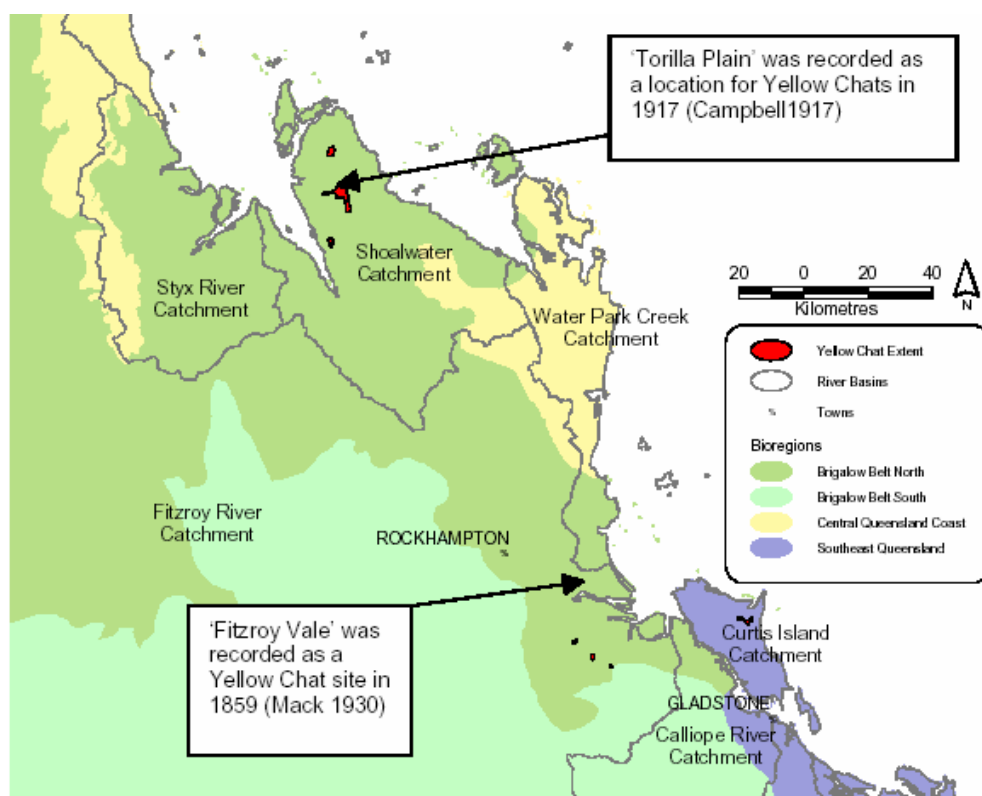


Figure 1: Current (July 2005) and historical distribution of the Capricorn yellow chat (Houston *et al.* unpub. data).

Habitat description

All Capricorn yellow chat sites are associated with seasonally inundated marine plain wetlands with varying degrees of fresh and saltwater influence. Marine plains are generally treeless (except where mangroves occur under tidal influence) and grassland-dominated. Wetlands of marine plains can be broadly regarded as ecotonal and subtle variations in topography, relict soil salinities (Burgis 1974) and tidal influence over land with extremely gentle gradients contribute much to the complex mixture of vegetation types (Houston *et al.* 2004a, 2004b). Extensive inundation of marine plains occurs in this region and both Curtis Island and Torilla Plain can be flooded across their full extent with depths varying from a few centimetres to more than a metre in places (Barnard 1913, Gary Porter pers. comm., Craig Mace pers. comm.).

There appear to be two important components to the Capricorn yellow chat's habitat:

1. areas of moderate to tall rush/sedge or grass vegetation (0.4 to 2m tall) along drainage lines and depressions providing shelter and nesting habitat; and
2. foraging habitat comprising these shelter areas and nearby more open vegetation types, particularly more sparse grasslands and samphire (Houston *et al.* 2004a, Jaensch *et al.* 2004a).

Capricorn yellow chat sites form three groups based on dominant plant species within channels providing cover/shelter for the chats. All three groups are dependent on freshwater flows in the wet season but are variably influenced by water salinity, in a gradient of decreasing salinity as follows (Houston *et al.* unpub. data):

1. Sites with a tidal influence where saltmarsh species – marine couch *Sporobolus virginicus* and samphire, mainly *Halosarcia pergranulata*, provide the main cover (to around 0.4m maximum height) (one site).
2. Sites dominated by a club-rush *Schoenoplectus litoralis* (0.5 to 2.0m tall) (four sites). These are reached only by occasional extreme tidal events but have seasonally high salinities, frequently greater than seawater (Houston *et al.* 2004a). This is a consequence of relict soil salinity from deposition of these soils under marine influences (Burgis 1968) and evaporative processes during dry periods.
3. Sites dominated by the sedge *Cyperus alopecuroides* (0.5 to 1.5m tall) under predominantly freshwater influence (three sites). Para grass *Brachiaria mutica* and/or water couch *Paspalum distichum* are co-dominant at these sites (0.5 to 1.5m tall and 0.3 to 0.5m tall respectively).

At Curtis Island, *S. litoralis* sedge-beds are important for breeding and shelter from adverse weather, as well as for food (Houston *et al.* 2004a). Marine couch, para grass and *C. alopecuroides* have a similar function at other sites in Capricornia (Jaensch *et al.* 2004a, Houston *et al.* 2004b, Houston *et al.* unpub. data). Cover provided by sedges/grasses is also likely to offer protection from predation. Capricorn yellow chats feeding on a muddy channel edge at Torilla Plain were observed to retreat into adjacent tall cover of *C. alopecuroides* when disturbed by an Australian hobby (Houston *et al.* unpub. data).

Inland yellow chats (*E. c. crocea*) use various species of rushes and sedges (Ford and Parker 1972; Williams and Main 1976; Waugh 1978; Horton 1982; Reynolds *et al.* 1982; Woodall 1982; Black *et al.* 1983), rank grasses (Keast 1958; Williams and Main 1976) and/or wetland shrubs (Strong & Fleming 1987, Jaensch 2004b). It appears that it is the structure of the sedge, grass or shrub dominated vegetation and not the floristic composition that is important for survival of the species.

Regional Ecosystems

The majority of sub-populations of Capricorn yellow chats have been found associated with bioregional land zone 1 defined as:

“....deposits subject to periodic tidal inundation and/or Quaternary estuarine and marine deposits subject to periodic inundation by saline or brackish marine waters. Includes mangroves, salt pans, off-shore tidal flats and tidal beaches. Soils are predominantly Hydrosols (saline muds, clays and sands) or beach sand.” (Environmental Protection Agency 2004).

A small number of birds in the Fitzroy Delta also use adjoining alluvial flats (land zone 3) where shallow braided channels are extensive.

Regional ecosystems (RE) corresponding to known Capricorn yellow chat sub-populations are shown in Appendix 3. Their distribution with respect to the three main sub-populations of Curtis Island, Torilla Plain and Fitzroy Delta is mapped (Appendix 1, Figures B-D. Houston *et al.* unpub. data). Under the existing RE classification and based on current knowledge, 'Of Concern' regional ecosystem 11.1.3 (sedgeland on marine clay plains, see Appendix 3 for complete description) most adequately describes Capricorn yellow chat habitat. This regional ecosystem is rarely mapped as it mainly occurs in bands that are too narrow (e.g. 10 – 50m) to be identified at the 1:100,000 scale. It is recommended that mapping be done at the 1:25,000 scale or greater to overcome this problem.

There are extensive areas of marine couch and samphire dominated RE types 11.1.1, 11.1.2 and 12.1.2 in Queensland (approximately 1000km²). However, most locations do not support Capricorn yellow chat sub-populations as they lack habitat complexity or correspond to saltflats with little vegetation (RE 11.1.2a), whereas the Twelve Mile Creek site corresponds to RE 11.1.2b described as:

“Samphire forland on Quaternary estuarine deposits. Mainly saltpans and mudflats with clumps of saltbush including one or several of the following species; *Halosarcia* spp. (e.g. *Halosarcia indica* subsp. *julacea*, *Halosarcia indica* subsp. *leiostachya*), *Sesuvium portulacastrum*, *Sarcocornia quinqueflora* subsp. *quinqueflora*, *Suaeda australis*, *S. arbusculoides*, *Tecticornia australasica*, *Scleria ciliaris*, *Marsilea mutica*, *Salsola kali*, algal crusts and the grass *Sporobolus virginicus*. Sedges may be common.”
(Environmental Protection Agency 2004).

It is recommended that regional ecosystem 11.1.2b be mapped separately from RE 11.1.2a in order to distinguish potential Capricorn yellow chat habitat.

Habitat critical to the survival of the species

On current knowledge, habitat critical to the survival of the Capricorn yellow chat is wetlands and associated grasslands on seasonally inundated marine plains. These wetlands have shallow braided channels and depressions with a mosaic of dense sedge-beds (*Cyperus alopecuroides* or *Schoenoplectus litoralis*), grasslands (marine couch *Sporobolus virginicus*, para grass *Brachiaria mutica* and/or water couch *Paspalum distichum*), tall samphire (particularly *Halosarcia pergranulata*) and areas of mud and/or shallow water (Houston *et al.* 2004a, Jaensch *et al.* 2004a, Houston *et al.* unpub. data). Under current conditions, Torilla Plain appears to be the most productive site for Capricorn yellow chats as it supports at least 75 percent of the known population.

Breeding habitat includes all three areas identified as supporting Capricorn yellow chats. Besides the breeding population at Curtis Island, sites where breeding has been confirmed for both wet seasons studied to date include south, central and west Torilla Plain and Twelve Mile Creek in the Fitzroy Delta. The genetic viability of the subspecies may be dependent on maintaining several sub-populations. Specific breeding areas may be particularly important to enable the Capricorn yellow chat population size to increase quickly enough to ensure survival of some individuals through the dry season when food resources are scarce.

Knowledge regarding the subspecies' habitat requirements and ecology (e.g. dispersal triggers, habitat requirements when dispersing, drought and flood refuge habitat) is limited. Consequently, management plans based on existing knowledge should take a precautionary approach and take account of these unquantified factors.

Important populations

There is currently only one known population of the Capricorn yellow chat. This population is essential for the survival of the subspecies.

3. Threats

Biology and ecology relevant to threats

Being wetland associated birds, breeding of Capricorn yellow chats is likely to depend on rainfall and inundation events triggering food production. Food requirements of breeding Capricorn yellow chats may vary from site to site. Nesting habitat has been identified as sedges and grasses. Adults tending both non-fledged active young and fledged young forage near tall sedges in close proximity to abundant food resources (muddy edges of these sedge-beds and/or sedge seedheads). The conjunction of protective cover and abundant food resources appears to be an important component of optimal breeding habitat.

An important attribute of typical Capricorn yellow chat habitat is a high degree of complexity with a mosaic of vegetation types, shallow braided channels and associated vegetation. The more saline-influenced sites (two sites on the Torilla Plain and two of the three Fitzroy Delta sites) appear to be used mostly during the wetter months and early dry season coinciding with breeding (Houston *et al.* unpub. data). Proximity of the southern Torilla Plain saline sites to the freshwater-influenced *C. alopecuroides*-dominated area suggests that these two habitat types form an integrated breeding unit, with the *C. alopecuroides*-dominated site providing both breeding and refuge habitat but supplemented by breeding at the more saline *S. littoralis* dominated areas. The northern Torilla Plain site may have a similar pattern of integrated habitat availability but further studies are needed to confirm this.

Identification of threats

1. Land management activities

Land management activities that threaten the Capricorn yellow chat are those that:

1. Interfere with surface flows upon which productivity of these marine plain wetlands are dependent. As an example, any upstream land-use that reduces surface in-flows and/or sheet overland flows may reduce breeding and affect the long-term survival of the species. Both dams and ponded pasture banks may contribute to this problem. Ponded pasture banks are used extensively by pastoralists in this region to establish wetlands for ponded pasture grasses in order to increase production capacity of the land.
2. Reduce habitat and hydrological complexity. Capricorn yellow chats have not been observed where substantial levee banks (constructed either for vehicle access or ponded pasture creation) transgress the marine plain. This causes a discontinuity between the upper and lower marine plain and such banks have the capacity to cause extensive pooling of freshwater and a reduction of the complex braided drainage systems normally used by chats. Connectivity between upper and lower marine plain sites is also impaired. This does not include small check banks in channels because, while these reduce incursion of tidal saline water, they do not provide a significant barrier to freshwater flows. Consequently, the hydrology and availability of channels for Capricorn yellow chats is largely intact, and chats have been found breeding in association with check banks. The construction of levee banks is now illegal below the HAT (highest astronomical tide line) under the *Ponded Pastures Policy 2001*. This legislation was introduced primarily to protect fish habitats within upper tidal areas.
3. Damage sedges or grasses that provide shelter and nesting habitat. At Curtis Island, high densities of feral pigs have caused extensive uprooting of sedges and associated grasslands upon which Capricorn yellow chats depend for shelter and foraging. Feral pigs are present at all three localities where chats occur, although at other localities pig damage to sedges is relatively low. Trampling and grazing of sedges and grasses by cattle may contribute to damage of Capricorn yellow chat habitat.

4. Cause habitat loss. Industrial expansion within the Fitzroy Delta associated with saltfields development and port infrastructure may occur. At Twelve Mile Creek, lease holdings of one salt producer includes some of the breeding habitat. This area consists of saltmarsh and braided channels and lies at the upper extent of the leases, well upstream of present industrial operations. However if expansion of the saltfields into this area was to occur, there may be a substantial impact on this important breeding site. There are no known industrial expansion plans at the other two localities (Torilla Plain or Curtis Island), although economic deposits of shale oil have been found near the Torilla Plain.

2. Introduced plant species

Replacement of native sedges and grasses by introduced wet pasture grasses has the potential to alter habitat structure of marine plain wetlands and affect the value of these habitats to Capricorn yellow chats. Values of wetlands to waterbirds have been reduced by invasion of exotic pasture grasses in certain situations (e.g. Houston and MacCabe 1996, Ferdinands *et al.* 2005). Of the known Capricorn yellow chat sites, only one, the central Torilla Plain site, has been substantially altered by an introduced pasture grass (para grass). This species is now a dominant component of the marine plain vegetation at central Torilla Plain and, based on comparisons with vegetation zonation patterns elsewhere on the Torilla Plain and Curtis Island, it appears to have replaced the native water couch (Houston *et al.* unpub. data). However, as central Torilla Plain supports the greatest numbers of Capricorn yellow chats, it appears that, at least for para grass, impact on Capricorn yellow chat habitat is relatively benign and may even be favourable. Further research is needed to fully assess the affect of para grass to Capricorn yellow chat habitat.

The apparent benign impact of para grass at central Torilla Plain may not be the case for other species of ponded pasture grasses, nor apply to para grass under different management regimes. Several other exotic pasture species, regarded as environmental weeds because of their capacity for invasion of wetlands and displacement of key native species (Department of the Environment and Heritage 2004), occur at Capricorn yellow chat sites. Para grass occurs within the north-western arm of the marine plain on Curtis Island but not in the area occupied by yellow chats within the conservation park. Olive hymenachne *Hymenachne amplexicaulis* occurs in a single *Melaleuca* swamp on the marine plain at Curtis Island, and aleman grass *Echinochloa polystachya* occurs in basins on Torilla Plains. Of these species, aleman grass and Olive hymenachne pose the greatest threat to Capricorn yellow chat habitat and may have the capacity to displace *C. alopecuroides*, the dominant sedge within freshwater-influenced secondary channels and edges of main channels.

3. Cattle grazing intensity

Other threats include damage to chat habitat by cattle trampling and grazing where grazing pressure is too high. Substantial damage to sedges has been observed at Curtis Island in recent years in conjunction with a prolonged drought at this site. However, grazing at sustainable levels is not necessarily detrimental as evidenced by the relatively large population of Capricorn yellow chats at Torilla Plain (approximately 75 percent of the known population). Here the grazing management practices (rotational grazing, moderate stocking densities) seem to provide favourable habitat for Capricorn yellow chats.

Where exotic pasture grasses are established, such as central Torilla Plain, removal of grazing may constitute a threat. For example, at a site near Townsville, removal of grazing resulted in displacement of native species and an increase in para grass biomass while re-introduction of grazing reduced para grass cover and biomass (Williams *et al.* 2005). A downturn in the rural economy could potentially trigger such a contingency but, given the high value of the Torilla Plain to the pastoral economy, this is unlikely.

4. Other threats

In addition to known threats, a number of potential, as yet, ill-defined threats to Capricorn yellow chats may exist including:

- increased groundwater salinisation from salt mining activities and consequent change in vegetation composition and structure;
- siltation of existing channels as a result of current management regimes (grazing, clearing in catchment, changes in flow regime) or industrial expansion;
- unmanaged public access or uncontrolled ecotourism and possible trampling of sedges and disturbance to birds;
- prolonged floods, impacting on breeding success;
- potential consequences associated with climate change (e.g. prolonged drought, accelerated sea level rise, increased storm surge or reduced average regional rainfall). Rises in sea level associated with climate change would raise the importance of corridors between areas of existing and potential Capricorn yellow chat habitat;
- predation by feral animals including cats. Cats are present at both Torilla Plain and Curtis Island and represent a potential threat. The large percentage of young recruits into the sub-population observed at Torilla Plain in May 2005 indicates that the threat from cats is currently low.

Areas under threat

Most of the sites where Capricorn yellow chats occur remain under threat including Curtis Island Conservation Park. Industrial development, particularly mining, has the greatest potential to impact existing areas of known Capricorn yellow chat occurrence. Identified threats to Capricorn yellow chats and areas subject to specific threats are tabled (Table 1).

Populations under threat

The entire known population of the Capricorn yellow chat is considered to be under threat.

Threats Summary

Table 1. Identified threats to Capricorn yellow chats and areas subject to specific threats

Threat	Potential Severity	Current actions to reduce threats	Future actions to reduce threats
General – all sites			
1. Lack of knowledge regarding key aspects of Capricorn yellow chat ecology and habitat requirements.	Severe		Undertake ecological research to enhance knowledge base for undertaking management actions.
2. Construction of barriers such as extensive levee banks for ponded pasture development or road works within tidal areas.	Severe	No longer likely as it is illegal (<i>Ponded Pastures Policy 2001</i>).	
3. Construction of impoundments (weirs and dams or ponded pastures) upstream of areas supporting yellow chats..	Severe	Some regulation in the Fitzroy catchment (but not Torilla Plain) under the <i>Moratorium on Overland Flow Water</i> *.	Liaise with land managers (including DNR&W) as to the importance of unregulated surface flows and maintaining current drainage patterns in chat catchments.
4. Spread of exotic pasture grasses, particularly aleman grass and Olive hymenachne.	Severe		Maintain monitoring programmes at all sites for presence or, where already present, invasion of other microhabitats. Maintain grazing at level consistent with maintaining favourable chat habitat.
5. Increase in cattle stocking densities where chats currently occur.	Moderate		EPA negotiate with DNR&W and lessees for lower stock densities on leases.
6. Uncontrolled fire.	Moderate	At Torilla Plain, fire management is undertaken only when there is a low risk of burning the marine plain.	Incorporate fire management into property management guidelines.
Threats to specific sites			
<u>Curtis Island</u>¹			
7. Destruction of habitat by feral pigs.	Severe	An island-wide pest management strategy is being developed by EPA (Hall 2005). Monitoring and control techniques are being trialled.	Implement pest management strategy including island-wide control strategies, monitoring of pig population and impact on chat habitat.

Threat	Potential Severity	Current actions to reduce threats	Future actions to reduce threats
8. Trampling and grazing of sedges by cattle.	Moderate		Review management of the conservation and national park as it applies to chat habitat. Establish management protocols as part of the lease agreement aimed at maintaining the plain in 'good' condition. Follow guidelines provided by Torilla Plain (rotational grazing, moderate stocking densities). Consider fencing an enclosure around key chat habitat on the marine plain.
<u>Twelve Mile Creek²</u>			
9. Loss of habitat associated with expanded industrialization within the Fitzroy delta, particularly saltworks and port development.	Severe	Identification of site as breeding habitat for Capricorn yellow chats – WildNet.	Liaise with industry with a view to increased conservation status for the area (e.g. voluntary conservation agreements or lease relinquishment if appropriate). Recognition of chat habitat requirements in company environmental management plans.
10. Trampling and cattle grazing of saltmarsh habitat (RE 11.1.1 and 11.1.2b).	Moderate		Fencing of riparian and saltmarsh habitat currently within freehold or lease tenure.
11. Complicated land tenure making management difficult.	Low		Investigate voluntary conservation agreements or lease relinquishment if appropriate and incorporation into camping reserve.
<u>Central Torilla Plain³</u>			
12. Removal of grazing.	Moderate	It is unlikely that grazing will be completely removed at any time in the near future (see page 14).	
<u>Torilla Plain</u>			
13. Discovery of economic shale oil deposits.	Severe	Capricorn yellow chat location data are lodged with EPA.	Yellow chat location data and habitat mapping should be made available to EPA planners, for use in development assessments and scientific purposes permits.

1. Curtis Island: 23° 34.20' S 151° 10.98' E, approximately 40 birds, Grazing lease, Conservation and National Park. **2. Twelve Mile Creek:** 23° 39.82' S 151° 45.28' E, 20-40 birds, several tenure: freehold, grazing lease, special lease for saltworks, camping reserve. **3. Central Torilla Plain:** 22° deg 22.08' S, 150° 02.49' E; up to 60-225 depending on season; freehold.

* This moratorium does not apply to the catchments of Wadallah and Coonyan Creeks, which are the main water sources for the Torilla Plain. These are protected within the Shoalwater Training Area (which as a Defence property is subject to the Commonwealth Wetlands Policy and stringent EIA before any development under the EPBC Act).

4. Recovery Objectives, Performance Criteria and Actions

Overall objective

The overall objective of the recovery plan is to improve the conservation status of the Capricorn yellow chat and manage its habitat.

Specific Objective 1: Protect, enhance and manage yellow chat habitat

Action 1.1 Survey Curtis Island National Park where it overlaps the marine plain to establish its current use by Capricorn yellow chats and its habitat potential for chats.

Performance criterion 1.1 The current use of Curtis Island National Park, where it overlaps the marine plain, by Capricorn yellow chats has been determined and reported on.

Background, justification and methods:

Previous surveys have not found Capricorn yellow chats to the east of the border between the conservation and national parks. However, these surveys are few in number and restricted to the late dry – early wet season periods. Comprehensive surveys over a full year under both drought and a wetter climatic period are required to fully assess Capricorn yellow chat use of this area. This will ascertain the relative importance of the two protected areas under the present management regime (grazing over both the conservation park and national park) and determine if fencing this area will promote protection of pre-existing chat sites on the national park side of the boundary. Surveys using standard protocols need to be undertaken at least every two months

Potential contributors: EPA, Researchers (e.g. Central Queensland University), Birds Australia, local bird watching groups.

Estimated cost: \$28,000.

Action 1.2 EPA establish management strategies for the conservation and enhancement of the Capricorn yellow chat habitat on Curtis Island Conservation and National Parks.

Performance criterion 1.2 Management practices favourable to Capricorn yellow chat habitat in protected areas are implemented.

Background, justification and methods:

Grazing:

These strategies should consider how best to protect chat habitat and the role of grazing in maintaining chat habitat. Options include:

- a) reducing stocking rates and regulating the level of grazing to ensure that chat shelter and breeding habitat are maintained in a healthy condition, particularly during drought periods;
- b) fencing to exclude cattle from known chat habitat; and
- c) if Action 1.1 confirms use of national park by chats, fencing the boundary between conservation and national parks.

Possible approaches include integration of sustainable pasture management guidelines (e.g. rotational grazing and paddock ‘spelling’) and pasture monitoring protocols into the property management plan at Curtis Island Conservation Park (and national park if required).

If grazing ex-closures were constructed, then monitoring would contribute to a better understanding of the role of grazing in maintaining chat habitat.

Fire and Weeds:

Fire and weed management strategies for the entire protected area are required and should be developed. The weed management strategy should address the need to maintain the marine plain free of para grass. To maintain this habitat will require regular monitoring and, if found, control of para grass, Olive hymenachne and aleman grass.

Potential contributors: EPA, Leaseholders of pastoral property.

Estimated cost: \$14,000 a year for the first two years. Total cost: \$28,000.

Action 1.3 Control numbers of feral animals considered to be a threat to yellow chats.

Performance criterion 1.3 Feral animal control has been implemented and the impact of this control has been measured and reported on.

Background, justification and methods:

Implement pest management strategy including island-wide control strategies, monitoring of pig population, impact of control measures on chat habitat and numbers.

Potential contributors: EPA, Leaseholders of pastoral property, FBA NRM, DNR&W, DPI&F.

Estimated cost: \$45,000 a year for the first two years, \$20,000 a year for the following three years. Total cost: \$150,000.

Action 1.4 Investigate possible voluntary conservation agreements over freehold and leasehold land at all sites where appropriate.

Performance criterion 1.4 Area of land in voluntary conservation agreements increased at Torilla Plain and Raglan Creek (if possible).

Background, justification and methods:

Most of the known Capricorn yellow chat population lies on freehold land and voluntary conservation agreements such as nature refuge agreements through EPA should be sought. Voluntary agreements over graziers' most productive land will recognise business needs. To encourage the protection of natural assets on private property, financial incentives such as transfer duty and land tax reimbursements may be available to landholders through the EPA NatureAssist program. Such agreements could provide industry 'best practice' standards for other marine plain properties with potential for yellow chats. Termed management agreements could be an initial action. Under a nature refuge agreement use of the land for various activities is negotiated directly with the landholder. Evidence suggests that low cattle stocking densities are compatible with yellow chats and rotational grazing whereby cattle are excluded during the wet season, may be more likely to be compatible with their conservation.

Potential contributors: EPA, FBA NRM, freeholders.

Estimated cost: \$3500 a year for the first two years. Total cost: \$7000.

Action 1.5 Investigate acquiring appropriate leasehold land at Inkerman and Twelve Mile Creeks or attaining nature refuge covenant over this land.

Performance criterion 1.5 Area of land in protected area and/or voluntary conservation agreements increased at Inkerman and Twelve Mile Creek.

Background, justification and methods:

There is a term lease in the Twelve Mile Creek area bordering the camping reserve. This block has provided breeding habitat for a small number of Capricorn yellow chats in both 2004 and 2005. The lessee regards this area as an important area for his cattle, particularly during the

winter. Appropriate extension staff (e.g. EPA, FBA NRM) to explore the options for this area of habitat.

Most of the known breeding habitat for Capricorn yellow chats at Twelve Mile Creek lies within the upper extent of the leases held by a salt production company and is well upstream of present industrial operations. Ongoing conservation management secured through a voluntary conservation agreement over the appropriate section of the lease (approximately 200ha) would improve the conservation outlook for this sub-population.

Management of these additional areas could be integrated with the camping reserve.

Potential contributors: EPA, DNR&W, FBA NRM.

Estimated cost: \$1750.

Specific Objective 2: Address known threats, identify and quantify potential threats

Action 2.1 Ensure that the Plan is integrated into government agency and NRM strategies including water managers.

Performance criterion 2.1 Enhance awareness of natural resource managers (DNR&W, shire councils and others) that loss of surface flows to chat habitat may be detrimental.

Background, justification and methods:

This action applies particularly to natural resource managers and government agencies involved with managing streams and surface flows so that they are aware of the significance of inundation of downstream Capricorn yellow chat habitats. It also applies to threats from loss of surface flows into habitat supporting Capricorn yellow chats and construction of levee banks in tidally influenced portions of their habitat. Relevant catchments include Bark Lagoons, Wadallah and Coonyan Creeks on Torilla Plain, Twelve Mile, Raglan, Pelican, Eight Mile and Six Mile Creeks (these form Inkerman Creek) in the Fitzroy Delta.

Potential contributors: DNR&W, shire councils (Calliope, Fitzroy and Livingstone) FBA NRM, EPA.

Estimated cost: \$3500.

Action 2.2 Control feral pig numbers at Curtis Island to within thresholds damaging to chat habitat, once determined.

Performance criterion 2.2 Reduction in numbers of pigs on the Curtis Island marine plain.

Background, justification and methods:

Implement pest management strategy including island-wide control strategies, monitoring of pig population, impact of control measures on chat habitat and numbers. If possible, ascertain pig abundance and damage to chat habitat so that pig density thresholds for management purposes can be determined. This action is complimentary to Actions 1.3 and 2.7.

Potential contributors: EPA, Leaseholders of pastoral property, FBA NRM, DNR&W, DPI&F.

Estimated cost: Expenses incorporated into estimated costs for Action 1.3.

Action 2.3 Develop a fire management strategy for Curtis Island marine plain.

Performance criterion 2.3 Improved fire management for the protected estate at Curtis Island.

Background, justification and methods:

A fire management strategy for the protected area estate, containing chat habitat, is required and should be developed in collaboration with lessees and neighbours. This action is complementary to Action 1.2.

Potential contributors: EPA, Leaseholders of pastoral property.

Estimated cost: Expenses incorporated into estimated costs for Action 1.2.

Action 2.4 Develop a weed management strategy, including introduced ponded pasture grasses, for the whole range of the Capricorn yellow chat.

Performance criterion 2.4 improved weed management, reduction in the range and populations of olive hymenachne and aleman grass, and eradication of these species and para grass from the Curtis Island National Park and associated Conservation Park.

Background, justification and methods:

The weed management strategy should address the need to maintain the marine plain free of para grass. This will require regular monitoring and if found, control of para grass, Olive hymenachne and aleman grass. This action is congruent with Action 1.2.

Potential contributors: EPA, Leaseholders of pastoral property.

Estimated cost: Expenses incorporated into estimated costs for Action 1.2.

Action 2.5 Consult with Fitzroy Shire Council as to the areas currently occupied by Capricorn yellow chats within their shire and ensure that industry planners are aware of the location and habitat requirements of the Capricorn yellow chat.

Performance criterion 2.5 Threat of expansion in the industrial area within the Fitzroy Delta is reduced.

Background, justification and methods:

Sites within Fitzroy Shire Council include Twelve Mile, Raglan, Pelican and Inkerman Creeks (comprised of Eight and Six Mile Creeks).

Potential contributors: EPA, FBA NRM, Researchers.

Estimated cost: \$1050.

Action 2.6 Undertake fencing at Twelve Mile Creek area to exclude cattle from Capricorn yellow chat saltmarsh and sedge vegetation during breeding (October to April).

Performance criterion 2.6 Fencing has been erected in the Twelve Mile Creek area to exclude cattle from Capricorn yellow chat habitat during breeding.

Background, justification and methods:

The lessees may be interested in reducing grazing levels in chat habitat by undertaking fencing in conjunction with controlled grazing. Grazing is already excluded from one leased area and grazing levels appear to be relatively low within the term lease area. Recovery team to investigate options.

Site managers will need to be aware of potential problems arising from invasion by wet pasture grasses and develop a set of management guidelines to cater for such an issue. However, this issue is unlikely to be a problem at Twelve Mile Creek due to tidal influence. This action is complimentary to Actions 1.4 and 1.5.

Potential contributors: EPA, DNR&W, FBA NRM and lessees.

Estimated cost: \$4000.

Action 2.7 Evaluate the impact of existing cattle grazing regimes and feral pigs (at Curtis Island) on chat habitat.

Performance criterion 2.7 Knowledge of existing threats, particularly cattle grazing and feral pigs, has been increased and reports prepared for relevant parties.

Background, justification and methods:

The role of grazing in both promoting and decreasing the habitat suitability of marine plains for Capricorn yellow chats is poorly understood. Cattle exclusion from parts of the marine plain at Curtis Island would provide an opportunity to assess the effect of removal of grazing from a portion of the marine plain and its impact on Capricorn yellow chat habitat. Abundance of chats within enclosures could also be monitored.

Although pigs have been observed to damage sedge-beds used by chats for nesting and shelter at Curtis Island, the extent of damage to chat habitat has not been quantified. Vegetation and evidence of feral pig damage should be monitored at Curtis Island (minimum of five transects across favourable chat habitat).

This action will be carried out in conjunction with Actions 1.2, 1.3, 2.2 and 2.8.

Potential contributors: EPA, DPI&F, Researchers (e.g. CQU).

Estimated cost: \$12,000 a year for five years. Total cost: \$60,000.

Action 2.8 Undertake research and monitoring of chat ecology and capture this information in technical reports and papers.

Performance criterion 2.8 Bi-annual surveys of Capricorn yellow chat abundance and habitat use conducted, research of chat ecology progressed and this information captured in reports.

Background, justification and methods:

Bi-annual surveys will provide baseline data on chat abundance (based on site specific population monitoring protocols) and habitat use. An understanding of population numbers and habitat condition is required for management. Habitat condition monitoring to include vegetation structure and floristics, channel dimensions, pool depths and salinity of favoured microhabitat. This will also enable early warning of invasion of chat habitat by ponded pasture grasses.

Vegetation structure, floristics and drainage patterns on marine plains provide the habitat framework upon which Capricorn yellow chats depend. Detailed and ground-truthed vegetation/drainage pattern maps of the three known chat localities (Torilla Plain, Curtis Island marine plain and the Fitzroy Delta area) will provide a baseline from which to detect any long-term changes in vegetation and associated channels. These maps will be available to landholders.

Potential contributors: Researchers (e.g. CQU), EPA, Birds Australia, local bird watching groups.

Estimated cost: \$20,000 for the first year, \$18,000 a year for the following four years. Total cost: \$92,000.

Action 2.9 Undertake regional ecosystem (RE) mapping at an appropriate scale (1:25,000 or greater) to permit definition of RE 11.1.2b from 11.2.1a and definition of narrow bands of RE 11.1.3.

Performance criterion 2.9 Mapping of REs 11.1.2a, 11.1.2b and 11.1.3 completed and included in EPA regional ecosystem mapping.

Background, justification and methods:

Capricorn yellow chats breed at Twelve Mile Creek in association with saltmarsh habitat defined as 11.1.2b. RE 11.1.2 (Samphire forland or bare mud-flats) is extensive in the region but the majority is lightly vegetated saltflats classified as RE 11.1.2a that are rarely used by chats. RE 11.1.3 (sedgeland on marine clay plains) is rarely mapped due to narrowness of zones where it occurs. Identification of these RE's will enable potential chat habitat to be assessed and enhance management opportunities. RE 11.1.3 is listed as 'Of Concern' under the VMA and therefore once this area is mapped it is protected from broadscale clearing under the legislation.

Potential contributors: EPA, Researchers (e.g. CQU)

Estimated cost: \$4000.

Action 2.10 Research genetic structure, demographics and dispersal of the Capricorn yellow chat; identify linkages between chat breeding and productivity including key food requirements.

Performance criterion 2.10 Research into the genetic structure, demographics and dispersal of the Capricorn yellow chat completed and reported on.

Background, justification and methods:

Understanding of the linkages between the sub-populations, breeding success, longevity, annual survival rates, dispersal habitats, corridor requirements and diet is key to managing threatened species but there is almost nothing known about these aspects of Capricorn yellow chats ecology. Methods to include tagging young individuals at known breeding locations in the breeding / post-wet season period (seven to eight locations), monitoring movements intensively in the post-wet period (fortnightly) when thought to be dispersing and genetic samples of three main sub-populations of Capricorn yellow chats.

If tagging is successful, it will also enable standard indices of population abundance trend to be calibrated against density data based on mark and recapture techniques.

This action will provide a greater depth of insight into the most important aspects of the Capricorn yellow chat ecosystem linking habitat requirements with an understanding of drivers of production (both chat abundance and their food). Methods to include determination of production cycles of main vegetation supporting breeding of chats e.g. samphire, grassland and sedge communities plus desk-top study of climatic models of rainfall in the region plus consequences for inundation of target marine plains; historical satellite imagery (Spot 2) to gauge historical patterns of reliability of inundation and extent; integrate to develop a conceptual model.

Potential contributors: Researchers (e.g. CQU), EPA, Birds Australia, local birdwatching groups.

Estimated cost: \$47,000 for the last three years of the plan. Total cost: \$135,000.

Action 2.11 Search for further sub-populations.

Performance criterion 2.11 Surveys for further sub-populations completed and if found, locations recorded with EPA.

Background, justification and methods:

The conservation outlook for the subspecies can be further improved if additional sub-populations and / or breeding habitats are found. Undertake surveys of potential chat habitat areas during favourable periods – wetter months before on-set of seasonal dry period.

Potential contributors: Researchers (e.g. CQU), EPA, Birds Australia, local bird watching groups.

Estimated cost: \$6500 a year for the first two years. Total cost: \$13,000.

Specific Objective 3: Increase knowledge and awareness of the Capricorn yellow chat throughout the community, industry and landholders

Action 3.1 Liaise with landholders / managers as to the requirements of Capricorn yellow chats and the contribution they can make to maintaining chat habitat.

Performance criterion 3.1 Information on Capricorn yellow chat habitat and management requirements incorporated into property plans and staff awareness raised.

Background, justification and methods:

Applies particularly to land managers involved with managing properties so that they are aware of the Capricorn yellow chats, their ecology and management requirements (e.g. low to moderate stocking densities, use of rotational grazing if applicable, avoiding introducing new exotic invasive pasture grasses, maintaining relatively natural hydrology and that ponded pastures may be deleterious). Managers will be encouraged to become involved.

Produce a brochure for landholders detailing main findings on chat ecology and habitat requirements. This action compliments Actions 1.4, 1.5, 2.5 and 2.6.

Potential contributors: DPI&F, FBA NRM, Researchers (e.g. CQU), EPA.

Estimated cost: \$3500 a year for the first year, \$700 a year for the following four years. Total cost: \$6300.

Action 3.2 Ensure that the environmental values of chats and their habitat requirements are recognized in industry operational plans.

Performance criterion 3.2 Information on Capricorn yellow chat ecology is included in company management strategies in the Fitzroy Delta industrial area and staff awareness raised.

Background, justification and methods:

Industrialization of the Fitzroy Delta area is expanding. It is essential that companies in the area recognize the values of Capricorn yellow chats and incorporate management knowledge into management plans and awareness documents.

Consult with environmental officers of key industries to ensure that environmental values of chats and their habitat requirements are recognized in the site environmental plan, site management strategies and included in staff awareness and induction programs. This action compliments Action 2.5.

Potential contributors: DNR&W, FBA NRM, Researchers (e.g. CQU), EPA, state development.

Estimated cost: \$1050 a year for five years. Total cost: \$5250.

Action 3.3 Continue community awareness of Capricorn yellow chat conservation issues at the local, regional, state and national levels through talks, media releases, newsletter articles and brochures and involvement of Indigenous groups.

Performance criterion 3.3 Information provided to community stakeholders (bird groups, NGO's, indigenous groups, recreational fishers) on chat conservation issues is maintained.

Background, justification and methods:

Enhanced community awareness (e.g. newsletters, media releases etc) will contribute to its conservation outlook. Interpretive signage at Twelve Mile Creek has already been installed and will contribute to awareness of the issue among recreational fishers.

Potential contributors: FBA NRM, Researchers (e.g. CQU), EPA, Indigenous groups, Birds Australia, local bird watching groups.

Estimated cost: \$700 a year for five years. Total cost: \$3500.

Summary of specific objectives, performance criteria and actions

Table 2: Summary of objectives, performance criteria and actions. Priority rating: H, high; M, medium; L, low.

Specific objective	Performance criteria	Action	Potential Contributors	Priority
Objective 1 Protect, enhance and manage yellow chat habitat	1.1 The current use of Curtis Island National Park, where it overlaps the marine plain, by Capricorn yellow chats has been determined and reported on.	1.1 Survey the Curtis Island National Park where it overlaps the marine plain to establish its current use by Capricorn yellow chats and its habitat potential for chats.	EPA, Researchers (e.g. CQU), Birds Australia, local birdwatching groups	L
	1.2 Management practices favourable to Capricorn yellow chat habitat in protected areas are implemented.	1.2 EPA establish management strategies for the conservation and enhancement of the Capricorn yellow chat habitat on Curtis Island Conservation and National Parks.	EPA, Leaseholders of pastoral property	H
	1.3 Feral animal control has been implemented and the impact of this control has been measured and reported on.	1.3 Control numbers of feral animals considered to be a threat to yellow chats.	EPA, Leaseholders of pastoral property, FBA NRM, DNR&W, DPI&F	H
	1.4 Area of land in voluntary conservation agreements increased at Torilla Plain and Raglan Creek (if possible).	1.4 Investigate possible voluntary conservation agreements over freehold land at all sites where appropriate.	EPA, FBA NRM, freeholders	H
	1.5 Area of land in protected area and/or voluntary conservation agreements increased at Inkerman and Twelve Mile Creek.	1.5 Investigate acquiring appropriate leasehold land at Inkerman and Twelve Mile Creeks or attaining secure Nature Refuge covenant over this land.	EPA, DNR&W, FBA NRM	M
Objective 2 Address known threats, identify and quantify potential threats	2.1 Enhance awareness of natural resource managers (DNR&W, shire councils and others) that loss of surface flows to chat habitat may be detrimental.	2.1 Ensure that the Plan is integrated into government agency and NRM strategies, including water managers.	DNR&W, Defence Department, shire councils (Calliope, Fitzroy, Livingstone), FBA NRM, EPA	H
	2.2 Reduction in numbers of pigs on the Curtis Island marine plain.	2.2 Control feral pig numbers at Curtis Island to levels below thresholds damaging to chat habitat.	EPA, Leaseholders of pastoral property, FBA NRM, DNR&W	H
	2.3 Improved fire management for the protected estate at Curtis Island.	2.3 Develop a fire management strategy for Curtis Island marine plain.	EPA, Leaseholders of pastoral property	H
	2.4 Improved weed management for the protected estate at Curtis Island.	2.4 Develop a weed management strategy including introduced ponded pasture grasses for Curtis Island marine plain.	EPA, Leaseholders of pastoral property	H
	2.5 Threat of expansion in the industrial area within the Fitzroy Delta is reduced.	2.5 Consult with Fitzroy Shire as to the areas currently occupied by Capricorn yellow chats within their shire.	EPA, FBA NRM, Researchers	H

Specific objective	Performance criteria	Action	Potential Contributors	Priority
	2.6 Fencing has been erected in the Twelve Mile Creek area to exclude cattle from Capricorn yellow chat habitat during breeding.	2.6 Undertake fencing at Twelve Mile Creek area to exclude cattle from Capricorn yellow chat saltmarsh and sedge vegetation when breeding (October to April).	EPA, DNR&W, FBA NRM and lessees	H
	2.7 Knowledge of existing threats, particularly cattle grazing and feral pigs, has been increased and reports prepared for relevant parties.	2.7 Evaluate the impact of existing cattle grazing regimes and feral pigs (at Curtis Island) on chat habitat.	EPA, DPI&F, Researchers (e.g. CQU)	H
	2.8 Bi-annual surveys of Capricorn yellow chat abundance and habitat use conducted, research of chat ecology progressed and this information captured in reports.	2.8 Undertake research and monitoring of chat ecology and capture this information in technical reports and papers.	Researchers (e.g. CQU), EPA, Birds Australia, local birdwatching groups	H
	2.9 Mapping of REs 11.1.2a, 11.1.2b and 11.1.3 completed and included in EPA regional ecosystem mapping.	2.9 Undertake regional ecosystem (RE) mapping at an appropriate scale (1:25,000 or greater) to permit definition of RE 11.1.2b from 11.2.1a and definition of narrow bands of RE 11.1.3.	EPA, Researchers (e.g. CQU)	H
	2.10 Research into the genetic structure, demographics and dispersal of the Capricorn yellow chat completed and reported on.	2.10 Research genetic structure, demographics and dispersal of the Capricorn yellow chat; identify linkages between chat breeding and productivity including key food requirements.	Researchers (e.g. CQU), EPA, Birds Australia, local birdwatching groups	M
	2.11 Surveys for further sub-populations completed and if found, locations recorded with EPA.	2.11 Search for further sub-populations.	Researchers (e.g. CQU), EPA, Birds Australia, local birdwatching groups	L
Objective 3 Increase knowledge and awareness of the Capricorn yellow chat throughout the community, industry and landholders	3.1 Information on Capricorn yellow chat habitat and management requirements incorporated into property plans and staff awareness raised.	3.1 Liaise with landholders / managers as to the requirements of Capricorn yellow chats and the contribution they can make to maintaining chat habitat.	DPI&F, FBA NRM, Researchers (e.g. CQU), EPA	M
	3.2 Information on Capricorn yellow chat ecology is included in company management strategies in the Fitzroy Delta industrial area and staff awareness raised.	3.2 Ensure that the environmental values of chats and their habitat requirements are recognized in industry operational plans.	DNR&W, FBA NRM, Researchers (e.g. CQU), EPA, state development	M
	3.3 Information provided to community stakeholders (bird groups, NGO's, Indigenous groups, recreational fishers) on chat conservation issues is maintained.	3.3 Continue community awareness of Capricorn yellow chat conservation issues at the local, regional, state and national levels through talks, medial releases, newsletter articles and brochures, and the involvement of Indigenous groups.	DEH, FBA NRM, Researchers (e.g. CQU), EPA, Indigenous groups, Birds Australia, local bird watching groups	L

5. Costs of recovery

Table 3: Cost (\$) of recovery actions per annum.

Action	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1.1 Survey the Curtis Island National Park where it overlaps the marine plain to establish its current use by Capricorn yellow chats and its habitat potential for chats.	20,800	0	0	0	0	20,800
1.2 EPA establish management strategies for the conservation and enhancement of the Capricorn yellow chat habitat on Curtis Island Conservation and National Parks*.	14,000	14,000	0	0	0	28,000
1.3 Control numbers of feral animals considered to be a threat to yellow chats.	45,000	45,000	20,000	20,000	20,000	150,000
1.4 Investigate possible voluntary conservation agreements and/or development of property management plans at all sites where appropriate.	3500	3500	0	0	0	7000
1.5 Investigate acquiring appropriate leasehold land at Inkerman and Twelve Mile Creeks or attaining secure Nature Refuge covenant over this land.	1750	0	0	0	0	1750
2.1 Ensure that the Plan is integrated in government agency and NRM strategies, including water managers.	3500	0	0	0	0	3500
2.2 Control feral pig numbers at Curtis Island to levels below thresholds damaging to chat habitat.	-	-	-	-	-	Refer to Action 1.3
2.3 Develop a fire management strategy for Curtis Island marine plain.	-	-	-	-	-	Refer to Action 1.2
2.4 Develop a weed management strategy including introduced ponded pasture grasses for Curtis Island marine plain.	-	-	-	-	-	Refer to Action 1.2
2.5 Consult with Fitzroy Shire as to the areas currently occupied by Capricorn yellow chats within their shire.	1050	0	0	0	0	1050
2.6 Undertake fencing at Twelve Mile Creek area to exclude cattle from Capricorn yellow chat breeding habitat.	4000	0	0	0	0	4000
2.7 Evaluate the impact of existing cattle grazing regimes & feral pigs (at Curtis Island) on chat habitat.	12,000	12,000	12,000	12,000	12,000	60,000
2.8 Undertake research and monitoring of chat ecology and capture this information in technical reports and papers.	20,000	18,000	18,000	18,000	18,000	92,000
2.9 Undertake regional ecosystem (RE) mapping at an appropriate scale (1:25000 or greater) to permit definition of RE 11.1.2b from 11.2.1a and definition of narrow bands of RE 11.1.3.	4000	0	0	0	0	4000
2.10 Research genetic structure, demographics and dispersal of the Capricorn yellow chat; linkages between chat breeding and productivity including key food requirements.	0	0	47,000	44,000	44,000	135,000
2.11 Search for further sub-populations.	6500	6500	0	0	0	13,000

Action	Year 1	Year 2	Year 3	Year 4	Year 5	Total
3.1 Liaise with landholders / managers as to the requirements of Capricorn yellow chats and the contribution they can make to maintaining chat habitat.	3500	700	700	700	700	6300
3.2 Ensure that the environmental values of chats and their habitat requirements are recognized in industry operational plans.	1050	1050	1050	1050	1050	5250
3.3 Continue community awareness of Capricorn yellow chat conservation issues at the local, regional, state and national levels through talks, medial releases, newsletter articles and brochures, and the involvement of Indigenous groups.	700	700	700	700	700	3500
Total cost per year (\$)	141,350	101,450	96,450	96,450	96,450	535,150

* Estimates for fencing Conservation Park / National Park boundary not included as these will depend on EPA review (estimated cost is \$63,000, Hall 2005)

6. Management practices

Proper management of yellow chat habitat is critical to the survival of this species. Guidelines for habitat management, based on current knowledge of the biology of Capricorn yellow chats, are outlined below. These guidelines may be modified as knowledge of the biology of and threats to the Capricorn yellow chat improves.

1. Maintain surface flows to breeding habitat

Any reduction or alteration of surface flows into catchments supporting Capricorn yellow chat sub-populations may adversely affect the timing and extent of inundation of habitat required to promote breeding and subsequent survival during the dry season. Further stream diversions due to construction of weirs, road infrastructure, water-harvesting initiatives or ponded pasture proposals in significant yellow chat catchments (Wadallah, Coonyan and Twelve Mile Creeks) should be assessed for potential adverse effect on habitat.

In particular, care will be needed in planning drainage around roads, rail and pipelines, as well as filling for industrial land development of tidal lands as the slight gradients on tidal lands and the adjacent marine and alluvial plains make them particularly susceptible to disturbance and degradation.

2. Industrial development proposals

Any works which occur at the freshwater-tidal interface should be planned and engineered so as to maximize connectivity of both tidal inflows and freshwater outflows and retention of the ponding within the exchange area to a maximum extent.

For essential projects of State or National significance, this strategy could be utilised to create modified (artificial) habitat but such a habitat should address the key management needs of fishway connectivity and retention or expansion of the critical brackish water habitat of high value to yellow chat breeding.

3. Levee bank construction

Extensive levee banks within tidal areas that cause widespread pooling of freshwater and a reduction of the complex braided drainage systems normally used by chats are likely to cause loss of yellow chat breeding habitat and should not be permitted. Currently, the construction of levee banks is illegal below the HAT (highest astronomical tide line).

4. Managing the impact of feral animals

Where pigs are causing significant damage to yellow chat habitat, pig numbers must be reduced.

5. Managing cattle stocking densities

Issuing of new grazing leases on State Land covering tidal areas of marine couch should be avoided as any grazing of these reduces the structure and extent of yellow chat habitat. On freehold and leasehold grazing lands, where saltmarsh and sedge communities comprise the main breeding habitat (e.g. Twelve Mile Creek), manage known breeding habitat so that it is grazed intermittently only during the dry season.

When cattle stocking densities are too high, taller grasses and sedges providing shelter and breeding habitat for yellow chats can be overgrazed and trampled. Reduce stocking densities to moderate levels and spell paddocks when they are at their wettest to allow development of cover species such as sedges and tall grasses. Where ponded pasture grasses exist (e.g. high freshwater inflow areas), maintain grazing pressure at a level sufficient to prevent ponded pasture species proliferating and displacing native sedges within drainage lines.

6. Introduction of further ponded pasture grasses

Prevent further introduction of invasive introduced pasture grasses into known yellow chat catchments.

7. Fire management

Marine plains should be protected from fire.

8. Landholder agreements for conservation

Where applicable, protection and conservation management of yellow chat habitat could be improved by: (i) informal landholder agreements, (ii) securing leasehold and adjacent freehold lands under appropriate voluntary conservation agreements such as a nature refuge under the *Nature Conservation Act 1992*, or (iii) establishment of a conservation park. The latter has the capacity to permit sustainable and compatible land uses, including sustainable grazing, provided they are complementary with protection of the natural values. These options need to be explored in consultation with the current land owners / managers and the community.

9. Monitoring

Habitat condition and yellow chat numbers should be monitored to ensure threats to its habitat are properly managed. Where the impact of development is to be assessed, monitoring must be carried out a year or preferably more, before development starts.

7. Evaluation of recovery plan

The recovery team will evaluate the recovery plan in the first year of its operation and then progress will be evaluated against performance criteria in the fifth year of the plan.

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Glossary

Chenopods Succulent plants of the Family Chenopodiaceae adapted to saline soils

Ecotonal: Refers to a transition zone between two or more ecological communities.

HAT: Highest Astronomical Tide; the highest water level that can be predicted to occur under average meteorological conditions.

Marine plain: defined by Speight (1990) as '...typically depositional landforms that have been formed predominantly by marine processes and have very gentle gradients with subtle changes in elevation...'. They include estuarine deposits.

Samphire: Semi-woody plants of low shrub or prostrate habit, tolerant of saline conditions and brief inundation (daily or intermittent), many of which have succulent stems. Important component of saltmarsh vegetation.

Site: Discrete sub-population (> 1 km from another site) or difference in habitat use

Torilla Plain: North-west portion of the Torilla Peninsula on soils of marine origin (hence marine plain)

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Appendix 1: Supporting Figures

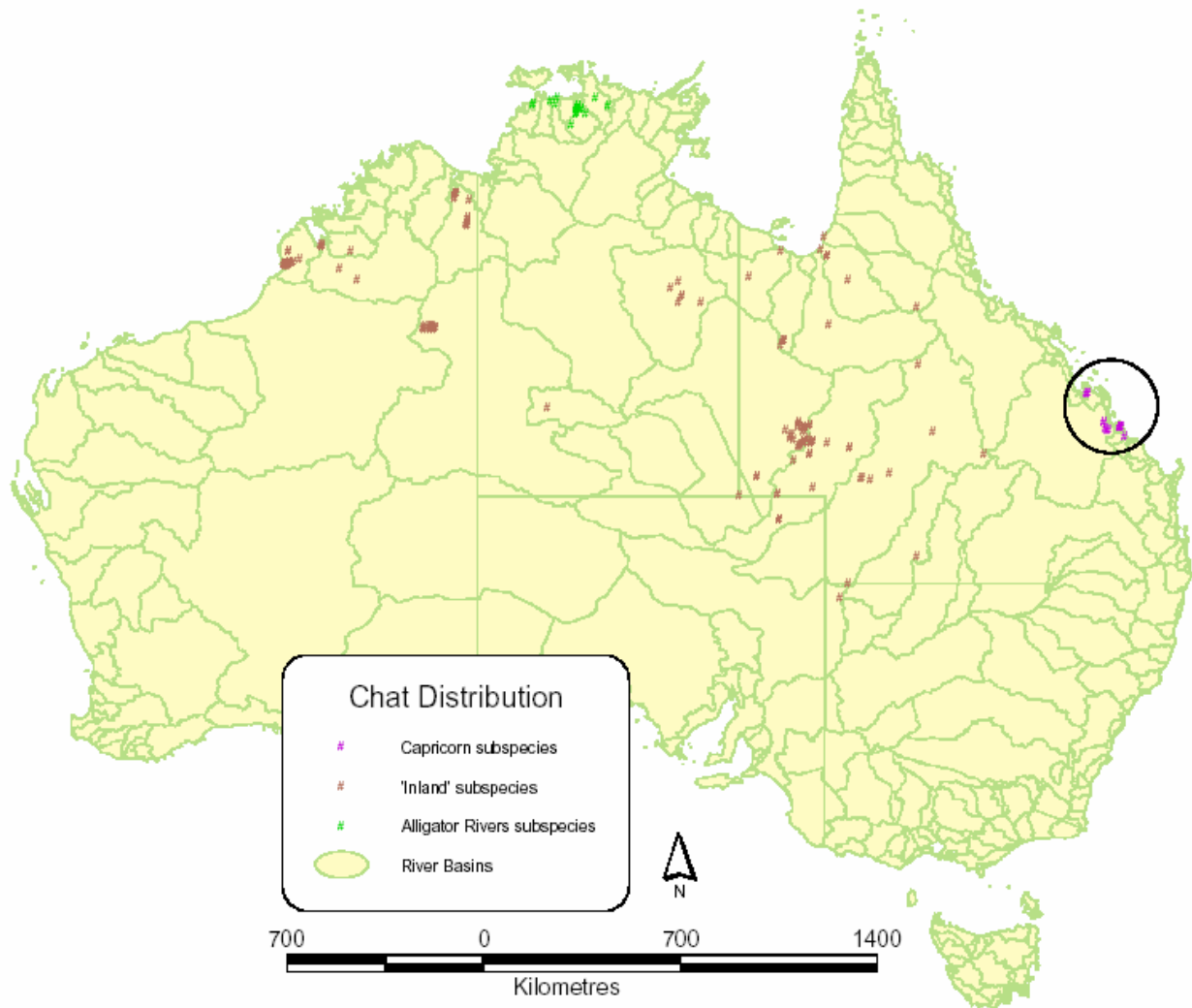


Figure A: Australian distribution of the three subspecies of yellow chats based on WildNet and Birds Australia databases (July 2005) and Houston et. al (unpub. data) (circled area defines current extent of Capricorn yellow chat distribution).

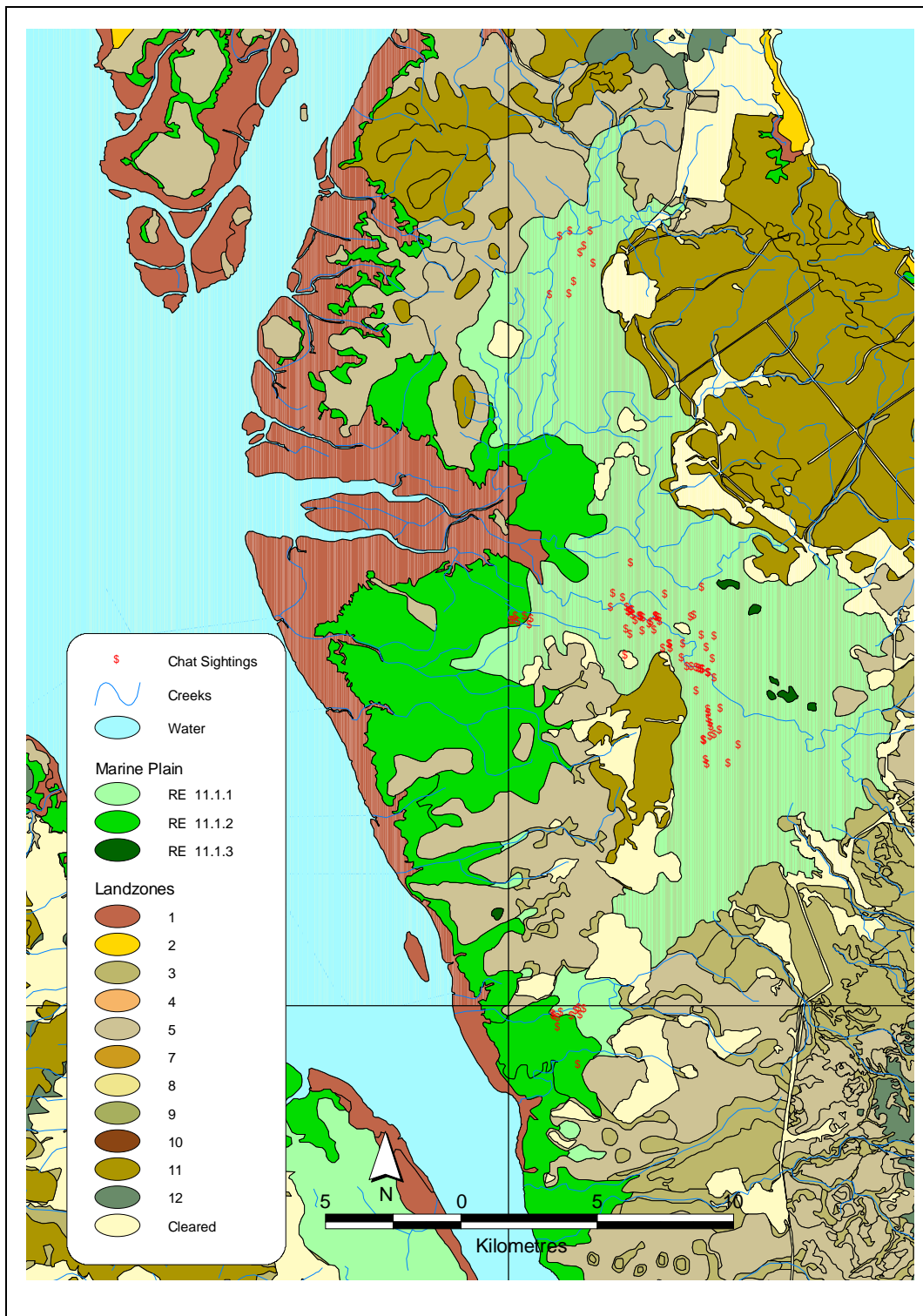


Figure B: Chat distribution on the Torilla Plain; largest drainage lines also shown (Houston *et al.* unpub. data, July 2005) – the marine plain corresponds to the green areas delineated by 11.1.1 + 11.1.2.

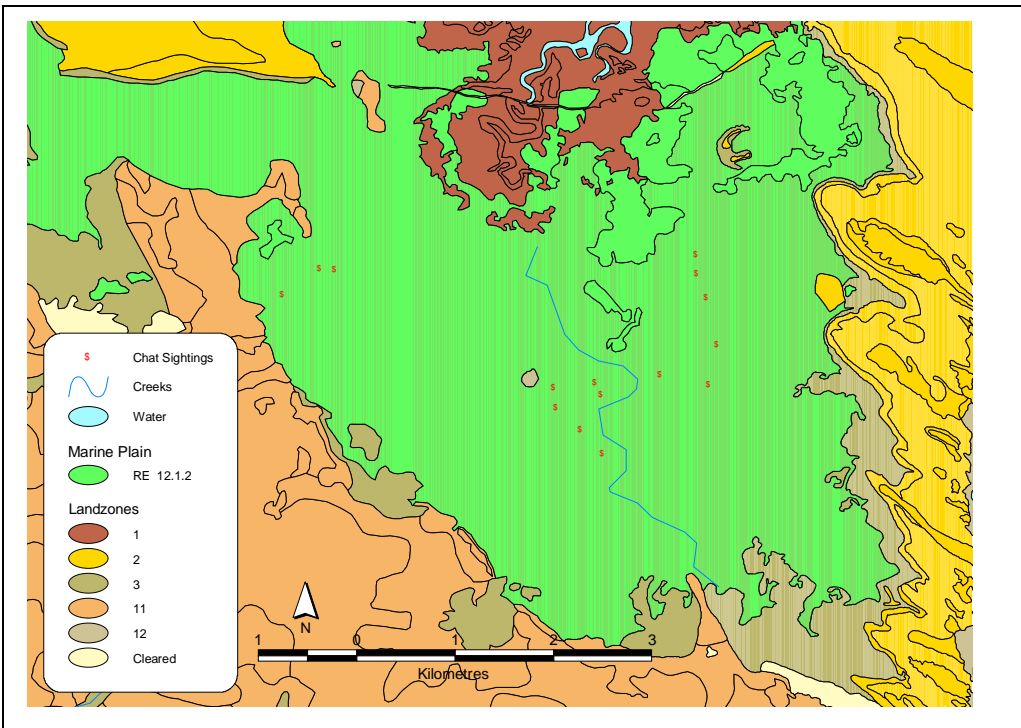


Figure C: Chat distribution at Curtis Island, drainage lines also shown (Houston *et al.* unpub. data, July 2005).

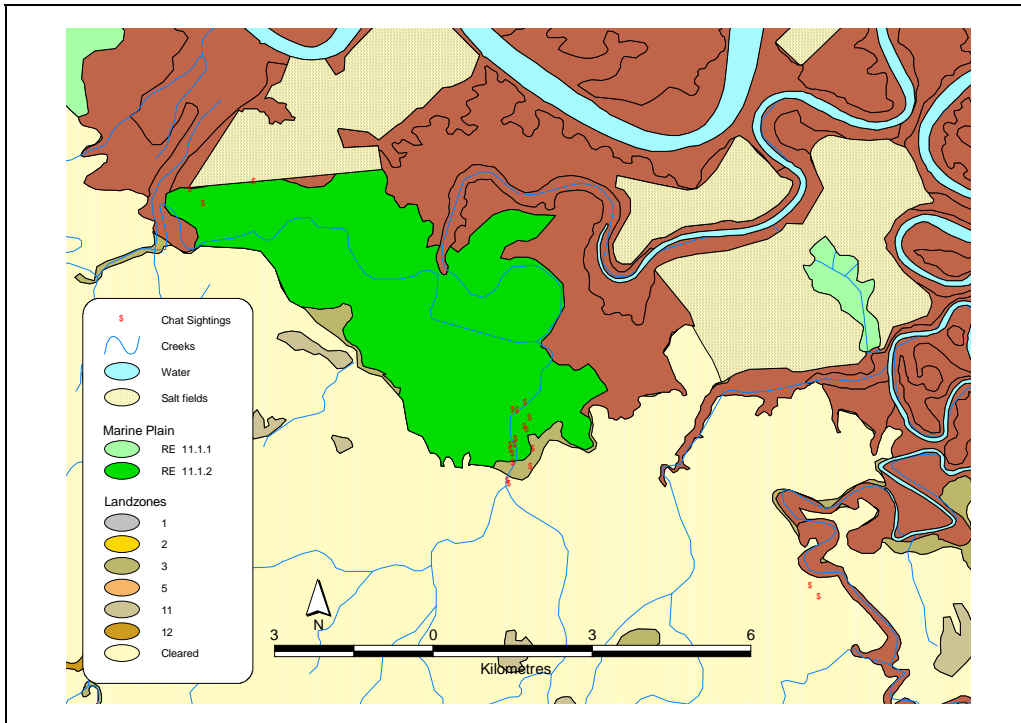


Figure D: Chat distribution at Fitzroy Delta, drainage lines also shown (Houston *et al.* unpub. data, July 2005). Stippling indicates location of salt evaporation industry.

Appendix 2: Summary of knowledge regarding various life history parameters for the Capricorn yellow chat

Parameter	Findings	Observation type	Comments/ other relevant data
Population			
Size	300 adults	2 years data based on standard sampling protocols.	Highest counts are immediately post-breeding when large flocks concentrate along channels.
Linkages between sub-populations of Capricorn yellow chats.	No data		
Linkage with other subspecies.	No data		Nearest record is from the headwaters of the Barcoo River (Lake Eyre basin) where it abuts the Nogoia River catchment (Fitzroy basin) - observation date is from the 1930s.
Genetic difference to other subspecies.	No data		Subspecies differentiation is based on morphological differences.
Habitat & life history			
Habitat use.	Use sedges, grasses and samphire associated with channels & depressions on marine plains.	Two years observations on where chats occur and associated vegetation type, species and structure.	Based on nine surveys of all vegetation zones on Torilla marine plain and Twelve Mile Creek + four surveys of Curtis Island.
Dry season habitat.	Dry channels/depressions plus adjacent grasslands (para grass at central Torilla Plain and marine couch/water couch at Curtis Island).	Two years observations on where chats occur and associated vegetation type, species and structure.	Yet to locate Fitzroy Delta dry season habitat.
Habitat critical for drought refuge.	Based on current understanding, persist on marine plains where vegetation is sufficiently complex and seasonally inundated (both Curtis Island and Torilla Plain).	Several years observations on where chats occur and associated vegetation type, species and structure.	Need longer term data to confirm but persisted on the marine plain at Curtis Island despite below average rainfall in 2001-2002 and salinities greatly in excess of seawater in their habitat (e.g. 70ppt, Houston <i>et al.</i> 2004a).
Habitat critical for flood refuge.	No data.		
Habitat critical for dispersal.	No data.		
Foraging habitat.	Less dense vegetation but including sedges and muddy margins, grazed tall grasses, open grasslands, moist samphire, herbaceous cover in channels and depressions,	Informal observation.	Based on numerous natural history observations.
Shelter habitat.	tall sedges and grasses.	Informal observation.	Based on numerous natural history observations.
Nesting habitat.	<i>S. littoralis</i> or marine couch/ <i>S.littoralis</i> at Curtis Island (Two nests); marine couch at Twelve Mile Creek (Two nests).	Two years observations on where chats occur and associated vegetation type, species and structure.	Yet to locate which vegetation types are used for nesting at Torilla Plain.
Feeding habitat for fledged young (post-breeding habitat).	Sedge-lined channels and depressions with muddy substrates; moist samphire vegetation.	Two years observations on where chats occur and associated vegetation type, species and structure.	The conjunction of protective cover and abundant food resources appear to be important components of optimal breeding habitat..
Water requirements.	No data.		Seen bathing and/or drinking suggesting may be required under certain seasonal conditions
Diet	Insectivorous (although do have a brush tongue with the potential to feed on nectar).	Informal observation.	The species is regarded as predominantly insectivorous based on gut contents analysis.

Parameter	Findings	Observation type	Comments/ other relevant data
Diet when feeding young.	Caterpillars from samphire vegetation at Twelve Mile Creek and spiders at Curtis Island; often seen foraging on muddy substrates and seedheads of sedges.	Informal observation.	
Longevity.	No data.		Less than three years in other chat species.
Morbidity.	No data.		
Predators.	No data.		A group of about 40 birds retreated to nearby cover (<i>C. alopecuroides</i>) in response to raptor overhead (Australian hobby).
Life history strategy - opportunist or specialist.	No data.		Postulated that breed rapidly when conditions are favourable.
Dispersal ability.	Appear to have left breeding habitat at Twelve Mile Creek and saline sites on Torilla Plain in the dry season in both years of observation.		Based on the inland subspecies, the species is generally regarded as capable of dispersing widely.
Breeding season.	Spring-summer confirmed (nests found).	Informal observation.	Autumn also likely (based on age of young).
Trigger for breeding.	No data.		Breeding preparedness was observed at Curtis Island following spring storms (September – November); postulated to be increasing day length and/or rainfall and associated inundation of wetlands.
Clutch size.	Limited data, 2-3 eggs (based on four nests).		Adults with up to four fledged young have been seen.
Incubation period.	10-14 days (1 observation only).		Matches period observed in other chat species.
Time to leaving nest.	No data.		14 days in other chat species.
Time to independence.	No data.		
Time committed by adults to reproduction.	No data.		Minimum of five weeks in other chat species.
Survival/recruitment of young.	No data.		
Age at first breeding.	No data.		Postulated to be at one year in other chat species.
Ability to breed more than once per year.	No data.		Based on other chat species, it is postulated that can breed more than once.
Territoriality.	Defend territories in breeding season.	Informal observation	Supported by observations of other species.
Size of territories.	Estimated that males are defending about 100m of channel / sedge-bed.	Informal observation	
Triggers for dispersal.	No data.		
Patterns of dispersal and importance of corridors.	No data.		
Ecological drivers			
Primary production, rainfall / inundation.	No data.		Informal observations suggest that primary production (and therefore insect production) of their breeding habitat (marine plain wetlands) is stimulated by wet season rainfall and inundation.

Appendix 3: Description of Regional Ecosystems (current as of 2005)

Complete description of current Regional Ecosystems (REs) where Capricorn yellow chats occur (Environmental Protection Agency 2004).

RE	Description	Capricorn yellow chat sites
11.1.1	<i>Sporobolus virginicus</i> grassland on Quaternary estuarine deposits. Other species usually present are <i>Fimbristylis ferruginea</i> , <i>Cyperus victoriensis</i> , <i>C. scariosus</i> , and sometimes <i>Eleocharis spiralis</i> and <i>Leptochloa fusca</i> . Occurs on marine plains with extensive extratidal and supratidal flats adjacent to intertidal flats; seaward margins irregularly inundated with tidal waters and dissected by small tidal channels. Formed from Quaternary estuarine sediments with deep saline clay soils.	Torilla Plain area (Raglan Creek area is too small to be mapped but corresponds to this RE).
11.1.2	Samphire forbland or bare mud-flats on Quaternary estuarine deposits.	Twelve Mile & Inkerman Creek in the Fitzroy Delta; and more saline sections of the Torilla Plain.
11.1.3 (Of Concern)	Sedgeland to grasslands on Quaternary estuarine deposits. Sedgeland areas typically dominated by <i>Schoenoplectus litoralis</i> although a range of other sedges and grasses may also dominate localised areas. Other dominant species include the sedges <i>Eleocharis philippensis</i> , <i>Cyperus alopecuroides</i> , <i>C. scariosus</i> and <i>C. iria</i> and the grasses <i>Phragmites australis</i> , <i>Cynodon dactylon</i> , <i>Sporobolus virginicus</i> and <i>Paspalum vaginatum</i> . Other typical species in shallower margins include <i>Fimbristylis ferruginea</i> , <i>Phyla nodosa</i> and <i>Cyperus polystachyus</i> . Occasional twiners such as <i>Cynanchum carnosum</i> may be present. Occurs in depressions on Quaternary estuarine deposits which are brackish to saline. These are seasonally inundated with fresh water, but dry out completely before the next season's rain.	Common element on marine plain of the Torilla Peninsula. Most heavily exploited by Capricorn yellow chats but not often mapped due to scale. Similar vegetation also used by chats at Curtis Island.
Non-remnant land zone 3	Alluvial plain with a dense network of shallow braided channels.	Twelve Mile Creek and Pelican Creek, Raglan Creek.
12.1.2	Saltpan vegetation comprising <i>Sporobolus virginicus</i> grassland and samphire herbland on Quaternary estuarine deposits. Grasses including <i>Zoysia micrantha</i> sometimes present in upper portions of tidal flats. Marine plains/tidal flats. Includes saline or brackish sedgeland.	Curtis Island.