Red Emperor (2018)

Lutjanus sebae

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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Western Australia	Gascoyne	GDSMF, GDSMF || WCDGDLIMF || WCDSIMF, WCDGDLIMF, WCDSIMF	Sustainable	Age structure, fishing mortality rates of indicator species
Western Australia	Kimberley	NDSMF	Sustainable	Spawning stock level, age structure, catch, CPUE
Western Australia	Pilbara	PFTIMF, PFTIMF || PLF || PTMF, PLF, PTMF	Sustainable	Spawning stock level, age structure, catch, CPUE
Northern Territory	Northern Territory	CLF, DF, TRF	Undefined	Catch, trigger reference points
Queensland	East Coast Queensland	CRFFF	Undefined	Catch, effort, standardised CPUE
Queensland	Gulf of Carpentaria	GOCDFFTF, GOCLF	Undefined	Catch, standardised CPUE , observer surveys

CLF Coastal Line Fishery (NT), DF Demersal Fishery (NT), TRF Timor Reef Fishery (NT), LFR Line Fishery (Reef) (QLD), GOCDFFTF Gulf of Carpentaria Developmental Fin Fish Trawl Fishery (QLD), GOCLF Gulf of Carpentaria Line Fishery (QLD), GDSMF Gascoyne Demersal Scalefish Managed Fishery (WA), NDSMF Northern Demersal Scalefish Managed Fishery (WA), PFTIMF Pilbara Fish Trawl (Interim) Managed Fishery (WA), PLF Pilbara Line Fishery (WA), PTMF Pilbara Trap Managed Fishery (WA), WCDGDLIMF West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WA), WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery (WA), GDSMF || WCDGDLIMF || WCDSIMF Various Fisheries combined due to 3 boat rule (WA), PFTIMF || PLF || PTMF Various Fisheries combined due to 3 boat rule (WA)

STOCK STRUCTURE

Red Emperor is exploited primarily in the North Coast Bioregion of Western Australia [Newman et al. 2018a]. Smaller catches are taken in the Northern Territory and Queensland. Red Emperor is one of the indicator species used to assess the status of the demersal resources in the North Coast Bioregion [Newman et al. 2018b]. Van Herwerden et al. [2009] examined the

genetic connectivity of Red Emperor using mitochondrial DNA from samples collected at two locations in Western Australia (Browse Island, Kimberley region; Montebello Islands, Pilbara region) and two locations on the east coast (High Peak Island and Catfish Shoal, East Coast Queensland). The mitochondrial DNA data for Red Emperor did not differ genetically either within or between coasts at the locations examined, suggesting a panmictic population structure with high levels of gene flow among populations. This study indicates that eastern and western Australian populations of Red Emperor form a single inter-breeding genetic stock [van Herwerden et al. 2009] or one biological stock.

The results of van Herwerden et al. [2009] confirm those derived by Johnson et al. [1993] using allozymes for Red Emperor in Western Australian waters. Johnson et al. [1993] examined allozyme samples of Red Emperor from the Lacepede Islands, Bedout island, Lowendal Islands, Ningaloo and Shark Bay. This study reported extensive connectivity and gene flow among populations throughout the sampled range of 1 400 km in Western Australia.

Stephenson et al. [2001] examined stable isotopes in sagittal otolith carbonates of Red Emperor from four locations; Shark Bay (Gascoyne), Ningaloo (Gascoyne), Pilbara and Broome (Kimberley). Significant differences in stable isotope ratios provided evidence that there was limited mixing of adult Red Emperor between three broad zones; Shark Bay (Gascoyne), Pilbara, and Broome (Kimberley), a distance of approximately 1 400 km [Stephenson et al. 2001]. Therefore, these broad locations could be managed separately for the purposes of fishery management, if management arrangements were established in a way that harmonized with the spatial patterns of exploitation. Stephenson et al. [2001] reported partial mixing of Red Emperor from Pilbara west and east sites. The overlap in the multivariate analyses of otolith stable isotope signatures between some sites potentially reflects dispersal by a proportion of juvenile or adult fish. This suggests that, in Western Australia, Red Emperor can be managed as a number of separate management units.

Here, assessment of stock status is presented at the management unit level—Gascoyne, Pilbara and Kimberley (Western Australia); Gulf of Carpentaria and East coast (Queensland); and at the jurisdictional level—Northern Territory.

STOCK STATUS

East Coast Queensland

There has been no stock assessment to determine biomass, and there is no estimate of MSY, for the east coast Queensland stock of Red Emperor. Recreational catches of Red Emperor were around 65 per cent (83 t) of the total landings for the species based on the 2013–14 recreational catch numbers [Webley et al 2015] and commercial landings, using a weight conversion [McPherson et al. 1992] based on average fish length from fishery-dependent surveys in 2016–17 [Department of Agriculture and Fisheries unpublished data]. Recreational harvest estimates decreased from approximately 47 000 fish in 2000–01, to 35 000 in 2010–11, to 16 000 in 2013–14. It is not known if declining recreational catch and harvest is related to lower biomass or decreased effort (or both). A similar level of reduction in harvest was also reported in charter catch from 23 t in 2007–08 to 9 t 2013–14 (charter fishing is a subset of recreational fishing), but this has increased again to around 15 t in 2016–17.

In 2004–05 the reported commercial harvest declined from between 100–200 t per year to less than 61 t per year. The decrease coincided with expansion of no-take marine reserves within the Great Barrier Reef Marine Park and the introduction of a quota management system for coral reef finfish species. Both management interventions are likely to have depressed commercial harvest. Over the last decade, annual commercial catches have generally declined from 61 t (2009–10) to 36 t (2016–17). Commercial harvest of Red Emperor falls under the "Other Species" quota in the CRFFF (956 t in 2016–17), which comprises many other coral reef finfish species. The Indigenous catch is unknown but is expected to be minor. A portion of the biomass is not available to the fishery because of no-take marine reserves within the Great Barrier Reef Marine Park although this has not been quantified. There is insufficient information available on the current biomass to confidently classify the status of

this stock.

On the basis of the evidence provided above, the East Coast Queensland management unit is classified as an **undefined stock**.

Gascoyne

The Gascoyne management unit of Red Emperor is a component of the Gascoyne Demersal Scalefish Managed Fishery (Western Australia) (GDSMF) [Gaughan and Santoro 2018]. Red Emperor is assessed on the basis of the status of the indicator species for other demersal finfish species in the GDSMF (particularly Goldband Snapper [Newman et al. 2018b]).

Red Emperor is assessed on the basis of the status of the indicator species, Goldband Snapper. An assessment of fishing mortality derived from representative samples of the age structure of Goldband Snapper was undertaken in the GDSMF in 2017. These fishing mortality based assessments utilise reference levels defined below for the Pilbara management unit. The fishing mortality based assessments and associated uncertainty ranges indicated that the fishing mortality rate on Goldband Snapper was less than the target level, indicating that the level of exploitation experienced by Goldband Snapper in the Gascoyne has been low. Catches of Red Emperor in the GDSMF have been low and stable for the past five years (2013–17), ranging from 7–14 tonnes (t), with a mean annual catch of 10.3 t. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

Based on the evidence provided above, the Gascoyne (Western Australia) management unit is classified as a **sustainable stock**.

Gulf of Carpentaria

Red Emperor in the Gulf of Carpentaria has historically been taken by demersal fish trawl (Gulf of Carpentaria Developmental Fin Fish Trawl Fishery [GOCDFFTF]) and by line (Gulf of Carpentaria Line Fishery [GOCLF]). Participants in the GOCLF primarily target Spanish Mackerel (*Scomberomorus commerson*) by trolling. Since 2010, the catch of Red Emperor in this fishery has fallen to very low levels, primarily as a result of decline in fishing effort in the area. There is no reliable estimate of recreational or Indigenous harvest of Red Emperor in the Gulf of Carpentaria, but it is expected to be minor given the offshore nature of the fishery.

Commercial catches in the GOCDFFTF have been historically variable. Fish trawl effort in the Gulf of Carpentaria declined markedly in 2012 and further since as a result of transfer of effort to Northern Territory regions outside the Gulf. Catch in 2015 was around 2 t with no fishing since the 2016–17 quota (financial) year. There are limited data on the distribution and abundance of Red Emperor in the Gulf of Carpentaria. Nominal commercial catch rates have been historically variable, although long-term standardised catch rates to 2009 showed significant declines [O'Neill et al 2011]. Observer surveys in 2004–06 showed most Red Emperor caught in the GOCDFFTF were discarded, the majority of which were immature [Department of Agriculture and Fisheries, unpublished data]. Red Emperor maximum sustainable yield (MSY) is estimated to be approximately 20 t in the eastern part of the Gulf of Carpentaria [Leigh and O'Neill 2016]. While catches have always been lower than the MSY, the high discard rate creates uncertainty regarding fishing mortality. There is insufficient evidence available to confidently classify the status of this stock

Based on the evidence provided above, the Gulf of Carpentaria (Queensland) management unit is classified as an **undefined stock**.

Kimberley

The major performance measures for the Kimberley management unit of Red

Emperor are spawning stock levels estimated using an integrated age-structured assessment. The target level of spawning biomass is 40 per cent of unfished (1980) levels. The limit level is 30 per cent of the unfished levels. The spawning biomass level of Red Emperor was estimated to be approximately 38 per cent in the Northern Demersal Scalefish Managed Fishery (NDSMF) in 2015, the year the last integrated assessment was undertaken [Newman et al. 2018a]. Catch levels of Red Emperor in the NDSMF over the past five years (2013–17) have been stable, ranging between 130 t and 138 t, and are below the catch levels obtained for the preceding five year period (2008–12) of sustainable fishing, where catches ranged between 127 t and 176 t [Newman et al. 2018a]. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

An assessment of fishing mortality derived from representative samples of the age structure of Red Emperor has also been undertaken for the NDSMF. These fishing mortality based assessments utilise reference levels defined above for the Pilbara management unit. The fishing mortality based assessments indicated that the fishing level on Red Emperor was close to the target level in 2012 [Newman et al. 2018a]. This indicates that fishing is not having an unacceptable impact on the age structure of the population. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

Based on the evidence provided above, the Kimberley (Western Australia) management unit is classified as a **sustainable stock**.

Northern Territory

Red Emperor comprises around two per cent of the total catch in the Northern Territory offshore snapper fisheries and is managed as part of the 'group' species in the Timor Reef and Demersal Fisheries [DPIR 2018]. The performance indicators and trigger points are based on significant changes in species composition of the catch, used to indicate whether significant catch increases warrant further management efforts. Since 1995, catches of Red Emperor have varied between 1.5 and 4.5 per cent of the total annual catch and catches have increased from 20 t in 1995 to 95t in 2017. The trigger point of an increase of more than 15 per cent of the species' previous year's catch weight, or of a species becoming dominant relative to other species in the group, was not reached in 2017.

This evidence suggests that the current level of fishing mortality is unlikely to cause Red Emperor in the Northern Territory to cause the stock to become recruitment impaired. However, there is insufficient information available on the current biomass to confidently classify the status of this stock.

Based on the evidence provided above, Red Emperor in the Northern Territory is classified as an **undefined stock**.

Pilbara

The major performance measures for the Pilbara management unit of Red Emperor landed in the Pilbara Trap Managed Fishery and Pilbara Fish Trawl Interim Managed Fishery are spawning stock levels estimated using an integrated age-structured assessment. The target level of spawning biomass is 40 per cent of unfished (1972) biomass. The limit level is 30 per cent of the unfished spawning biomass. Estimates of the relative spawning biomass for the overall stock have fluctuated between the target and threshold levels in the Pilbara Demersal Scalefish Fisheries since the mid-1980s. The spawning biomass level of Red Emperor overall (across all management areas) was estimated to be above the threshold level in the Pilbara Demersal Scalefish Fisheries in 2015, the year the last integrated assessment was undertaken [Newman et al. 2018a]. All scenarios evaluated in the assessment model indicate that there is a high probability that the estimate of spawning biomass of Red Emperor is above the threshold level. The above evidence indicates that the biomass of this stock is

unlikely to be depleted and that recruitment is unlikely to be impaired.

An assessment of fishing mortality derived from representative samples of the age structure of Red Emperor has also been undertaken for separate management areas in the Pilbara biological stock in 2015. These fishing mortality (F)-based assessments utilise the following reference levels based on ratios of natural mortality (M) that are applicable to each species, such that Ftarget = 2/3M, Fthreshold = M and Flimit = 3/2M (DPIRD 2017). The fishing mortality based assessments indicated that the fishing level on Red Emperor in 2011 was generally between the target and the threshold level, but between the threshold and limit levels in some areas. This indicates that fishing was having an impact on the age structure of the population in some management areas. Effort reductions since 2008 have resulted in decreasing catch levels and the total retained catches of Red Emperor in the Pilbara Demersal Scalefish Fisheries have been stable since trawl effort was reduced in 2009 as part of a stock rebuilding strategy. Recreational catches are a minor component of total catches. These stable annual catch trends and estimates of F that are below the limit level in all areas suggest no evidence of recent stock depletion. The stability in the adjusted fish trawl catch rates since 1998 indicates that stock abundance has remained stable during this period, with some indication of recent increasing abundance in the western area of the fishery. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

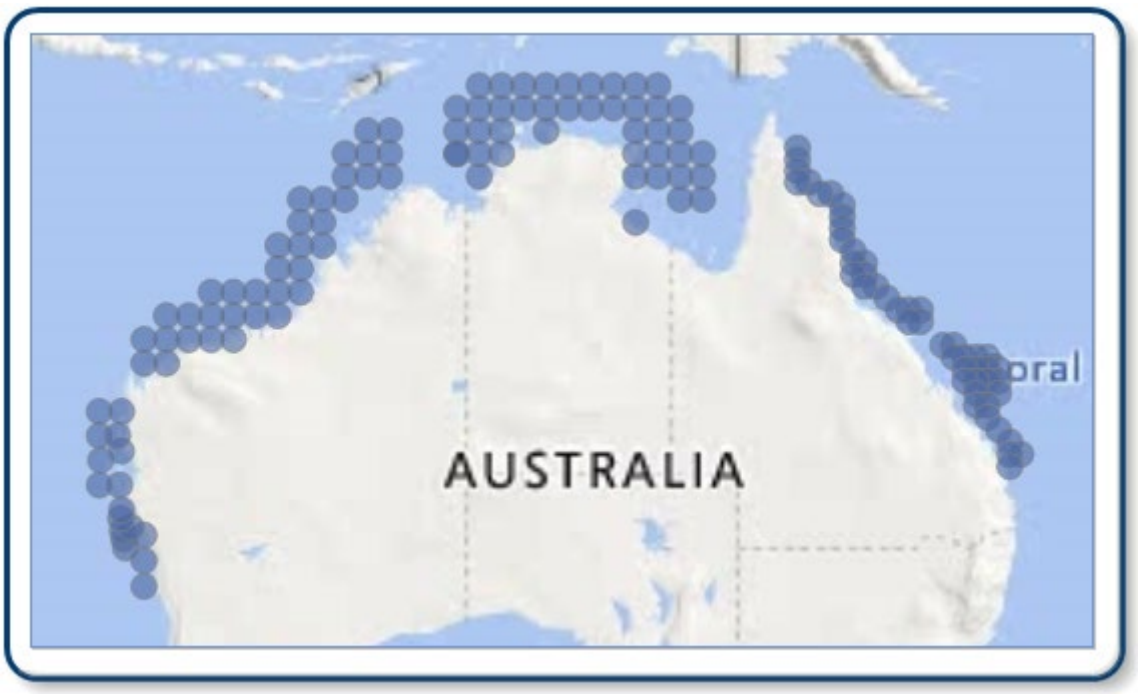
Based on the evidence provided above, the Pilbara (Western Australia) management unit is classified as a **sustainable stock**.

BIOLOGY

Red Emperor biology [McPherson *et al.* 1992, Newman and Dunk 2003, Newman et al. 2000, 2001, 2010, O'Neill et al. 2011, McPherson and Squire 1992, DAF unpublished data 2018]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Red Emperor	WA: 40–45 years' 800 mm FL (860 mm TL) East coast Queensland: 22 years, at least 900 mm TL	WA: 4–6 years, 430–460 mm FL (460–490 mm TL) East Coast Queensland: 5 years, 542 mm FL for females

DISTRIBUTION



Distribution of reported commercial catch of Red Emperor

TABLES

Commercial Catch Methods	Northern Territory	Queensland	Western Australia
Demersal Longline	✓		
Dropline	✓		✓
Fish Trap	✓		✓
Gillnet			✓
Hand Line, Hand Reel or Powered Reels			✓
Hook and Line	✓	✓	✓
Midwater Trawl	✓		
Otter Trawl	✓		✓
Traps and Pots			✓
Trawl		✓	
Trolling	✓		✓
Trotline	✓		
Unspecified			✓

Fishing methods			
	Northern Territory	Queensland	Western Australia
Charter			
Hook and Line		✓	✓
Spearfishing		✓	
Commercial			
Dropline	✓		✓
Fish Trap	✓		✓
Gillnet			✓
Hand Line, Hand Reel or Powered Reels			✓
Hook and Line	✓	✓	✓
Midwater Trawl	✓		
Otter Trawl	✓		✓
Trawl		✓	
Unspecified			✓
Indigenous			
Hook and Line		✓	
Spearfishing		✓	
Recreational			
Hook and Line	✓	✓	✓

Spearfishing		✓	✓

Management Methods			
	Northern Territory	Queensland	Western Australia
Charter			
Bag and possession limits		✓	
Bag limits			✓
Gear restrictions		✓	
Limited entry			✓
Passenger restrictions	✓		✓
Possession limit		✓	
Size limit		✓	✓
Spatial closures		✓	✓
Spatial zoning			✓
Temporal closures		✓	
Commercial			
Effort limits			✓
Gear restrictions	✓	✓	✓
Limited entry		✓	✓
Quota		✓	
Size limit		✓	✓
Spatial closures	✓	✓	✓
Spatial zoning	✓		✓
Temporal closures		✓	
Total allowable catch	✓	✓	✓
Total allowable effort			✓
Vessel restrictions		✓	✓
Indigenous			
Laws of general application			✓
Recreational			

Bag and possession limits	✓	✓	
Bag limits			✓
Gear restrictions		✓	
Licence (Recreational Fishing from Boat License)			✓
Possession limit			✓
Size limit		✓	✓
Spatial closures	✓	✓	✓
Temporal closures		✓	

Active Vessels			
	Northern Territory	**Queensland**	**Western Australia**
	14 LICENCES in CLF, 8 LICENCES in DF, 5 LICENCES in TRF,	182 in CRFFF, 0 in GOCDFFTF, 2 in GOCLF,	15 in GDSMF, <3 in PFTIMF, 7 in PLF, <3 in PTMF, <3 in WCDGDLIMF, 19 in WCDSIMF, 27 in Charter, 6 in NDSF,

CLF Coastal Line Fishery(NT)

DF Demersal Fishery(NT)

TRF Timor Reef Fishery(NT)

LFR Line Fishery (Reef)(QLD)

GOCDFFTF Gulf of Carpentaria Developmental Fin Fish Trawl Fishery(QLD)

GOCLF Gulf of Carpentaria Line Fishery (QLD)

GDSMF Gascoyne Demersal Scalefish Managed Fishery(WA)

PFTIMF Pilbara Fish Trawl (Interim) Managed Fishery(WA)

PLF Pilbara Line Fishery(WA)

PTMF Pilbara Trap Managed Fishery(WA)

WCDGDLIMF West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery(WA)

WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery(WA)

Charter Tour Operator(WA)

NDSF Northern Demersal Scalefish Fishery(WA)

Catch			
	Northern Territory	**Queensland**	**Western Australia**

Charter			10.7 t
Commercial	0.111t in CLF, 62.3807t in DF, 31.9725t in TRF,	35.716t in CRFFF, 0t in GOCDFFTF, 0.036t in GOCLF,	18.2959t in GDSMF || WCDGDLIMF || WCDSIMF, 138.248t in NDSMF, 174.27t in PFTIMF || PLF || PTMF,
Indigenous	Unknown	Included in recreational estimate	Unknown
Recreational	0.6 t	83 t (16 000 fish, 2013–14)	20.77 t ± 4.31 t se

CLF Coastal Line Fishery (NT), DF Demersal Fishery (NT), TRF Timor Reef Fishery (NT), LFR Line Fishery (Reef) (QLD), GOCDFFTF Gulf of Carpentaria Developmental Fin Fish Trawl Fishery (QLD), GOCLF Gulf of Carpentaria Line Fishery (QLD), GDSMF Gascoyne Demersal Scalefish Managed Fishery (WA), NDSMF Northern Demersal Scalefish Managed Fishery (WA), PFTIMF Pilbara Fish Trawl (Interim) Managed Fishery (WA), PLF Pilbara Line Fishery (WA), PTMF Pilbara Trap Managed Fishery (WA), WCDGDLIMF West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WA), WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery (WA), GDSMF || WCDGDLIMF || WCDSIMF Various Fisheries combined due to 3 boat rule (WA), PFTIMF || PLF || PTMF Various Fisheries combined due to 3 boat rule (WA),

Western Australia Active Vessels data is confidential as there were fewer than three vessels in the Pilbara Fish Trawl Interim Managed Fishery, the Pilbara Trap Managed Fishery and the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery.

Western Australia – Commercial (management methods) Red Emperor forms part of the combined Total Allowable Commercial Catch for other mixed demersal species in the Gascoyne Demersal Scalefish Managed Fishery.

Western Australia – Recreational (Catch) Boat-based recreational catch is from 1 September 2015–31 August 2016. These data are derived from those reported in Ryan et al. 2017.

Western Australia – Recreational (management methods) A Recreational Fishing from Boat Licence is required for the use of a powered boat to fish or to transport catch or fishing gear to or from a land-based fishing location.

Western Australia – Indigenous Subject to the defence that applies under Section 211 of the *Native Title Act 1993* (Cth), and the exemption from a requirement to hold a recreational fishing licence, the non-commercial take by Indigenous fishers is covered by the same arrangements as that for recreational fishing.

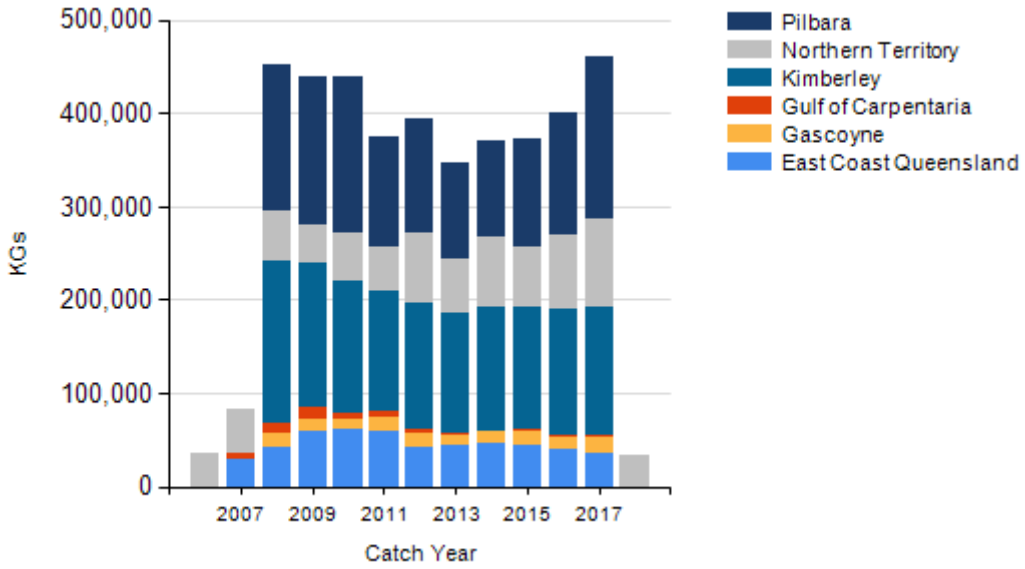
Northern Territory — Charter (management methods) In the Northern Territory, charter operators are regulated through the same management methods as the recreational sector, but are subject to additional limits on license and passenger numbers.

Northern Territory – Indigenous (management methods) The *Fisheries Act* 1988 (NT), specifies that "…without derogating from any other law in force in the Territory, nothing in a provision of this Act or an instrument of a judicial or administrative character made under it limits the right of Aboriginals who have traditionally used the resources of an area of land or water in a traditional manner from continuing to use those resources in that area in that manner".

Queensland – Indigenous (management methods) In Queensland, under the *Fisheries Act 1994* (Qld), Indigenous fishers are entitled to use prescribed traditional and non-commercial fishing apparatus in waters open to fishing. Size and possession limits and seasonal closures do not apply to Indigenous fishers. Further exemptions to fishery regulations may be applied for through permits.

Queensland In Queensland, data for the Coral Reef Fin Fish Fishery and Deep Water Fin Fish Fishery relates to the 2016–17 financial year. Data for the Gulf of Carpentaria Line Fishery and Gulf of Carpentaria Developmental Fin Fish Trawl Fishery are for the 2017 calendar year.

CATCH CHART



Commercial catch of Red Emperor - note confidential catch not shown

EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

ENVIRONMENTAL EFFECTS on Red Emperor

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