

# Spangled Emperor (2018)

*Lethrinus nebulosus*



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## STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Western Australia	Gascoyne	GDSMF	Sustainable	Spawning potential ratio, fishing mortality
Western Australia	Kimberley	NDSMF	Sustainable	Estimated spawning biomass, fishing mortality
Western Australia	Pilbara	PFTIMF, PFTIMF    PLF    PTMF, PLF, PTMF	Sustainable	Estimated spawning biomass, fishing mortality
Western Australia	West Coast	WCDGDLIMF, WCDGDLIMF    WCDSIMF, WCDSIMF	Recovering	Spawning potential ratio, fishing mortality
Northern Territory	Northern Territory	CLF, DF, TRF	Sustainable	Catch, SAFE assessment
Queensland	East Coast Queensland	CRFFF	Sustainable	Catch, effort, standardised CPUE
Queensland	Gulf of Carpentaria	GOCDFFTF	Undefined	Catch, effort
New South Wales	New South Wales	N/A	Negligible	Catch

N/A Not Applicable (NSW), 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), 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), PFTIMF || PLF || PTMF Various Fisheries combined due to 3 boat rule (WA), WCDGDLIMF || WCDSIMF Various Fisheries combined due to 3 boat rule (WA)

## STOCK STRUCTURE

Spangled Emperor have a widespread Indo-West Pacific distribution, ranging from the Red

Sea, Persian Gulf, and East Africa east to southern Japan in the north, around northern Australia and extending east to Samoa [Carpenter and Allen 1989]. In Australia, Spangled Emperor are found from around Rottnest Island in the lower west coast, around northern Australia to south of Sydney on the east coast [Carpenter and Allen 1989, Carpenter and Niem 2001]. The population structure of Spangled Emperor in Western Australia has been studied by assessing spatial variation in allozymes [Johnson et al. 1993], otolith microchemistry [Moran et al. 1993], tagging and recapture [Moran et al. 1993], DNA micro-satellite markers [Berry et al. 2012], and acoustic telemetry [Pillans et al. 2014]. Individuals generally demonstrate a limited home range of less than three nautical miles [Moran et al. 1993]. Relatively high site fidelity has been shown for at least some individuals in Western Australia and elsewhere [Pillans et al. 2014, Chateau and Wantiez 2008]. Limited mixing of post-settlement individuals is also indicated from an analysis of otolith microchemistry of Spangled Emperor sampled from different sites [Moran et al. 1993].

Genetic studies have demonstrated homogeneous genetic characteristics across broad spatial scales (10–1 500 km) throughout its Western Australian distribution [Johnson et al. 1993]. Analysis of fine scale patterns using high resolution micro-satellite markers, however, has found that juveniles exhibit fine scale genetic autocorrelation, which declines with age [Berry et al. 2012]. This implies both larval cohesion and limited juvenile dispersal prior to maturity, primarily in the vicinity of the Ningaloo Marine Park [Berry et al. 2012]. Hydrodynamic modelling indicated that Spangled Emperor larvae were likely to be transported hundreds of kilometres, easily accounting for the observed gene flow, despite relatively restricted adult dispersal [Berry et al. 2012]. As such, Spangled Emperor are considered to comprise a single biological stock in at least Western Australia. However, there is limited mixing of adult Spangled Emperor. Further, management arrangements are mediated in a way that harmonises with the spatial patterns of exploitation. This indicates that in Western Australia, Spangled Emperor comprise separate management units.

There is a high likelihood that these population characteristics (extensive gene flow, limited adult movement) are shared across each of the jurisdictions. Low genetic subdivision between northwest Western Australia and the Great Barrier Reef suggests gene flow is likely to be high between these regions [Berry et al. 2012]. There is possibly one genetic stock in Australia, however, improved stock delineation is required in jurisdictions outside of Western Australia.

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

## STOCK STATUS

**East Coast Queensland** There has been no formal stock assessment of the species across this management unit. Estimated recreational harvest of Spangled Emperor on the east coast of Queensland has declined over successive state-wide surveys from 29 000 to 20 000 to 14 000 fish in 2000–01, 2010–11 and 2013–14 respectively [Webley et al. 2015] which represents a decrease from 66 t to 41 t to 29 t. An increase in minimum legal size in 2003 (from 400 to 450 mm TL) and decrease in the possession limit (from 10 to 5) [Fisheries Regulation 1995] would have contributed to this decline. Recreational catches were around one third of the total landings for the species by weight based on 2013–14 recreational catch numbers [Webley et al. 2015], using fish lengths from fishery dependent monitoring [DAF unpublished data] and a length/weight conversion [Currey et al. 2010]. There is insufficient information available to confidently classify the status of this stock.

A decreased commercial catch 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 around 2003–04. Over the past nine years, the numbers of commercial fishing days where Spangled Emperor were reported have been stable (average 11 600 tender days), although with a higher level of 15 000 tender days in 2009–10. Fishing effort reported was much lower in the preceding 10 years (average 3 700 tender days). The annual reported commercial line harvest has been relatively stable with an average of 56 t for the last nine years and 51 t in 2016–17. A decline in

landings over the past four years is likely due to reduced overall days where Spangled Emperor were reported rather than a change in stock abundance.

Spangled Emperor was added to the logbook template for the Coral Reef Fin Fish Fishery in July 2007. Estimates prior to 2007 are likely underestimates as part of the catch and effort would have been reported in the group 'emperor' in the logbooks. Standardised commercial catch rates have remained stable since 2006–07 at around 10 kg/dory day. It is likely that a portion of the biomass would be afforded some protection from fishing through the no-take marine reserves existing within the Great Barrier Reef Marine Park system, although this has not been quantified. The above evidence indicated that the current level of fishing pressure is unlikely to cause the stock to become recruitment impaired.

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

**Gascoyne** The Gascoyne management unit of Spangled Emperor is exploited as a component of the Gascoyne Demersal Scalefish Managed Fishery (GDSMF, Western Australia) [Gaughan and Santoro 2018]. Spangled Emperor is assessed on the basis of the status of the indicator species for other demersal finfish (e.g. 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 use reference levels that are based on ratios of natural mortality for each species, such that  $F_{target} = 2/3M$ ,  $F_{threshold} = M$  and  $F_{limit} = 3/2M$  (DPIRD 2017). The fishing mortality based assessments and associated uncertainty ranges indicated that the fishing levels on Goldband Snapper were less than the target level. This suggests that, on average, the level of exploitation experienced by the indicator species, Goldband Snapper in the Gascoyne has been low. In addition, the catch of Spangled Emperor in the GDSMF has been low and stable for the past five years (2013–17), ranging from 1.5–2.5 tonnes (t), with a mean annual catch of 2.1 t. The above evidence indicates that the Spangled Emperor biomass is unlikely to be depleted and recruitment is unlikely to be impaired. Furthermore, 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** There has been no stock assessment of the species across this management unit. Spangled Emperor are a byproduct species group in the Gulf of Carpentaria Line Fishery and Gulf of Carpentaria Demersal Fin Fish Trawl Fishery with low annual catches (~1 t average since 2011–12). There are no reliable estimates of catch of Spangled Emperor for Indigenous or recreational catch in the GOC. There is insufficient information available to confidently classify the status of this stock.

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

**Kimberley** Spangled Emperor is landed in the Northern Demersal Scalefish Managed Fishery (NDSMF) in the Kimberley management region of the North Coast Bioregion of Western Australia [Newman et al. 2018a]. Spangled Emperor is assessed on the basis of the status of two indicator species (Red Emperor and Goldband Snapper) that represent the entire inshore demersal suite of species occurring at depths of 30–250 m in the Kimberley management region of the North Coast Bioregion [Newman et al. 2018b]. The major performance measures for these indicator species are estimates of relative spawning stock levels using an integrated age-structured model. The target level of spawning biomass is 40 per cent of the unfished level. The limit level is 30 per cent of the estimate of

initial spawning biomass [DPIRD 2017]. The spawning biomass levels of these two indicator species were either greater than the target level or between the target level and the threshold level in the NDSMF in 2015 [Newman et al. 2018a]. The above evidence indicates that the biomass of the Spangled Emperor stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

The catch of Spangled Emperor in the NDSMF has been low and stable for the past five years (2013–17), ranging from 17–35 t, with a mean annual catch of 24.2 t. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

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

### **New South Wales**

Stock status for Spangled Emperor in New South Wales is reported as Negligible due to historically low catches in this jurisdiction and because the stock has generally not been subject to targeted fishing. The New South Wales commercial catch in the period 2012–17 averaged 0.12 t per annum, and Spangled Emperor is not a major component of recreational landings [West et al. 2015]. Fishing is unlikely to be having a negative impact on the stock.

On the basis of the evidence provided above, Spangled Emperor in New South Wales is classified as a **Negligible stock**.

### **Northern Territory**

Only small catches are reported from the Coastal Line, Demersal and Timor Reef fisheries. Because Spangled Emperor are only an incidental catch in these fisheries and catches by recreational fishers are likely to be very small (< 1 t), a semi-quantitative sustainable assessment for fishing effects model [Zhou and Griffiths 2008] was used to assess the fishing mortality rate on this species, using data up to 2015. The model results indicated that there is a low risk of Spangled Emperor being overfished at current levels of harvest, as there is a very low overlap of the fisheries activity and their distribution in Northern Territory waters. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired; and that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, Spangled Emperor in the Northern Territory is classified as a **sustainable stock**.

### **Pilbara**

Spangled Emperor is landed in the in the Pilbara Demersal Scalefish Fisheries (PDSF: Pilbara Fish Trawl Interim Managed Fishery, Pilbara Line Fishery and Pilbara Trap Managed Fishery) in the Pilbara management region of the North Coast Bioregion of Western Australia [Newman et al. 2018a]. Spangled Emperor is assessed on the basis of the status of three indicator species (Red Emperor, Rankin Cod and Bluespotted Emperor) that represent the entire inshore demersal suite of species occurring at depths of 30–250 m in the Pilbara management region of the North Coast Bioregion [Newman et al. 2018b]. The major performance measures for these indicator species are estimates of relative spawning stock levels using an integrated age-structured model. The target level of spawning biomass is 40 per cent of the unfished level. The limit level is 30 per cent of the estimate of initial spawning biomass [DPIRD 2017]. The spawning biomass levels of these three indicator species were either greater than the target level or between the target level and the threshold level in the PDSF in 2015 [Newman et al. 2018a]. The above evidence indicates that the biomass of the Spangled Emperor stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

Spangled Emperor catches from the PDSF have been somewhat variable for the past five years (2013–17), ranging from 20–79 t, with a mean annual catch of

50 t. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

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

**West Coast** The West Coast management unit of Spangled Emperor is exploited as a component of the West Coast Demersal Scalefish (Interim) Managed Fishery (WCDSIMF) [Gaughan and Santoro 2018]. Spangled Emperor is assessed on the basis of the status of three indicator species (West Australian dhufish, Snapper and Baldchin Groper) that represent the entire inshore demersal suite of species occurring at depths of 30–250 m in the West Coast Bioregion [Newman et al. 2018b].

In 2007, an assessment of three indicator species for the suite of demersal species in the West Coast management unit where Spangled Emperor is exploited, identified that overfishing had been occurring (fishing mortality rates exceeded the limit reference point). These fishing mortality-based assessments use reference levels that are based on ratios of natural mortality for each species, such that  $F_{target} = 2/3M$ ,  $F_{threshold} = M$  and  $F_{limit} = 3/2M$  (DPIRD 2017). Management arrangements for both the commercial and recreational sectors were introduced between 2007 and 2010 and in 2015 to rebuild stocks of all demersal species (including the West Coast management unit of Spangled Emperor) in that management unit. These arrangements were designed to reduce effort and hence catch by at least 50 per cent in the West Coast management unit. This recovery strategy is designed to reduce fishing mortality to less than the threshold reference point.

The level of fishing mortality for fully-recruited age classes of the key demersal indicator species and spawning potential ratios in the most recent assessment (age frequency data for 2012–14) remained above and below their respective limit reference points. However, a decrease in fishing mortality was identified for the small number of cohorts recruited to the fishery since management changes commenced vs. those that had recruited prior to those changes [Department of Primary Industries and Regional Development, unpublished data]. This suggested that recent fishing mortality rates would have also decreased for the West Coast management unit of Spangled Emperor. The catch of Spangled Emperor in the WCDSIMF has been low and stable for the past five years (2013–17), ranging from 5.8–14.0 t, with a mean annual catch of 7.9 t.

The above evidence indicates that prior to management changes the biomass of the West Coast management unit of Spangled Emperor was likely experiencing recruitment overfishing. However, for the period 2008–17 these indicators suggest a recovering stock.

The above evidence indicates that the current level of fishing mortality should allow the stock to recover from its recruitment impaired state.

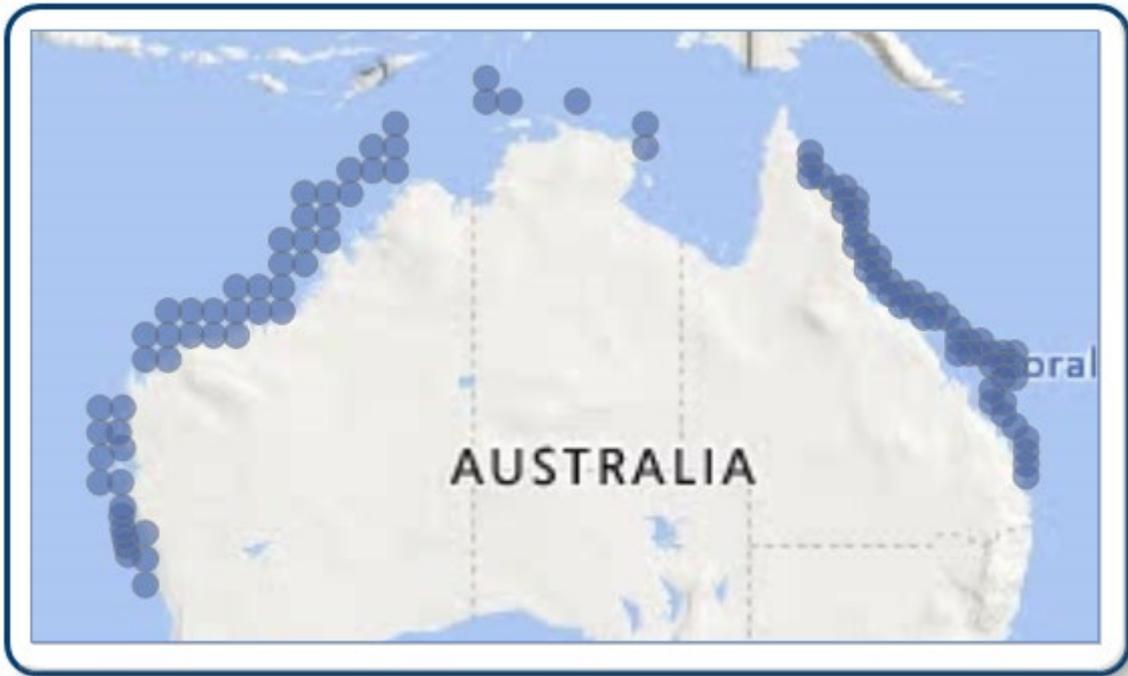
On the basis of the evidence provided above, the West Coast (Western Australia) management unit is classified as a **recovering stock**.

## BIOLOGY

**Spangled Emperor biology** [Currey et al. 2013, DAF unpublished data, Marriott et al. 2010, 2011]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Spangled Emperor	31 years: 707 mm FL (WA) 24 year.; 810 mm FL and 8.9kg (east coast Queensland/GBR)	3.6 years: 350 mm FL

**DISTRIBUTION**



Distribution of reported commercial catch of Spangled Emperor

**TABLES**

<b>Commercial Catch Methods</b>	<b>New South Wales</b>	<b>Northern Territory</b>	<b>Queensland</b>	<b>Western Australia</b>
Demersal Longline		✓		
Dropline				✓
Fish Trap		✓		✓
Gillnet				✓
Hand Line, Hand Reel or Powered Reels				✓
Haul Seine				✓
Hook and Line		✓	✓	✓
Longline (Unspecified)				✓
Midwater Trawl		✓		
N/A	✓			
Otter Trawl		✓		✓
Trawl			✓	
Unspecified				✓

<b>Fishing methods</b>			
	<b>Northern Territory</b>	<b>Queensland</b>	<b>Western Australia</b>
<b>Charter</b>			
Hook and Line		✓	✓

Spearfishing		✓	
<b>Commercial</b>			
Dropline			✓
Fish Trap	✓		✓
Gillnet			✓
Hand Line, Hand Reel or Powered Reels			✓
Hook and Line	✓	✓	✓
Otter Trawl	✓		✓
Trawl		✓	
Unspecified			✓
<b>Indigenous</b>			
Hook and Line		✓	
Spearfishing		✓	
<b>Recreational</b>			
Hook and Line		✓	✓
Spearfishing		✓	✓
<b>Management Methods</b>			
	<b>Northern Territory</b>	<b>Queensland</b>	<b>Western Australia</b>
<b>Charter</b>			
Bag limits			✓
Gear restrictions		✓	
Limited entry	✓		✓
Passenger restrictions	✓		✓
Possession limit		✓	
Size limit		✓	✓
Spatial closures		✓	✓
Spatial zoning			✓
Temporal closures		✓	
<b>Commercial</b>			
Effort limits			✓
Gear restrictions	✓	✓	✓
Limited entry	✓	✓	✓
Quota		✓	
Size limit		✓	✓

Spatial closures	✓	✓	✓
Spatial zoning	✓		✓
Temporal closures		✓	
Total allowable catch	✓	✓	
Total allowable effort			✓
Vessel restrictions		✓	✓
<b>Indigenous</b>			
Laws of general application			✓
<b>Recreational</b>			
Bag and possession limits	✓		
Bag limits			✓
Gear restrictions	✓	✓	
Licence (Recreational Fishing from Boat License)			✓
Possession limit		✓	✓
Size limit		✓	✓
Spatial closures	✓	✓	✓
Temporal closures		✓	

<b>Active Vessels</b>	<b>Northern Territory</b>	<b>Western Australia</b>
	14 LICENCES in CLF, 8 LICENCES in DF, 5 LICENCES in TRF,	12 in GDSMF, &3 in PFTIMF, 7 in PLF, &3 in PTMF, &3 in WCDGDLIMF, 25 in WCDSIMF, 50 in Charter, 6 in NDSF,

**CLF** Coastal Line Fishery(NT)

**DF** Demersal Fishery(NT)

**TRF** Timor Reef Fishery(NT)

**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)

**WCDGLIMF** 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	New South Wales	Northern Territory	Queensland	Western Australia
<b>Charter</b>				8.50542t in Tour Operator
<b>Commercial</b>		0.138t in CLF, 0.1832t in DF, 1.028t in TRF,	50.5152t in CRFFF, 0t in GOCDFFTF,	2.2396t in GDSMF, 35.3226t in NDSMF, 67.0425t in PFTIMF    PLF    PTMF, 14.0321t in WCDGLIMF    WCDSIMF,
<b>Indigenous</b>			Unknown	Unknown
<b>Recreational</b>			29 t (14 000 fish, 2013–14)	4.281 t ± 1.052 t se in North Coast (Kimberley and Pilbara), 14.469 t ± 2.316 t se in Gascoyne, 0.773 t ± 0.205 t se in West Coast

N/A Not Applicable (NSW), 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), 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), WCDGLIMF West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WA), WCDSIMF West Coast Demersal Scalefish (Interim) Managed Fishery (WA), PFTIMF || PLF || PTMF Various Fisheries combined due to 3 boat rule (WA), WCDGLIMF || WCDSIMF Various Fisheries combined due to 3 boat rule (WA),

**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 License 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.

**Western Australia – Commercial (catch)** Catch is unavailable as there were fewer than three vessels in the Pilbara Fish Trawl Interim Managed Fishery, Pilbara Trap Managed Fishery and

West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery.

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

**Western Australia – Commercial (management methods)** Spangled Emperor forms part of the combined Total Allowable Commercial Catch for other mixed demersal species in the GDSMF.

**Queensland** The reporting period for the commercial component of the Coral Reef Fin Fish Fishery (Queensland) is financial year (2016–17).

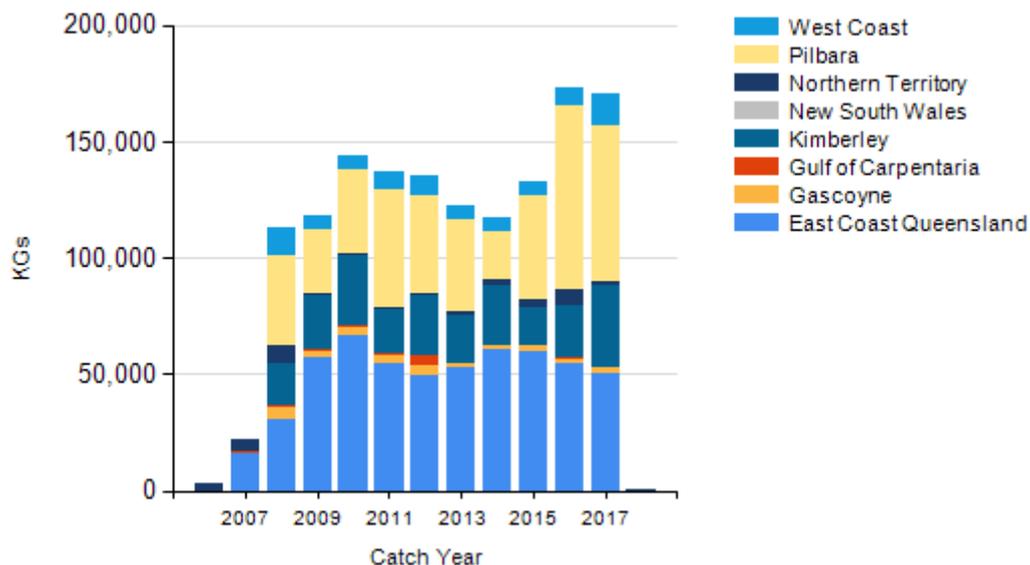
**Queensland – Commercial (fishing methods)** Spangled Emperor is trawled in only one of the Queensland fisheries in which it is caught commercially - the Gulf of Carpentaria Developmental Fin Fish Trawl Fishery

**Queensland – Indigenous (management methods)** Under the *Fisheries Act 1994* (Qld), Indigenous fishers in Queensland 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.

**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".

## CATCH CHART



Commercial catch of Spangled Emperor - note confidential catch not shown

## EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

### ENVIRONMENTAL EFFECTS on Spangled Emperor

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