Spangled Emperor (2020)

Lethrinus nebulosus

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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Stock status	Indicators
Western Australia	Gascoyne	Sustainable	Spawning potential ratio, fishing mortality
Western Australia	Kimberley	Sustainable	Estimated spawning biomass, fishing mortality
Western Australia	Pilbara	Sustainable	Estimated spawning biomass, fishing mortality
Western Australia	West Coast	Recovering	Spawning potential ratio, fishing mortality
Northern Territory	Northern Territory	Sustainable	Catch, SAFE assessment
Queensland	East Coast Queensland	Sustainable	Catch, effort, standardised CPUE
Queensland	Gulf of Carpentaria	Undefined	Catch, effort
New South Wales	New South Wales	Negligible	Catch

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 on the lower west coast, across 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 [Chateau and Wantiez 2008, Pillans et al. 2014]. 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 the distribution of Spangled Emperor in Western Australian [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 work is required in jurisdictions outside 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 from 50 tonnes (t) to 27 t over successive state-wide surveys between 2000–01 and 2019–20 respectively [Webley et al. 2015, Teixeira et al. 2021]. An increase in minimum legal size in 2003 (from 400 to 450 mm TL) and decrease in the possession limit (from 10 to 5) would likely have contributed to this decline. Recreational catches was 32 per cent of the total recreational and commercial landings for the species by weight based on 2019–20 recreational catch numbers.

In 2004, 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. The numbers of commercial fishing days where Spangled Emperor were reported since 2010–11 have been stable [QFISH 2020]. The annual reported commercial line harvest has been relatively stable with an average of 56 t for the last nine years and 58 t in 2018–19. Catch rates (kg per dory day and kg per primary vessel day) have also been stable since 2008–09.

Spangled Emperor is a secondary target and by-product species in the Reef Line Fishery (RLF). While commercial harvest is only constrained by a multi-species total allowable commercial catch (TACC) and a minimum legal size, species-specific harvest control rules and catch reference points introduced in early 2020 for secondary target species including Spangled Emperor through the RLF Harvest Strategy [QDAF 2020] provide additional harvest constraints. Harvest of Spangled Emperor that exceeds the harvest reference points and control rules will trigger a stock assessment and the implementation of an interim species-specific TACC. Recreational harvest is also controlled through the minimum legal size and a possession limit. The Indigenous harvest of Spangled Emperor is unknown but is considered to be minor. It is likely that a portion of the biomass

would be afforded some protection from fishing through zoning (restricting or prohibiting fishing) in the Great Barrier Reef Marine Park system, although this has not been quantified. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and 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]. An assessment of fishing mortality derived from representative samples of the age structure of Spangled Emperor was last undertaken in 2007-2008 for the northern and southern areas of the Gascoyne Bioregion [Marriott et al. 2012]. 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 and associated uncertainty ranges indicated that the fishing mortality levels for Spangled Emperor in 2007-2008 in the North Gascoyne were below the limit level but above the threshold level. Estimates of fishing mortality levels for Spangled Emperor in 2007-2008 in the South Gascoyne were below the target level. The fishing mortality based assessments and associated uncertainty ranges indicated that the fishing mortality levels on Spangled Emperor in 2007-2008 across both management areas were between the target and threshold levels.

Moreover, Spangled Emperor have been a very minor component of the mixed demersal catch in the GDSMF. Within the combined TACC for other mixed demersal species (227 t) in the GDSMF, the landed catch of Spangled Emperor is <5 t. In addition, the catch of Spangled Emperor in the GDSMF has been low and stable for the past 10 years (2010–19), ranging from 1.5–4.5 t, with a mean annual catch of 2.5 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 harvest (~1 t average since 2011–12). There are no reliable estimates of catch of Spangled Emperor for Indigenous or recreational fishers 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. 2020]. 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. 2018]. 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, with a threshold reference level of 30 per cent and a limit reference level of 20 per cent of the estimate of initial spawning biomass [DPIRD 2017]. The spawning biomass levels of these two indicator species were at the threshold level in the NDSMF in 2017 [Newman et al. 2020]. 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 10 years (2010–19), ranging from 17–35 t, with a mean annual catch of 25 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 2012–19 averaged 0.12 t per annum, and Spangled Emperor is not a major component of recreational landings [West et al. 2015, Murphy et al. 2020]. 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

Stock status for Spangled Emperor in the Northern Territory is reported as Negligible due to historically low catches in this jurisdiction, and because the stock has generally not been subject to targeted fishing. During the period 2010–2019, Fishing Tour Operators in the Northern Territory have reported small (< 0.1 t) annual catches of Spangled Emperor.

On the basis of the evidence provided above, Spangled Emperor in the Northern Territory is classified as a **Negligible 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. 2020]. 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. 2018]. 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, with a threshold reference level of 30 per cent and a limit reference level of 20 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. 2020]. 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 10 years (2010–19), ranging from 20–79 t, with a mean annual catch of 47 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. 2018]. 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 Ftarget = 2/3M, Fthreshold = M and Flimit = 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 fishing 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 compared to those cohorts that had recruited prior to those changes [Department of Primary Industries and Regional Development, unpublished data]. This observation 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 10 years (2010–19), ranging from 5.8–14.0 t, with a mean annual catch of 8.1 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.

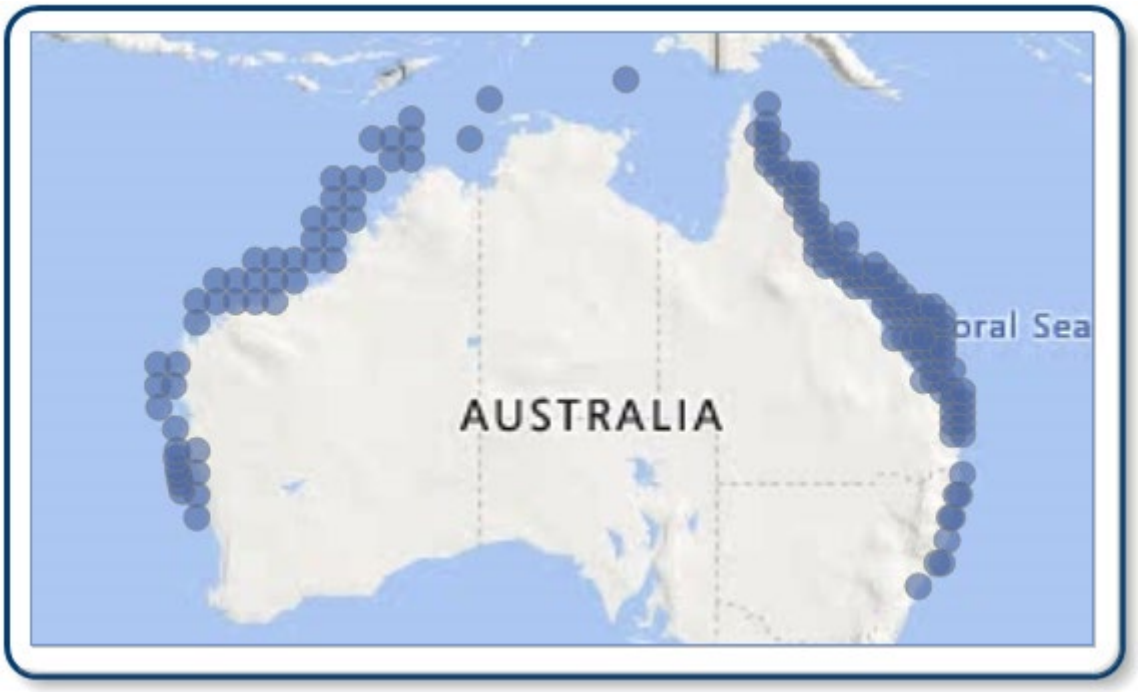
On the basis of the evidence provided above, the West Coast (Western Australia) management unit is classified as a **recovering stock.**

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

Fishing methods				
	New South Wales	Northern Territory	Queensland	Western Australia
Charter				
Hook and Line			✓	
Rod and reel				✓
Spearfishing			✓	✓
Commercial				
Bottom Trawls		✓		
Dropline				✓
Fish Trap		✓		✓
Gillnet				✓
Hand Line, Hand Reel or Powered Reels				✓
Line	✓		✓	✓
Midwater Trawl			✓	
Otter Trawl				✓
Various	✓			
Recreational				
Hook and Line			✓	✓
Spearfishing			✓	✓

Management				

Methods			
	Northern Territory	Queensland	Western Australia
Charter			
Bag limits			✓
Gear restrictions		✓	
Limited entry	✓		✓
Passenger restrictions	✓		✓
Possession limit		✓	
Size limit		✓	✓
Spatial closures		✓	✓
Spatial zoning			✓
Temporal closures		✓	
Commercial			
Effort limits			✓
Gear restrictions	✓	✓	✓
Individual transferable quota		✓	
Limited entry	✓	✓	✓
Quota		✓	
Size limit		✓	✓
Spatial closures	✓	✓	✓
Spatial zoning	✓		✓
Temporal closures		✓	
Total allowable catch	✓	✓	
Total allowable effort			✓
Vessel restrictions		✓	✓
Recreational			
Bag and possession limits	✓		
Bag limits			✓
Gear restrictions	✓	✓	
Licence (Recreational Fishing			✓

from Boat License)			
Possession limit		✓	✓
Size limit		✓	✓
Spatial closures	✓	✓	✓
Temporal closures		✓	

Catch				
	New South Wales	**Northern Territory**	**Queensland**	**Western Australia**
Charter				8 t
Commercial	0.1224 t	0.023 t	57.501 t	91.312 t
Indigenous			Unknown	Unknown
Recreational			27 t (2019–20)	20 t (2017–18)

Western Australia – Recreational (Catch) Boat-based recreational catch is from 1 September 2017–31 August 2018. These data are derived from those reported in Ryan et al. (2019).

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 (management methods) Subject to application of 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 – 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

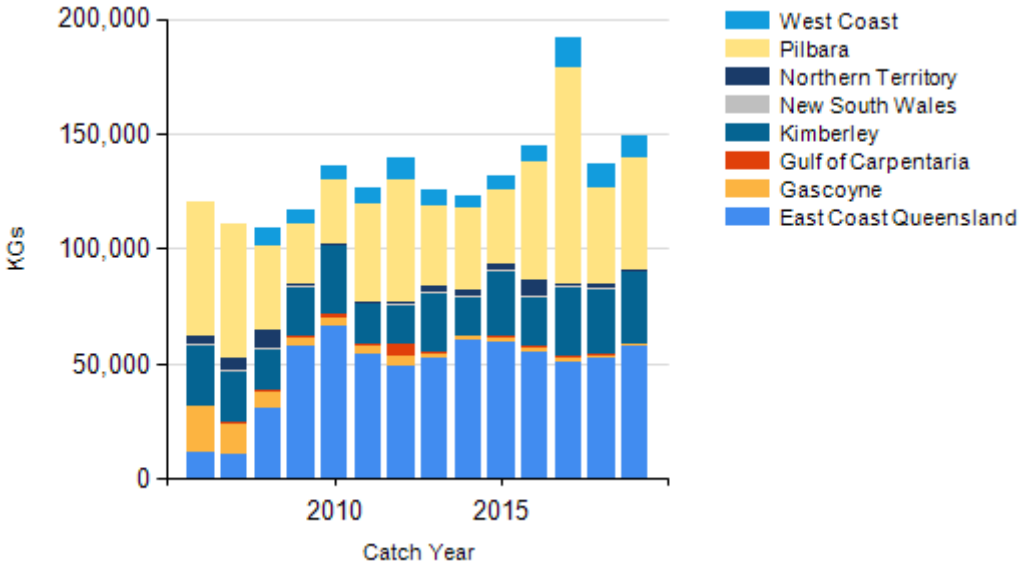
Queensland – Indigenous (management methods) for more information see https://www.daf.qld.gov.au/business-priorities/fisheries/traditional-fishing

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".

CATCH CHART



Commercial catch of Spangled Emperor - note confidential catch not shown

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