



Fishery and spatial management solutions to inform the protection and recovery of Australia's threatened endemic elasmobranchs.

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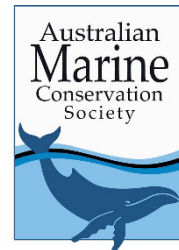
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Executive Summary

This report is about Australian, endemic elasmobranchs (hereafter 'sharks and/or rays') that require immediate action to conserve, manage, and recover populations according to the 2021 Action Plan for Australian Sharks and Rays. Fourteen Australian endemic sharks and rays are threatened. This report identifies ten which interact with the Southern and Eastern Scalefish and Shark Fishery (SESSF). The SESSF fishery was used as a best-case scenario of data availability.

Mitigation measures that will see these species moved to lower threat categories, or removed from threatened species status, is the primary conservation goal. A three-step approach towards achieving this is used in this report. Firstly, insights into the changing threats from Commonwealth Fisheries are presented; secondly, a case is made to support the retention and/or expansion of existing spatial closures to support breeding success and connectivity between adult and juvenile habitats; and lastly, an improved mapping approach to support design of effective spatial closures or protected areas under or across various jurisdictions is recommended. This process identified six Candidate Areas for consideration into marine spatial planning that should limit and/or halt declines and support the recovery of the identified threatened Australian endemic sharks and rays.

Candidate Area selection was based on identification of areas of critical habitats with lower historical removals, and existing State and Commonwealth fisheries closures and/or MPAs. Critical habitat was defined through published scientific knowledge on the biological, ecological, and geographical requirements and attributes of the selected species. This was complemented by tracking data for two of the endemic shark species. Tracking data was also used to consider closure size for those species. Spatial distribution of removals was considered by analysis of Australian Fisheries Management Authority (AFMA) fisheries and logbook data, broken down by fishing zone. Recent AFMA observer data was also examined but found not adequate to estimate depletions or determine demographic structure of populations. Recommendations for improvements to data quality for informing spatial protections, as well as maps of the identified Candidate Areas, are presented for the ten threatened Australian endemics.

Objectives

The primary aim of this report was to assess fisheries impacts and identify possible protected areas necessary for the persistence and recovery of threatened Australian endemic sharks and rays. Specific objectives include:

1. Identify spatial areas within the Southern and Eastern Scalefish and Shark Fishery (SESSF) with the potential to support the recovery of threatened endemic sharks and rays as identified in the Australian Action Plan for Sharks and Rays (Kyne et al., 2021);
2. Project the estimated degree of recovery of each identified species over their respective three-generation time length, based on the protections afforded by proposed spatial protections and/or fisheries closures;
3. Present specific case studies of both deep-water and coastal species which examine the feasibility and projected outcomes of proposed spatial protections;
4. Produce maps as a visual aid to communicate the results and support the inclusion of the endemic species and their essential and/or critical habitats into SESSF fisheries closures, State-based MPA and AMP Network Plans, and onto the Finalised Priority Assessment List (FPAL) of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Key Findings

This report considered conservation of ten threatened endemic Australian sharks and rays at the strategic, tactical and implementation levels. At the strategic level, a combined fisheries and spatial management approach is key. Tactical considerations to achieve this include the location, size, number, and connectivity of closures and/or protected areas, as well as activity restrictions within those areas. Tactical considerations are challenged by limited data. Implementation of strategic and tactical measures are challenged by jurisdictional complexity.

Key findings of this report are:

1. Threatened endemic sharks and rays in southern and eastern Australia remain under-represented in current management and/or conservation arrangements. Mapping analysis found there is minimal overlap between critical habitat and current spatial protective measures (e.g., SESSF fisheries closures, Australian Marine Park [AMP] networks or State MPAs). Currently there is limited co-ordination across jurisdictional boundaries (e.g., State-to-Commonwealth or State-to-State). Effective implementation of additional protections can be achieved but will need cohesive strategies implemented across multiple jurisdictions.
2. The ten threatened endemic species will remain highly susceptible to further declines under current SESSF fishing activities without inclusion into spatial protection measures. Some of these species have previously undergone major population declines (~30-90%) from demersal fisheries operating across their ranges for over 40 years.
3. Ongoing threats from the SESSF fishery to the species of concern are changing. There was a substantial (60%) reduction in the number of trawl operations between 2000 and 2021. For non-trawl methods, effort has increased in some areas since 2008. The consequence of these changes for fisheries is that new risks are emerging inshore, on different habitats, with cumulative effects.
4. Depletion levels for *Cephaloscyllium albiginnum* across its full range from trawl activity was not as severe as previously thought, however this species now faces further threat from increased auto line fishing effort. Inshore skates and stingarees are predicted to be heavily impacted by increased Danish Seine efforts, but increased gillnet effort in Bass Strait is not expected to have substantial impact to the sharks and rays as very few are selected by this fishing method despite range overlaps.
5. Improved core habitat distribution maps for the endemic sharks and rays presented in this report support the identification and delineation of proposed Candidate Areas and subsequent map outputs. The maps predict distributions based on abiotic data (i.e., temperature and depth) and were further refined with bathymetric (e.g., seafloor depth) data. This approach is simplistic but realistic for demersal species, particularly skates and rays, because they are strongly associated with the sea floor. The maps presented provide a more reliable basis for spatial planning because they are more representative of where the highest numbers of individuals would be found.
6. Six Candidate Areas for spatial protections are proposed. These are based on a set of selection criteria which identify species critical habitats using biological, ecological, and environmental information. Objectivity and repeatability of Candidate Area identification can be maintained by consistent application of these criteria.

The criteria and sub-criteria are:

Criterion 1.	Suitable Habitat
Criterion 2.	Biological Importance
Sub-criterion 2a.	Breeding Habitat
Sub-criterion 2b.	Essential Habitat
Criterion 3.	Ecological Importance
Sub-criterion 3a.	Threat
Sub-criterion 3b.	Diversity
Criterion 4.	Abundance and Extent

7. Spatial management strategies for the Candidate Areas should be considered on a case-by-case basis according to the species and habitat type selected. Proposed Candidate Areas are intended to correlate with existing State and Commonwealth fisheries closures and/or MPAs. Candidate Areas represent locations where sufficient information to meet the criteria exists, and where existing closures or protected areas could be modified by zoning review to include the endemic sharks and rays specifically. Further application of the criteria and identification of additional Candidate Areas is recommended to comprehensively meet conservation objectives for these species. Effective implementation of any spatial protections for each Candidate Area can be achieved but will need cohesive strategies implemented across multiple jurisdictions.

8. Tracking data results for *Cephaloscyllium albipinum* and *Squalus chloroculus* in Candidate Area 4 emphasise that some knowledge of individual movement scale is essential for designing effective closures. This means that the existing paradigm of protecting a sum of 30% of habitat in the combined closures for a species will not necessarily be enough to conserve that species.

9. Zoning is critical to the performance of marine parks in State MPA and Commonwealth AMP networks. Only Marine Sanctuaries (IUCN Ia), Marine National Parks (IUCN II) or Habitat and/or Species Protection Areas (IUCN IV) as defined by the EPBC Act and implemented in State and Commonwealth Marine Parks will meet the conservation objectives of this study. Substantial increases in size and rezoning would be needed for Candidate Areas to meet or fully meet all criteria. This would have major economic consequences.

10. Improved life history data for the endemic sharks and rays will support accurate recovery predictions and assist in development of effective spatial protections. Without further knowledge on habitat use for movements, reproduction, and/or feeding, or the species demographics (e.g., size, sex), size considerations for any MPA or fisheries closures cannot be comprehensive.

Recommendations

Key findings from the mapping and effort analysis in this report contribute to knowledge of critical habitats and current threats for endemic Australian sharks and rays. The recommendations below are intended to translate these findings into actions that can support the conservation status, recovery, and persistence of these species. We also highlight improvements to data quality and assessment methods that would reduce the substantial uncertainty risks in managing and conserving these species. Recommendations include:

Actionable Steps Towards Conservation

1. Maintain and consolidate AFMAs Upper Slope Dogfish Management Strategy. Broaden the strategy in conjunction with the Commonwealth Department of Environment to include *Cephaloscyllium albipinum* and *Dipturus canutus*.
2. In the South-east region consider expanding areas closed to all fishing methods in Bass Strait to protect endemic skates and stingarees. Importantly such expansion would need to consider the potential impacts of effort displacement onto protected species, such as school sharks and Australian sea lions.
3. In the Temperate East Australian Marine Park Network, consider expanding areas closed to all fishing methods in the Jervis Marine Park by changing boundaries and rezoning of special purpose fishing zones. Develop complimentary closed area measures with Jervis Bay Marine Park in New South Wales to link offshore adult habitat to inshore breeding and juvenile habitat. Obtain effort data from NSW fisheries to explore alternative scenarios of closure size.
4. Maintain and consolidate the Tasmanian Shark Nursery Areas. Consider further restrictions on fishing in Storm Bay to increase migration of sharks and rays from egg-laying and pupping areas in enclosed waters to adult habitat in coastal waters. Consider further restrictions of fishing in the coastal waters adjacent to Storm Bay where suitable adult habitat occurs.
5. Off South Australia, maintain areas closed to all fishing methods, and modify the current MPA zoning in the northeast of Kangaroo Island primarily to conserve *Urolophus orarius*, as this is the species with the most restricted range of any endemics considered here.
6. Overall deep-sea fisheries management arrangements for sharks and rays should be considered, and developed in a more precautionary manner, in light of data deficiency on species composition, biology and habitats given the high risk of mortality for these species in bycatch, their current rates of population decline, and future impacts of environmental change.

Data and Analysis Improvements

1. Improve access to existing State and Commonwealth fishing effort data and catch data for bycatch species (noting that catch data for commercial species needs to remain confidential).
2. Develop a comprehensive strategy for the collection of future data. Periodically undertake detailed onboard observations/surveys of endemic shark and ray catch rates to support ongoing CPUE analysis. Undertake a statistical analysis of the coverage required. Develop data limited methods to standardise CPUE considering longitude, latitude, and depth and apply these to trawl effort at minimum across the full geographic range of the fishery. Develop methods to examine CPUE in the auto longline and Danish Seine sectors.
3. Improve resourcing for on-board observers in the SESSF. Collect length frequency and sex data for endemic sharks and rays during on board observations (observer data). Provide training in species identification to resolve misidentifications and improve data validity. Increase the number and geographic range of on-board observations. While the implementation of e-monitoring holds potential for more cost-effective monitoring in the future (at least for State fisheries that have no ongoing onboard observer programs), this is not considered an effective replacement for onboard observations in the SESSF at this time.

NORTH-EAST KANGAROO ISLAND

CANDIDATE AREA 1

Criterion 1: Suitable Habitat ✓

Criterion 2: Biological Importance ✓

Criterion 3: Ecological Importance ✓

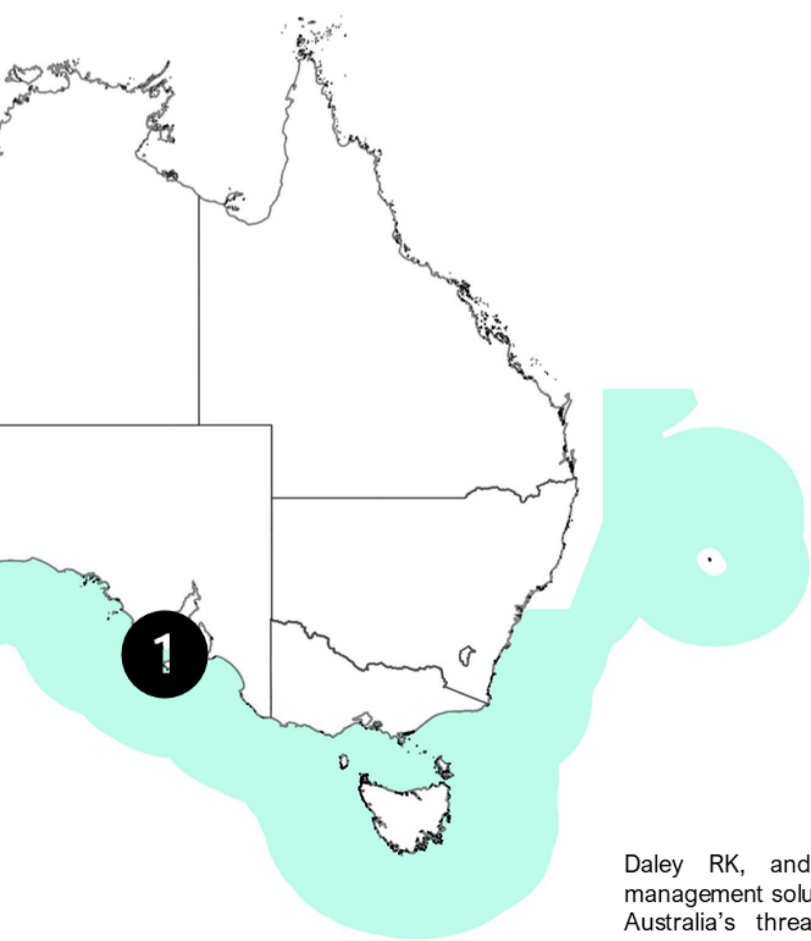
Criterion 4: Abundance and Extent ✓

This area was primarily considered for *Urolophus orarius* as it encompasses a sufficient proportion of the species geographic range and suitable habitat, as well as for the occurrence of *Spiniraja whitleyi*. Inshore conditions are representative of essential breeding habitat and nursery areas as identified elsewhere for other *Urolophus* species. Given the very restricted geographic range and suitable habitat of *Urolophus orarius* it can be assumed that all vital functions for the species occur in the area.

Minimal suitable habitat of *Urolophus orarius* occurs outside of the Southern and Eastern Scalefish and Shark Fishery (SESSF) boundaries apart from in St Vincent and Spencer Gulfs which are in South Australian State waters. The area is partially included into the South Australian State-managed Encounter Marine Park which is primarily zoned for Habitat Management (IUCN IV) with small sections zoned as no-take Marine Sanctuary (IUCN Ia) or Marine National Park (IUCN II). *Urolophus orarius* or *Spiniraja whitleyi* are not listed or recognised in any current South Australian State MPA Management Plans.

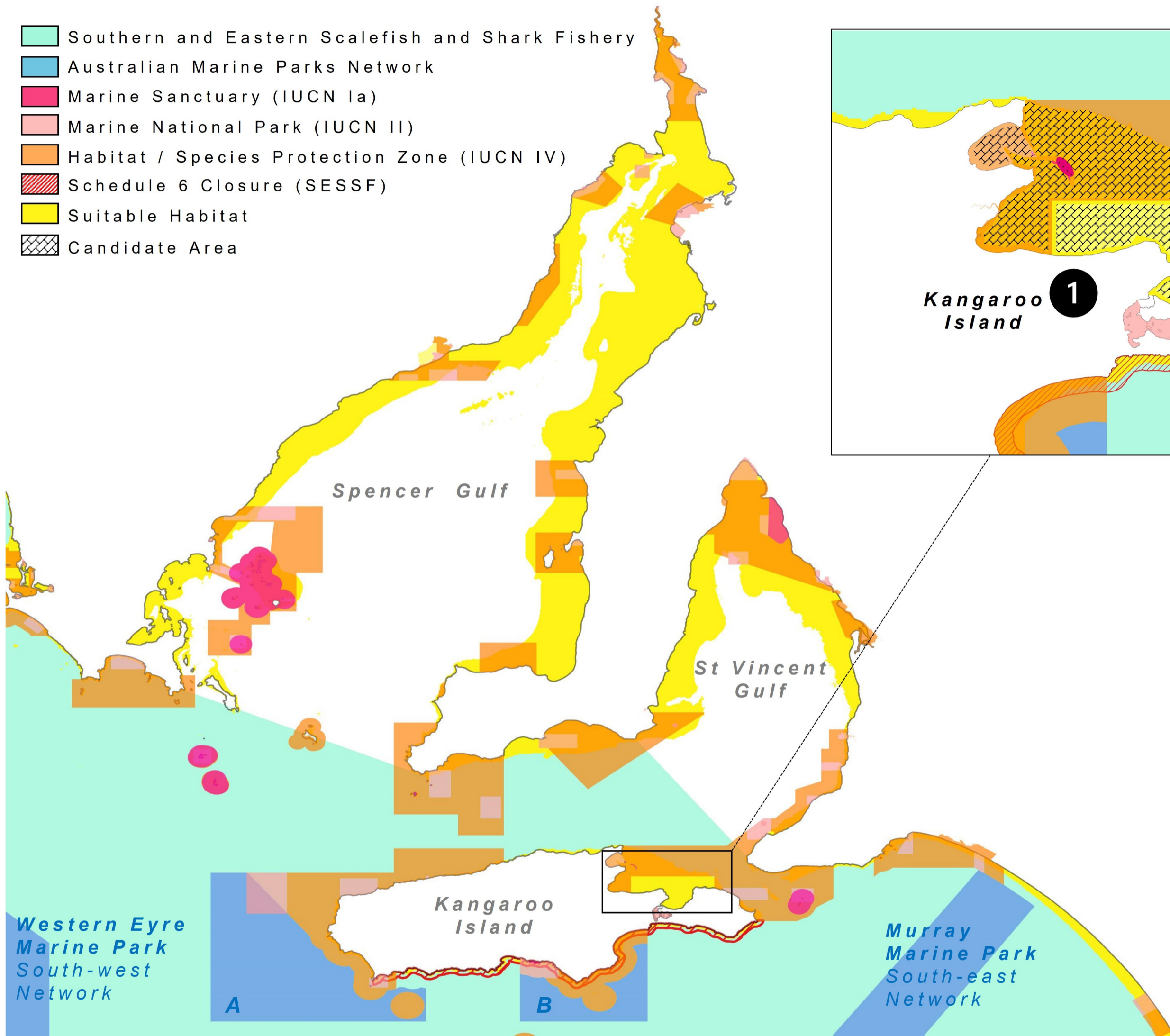
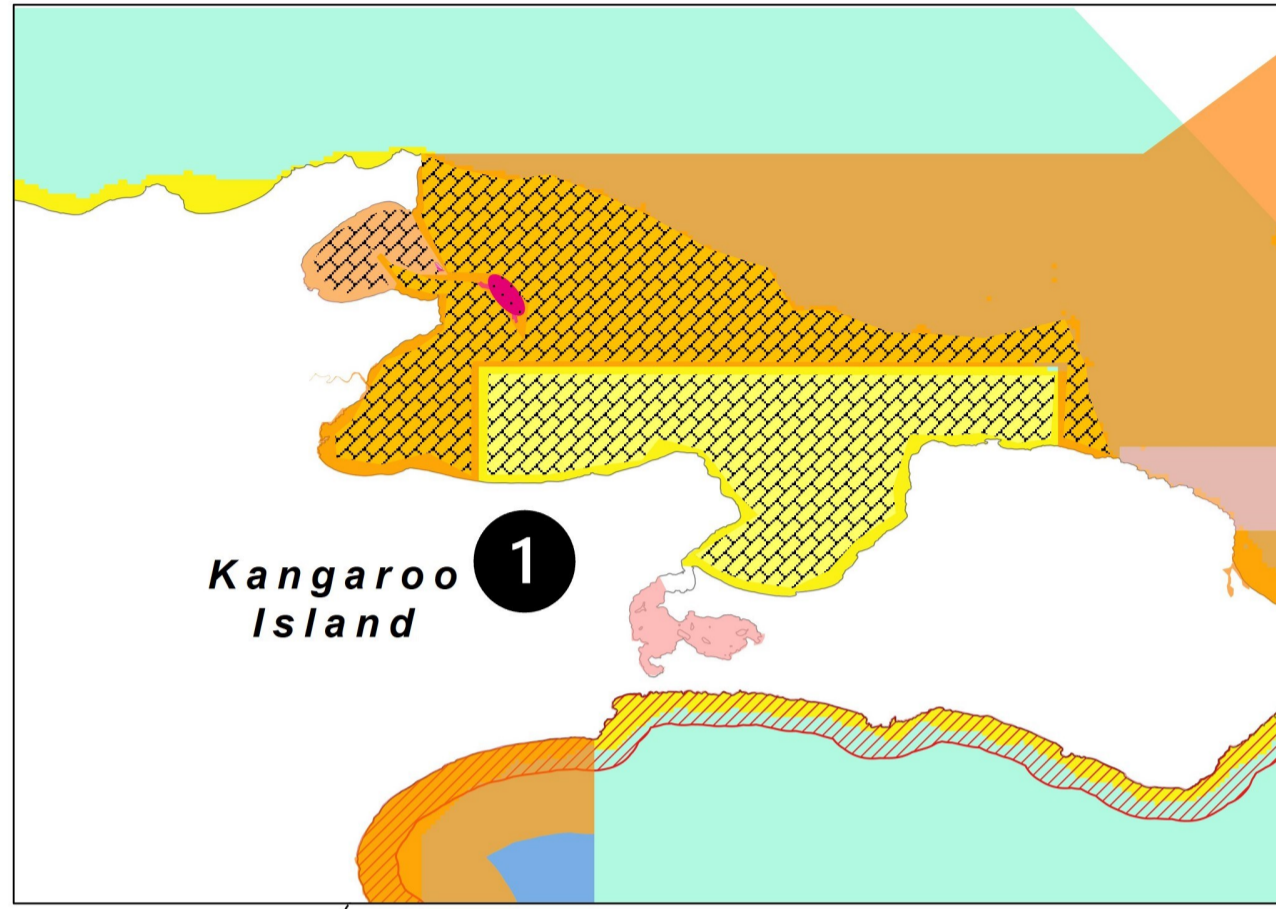
The area is currently closed to SESSF gillnet, longline and trawls (Schedule 5 South Australian Gillnet Closure – Backstairs Passage) to protect breeding school sharks and sea lions. It is also outside of current Australian Marine Parks jurisdiction being too far inshore (<3nm) for inclusion into the current South-west or South-east AMP networks. The entire bay from North Cape to Kangaroo Head should be considered under fisheries and MPA spatial protection. A continued lack of adequate spatial protections for *Urolophus orarius* place this species' entire global population at high risk of extinction thus impacting shark/ray and regional biodiversity.


Candidate Area 1 meets: Criterion 1 Suitable Habitat; Criterion 2 Biological Importance for (a) Breeding Habitat, and (b) Essential Habitat; Criterion 3 Ecological Importance for (a) Threat, and (b) Diversity; and Criterion 4 Abundance and Extent



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- Southern and Eastern Scalefish and Shark Fishery
- Australian Marine Parks Network
- Marine Sanctuary (IUCN Ia)
- Marine National Park (IUCN II)
- Habitat / Species Protection Zone (IUCN IV)
- Schedule 6 Closure (SESSF)
- Suitable Habitat
- Candidate Area





Coastal Stingaree
Urolophus orarius EN

Endemic to South Australia with a restricted distribution to shallow inshore, coastal waters between 16-18°C and 5-50m depth.







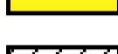



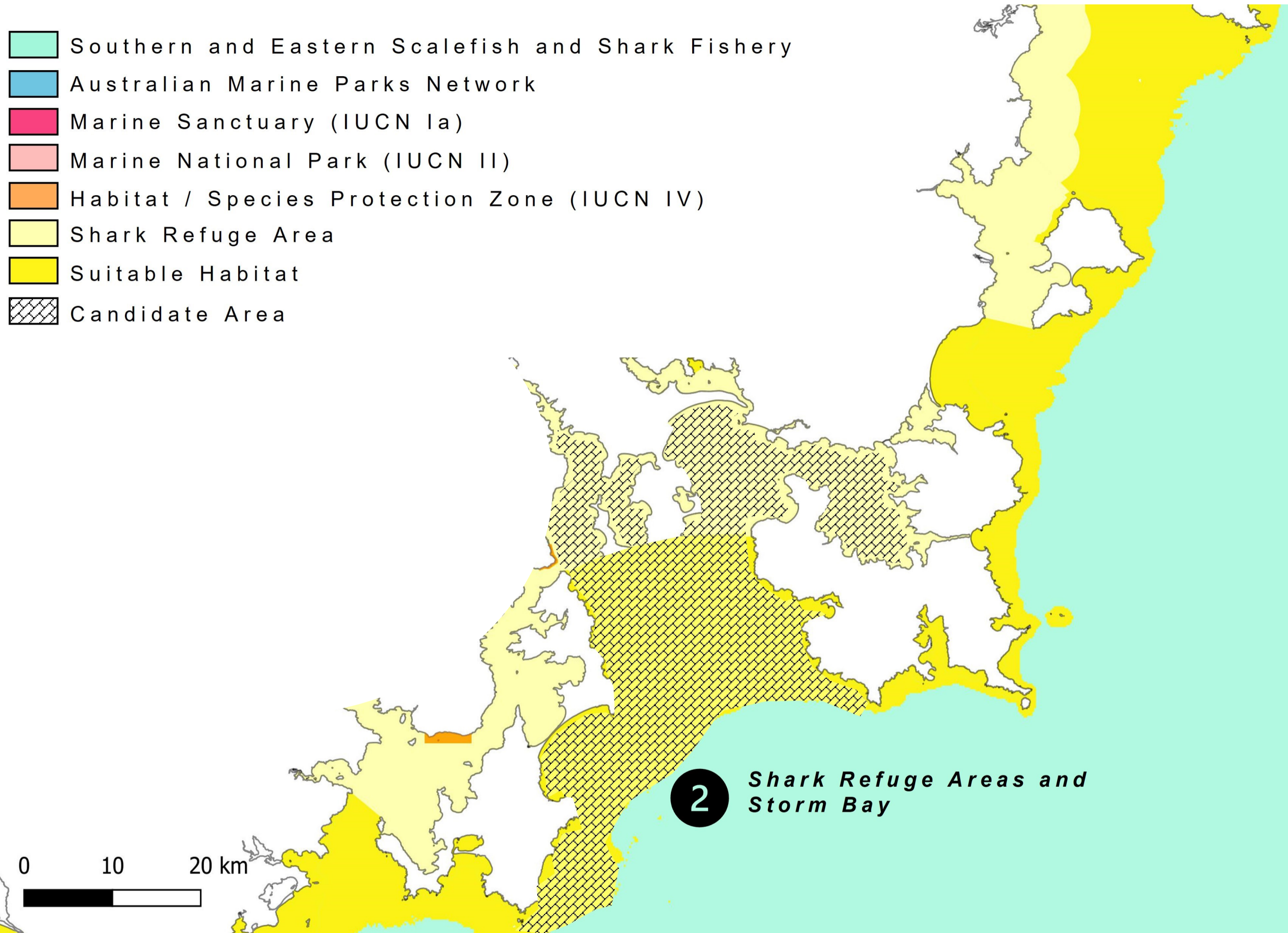
Melbourne Skate
Spiniraja whitleyi VU

Endemic to southern Australia (NSW, VIC, TAS, SA, WA) on the continental shelf and slope in waters 14-18°C and 0-345m depth.

STORM BAY

CANDIDATE AREA 2

-  Southern and Eastern Scalefish and Shark Fishery
-  Australian Marine Parks Network
-  Marine Sanctuary (IUCN Ia)
-  Marine National Park (IUCN II)
-  Habitat / Species Protection Zone (IUCN IV)
-  Shark Refuge Area
-  Suitable Habitat
-  Candidate Area

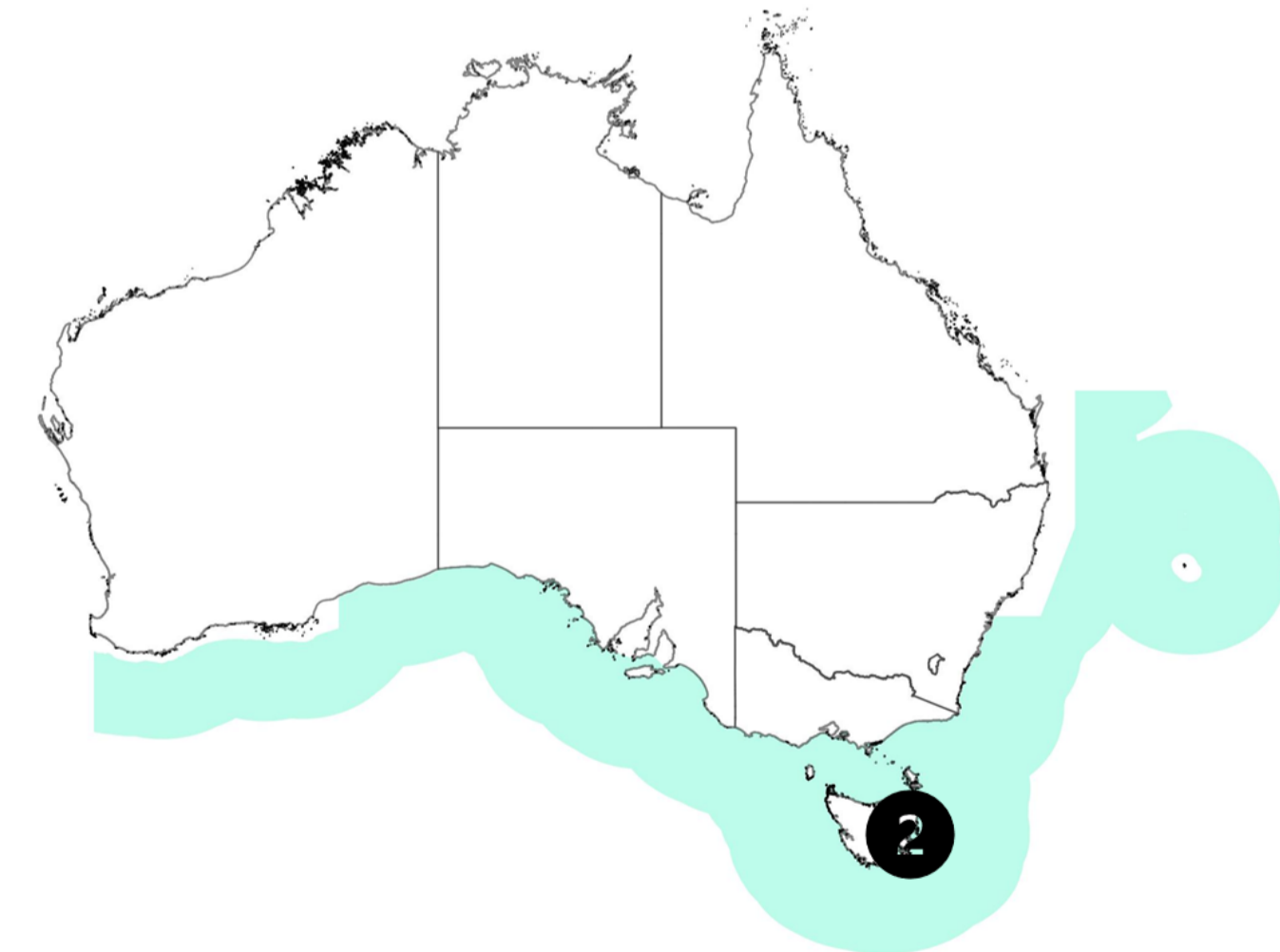



- Criterion 1: Suitable Habitat ✓**
- Criterion 2: Biological Importance ✓**
- Criterion 3: Ecological Importance ✓**
- Criterion 4: Abundance and Extent ✓**

This area is within the global range, adult habitat, and nursery areas of both *Dentiraja confusa* and *Spiniraja whitleyi*. Inshore areas are classified under Fishing Tasmania's Shark Refuge Areas, but adjacent adult habitat is outside of both SESSF and Australian Marine Parks jurisdiction. Any inshore fishing in Storm Bay places both species at risk of discarded bycatch mortality.

Adequate spatial protection requires additional connection between juvenile inshore habitat and offshore adult habitat to achieve reproductive success. Consequently, Storm Bay should be an area of high consideration for ecological connectivity. The minimum extent of this connection should extend up to 50km from shore.


Candidate Area 2 meets: Criterion 1 Suitable Habitat; Criterion 2 Biological Importance for (a) Breeding Habitat; Criterion 3 Ecological Importance for (a) Threat, and (b) Diversity; and Criterion 4 Abundance and Extent





Longnose Skate
Dentiraja confusa CR

Endemic to south-eastern Australia on the continental shelf and slope in waters 14-27°C and 20-395m depth.



Melbourne Skate
Spiniraja whitleyi VU

Endemic to southern Australia (NSW, VIC, TAS, SA, WA) on the continental shelf and slope in waters 14-18°C and 0-345m depth.



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WESTERN BASS STRAIT

CANDIDATE AREA 3

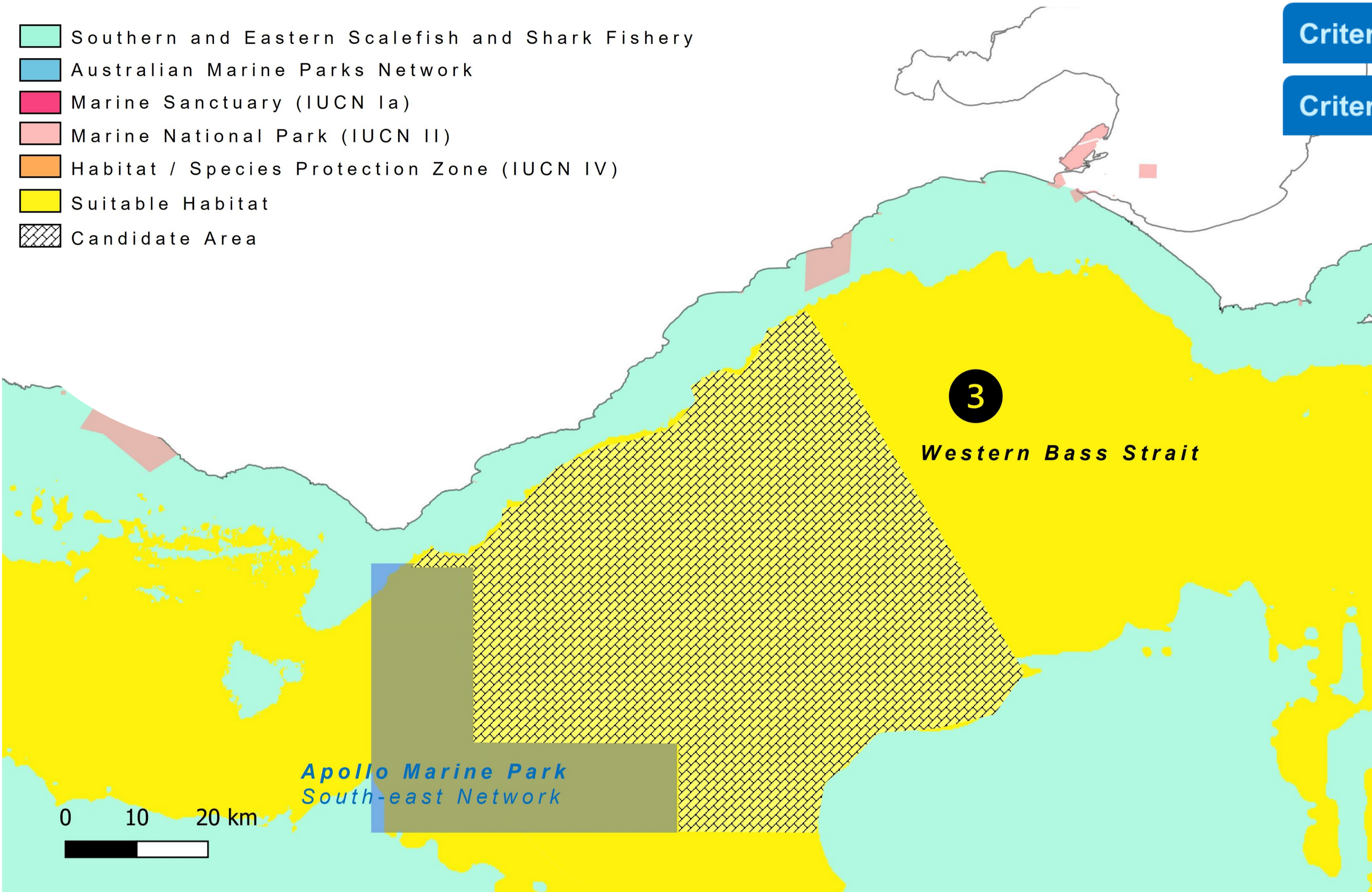
Criterion 1: Suitable Habitat ✓

Criterion 2: Biological Importance ✓

Criterion 3: Ecological Importance ✓

Criterion 4: Abundance and Extent ✓

- Southern and Eastern Scalefish and Shark Fishery
- Australian Marine Parks Network
- Marine Sanctuary (IUCN Ia)
- Marine National Park (IUCN II)
- Habitat / Species Protection Zone (IUCN IV)
- Suitable Habitat
- Candidate Area

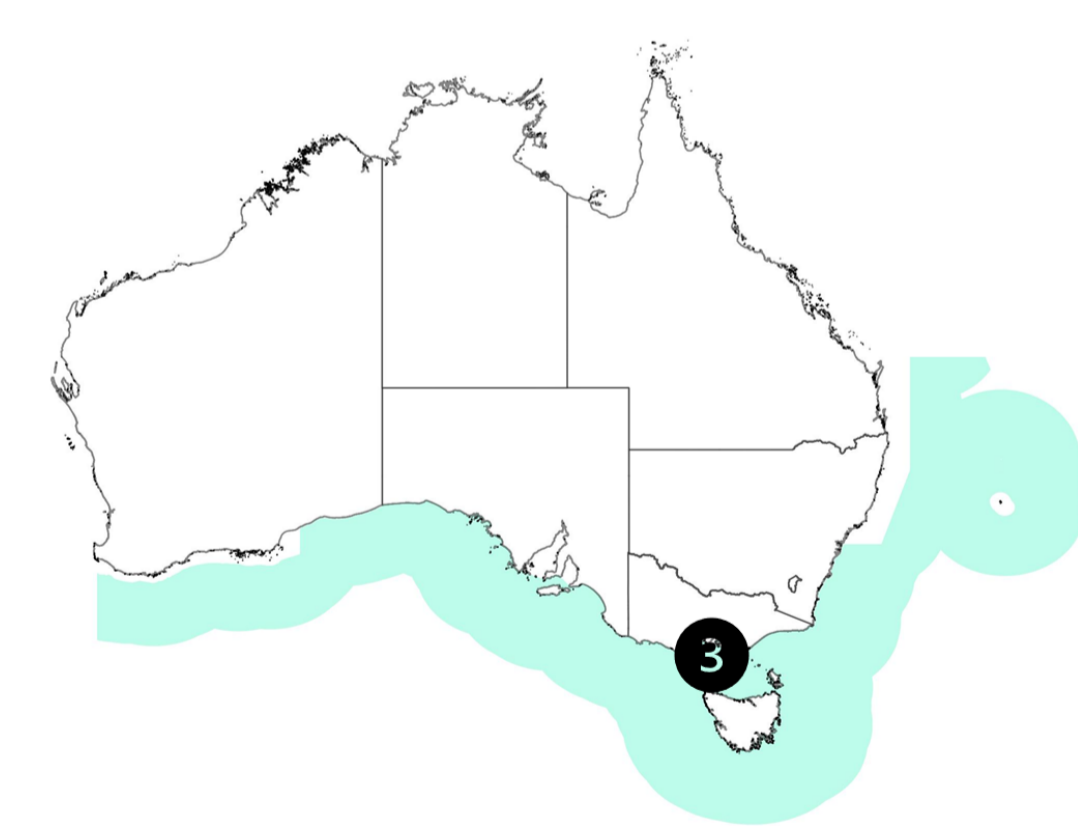



The area is at the western extent of *Urolophus viridis* range and within the largest proportion of its suitable habitat. Suitable habitat for *Spiniraja whitleyi* also occurs. Evidence of *Urolophus viridis* reproductive activity occurring adjacent to the area has been reported in Trinnie et al. (2015).

Like other stingarees and skates, both species are subject to bycatch mortality in the SESSF. Part of the area is closed to SESSF trawl closures (Schedule 2 Bass Strait Trawl Closure) but largely remains open to gillnet and longline fishing. Relative abundance of *Urolophus viridis* in the area is reported as *common* in Trinnie et al. (2015) but declines may have occurred.

A 50-100km extension of Apollo Marine Park's eastern boundaries would encompass more suitable habitat of both species, and breeding grounds of *Urolophus viridis* leading to ongoing reproductive success.

Candidate Area 3 meets: Criterion 1 Suitable Habitat; Criterion 2 Biological Importance for (a) Breeding Habitat; Criterion 3 Ecological Importance for (a) Threat, and (b) Diversity; and Criterion 4 Abundance and Extent





Greenback Stingaree
Urolophus viridis VU

Endemic to southeastern Australia with a distribution to inshore and coastal waters between 13-20°C and 20-330 depth.



Melbourne Skate
Spiniraja whitleyi VU

Endemic to southern Australia (NSW, VIC, TAS, SA, WA) on the continental shelf and slope in waters 14-18°C and 0-345m depth.

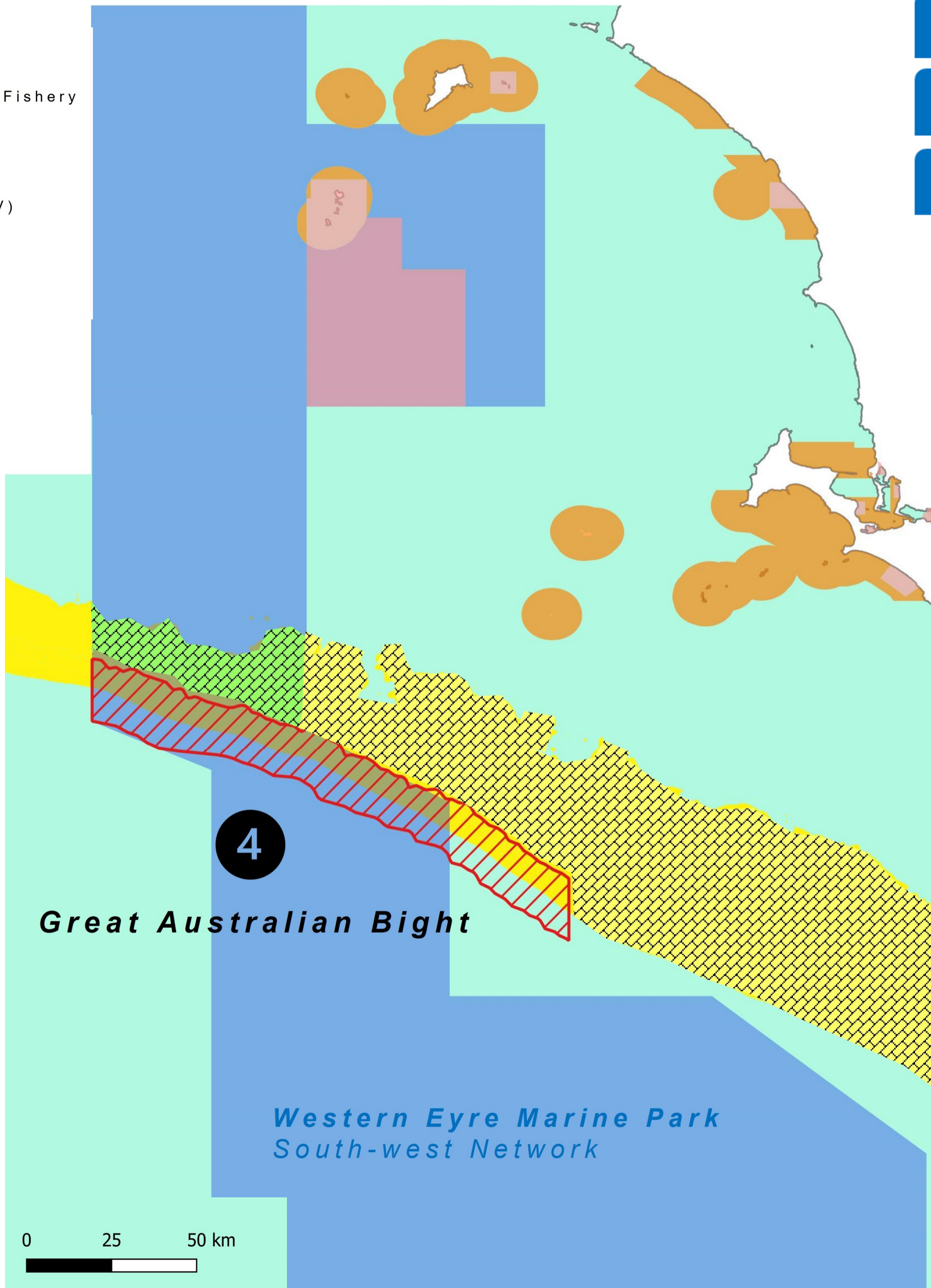


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GREAT AUSTRALIAN BIGHT

CANDIDATE AREA 4

- Southern and Eastern Scalefish and Shark Fishery
- Australian Marine Parks Network
- Marine Sanctuary (IUCN Ia)
- Marine National Park (IUCN II)
- Habitat / Species Protection Zone (IUCN IV)
- Schedule 10 Closure (SESSF)
- Suitable Habitat
- Candidate Area



Whitefin Swellshark
Cephaloscyllium albiginum CR

Endemic to south-eastern Australia on the continental shelf and upper slope in waters 10-15°C and 126-554m depth.

Greeneye Spurdog
Squalus chloroculus EN

Endemic to southern Australia (NSW - WA) on the upper to mid continental slope in waters 6-15°C and 216-1360m depth.

Grey Skate
Dipturus canutus EN

Endemic to southern Australia (NSW - WA) on the continental slope in waters 2-10°C and 155-1050m depth.

Criterion 1: Suitable Habitat ✓

Criterion 2: Biological Importance ✓

Criterion 3: Ecological Importance ✓

Criterion 4: Abundance and Extent ✓

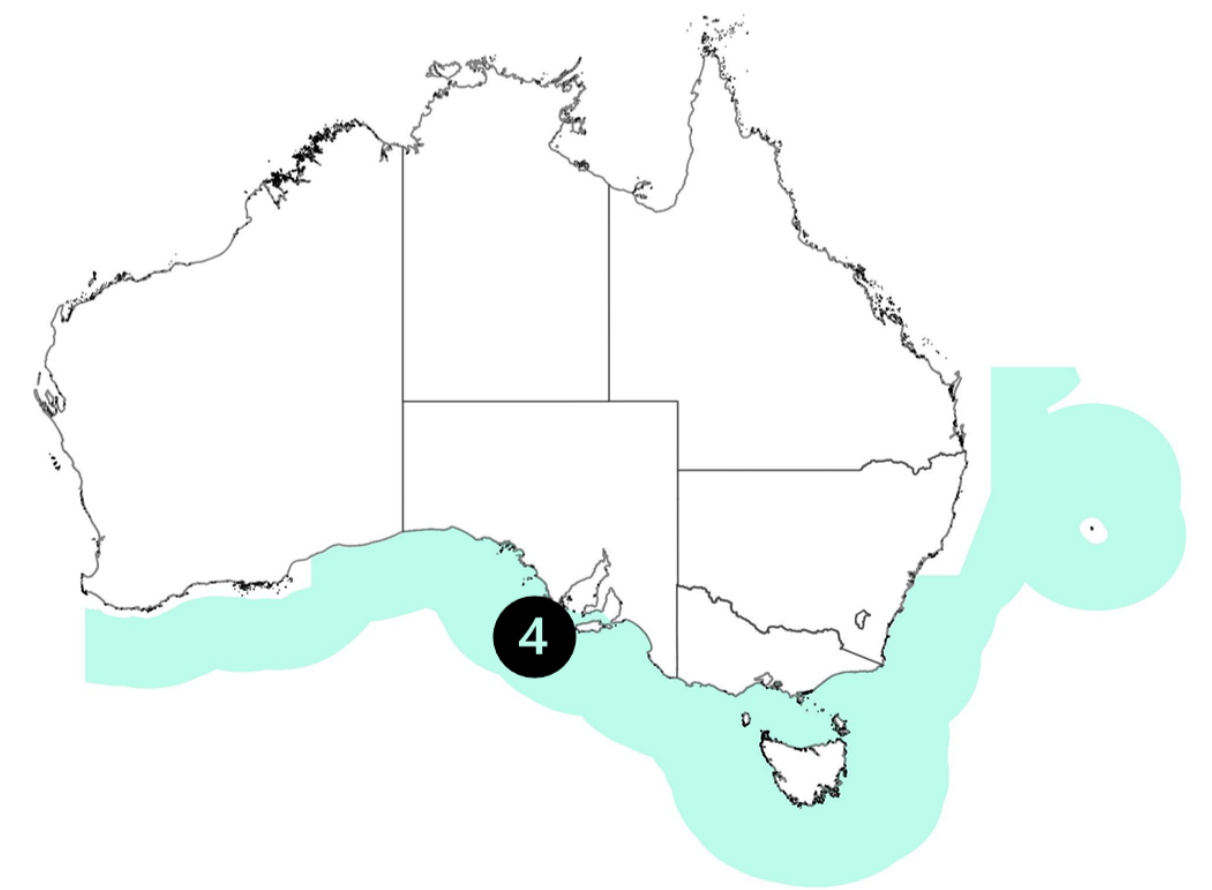
The area is within the geographic range of *Cephaloscyllium albiginum*, *Squalus chloroculus*, and *Dipturus canutus*. Observer and tracking data show the existing SESSF hook and trawl closure (Schedule 10 Commonwealth Gulper Shark Closure – Southern Dogfish) is within the core adult habitat depth range.

Further, the tagging data shows mature females of *Cephaloscyllium albiginum* and *Squalus chloroculus* are present. Effort summaries show that depletion is likely to be low here because historical trawl effort has been lower than eastern areas.

The area is too deep for gillnet and was not substantially impacted by auto line gear prior to 2000. Three species of interest co-occur here in an area of mixed habitat consisting of interspersed steep terraces, small canyons, and pinnacles (Daley et al. 2015).

The area is an important site for maintenance of biological and ecological diversity in the region. Tracking data suggest that spatial protections extending at least 80km along the upper slope are likely to be effective.

Candidate Area 4 meets: Criterion 1 Suitable Habitat; Criterion 2 Biological Importance for (a) Breeding Habitat, and (b) Essential Habitat; Criterion 3 Ecological Importance for (a) Threat, and (b) Diversity; and Criterion 4 Abundance and Extent.




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FLINDERS ISLAND


CANDIDATE AREA 5

- Southern and Eastern Scalefish and Shark Fishery
- Australian Marine Parks Network
- Marine Sanctuary (IUCN Ia)
- Marine National Park (IUCN II)
- Habitat / Species Protection Zone (IUCN IV)
- Schedule 12 & 39 Closure (SESSF)
- Suitable Habitat
- Candidate Area




Whitefin Swellshark
Cephaloscyllium albipinnum CR

Endemic to south-eastern Australia on the continental shelf and upper slope in waters 10-15°C and 126-554m depth.



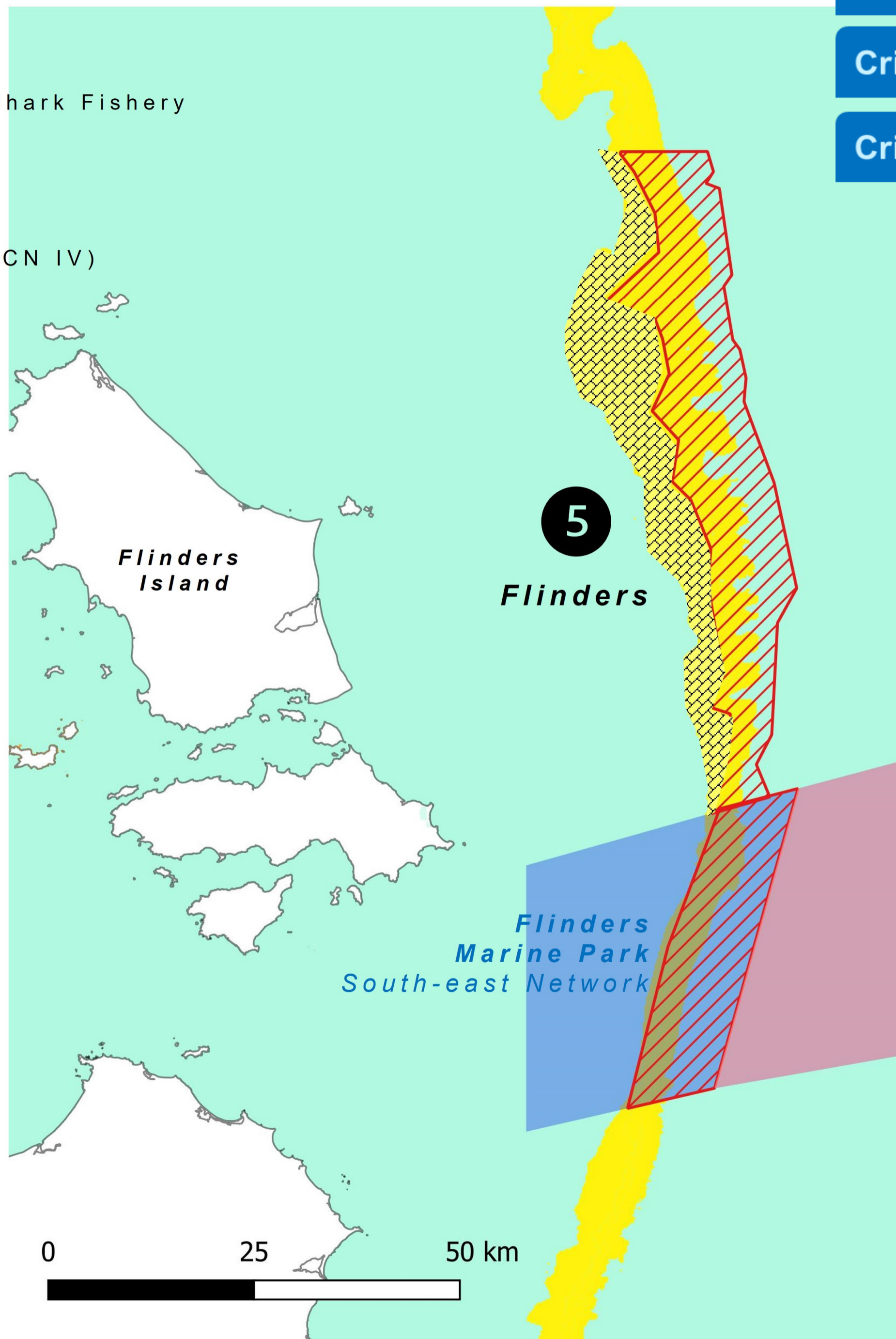
Greeneye Spurdog
Squalus chloroculus EN

Endemic to southern Australia (NSW-WA) on the upper to mid continental slope in waters 6-15°C and 216-1360m depth.



Grey Skate
Dipturus canutus EN

Endemic to southern Australia (NSW - WA) on the continental slope in waters 2-10°C and 155-1050m depth.

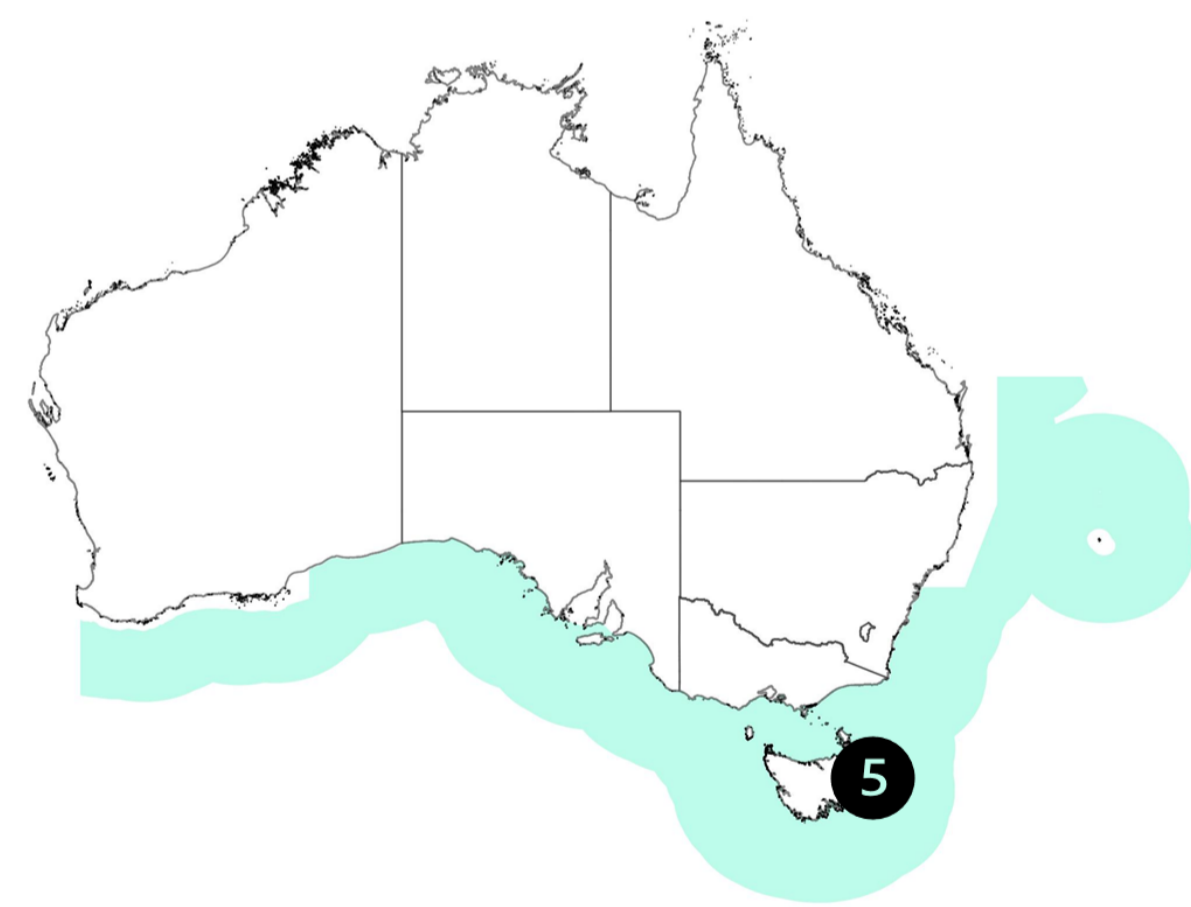


- Criterion 1: Suitable Habitat ✓
- Criterion 2: Biological Importance ✓
- Criterion 3: Ecological Importance ✓
- Criterion 4: Abundance and Extent ✓

This area is proposed for *Cephaloscyllium albipinnum*, *Squalus chloroculus*, *Dipturus canutus* and *Spiniraja whitleyi* and has similar value to Candidate Area 4 for habitat. There has been greater historical fishing in adjacent fishing grounds therefore depletion is likely to have been higher.

Current SESSF hook closures to protect upper-slope dogfish (Schedule 12 Gulper Shark Closure – Harrison’s dogfish and Schedule 39 Flinders Research Zone Closure) occur within the area. There has not been tracking in this area. Tracking results from similar habitats suggest reserves should extend 80km along slope to encompass individual home range. The outer extent of *Dentiraja confusa* and *Spiniraja whitleyi* suitable habitat also occurs in the area.

Candidate Area 5 meets: Criterion 1 Suitable Habitat; Criterion 2 Biological Importance for (a) Breeding Habitat, and (b) Essential Habitat; Criterion 3 Ecological Importance for (a) Threat, and (b) Diversity; and Criterion 4 Abundance and Extent.

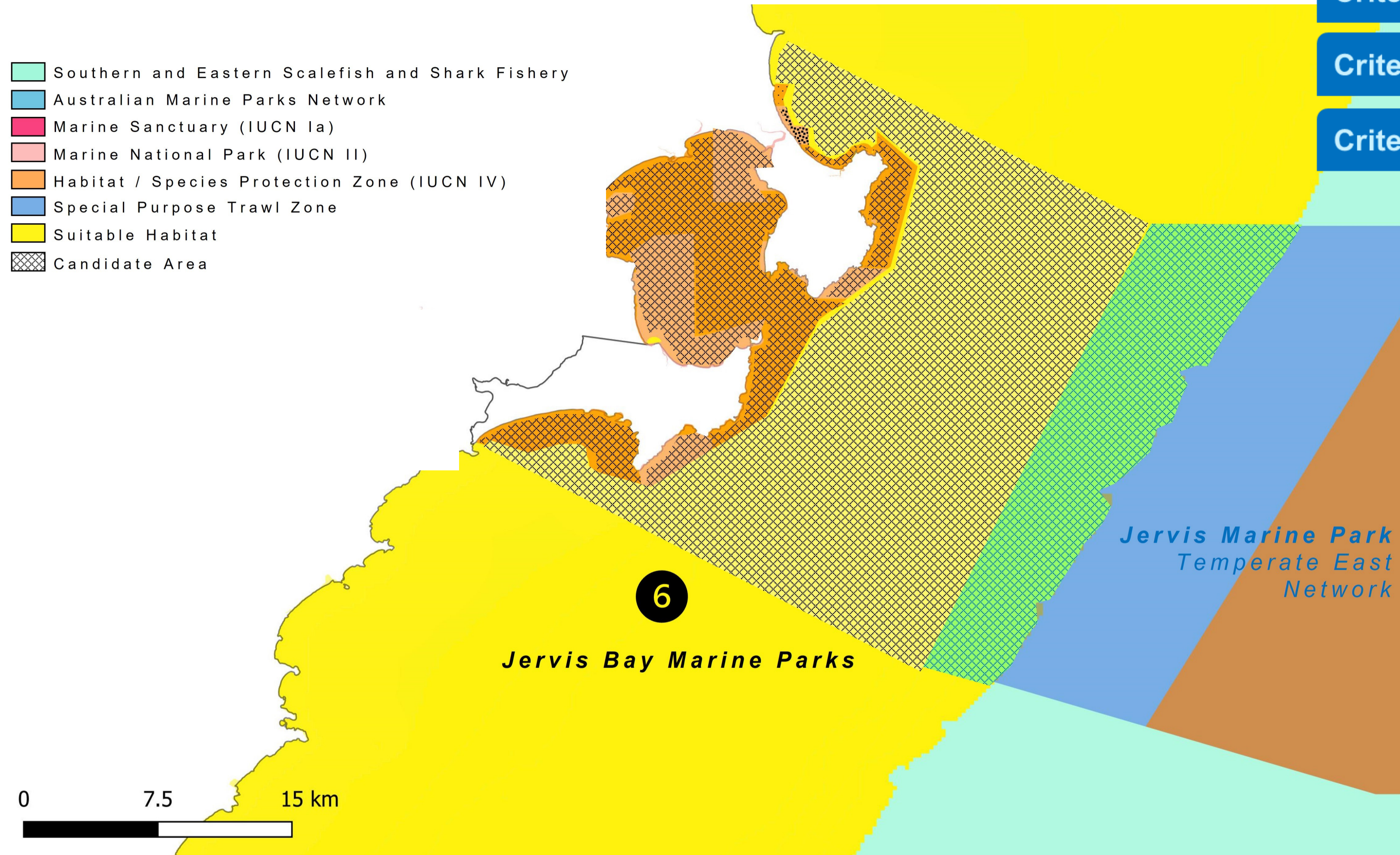


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JERVIS BAY AND JERVIS MARINE PARKS

CANDIDATE AREA 6

- Southern and Eastern Scalefish and Shark Fishery
- Australian Marine Parks Network
- Marine Sanctuary (IUCN Ia)
- Marine National Park (IUCN II)
- Habitat / Species Protection Zone (IUCN IV)
- Special Purpose Trawl Zone
- Suitable Habitat
- Candidate Area



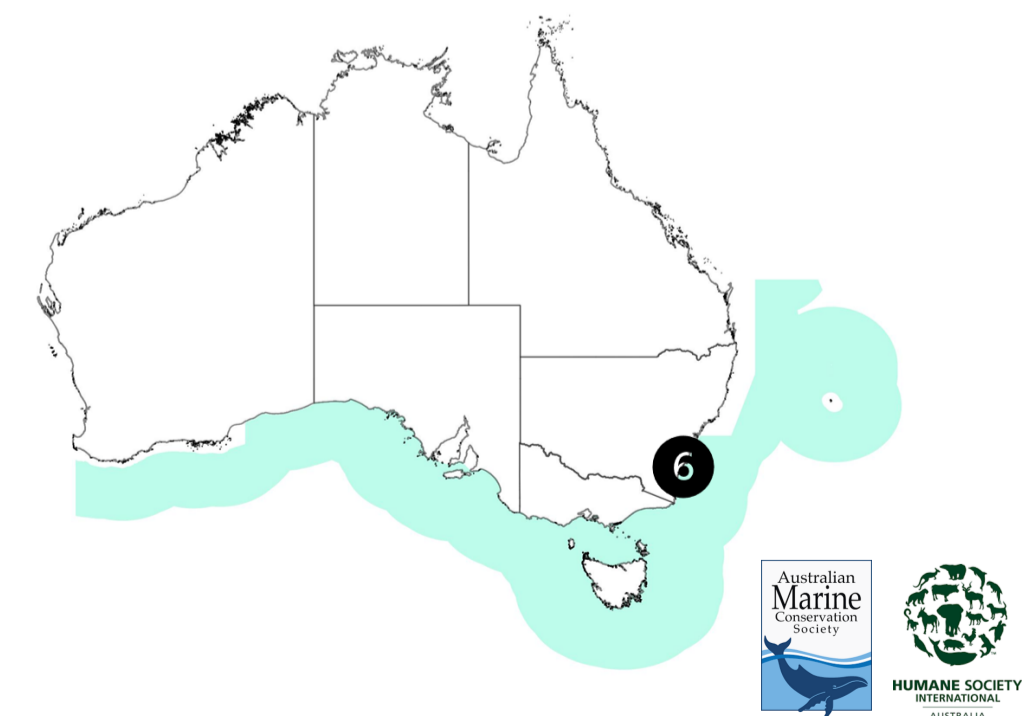
- Criterion 1: Suitable Habitat ✓
- Criterion 2: Biological Importance ✓
- Criterion 3: Ecological Importance ✓
- Criterion 4: Abundance and Extent ✓

Suitable habitat for 9 of the 10 endemics occurs in the area from inshore Jervis Bay Marine Park (NSW State-managed) to offshore Jervis Marine Park (AMP Temperate East Network). A proportion of the AMP Jervis Marine Park designated as a Special Use Trawl Zone also covers an extent of suitable habitat area placing any of the species at high risk of bycatch and associated mortality. Inshore, the current Jervis Bay Marine Park area is classified either Marine National Park (IUCN II) or Habitat Management (IUCN IV) zones, yet none of the endemics which occur here are identified in its management plan.

The area is within the SESSF and may also be subject to inshore State fisheries, particularly in habitat which is outside of both the current State MPA and AMP boundaries. This is especially important to consider for *Dentiraja confusa*, *Squatina albipunctata*, *Urolophus sufflavus*, *Urolophus viridis*, *Spiniraja whitleyi*, and *Dentiraja australis* which move between shallow (1-50m depth) and deep waters (~350m) and may become disconnected from inshore breeding areas.

Recent research has identified other rays (i.e., smooth stingrays [*Bathytochia brevicaudata*]) exhibiting philopatry at Jervis Bay, repeatedly moving out of the bay and returning (Pini-Fitzsimmons, 2022). This suggests the area has importance to a wider diversity of elasmobranch species which is an important biodiversity consideration. Removal of trawl fisheries pressures and adequate spatial protections by an extension of the Jervis Bay Marine Parks eastern and Jervis Marine Park's western boundaries to meet will encompass connectivity between areas of inshore habitat and suitable adjacent offshore habitat for all species and will maintain the species and areas' biological and ecological diversity. It will also allow the area to act as a connective corridor between the northern and southern extent of each nominated species' ranges.

Candidate Area 6 meets: Criterion 1 Suitable Habitat; Criterion 2 Biological Importance for (a) Breeding Habitat, and (b) Essential Habitat; Criterion 3 Ecological Importance for (a) Threat, and (b) Diversity; and Criterion 4 Abundance and Extent.



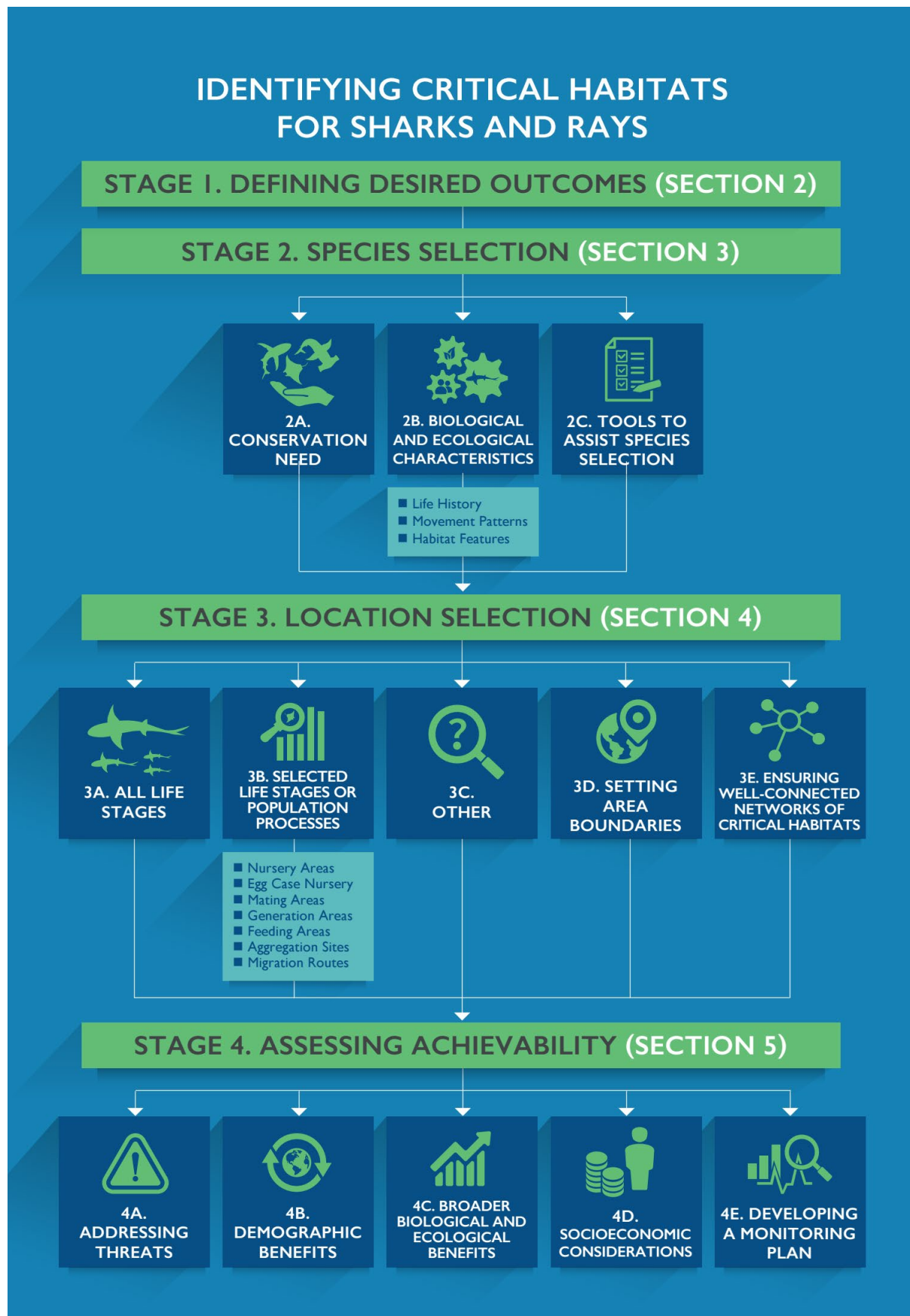
 Whitefin Swellshark <i>Cephaloscyllium alpinum</i> <small>Endemic to south-eastern Australia on the continental shelf and upper slope in waters 10-15°C and 126-554m depth.</small>	 Longnose Skate <i>Dentiraja confusa</i> <small>Endemic to south-eastern Australia on the continental shelf and slope in waters 14-27°C and 20-395m depth.</small>	 Yellowback Stingaree <i>Urolophus sufflavus</i> <small>Endemic to eastern Australia (QLD, NSW) with a distribution to inshore and coastal to the continental shelf and upper slope in waters between 12-20°C and 45-320 depth.</small>	 Melbourne Skate <i>Spiniraja whitleyi</i> <small>Endemic to southern Australia (NSW, VIC, TAS, SA, WA) on the continental shelf and slope in waters 14-18°C and 0-345m depth.</small>	 Sydney Skate <i>Dentiraja australis</i> <small>Endemic to eastern Australia (QLD, NSW) in coastal waters out to the continental shelf and upper slope in waters 18-21°C and 20-325m depth.</small>
 Greeneye Spurdog <i>Squalus chloroculus</i> <small>Endemic to southern Australia (NSW - WA) on the upper to mid continental slope in waters 6-15°C and 216-1360m depth.</small>	 Grey Skate <i>Dipturus canutus</i> <small>Endemic to southern Australia (NSW - WA) on the continental slope in waters 2-10°C and 155-1050m depth.</small>	 Greenback Stingaree <i>Urolophus viridis</i> <small>Endemic to southeastern Australia with a distribution to inshore and coastal waters between 13-20°C and 20-330 depth.</small>	 Eastern Angelshark <i>Squatina albipunctata</i> <small>Endemic to eastern Australia (QLD - VIC) in coastal waters out to the continental shelf and slope in waters 14-20°C and 35-414m depth.</small>	

Daley RK, and Hyde CA (2023) Fishery and spatial management solutions to inform the protection and recovery of Australia's threatened endemic elasmobranchs. Australian Marine Conservation Society and Humane Society International.

Annex B - Important Shark and Ray Area (ISRA) Criteria

CRITERIA	DESCRIPTION
Criterion A Vulnerability	Areas important to the persistence and recovery of threatened sharks. <i>(This criterion must be associated with an additional criterion.)</i>
Criterion B Range Restricted	Areas holding the regular and/or predictable presence of range-restricted sharks, that are occupied year round or seasonally.
Criterion C Life-History	Areas that are important to sharks for carrying out vital functions across their life-cycle (i.e., reproduction, feeding, resting, movement, or undefined aggregations).
Sub-criterion C1 Reproductive Areas	Areas that are important for sharks to mate, give birth, lay eggs, or provide refuge and other advantages to the young.
Sub-criterion C2 Feeding Areas	Areas that are important for shark nutrition at one or more life-cycle stages.
Sub-criterion C3 Resting Areas	Areas that are important for sharks to conserve energy, often related to environmental conditions or temporal factors.
Sub-criterion C4 Movement	Areas used by sharks regularly or predictably during their movements, such as migrations, which contribute to connectivity of other functionally important areas.
Sub-criterion C5 Undefined Aggregations	Areas where an aggregation or assemblage of sharks regularly and/or predictably occur, year round or seasonally, but the function of the aggregation or assemblage is currently unknown.
Criterion D Special Attributes	Areas important for sharks considered for distinct biological, behavioral, or ecological attributes (unique or associated with a unique habitat type), or which support an important diversity of species.
Sub-criterion D1 Distinctiveness	Areas with sharks that display distinct biological, behavioral, or ecological characteristics.
Sub-criterion D2 Diversity	Areas that sustain an important diversity of sharks.

Annex C – Shark and Ray Recovery Initiative (SARRI) Framework



Fishery and spatial management solutions to inform the protection and recovery of Australia's threatened endemic elasmobranchs.