Fisheries Scientific Committee

Proposed Determination

White's seahorse
Hippocampus whitei

Proposed Listing Category: Endangered

The Fisheries Scientific Committee, established under Part 7A of the *Fisheries Management Act 1994* (the Act), has made a Proposed Determination to list the ***Hippocampus whitei*** (**White's Seahorse)** as an **ENDANGERED SPECIES** in Part 1 of Schedule 4 of the Act.

The listing of ENDANGERED SPECIES is provided for by Part 7A Division 2 of the Act.

As prescribed under Section 284 of the Act, this Proposed Determination will be publicly exhibited for a period of at least 30 days for public comment.

The Fisheries Scientific Committee, with reference to the criteria relevant to this species, prescribed by Part 16 Division 1 of the *Fisheries Management (General) Regulation 2010* (the Regulation) has assessed and determined that:

Species information and status

a) Species:

Hippocampus whitei – White's Seahorse, Bleeker, 1855 (family Syngnathidae) is a valid, recognised taxon and is a species as defined in the Act. The species is endemic to NSW and QLD.

b) Taxonomy

Hippocampus whitei was first discovered in 1789 in Port Jackson (Sydney Harbour) and named after John White, surgeon general to the first fleet and author of *Journal of a Voyage to New South Wales 1789*, in which a portrait of *H. whitei* is published and was described by Bleeker in 1855. *Hippocampus novaehollandiae* Steindachner, 1866 is a synonym.

In 2016, *Hippocampus procerus* was determined to be a synonym of *Hippocampus whitei* as there were no morphological or genetic differences between individuals of the two species (Lourie et al., 2016; Graham Short pers. comm – California Academy of Science).

There are 40 genera of Syngnathids (Pipefishes and Seahorses) in Australia and within Hippocampus there are at least eight recognized species in NSW (Kuiter, 2009; Lourie et al.,

2016; Australian Museum, 2018); however, only two species are known from Sydney Harbour (Hutchings et al., 2013), the Pot-belly Seahorse *H. abdominalis* Lesson 1927 and *H. whitei*. Other species recently recorded in NSW includes the Thorny Seahorse *H. histrix* Kaup, 1856 (Harasti, 2015) and the Great Seahorse *H. kelloggi* Jordan & Snyder, 1901 (Harasti, 2017).

c) Current conservation status

Jurisdiction	State / Territory in which the species is listed	Date listed or assessed (or N/A)	Listing category
International (IUCN Red List)	**Endangered**	**2017**	**A2bc**
National (EPBC Act)	**Not listed**	**N/A**	**N/A**
State / Territory	**Not listed**	**N/A**	**N/A**

d) Description of species

Hippocampus whitei is a small (maximum total length approximately 16 cm (Harasti et al., 2012)), long snouted seahorse. Morphological characteristics of *H. whitei* are: dorsal-fin rays 16–17, pectoral-fin rays 15–17; tail-rings 33–34; the coronet is high, inclined backwards, and arranged in a five-pointed star at the apex; spines are variable ranging from low to moderately developed and from round to quite sharp and it has a long snout with sharp eye spines (Lourie et al., 1999; Kuiter, 2001). The species is known to live in the wild for up to 5-6 years (Harasti et al., 2012).

e) Distribution of species

Hippocampus whitei is known to occur in estuaries from Lake Illawarra (Wollongong), NSW to Hervey Bay, QLD (Kuiter, 2009; Harasti et al., 2012). Records from the Queensland Museum indicate the species is predominantly found around the Moreton Bay region but does occur up to Hervey Bay (Jeff Johnson – QLD Museum records). Other records from Queensland such as Port Curtis and Burnett River from the 1920s and 1930s are inclusive as if to whether they are actually *H. whitei* (Graham Short pers. comm - California Academy of Science). There is a single record from the Gulf of Carpentaria but this is likely a misidentification (Kuiter, 2001; Jeff Johnson pers. comm 2018).

Lourie et al (2016) indicated that the species also occurs in Vanuatu, the Solomon Islands and Papua New Guinea, but this was based on unverified identifications from international museum collections listed in online databases. Recent communications by the FSC with the relevant museum curators, who checked the identities of the specimens in question, confirmed that the specimens reported from these regions are not *H. whitei* (Nalani Schnell and Agnes Dettai, Muséum national d'Histoire naturelle Paris, pers. coms). Similarly, the species does not occur in South Australia or Victoria as indicated by Lourie et al. (2016), as these museum specimens are in fact *H. breviceps* (confirmed by Karsten Hartel of Museum of Comparative Zoology, Harvard University, and David Cantana and Graham Short of the California Academy of Science). Martin Gomon of Museum Victoria confirmed his museum contains no specimens of *H. whitei* from Victoria.

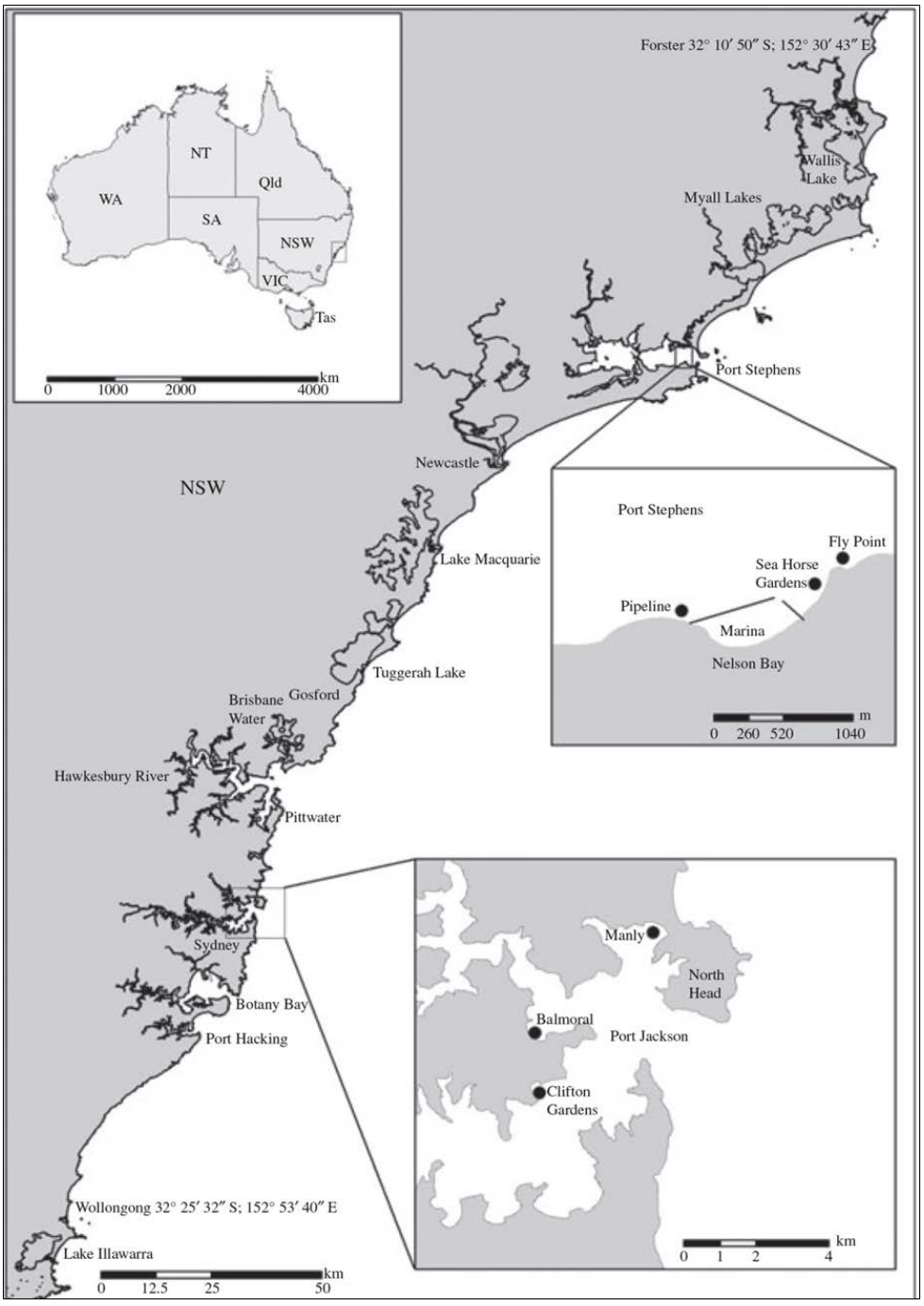

Figure 1 Known distribution of Hippocampus whitei in estuaries in NSW (not including Tweed River), Australia, with insert boxes showing Port Stephens and Sydney Harbour study sites. Source: Harasti et al. (2012).

In NSW the species occurs in nine estuaries between Forster and Wollongong and in the Tweed River (previously identified as *H. procerus*). There is a recent record (January 2018) of a juvenile *H. whitei* from St Georges Basin that was logged through REDMAP (www.redmap.org.au); however, there is no evidence to suggest that a population exists in St Georges Basin, as this is the only confirmed sighting from this location and the individual is considered to be a vagrant. The current Area of Occupancy for NSW is 457 km^2 whilst in Queensland is estimated to be less than 1,500 km^2 (Hervey Bay, Moreton Bay and Gold Coast seaway). Several of the northern records from Queensland, such as locations of Port Curtis and

Burnett River (specimens in Australian Museum), are inclusive as if to whether they are actually *H. whitei* (Graham Short pers. comm - California Academy of Science); however, these records are ~ 100 years old and there is no recent evidence to suggest *H. whitei* is currently found further north than the Hervey Bay region.

f) Relevant biology/ecology of the species

Hippocampus whitei displays rapid growth, early maturity and reproduction; age at sexual maturity is 210 days old (Mean total length =106.7 mm) and life expectancy is 5–6 years (Harasti et al., 2012); the generation length is estimated at 3 years. Litter size is ~ 150 (Vincent & Giles, 2003); in a breeding season a large male can reproduce up to 8 times (Harasti et al., 2012). However, litter size is considered to decrease following each reproduction (Vincent & Giles, 2003).

The survival rate for juvenile *H. whitei* is unknown; however it is considered to be very low (< 5%) (D. Harasti unpub. data). These growth and reproductive traits indicate that the species has the ability to develop large populations if conditions are appropriate, such as the availability of suitable habitat and few predators (Harasti et al., 2015). However, the species has very limited dispersal ability given that there is no pelagic stage for juveniles, with newborns generally settling in the area of birth and not travelling far (Harasti et al., 2014b). The species has no pelagic stage (Kuiter, 2009) and is not associated with 'rafting' as observed in other seahorse species.

Von Bertalanffy growth parameters for Port Stephens were: females $L\infty = 149.2$ mm and K= 2.034 per year and males $L\infty = 147.9$ mm and K=2.520 per year compared to estimates from Sydney Harbour: females $L\infty = 139.8$ mm and K= 1.285 per year and males $L\infty = 141.6$ mm and K=1.223 per year (Harasti et al., 2012).

g) Habitat requirements of the species

Hippocampus whitei is known to occur at depths between 1 and 15 metres and is found utilising a wide range of habitat types (both natural and artificial). In Port Stephens, juveniles prefer gorgonian habitats (*Euplexaura* sp.) whilst adults had a preference for both sponges and soft coral (*Dendronephthya australis*) habitats. They were also found occurring in *Posidonia australis* seagrass and juveniles also used *Sargassum* sp. and soft coral habitats (*Carijoa* sp. and *D. australis*) (Harasti et al., 2014b). They prefer more complex habitats, believed to provide better protection and more available food resources (Hellyer et al., 2011; Harasti et al., 2010).

The species displays strong site fidelity, with tagged males occurring on the same site for up to 56 months and females 49 months, with no seahorse ever recorded moving between sites. Individuals are not known to move far, as the largest distance a tagged animal was found to travel was only 70 m. Individuals show strong fidelity to holdfasts such as sponges, with some individuals being recorded on the same holdfast for up to 17 months (Harasti et al. 2014b).

Within Sydney Harbour, seahorses are generally found on artificial habitats such as the protective swimming net enclosures and also on jetty pylons. Their use of artificial habitats appears to be most common in areas where natural habitat (such as seagrass, sponges and soft corals) has been lost within Sydney Harbour. While seagrass decline has been quantified for Sydney Harbour (West et al., 2004), there are no quantitative estimates for loss of other natural habitat such as sponges and soft corals. The soft coral *Dendronephthya australis* and sponges are a preferred habitat for *H. whitei* (Harasti et al., 2014) and both are declining in distribution and abundance within Port Stephens (Harasti, 2016). *Dendronephthya australis* has previously been recorded in areas closer to and within Sydney, NSW, such as Sydney Harbour (Balmoral

and near Watson's Bay) during the 1970s (R. Kuiter, pers. comm in Poulos et al., 2015), but, now the species occurrence (particularly large, mature colonies) within and around Sydney is rare (John Turnbull, URG, pers. comm).

h) Criteria – reduction in abundance, geographic distribution or genetic diversity (Regulation clause 271)

Background

Information is available on population status of *Hippocampus whitei* from two estuaries where populations were previously most abundant, Port Stephens and Port Jackson (Sydney Harbour) (Harasti et al., 2012). Resurveys of population abundance at both Port Stephens and Sydney Harbour have found declines in population abundance over the past decade. There have been large population declines in Port Stephens (+90% decline from 2006 – 2015) and in Sydney Harbour (Manly) (+40% decline 2007 – 2015). Declines in Sydney Harbour have also been observed at Clifton Gardens (Chowder Bay) (Harasti et al., 2010) and Balmoral (Harasti unpub. data). No population abundance surveys have been undertaken for these two locations over past 8 years. However, populations of the swimming nets are known to be greatly affected by council cleaning of the nets (Harasti et al., 2010) and fluctuate in response to cleaning.

Initial population declines were first noticed between 2010 and 2013 (Harasti, 2014) in Port Stephens. Populations at the two largest known aggregation sites, the Pipeline and Seahorse Gardens, were found to decline in abundance from 2006 to 2015. The Seahorse Gardens had a population estimate of ~600 mature animals in 2006, while resurveys of the site in 2015 provided a population estimate of only 10 animals (Harasti, 2016); a 98% decline if extrapolated over 10 years (Harasti 2016).

Similarly, the Pipeline site also experienced a large decline: population estimate of ~200 animals was indicated in 2006, compared to only 45 animals in 2015; a 95% decline if extrapolated over 10 years (see Figure 2 below from Harasti (2016)). The population declines in Port Stephens were correlated with significant declines in the preferred habitats of seahorses. Both soft coral and sponge habitats were found to decline significantly ($F_{1,76} = 7.801$, $p < 0.001$) at both these sites from 2009 to 2015 (Harasti, 2016).

In April 2018, population surveys were repeated at the Seahorse Gardens site, however, only one individual (juvenile) was found over three consecutive daily surveys (Harasti unpub. data).

Populations in Sydney Harbour (Manly Harbour) on the protective swimming enclosure (referred to as the Manly Net) also declined at the one location where population abundance data had been collected. The adult population size on the Manly Net from May 2007 to February 2008 was estimated at 315 (95% CI 304–326). This net was resurveyed from November 2014 to April 2015, and it was found that the population had declined by approximately 40% with a population abundance estimate of 176 (165–189); or 56% if extrapolated over 10 years (D. Harasti unpub. data).

Anecdotal information and diving surveys on *H. whitei* populations in Sydney Harbour indicates that there have been declines at various other locations within the harbour. Surveys of the Clifton Gardens net in February 2015 recorded only seven mature animals, compared to 70 animals on the previous survey of the net in 2008; a 98% decline if extrapolated to 10 years (D. Harasti unpub. data).

In Nov 2005 and May 2006, 146 and 206 individuals, respectively, were tagged on the Balmoral net (K. Martin-Smith unpub data), but in February 2015 a survey of the net found only three seahorses (D. Harasti, unpub. data).

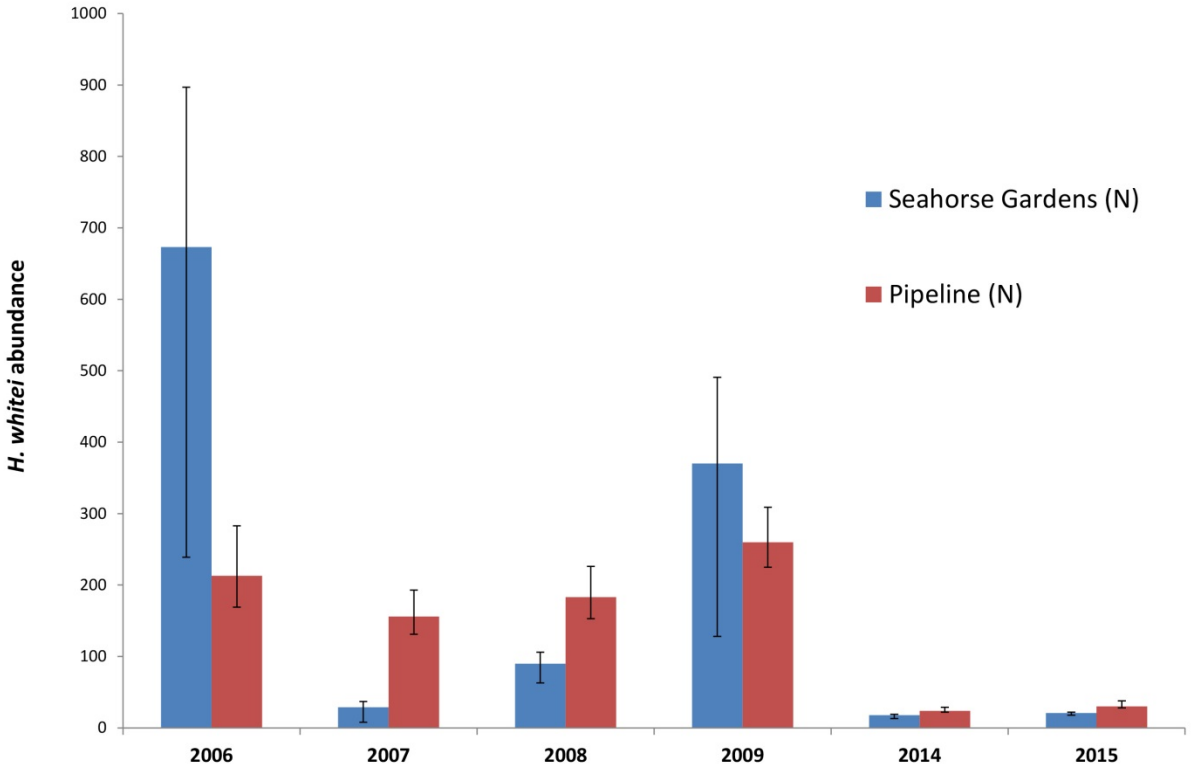

Figure 2 Changes in *Hippocampus whitei* population abundance estimates (with 95% confidence interval [CI]) at 2 sites in Port Stephens (2006−09 and 2014−15) using closed population model with JH Estimator in the program NOREMARK (source: Harasti, 2016).

From 2005–2009, diving surveys (n=100+) were undertaken across 24 coastal embayments and estuaries along the entire NSW coast, which found *H. whitei* in several locations (Harasti et al., 2012). The only locations where high abundances of *H. whitei* occurred were Sydney Harbour and Port Stephens, with the most found at any of the other locations being eight individuals in Port Hacking. The current status of *H. whitei* populations in estuaries other than Port Stephens and Sydney Harbour is unknown, but there are no indications or evidence to suggest that large populations exist outside of Port Stephens or Sydney Harbour. Even though the species is totally protected in NSW, essential habitats continue to be threatened from anthropogenic inputs and as such it is likely that the decreasing population trend will continue in the future. Loss of essential habitats such as the seagrass *P. australis*, soft coral *D. australis* and sponge gardens have been found to be in decline in both Port Stephens and Sydney Harbour over the past two decades (West et al., 2004; Glasby & West, 2015; Harasti, 2016).

In Queensland, there has been no assessment of its population status and it's not possible to determine if *H. whitei* has declined in Qld waters (Col Limpus pers. comm). The occurrence of *H. whitei* in Queensland waters is considered rare, as individuals are seldom encountered. Extensive surveys in seagrass habitats in Moreton Bay and the Gold Coast seaway for *H. procerus* (*whitei*) using net and snorkel surveys in 2014 & 2016 recorded only four individuals (Graham Short, California Academy of Science unpub. data). Extensive seagrass surveys between 2017 and 2018 in Moreton Bay using six replicate 50m beam trawls at four locations, sampling every six weeks in areas that are at least 75% *Zostera*, only recorded six individual *H. whitei* (Dana Burfeind, University of Queensland unpub. data).

The species is not confirmed to occur in Victorian or South Australian waters.

Assessment against IUCN Redlist Categories and Criteria (Version 3.1)*		
A.	Population size reduction (evidence of decline)	**Endangered [A2bc]** Initial population declines were first noticed between 2010 and 2013 in Port Stephens (Harasti, 2014). The population declines observed in two of the largest known concentrations of the species over a six-year study (2009-2015) in Port Stephens are reported as over 90% with some fluctuation (Harasti, 2016). If extrapolated over 10 years, the Port Stephens population declines are estimated to be over 95%. Population trends varied in other areas, ranging from stability to declines of 40% at one site in Sydney Harbour. Although the numbers in main population survey sites (Harasti et al., 2012; Harasti et al., 2014a; Harasti, 2016) indicate that the species may reach thresholds for a Critically Endangered listing, subpopulations are stable in a few localities and the species is not likely declining as quickly in less populated parts of its range where habitats are not as threatened. It is suspected that across the species' range, declines of 50-70% have occurred in the past three generations (<10 years). Large declines (>90%) in essential habitats for the species (soft corals, sponges and seagrass) have been documented over the past few decades in both Sydney Harbour and Port Stephens (West et al., 2004; Glasby & West, 2015; Harasti, 2016). Therefore, *H. whitei* is eligible to be listed as Endangered under Criterion A2bc.
B.	Geographic range (EOO and AOO, number of locations and evidence of decline)	Although the historical distribution is unknown, in New South Wales (NSW) *H. whitei* is now known to occur in only nine estuaries from Forster (Wallis Lake) to Wollongong (Lake Illawarra) and in the Tweed River. In Queensland, *H. whitei* has been confirmed to occur from Hervey Bay to the Gold Coast Seaway (Queensland Museum and Australian Museum records). The current Area of Occupancy (AOO) for NSW is ~457 km^2 whilst in Queensland its AOO is estimated to be < 1,500 km^2 (Hervey Bay, Moreton Bay estuary and Gold Coast seaway). Populations both in Port Stephens and Sydney Harbour have been observed to decline over the past decade (Harasti, 2016) as a result of ongoing habitat loss. The Extent of Occurrence is similar to AOO and estimated to be ~ 2,000 km^2.
C.	Small population size and decline (population size, distribution and evidence of decline)	The number of mature animals found across both NSW and QLD has not been documented and is considered data deficient. Therefore, there are insufficient data to demonstrate if *H. whitei* is eligible for listing in any category under this criterion.
D.	Very small or restricted population (population size)	The number of mature animals found across both NSW and QLD has not been documented and is considered data deficient. Therefore, there are insufficient data to demonstrate if *H. whitei* is eligible for listing in any category under this criterion.
E.	Quantitative	A quantitative analysis has not been undertaken for the species.

	analysis (statistical probability of extinction)	Therefore, there are insufficient data to demonstrate if *H. whitei* is eligible for listing in any category under this criterion.

* In 2015 the NSW Government signed an Intergovernmental Memorandum of Understanding on the Agreement on a Common Assessment Method for listing of threatened species and threatened ecological communities (the CAM). The CAM provides a nationally consistent approach to assessing and listing threatened species in Australia, using the IUCN Redlist Categories and Criteria (Version 3.1). To ensure that this Proposed Determination meets the requirements under the CAM, an assessment against the IUCN Redlist Categories and Criteria (Version 3.1) has been included. This assessment also reflects the requirements for listing species provided under clause 271 of the *Fisheries Management (General) Regulation 2010*.

For more information on the CAM please visit
http://www.environment.gov.au/biodiversity/threatened/cam

i) Criteria – threatening processes (Regulation clause 272)

Threat	Extent	Impact
Habitat Loss	The major threat to *Hippocampus whitei* is loss of essential marine habitats across its range. *H. whitei* is known to occur along some of the most heavily populated estuaries in Australia. As the species displays strong site fidelity and has specific habitat preferences, the further loss of key habitats through anthropogenic effects would result in a negative effect on species abundance and distribution; as occurred in Port Stephens (Harasti, 2016). See Harasti (2016) for the impact of habitat loss on population abundance.	The level of threat of habitat loss is considered HIGH. Whilst the Port Stephens estuary was previously considered a 'stronghold' for populations of *H. whitei*, the recent population declines as a result of habitat loss indicates that its long-term conservation within the Port Stephens waterway is at risk if essential marine habitats continue to be lost. The main impacts known to threaten *H. whitei* habitats in Port Stephens include anchor damage, sand inundation and damage from moorings (Glasby and West, 2015; Harasti, 2016).
Cleaning of protective swimming nets (Sydney Harbour)	Within Sydney Harbour, it has been shown that *H. whitei* are very susceptible to councils cleaning the nets as removal of epibiota caused a decrease in *H. whitei* abundance and that *H. whitei* showed significant avoidance to areas devoid of epibiotic growth (Harasti et al., 2010). Guidelines for cleaning of the nets to minimise harm to the seahorses were developed and provided to councils in 2009 (Harasti et al., 2010); however, councils rarely implement these guidelines (David Harasti pers. comm).	The level of threat from the cleaning of the protective swimming nets is considered moderate. Research has shown that populations of *H. whitei* on swimming nets can significantly decline following council cleaning of the nets and can take years to recover. See Harasti et al. (2010) that documents the impact of cleaning of swimming nets by councils on local population abundance.

j) Conclusion pursuant to Section 220F of the Act:

It is the opinion of the Fisheries Scientific Committee that *Hippocampus whitei* is:

a) facing a very high extinction risk in New South Wales in the near future, as determined in accordance with criteria prescribed by the regulations, and

b) is not eligible to be listed as a critically endangered species.

As such, *H. whitei* is eligible to be listed as an endangered species.

k) Assessment under the Common Assessment Method (CAM)

It is the opinion of the Fisheries Scientific Committee that *Hippocampus whitei* is eligible to be listed nationally as an endangered species under the Common Assessment Method.

l) Additional information

Fisheries Scientific Committee Management Recommendations for *H. whitei*

Current and recommended management and research actions that will benefit the conservation of the species:

- Collate and synthesise data collected to quantify the significance of high and moderate risk threat interactions with *Hippocampus whitei* (Medium priority).
- Reduce the impact of public and private boat moorings that impact on *Hippocampus whitei* habitats (High priority).
- Council to maintain best practice management of protective swimming nets by using the suggested NSW DPI seahorse friendly cleaning methods (High Priority).
- Consider information on *Hippocampus whitei* distribution, abundance and habitat preferences during development and review of Marine Park Zoning Plans (Medium priority).
- Negotiate with relevant authorities to encourage the identification, assessment and modification of natural resource management plans and policies to minimise impacts on *Hippocampus whitei* habitats (Medium priority).
- Continue to monitor the distribution and abundance of *Hippocampus whitei* at important sites (Port Stephens and Sydney Harbour) to inform population status and to assist in determining the effectiveness of recovery actions (High priority).
- Develop and trial artificial habitats to promote recovery of *Hippocampus whitei* populations (High priority).
- Implement research using eDNA to investigate the occurrence of *Hippocampus whitei* in estuaries and embayments across its range (High priority).

- Implement genetics research to investigate population structure of *Hippocampus whitei* across its entire range (NSW and QLD) (Medium priority).

- Encourage the reporting of sightings of seahorses along the east coast of Australia to iSeahorse and iNaturalist (Medium priority).

m) Statement on the standard of scientific evidence and adequacy of survey:

This assessment and determination has been prepared by the Fisheries Scientific Committee in good faith using the highest possible standard of scientific evidence and adequacy of survey.

As prescribed under Section 4 of the Intergovernmental MOU on the CAM, in preparing this documentation the Committee gave consideration to:

(i) the nature of the data, including adequacy of survey (occurrences) and monitoring (to detect change), including factors such as sampling design, effort applied, number of variables considered, proportion of a species' range covered, time period covered etc.;

(ii) the number of data sets relevant to the conclusion;

(iii) the range of uncertainty in the data and degree of consistency between different data sets;

(iv) the source of the data and its credibility; and

(v) the relevance of the data to the particular assessment criterion.

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