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**REGULAR PAPER**

# The endangered White's seahorse *Hippocampus whitei*)chooses artificial over natural habitats

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**ABSTRACT**

To explore whether the endangered White's seahorse *Hippocampus whitei* would choose to inhabit artificial over natural habitats, ten adult *H. whitei* individuals were put through a series of binary choice trials in aquaria, during which they were offered different paired combinations of natural (different types of macroalga and seagrass) and artificial habitat (panels of swimming-net material). It was found that *H. whitei* displayed a significant choice for swimming-net material over all other available natural habitats and chose habitats according to the following rankings: (1) Net; (2) *Sargassum* sp.; (3) *Posidonia australis*; (4) *Zostera muelleri*. *Hippocampus whitei*'s choice of swimming net material over natural habitat suggests that these artificial structures could be a useful conservation measure for seahorses in areas where natural habitat is becoming less favourable due to declines in abundance or quality.

**KEYWORDS**

conservation, habitat selection, seagrass, *Hippocampus whitei*, Syngnathidae, urbanised habitats

## 1 | INTRODUCTION

Increased urbanisation has resulted in a significant decline in natural habitat availability for marine animals (Gibson *et al*., 2007; Lai *et al*., 2015). As a result of decreased natural habitat

availability, which often affects species in combination with other negative influences such as disturbance and overfishing, marine animals have experienced significant population declines, with many species being threatened with extinction (Mace & Lande, 1991; Stuart *et al*., 2004; Airoldi *et al*., 2008; Waycott *et al*., 2009). Large areas of natural shorelines have been replaced by artificial structures in what is referred to as ocean sprawl, a phenomenon that is recognised as a significant threat to marine ecosystems (Airoldi & Beck, 2007; Firth *et al*., 2013, Dafforn *et al*., 2015). These artificial structures are deployed for a number of purposes, such as coastal defence (*e.g*., seawalls, breakwaters) and commercial (*e.g*., ports) or recreational use (*e.g*., swimming nets, marinas; Dafforn *et al*., 2015).

Artificial structures are considered to have a number of ecological implications for marine communities, including loss of biodiversity (Bulleri & Chapman, 2010; Gittman *et al*., 2016) and spread of invasive species (Dafforn *et al*., 2009; Simkanin *et al*., 2012). While the effect of artificial structures is considered mostly negative, there are cases of rare or threatened species seeking refuge on artificial structures where natural habitat may be absent or sparse (Garcia-Gomez *et al*., 2011; Claassens *et al*., 2018). Purpose-built structures in the form of artificial reefs have been commonly built to replace degraded habitat (Ambrose, 1994; Feary *et al*., 2011). There is also an increasing interest in building microhabitats in marine artificial structures to enhance native species colonisation through ecological engineering (*i.e*.,, the combination of ecological and engineering principles to design structures that benefit both humans and nature; Chapman & Underwood, 2011). Eco-engineering has been targeted at

threatened species in some cases; *e.g.*, drilling of pits into seawalls significantly increased the density of an over-exploited limpet in Portugal due to their association with this microhabitat on natural rocky shores (Martins *et al*., 2010). There exists the possibility that artificial structures, either pre-existing or purposefully created could be used as a tool in the conservation of threatened marine fishes.

The Syngnathidae are a family of marine fish that are especially susceptible to population collapse following habitat loss or overfishing due to low population densities, weak swimming abilities and small home range (Vincent & Foster 2004; 2011). A number of seahorse species (*Hippocampus* spp.) are considered threatened and are listed on the IUCN Red List as Vulnerable ($n$ = 12) or Endangered ($n$ = 2; IUCN, 2018). Natural seahorse habitats, such as macroalgae, sponges, soft coral and seagrass provides shelter from predators and an attachment holdfast for seahorses to grip with their prehensile tail while feeding or resting (Woods, 2002; Quin *et al*., 2014). Seahorses may be habitat specific (Lourie & Randall, 2003) and display strong habitat preferences depending on the species and life stage of the seahorse (Harasti *et al*., 2014; Gristina *et al*., 2014). In Brazil, the alga *Caulerpa racemosa* was the most frequently inhabited holdfast *in situ* for the slender seahorse *Hippocampus reidi* Ginsburg 1933 (Dias & Rosa, 2003). The long snouted seahorse *Hippocampus guttulatus* Cuvier 1829 and the short snouted seahorse *Hippocampus hippocampus* (L. 1758) have inhabited artificial habitat structures in a Ria Formosa lagoon (Portugal; 37$^{o}$ 012N, 08$^{o}$ 002W) that had suffered extensive natural habitat loss and showed strong selections for specific design materials and holdfast

densities (Correia *et al*., 2013; 2015). The endangered seahorse *Hippocampus capensis* Boulenger 1900 were more likely to inhabit artificial structures over natural habitat in *in situ* choice chambers (Claassens *et al*., 2018). Use of various habitats by seahorses may vary according to scale, location and species, but a pattern of strong affiliation with artificial habitat, even in the presence of natural habitats, is apparent.

In Australia, White's seahorse *Hippocampus whitei* Bleeker 1855 has undergone significant declines in abundance, most likely as a result of habitat loss (Harasti, 2016). In Port Stephens (NSW; 32$^{o}$ 422S, 152$^{o}$ 062E), *H. whitei* display ontogenetic differences in habitat use; juveniles tend to be found on gorgonian fan habitats whilst adults prefer soft coral and sponge habitats (Harasti *et al*., 2014). In Sydney Harbour, these preferred natural habitats (Gorgonian fans, soft coral and sponge) are largely absent. However, *H. whitei* has been observed inhabiting protective swimming nets, as well as natural habitats that are present in the harbour, such as the seagrasses *Posidonia australis* and *Zostera muelleri* and the brown alga *Sargassum* sp. (Vincent *et al*., 2005). *Hippocampus whitei* has been shown to inhabit swimming nets in relatively high numbers compared with patches of natural habitats around the harbour (Harasti *et al*., 2010). Most swimming nets are deployed for the entire year in Sydney Harbour, but some may be removed during the winter months or for cleaning (Harasti *et al*., 2010). When a new net is constructed, seahorses can take up to 4 months to colonise the new netting and numbers of seahorses on permanent netting were 10 to 100 times greater compared with those that were removed seasonally (Clynick, 2008). Further research found that the addition of further material

to a new net to increase structural complexity resulted in increased seahorse abundance on experimental nets in the field, with habitat preference assays in the labratory demonstrating that seahorses displayed a significant preference for swimming net material of higher complexity (Hellyer *et al*., 2011).

While we know about seahorse preferences of natural habitat in areas absent of swimming nets (Harasti *et al*., 2014) and seahorse preference of swimming-net material of varying complexity (Hellyer *et al*., 2011), it is not currently understood whether seahorses choose to inhabit artificial structures such as swimming nets over natural habitat when the two are in close proximity. This information is important because it may help explain the greater seahorse densities found on swimming nets than on natural habitat within Sydney Harbour. It is currently unknown whether seahorses inhabit swimming nets in high densities through choice or availability of suitable habitat. A series of experiments were held in aquaria to assess whether *H. whitei* choose swimming-net material over the natural habitats found in close proximity to nets in Sydney Harbour, while also exploring which of these natural habitats were more frequently chosen by *H. whitei*. The research tested the hypothesis that, in each binary habitat choice trial, the time spent on either habitat would differ significantly from 50%, indicating a choice has been made. From the results of these experiments, a choice ranking of *H. whitei* habitats is constructed.

## 2 | METHODS

This research was conducted under Department of Primary Industries scientific collections permit No: P17/0028-1.1 and with approval from the Sydney University Ethics Committee, project No. 2016/1066.

**2.1 | Seahorse collection and housing**

Ten *H. whitei* (five male and five female) were collected from the swimming net located at Chowder Bay, Sydney Harbour by scuba diving (11 May 2017). All individuals collected were at least 7cm total length from the top of the coronet to the end of the tail as this size means they considered adults. This measurement was used as a minimum length for *H. whitei* collection as it is at this size that the brood pouch becomes well defined, allowing for visual determination of sex (Harasti *et al*., 2012). Visual implant fluorescent elastomer (VIFE; Northwest Marine Technologies; www.nmt.us) was used as per Woods and Martin-Smith (2004) to give each *H. whitei* a unique tag for identification during and after the experiment. VIFE tagging is a harmless and effective method of applying individual identifiable tags to seahorses and has been successfully used for identification of experimental animals (Harasti, 2010). Tagging was performed to track individual *H. whitei* as they were moved among different tanks and choice. The provision of a unique tag also allowed for some degree of monitoring of fish health after

experiment completion, as all animals were released back onto the net at Chowder Bay after the aquaria habitat-choice experiments were completed.

*Hippocampus whitei* were kept in aquaria for a total of 3–4 weeks. They were given a week-long acclimation period, in which they were all kept in a 100 l tub with flow-through system of seawater from Chowder Bay. The water pumped through the system was at ambient sea temperature of 19.5–20.5$^{o}$C, as measured at Chowder Bay during the month of May 2017 and was pumped into each tub at a mean rate of 0.5 l min$^{-1}$. Holdfasts consisting of nylon rope, dowel wood poles and kelp were provided during this period to reduce stress. None of these nominal habitats were used in the choice experiments to prevent any initial bias. *Hippocampus whitei* were fed daily on a diet of enriched brine shrimp, as well as caprellid amphipods cultured on-site at Sydney Institute of Marine Science (SIMS).

**2.2 | Choice experiment habitats and design**

Two of the habitats used in this experiment, the alga *Sargassum* sp. and seagrass *Posidonia australis*, are native taxa found in Sydney Harbour, each known to be used as habitat by *H. whitei* (Harasti *et al*., 2014). The seagrass *Zostera muelleri* is also commonly found in Sydney Harbour and was included in this experiment to establish whether *H. whitei* would choose to inhabit *P. australis* over *Z. muelleri* when these seagrasses are equally available, as observed in previous field studies (Harasti *et al*., 2014; Manning *et al*., 2018).

Panels of netting were cut *in situ* from remnant netting material at Clifton Gardens. Only net panels with sufficient levels of epibiotic growth were used in this experiment, as previous research has shown that *H. whitei* prefers fouled to clean netting (Harasti *et al*., 2010) and bio-fouled nets are most frequently found in the wild; the exception being the immediate months after net cleaning occurs, or the installation of a new net. All habitats were placed in the flow-through system for one week prior to the experiment beginning to ensure associated food sources for *H. whitei* would be flushed, as to not introduce bias in their habitat selection.

It is recognised that while *H. whitei* were collected from one of the habitats that would be featured in the choice experiments (swimming net), any bias in seahorse habitat choice as a result of this is likely to be negligible. All natural habitats used in the choice experiments are present in close proximity to the Chowder Bay swimming net, so it is reasonable to expect that seahorses have encountered all of these habitats during their lives. Previous observations of tagged seahorses moving between habitats (Harasti *et al*., 2010), as well as current observations (M. Simpson, unpubl. data), indicate that *H. whitei* move between the swimming net and surrounding natural habitats at Chowder Bay, thus demonstrate that they can and do change habitats. The one week acclimation period that *H. whitei* experienced prior to the experiment also existed to minimise any pre-existing bias towards habitats featured in the choice experiments.

*Hippocampus whitei* were placed into 75 l habitat-choice chambers in which they were able to choose to inhabit one of two available habitats (Figure 1). Enough habitat was placed into each choice chamber to cover each respective tub wall (*c*. 30 x 30cm). Surface area, as opposed

to frond or holdfast density, was used in this experiment due to the wide variation in holdfast–frond size between habitats. All habitats were weighted to the tank floor with steel nuts, with nets being attached to the top of the tub with cable ties to ensure the material would stay upright. Fibreglass window mesh was needed to keep seagrass rhizomes intact, so mesh was placed underneath all habitats to remove any confounding effect of *H. whitei* habitat selection.

At the start of each experimental run, *H. whitei* were placed into the centre of the choice chamber in small plastic transport container, through which *H. whitei* could assess each habitat. *Hippocmpus whitei* were released after 5 min and their selection of habitat was recorded every 0.5 h for 12 h to give 24 data points in total using a Go-Pro camera (www.gopro.com) located 30 cm directly above each tank. After each 12 h period was completed, the proportion of time (*i.e*, data points) that *H. whitei* spent attached to each habitat in the chamber was calculated. A space of 24 h was held between experiments.

Six binary choice trial experiments were run, with each combination of habitats: (1) net *v. Z. muelleri;* (2) *Z. muelleri v*. *Sargassum* sp.; (3) net *v*. *Sargassum* sp.; (4) *P. australis v*. *Z. muelleri;* (5) *P. australis v*. *Sargassum* sp.; (6) *P. australis v*. net.

All *H. whitei* were tested in each habitat choice experiment and as they were being reused, a cross-over design was employed in order to dictate the order through which each *H. whitei* undertook subsequent experiments, as per Ratkowsky *et al*. (1993). Such a design allows for each fish to undertake the habitat-choice experiments in a different sequence, removing possible bias that may carry over from any previous experiment. To account for any possible

left-right bias of seahorses, five seahorses were used in each experiment in an XY (*i.e.*, habitat X on the left and habitat Y on the right) arrangement, while the other five experienced choices in a YX (*i.e.*, habitat Y on the left, habitat X on the right) arrangement. Different patches of habitat were used in each choice chamber experiment as to prevent any potential effect of co-specific odours in habitat selection. To maximise efficiency, ten choice chamber tanks were used at a time in each experimental run so that each *H. whitei* would be put through a choice experiment on a daily basis.

If a *H. whitei* was to spend 100% of time on the first habitat in the experiment title (for example, net in the net *v. Z. muelleri* experiment, then that data point will read 12 for that replicate. If the opposite occurs, the data point will read –12. Thus, if a *H. whitei* was to display zero choice and spend 50:50 time on either habitat in the experiment, a score of 0 will be recorded for that fish. Within experiments, one sample *t*-tests were used to compare the mean score of the ten *H. whitei* to a hypothetical test value of zero.

A contingency table of rank frequencies (1st or 2nd) for each habitat was constructed in order to determine a ranking of habitats. The transitivity of *H. whitei* habitat selections will be explored when observing habitat selection rankings, meaning that if habitat A is selected over habitat B and habitat B is selected of habitat C, then habitat A will be also be selected over C with no contradictions in choice (Regenwetter *et al*., 2011).

## 3 | RESULTS

### 3.1 | Habitat Choice Experiments

The mean choice score across all *H. whitei* differed significantly from the test-score of zero, indicating that choices of habitat had been made in all experiments (Table 1). Swimming net was chosen over *Z. muelleri*, *Sargassum* sp. and *P. australis* in experiments 1, 3 and 6, respectively. *Sargassum* sp. was chosen over *Z. muelleri* and *P. australis* in experiments 2 and 5, respectively. In experiment 4, *P. australis* was chosen over *Z. muelleri* (Figure 2).

### 3.2 | Ranking of Habitats

Net was chosen the greatest number of times throughout the experiments, with no other habitat being chosen over net throughout (Table 2 and Figure 2). Thus, net is ranked first out of the four habitats tested. *Sargassum* sp. was ranked second, as it was chosen twice over both species of seagrass. Of the two seagrass species, *P. australis* (ranked third) was chosen only over *Z. muelleri*, which was ranked fourth and chosen over no other habitats (Table 2 and Figure 2). This pattern is reflected in Figure 3, which shows that across all experiments, net had the greatest mean number of selections, followed by *Sargassum*, *P. australis* and *Z. muelleri*. As these data were not independent (time spent on one habitat is dependent on the time spent on the other), ANOVA tests were not possible. *Hippocampus whitei* habitat selections in this experiment were

transitive, with the results of each binary trial supporting a clear ranking of habitats; *i.e*., habitat A > B > C > D.

## 4 | DISCUSSION

As predicted, *H. whitei* displayed a significant choice of habitat during every choice trial, with the resulting ranking of chosen habitats showing that the swimming-net material is actively chosen over other equally available natural habitats. Of the natural habitats used in this experiment, *Sargassum* sp. was the highest ranked, with *P. australis* and *Z. muelleri* in 3rd and 4th respectively.

When dealing with experiments that involve threatened animals, researchers often have to compromise by using low animal numbers to decrease any possible threat or damage to the populations of these species that are already in decline. An obvious disadvantage is that a low sample size may impede robust statistical results. While the number of *H. whitei* used in this research ($n$ = 10) was adequate to test for habitat choice among *H. whitei* as a whole, we were unable to test differences in habitat choice between sexes ($n$ = 5).We feel this limitation is minor, however, as Harasti (2014) showed that there were no differences in habitat preference of *H. whitei*. There are methods by which low numbers of study animals can still be used successfully in experiments to gain robust results, such as the re-use of animals for subsequent experiments through the implementation of a cross-over design. This was the design used here for the habitat

choice experiment. However, when interpreting results from an experiment with low numbers such as this, it is advisable that the inevitable limitations be kept in mind.

Similar patterns to those observed here were obtained from work done on *Hippocampus capensis* in the Knysna Estuary (South Africa; Claassens *et al*., 2018). Much like *H. whitei* in Sydney Harbour, this seahorse inhabits artificial structures (Reno mattresses filled with rocks) in high densities despite the availability of natural habitat (Claassens *et al*., 2018). Claassens *et al*. (2018) showed that, when placed in a choice chamber and given the option to inhabit both, *H. capensis* would choose to inhabit artificial structures over equally present *Zostera capensis*. With habitat availability the suspected cause of *Hippocampus* spp. population declines in Ria Formosa lagoon, artificial holdfast units were deployed as a potential conservation tool for the species *H. guttulatus* and *H. hippocampus* (Correia *et al*., 2015). These artificial habitats were inhabited by large densities of *Hippocampus* spp., though results suggested that these units may have limited effect when placed in close proximity to undamaged, high complexity natural habitats (Correia *et al*., 2015). Although it is known that artificial habitats may be selected by seahorses such as *H. whitei*, it is not known how these choices work at scale, nor where large amounts of preferred habitat are present; *i.e*., soft coral and sponge habitats.

A number of factors dictate seahorse habitat choice and many of these may explain why *H. whitei* may choose swimming net over natural habitat. It is important to address a number of these factors that can be ruled out as a result of the design of this experiment. Often habitats in the wild will be selected because they are simply available in a higher abundance, offer a greater

or more readily available food source for the animal (Hellyer *et al*., 2011), or because one habitat offers greater protection from predation pressure (Chick and Mlvor, 1997). As habitats were offered to *H. whitei* at equal availability, rinsed of natural food sources and in isolation from potential predators, these reasons can be discarded as an explanation for habitat choice in this experiment. It is reasonable to presume, therefore, that *H. whitei* may be relying on other cues when choosing a habitat, such as visual cues (colour, shape, size) or the quality and suitability of the habitat as a holdfast. It is possible that *H. whitei* choose to inhabit swimming nets as these structures share some similarities with the natural branching habitats that *H. whitei* have inhabited in the wild.

As seahorses grasp onto holdfasts for shelter from water currents during feeding (Quin *et al*., 2014), they prefer solid, tubular holdfasts with greater complexity (Perante *et al*., 1998, Harasti *et al*., 2014). Swimming-net material would seem to fit these criteria more than the other habitats used in this experiment, despite not being natural. Seagrasses, while often a successful habitat for seahorses in the wild, may be less favourable of a holdfast because it possesses blade-like holdfast structures rather than solid tube-like holdfasts. While it is possible for *H. whitei* to grasp these structures and inhabit them if necessary, they may not be as suitable or stable as other habitat types. Among the two seagrass species used in this experiment, it was not surprising that seahorses chose *P. australis*, the species with the larger, more stable holdfast structure, over *Z. muelleri*. This was supported by studies in Nelson Bay, which showed that *H. whitei* are found in

higher densities in *P. australis* than *Z. muelleri* due to its greater blade length and density (Manning *et al*., 2018).

Juvenile seahorses may display a preference for *Sargassum* sp. in the wild as the smaller fronds provide a more suitable holdfast for the juveniles' smaller tails to grasp, while adult seahorses preferred bulkier holdfasts (Perante *et al*., 1998, Harasti *et al*., 2014). Thus, it is easier to understand why *H. whitei* may choose a sturdier, bulkier, similarly complex habitat such as net over *Sargassum* sp. These results suggest that holdfast stability and thickness is equally or more important to adult *H. whitei* when choosing habitat than complexity. Future research can implement studies on juvenile *H. whitei* habitat choice that include both artificial and natural habitat to further explore these differences in habitat choice. From the experiments in aquaria, we would expect to find *H. whitei* in higher densities on *Sargassum* sp. than on seagrass in the wild, but anecdotal evidence from surveys in Sydney Harbour suggest that this is not the case. It is possible that, while *Sargassum* sp. is the preferred habitat of *H. whitei* in a laboratory environment where both are of equal availability, *Sargassum* sp. is simply too patchy and seasonal in the wild, whereas *P. australis* tends to grow in larger beds and is year round. It may also be the case that, once food availability and protection from predation are taken into account, *P. australis* may be a preferable habitat for seahorses in the wild, as recently indicated by Manning *et al*., 2018. Studies have shown that fragmented islands of habitat result in less successful animal populations than larger, less fragmented blocks (Andren, 1994). While not explored in the habitat choice experiment, as the net panels used had only a small amount of

epibiotic algal growth, a reason for *H. whiteis* greater affiliation with swimming net as a habitat may be that the net has the capability to act as a base structure for other habitat-forming species to grow upon. Soft coral and sponge species can be found growing on some of the lesser maintained swimming nets around Sydney Harbour, as well as *Sargassum* sp. and the kelp *Ecklonia radiate*, which may further attract seahorses.

The results of the choice experiment emphasise the potential of artificial habitats as a valuable tool in the conservation of *H. whitei* in Australia and potentially worldwide. The observation that *H. whitei* will choose to inhabit swimming-net material in the presence of other natural habitats that may be in decline in the wild indicates that swimming nets could potentially be used to support *H. whitei* populations when natural habitat is dwindling, becoming patchier and as a result, a less viable habitat. In the future, priority should be placed on seahorse-friendly swimming-net management (Harasti *et al*., 2010), cleaning and construction materials. A key consideration when managing artificial habitats for *H. whitei* is that the artificial habitat presence results in increased *H. whitei* production at a site, rather than simply an attraction of *H. whitei* away from their natural habitat (Brickhill *et al*., 2005; Chapman *et al*., 2018). Similarly, it is important to explore whether *H. whitei* population fitness is equal on both artificial and natural habitats to ensure that *H. whitei* are not choosing a lesser quality habitat as a result of instinctual cues. This phenomenon is observed in the case of ecological traps (Schaepfler *et al*., 2002; Battin, 2004; Sherley, 2017) and can be an unintended consequence of restoration projects (Hale & Swearer, 2017). As *H. whitei* have been shown to not discriminate against viable habitats due

to their artificiality, this research suggests that *H. whitei* will choose to inhabit well designed artificial habitat that may be used to bolster *H. whitei* populations where natural habitat is absent.



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**Contributions**

M.S., R..LM., D.H. and R.A.C. conceived the ideas and designed the methodology; M.S. collected and analysed the data; M.S., R.L.M., D.H. and R.A.C. interpreted the data and wrote the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

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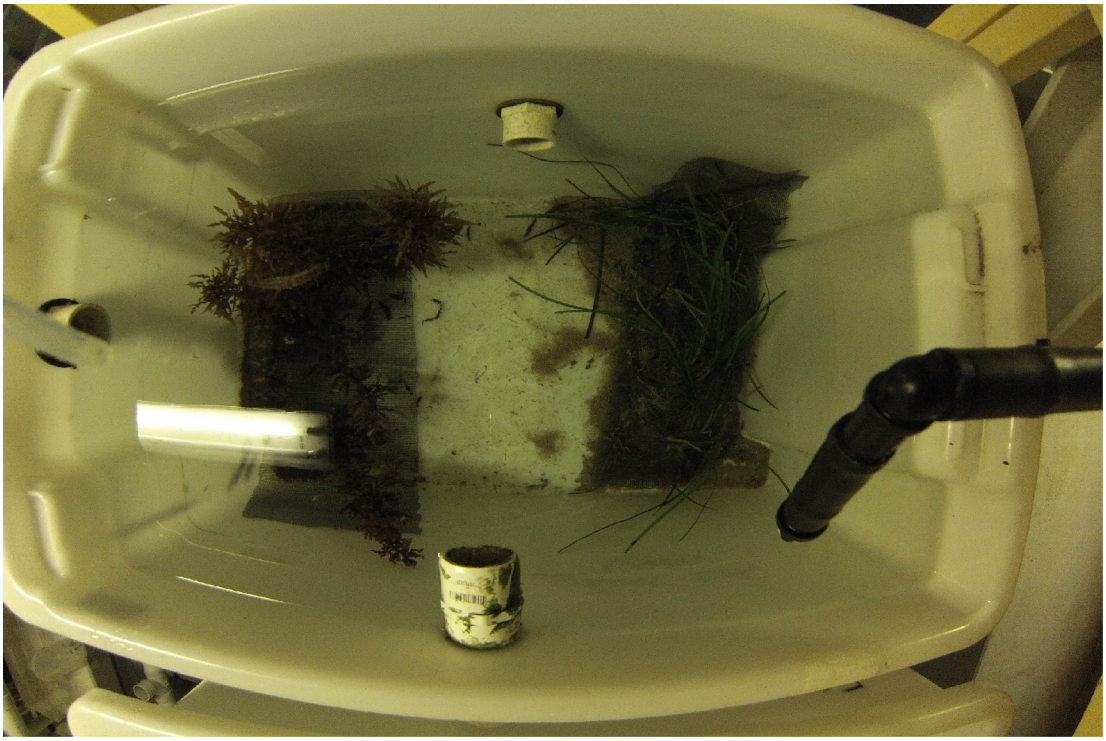

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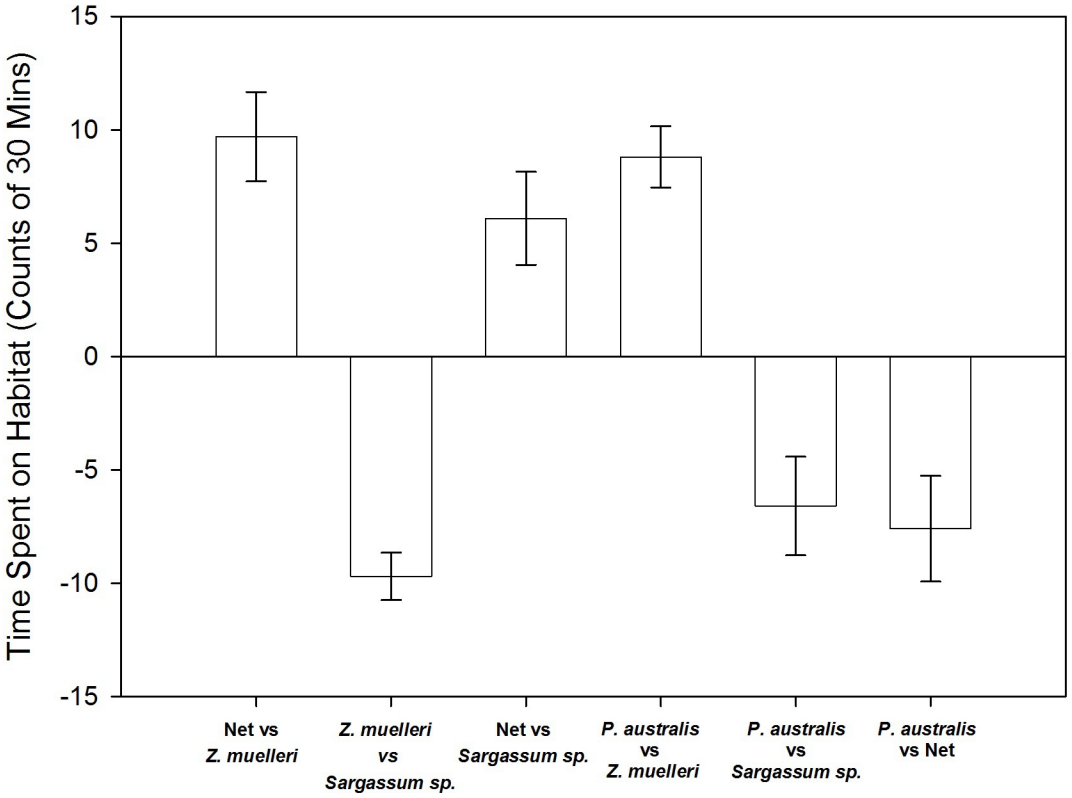


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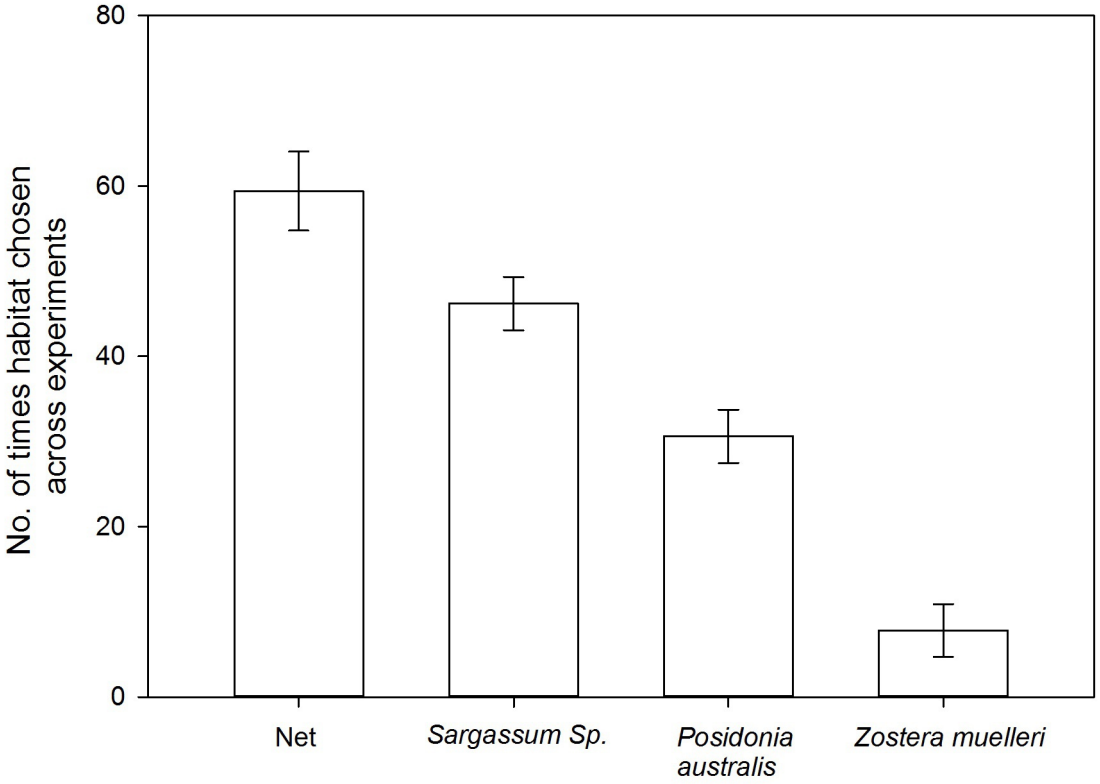


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**FIGURE 1** A 75 l tub 30 x 65 x 40 cm (base) choice chamber where *Hippocampus whitei* has the choice to inhabit either *Zostera muelleri* or *Sargassum* sp., each of *c.* 30 x 30cm. Cameras were placed 30 cm above the surface of the water.

**FIGURE 2** Mean (± SE) time that *Hippocampus whitei* spent on the first-choice habitat A in each pair of habitats presented as an A *v.* B test ($n$ = 10; Table 1). Habitats: Net, Swimming-net material; *Zostera muelleri*; *Posidonia australis*; *Sargassum* sp.

Typesetter

1 Change vs to *v.*

2 Change *sp*. to sp.

3 Change *P. australis* vs Net to *P. australis v*. net.

4 Chane y-axis to read Time on habitat ($n$ 30 $min^{-1}$).

5 Change hyphen minus signs to en dashes.

**FIGURE 3** Mean (± SE) number of times each habitat was chosen by *Hippocampus whitei* across all experiments ($n$ = 10).

**TABLE 1** Results of Student's *t*-tests run for each experiment, which tested the null hypotheses that the mean choice scores for *Hippocampus whitei* (within each experiment) were equal to zero. In a significant A *v.* B test, a positive t test indicates that habitat A has been chosen and *vice versa*.

| **Comparison** | ***t*** | **df** | ***P*** |
|---|---|---|---|
| Net *v*. *Z. muelleri* | 4.918 | 9 | < 0.001 |
| *Zostera. muelleri v*. *Sargassum* sp. | –9.291 | 9 | < 0.001 |
| Net *v*. *Sargassum* sp. | 2.965 | 9 | < 0.05 |
| *Posidonia australis v. Z. muelleri* | 6.527 | 9 | < 0.001 |
| *P. australis v. Sargassum* sp. | –3.039 | 9 | < 0.05 |
| *P. australis v.* Net | –3.262 | 9 | < 0.05 |

**TABLE 2** Contingency table of rank frequencies for each habitat. This table displays the frequency each habitat was ranked 1st or 2nd in a habitat choice experiment.

| | Ranks | |
|---|---|---|
| **Habitats** | **1st** | **2nd** |
| Net | 3 | 0 |
| *Sargassum* sp. | 2 | 1 |
| *Posidonia australis* | 1 | 2 |
| *Zostera. muelleri* | 0 | 3 |

Statement of Significance

Urbanisation presents a significant threat to the habitats of marine organisms, but it is possible that artificial structures may be attractive alternatives. To explore this, representatives of a locally threatened seahorse species (*Hippocampus whitei*) were put through binary choice trials in aquaria. Seahorses chose swimming net material over all other available natural habitats, which suggests that these nets could be a useful conservation measure for seahorses in areas where natural habitat is declining.