

Monitoring of marine INNS using submerged settlement panels

Stranraer Marina and Portpatrick Harbour, May to September 2017

Solway Firth Partnership September 2017



Stranraer Marina

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1. Introduction

The GB non-native species secretariat (2015a) defines an invasive non-native species (INNS) as “any non-native animal or plant that has the ability to spread causing damage to the environment, the economy, our health and the way we live.” Globally, 84% of marine ecoregions have reported marine invasion (Molnar *et al.*, 2008). In the UK marine environment INNS have the potential to pose a significant threat to native marine biodiversity and commercial interests. Scottish Natural Heritage is the overarching coordinator for NNS in Scotland and lead for terrestrial habitats and wetlands, whilst Marine Scotland lead for marine habitats.

Known impacts of INNS on native biodiversity are the spread of disease, competition for habitat and food and direct predation (GB NNSS, 2015b). Direct impacts include where biological indices display lower scores where INNS are present. Indirect impacts include where INNS densities are so high that a reduction in abundance of other taxa is observed (SEPA, 2013). The major pathways by which marine INNS are introduced include shipping, recreational boating, aquaculture stock movements and natural dispersal (GB NNSS, 2015c). Once INNS have established in a marine ecoregion, they are very difficult or even impossible to eradicate as many filter-feeding marine invertebrate animals live attached to solid surfaces and, along with algae, may be spread along coastlines marina-to-marina as fouling growth on the hulls of leisure craft. For this reason early detection and monitoring of marine INNS introduction is crucial.

2. Method

In 2016 panels were constructed following the methodology employed by John Bishop of the Marine Biological Association (MBA) of the UK. Panels were constructed from 15 x 15 cm panels made from 4 mm square black Correx polypropylene sheet. Holes were made in the top and bottom of the panel using a hole-puncher and a 6 oz fishing weight attached to the bottom hole using nylon fishing line, see Photo 1.

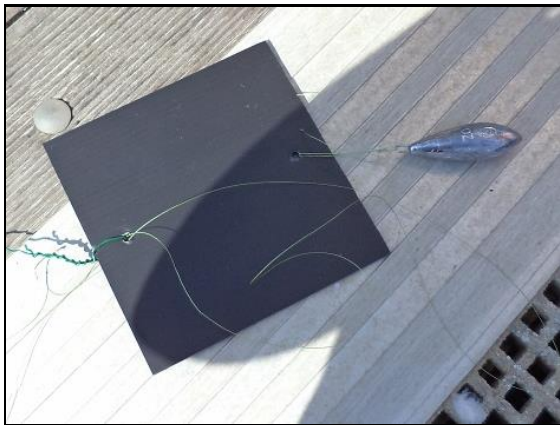


Photo 1 – Correx panel structure



Photo 2 – Complex Correx panel structure

In 2017 communication with Marine Scotland and Marine Services, Orkney resulted in a revised design of panel being used. A multi-surfaced settlement panel was constructed and used alongside the flat panel design. Both panels were rubbed with sandpaper to give a better gripping surface for colonising organisms (see Photo 2).

Twelve settlement panels, one of each type at six locations, were attached to pontoons within Stranraer Marina (Figure 1) on 23 May 2017. A further four panels, one of each type at two locations were attached to the RNLi pontoon at Portpatrick Harbour (Figure 2) on the same day.

The panels were attached to the underside of the pontoons and submerged to around one metre depth using strong paracord and weighed down with 6 oz fishing weights (Photo 3).

Stranraer was chosen as a repeat site for monitoring due to the ease of installing the panels and because the site is active with both recreational and fishing boats using the port. Portpatrick was also chosen as an active port used by mostly small recreation, tourism and fishing boats.

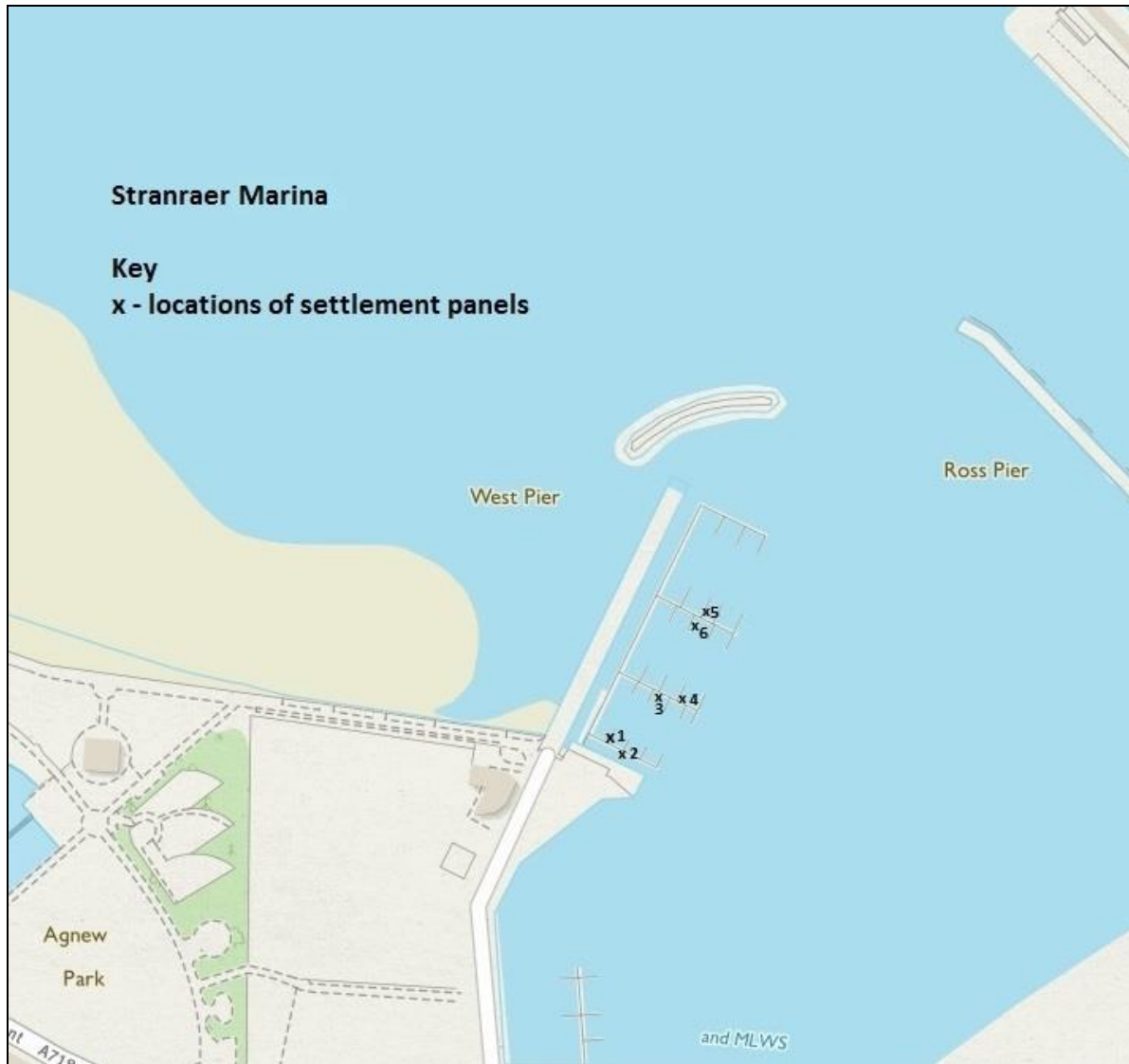


Figure 1: Stranraer Marina, Location of Settlement Panels, 1 – 6

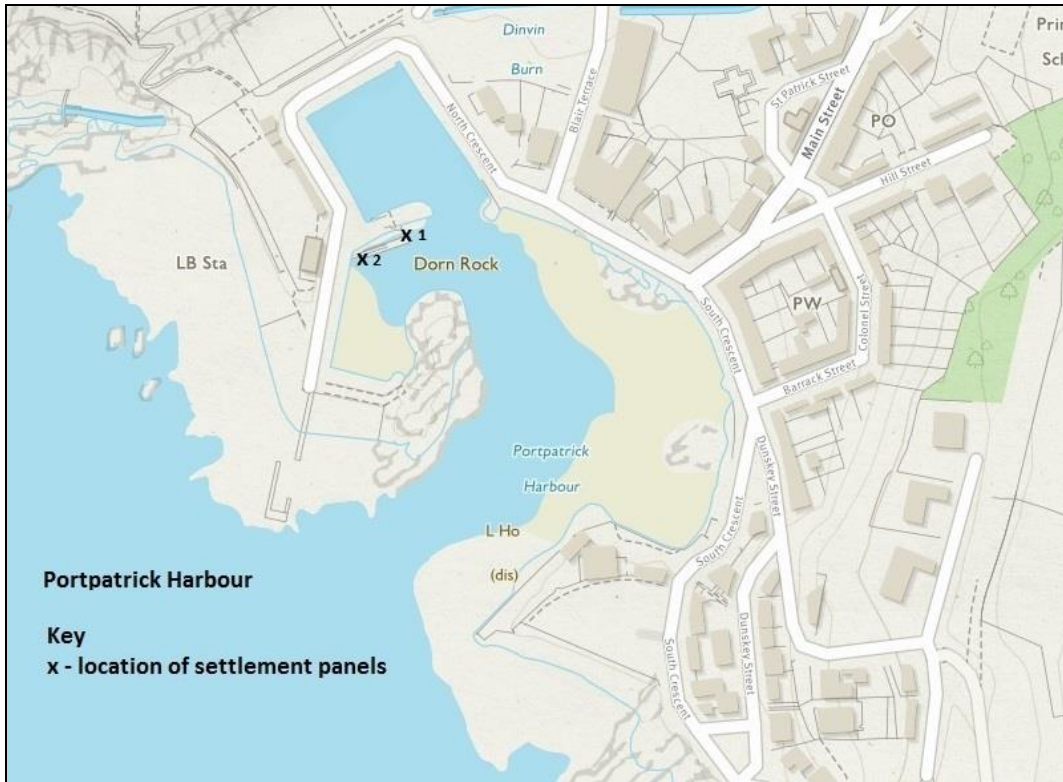


Figure 2: Portpatrick Harbour, Location of Settlement Panels, 1 – 2

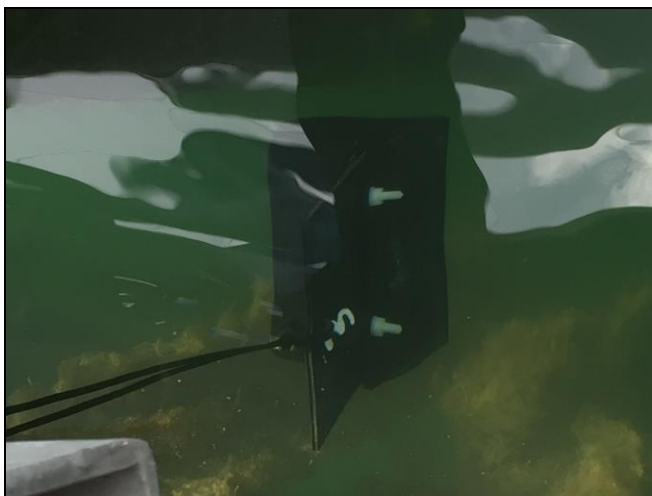


Photo 3 – Submerged complex Correx panel

After sixteen weeks, at the end of summer (12 September 2017) the panels were collected, photographed (Photos 4 and 5), scored for percentage cover of surface species and then discarded. Mobile organisms, including barnacle cyprids and crabs were counted individually. Each side of each panel was assessed individually for species present and percentage cover.



Photo 4 – Flat panel



Photo 5 – Complex panel

In addition, other species present on buoys and on the underside of the pontoon were recorded (Photos 6 and 7).



Photo 6 – Underside of buoy

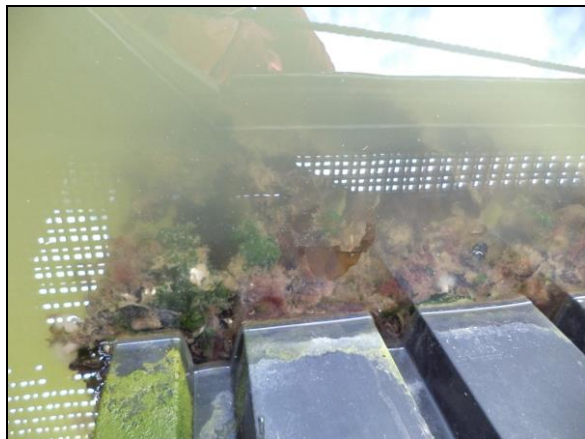


Photo 7 – Underside of pontoon

3. Results

Nine of the twelve panels installed in Stranraer marina were recovered. Both panels at location 1 were lost and the flat panel at location 6 was lost. Only two out of the four panels were recovered at Portpatrick marina. Complex and simple panels at location 1 were entangled and could not be safely retrieved.

A Rapid Assessment Survey (RAS) was also conducted at Stranraer, looking at the pontoons, buoys and vessels present. The invasive orange-tipped sea squirt, *Corella eumyota* was recorded during the RAS but no marine INNS additional to those on the panels were found. An assessment was not conducted at Portpatrick, as the floating pontoon where the panels were anchored was relatively small with no buoys available for inspection.

In contrast to the survey carried out in 2016 most of the panels recovered were colonised by a variety of species typical of a west coast harbour environment, with many individuals larger in size and at a later stage of growth than previously recorded using the non-scratched flat design panels. The space in the base of the complex panels was often accumulated with mud, tunicates and small crabs and worms. However, between the flat design and complex design panels, there was little difference in species assemblage, although the greater surface area of the complex panels could host more individuals. This suggests that the scratched surface of the panels was a determining factor in settlement rates of both native and marine INNS.

Species richness was higher than previously recorded; although this may be a result of changing the panel design and having a longer settlement period than in previous surveys (see Appendix I). The native tunicate, *Ascidella aspersa* as well as the green algae, *Cladophora rupestris*, and the peacock worm, *Sabella pavonina* appeared to dominate the assemblage of most recovered panels. The native tunicates ranged in size from 1 cm to >10 cm across all recovered panels. Other common species included the encrusting worm, *Pomatoceros triqueter* worm, blue mussel, *Mytilus edulis* and coral weed, *Corallina officianalis*. The sponge, *Sycon silicium* was also occasionally present at Stranraer.

The complex and simple panels recovered from Portpatrick had a lesser degree of colonisation, although juvenile oysters were recorded growing on the complex panel (It was unclear whether these were native, *Ostrea edulis* or Pacific oysters, *Crassostrea gigas*). No INNS were recorded at Portpatrick, although only being able to retrieve two out of four panels may have influenced this result. Juvenile oysters were also recorded on some of the panels at Stranraer marina.

The Japanese skeleton shrimp, *Caprella mutica*, which was recorded in multiple locations during the last INNS survey in Stranraer marina, was not found on either the panels or during a check of previously contaminated buoys. However, it remains uncertain whether the invasive shrimp is still present elsewhere within the marina.

The only marine invasive species confidently identified at Stranraer on the settlement panels was the orange-tipped sea squirt, *Corella eumyota*. However, it was unknown whether any of the barnacles found were the invasive Darwin's barnacle, *Elminius modestus* as the individuals were too small to identify.

4. Conclusion

This assessment found the marine invasive non-native species (INNS) orange-tipped sea squirt, as well as other macrofauna and algae appeared to more readily colonise the scratched surface panels as opposed to the previously used non-scratched flat panels. Both the scratched flat and complex panels also appeared to also have a greater succession of growth than was found in previous marine INNS surveys at Stranraer and Portpatrick.

Biodiversity was greater on the scratched simple and complex panels, with most frequently recorded species being the native tunicate, *Ascidiella aspersa* as well as the green algae, *Cladophora rupestris*, and the peacock worm, *Sabella pavonina*. Many individuals appeared well developed with the peacock worm and tunicate often > 5 cm in length. The structure provided by these dominant species allowed for the colonisation of other species such as the encrusting worm, *Pomatoceros triqueter* worm, blue mussel, *Mytilus edulis* and coral weed, *Corallina officianalis*.

The current study suggests re-visiting Stranraer marina again in the growing season of 2018 to see if species have changed or if the spread of INNS has changed. Portpatrick harbour should be visited at the same time to deploy INNS panels as the original panels from 2017 could not be recovered. Both sites would also benefit from a rapid site assessment, to allow for a more thorough INNS assessment, beyond the area in which the panels had been deployed.

Continued awareness of INNS gained from the use of the panels and the rapid site assessments will allow for improved biosecurity control of invasives at the two locations. It is recommended that the scratched panels as opposed to the non-scratched panels be used in future surveys to encourage settlement and colonisation.

5. References

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Personal Communication with Jenni Kakkonen, Marine Biologist with Marine Services in Orkney

Appendix 1: Stranraer and Portpatrick settlement panel results

Stranraer Marina Settlement Panels - Panels installed on 23/05/17 and retrieved and assessed on 12/09/17						
Panel No	Grid Ref	Species - Common Name	Species Name	Abundance	Invasive spp.?	Comments
1 - Flat	NX0587861181	Panel lost				
1 - Complex	NX0587861181	Panel lost				
2 - Flat	NX0588561176	Orange tipped sea squirt	<i>Corella eumyota</i>	R	Yes	4 individuals
2 - Flat	NX0588561176	Sugar kelp	<i>Saccharina latissima</i>	R	No	
2 - Flat	NX0588561176	Barnacles		R	Possible	Could be Darwin barnacles but too small to tell
2 - Flat	NX0588561176	Sea Squirt	<i>Asciidiella aspersa</i>	C	No	many small sea squirts approx. 1cm long
2 - Flat	NX0588561176	Green seaweed	<i>Cladophora rupestris</i>	A	No	
2 - Flat	NX0588561176	Worm	<i>Pomatoceros triqueter</i>	R	No	
2 - Flat	NX0588561176	Bryozoan	<i>Conopeum reticulum</i>	F	No	
2 - Complex	NX0588561176	Orange tipped sea squirt	<i>Corella eumyota</i>	C	Yes	23 individuals
2 - Complex	NX0588561176	Sponge	<i>Sycon ciliatum</i>	O	No	5 - 10 individuals
2 - Complex	NX0588561176	Blue mussel	<i>Mytilus edulis</i>	R	No	1 individual
2 - Complex	NX0588561176	Sea Squirt	<i>Asciidiella aspersa</i>	A	No	50+ individuals - Large sea squirts, approx. 5cm long
2 - Complex	NX0588561176	Kelp	<i>Laminaria hyperborea</i>	R	No	1 frond
2 - Complex	NX0588561176	Worm	<i>Pomatoceros triqueter</i>	F	No	
2 - Complex	NX0588561176	Sea lettuce	<i>Ulva lactuca</i>	R	No	1 frond
2 - Complex	NX0588561176	Bryozoan	<i>Conopeum reticulum</i>	R	No	
2 - Complex	NX0588561176	Ragworm	<i>Nereis virens</i>	R	No	1 individual
3 - Flat	NX0590260201	Orange tipped sea squirt	<i>Corella eumyota</i>	F	Yes	10 individuals
3 - Flat	NX0590260201	Sea Squirt	<i>Asciidiella aspersa</i>	A	No	50+ individuals - Large sea squirts, approx. 5cm long
3 - Flat	NX0590260201	Sea lettuce	<i>Ulva lactuca</i>	R	No	
3 - Flat	NX0590260201	Peacock Worm	<i>Sabella pavonina</i>	S	No	
3 - Flat	NX0590260201	Shrimp	<i>Gammarus sp</i>	R	No	10 individuals

3 - Flat	NX0590260201	Coralweed	<i>Corallina officinalis</i>	O	No	
3 - Flat	NX0590260201	Barnacles		O	Possible	
3 - Complex	NX0590260201	Sponge	<i>Sycon ciliatum</i>	R	No	1 individual
3 - Complex	NX0590260201	Barnacles		O	Possible	
3 - Complex	NX0590260201	Sea Squirt	<i>Asciella aspersa</i>	F	No	
3 - Complex	NX0590260201	Red Comb weed	<i>Plocamium cartilagineum</i>	R	No	
3 - Complex	NX0590260201	Peacock Worm	<i>Sabella pavonina</i>	F	No	
3 - Complex	NX0590260201	Coralweed	<i>Corallina officinalis</i>	O	No	
3 - Complex	NX0590260201	Green seaweed	<i>Cladophora rupestris</i>	C	No	
3 - Complex	NX0590260201	Shrimp	<i>Gammarus sp</i>	O	No	
3 - Complex	NX0590260201	Worm	<i>Pomatoceros triqueter</i>	R	No	
3 - Complex	NX0590260201	Green shore crab	<i>Carcinus maenas</i>	R	No	2 individuals
4 - Flat	NX0591261198	Blue mussel	<i>Mytilus edulis</i>	R	No	1 individual
4 - Flat	NX0591261198	Sea Squirt	<i>Asciella aspersa</i>	A	No	60 individuals
4 - Flat	NX0591261198	Peacock Worm	<i>Sabella pavonina</i>	A	No	
4 - Flat	NX0591261198	Coralweed	<i>Corallina officinalis</i>	C	No	
4 - Flat	NX0591261198	Sea lettuce	<i>Ulva lactuca</i>	R	No	
4 - Flat	NX0591261198	Worm	<i>Pomatoceros triqueter</i>	R	No	
4 - Flat	NX0591261198	Sea slug	<i>Polycera quadrilineat</i>	R	No	1 individual
4 - Complex	NX0591261198	Orange tipped sea squirt	<i>Corella eumyota</i>	R	Yes	3 individuals
4 - Complex	NX0591261198	Barnacles		R	Possible	
4 - Complex	NX0591261198	Blue mussel	<i>Mytilus edulis</i>	R	No	1 individual
4 - Complex	NX0591261198	Sea Squirt	<i>Asciella aspersa</i>	A	No	50 individuals
4 - Complex	NX0591261198	Coralweed	<i>Corallina officinalis</i>	C	No	
4 - Complex	NX0591261198	Star Ascidian	<i>Botryllus shlosseri</i>	R	No	
4 - Complex	NX0591261198	Peacock Worm	<i>Sabella pavonina</i>	C	No	
4 - Complex	NX0591261198	Orange colonial sea squirt		R	No	Most likely to be a polyclinid ascidian
5 - Flat	NX0592261234	Orange tipped sea squirt	<i>Corella eumyota</i>	R	Yes	1 individuals
5 - Flat	NX0592261234	Sponge	<i>Sycon ciliatum</i>	O	No	5 individuals
5 - Flat	NX0592261234	Blue mussel	<i>Mytilus edulis</i>	R	No	5 individuals
5 - Flat	NX0592261234	Sea Squirt	<i>Asciella aspersa</i>	C	No	

5 - Flat	NX0592261234	Green seaweed	<i>Cladophora rupestris</i>	A	No	
5 - Flat	NX0592261234	Peacock Worm	<i>Sabella pavonina</i>	C	No	
5 - Flat	NX0592261234	Sea lettuce	<i>Ulva lactuca</i>	R	No	
5 - Flat	NX0592261234	Oyster	?	R	No	Small spats settled on panels – unable to ID as native or Pacific oysters
5 - Complex	NX0592261234	Orange tipped sea squirt	<i>Corella eumyota</i>	O	Yes	13 Individuals - all large <5cm
5 - Complex	NX0592261234	Sponge	<i>Sycon ciliatum</i>	O	No	5 individuals
5 - Complex	NX0592261234	Barnacles		R	Possible	
5 - Complex	NX0592261234	Blue mussel	<i>Mytilus edulis</i>	R	No	3 individuals
5 - Complex	NX0592261234	Sea Squirt	<i>Asciella aspersa</i>	C	No	large <5cm
5 - Complex	NX0592261234	Green seaweed	<i>Cladophora rupestris</i>	C	No	
5 - Complex	NX0592261234	Peacock Worm	<i>Sabella pavonina</i>	A	No	
5 - Complex	NX0592261234	Sea lettuce	<i>Ulva lactuca</i>	R	No	
5 - Complex	NX0592261234	Green Shore Crab	<i>Carcinus maenas</i>	R	No	1 individual
6 - Flat	NX0591961232	Panel lost				
6 - Complex	NX0591961232	Orange tipped sea squirt	<i>Corella eumyota</i>	O	Yes	7 Individuals
6 - Complex	NX0591961232	Sponge	<i>Sycon ciliatum</i>	O	No	6 individuals
6 - Complex	NX0591961232	Barnacles		R	Possible	
6 - Complex	NX0591961232	Blue mussel	<i>Mytilus edulis</i>	F	No	30 individuals
6 - Complex	NX0591961232	Sea Squirt	<i>Asciella aspersa</i>	C	No	large <5cm
6 - Complex	NX0591961232	Green seaweed	<i>Cladophora rupestris</i>	C	No	
6 - Complex	NX0591961232	Peacock Worm	<i>Sabella pavonina</i>	O	No	
6 - Complex	NX0591961232	Worm	<i>Pomatoceros triqueter</i>	R	No	
6 - Complex	NX0591961232	Sea lettuce	<i>Ulva lactuca</i>	R	No	
6 - Complex	NX0591961232	Green Shore Crab	<i>Carcinus maenas</i>	R	No	1 individual
6 - Complex	NX0591961232	Oyster	?	R	No	Small spats settled on panels – unable to ID as native or Pacific oysters

Other records from Marina (not already recorded above)	Under pontoons	Plumose anemone	<i>Metridium senile</i>	O	No	
	Under pontoons	Irish sea moss	<i>Chondrus crispus</i>	R	No	
	Under pontoons	Sea mat	<i>Conopeum reticulum</i>	R	No	

Portpatrick Marina Settlement Panels - Panels installed on 23/05/17 and retrieved and assessed on 12/09/17

1 - Flat	NW9981354146	Barnacles		R	Possible	
1 - Flat	NW9981354146	Star Ascidian	<i>Botryllus shlosseri</i>	O	No	
1 - Flat	NW9981354146	Sea mat	<i>Conopeum reticulum</i>	O	No	
1 - Flat	NW9981354146	Green seaweed	<i>Cladophora rupestris</i>	R	No	
1 - Flat	NW9981354146	Worm	<i>Pomatoceros triqueter</i>	R	No	
1 - Flat	NW9981354146	Sea lettuce	<i>Ulva lactuca</i>	R	No	
1 - Complex	NW9981354146	Sponge	<i>Sycon ciliatum</i>	R	No	1 individual
1 - Complex	NW9981354146	Orange tipped sea squirt	<i>Corella eumyota</i>	C	Yes	20 individuals
1 - Complex	NW9981354146	Star Ascidian	<i>Botryllus shlosseri</i>	R	No	
1 - Complex	NW9981354146	Green seaweed	<i>Cladophora rupestris</i>	F	No	
1 - Complex	NW9981354146	Worm	<i>Pomatoceros triqueter</i>	R	No	
1 - Complex	NW9981354146	Coralweed	<i>Corallina officinalis</i>	R	No	
1 - Complex	NW9981354146	Green Shore Crab	<i>Carcinus maenas</i>	R	No	1 individual
1 - Complex	NW9981354146	Oyster	?	R	No	Small spats settled on panels– unable to ID as native or Pacific oysters
2 - Flat	NW9979154137	Unable to retrieve				
2 - Complex	NW9979154137	Unable to retrieve				

Abbreviation SACFOR		Percentage (%)
S	Super-Abundant	80-100
A	Abundant	40-80
C	Common	20-40
F	Frequent	10-20

O	Occasional	5-10
R	Rare	>5
