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# The Marine Invasive Non-Native Species *Didemnum vexillum*: Survey of intertidal and shallow sub-tidal artificial infrastructure in Loch Creran

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## Background

A Rigid Inflatable Boat (RIB) survey of Loch Creran took place on Tuesday 1<sup>st</sup> and Wednesday 2<sup>nd</sup> of November 2016, to look for the presence of *Didemnum vexillum* (Dvex) on structures within the loch. A range of floating, natural and artificial hard structures were looked at during the survey. Three MSS staff (Matt Gubbins, Paul Macdonald and Lyndsay Brown) and two SNH staff (David Donnan and Jane Dodd) were involved. Types of structures that were surveyed are listed in Table 1 and Table 2 provides details for each structure. Areas of the loch surveyed with location of structures are detailed in Figure 1.

**Table 1**

Type and number of structures surveyed within the loch.

<b>Structure type</b>	<b>No. of structures surveyed</b>
Individual moorings (M)	29
Vessels plus their moorings (VM)	11
Disused mussel farm moorings (MFM)	5
Rafts (R)	2
Piers (PR)	2
Pontoons (PN)	3
Bridge (B)	1
Natural mussel bed (NMB)	1

A combination of visual inspection and live camera feed via a pole-cam was used in the survey. At each structure the pole-cam was lowered into the water and gently manoeuvred around the structure while the live feed was monitored on a screen (Figure 1). Live feed was recorded on a GoPro that was also attached to the pole so that footage could be played back for closer, clearer inspection of fouling (Figure 2).

No Dvex-looking material was observed on any surveyed structure. General fouling communities consisting of algae, mussels, barnacles, amphipods, bryozoans and solitary and colonial sea squirts were found on moorings, pontoons, piers, rafts and the bridge (Figures 3 – 20). Vessel hulls were in good order, some with the beginnings of an algal biofilm and barnacles. Screen shots from GoPro footage show typical fouling on each of the surveyed structure types (Figures 21 – 29). No colonial sea squirt observed resembled Dvex, however two unidentified samples were collected for molecular identification to confirm that they are not Dvex (M29 (LcDv42) and R1 (LcDv41), Table 2 and Figure 16). Sequencing of the partial COI gene indicated that the unidentified organisms was not Dvex but a *Rophalaea*-like tunicate.

Water sampling for further investigative work into the feasibility of eDNA took place off the Caledonian Oysters site and South Shian Fisheries site. Three replicates at three different locations at each site were collected (Table 3).

**Table 2**

Details of structures surveyed and Dvex observations.

Survey ID	Structure	Date	Time	Lat/long	Dvex observation
M1	Mooring	1/11/16	12.03	56 33.188N, 005 15.828W	-ve
M2	Mooring	1/11/16	12.06	56 33.218N, 005 15.879W	-ve
VM1	Vessel 'Spindrift' and mooring	1/11/16	13.14	56 33.215N, 005 15.904	-ve
M3	Mooring	1/11/16	12.22	56 32.891, 005 17.037W	-ve
NMB	Mussel bed	1/11/16	12.29	56 32.936, 005 16.885W	-ve
B1	Bridge pier	1/11/16	12.39	56 32.838N, 005 17.428	-ve
M4	Creagan Inn 1	1/11/16	12.54	56 32.951N, 005 18.057W	-ve
M5	Creagan Inn 2	1/11/16	12.59	56 32.968, 005 18.067W	-ve
M6	Creagan Inn 3	1/11/16	13.01	56 32.993N, 005 18.068W	-ve
M7	Mussel farm (single buoy)	1/11/16	13.36	56 32.517N, 005 19.434W	-ve
M8a	Mussel farm (group of buoys)	1/11/16	13.48	56 32.492N, 005 19.494W	-ve
M8b	Single buoy beside group	1/11/16	13.59	56 32.488N, 005 19.500W	-ve
M9	Second group of buoys	1/11/16	14.17	56 32.355N, 005 19.668W	-ve

M10	Third group of buoys	1/11/16	14.45	56 32.224N, 005 19.814W	-ve
PR1	Old pier at Creran moorings	1/11/16	13.04	56 31.680N, 005 19.288W	-ve
PR2	Barcaldine MRC pier	1/11/16	15.11	56 31.715N, 005 19.095W	-ve
PN1	Scottish Sea Farms pontoon at MRC	1/11/16	15.28	56 31.719N, 005 19.036W	-ve
M11	Yellow mooring off MRC	1/11/16	15.40	56 31.742N, 005 19.200W	-ve
M12	Creran moorings	1/11/16	15.42	56 31.737N, 005 19.237W	-ve
M13	Creran moorings	1/11/16	15.45	56 31.733N, 005 19.272W	-ve
M14	Creran moorings	1/11/16	15.46	56 31.735N, 005 19.332W	-ve
M15	Creran moorings	1/11/16	15.48	56 31.740N, 005 19.375W	-ve
M16	Creran moorings	1/11/16	15.50	56 31.732N, 005 19.408W	-ve
M17	Creran moorings	1/11/16	15.52	56 31.746N, 005 19.441W	-ve
M18	Creran moorings	1/11/16	15.55	56 31.768N, 005 19.495	-ve
M19	Grey mooring east of MRC	2/11/16	11.12	56 32.027N, 005 18.695W	-ve
VM2	Vessel 'SSF' and mooring	2/11/16	11.18	56 32.000N, 005 18.746W	-ve
M20	Grey mooring	2/11/16	11.27	56 32.029N, 005 18.788W	-ve
VM3	Vessel 'Felsted' and mooring	2/11/16	11.31	56 32.051N, 005 18.838W	-ve
M21	Grey buoy	2/11/16	11.49	56 32.302N, 005 18.601W	-ve
M22	Creel buoy	2/11/16	11.55	56 32.221N, 005 18.703W	-ve
M23	Yellow buoy	2/11/16	11.57	56 32.137N, 005 18.896W	-ve
M24	Green navigation buoy	2/11/16	12.03	56 31.876N, 005 19.162W	-ve
VM4	Vessel 'Legend of Brough' and mooring	2/11/16	12.09	56 31.877N, 005 19.018W	-ve
VM5	Vessel 'Staffa Tours' and mooring	2/11/16	12.13	56 31.721N, 005 19.171W	-ve
VM6	Vessel 'Serpula' and moorings	2/11/16	12.19	56 31.678N, 005 19.354W	-ve
M25	Navigation mark on west side Creran moorings	2/11/16	12.27	56 31.687N, 005 19.600W	-ve

M26	Moorings at South Shian	2/11/16	14.04	56 31.594N, 005 24.283W	-ve
M27	Mooring	2/11/16	14.10	56 31.580N, 005 24.323W	-ve
M28	Mooring	2/11/16	14.15	56 31.607N, 005 24.330W	-ve
M29	Small mooring	2/11/16	14.20	56 31.634N, 005 24.330W	-ve but UI suspect sample collected was <i>Rophalaea</i> - like
M30	Small mooring	2/11/16	14.32	56 31.664N, 005 24.289W	-ve
M31	mooring	2/11/16	14.40	56 31.701N, 005 24.246W	-ve
R1	Ex mussel raft – now tern colony	2/11/16	14.47	56 31.762N, 005 23.996W	-ve but UI suspect sample collected was <i>Rophalaea</i> - like
M32	Red mooring	2/11/16	15.10	56 31.174N, 005 23.802W	-ve
M33	Mooring	2/11/16	15.13	56 31.111N, 005 23.915W	-ve
M34	Mooring	2/11/16	15.15	56 31.076N, 005 23.924W	-ve
VM7	Vessel 'Tilleadh' and mooring	2/11/16	15.18	56 31.031N, 005 23.900W	-ve
VM8	Vessel moored off Caledonian Oysters site	2/11/16	15.29	56 30.798N, 005 22.513W	-ve
R2	Raft at sealife centre	2/11/16	15.40	56 31.170N, 005 20.538W	-ve
VM9	Vessel 'Audrey' and mooring	2/11/16	15.44	56 31.168N, 005 20.627W	-ve
VM10	Vessel 'Louise' and mooring	2/11/16	15.47	56 31.167N, 005 20.586W	-ve
VM11	Vessel 'Three Girls' and mooring	2/11/16	15.50	56 31.168N, 005 20.556W	-ve
PN2	Sealife centre pontoon	2/11/16	15.53	56 31.141, 005 20.598W	-ve
PN3	MRC pontoon	2/11/16	16.05	56 31.776N, 005 18.924W	-ve

**Table 3**

Water sampling details.

<b>Survey ID</b>	<b>Area</b>	<b>Date</b>	<b>Time</b>	<b>Lat/long</b>	<b>Depth (m)</b>
HV farm 1	Off Caledonian Oysters farm	2/11/16	12.46	56 30.838N, 005 23.088W	Not recorded
HV farm 2	Off Caledonian Oysters farm	2/11/16	12.51	56 30.877N, 005 23.137W	2.5
HV farm 3	Off Caledonian Oysters farm	2/11/16	12.59	56 30.996N, 005 23.295W	2.2
RT farm 1	Off South Shian Fisheries farm	2/11/16	13.16	56 31.603N, 005 24.069W	6.8
RT farm 2	Off South Shian Fisheries farm	2/11/16	13.25	56 31.573N, 005 24.308W	7.0
RT farm 3	Off South Shian Fisheries farm	2/11/16	13.34	56 31.594N, 005 24.378W	5.5



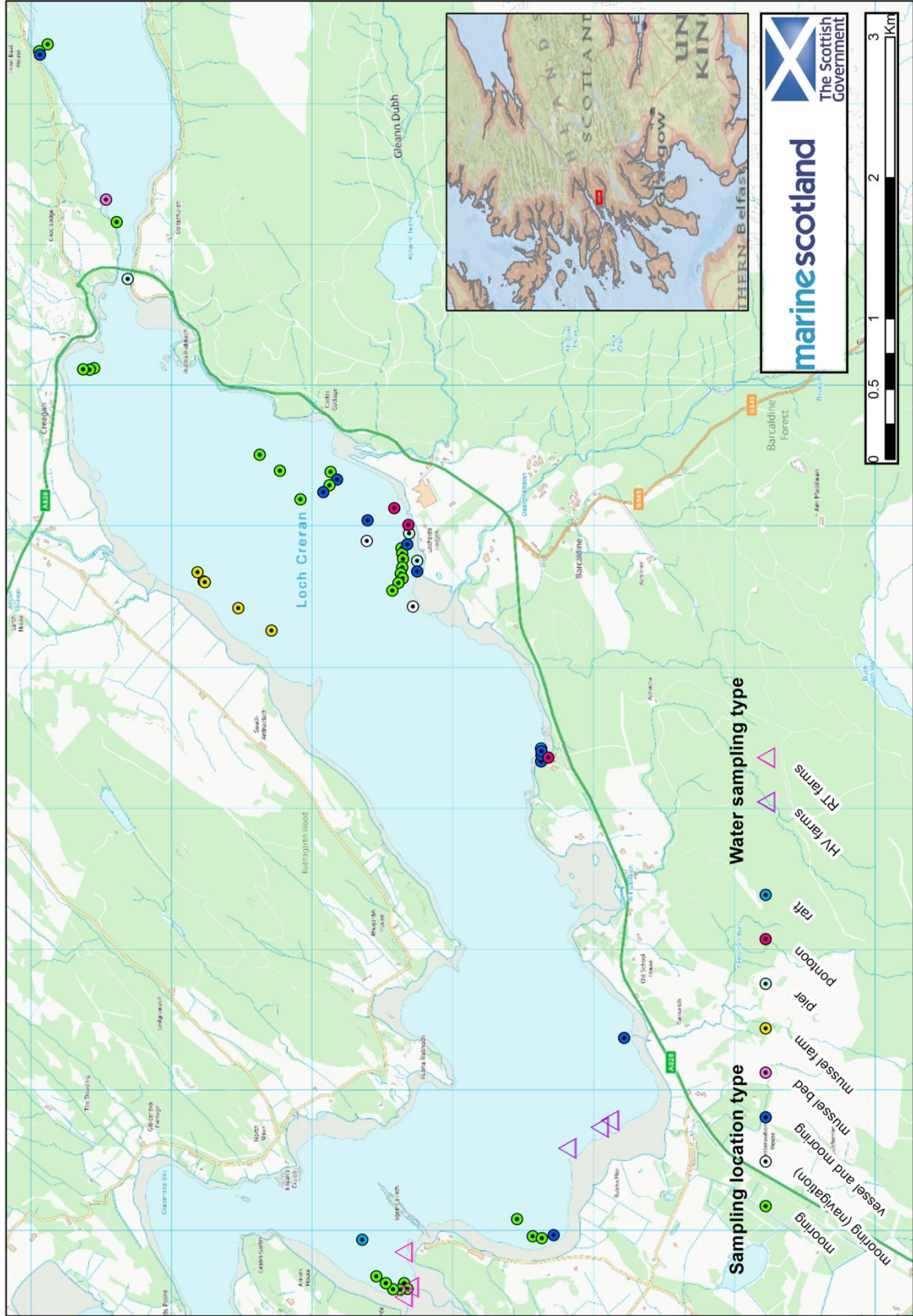


Figure 1: Areas of the loch surveyed showing locations of structures.



**Figure 2:** Pole-cam surveying a mooring.



**Figure 3:** Pole-cam with GoPro attached.





**Figure 4:** Typical fouling of algae and mussels on mooring

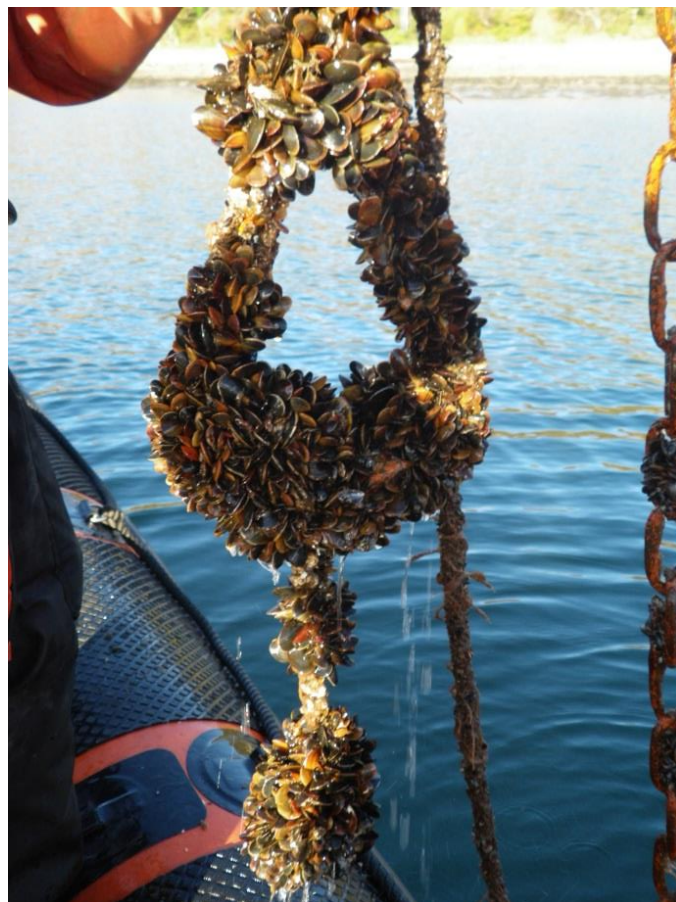


**Figure 5:** Fouling of mussels and barnacles on central stanchion of bridge.





**Figure 6:** Light fouling of barnacles and mussels on mooring, with mussels visible on the mooring chain.



**Figure 7:** Heavy fouling of mussels on mooring rope.



**Figure 8:** Some fouling of barnacles on disused mussel farm moorings.

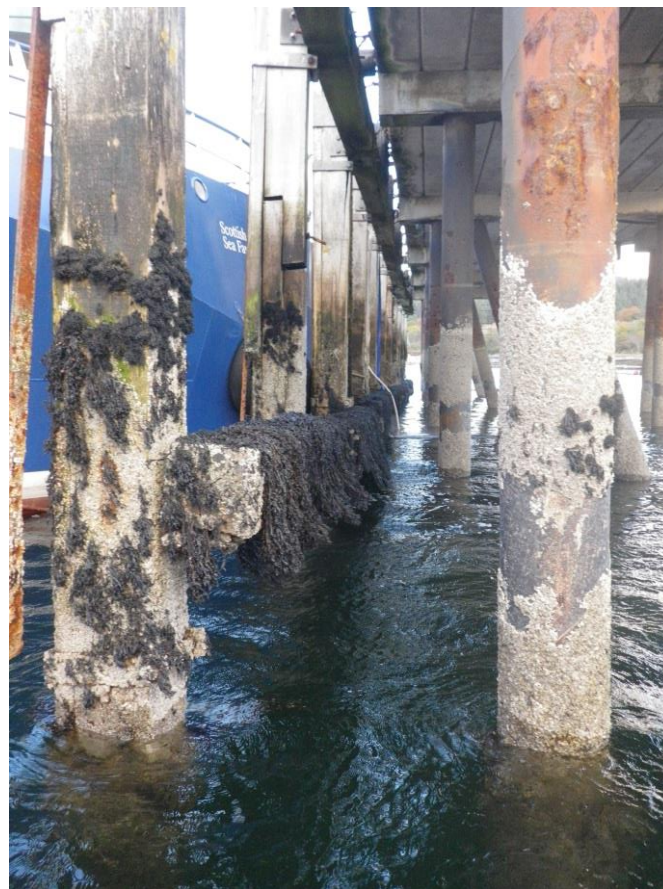


**Figure 9:** Heavy general fouling assemblage on disused mussel farm netting.





**Figure 10:** Sections of old pier at Creran Moorings.



**Figure 11:** Fouling of pier at Barcaldine, Marine Resource Centre with algae, mussels and barnacles.



**Figure 12:** Scottish Sea Farms pontoon at the Marine Resource Centre.

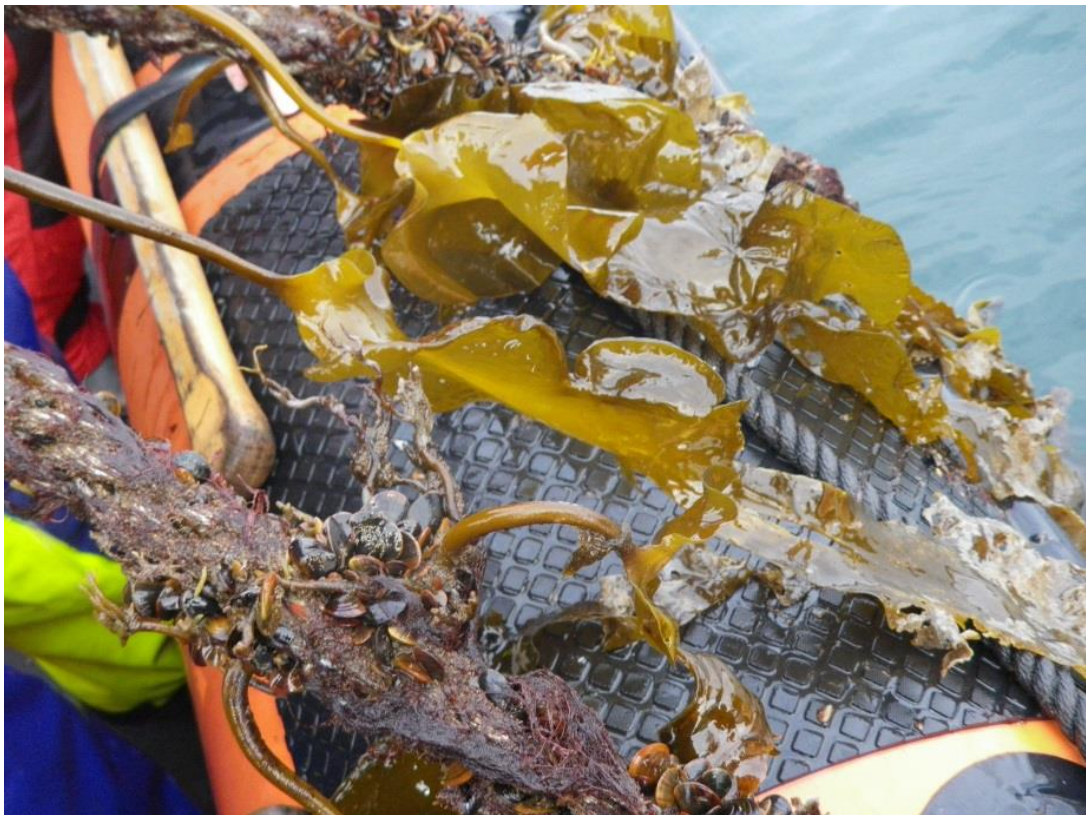


**Figure 13:** Light algal biofilm on mooring.





**Figure 14:** Hydroids and some algae present on a mooring.



**Figure 15:** Fouling of algae and mussels on mooring ropes.





**Figure 16:** Unidentified colonial tunicate (*Rophalaea*-like) on mooring M29.



**Figure 17:** Unused mussel raft currently used as tern colony.



**Figure 18:** Raft at Sealife Centre.



**Figure 19:** Pontoon at Sealife Centre.





**Figure 20:** Pontoon at Marine Resource Centre.



**Figure 21:** Video footage still of vessel hull.



**Figure 22:** Video footage still of vessel mooring chain.



**Figure 23:** Video footage still of vessel mooring underside.



**Figure 24:** Video footage still of disused mussel farm mooring and ropes.



**Figure 25:** Video footage still of raft.





**Figure 26:** Video footage still of pier stanchion.



**Figure 27:** Video footage still of pontoon underside.



**Figure 28:** Video footage still of bridge stanchion.



**Figure 29:** Video footage still of natural mussel bed.

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