Citizen Science Search for Seagrass

*Zostera noltii* and *Zostera marina*

on the Republic of Ireland Coast

Coastwatch

Collated by Karin Dubsky and Angel Duarte Campos

Final June 2019

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Surveyors data analyses and seagrass distribution maps by Angel Duarte Campos.
Abstract
This report summarises a first Coastwatch volunteer seagrass location audit and ways to overcome search and identification problems, before setting out verified Zostera marina and Z. noltii bed locations found by citizen scientists around the Irish coast. Highlights include confirmed new seagrass records, with GIS mapping of these locations to 500m Coastwatch survey unit level. The report also includes notes on seagrass pressures and makes recommendations for better seagrass protection and management in Ireland. On a broader scale, it draws tentative conclusions on including citizen science seagrass surveys and observations in the implementation of EU water law - the WFD and the MSFD.
Seagrass Species Around Ireland and Ecosystem Services.

Most seagrass, or eelgrass found around the Irish coast belongs to the genus *Zostera* with two species generally recognised, the subtidal and intertidal *Zostera marina* and the intertidal *Zostera noltii*. *Z marina* has a variant *Z. angustifolia* which grows in shallow water. There are also some rare records of *Ruppia maritima*, but in this study surveyors were focused on the *Zostera* species.

<table>
<thead>
<tr>
<th><em>Zostera marina</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Flat grass blade with visible veins and smooth rounded tip</td>
</tr>
<tr>
<td>• Closed sheath (cover of the grass blade)</td>
</tr>
<tr>
<td>• Rhizome robust with terminal shoots</td>
</tr>
<tr>
<td>• 2 bundles of roots per node</td>
</tr>
<tr>
<td>• Flowers (rarely seen) on repeatedly branched stem.</td>
</tr>
</tbody>
</table>

*Z marina* which is typically 30cm to 1 m long (longest seen in Ireland by Coastwatchers was 1.9m) *Z marina* meadows or beds are only exposed in spring low tides. *Zostera angustifolia* looks like a vigorous shorter version of *Z marina* and is typically found in intertidal pool.

<table>
<thead>
<tr>
<th><em>Zostera noltii</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Flat narrow leaves typically 10 to 30 cm, rounded tips but with notches (use magnifying glass to see this)</td>
</tr>
<tr>
<td>• Open sheath</td>
</tr>
<tr>
<td>• Thin rhizome with shoot from each node</td>
</tr>
<tr>
<td>• Flowers on branched stem</td>
</tr>
</tbody>
</table>

*Z noltii* grows right up to the high shore and typically looks like a thin lawn after heavy rain.


Ecosystem services of seagrass beds listed by Hemminga and Duarte (2000) were:

⇒ providing foraging and refuge habitat,
⇒ acting as a nursery and spawning site including commercially important fish species,
⇒ providing a source of nutrients for mobile fauna such as the internationally important Light-bellied Brent Geese (*Branta bernicla hrota*) and many sessile species,
⇒ facilitating coastal protection, sediment stabilisation, and nutrient cycling.

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1. Introduction

Seagrass beds, formed mainly by Zostera species in Northern Europe and Posidonia in the Mediterranean, are recognised as important habitats under European legislation including the Habitats Directive (92/43/EEC). They are considered biological quality elements in the implementation of the Water Framework Directive (WFD, 2000/60/EC) and the Marine Strategy Framework Directive (MSFD, 2008/56/EC). Zostera beds have been included on the OSPAR List of threatened and/or declining species and habitats for the past decade (OSPAR agreement 2008-6).²

Sea grasses are highly sensitive to human disturbance and their distribution has diminished drastically over the last 80 years across Europe including Ireland (Foden and Brazier, 2006).³ Disease, eutrophication, mechanical destruction of habitat and siltation are cited among the chief reasons for this decline. Isolated signs of recovery in some Irish intertidal areas have been logged where nutrient levels are falling (Wilkes et al., 2017).⁴

This report outlines a first Irish seagrass citizen science project, where seagrass locations reported by volunteers in the Coastwatch autumn surveys over 6 years were examined together with volunteer identification challenges and recommendations for future seagrass monitoring and protection. This work was a fully collaborative process between surveyors and Coastwatch marine ecologist project leaders, who in turn shared views and challenges with experts, especially on Z noltii work which was mentored by Dr Robert Wilkes. Draft joint outcomes of seagrass bed locations and pressures were produced in December 2018. Comments and edits received were incorporated in this final report.

² https://www.ospar.org/documents?d=7190
Ocean Literacy and Citizen Science

Given that Zostera beds are such a valuable, yet fragile habitats, easily damaged by a range of recreational and inshore work-related activities, it was included in the Coastwatch autumn survey form. Coordinators felt that is in the public interest that they would be known, loved and cherished. A ‘ocean literate’ citizen should be able to identify the 2 or 3 species they might come across, know that they are really valuable components of the marine ecosystem and distinguish them from their green seaweed look a likes.

But finding seagrass and correct identification is challenging for citizens. When previously spot checked, Coastwatch survey results yielded much unreliable data, with green seaweed carpets often mistaken for Zostera. There have been some Coastwatch trials to address this – such as the Lough Swilly biodiversity week project. 5

In 2018 Coastwatch sought and received a Department of Housing, Planning and Local Government, grant to work on both citizen seagrass awareness information and data gathering. The aims were to (i) better inform surveyors by providing ID training and (ii) to carry out ground truthing fieldwork to verify the locations where Zostera had been reported as growing and washed up.

2. Method

The annual Coastwatch autumn citizen science survey question D3 covers broad seaweed categories and a small number of shore plants, including *Zostera*.

| Q D3: Which of the plants and seaweeds did you find in the intertidal &/or splashzone? | Plants then listed are: Glasswort (*Salicornia*), Cord grass (*Spartina*) and Seagrass (*Zostera*). For Zostera we ask further whether it was found swept up and/or growing. The active link in the online survey form then leads to the guide notes with *Z noltii* and *Z marina* description. |

This survey question has been posted in the same manner since 2013, with photos welcomed. Before that, only *Zostera* presence/absence was recorded.

2.1 Data reliability

*Zostera* records fell into the least reliable Coastwatch autumn survey data category. We knew some reasons - for example most surveyors found it difficult to differentiate between *Z noltii* and some green seaweeds which can occur in the same sandy mud habitats, especially *Ulva intestinalis*. *Zostera marina* growing in the literal fringe would only be exposed at spring low tide and hence easily missed, so most findings were of the short *Z marina* phenotype typically found in intertidal pools.

2.2 Planning fieldwork

Coastwatch data for the last 6 autumn surveys was combined into one composite table. A core team of Coastwatchers who were familiar with both *Zostera noltii* and *Zostera marina* then carried out one joint training fieldtrip to Merrion Gates in Dublin bay to finalise the search method and agree on density to be described as a bed and health indicators and photographic record protocol.

A first screening was undertaking by photo identification eliminated those on rocks and in streams which were definitely green seaweeds. Then surveyors were contacted by phone and mail to ask for more information about their seagrass findings.
There was support and extensive *Z noltii* work carried out by Dr Robert Wilkes around the whole Irish coast and a mix of sources of *Z marina* bed locations when SAC site synopses were studied as well as the NPWS Zostera management manual (Dale et al. 2007). Robert Wilkes shared latest EPA monitoring *Z noltii* maps and this was overlaid on the GIS mapped Coastwatcher seagrass reports. Where surveyor records matched the EPA locations, site visits were put on the B list of areas which could be omitted if necessary.

Then pairs of trained verifiers planned their trips and travelled to the different locations where surveyors had indicated seeing seagrass, meeting surveyors and jointly looking at the sites at low tide where possible. Spring low tides were sought for *Zostera marina* sites.

In meetings and phone conversations surveyors were also asked how we could improve the Coastwatch survey and guide materials to help finding the seagrass and correct identification.

**Other inhouse seagrass information**

As apart from the annual Coastwatch autumn survey, some seagrass fieldwork had been initiated by Coastwatchers as summarised in table 1. This work provided the base for exploring further seagrass work, moving from locating seagrass to estimates or formal measurements of extent, blade length and in some cases associated biota.

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Table 1: an overview of Coastwatch linked Seagrass information gathering by inlet.

<table>
<thead>
<tr>
<th>Site</th>
<th>Zostera</th>
<th>Seagrass checks or project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carlingford Lough</td>
<td>Z noltii</td>
<td>Checks triggered by concerns over expansion in shellfish aquaculture and potential known bed damage. Also Cross border Bioblitz and Seasearch project</td>
</tr>
<tr>
<td>Malahide Estuary</td>
<td>Z noltii</td>
<td>A Coastwatch Dredge-Watch in January 2019 monitored silt deposition on Z noltii during Marina dredging.</td>
</tr>
<tr>
<td>Dublin Bay</td>
<td>Z noltii</td>
<td>Shrinkage of Z noltii bed at Bull island and waxing/waning of the Sandymount strand bed stimulated extra observations. Also it is a convenient save student training ground</td>
</tr>
<tr>
<td>Bannow Bay</td>
<td>Z noltii</td>
<td>Part of the Wexford coco lead pilot stream and N 2000 site (RIF supported ) project 2016/17</td>
</tr>
<tr>
<td>Bantry Bay</td>
<td>Z marina</td>
<td>Seagrass swept up several years in a row, without any known source, prompted a ‘did you see this?’ enquiry focussing on fishermen and kayakers first, later taken up in the Adrigole LAWCO supported CEF kayak survey and the Kelp campaign.</td>
</tr>
<tr>
<td>Castlemaine</td>
<td>Z noltii</td>
<td>Initiated after local concern over aquaculture and vehicles driving on the shore. Seagrass and damage confirmed and locals now actively discourage driving over seagrass.</td>
</tr>
<tr>
<td>Blacksod Bay</td>
<td>Z marina</td>
<td>Reports of Z marina damage by large scallop dredgers led to Coastwatch shore surveys and government dredge halt.</td>
</tr>
<tr>
<td>L Swilly</td>
<td>both</td>
<td>Several Lough Swilly biodiversity events led to first bed discoveries, then mapping and fieldwork training. Later revisits collecting local historic use information and further visits as concerns over bottom mussel culture dredge impacts rose. Work carried out with traditional fishermen.</td>
</tr>
<tr>
<td>L Foyle</td>
<td>both</td>
<td>Finding one Moville bed spurred the local boating community and Coastwatch group to plan biodiversity week events locating a string of Z marina beds, crafting viewers to aid observations from boats and recording difference in bed health and blade length.</td>
</tr>
</tbody>
</table>
3. Results

A total of 34 sites, where seagrass had been reported growing in the last 6 years, were visited by trained ‘verifiers’. Shores where seagrass had been reported ‘swept up’ on several occasions were added to some site visits in a bid to locate extra Z marina beds.

Surveyors with good local knowledge contributed particularly valuable extra information. Naturalists like Jim Hurley responded for example with the photograph (Fig. 1) and description below. Lough Swilly Coastwatchers researched traditional use and management of *Z marina* in the lough.

**Figure 1.** Zostera bed Co. Wexford ‘The attached image shows St Patrick’s Bridge in the foreground and Kilmore Quay harbour in the background looking west with the reef at Nemestown on the right (north). The bed of Zostera is at the dark area in the centre with Sargassum abundant throughout. The Zostera was alive and healthy-looking when I snorkelled there in July 2018. The water was about waist to chest deep at low water of spring tides.’

Jim Hurley

3.1 Citizen Science - Finding Seagrass Challenges

From the conversations and the surveyor feedback, there appear to be four main reasons for difficulty with this citizen science work compared to say counting drinks containers. These can be summarised as follows:
3.1.1 Misconception
Green growth on the seashore is widely referred to as ‘seagrass” by observers. So when our survey form asks about ‘Seagrass Zostera’, many are happy to home in on the English word. Guide notes and posters are there, but often not consulted on this topic as the surveyor thinks he/she already knows and is also answering many other questions in a shore audit. This was the most common reason for misidentification of Zostera noltii.

3.1.2 Awareness and confidence
Most Coastwatch surveyors have no formal scientific training. From discussions and fieldwork with volunteers, the appreciation of the diversity of marine life on our shores and the subtle differences in sediment and water of a seemingly boring mudflat is only awakening.

Some who have not had a formal scientific training, told us, that they have never looked closely to see differences between plants. They felt they lacked the vocabulary to go into the identification detail, and/or felt they would not have the eye to see the differences between a green seaweeds - like Ulva intestinalis, Ulva linza and Cladophora - and the real grass, Zostera species which have roots and shoots and grass blades with veins.

3.1.3 Location
Many do not know where to look and hence would miss smaller beds on a wide intertidal. Feeding geese as useful location indicator made a big difference to where to concentrate effort, while also alerting surveyors to potential wildlife disturbance.

3.1.4 Washed up seagrass
While washed up Z noltii is so inconspicuous that it is usually missed, naturally dislodged or damaged Z marina seagrass swept up on the shore could provide a good indicator of a bed nearby. Z marina is easy to spot when fresh. It is less well known that it looks like old fashioned black shiny tape recorder tape once it dries out. In summer 2018 some bleached white seagrass was brought to our attention which we had not seen previously.
3.2 Actions taken

To address these reasons, we need to look at our survey materials, training sessions and our wider education system.

Here is a summary of actions taken:

1. Our guide notes were refined to put extra emphasis on the importance of *Zostera*, the value of the surveyor finding it and where you might like to live if you were a *Zostera* grass.

2. In training we tried to seek out areas which included *Zostera* where we had a say in fieldwork location, so we could introduce the real thing. There was a noted increase in confidence when virtually everyone who tried to differentiate seagrass and seaweed specimens with revised Coastwatch guidance succeeded.

3. Lack of good citizen science seagrass information was pointed out as a missing tool to protect this habitat by several surveyors. So notes on location, seagrass identification, traditional knowledge and habitat interest and legislation gathered from verification meetings and training were kept for future seagrass leaflet and posters for local community use.

3.3 *Zostera* stocks

An GIS map was produced (see Map 1 A) to mark all 500m survey sites where Coastwatchers reported *Zostera noltii* and/or *Zostera marina* growing over the last 6 years and where verification visits in summer and autumn 2018 confirmed that the beds were present or still present. Beds which were confirmed in earlier extra project work, but no longer found in the 2018 fieldwork are also marked. A second GIS map included the same information and extra records of seagrass fragments or whole found plants washed up by surveyors in the 2018 survey. Most were confirmed by photos and/or samples sent in. The swept up Zostera marina suggests that there are further beds to be discovered.
Map 1(a) Zostera marina and noltii beds reported by Coastwatchers in the Republic of Ireland over the past 6 years, confirmed present in the 2018 verification/update project. (b) Zostera beds verified in 2018 and records of Z marina reported as washed up in autumn 2018. Beds verified as in the last 6 years but not found in the 2018 resurvey were marked as ‘lost’ in both maps.

While the verification work did bring us to sites where green seaweeds were mistakenly reported as Zostera, it also included exciting confirmation of as yet undiscovered or unreported beds.

Official overview records are published separately for Zostera noltii (EPA) and Zostera marina (NBDC) using different presentation systems. These maps include the original records contained in Natura forms for Natura 2000 sites, except for Galway Bay, where the Natura Form includes a Zostera marina patch, but the NBDC map does not.

To aid comparison, Coastwatch results are split in the same fashion as the official maps in analyses below. It should be noted that in some locations the two species share a site; with pools occupied by Z agustofolia (short Z marina phenotype) and higher ground and occasionally dryer sandy mudflats occupied by Zostera noltii.
3.3.1 Zostera noltii

Map 2 depicts the intertidal thin ‘wet lawn look’ *Zostera noltii* beds verified in summer and autumn 2018. These are the beds which some surveyors referred to as their ‘Brent geese lawns’.
Map 2: Dwarf seagrass *Zostera noltii* around the Republic of Ireland coast reported by Coastwatch surveyors and verified in summer 2018, with beds lost in the last 6 years included.
In 2017 Dr Robert Wilkes published his latest comprehensive intertidal seagrass *Zostera noltii* map for Ireland. (Wilkes et al., 2017). The majority of the sites are also monitored by him/his team as EPA bioindicator reporting under the Water Framework Directive. The map is copied here for comparison with Coastwatch seagrass distribution findings as Map 3. For each inlet where *Zostera* was recorded, Dr Wilkes has more detailed maps of the *Zostera* bed locations and has made them freely available to Coastwatch.

**Map 3a (I)** – Official EPA intertidal seagrass beds from Wilkes et al. (2017) Fig 1 Intertidal seagrass beds assessed in current study. Numbers refer to sites in 5: Malahide Bay, 6: Baldoyle Estuary, 7: Tolka Estuary, 18: Ballysadare Estuary, 19: Garavogue Estuary.

**Map 3b®** – Official EPA map as in 3A, with locations of extra *Zostera noltii* beds found in Coastwatch surveys 2013 to 2018 and verified in 2018. Of these the Lough Swilly Inch bed has been lost in 2017/8 confirmed in a second site visit in spring 2019. The Dundalk Bay bed remains also confirmed in 2018 is not included as it is no more than a ± 12 m² patch.

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Over the last 30 years, Coastwatchers have surveyed in all of the bays and estuaries where the seagrass was recorded by Wilkes, although not necessarily in the locations where the seagrass grows.

Some beds surveyed in 2012 – 2017 period, had been verified and mapped earlier in focused projects, giving us an impression of health and size over time.

If we take the most recent six years from 2013 onward, Coastwatchers surveyed and recorded *Zostera noltii* in 12 of the 18 official Republic of Ireland sites, with gaps concentrated in the North West, where the EPA map shows *Zostera noltii* sites of Barrow Harbour, the three Mayo inlets and Ballysadare Estuary and Garavogue Estuary in Sligo.

Coastwatchers also found *Zostera noltii* beds outside the sites located on the EPA maps. Bed locations are marked on Map 3b. In clockwise direction that is:

- A long bed at Bannow Island inlet, Bannow Bay, Co Wexford
- A large bed in Swilly in the lee of Inch Island, (see below re recent loss)
- And in Lough Foyle near Muff at the S end of the L Foyle SPA.

A vestigial patch of the large Dundalk Bay *Z noltii* bed was recorded at Blackrock. While still present in 2018 verification it was too small to be described as a bed.

### 3.3.2 Zostera marina

Map 4 depicts the confirmed *Zostera marina* distribution as found by surveyors and visited by the project team in 2018. As most *Zostera marina* is subtidal, the bed location often involved follow up on areas where surveyors noted *Zostera* swept up.
Map 4 *Zostera marina* meadows found by Coastwatchers and/or by others when asked to suggest where the swept-up seagrass may have come from. Verified 2018.
Map 5a (l) National Biodiversity Data Centre (NBDC) map of Zostera marina beds in 50km grid squares. (Trinity College, Marine Sites, habitats and species data collected during the BioMar survey of Ireland, National Biodiversity Centre, Ireland, Eelgrass (Zostera marina) image accessed 30 November 2018 https://maps.biodiversityireland.ie/Species/TerrestrialDistributionMapPrintSize/28095?datasetId=258

Map 5b (r) The NBDC Z marina 5a map, with added beds in blue found by Coastwatchers in 6 bays.

The live version of the NBDC map (5a above) open out, to give Z marina locations. Map 5b superimposes six extra Coastwatch sites which to the best of our knowledge are not officially registered- as detailed in clockwise direction around Ireland:

- Kilmore Quay in Co Wexford on both sides of St Patricks bridge as new record, significantly expands the Z marina range eastwards.

- Bantry Bay with Adrigol Harbour added as large extra ‘infill’ site in West Cork. This bay sports many small beds, with one like a string of pearls at the mouth of Adrigol Harbour, two inner Bantry beds at Zetland pier and at Whiddy island lagoon entrance an outer bed off Bear Island and an Adrigol Harbour bed.

- A bed off Fenit pier in Tralee bay, which has several other known beds.

- a number of Galway bay records from large bed off Auginish Island, Co Clare to adjacent Galway mainland and patches at Traught beach. Also a ‘boutique’ bed of intertidal Z marina phenotype discovered in a pool just off Salthill fair ground, but seen shrinking to a tiny patch over the last 3 years.

- The Wee Lee bed at Inch Island in Lough Swilly (also shrinking).

- A discontinuous band of Z marina meadows in shallow water along the L Foyle Donegal coast from Green Castle to Red Castle, including very long grass just south of Moville.
Extra beds were reported from several Galway bays since but not yet verified.

Swept up Seagrass

There are many areas where some *Zostera marina* is swept up, carried by currents and wind and deposited on the tideline. They can be picked out fresh among seaweeds as bright green, but soon turn shiny black. In certain areas of the Galway and Mayo coast large amounts of seagrass are swept forming banks, suggesting there are large beds nearby with exact bed location still to be established.
3.4 Zostera Health and Pressures

The survey and verification work cover beds confirmed present in 2018 and also beds which Coastwatchers have surveyed in earlier years and special projects for which we found photos and comments. This allows us to give an impression of intertidal Zostera gain, loss and damage. Several sites appear to wax and wane in size. In Dublin Bay the Merrion Strand bed expanded towards Ringsend possibly related to less green seaweed smothering over recent years. There was also recovery of an old bed adjacent to the closed Tramore dump in 2012. However, it was lost again 2 years later.

Known losses outnumber known gains. In Table 1 we summarise pressure, damage and loss information in clockwise direction from Carlingford Lough.

Pressures raised by local Coastwatchers and observed in verification visits include physical damage by driving, walking and bait digging. Opportunistic seaweeds growing over Z noltii beds in summer was common. In some cases eutrophication indicator Ulva blooms formed such dense mats that anaerobic conditions developed below them at low tide. IAS (Invasive Alien Species) were often seen in the same areas as green seaweed mats. Cord Grass Spartina has closed in over intertidal Zostera noltii ground in the Boyne estuary, Dundalk Bay and Rogerstown estuary and we saw it expanding at Dublin Bay Bull island causeway, at Bannow Island, in Tramore Back Marsh and Dungarvan inner bay.

Not enough is known about the subtidal Zostera marina beds to attempt a loss/gain analysis, but we are aware of some IAS and dredge related Zostera marina damage. In Kilmore Quay Sargassum is growing in one part of the Zostera marina bed and probably competing for sunlight. In Lough Swilly we noted Gigas oyster settlement very close to the Wee Lee Zostera marina bed and are aware of Gigas removal dredging with heavier kite dredges. As Gigas oyster dredging to control this IAS is practised now without AA as it is deemed to be a site management measure this is of serious concern. While local fishermen know the Z marina bed and avoid it, Zostera is not listed in the Lough Swilly SAC site conservation objectives and it is wide open to damage by outside boats.

In Lough Foyle both rapidly expanded unlicensed aquaculture which stretches into the shallow sublittoral and is accompanied by extensive tractor and amphibious vehicle track damage is of serious concern for both Z marina and the Z noltii bed in the SPA.
Table 2 PRESSURES: Intertidal seagrass beds where threats &/or damage were identified

<table>
<thead>
<tr>
<th>Location</th>
<th>Species</th>
<th>Pressure/damage/loss</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carlingford Lough</td>
<td>Z. marina both phenotypes</td>
<td>Access route to Gigas oyster aquaculture leads over the bed</td>
<td>Large otherwise healthy bed with vehicle tracks 2016 onwards. Zostera loss in the main tractor access routes which cross the bed. Z. marina short phenotype seen in 2014 and 15, but not found in 2018. No check of subtidal Z. marina</td>
</tr>
<tr>
<td>Carlingford village Bed</td>
<td></td>
<td>Expansion of oyster aquaculture to the bed</td>
<td></td>
</tr>
<tr>
<td>East of Greenore low tide/sublittoral</td>
<td>Z. noltii and Rupera</td>
<td>Spartina encroachment + possibly other pressures.</td>
<td>Mechanical cockle harvest permitted and active at intervals over former seagrass ground</td>
</tr>
<tr>
<td>Dundalk Bay now restricted to very small patches at Blackrock North</td>
<td>Z. noltii &amp; Z. marina short form</td>
<td>Spartina expansion over Z ground, sitting and possibly eutrophication?</td>
<td>Last recorded on the Baltray side (+ patches on Meath side) in 2000. Port capital dredging scheme altered the estuary in 2000.</td>
</tr>
<tr>
<td>Boyne Estuary</td>
<td>Z. noltii</td>
<td>Spartina expansion and green seaweed smothering</td>
<td>The estuary is poor quality in current rbmp wfd status</td>
</tr>
<tr>
<td>Roperstown estuary</td>
<td>Z. noltii</td>
<td>Eutrophication with thick Ulva cover over dwindling Zostera. Water is very silty,</td>
<td>Spartina expansion may be a factor. Last seen by Coastwatchers in autumn 2016 bait digging was intense near the bed</td>
</tr>
<tr>
<td>Dublin Bay – Bull Island Lagoon, both sides of the causeway</td>
<td>Z. noltii</td>
<td>Large bed increased in 2017, but shrunk in 2018. Trampling walking and cycling across in fine summer weather. In designated bathing w.</td>
<td></td>
</tr>
<tr>
<td>Dublin Bay Merrion Gates and Sandymount beach bed</td>
<td>Z. noltii</td>
<td>Lugworm and lugworm digging in one area caused damage in bed centre 2018 Oxygen/heat related with mud T &gt; 30C a factor? Human traffic.</td>
<td></td>
</tr>
<tr>
<td>Bannow Bay at Bannow island Saltmills bed</td>
<td>Z. noltii</td>
<td>Bait digging and Ulva overgrowing seagrass in spots Pollution point source and</td>
<td>More sandy patches with no lugworm look really lush. Lush large except around one stream pollution source.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>eutrophication</td>
<td></td>
</tr>
<tr>
<td>Tramore beside closed dump.</td>
<td>Z. noltii &amp; Z. marina short phenotype</td>
<td>Bleach lines first appeared, then whole bed went. Possibly dump discharge work or dump gas related?</td>
<td>Z noltii bed was killed in 1980s by dump leachate. Noted strong re-growth Z noltii and Z marina in channels in 2012, but then died off in bleach lines in 2013/ 2014.</td>
</tr>
<tr>
<td>Tramore Drivers dyke to restored wetland entrance</td>
<td></td>
<td>Encroaching Spartina and Ulva smothering</td>
<td>Large bed with boundary size fluctuations. Mudflat gets v hot.</td>
</tr>
<tr>
<td>Dungarvan Bay (i) Cockle bank bed off the Cunnigar</td>
<td>Z. noltii</td>
<td>Aquaculture: bed now covered Eutrophication Ulva growing over seagrass</td>
<td>Oyster trestle aquaculture and driving right on top of this large bed. Bed disappeared by 2013 according to local Coastwatchers.</td>
</tr>
<tr>
<td>(ii) small bed in lee of Cunnigar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Castlemain Hb Reenalagane bed</td>
<td>Z. noltii</td>
<td>Driving over the bed causing visible rhizome damage</td>
<td>This large bay needs a Zostera review.</td>
</tr>
<tr>
<td>Galway Bay Salthill bed</td>
<td>Z. marina short phenotype</td>
<td>Unsere storm related and/or disease? Blackening blades noted in 2017 and 18.</td>
<td>Lush bed filling the large shallow rockpool in 2015, declining since to patch in autumn 2018. Sabellana reef here suffered massive decline too with storms as likely key factor.</td>
</tr>
</tbody>
</table>
While we now have LAWCO and priority action areas under the WFD rbmps, there are few records of action to address direct pressures as described in this case study from Kerry.

**Case Study** of tackling Castlemain Harbour Seagrass bed damage by driving
By Maurice Murphy Rossbeigh-Glenbeigh-Dooks Co Kerry

The Reenalagane seagrass bed was surveyed in the 2017 Coastwatch survey and verified as *Zostera noltii*. It is much used by Brent geese in winter. In August 2018 bed damage was noticed as it was being driven over many times during the hot weather. Local Coastwatchers became concerned. They identified a 4 x 4 black jeep as causing the damage. It belonged to a crab fisher operating along the Caragh River who was using the access to the foreshore at Reenalagane. The SFPA was contacted, but did not have any major concerns as to the fisherman’s activities. As the damage continued locals approached the fisherman themselves and informed him of the protected seagrass. This prevented further damage as he changed his access route to avoid the bed. The seagrass bed is now recovering.

While in this case there was a very positive outcome, we are looking for proactive information signs about fragile habitats in protected sites and a site management structure which we as interested local stakeholders could participate in.

![Figure 6](L) car driving through the *Zostera noltii* bed and (R) tyre marks on the *Zostera* bed. Summer 2018.

### 3.5 Loss

Three sites which featured in early Coastwatch surveys with confirmed seagrass but now no longer marked as seagrass sites by surveyors were also visited. A thorough check by a team of volunteers of the Boyne estuary *Z noltii* and *Z marina* sites in August 2018 ended with no records. The same happened in the Tramore inner bay bed beside the now closed landfill site. The Lough Swilly bed which had been mapped in 2012 in an earlier Coastwatch seagrass site mapping project and was then just over
500m long, was close to mussel bottom aquaculture and appeared to be silting up in 2014. On a quick visit in summer 2016 it appeared smaller with softer ground. In October 2018 it was rechecked by a local surveyor who noted very soft silt and no seagrass. A revisite in spring 2019 confirmed Z noltii absence. Over recent months 100’s of hectares of lands straddling the inner Lough Swilly have been cleared and drains deepened with a massive extra silt load entering the lough.

4. Conclusions

The verification study had a dual purpose to support people and seagrass monitoring. It was designed to fanning a Coastwatch surveyor interest in seagrass, jointly explore how to get the best possible seagrass search and assessment data and deliver verified seagrass location information.

People

Volunteers who participate in the annual Coastwatch survey do so for many reasons. Seagrass occupies just one tiny part of the survey form and is not a priority for surveyors – unless they know there is a good reason and it might be in their area. Once we set out the ecosystem values, the use of their data in wider seagrass protection and the own initiative emergency rescue options as in Malahide estuary Dredge-watch, there was full engagement and interest.

The approach taken over the summer of 2018 with many exploratory phone calls, mails and meetings with Coastwatch surveyors who had reported seeing seagrass worked. Seagrass information was received with interest and surveyors pointed out their needs to feel competent finding and identifying seagrass on the shore. When out on joint verification fieldwork there was a great shared joy when a Zostera bed was confirmed, as well as a full understanding if it turned out to be green seaweed. Green seaweed and problematic blooms became an important secondary talking point. The request to help improve Coastwatch survey guidance yielded valuable feedback, some of which came in time to be integrated into the 2018 autumn survey guidance.

As a result of this effort there was a surge of interest in seagrass, with extra beds identified in the autumn 2018 survey and subsequently by divers and kayakers around Bantry Bay and Kinsale Harbour.
Contribution to Seagrass location data

Verified volunteer survey results confirm locations of some officially known beds as well as new beds not previously included in the habitat maps produced by the EPA and MBDC.

Where surveyors found seagrass beds and the identification was confirmed, with value conveyed, they were both proud and protective of the feature. However, there is also growing frustration with the lack of information on the legal status and who is responsible for protection and site management in case of beds located in Natura 2000 sites. Local communities who want to protect these sites don’t know where to turn.

Traditional knowledge

We discovered from conversations with local farmers that some *Zostera marina* beds have been known for decades or even centuries and some have been harvested in the past. The Wee Lee ‘sweet grass’ bed at Inch island was mown once a year in lowest spring tides. The effort was limited to one full moon and is an example of a locally devised and implemented management plan to avoid overharvesting.

Overlay with NPWS Natura 2000 sites showed that most of the seagrass beds found are located in Natura 2000 sites. The two large exceptions are Bantry Bay where Coastwatchers found seagrass *Zostera marina* beds in the inner and outer bay and the Lough Foyle Donegal shore where the *Zostera marina* meadows straddle most of the coast from Greencastle down to Redcastle. It includes one spot where in 2014 surveyors measured the grass up to 1.92m high. That is the longest grass we have come across in our surveys and almost twice as high as the typical ±1m length.

If a seagrass bed occurs in a protected site but is not officially known to be there, then it may be just as vulnerable as outside protected areas. It was confirmed to us that the Marine Institute for instance would rely on NPWS site information and (often generic) conservation objectives, to prepare its Natura plans for aquaculture and fisheries. This relates to positioning of aquaculture operations and access routes. There is no routine field survey to support the advice. (Oliver Tully, personal communication).

Typically, shellfish aquaculture operations do not require an EIS and information on site surveys carried out years ago may be relied upon.
It should also be noted that even where a bed location is known, as in Dungarvan SPA, this has not prevented known pressures like aquaculture to expand over it.

![Relic Zostera noltii patch with Spartina in the background](image)

**Figure 7** Relic *Zostera noltii* patch with *Spartina* in the background (Photo Breffni Martin).

A recent European Commission commissioned seagrass accounting report\(^8\) highlighted the potential for mapping location, spatial extent and condition of seagrass beds across the EU through metrics that align with WFD and MSFD reporting requirements (i.e. seagrass bed extent, taxonomic composition, and annual mean shoot density and pressures) to then advance an ‘Integrated seagrass account’. The role of citizen science was not explored. Based on the results achieved in the Coastwatch survey and verification study there is not only a place for citizen science work – but a need, as it fulfils the dual objective of improving ocean literacy with local care and responsibility as well as for these keystone habitats. We hope that this can be explored further in coming months as the second round of MSFD measures and indicators are being drawn up with public participation.

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5. Recommendations

IRELAND

1. **Tackle identified pressures on Zostera stocks and plan management:**

1.1 Clarify enforcement powers and produce a seagrass information leaflet which sets out who to call and what that body should do to deal with immediate seagrass damage threats like bulldozer on the shore.

1.2 Halt unlicensed aquaculture in Lough Foyle.

1.3 Update official *Zostera* maps to include the additional verified Coastwatcher beds so that they are taken into account in permitting activities.

1.4 Set up a national seagrass protection and monitoring working group under the current MSFD second national plan drafting initiative to manage seagrass monitoring and protection measures.

1.5 Retrofit all BIM aquaculture signs in Natura 2000 sites which host seagrass beds by end of 2019, to provide Natura 2000 site and seagrass information as well as who to contact in case of threat or damage.

1.6 Support drafting of bay or bed specific seagrass restoration and management measures under WFD and/or MSFD plans, including trials to tackle widespread pressures – e.g. invasive alien species like *Spartina* and *Sargassum* encroachment. Provide adequate funding to both achieve goals and disseminate methods, problems encountered and results.

1.7 Continue the EPA lead *Zostera noltii* bed extend and health work as carried out by Dr Robert Wilkes, expanding it to new sites and to *Zostera marina*.

1.8 Review the national Biodiversity Action Plan to include *Zostera* as priority species in line with OSPAR recommendations and UK approach.

1.9 Review Natura 2000 site Conservation Objectives and include seagrass where it occurs in Natura 2000 sites.

1.10 Include all known *Zostera* bed locations our first MSP and set out GES goals.
2. Citizen Science and Ocean Literacy

2.1 Support further citizen science research to locate *Zostera marina* beds where the general area has been identified by tide mark accumulations.

2.2 Support NGO lead further citizen science work A *Zostera marina* bed size, plant length and character survey could be run here, or in the OSPAR region.

2.3 Promote public engagement regarding identification and designation of further marine protected areas to complete the coherent network of inshore MPAs – e.g. in Bantry bay, Kinsale harbour and Cross border in Lough Foyle to protect the range of fragile habitats and the biota which depends on these.

2.4 Draft MPA maps and signs which celebrate marine MPAs with public participation and include citizen science data so they have local support. Erect these as Biodiversity Day MPA project 2020.

INTERNATIONAL

3. Add more nature information and experience into the school curriculum-

3.1 Introduce a Spring Low tide or a Marine Day in the school calendar;

3.2 Teaching basic identification skills starting in primary school. The standard exercise ‘tell the differences’ between two pictures or objects can be creatively used. Instead of using people, or stylised flowers pupils could be given pictures or real green seaweeds and *Zostera* to tell apart. This way science becomes an everyday tool very early on.

4. Devise an agreed seagrass monitoring protocol which includes citizen science for implementation of the MSFD, building on excellent work done⁹.

5. Roll out an international training and nature knowledge certification for those harvesting from the wild and those involved in coastal tourism, aquaculture and other activities which could impact on nature including seagrass beds.

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