Sea Synergy Oyster Project (SSOP) 2023

A. Introduction & Aim

The Sea Synergy Oyster Project (SSOP) aims to improve knowledge of the distribution of the Native European Oyster (*Ostrea edulis*) and other species associated with its habitat in the Portmagee Channel. *O. edulis* is a reef building bivalve that was once very common in European coastal waters but due to overfishing, disease and the introduction of invasive species its population has declined by 95%. This decline means *O. edulis* reefs are categorised as 'Critically Endangered' on the European Habitat Red List[1].

The funding received in 2023 was used to begin mapping the distribution of *O. edulis* within the channel, to create baseline records of the biodiversity within the Portmagee channel and to engage the community through three citizen science recording events, school workshops and at both Discover Derrynane and Cromane SeaFest.

B. Fieldwork

B.1. Methods

A total of 9 sites were selected along both banks of the Portmagee Channel and the following methodology was used at each of these sites to record the density of *O. edulis* and biodiversity.

1. Oyster Density

Intertidal Survey: A transect line was laid out along the low tide line at each site. The end point of these transects was determined by no live *O. edulis* being seen for 100m beyond that point. The abundance of *O. edulis* within 3m of either side of the line were then recorded.

Subtidal Survey: A snorkel survey was conducted at each site by two people at low tide to locate patches of subtidal *O. edulis*. The area surveyed by snorkel was mapped by towing a phone mapping app in a dry bag. The number of *O. edulis* seen was recorded. The extent of the subtidal area surveyed was set at 500m of shoreline but varied according to the abundance of *O. edulis.* Where *O.edulis* were infrequent a shoreline distance greater than 500m was covered. At some sites *O. edulis* were confined to a single clearly defined patch within the 500m and the area of this patch only was used.

2. Appropriate Oyster Habitat Areas (AOHA)

The area in which *O. edulis* were present at a density of Occasional, Frequent, Common, Abundant or Super Abundant according to the SACFOR scale (see Table 1) in either the intertidal or subtidal surveys, was defined as Appropriate Oyster Habitat Areas (AOHA) for potential restoration sites.

Table 1: The SACFOR scale used to survey *O. edulis* in the Portmagee Channel (adapted from Moore, 2019)[2].

Size of Individuals: 3 - 15cm	**Density**
Superabundant (S)	1000 - 9999/m²
Abundant (A)	100 - 999/m²
Common (C)	10 - 99/m²
Frequent (F)	1 - 9/m²
Occasional (O)	1-9/10m²
Rare (R)	1-9/100m²

3. Biodiversity

3.1 Intertidal Surveys: Lower shore intertidal biodiversity was assessed using quadrats placed at 20m intervals along a 100m transect line. Only living organisms were recorded. Seaweeds and encrusting species (ie. sponges) were recorded as percentage cover while individual animals were counted.

3.2 Subtidal Snorkel and Dive Surveys: Subtidal biodiversity was recorded using the full SACFOR scale according to Moore (2019) while the surveyor was snorkelling/diving. The SACFOR scale is subjective, so to improve reliability of this data and allow for comparison between sites the same observer recorded the abundance of each species using the scale.

For both Intertidal and subtidal species photos were taken to improve the reliability of the data and help with the identification of unfamiliar species.

B.2. Results

1. Oyster Density

O. edulis were found at all our nine survey sites but as would be expected their density at each site varied, as did whether they occurred in the intertidal or subtidal (see Table 2).

At Sites 1, 3 and 5 the population was almost exclusively intertidal and these intertidal populations occurred at relatively high density. In terms of the subtidal populations, density/100m^2 was highest at Sites 2, 6, 7 and 8.

Table 2: The recorded number of *O. edulis*, survey area, *O. edulis* density and associated SACFOR code for the nine sites.

	Site	1	2	3	4	5	6	7	8	9
Intertidal Transects	**Number of *O.edulis***	50	0	37	0	33	1	0	0	0
	Area Surveyed (m²)	1200	600	1800	600	600	600	600	600	1800
	Density/100m²	4.17	0	2.05	0	5.5	0.17	0	0	0
	SACFOR Code	O	-	O	-	O	R	-	-	-
Subtidal Snorkels	**Number of O.edulis**	3	57	3	2	7	154	20	34	2
	Area Surveyed (m²)	1200	450	1200	2000	17000	1400	250	800	2000
	Density/100m²	0.25	12.67	0.25	0.1	0.04	11	8	4.25	0.1
	SACFOR Code	R	F	R	R	R	F	O	O	R

2. Appropriate Oyster Habitat Areas (AOHA)

For an area to be considered Appropriate Oyster Habitat Area (AOHA) for a potential restoration site, *O. edulis* density had to be classified as Occasional (O), Frequent (F), Abundant (A) or Superabundant (SA) according to the SACFOR scale. This was the case at Sites 1, 2, 3, 5, 6, 7 and 8.

The areas of high oyster density at Sites 1 and 5 were solely intertidal and occurred directly next to each other so were grouped together to create Area 1 therefore giving us 6 six AOHA's.

3. Biodiversity

3.1 Intertidal Surveys

A total of 54 species from 11 different taxa were recorded by the intertidal biodiversity surveys (see Table 3). Of these 11 taxa the number of different species was greatest in the seaweeds, gastropoda, crustacea and annelids.

Table 3: Number of species found in each taxa during the Intertidal Surveys along the Portmagee Channel.

Taxa	No. of species	Taxa	No. of species
Seaweeds	13	Bryozoa	2
Gastropoda	12	Tunicata	2
Crustacea	9	Polyplacophora	1
Annelids	8	Cnidaria	1
Sponges	3	Pisces	1
Bivalvia	2	**Total Species**	**54**

Species Richness was also calculated for each Site (see Fig. 1) with Site 5 having the lowest species richness (10) and Site 2 and 7 the highest (23 and 25 respectively).

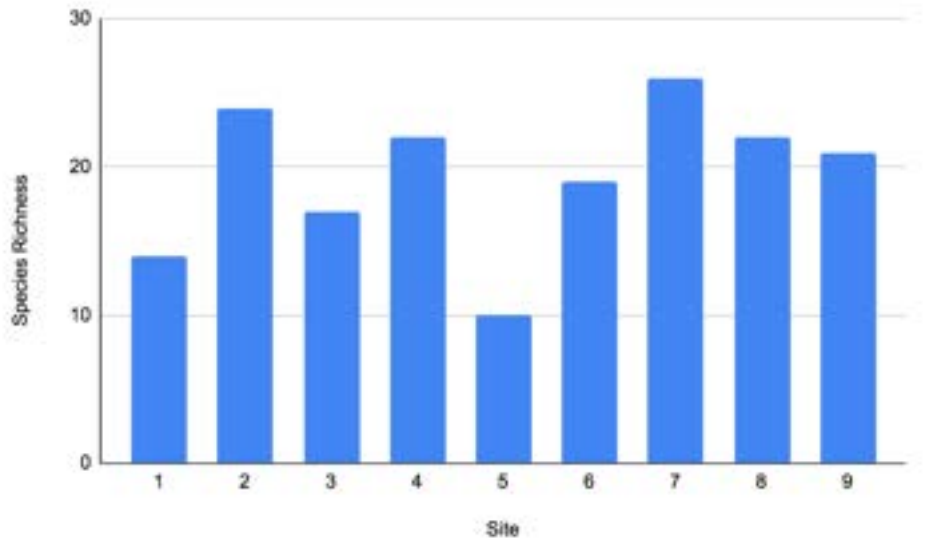

Figure 1: The species richness recorded during the Intertidal surveys for each Site.

3.2 Subtidal Snorkel and Dive Surveys

A total of 159 species from 18 different taxa were recorded during the Snorkel and Dive Surveys (see Table 4). Of these 18 taxa the number of different species was greatest in the seaweeds, pisces, cnidaria, crustacea, tunicata, gastropoda and sponges.

Table 4: Number of species found in each taxa during the Snorkel and Dive Surveys within Portmagee Channel.

Taxa	No. of species	Taxa	No. of species
Seaweeds	28	Opisthobranchia	6
Pisces	19	Bryozoa	3
Cnidaria	17	Echinodermata	3
Crustacea	16	Mammalia	2
Tunicata	14	Cephalopoda	1
Gastropoda	14	Nemertea	1
Sponges	12	Polyplacophora	1
Annelids	10	Phoronida	1
Bivalvia	10	Platyhelminthes	1
		Total Species	**159**

Species Richness was calculated for each site (see Fig. 2) with Sites 4 and 9 having the lowest species richness - 62 and 73 respectively. The only sites that appear to have noticeably higher species richness were Sites 2 (102) and 3 (119). This could be due to the dive surveys that were conducted at these sites in addition to the snorkel surveys. The dive surveys resulted in an additional 14 species being recorded at Site 2 and 15 species at Stie 3 that were not encountered during the snorkel surveys. Correcting for this, Site 3 remains the only site with a noticeably higher species richness of 104.

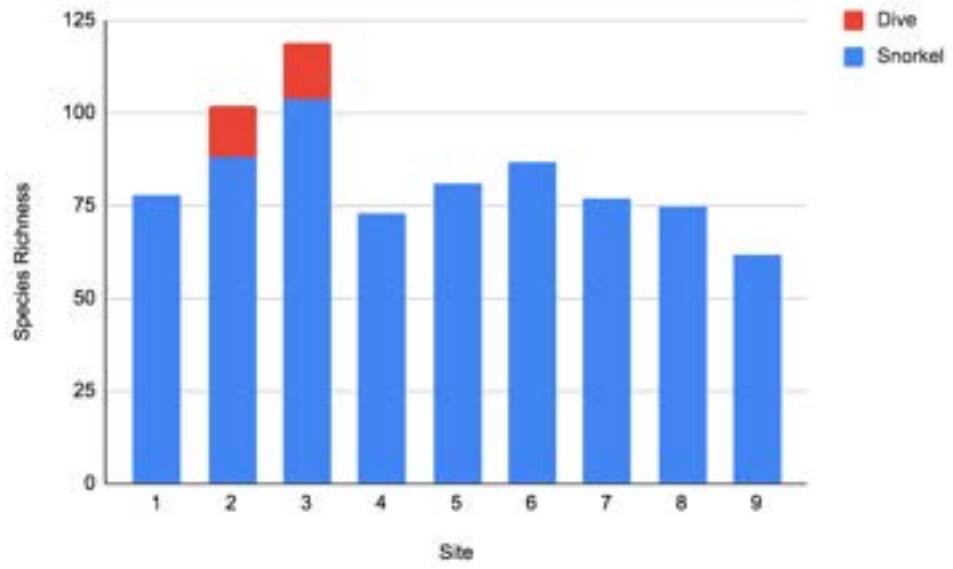

Figure 2: Species richness from the Snorkel and Dive Surveys at each of the 9 Sites.

Terrestrial species

Surveyors also kept a note of any terrestrial species observed during site visits. 33 terrestrial species (Table 5) were observed across all 9 sites.

Table 5: Number of terrestrial species observed informally during field work at each site.

Taxa	No. Species
Birds	18
Flowering Plants	13
Lichens	2
Total	33

Combined species richness

A total of 168 marine species were recorded from both the intertidal and the snorkel and dive surveys. When the additional 33 terrestrial species are included this increases the species total recorded this summer along the Portmagee Channel to 201 species from 20 different taxa. The taxa that accounted for the most records were; Seaweeds, Crustacea, Pisces & Birds (see Fig 3).

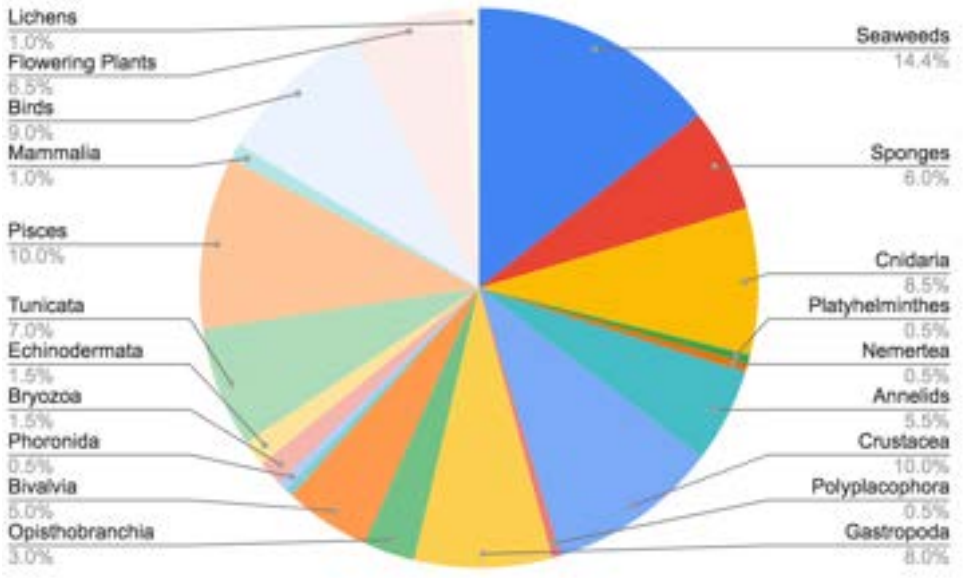

Figure 3: Pie chart of the relative abundance of the different taxa within the Portmagee Channel from all surveys.

B.3. Discussion

Oysters:

The long term goal of SSOP is to facilitate the growth of healthy populations of *Ostrea edulis* and achieve a density whereby they begin to form oyster reefs. This year's surveys provided evidence of living *O.edulis* occurring at a variety of densities within the Portmagee Channel and resulted in six Appropriate Oyster Habitat Areas being identified as suitable for potential restoration.

The fieldwork also improved the team's understanding of where *O. edulis* are likely to occur based on a site's substrate type (gravel and shells) and what other species are present (eg encrusting algae) both good indicators of low levels of siltation which threatens oysters with burial. Such conditions

mean a site would have an abundance of suitable substrate for *O. edulis* to settle on and also indicates that the risk of burial due to high siltation is low.

A number of observations were also made that could potentially impact the future success of SSOP as well as the overall health and diversity of life within the Channel. These observations are noted below and require further research to determine what, if any, their impact might be.

- Our results to date indicate that the population of native oysters within the channel is not large enough to withstand the impacts of either dredging (which is permissible within the SAC) or hand foraging for private consumption (evidence of which was present at some Sites).
- High levels of siltation was noted at some sites leading to the burial of living oysters and is likely linked to sediment run-off from nearby streams and rivers.
- A small number of naturalised pacific oysters, which are an invasive species known to compete with *O.edulis,* were observed. The proposal for multiple new Pacific oyster aquacultures within the SAC and Portmagee Channel raises concerns that a wild population of Pacific oysters may over time become established in the channel.
- Another invasive species, the leathery sea squirt, was also observed in the channel. Originally native to the NW Pacific it was first recorded in European waters in the 1950s and is a significant fouling pest on both ships hulls and oyster beds - a potential problem for both native oyster reefs and oyster aquaculture.

Biodiversity:

This year's fieldwork also enabled us to begin gathering baseline data of the Channel's intertidal, subtidal and terrestrial biodiversity. This data is useful not only in itself but also to monitor the impact future *O. edulis* restoration may have on species richness or diversity. Species richness varied between sites, which could be due to a number of factors; substrate type, human pressures, current speed and observational bias. It was interesting to note that the two sites with the lowest species richness (4 and 9) also had the lowest *O. edulis* densities. It was beyond the remit of this study to determine if species richness was significantly different between sites or if there is a correlation between *O. edulis* density and species richness but it would be an interesting area for further research.

The overall diversity of species and the species richness recorded during the intertidal surveys at each site was lower than those recorded during the snorkel and dive surveys. This would be expected because not only does a greater diversity of life exist in the subtidal but also the snorkel and dive surveys generally covered a larger area than the intertidal surveys.

Our recording methods were exclusively based on visual techniques, a decision based on it being the least destructive to the organism and most cost effective. This meant the data collected favoured the highly visible species - seaweeds, fish - and microscopic plankton and infaunal benthic organisms went unrecorded. Even within the more visible species such as sponges, seaweeds and sea squirts exact identification can be difficult, requiring expert knowledge or a study of the organism's microscopic structure. The methodology also limited the area we covered which meant species present in the high and mid shore and mid channel were not surveyed.

C. Citizen Science Training and Recording Events

The aim of the four citizen science and training events we ran with the aid of this grant was to upskill local interest groups and budding naturalists to accurately observe, record and map species. Of the four proposed events one was cancelled due to lack of participants. Of the three that did run two were shore based intertidal biodiversity and *O. edulis* surveys and the third was a subtidal snorkel survey. The snorkel survey was for those that had attended an earlier event and wanted to be more involved.

The shore based surveys (30th September and 4th October) introduced participants to the common shoreline species and our biodiversity and the *O. edulis* survey methods before giving them the opportunity to run a set of transects and record the data themselves. The event concluded with lively open discussion sessions.

The subtidal snorkel survey (14th October) introduced those wanting to learn more to our subtidal *O. edulis* and biodiversity survey methodology. Below are some of the participants' testimonials.

"I had a brilliant time getting involved with Sea Synergy's Citizen science events! I've always wanted to know more about my local coastal wildlife and I learned lots from the friendly & knowledgeable people running the events. It's inspired me to talk to others in my community about our incredible wildlife and the threats it faces. And I learned surveying skills too. I look forward to doing more in the future and hope there will be more events!" **Louise Weinzweig**

"As a local artist I found this experience informative and inspirational, it was a wonderful opportunity to explore and learn about marine creatures living nearby in the Portmagee channel, fascinating worms, anemones and sponges, lots of new creatures I hadn't seen before! I really enjoyed participating in this event. Thank you. Go raibh míth agaibh." **Róisín Ni Chionnfhaolaidh**

"I'm very grateful for the opportunity to participate in this community science event. I spent a full morning experiencing, first hand, some of the science and research work behind conserving the native oysters in the Portmagee Channel. Taking part in the survey really brought the project into focus. The leaders were very knowledgeable and engaging; just what is needed to inspire a community to support the valuable work they do." **Leonie Merrifield**

Image 1 & 2: Participants at the shore based and subtidal citizen science training events.

D. Data Dissemination

During the field season workshops at two local events, Cromane SeaFest and Discover Derrynane, and three primary schools, Scoil Saidhbhin, Cahersiveen, St Finian's National School, Waterville and Scoil dar Earca, Valentia Island were run.

.

1. Discover Derrynane and Cromane Seafest

Great two-day events which attracted around 1000 visitors and where the work being done for the Sea Synergy Oyster Project was showcased. The public visiting the stall learnt about the different species of native and non-native oysters found in Ireland, including fossilised oysters from the Jurassic period (165 million years ago), the types of survey work we were doing and the importance of the species rich Portmagee Channel as a habitat. Included in our stall was a small aquarium tank to enable children to see up close some of the crabs, fish and starfish that live in the Channel as well as oyster habitat colouring sheets that went like hotcakes!

Image 3 & 4: The stall at Cromane Seafest highlighting the importance of the Portmagee Channel in terms of biodiversity and *O. edulis*.

2. Workshops at Local Schools

An hour's workshop was delivered to 3rd, 5th and 6th class in three local primary schools, Scoil Saidhbhin, Cahersiveen, Scoil Dar Earca, Valentia Island and St Finian's National School, Waterville. The workshops introduced the students to the variety of biodiversity within the channel before focusing on the natural history of *O. edulis*. The second half of the workshop gave the students a chance to emulate our field work from counting *O. edulis* to identifying the animals and seaweed species within the quadrat on their desks and recording percentage cover and abundance.

The children and staff loved the workshops and asked lots of great questions. They were amazed by the variety of life within the Portmagee Channel, delighted in learning how to identify the different species in their quadrats and enjoyed using their mathematical skills to fill in their data sheets.

Image 4 & 5: Delivering school workshops.

E. Outcomes & Impacts

By surveying a total of nine sites around the Portmagee Channel this project has improved our understanding of the distribution of the living *O. edulis* within the Portmagee channel as well as an indication of their relative density. Our surveys also resulted in the recording of 201 different species across the Portmagee Channel which can be added to the national database.

The citizen science recording events were incredibly well received enabling interested members of the community to improve their identification skills, learn about their local marine fauna and flora, have a sense of pride in their natural heritage, feel more confident about submitting records themselves and get involved in recording events. Our school and local event workshops engaged budding naturalists and raised awareness of local marine biodiversity, helping to build a sense of pride in our natural heritage and will hopefully lead to greater engagement at future recording and conservation events. It is estimated around 500 people were reached through this project via the Citizen Science Events, School and Event Workshops and our social media posts produced as a result of these engagement activities.

F. Future Work

The aim for the next two years is to build upon the fieldwork and citizen science engagement conducted this year and amend our methods to generate more robust subtidal data. This would help build a more complete picture of the distribution of *O. edulis* and associated biodiversity within the Portmagee Channel, determine which location within the channel would be suitable for a pilot restoration project and how best to achieve that going forward. This would require investing in extending fieldwork to include benthic, planktonic and hard to identify species such as sponges as well as SCUBA gear. The SCUBA gear would enable a wider range of survey techniques to be carried out within the subtidal areas for both *O. edulis* and other biodiversity. It would also allow researchers to access deeper parts of the channel to generate a more accurate picture of species distribution within the channel.

G. References

1. https://nativeoysternetwork.org/#:~:text=Native%20oyster%20populations%20have%20declined,threatened%20marine%20habitats%20in%20Europe.
2. Moore, J. (2019). *Optimisation of Benthic Image Analysis Approaches.* Joint Nature Conservation Committee: Report No. 641.