



NAFC Marine Centre  
University of the  
Highlands and Islands

**Coastal Lagoons Workshop**

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## Coastal Lagoons Workshop

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## 1 Introduction

### 1.1 Purpose

The purpose of this workshop was to increase understanding of coastal lagoon systems in Scotland. Lagoon systems are relatively understudied with limited survey work to date on most coastal lagoons across Scotland. Topics covered by the workshop included:

- Lagoon Definition
- Distribution of Lagoons across Scotland
- Typical Lagoon Biota
- Specialist Lagoon Biota
- Conservation of Lagoons
- Functionality
- Pressures on lagoon habitats
- Climate change
- Monitoring

Stewart Angus (SNH) took the workshop which was hosted at the NAFC Marine Centre in Shetland on 19<sup>th</sup> July 2017. Stewart is a Policy and Advice manager in Scottish Natural Heritage (SNH). His work covers coastal casework, monitoring, and survey of: sand dunes, machair, cliffs, shingle, saltmarsh, and saline lagoons.

### 1.2 Attendees

The following delegates attended the workshop covering a range of interested parties.

Abi Cowing – NAFC Marine Centre

Richard Shelmerdine – NAFC Marine Centre

Rachel Shucksmith – NAFC Marine Centre

Eilidh Johnston – SEPA

Juan Brown – SNH

Kirsty North- SNH

Austin Taylor – Shetland Islands Council

Ryan Leask – Shetland Islands Council

Martin Schofield – RSPB

Rhiannon Inkster – representative for the Shetland Biology Teachers

## 2 Workshop Content

### 2.1 Definition of Lagoons

Definitions of lagoons vary globally. The lagoon definition which should be used is:

*“Lagoons are expanses of shallow coastal salt water, of varying salinity and water volume, wholly or partially separated from the sea by sand banks or shingle, or less frequently, by rocks.”*

### 2.2 Distribution of Lagoons across Scotland

The majority of Scotland’s coastal lagoons are found on the low-lying coastlines of the Western Isles and the northern islands of Orkney and Shetland. Loch of Stenness in Orkney is the largest UK saline lagoon (almost double the size of the largest English lagoon). The only

inventory survey on coastal lagoons across Scotland was conducted by the Joint Nature Conservation Committee in 1998 which described 142 lagoons at 139 sites. However further investigation of these sites, via desk study, revealed that 27 of them appeared to be fully saline inlets, 14 were entirely artificial, one had disappeared, with another now being regarded as a tidal pool. A further four 'new lagoons' were identified during an SNH (unpublished) survey which would make the revised total for Scotland 103, covering 33.29km<sup>2</sup>. Most lagoons are shallow water systems with recorded maximum depths of 4m, however Loch Obasaraigh is an anomaly with a maximum depth of 45m.

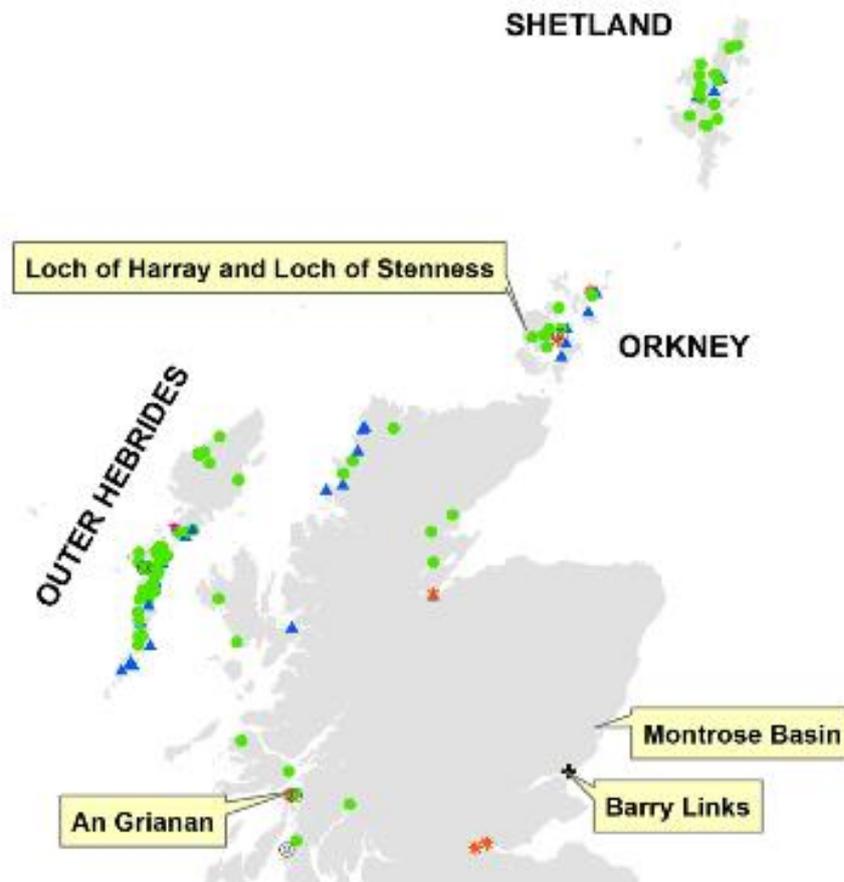


Figure 1: Distribution of Habitats Directive lagoons in Scotland (Angus, 2016a). Green = 'known' lagoons, concentric circles = new lagoons, blue triangles = lagoons now regarded as marine inlets, orange asterisk = artificial lagoons, black cross= lost site and purple star = tidal pool

### 2.3 Lagoon Biota

In the UK there are 40 recorded specialist lagoon species, ten of these have been recorded in Scotland (Howson *et al.*, 2014), see Table 1.

**Table 1: Specialist Lagoon Species found in Scotland**

<b>Group</b>	<b>Species</b>
Charophytes	<i>Chara baltica</i> ; <i>Chara canescens</i> ; <i>Lamprothamnium papulosum</i> ; <i>Tolypella nidifica</i>
Tasselweed	<i>Ruppia cirrhosa</i>
Hydrobiids	<i>Ecrobia ventrosa</i> ; <i>Hydrobia acuta neglecta</i>
Lagoon cockle	<i>Cerastoderma glaucum</i>
Isopods	<i>Idotea chelipes</i> ; <i>Lekanesphaera hookeri</i>

It is very difficult to distinguish between marine species and specialist lagoons species. There has been taxonomic confusion which has led to some doubts for existing species records and without access to historical specimens it is difficult to assess the true distribution of specialist lagoon species. SNH have been working closely with taxonomists of the National Museums of Scotland (NMS) in order to more accurately record distribution and abundance of specialist lagoon biota in Scottish lagoons. A permanent collection of fully referenced botanical and zoological specimens has been created and is being added to.

SNH and NMS will not accept any new lagoon species records of specialist species being logged without an actual specimen being logged and sent to the NMS.

Many species found in lagoon systems are found in marine systems.

### 2.4 Conservation of Lagoons

Three directives apply to saline lagoons, these are:

- EU Habitats Directive
- Water Framework Directive (WFD)
- The Marine Strategy Framework Directive (MSFD)

Lagoons are classed as a Priority Habitat in Annex 1 of the Habitats directive.

There are ten SACs which have been designated for lagoons in the UK, five of these are in Scotland. A further eight SACs in the UK have lagoons listed as a qualifying feature, two of which are Scottish.

### 2.5 Functionality

Tidal ranges of lagoon systems are very small.

The tidal range in Shetland in general is small at 2.5m.

It is generally easier in lagoon systems for water to enter lagoons than to exit. The level of the lagoon sill will determine how much water will enter the lagoon.

Haloclines and thermoclines can develop quite dramatically in lagoon systems, however some systems are too shallow for these to occur.

New lagoons are created when freshwater lochs are overtopped or as a result of storm surges. The speed of change from a freshwater loch to a saline lagoon can either be gradual from sea level rise or quickly overnight/over a few days from a large storm event. Specialist lagoon biota can be transferred from one system to another through the movement of algae on birds. Lagoon species are very tolerant to salinity and temperature changes however if the lagoon

system was overtopped and inundated with more common species they would outcompete the specialists.

## 2.6 Pressures on lagoon habitats

Climate change is one of the main threats to lagoon systems. In addition to climate change, pressures on lagoons are nutrient input from the surrounding catchment and changes in salinity.

## 2.7 Climate change

Climate change is considered one of the main threats to lagoon systems both from increased sea level rise and increased storminess (with the sea overtopping the barrier). Shetland does not seem to be under as much pressure from sea level rise as the Western Isles and Orkney. This is likely due to the fact that in the last glaciation event Shetland was on the Scandinavian ice sheet rather than the Scotland ice sheet. Once relative sea level rise is greater than 3mm there will be an ecological shuffle.

## 2.8 Monitoring

There is a Saline Lagoon Action Plan, however this is used less and less.

UK Common Standards for Monitoring exist for saline lagoons however since 2008 these have been informally and unanimously abandoned as they were deemed 'unfit for purpose' at a meeting of the UK statutory conservation and environmental organisations held in Peterborough. SNH have since devised their own methodology for monitoring. The location of sampling points are very important. It is advised that sampling should not occur within 100m of a water source to be most accurate.

Monitoring of lagoons is expensive due to the use of boats, snorkelers/divers, and equipment such as data loggers. Monitoring of lagoon biota is also extremely difficult to do with any accuracy due to the high taxonomic knowledge required to correctly identify lagoon specific species.

For some algal species you need a license to collect samples however it is not always known at the time what species you have therefore it is always best to have the license at the start of the survey.

There has been a monitoring system in place in Loch Bi, south Uist, where SNH have provided data loggers and have an agreement with the council providing staff to monitor the data loggers. This has been an expensive set up but is providing interesting data on salinity levels at different locations around the Loch and at different times of the year. Loch Bi is the only bifurcated lagoon system in the UK and this is artificial by the use of sluice gates.

### 3 Field Trip - Loch of Hellister

The workshop went to visit a local lagoon system, the Loch of Hellister in Weisdale on the west of mainland Shetland. Key features such as water inlet and certain species (which were not thought to be lagoon specialists) were pointed out.



**Figure 2: Loch of Hellister**

### 4 Potential Next Steps

Potential next steps following the workshop could include a number of actions, funding depending. These could include:

- Pooling resources with other organisations in order to set up monitoring of certain systems. For example SNH may be able to provide the data loggers, SIC might be able to provide support personnel alongside the NAFC Marine Centre in order to monitor the data loggers similarly to what has taken place in Loch Bi.
- Community awareness programmes to highlight lagoons vulnerabilities to terrestrial pressures and what impact anthropogenic activities can have.
- An observational survey of the identified Lagoons could be undertaken to ensure the current information is correct and the systems still exist. This would also take into consideration land use surrounding the lagoons and where potential anthropogenic impacts could arise and their sources for each system.
- Any data generated would inform the Shetland Islands Regional Marine Plan. If there were any areas identified as needing further investigation/protection additional policies could be explored to protect the systems in conjunction with the Local Development Plan.

### 5 Summary

It must be appreciated that lagoons by their nature are ephemeral systems and some change in their status is inevitable with time. In addition they seem to be quite tolerant systems raising the question of whether they need any additional protection or whether they can 'look after themselves'.

The systems are difficult and expensive to monitor and there has been a high level of taxonomic error in past surveys due to similarities between marine species and lagoon specialist species. A very high taxonomic standard is required when surveying lagoons.

A key issue with lagoons is the lack of awareness and knowledge of the systems and species. Raising awareness in local communities of existing lagoon systems may reduce the anthropogenic pressures on lagoons through management of activities and their potential impacts and therefore assist in the long term protection of lagoon systems.

## 6 References

Angus, S. 2016a. Monitoring and surveillance of a highly variable habitat: The challenge posed by Scottish saline lagoons. *Regional Studies in Marine Science*. **8**: 20-26.

Angus, S. 2016. Scottish saline lagoons: Impacts and challenges of climate change. *Estuarine, Coastal and Shelf Science*. *In Press, Corrected Proof*.

Howson, C.M. Chamber, S.E., Pye, S.E., Ware, F.J. (2014). Uist Lagoons Survey. Scottish Natural Heritage Commissioned Report No.787.

## 7 Acknowledgements

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