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Monitoring and surveillance of a highly variable habitat: The challenge posed by Scottish saline lagoons

Stewart Angus

Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness IV3 8NW, United Kingdom

HIGHLIGHTS

- Habitats Directive monitoring of saline lagoons involves different sites and techniques from Water Framework Directive Monitoring.
- Habitats Directive monitoring lacks intercalibration.
- Very high taxonomic standards required.
- Methodology should provide for re-examination of data.
- With good baseline survey 'light touch' subsequent monitoring is enabled.

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ABSTRACT

The various legal obligations for the monitoring and surveillance of saline lagoons in Scotland are reviewed, in the context of the scale of any actual or potential impacts, the problem of a highly variable water column and biota, and likely cost–benefits. It is concluded that Habitats Directive obligations can be met with a single inventory survey, followed by a 'light touch' monitoring programme that targets selected sites for more detailed surveys of particular attributes, based on perceived current or future impact. As the main pressures reported for European lagoons barely affect the habitat in Scotland, it is suggested that Scottish reporting reflects this, avoiding the reporting of 'unfavourable' condition when the situation is merely less than ideal.

The protocols suggested here are largely compatible with previous surveys, but lack the time-consuming biotope element, and do not require that the absence of previously recorded species to be regarded as a problem. Importantly, the new protocols add a mandatory voucher provision, and a greater emphasis is placed on ecosystem function.

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1. Introduction

Scottish Natural Heritage (SNH) is the statutory agency responsible for natural heritage conservation in Scotland and as such reports to the Scottish Government in respect of the EU Habitats Directive, which lists saline lagoons as a Priority habitat on its Annex I. The Scottish Environment Protection Agency (SEPA) is Scotland's statutory environmental regulator, and is responsible in Scotland for implementation of the Water Framework Directive (WFD), which classifies water on the coast as either 'transitional' or 'coastal'. The Marine Strategy Framework Directive (MSFD) is the responsibility of Marine Scotland, part of the Scottish Government.

All three Directives apply to saline lagoons, and oblige the Scottish and UK Governments to report to Europe on the status of the habitat. Attempts to co-ordinate reporting in order to

E-mail address: stewart.angus@snh.gov.uk.

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save resources have been rendered difficult by a lack of agreed protocols for all three Directives, in turn impeded by differing and occasionally confusing definitions at a Scottish, UK and even European level.

Scottish Natural Heritage has commissioned several surveys that have largely concentrated on the identification and distribution of biotopes; though these undoubtedly contribute to the knowledge base, often significantly, they have largely been conducted without protocols that meet current requirements, especially in respect of voucher specimens: ASML (2014), BMT Cordah (2004), ICIT (2004), Moore et al. (2006), and Trendall et al. (2011).

2. What is a lagoon?

How saline lagoons are defined is perhaps the most fundamental variable that must be addressed. Definitions vary globally, while some authors have used different terminology, such as the semi-enclosed coastal systems (SECS) of Newton et al. (2014) and the Regions of Restricted Exchange (RRE) of Tett et al. (2003); the latter categorised the Clyde Estuary in Scotland as RRE but it has never been regarded as a lagoon. Scottish Natural Heritage is responsible in Scotland only for the Habitats Directive, and is thus obliged to comply with the definition associated with that Directive. The Habitats Directive Interpretation Manual EC (2013) gives as its primary definition of saline lagoons "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". As recently as 1989, only two years prior to the Habitats Directive, Barnes (1989) produced his list of 41 UK lagoons, including only 4 from Scotland. In 1998, the UK Joint Nature Conservation committee produced three reports of 142 lagoons at 139 sites comprising an inventory of Scottish saline lagoons (Covey et al., 1998; Thorpe, 1998; Thorpe et al., 1998) with methodology provided by Covey (1999). Only one of the four sites identified by Barnes (1989) was regarded as a lagoon by the JNCC analysis, and this site would now be excluded.

The UK Saline Lagoon Working Group commissioned Bamber (2010) to produce a management guide for the habitat, which resulted in a much improved approach to the habitat. The definition was revised to:

"areas of typically (but not exclusively) shallow, coastal saline water, wholly or partially separated from the sea by sandbanks, shingle or, less frequently, rocks or other hard substrata. They retain a proportion of their water at low tide and may develop as brackish, fully saline or hyper-saline water bodies".

This definition would exclude estuaries, which may support permanent populations of brackish species, but where water exchange with the sea is largely unrestricted. The text makes no reference to the nature of the material that restricts the lagoon's water exchange at the coast, i.e. that forms the partial enclosure or creates the partial isolation. Montrose Basin was included in the SEPA list of transitional water bodies (Fig. 1), yet it had never been suggested as a saline lagoon. The Basin empties to the river corridor at low tide, so that it is an estuary rather than a lagoon according to the criteria of Pérez-Ruzafa et al. (2011) and it is suggested here that any sea exchange should be sufficiently restricted to influence the functionality of a water body for it to qualify as a saline lagoon, in so far as this can be determined.

The only inventory survey of saline lagoons in Scotland was published by the Joint Nature Conservation Committee in 1998 (Covey et al., 1998; Thorpe, 1998; Thorpe et al., 1998) and describes 142 lagoons at 139 sites. However, using data within the reports, 27 of these appear to be fully saline inlets, a further 14 are entirely artificial and appear to lack biodiversity or other features of conservation interest, one has since disappeared due to natural coastal processes, and another is now regarded as a tidal pool. With the identification of 4 new lagoons during [unpublished] SNH survey, the revised total for Scotland would be 103 (Fig. 2), covering a total area of 33.29 km^2, with 164 in England (13.38 km^2), 15 in Wales (0.833 km^2) and 30 in Northern Ireland (1.77 km^2) (JNCC 2013) so that, in terms of area, Scotland holds 67.6% of the UK resource of 49.27 km^2 (Angus, 2016).

A pragmatic approach to monitoring this habitat would be for SNH and SEPA to pool resources and skills, a strategy already employed successfully in Scottish saltmarshes (Haynes et al., submitted for publication). However, the selection of Transitional Water Bodies for Scotland as defined by the Water Framework Directive (Fig. 1) has almost no overlap with the distribution of saline lagoons as defined by the Habitats Directive (Fig. 2). The differences between the two definitions are significant and explained by McLusky and Elliott (2007) and Newton et al. (2014) and would require water bodies regarded by SNH as saline lagoons to be monitored by SEPA using coastal waters methodology; this approach has already been applied in Europe, with apparent success (Newton et al., 2014) and to a certain extent overcomes many of the difficulties of classifying all lagoons as transitional waters highlighted by Pérez-Ruzafa et al. (2011). However, attempts to develop methodology for WFD monitoring of UK lagoons, whether they be transitional or coastal, concluded that "the IQI [infaunal quality index] is not currently used for assessing saline lagoons due to the particular challenges in setting suitable reference conditions for these water bodies" (WFDUKTAG, 2014). The methodology suggested below provides faunal reference condition, though subsequent compliance with that is qualified.

3. What should be monitored?

Though UK Common Standards for Monitoring (CSM) exist for the saline lagoon habitat, these were informally and unanimously abandoned in 2008 as "unfit for purpose" at a meeting of all the UK statutory conservation and environmental organisations in Peterborough. In the absence of progress at a UK level, SNH has developed its own protocols. Monitoring methodology in respect of the Habitats Directive lacks the EU-wide intercalibration required by the Water Framework Directive, so the UK is free to develop its own methodology and grading. Most UK Habitats Directive CSM was agreed in 2001, and is now widely (though far from universally) perceived as having been over-cautious, in that circumstances have been reported as 'unfavourable' that are in reality merely 'less than ideal'. The aim should thus be to report on the habitat in terms that are compliant with the Directive and report condition in terms that are meaningful in terms of site function and take due consideration of the scale and level of pressures on the habitat elsewhere in Europe. Of the 14 WFD pressures listed by Newton et al. (2014, Table 3), in respect of the European mainland, 7 are completely inapplicable in Scotland, and most of the others have a very low impact on Scottish lagoons; the others are agriculture, damming of streams, fishing, tourism, water sports and aquaculture. There has been one historic case of aquaculture which is unlikely to be repeated, and there is one possible impact of shipping, where a recent record of an invasive non-native species has been [conjecturally] attributed to ballast water discharge.

Most CSM includes mandatory reporting and minimum standards for at least extent, biodiversity and some aspect of structure/function.

Extent is not necessarily as straightforward as it might first appear. Though aerial imagery is available for all of Scotland for a range of dates, seasonality and weather play a part in lagoon extent that should be taken into consideration. Many lagoons are higher in winter and can thus be naturally more extensive, especially in

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