



**Alba Ecology Ltd.**

**Beaw Field Wind Farm**

**Freshwater Pearl Mussel Survey**

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COMMISSIONED REPORT

## Summary

BEAW FIELD WIND FARM FRESHWATER PEARL MUSSEL SURVEY.

Contractors: Alba Ecology Ltd

### BACKGROUND

Scotland is a global stronghold for the freshwater pearl mussel *Margaritifera margaritifera*, a species now fully protected under the Wildlife and Countryside Act (1981) (as amended) of Great Britain. It is also listed on Annexes II and V of the EC Habitats Directive (Council Directive 92/43/EEC) and Appendix III of the Bern Convention. Estimates suggest that Scotland holds perhaps up to half of the world's remaining viable populations, with several sites of international importance in the north of Scotland.

A proposal for a wind farm development has been made by the Applicant for Beaw Field Wind Farm, in Yell, Shetland. As part of this proposal, Alba Ecology Ltd. was commissioned to conduct a freshwater pearl mussel survey within the Planning Application boundary area.

### MAIN FINDINGS

- The Burn of Hamnavoe and Burn of Arisdale were surveyed by experienced and licensed surveyors in July 2012 led by Dr Peter Cosgrove of Alba Ecology Ltd.
- No freshwater pearl mussels were found in either watercourse.
- Some patches of potentially suitable, stable, freshwater pearl mussel habitat were recorded within both watercourses.
- This provides evidence that no freshwater pearl mussels are present within the proposed Beaw Field Wind Farm study area. Consequently, there are no freshwater pearl mussel sensitivities that need to be considered.

## 1 INTRODUCTION

### 1.1 Aim

The objective was to undertake a habitat suitability assessment and survey of potentially suitable watercourses for the endangered freshwater pearl mussel *Margaritifera margaritifera*, in relation to the proposed Beaw Field Wind Farm in Yell, Shetland.

### 1.2 Species background

During the past 100 years, the freshwater pearl mussel has declined throughout its Holarctic range to such an extent that it is now listed as an endangered species (IUCN, 1991). Scotland is a global stronghold for the freshwater pearl mussel, a species which is now fully protected under the Wildlife and Countryside Act (1981) (as amended) of Great Britain. It is also listed on the Annexes II and V of the EC Habitats Directive (Council Directive 92/43/EEC) and Appendix III of the Bern Convention.

Recent estimates suggest that Scotland holds an important proportion of the world's known remaining viable populations (Young *et al.* 2001a; Cosgrove *et al.* 2000a). However, the species has declined in Scotland, with gross industrial and agricultural pollution, over-exploitation by pearl fishermen, decline in salmonid host stocks (the short parasitic larval stage of freshwater pearl mussels is entirely dependent upon salmon and trout fry) and physical river bed habitat degradation due to hydro-electric operations and small-scale river engineering works (Cosgrove *et al.* 2000a).

Freshwater pearl mussels were recently rediscovered in Shetland (Cosgrove and Harvey, 2003; Cosgrove and Harvey, 2005) and so surveys of watercourses potentially holding suitable habitats are required to account for this potential sensitivity within the study area.

### 1.3 Habitat requirements

Freshwater pearl mussels are found in fast flowing rivers and streams, with detailed studies on Scottish freshwater pearl mussel populations suggesting that optimum water depths of 0.3-0.4m and optimum current velocities of 0.25-0.75ms<sup>-1</sup> at intermediate water levels are most suitable (Hastie *et al.* 2000). River bed substratum characteristics appear to be the best physical parameters for describing freshwater pearl mussel habitat. Freshwater pearl mussels prefer stable cobble/boulder dominated substrate with some fine substrate that allows the mussels to burrow (Cosgrove *et al.* 2000b). Adult and juvenile mussels tend to have similar habitat 'preferences', although adults are found over a wider range of physical conditions and juveniles appear to be more exacting in their requirements and sensitivity to environmental disturbance (Hastie *et al.* 2000). Juvenile mussels prefer finer stable sediments than adults, particularly clean sand and gravel.

Freshwater pearl mussels live buried or partly buried in the beds of clean, fast-flowing unpolluted streams and rivers and subsist by inhaling and filtering for the minute organic particles on which they feed (Cosgrove *et al.* 2000b). Of specific importance to freshwater pearl mussel survival are levels of silt, algae, suspended solids, calcium and chemical compounds generally associated with enrichment (eutrophication) i. e. nitrate, phosphate and biological oxygen demand (Bauer 1983). Various types of river engineering work can detrimentally impact the habitat of freshwater pearl mussels (Cosgrove and Hastie, 2001).

Freshwater pearl mussels have a short parasitic larval phase on the gills of suitable host fish. The larvae (glochidia) of *M. margaritifera* are very host-specific and can only complete their development on Atlantic salmon *Salmo salar* or brown trout *Salmo trutta*. Usually juvenile fish (fry and parr) are utilised (Young and Williams 1984). The presence of freshwater pearl mussels in any river therefore

depends on salmonid host fish availability. It is usually considered necessary for migratory salmonids to be present within a catchment for freshwater pearl mussels to be present.

## 2 SURVEY METHODOLOGY

### 2.1 Survey site selection

On the basis that there are no known historical records of freshwater pearl mussels within the Application boundary (e. g. Cosgrove and Young, 1998; Cosgrove and Harvey, 2005), survey site selection was directed towards establishing the status (presence or absence) of freshwater pearl mussels and habitat suitability within potentially suitable watercourses in the study area containing salmonids.

Survey site selection was based around knowledge of the species' habitat, host fish requirements, the study area (defined as the Application boundary) and standard SNH guidance for shallow-water freshwater pearl mussel surveys. At the time of survey (2012) no proposed watercourse crossings had been identified, so site selection was targeted towards establishing presence or absence of freshwater pearl mussels (as well as habitat suitability) throughout all potentially suitable watercourses within the Application boundary area. Based on this the following watercourses were selected for survey:

- Burn of Arisdale.
- Burn of Hamnavoe.

### 2.2 Survey methodology

A team of two experienced fieldworkers carried out the survey to optimise search efficiency and for Health and Safety reasons. The watercourse was entered and searched for freshwater pearl mussels, where Health and Safety conditions allowed, using an adapted version of the standardised methodology, as described in Cosgrove and Young (1998) and Young *et al.* (2001b) and recommended by SNH <http://www.snh.gov.uk/docs/A372955.pdf>.

A general survey was made of the selected watercourses and their substrate types within the survey reaches, by walking along the bank and/or by wading in the water. The aim was to identify specific areas that were most likely to harbour mussels using information on their habitat preferences from previous studies and experience. Once an apparently suitable area was found, the watercourse was entered at the nearest point and a search conducted, concentrated in the most favourable substrate types so as to optimise search efficiency. The searches were conducted in the following manner to ensure compatibility with other surveys and the standard SNH recommended methodology:

- Searches were made using a glass-bottomed viewing bucket;
- Viewing was conducted under favourable conditions i. e. bright light, clear water, low flow regime;
- Searches were made in water sufficiently shallow for safe wading;
- Searches were made in an upstream direction, checking favourable sites e. g. in the shelter of cobbles, boulders or overhanging banks;
- Loose debris and trailing weed were moved gently aside but no disturbance of the river bed was required; and
- The substrate in each transect was recorded and classified using the standard Wentworth

Scale (1922).

### 3 RESULTS

The two watercourses were surveyed under SNH licence (No 11658) for freshwater pearl mussels in July 2012 by a team led by Dr Peter Cosgrove. The water levels were low and clear and the weather was bright and sunny providing ideal conditions throughout surveying. No live mussels or empty/dead freshwater pearl mussel shells were found within either of the watercourses surveyed. However, areas of potentially suitable 'in-stream' habitats were present in some of the reaches surveyed.

#### 3.1 Burn of Hamnavoe

The Burn of Hamnavoe is small, permanent watercourse in the middle of the study area, flowing north to south. The lower and mid reaches are relatively steep, unstable and dominated by large sized substrates which are unsuitable for pearl mussels (Figure 1). The mid-upper reaches of the burn are characterised by gentle gradients, mixed sized partly stable substrates and hold small pockets of potentially suitable pearl mussel habitat (Figures 2 and 3). In the upper reaches the watercourse flows through degraded blanket bog, characterised by peat lined banks, slower flows and small deep pools. Some ephemeral tributary burns had collapsed peat banks (Figure 4).

**Figure 1. Burn of Hamnavoe – HU4976481890.**



**Figure 2. Burn of Hamnavoe – HU4974582084.**



**Figure 3. Burn of Hamnavoe – HU4978782254.**



**Figure 4. Tributary burn – HU4989382034.**



No live or dead pearl mussels were found during searches of the Burn of Hamnavoe. Table 1 provides a summary of the typical Burn of Hamnavoe habitats.

**Table 1. Typical Burn of Hamnavoe habitat summary**

Location surveyed		Substrate stability				Width	Depth	Land use/riparian vegetation	
Lower-middle reach									
Photo 1 at HU4976481890		Unstable				2m	0.2m	Rough grazing	
	<b>Bedrock</b>	<b>Boulder</b>	<b>Cobble</b>	<b>Pebble</b>	<b>Granule</b>	<b>C sand</b>	<b>F sand</b>	<b>Silt</b>	<b>Peat</b>
<b>Substrate</b>	20%	40%	30%						
<b>Comments:</b> Unsuitable substrates. Host salmonids present.									
Location surveyed		Substrate stability				Width	Depth	Land use/riparian vegetation	
Upper reach									
Photo 3 at HU4978782254		Mixed, partly stable				3m	0.3m	Rough grazing	
	<b>Bedrock</b>	<b>Boulder</b>	<b>Cobble</b>	<b>Pebble</b>	<b>Granule</b>	<b>C sand</b>	<b>F sand</b>	<b>Silt</b>	<b>Peat</b>
<b>Substrate</b>		15%	40%	25%	10%	10%			
<b>Comments:</b> Mixed patches of stable and suitable substrates. Host salmonids present.									

### 3.2 Burn of Arisdale

The Burn of Arisdale is small-moderate watercourse on the western edge of the proposed wind farm area, flowing north to south. There are gentle gradients in all surveyed reaches, with mixed stable and potentially suitable pearl mussel habitats present throughout (Figures 5-8). There were visibly high densities of host salmonids throughout all reaches surveyed.

No live or dead pearl mussels were found during searches of the Burn of Arisdale. Table 2 provides a summary of the typical Burn of Arisdale habitats.

**Table 2. Typical Burn of Arisdale habitat summary**

Location surveyed		Substrate stability				Width	Depth	Land use/riparian vegetation	
Lower-middle reach									
		Stable				6m	0.35m	Rough grazing	
	<b>Bedrock</b>	<b>Boulder</b>	<b>Cobble</b>	<b>Pebble</b>	<b>Granule</b>	<b>C sand</b>	<b>F sand</b>	<b>Silt</b>	<b>Peat</b>
<b>Substrate</b>		30%	30%	20%	10%	5%			5%
<b>Comments:</b> Stable and suitable substrates. Large numbers of host salmonids present. Macrophytes common throughout several survey reaches.									
Location surveyed		Substrate stability				Width	Depth	Land use/riparian vegetation	
Mid- upper reach									
		Predominantly stable				5m	0.3m	Rough grazing	
	<b>Bedrock</b>	<b>Boulder</b>	<b>Cobble</b>	<b>Pebble</b>	<b>Granule</b>	<b>C sand</b>	<b>F sand</b>	<b>Silt</b>	<b>Peat</b>
<b>Substrate</b>	5%	25%	25%	20%	10%	10%			5%
<b>Comments:</b> Mixed patches of stable and suitable substrates. Lots of host salmonids present.									



**Figure 5. Burn of Arisdale – HU48286822791.**



**Figure 6. Burn of Arisdale – HU481345826898.**



**Figure 7. Burn of Arisdale – HU479580835829.**



**Figure 8. Burn of Sunrabister (tributary) – HU4806208400743.**





## 4 DISCUSSION

### 4.1 Summary of results

The Burn of Hamnavoe and Burn of Arisdale were surveyed using SNH recommended standard methodologies. The sample based survey methodology used does not search every square metre of river bed, so it is conceivable that a small number of freshwater pearl mussels may have remained undetected somewhere within the survey reaches e. g. perhaps hidden under boulders or in deep, dark peaty pools. However, the use of experienced surveyors meant that potentially suitable habitats were thoroughly searched. It is highly unlikely (although hypothetically possible) that freshwater pearl mussels occur in the surveyed reaches where no mussels were found.

These limitations would apply to any freshwater pearl mussel survey carried out using the standard methodologies because it is a sample-based survey and not a complete census. Such a census would require the destructive searching of all loose substrate, including all potentially suitable habitats to search for hidden mussels. Census work of this nature is not carried out in Scotland due to the endangered status of the species and its legal protection, as well as Health and Safety considerations.

### 4.2 Implications of results

There is no evidence that freshwater pearl mussels are present within the proposed Beaw Field Wind Farm study area. Consequently, there are no particular freshwater pearl mussel sensitivities that need to be considered.

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