Freshwater Pearl Mussel Survey Report for Beinn Ghlas Repowering

Alba Ecology Ltd.

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Introduction

Beinn Ghlas Wind Farm is owned by Beaufort Wind Ltd which is a wholly owned subsidiary of Ventient Energy Ltd. Beinn Ghlas Wind Farm is located south-west of Taynuilt in Argyll, Scotland. It comprises of 14 wind turbines and has been operational since May 1999. In July 2021, planning consent was secured (subject to the agreement of a revised S75 agreement) to operate the wind farm for an additional ten years to August 2033.

A repowering project has also been proposed at Beinn Ghlas by Ventient. As part of the planning process, Alba Ecology Ltd. was commissioned to conduct a freshwater pearl mussel (hereafter 'pearl mussel') survey within the Application Boundary of Beinn Ghlas Repowering.

Scotland is a global stronghold for the pearl mussel, a species now fully protected under the Wildlife and Countryside Act (1981) (as amended)[1] of Great Britain and the Nature Conservation (Scotland) Act (2004). It is also listed on Annexes II and V of the EC Habitats Directive (Council Directive 92/43/EEC)[2] and Appendix III of the Bern Convention. Scotland's extant pearl mussel populations are of international importance (Cosgrove *et al.,* 2016).

Estimates suggest that Scotland holds an important proportion of the world's known remaining viable populations. However, the species has declined in Scotland, with gross industrial and agricultural pollution, over-exploitation by pearl fishers, climate change, decline in salmonid host stocks (the short parasitic larval stage of pearl mussels is entirely dependent upon Atlantic salmon and brown trout fry) and physical riverbed habitat degradation due to hydro-electric operations and small-scale river engineering works predominantly responsible (Cosgrove *et al.,* 2000a; Cosgrove *et al.,* 2016).

Pearl mussels are known to be present within Argyll watercourses and so were considered a potentially important ecological receptor for the Beinn Ghlas Repowering project.

Habitat Requirements

Pearl mussels are typically found in fast-flowing rivers and streams, with detailed studies on Scottish pearl mussel populations suggesting that optimum water depths of 0.3-0.4 m and optimum current velocities of 0.25-0.75 ms^{-1} at intermediate water levels are most suitable (Hastie *et al.,* 2000). Riverbed substratum characteristics appear to be the best physical parameters for describing pearl mussel habitat. 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.

[1] *UK Government (1981), Wildlife and Countryside Act 1981.*

[2] *European Commission (1992), The Habitats Directive (92/43/EEC)*

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 pearl mussel survival are levels of silt, algae, suspended solids, calcium and chemical compounds generally associated with enrichment i.e. nitrate, phosphate and high biological oxygen demand (Bauer, 1983). Various types of river engineering work can detrimentally impact the habitat of freshwater pearl mussels and directly kill them (Cosgrove and Hastie, 2001).

Pearl mussels have a short parasitic larval phase on the gills of suitable host fish. The larvae (glochidia) of pearl mussels are very host-specific and can only complete their development on Atlantic salmon or brown trout. Usually juvenile fish (fry and parr) are utilised (Young and Williams, 1984). The presence of 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 also be present.

Aims and Objective

The objectives for this survey and report are:

- To undertake a pearl mussel survey within, and watercourses downslope from, the Application Boundary of Beinn Ghlas Repowering.
- To assess if there are likely to be any impacts of the Beinn Ghlas Repowering on pearl mussels.
- To identify if any additional pearl mussel surveys may be required.

Study Area

The centre of the Application Boundary is situated at approximately Ordnance Survey (OS) grid reference NM 965 258 southwest of Taynuilt in Argyll (**Figure 1**).

Site Selection

Survey site selection was based on the likelihood of whether any watercourses within, and watercourses downslope from, the Application Boundary of Beinn Ghlas Repowering potentially held suitable pearl mussel habitat. Pearl mussels are almost exclusively found in watercourses with substantial headwater lochs/wetland, on relatively shallow gradients. One watercourse within the Application Boundary and one watercourse downslope of the Application Boundary were identified as having potential to hold suitable pearl mussel habitat. These were:

- The unnamed burn flowing out of Loch Bealach an Fhiodhain.
- The lower-mid reaches of the Garbh Allt, which flows into the Abhainn Cam Linnie which itself flows into Loch Nant. The upper reaches of the Garbh Allt were considered to be too shallow, steep, and therefore torrential, to hold pearl mussels.

Note, the small unnamed burn flowing directly north alongside the proposed access track was considered unsuitable for pearl mussel as there is no headwater loch and it is in very steep terrain and likely to be torrential and too fast flowing to support pearl mussels.

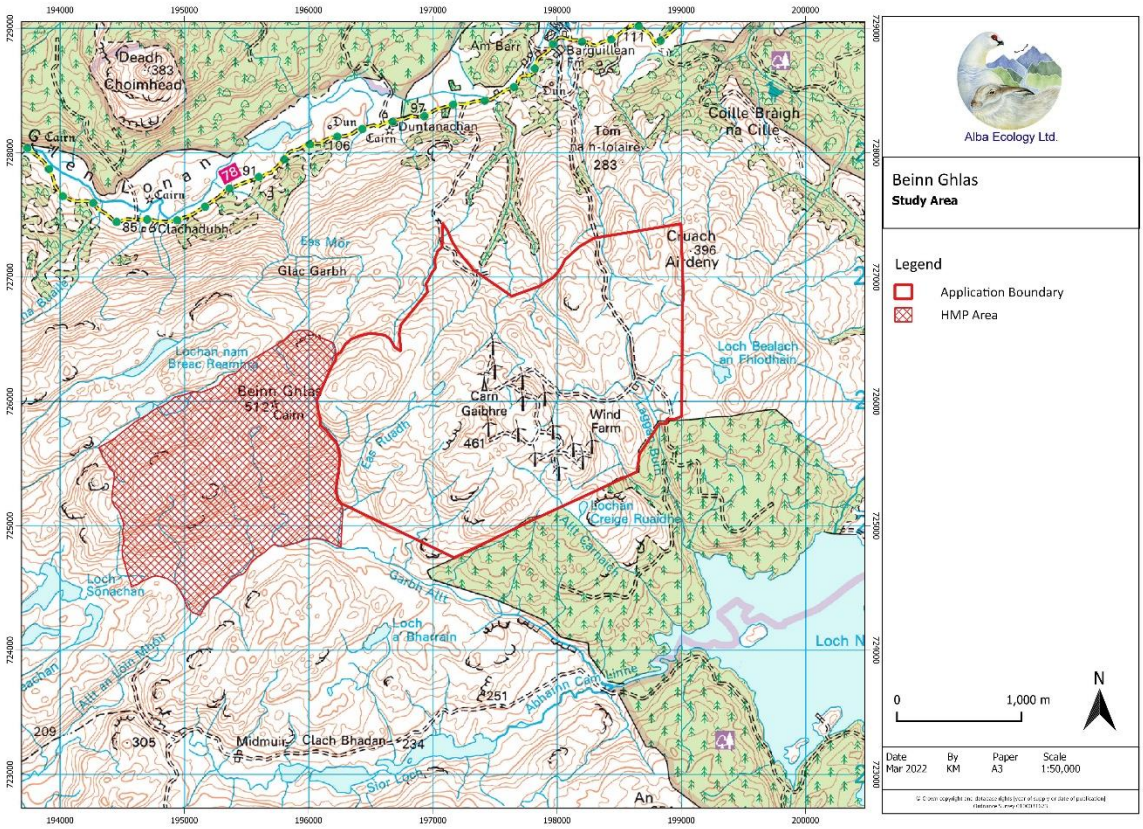


Figure 1: Study Area

Methods

The two watercourses were entered and searched for pearl mussels, where health and safety conditions allowed, using an amended version of the standardised methodology for site specific projects (Standing advice for planning consultations - Freshwater Pearl Mussels | NatureScot)[3].

At the beginning of each survey reach the watercourse was entered, where wide enough, or looked into from the bankside, by a surveyor and a search conducted in the following manner to ensure compatibility with other surveys and the standard NatureScot recommended methodology. 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 apparently suitable habitats were found, surveys concentrated in the most favourable substrate types so as to optimise search efficiency. Searches were:

- Made using a glass-bottomed viewing bucket;
- Conducted under favourable conditions i.e. bright light, clear water, low-moderate flow regime;
- In water sufficiently shallow for safe wading;

[3] *NatureScot, Standing advice for planning consultations – Freshwater Pearl Mussels.*

- In an upstream direction, checking favourable sites e.g. in the shelter of cobbles, boulders or overhanging banks; and
- Loose debris and trailing weed were moved gently aside. Where potentially suitable juvenile habitats were present, disturbance of the riverbed was undertaken to search for small and difficult to see juvenile pearl mussels.

A series of notes on standard substrate composition were recorded using the Wentworth Scale (1922).

Results

The watercourses were surveyed for pearl mussels in March 2022 and November 2023 by a team of highly experienced, licensed surveyors (Licence No: 123301 and 217698) comprising Dr Peter Cosgrove, FCIEEM and Dr Kate Massey MCIEEM. Surveys were conducted during a suitable weather when the water levels were low-moderate and turbidity low/clear and the weather bright providing optimal surveying conditions.

No live or dead pearl mussels were recorded in either watercourse and no substantial areas of suitable in-stream habitats were present either. No reaches were too deep to survey and so the survey was considered comprehensive.

Table 1: Annotated photos from unnamed burn flowing out of Loch Bealach an Fhiodhain, March 2022.

Grid ref	Note	Photo
NM 98796 26129	Unnamed burn was c. 2m wide and 20cm deep at this point. The substrate was bedrock, boulder, and cobble dominated.	
NM 98835 26174	Reasonable potential pearl mussel habitat in small 1-2m sections. c. 1m wide and 0.3m deep. Medium mixed substrates including gravel and fine sands present. Some macrophytes present indicting habitat stability.	
NM 98934 26298	Most of burn narrow and too shallow. It may freeze in winter or dry out in summer and so wholly unsuitable for pearl mussels. Mixed sized substrates dominate most of channel. c. 30cm wide, 10cm deep. For every c. 30m of this unsuitable habitat there might be c. 1m of suitable habitat.	 

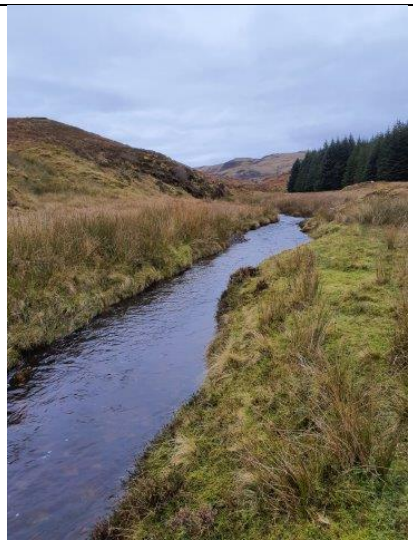
NM 99096 26364	Channel disappears underground for c. 2m here. There was some localised suitable pearl mussel habitat, but mostly it was unsuitable.	
NM 99254 26332	This section of the burn, near the outflow of Loch Bealach an Fhiodhain appeared likely to dry out during low flows. Unsuitable.	
NM 99281 26292	Shallow peat/silty subs at Loch Bealach an Fhiodhain. Crystal clear water. No evidence of pearl mussels present anywhere within this watercourse.	

Table 2: Annotated photos from Garbh Allt, November 2023.

Grid ref	Note	Photo
NM 98402 23714	Width c. 5 m, depth c. 0.4 m. Clear conditions. Bedrock dominated with boulders, unstable substrate. Wholly unsuitable.	
NM 98387 23751	Bedrock dominated substrate with shiny, unstable, superficial deposits on top of the bedrock. Wholly unsuitable.	
NM 98359 23776	Bedrock with shattered superficial and unstable substrate and boulders on top. Wholly unsuitable even in this low gradient 'less flashy' reach. No sign of any suitable mixed sized stable substrates. No macrophytes.	

NM 98307 23845	Width c. 5 m, depth 0.4 m. water levels moderate, but clear. Unsuitable bedrock dominated substrate.	
NM 98485 23685	Confluence with Abhainn Cam Linne. 100 % Bedrock with unstable superficial substrates on top. Unsuitable.	
NM 98528 23695	100 m downstream, of confluence into Abhainn Cam Linne unsuitable Bedrock dominated substrates. Width c. 8 m, depth c. 0.5 m.	
NM 97630 24252	Mid reach bedrock dominated and wholly unsuitable.	
NM 97466 24410	Low gradient section in mid-upper reach, bedrock dominated with shattered unstable superficial deposits on top. Wholly unsuitable.	

NM 97319 24396	Width c. 2 m, depth c. 0.4 m. Unstable shiny, mixed sized, fractured superficial deposit over bedrock. Wholly unsuitable. No evidence of pearl mussels present anywhere within this watercourse.	

Discussion

The unnamed burn flowing out of Loch Bealach an Fhiodhain and the lower-mid reaches of the Garbh Allt, were searched and all survey reaches were shallow enough to search safely and survey conditions were ideal. There was no evidence of any live or dead mussels recorded in either watercourse.

The vast majority of the surveyed reaches had habitats which were wholly unsuitable for pearl mussels. These were either due to a lack of suitable substrates and due to the shallow nature of the burn, which may have sections that freeze in the winter and/or dry out in the summer, or due to unsuitable angular substrates suggestive of highly mobile substrates. Some tiny patches of potentially suitable, though sub-optimal, habitat were occasionally recorded (e.g. in the unnamed burn flowing out of Loch Bealach an Fhiodhain), but these were not considered sufficient to provide enough suitable habitat for a pearl mussel population to establish.

Following the surveys conducted in the unnamed burn flowing out of Loch Bealach an Fhiodhain and Garbh Allt, it is considered that there are no issues or sensitivities with regard to pearl mussels from the proposed Beinn Ghlas Repowering project. As no evidence of pearl mussels were found, it is considered acceptable for this survey report to enter the public domain and not be considered confidential.

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