

**MASTS Small Grant report – SG499: Bats as Coastal Foragers (BACOF)**

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As the use of coastal environments by society intensifies worldwide, there is increasing potential for interactions between marine industries with wildlife for space and resources. These conflicts can only be avoided or mitigated if accurate, up-to-date information is available to regulators and other stakeholders, upon which to base sustainable long-term planning decisions. Bats (Chiroptera) have been studied for many years but several basic questions still remain about particular aspects of their ecology and vulnerability to human activities. Although not traditionally considered part of the marine environment, a limited number of studies suggest that bats can and do utilise coastal marine habitats for foraging and travel, including long-distance seasonal migrations (e.g., Ahlén et al. 2009; Hatch et al. 2013; Lagerveld et al. 2017). An appreciation of the willingness of bats to use ‘marine airspace’ and cross stretches of open water is important to understand the significance of these habitats for coastal populations, particularly in more remote areas such as Scotland where bats remain poorly studied to date. Moreover, bats may interact with various marine industries (e.g., shipping, aquaculture, marine renewable energy generation) while at sea; understanding the potential nature and magnitude of these interactions is important given bats’ protected status in Scotland and elsewhere.

The present study sought to gather baseline data on presence of bats in coastal marine environments in western Scotland. A total of four small autonomous AudioMoth v.1.0.0 broadband acoustic recorders (Open Acoustic Devices<sup>1</sup>; Figure 1A) were purchased under the MASTS Small Grant SG499 (including batteries and assorted peripherals) in Spring 2019. These devices are capable of recording sounds at ultrasonic frequencies up to >100kHz, allowing them to record echolocation calls of passing bats in their immediate surrounding area (within ~10 m of the recorder, as estimated by the manufacturer; N.B. this detection radius varied in accordance with weather conditions, ambient noise levels and spatial orientation of the bat relative to the receiver). Detectors had up to 128GB memory capacity, ran on 3 AA batteries and were housed in waterproofed plastic boxes (Figure 1B).



Figure 1A. An Audiomoth detector. The unit is ~ 5 x 4 x 2 cm in size. © Open Acoustic Devices.



Figure 1B. Example of an Audiomoth in its box installed on a fish farm barge in 2019. © Texa Sim/SAMS-UHI.

<sup>1</sup> Technical details available at <https://www.openacousticdevices.info/audiomoth>.

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In this pilot study, the waterproofed AudioMoths (sampling frequency set at 384 kHz) were deployed aboard the feed barges of four separate salmon farms (Loch Creran, Lismore East, Charlotte’s Bay and Scallastie; Figure 2) in coastal waters of Argyll, western Scotland on eleven separate occasions. Deployments occurred between April and October 2019. Barges were located in coastal waters between ~80-350 m from nearest land, in water depths of ~30-50 m. Deployments were undertaken by fish farm managers following instructions to deploy in an exposed spot well above the water (Figure 1B). Recorders were programmed to subsample, typically recording one minute every 2-5 minutes, and lasted between 7-21 days depending on battery and memory storage capacity. Monitoring effort was uneven, with most consistent monitoring undertaken on the Loch Creran farm, and significantly less data collected aboard the other three farms (Scallastie, Lismore East and Charlotte’s Bay), largely due to logistical difficulties in deploying and recovering units. A number of parallel shore-based deployments on beaches adjacent to SAMS were also carried out in early summer 2019; these data have yet to be analysed in detail.

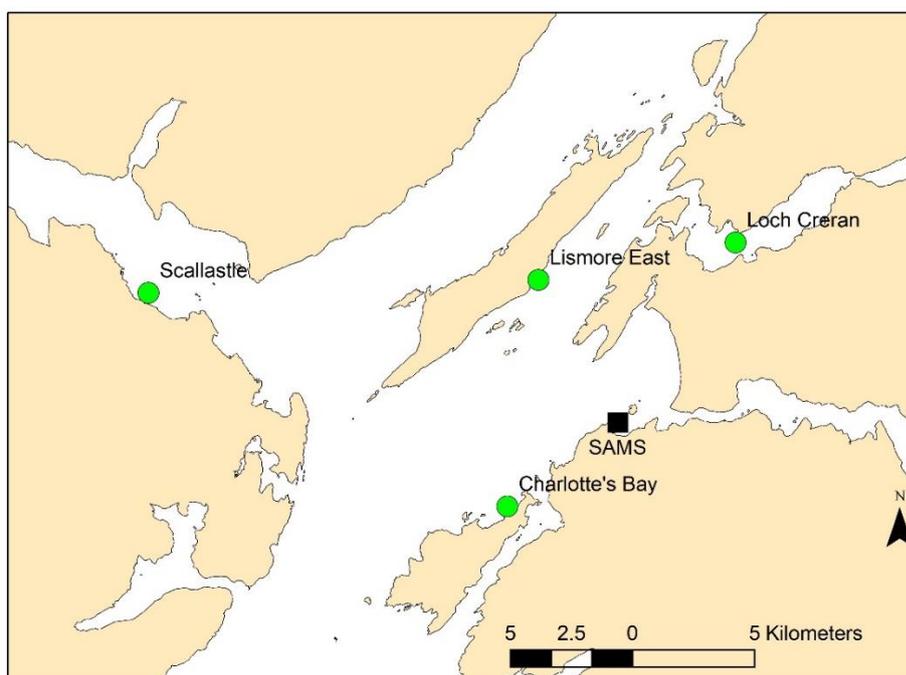


Figure 2. Locations of fish farms where AudioMoths were deployed in 2019. Contains Ordnance Survey and Crown data. © Crown copyright and database rights 2013. Not intended for navigation.

Raw .wav files were analysed for bat calls of a wide range of UK bat species using freely available BatClassify software (Scott 2017). This analysis resulted in numerous potential bat detections, which were then visually validated (Russ 2012). Data were aggregated by species and by minute, resulting in counts of ‘bat-positive minutes’ (BPM) for each species.

Initial analysis indicated that bats were detected regularly at the Loch Creran farm (8 deployments), and at least occasionally at Lismore East and Scallastie (2 deployments each; Table 1). No bats were detected at Charlotte’s Bay (1 deployment). Bat detections were dominated by Soprano pipistrelle (*Pipistrellus pygmaeus*), followed at some distance by Common pipistrelle (*P. pipistrellus*). Observations of other species (notably Daubenton’s bat, *Myotis daubentonii*) were very rare. Analysis of detection rates is still ongoing; at Loch Creran, Soprano pipistrelle average detection rates (BPM/hour) varied between 0.09 – 1.53 BPM/hour (Table 1), indicating regular but varying presence near the farm.

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Table 1. Summary of detection rates to date for Bat-Positive Minutes (BPM) involving Soprano (Ppyg) and Common (Ppip) pipistrelle. Please refer to Figure 2 for farm locations. \*NB. Potential Ppip detections during certain deployments still need to be independently verified due to widespread false positives resulting from electronic/mechanical noise.

Location	Dates monitored (all 2019)	Fraction of night periods monitored	# of BPM (Ppyg)	Average BPM (Ppyg)	# of BPM (Ppip)	Average BPM (Ppip)
Loch Creran	Apr 18 – Apr 27	0.25	1	0.09	0	0
	May 16 – May 24	0.20	2	0.16	10	0.81
	May 29 – Jun 6	0.20	3	0.23	2	0.16
	Jun 7 – Jun 19	0.50	5	0.12	3	0.07
	Jul 24 – Aug 2	0.50	64	1.53	5	0.13
	Aug 9 – Aug 16	0.50	10	0.37	TBD*	TBD*
	Aug 27 – Sept 6	0.33	4	0.11	TBD*	TBD*
	Sept 16 – Sept 27	0.27	19	0.53	TBD*	TBD*
Charlottes Bay	Apr 9 – Apr 18	0.25	0	0	0	0
	Aug 8 – Aug 30	Unit failed; no data collected				
Lismore East	May 15 – May 23	0.20	1	0.08	4	0.33
	May 24 – Jun 1	0.20	0	0	0	0
Scallastle	Jun 26 – Jul 17	0.25	2	0.07	TBD*	TBD*
	Sept 16 – Sept 28	0.25	4	0.11	TBD*	TBD*

Analyses are still ongoing to determine detection rates for common pipistrelle (*P.pipistrellus*), as the BatClassify software yielded significant numbers (hundreds) of false positives, likely caused by high-frequency sounds produced at the fish farm, either mechanically or electronically. Work is ongoing to determine the likely cause(s) of these signals. Likewise, meteorological data are presently being sought to determine potential drivers of bat presence at farms, notably Loch Creran. Additional efforts are currently underway to characterise bat calls as echolocation, prey capture and social calls. Finally, a further review of raw sound data will be carried out to confirm further observations of rare species, if indicated by BatClassify outputs.

This study has confirmed the presence of bats at Scottish fish farms located up to several hundred metres from shore, proving that bats do regularly venture at least this far from land on a regular basis. Ongoing analyses will shed more light on the ways in which bats use these environments, and how they might interact with aquaculture operations and other human activities. Further work is planned using the same detectors on fish farms and other nearshore platforms in the 2020 fieldwork season. I would therefore like to thank MASTS for their financial support which made this work possible. I also would like to thank fish farm managers for their practical and logistical support which ensured successful data collection.

#### Literature cited:

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