MRV *Alba na Mara*

Survey 0123A

Survey report

6-22 January 2023

Ports

Loading: Fraserburgh, 22 December 2022
Sailing: Fraserburgh, 6 January 2023
Half Landing: Gairloch, 15 January 2023
Unloading: Fraserburgh, 22 January 2023

Personnel

A Weetman SIC
K MacLennan (6-11 January 2023)
A Dobbie (6-15 January 2023)
J Hunter (15-22 January 2023)

Gear

1 x UWTV Sledge
1 x UWTV drop frame (large version)
1 x static time lapse camera frame/lander, plus floats and ropes
1 x stand-alone time lapse stills camera, recorder and power supply (for static camera frame)
1 x 600m umbilical towing cable
1 x armoured cable
Video cameras and associated equipment (plus backup) for sledge and drop frame
1 x Calibration grid
2 x Day grabs and table
Hand deployed mini-drop frame with self-contained camera (Data Group's Go Pro), lighting and power supply
Go Pro (Engineering Group) and lights for mini-drop frame
Multiple lasers and adjustable mounting brackets for the drop frame and sledge
1 x BT201 prawn trawl (plus minimal spares)
Prawn sorting table

Days per Project: 17 Days 20154

Objectives

1. To observe fauna using the static lander and time lapse camera.

2. To monitor burrow reconstruction following trawl activity.

3. To obtain video footage from *Nephrops* grounds using adjustable lasers mounted on the TV sledge and drop frame to estimate *Nephrops* burrow complex size.

4. To compare two different methodologies to establish *Nephrops* burrow abundance (using the sledge and drop frame UWTV systems).

5. To use the video footage to record occurrence of other benthic fauna and evidence of commercial trawling activity.

6. To obtain video footage from *Nephrops* grounds using a crane deployed, mini drop frame to measure *Nephrops* burrow diameter, and where possible, associated complex size.

7. To collect trawl caught samples of *Nephrops* for comparison of reproductive condition and morphometrics.

8. To record and collect any trawl caught marine litter.

Narrative

All Marine Directorate (MD) staff were onboard *Alba-na-Mara* by 10:00 on 6 January ready to sail for the west coast. However, due to the very strong westerly winds, the vessel remained in Fraserburgh all day.

On 7 January the direction of the wind had moved round to the south and had weakened sufficiently to allow the vessel to sail, but the medium range forecast indicated poor conditions at the Pentland Firth for a number of days, so the vessel made way for the more sheltered waters of the inner Moray Firth. On arriving in the afternoon of 7 January, a field of view calibration test was carried out on the underwater television (UWTV) sledge before carrying out five sledge deployments as part of the sledge and drop frame comparative trials, and then going to anchor off Burghead.

After arriving at the second site for comparative trials on the morning of 8 January, the sea state was unsuitable to launch the sledge. Following a short postponement in the hope the conditions would improve once daylight arrived, several attempts to deploy and tow the sledge in straight, parallel transects, and at a suitable speed were attempted, but the weather conditions proved too challenging, and so the vessel went to anchor until mid-afternoon. During the down time, the video equipment was transferred from the sledge to the drop frame and once the weather had improved later in the afternoon, the vessel returned to the original site of the sledge deployments and carried out three drop frame deployments, and therefore completing the required coverage for that site. The vessel then went to anchor at Portmahomack in readiness to head to the west coast on 9 January.

However, as frequently occurred during this trip, the forecast changed during the night and the latest update precluded going west, so the vessel returned to the Burghead area and carried out three drop frame tows over the muddy, *Nephrops* grounds. A major change in the forecast at midday meant there was a chance to steam west the following day, but this required catching an early tide through the Pentland Firth, which in turn meant the vessel travelled north to Sinclair Bay (off Wick) to anchor for the night – abandoning the site started earlier in the day.

The journey west on 10 January was particularly rough, with a huge sea swell. During this time, one member of staff sustained a twisted ankle whilst moving around the vessel. First aid was applied and the member of staff rested until the vessel arrived at Lochinver late in the afternoon. The weather remained unworkable during 11 January so the vessel remained in port. The injured member of staff showed no improvement over the previous 24 hours and so arrangements were made for her to return home to be assessed by qualified medical staff and if required, more appropriate treatment. This reduced MD scientific/engineering staff to two for the remainder of the survey.
After a significant steam to Loch Torridon, the vessel made its way to the Upper Loch where the lander, equipped with a time lapse camera, was deployed. As the Upper Loch was surprisingly

free of creels, three sites for comparative trial work were selected, with three drop frame deployments completed on each site before going to anchor in the middle of the loch.

Each of the three sites were revisited on 13 January where the standard five sledge deployments were made on two of the sites and two deployments on the third site before work was halted for the day, returning to the same anchorage as the previous night.

The final three sledge deployments on the third comparative site weird completed on the morning of 14 January in the softest sediment observed in a number of years, before five deployments of the mini drop frame, equipped with a Go Pro camera to measure burrow entrance size, were carried out. The vessel then recovered the lander to check it was working correctly, downloaded the images before redeploying it in the same area. The vessel then moved to Loch Shieldaig and then Outer Loch Torridon in hope to carry out more comparative trials in a different area. However, both lochs were too densely packed with creels to permit safe deployment of any camera equipment, so the vessel made way for Gairloch in readiness for the half landing on 15 January.

Following the half landing, when there was an exchange of MSS engineers, the weather outlook did not appear favourable for a number of days ahead to enable a return to the east coast and plans were made to try and reduce the distance to travel if a break in the weather was forecast. Therefore, the vessel returned to Loch Torridon and recovered the lander before heading to Lochinver for the night.

On the morning of 17 January in breezy conditions the mini drop frame was deployed five times in Lochinver, providing a good coverage of the available suitable muddy sediment in the area, before heading further north to Loch Inchard. After visually surveying the loch from vessel, there appeared to be too many creels and fish farms in the area to allow safe deployment of any of the cameras without the hazard of entanglement, so the vessel moved further north to Loch Laxford, where a similar situation was encountered. The vessel then went to anchor in Loch Laxford where it remained for the next two days, taking shelter from the very strong north westerly gales.

Early in the morning of 20 January the vessel made way for the east coast as the weather had broken, and after a slightly uncomfortable passage, the vessel anchored in Aberdour Bay late in the evening of 20 January.

Once again the weather changed significantly overnight from the forecast, generating unexpected 50 knots southerly winds which were unworkable, so the planned trial of new digital display devices and further mini drop frame work was cancelled and the vessel made way for the safety of Fraserburgh harbour, where all the scientific equipment was dismantled and all work spaces were thoroughly cleaned.

The vessel was unloaded on the morning of 22 January, after which MSS staff left the vessel and returned to the Marine Laboratory in Aberdeen.

Results

Objective 1.

Utilising local knowledge and a preliminary survey using the drop frame to confirm the sediment type and presence of *Nephrops*, the lander was deployed on the north side of Upper Loch Torridon (Figure 2), and remained in place for two days taking one image per hour. After recovering the lander for an equipment check and image download, the lander was redeployed

in a similar area, thus increasing the probability of being located over an active *Nephrops* burrow entrance, which was the primary purpose of this work: to monitor activity of *Nephrops* in and around a burrow entrance over a sustained period of time.

The images from the first deployment suggested the construction of a burrow entrance just out of view, although the edge of the burrow and associated excavated waste material was partially in view in the last frame.

Images from the second deployment were more successful and a *Nephrops* was clearly observed in a number of the stills 'gate-keeping' (i.e. mostly enclosed in the burrow but with claws protruding from the entrance of the burrow), with the *Nephrops* seen having fully exited the burrow on one image.

Although this objective was met, leaving the lander in situ for a longer period of time would likely to have provided more useful results. In addition, the sediment in the area was particularly soft which resulted in the heavy lander sinking a considerable amount into the mud which in turn narrowed the field of view, reducing the surface area observed and limiting the opportunity to obtain relevant and useful observations.

Objective 2.

Burrow recovery experiments have been carried out on previous surveys, with an aim to establish the time it takes for a *Nephrops* to re-establish a burrow entrance once a commercial trawl has passed over and either partially or completely infilled the entrance. This work requires surveying the same areas over a number of consecutive days, without further fishing activity taking place on the grounds. This has proved to be challenging activity on the east coast due to the size of the commercial fishing fleet but was likely to be more successful on the west coast due to the composition and reduced trawling activity of the local inshore fleet. However, with the weather forecasts so changeable during this survey, the possibility for being able to revisit the same site over a number of consecutive days looked unlikely and so after careful consideration, no attempt was made to undertake this work.

Objective 3.

One of several variables that WGNEPS is trying to address is the size of *Nephrops'* burrow complexes, and how this varies geographically. In order to try and investigate this, two lasers were mounted on the sledge in line with the direction of travel and 14 cm apart. This provided a scale from which complexes could be measured. This work follows on from similar work carried out on survey 0122A (as documented in the 2021 WGNEPS report), and a number of initial observations were made during survey 0123A whenever the sledge was used, where maximum, minimum and mean lengths were obtained – although due to the limited number of staff for most of this survey, further work needs to be carried out before any substantiated results can be reviewed. Expert advice will be sought for future similar work.

Objective 4.

Sledge and drop frame comparative trials have been carried out over several surveys, although the number of completed trials on each survey has been relatively low due to the time and suitable weather conditions that are required to deploy the drop frame. Work during this survey adds to the ever increasing catalogue of data, which includes a variety of *Nephrops* complex densities and working conditions.
All footage gathered on both the sledge or drop frame was treated as set out in the protocols generated by the governing ICES Expert Group, *Nephrops* Underwater Television Surveys

Working Group (WGNEPS): i.e. pre-survey training was completed; after reviewing the training manuals and receiving one-to-one training from an experienced member of the survey, relevant reference footage was reviewed; the number of burrow observations in each minute was analysed in R using Lin's concordance correlation coefficient (Lin's CCC); and further training was provided where required. Having passed the required training, the standard approach would be to have the footage from the survey be reviewed by two counters independently of each other, with the results analysed again using Lin's CCC. If there was insufficient correlation between the two counters, then a third, experienced counter would be required to review the footage again, with the two sets of data with the best relationship being submitted. This process ensures all required standards are met.

In all, four sites were completed during this survey (one in the Moray Firth (Figure 1) and three in Loch Torridon (Figure 2), but with one member of staff unable to complete the trip in full, it was not possible to review all the footage during the time at sea. As a result, from the 21 sledge deployments carried out during this survey, 31 out of the 42 reviews were completed; and from the 12 useable drop frame deployments, of the 24 reviews required, six were completed. The remaining footage will be reviewed at a later date.

Objective 5.

Throughout the reviewing process, standard recording forms were used, on which additional observations were noted, such as fish, sea pens and trawl marks, fully meeting this objective.

Objective 6.

In order to achieve this objective, a Go Pro camera and two high powered torches were attached to a metal, pyramidal frame, which was then secured to a winch wire fixed aboard the vessel. The arrangement (called a 'mini drop frame') was then lowered to the seabed where it was left for 30 seconds, a suitable time to allow any disturbed sediment to be washed clear from the field of view. The frame was then raised 7-10 m above the sea bed and held there for another 30 seconds as the vessel drifted over the ground. The frame was then lowered again and the process repeated for up to 30 minutes. A one meter metal rule was fastened to the base of the frame and within the field of view, which provided a scale to measure burrow entrances. The frame design and approach was based on the successful work carried out on survey 0120A.

During this survey five deployments were made in Upper Loch Torridon (Figure 2) and five were made in Lochinver (Figure 3). Footage from each area had some success, although the poor weather conditions did hinder the work. Further analysis of the footage will be at a later date.

Objectives 7 and 8.

As no trawling was undertaken during this survey, length frequency distributions, maturity and morphometric data could not be gathered, and no litter was collected.

Further work.

As well as the planned objectives, a number of additional tasks were carried out during this survey.

a) UWTV surveys require several experienced staff to not only carry out the sledge handling tasks and record the data, but to review the footage with confidence and to the

standard required. With recent staff losses to the UWTV team, new staff are required to fill these roles for this essential work to continue to the standard required. During this trip a member of staff new to UWTV approach was introduced to the survey, and after completing a significant amount of training, made excellent progress in carrying out the work and identifying relevant objects within the footage.

b) Throughout the trip, the Maxsea seabed acoustic mapping software was activated, recording seabed hardness during working hours. This data will be collected and utilized by other groups within MSS and merged with data from other surveys to create habitat maps.

c) Data transmitted from the sledge whilst being towed (distance travelled, depth and height off the seabed) as well as Davis Ship data (position, time, and date) as well as that from the time overlay feature (elapsed time), is recorded on a stand-alone sea going laptop. This device and the accompanying bespoke software is 15^{+} years old and during this survey, a new laptop and updated software was trialed. Whilst at sea data collected from sledge deployments were emailed to Aberdeen and tested by one of the assessment modelers with their R scripts to check for compatibility. Within the day, the results came back saying there were no issues with the data being collected by the new device with the scripts used in the assessments. The original machine is now regarded as the back-up PC.

d) A mini van Veen sediment grab is routinely fitted to the sledge and following each deployment during this survey, a sediment grab was attempted. Occasionally the grab failed if the grab jaws were kept open with a stone, but overall the grab was a success (Table 1 below). Sediment samples will be analysed using a Particle Size Analysis (PSA) machine and used to assess benthic changes over time and in relation to *Nephrops* density and size.

In summary, this survey was significantly impacted by poor weather and a significant reduction in staff soon after sailing. Despite this, the objective of reaching the west coast was achieved, and during the available time there a number of important trials were successfully carried out. Even when working on the east coast, the activities provided further important , relevant data. This trip was testing at times, as a result of reduced staff numbers, poor weather, frequent changes to the work plan, and limited workable time on the west coast, but despite this the majority of the objectives were met bar trawling (objective two) which impacted objectives seven and eight. However, four additional tasks were undertaken and completed successfully, future proofing data collection hardware for further surveys and providing succession planning for UWTV surveys.

The MSS staff on this survey would like to thank all those on MRV Alba-na-Mara for the friendly and professional service they provided throughout this varied and often challenging survey.

A Weetman
10 March 2023

Location	Number of sledge	Number of drop frame	Number of sites	Number of sledge	Number of	Number of still	Number of mini drop	Number of

	deployments during comparative trials	deployments during comparative trials	utilised during comparative trials	deployments for burrow abundance	lander sites	images from lander	frame deployments	sediment samples for PSA
Moray Firth	5	6*	2**	0	0	0	0	5
Loch Torridon	15	9	3	1	2	92	5	12
Lochinver	0	0	0	0	0	0	5	0
Total	**20**	**15**	**4**	**1**	**2**	**92**	**10**	**17**

Table 1: Summary of survey activity and outcomes during survey 0123A.
* Six deployments made on two sites but only three were valid.
**Two sites were surveyed with the drop frame but only one with the sledge, resulting in one site being invalid/incomplete.

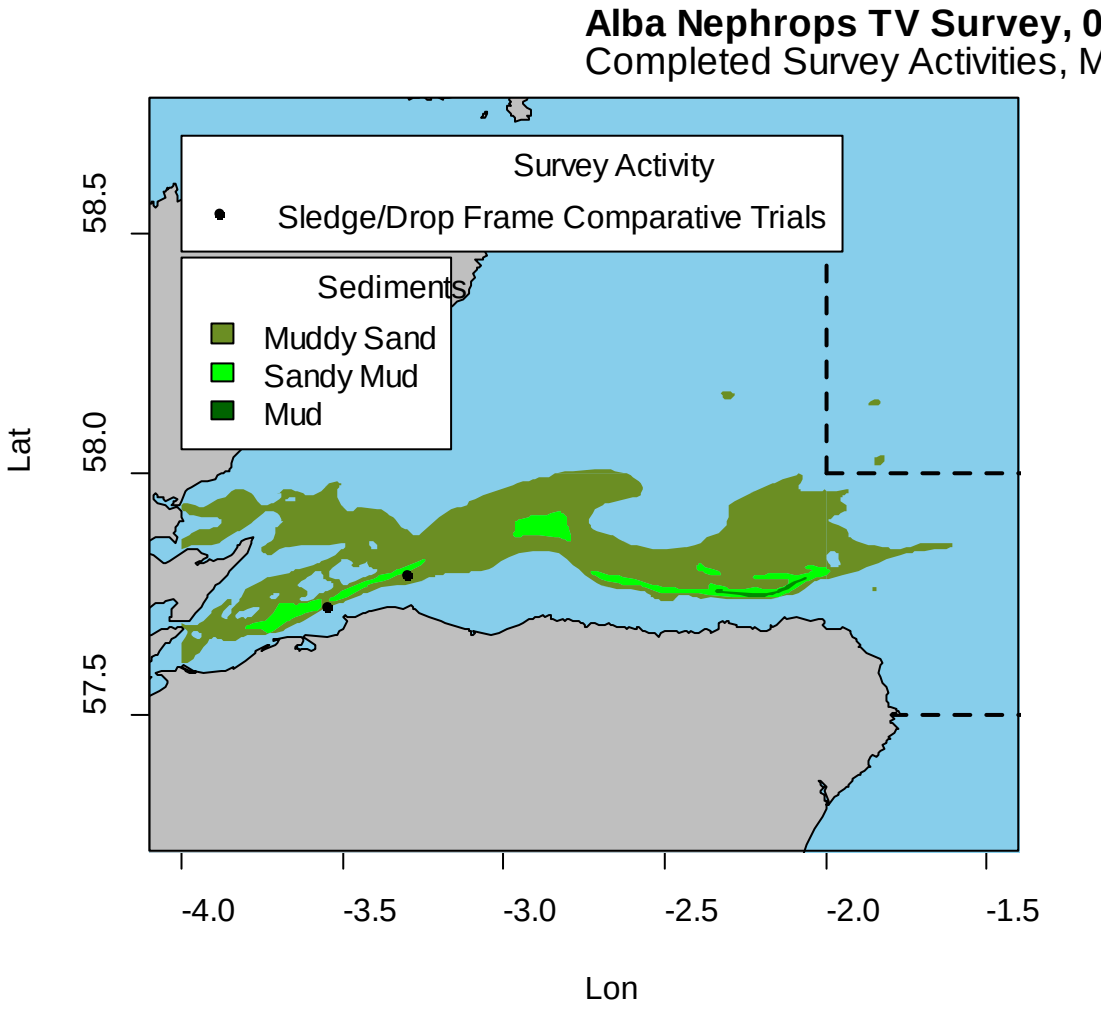

Figure 1: A plot of the Moray Firth illustrating distribution of the various sediment types and the activities undertaken during the survey 0123A.

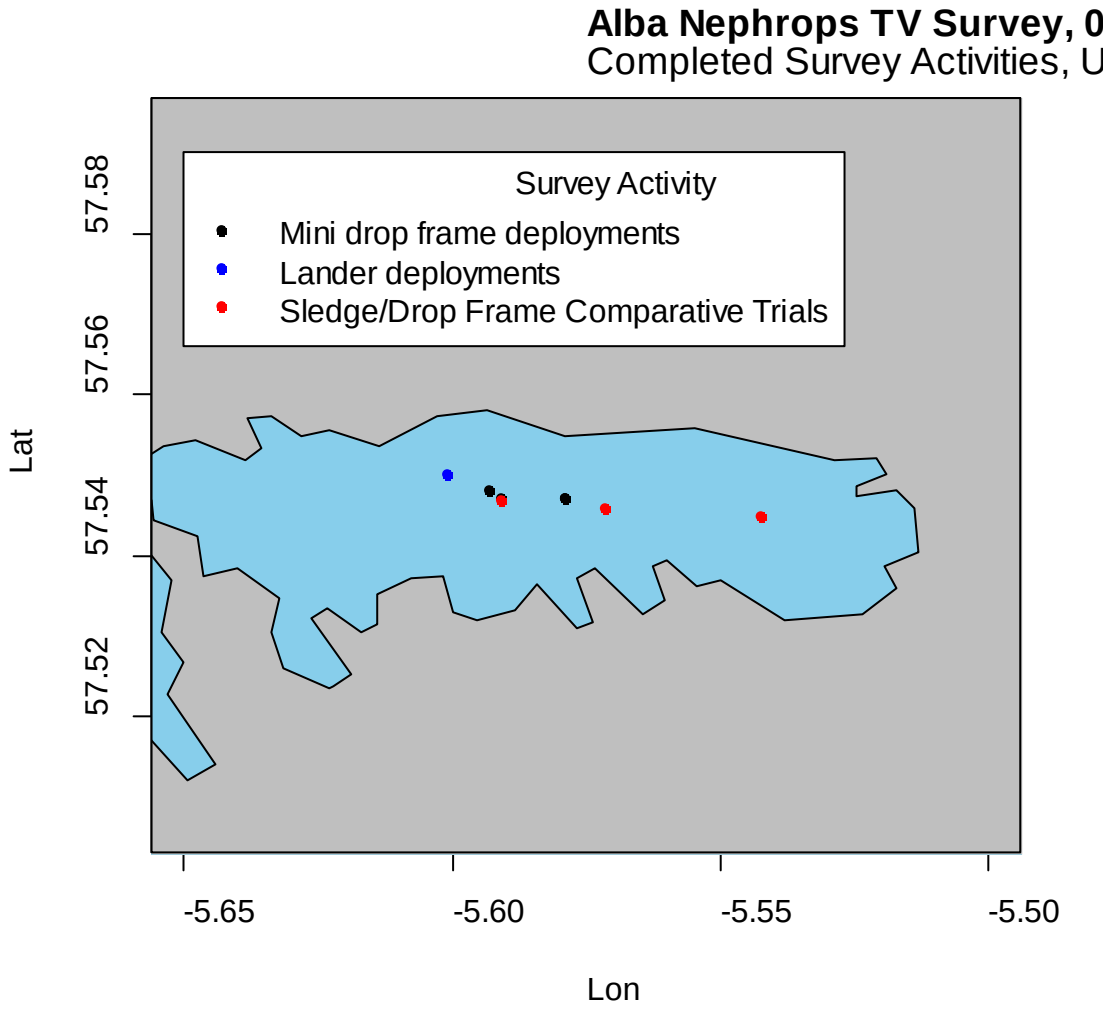

Figure 2: A plot of the area surveyed in Upper Loch Torridon during survey 0123A, illustrating the activities undertaken during that part of the survey. The location of some activity was in such close proximity to other activities, not all individual indicators are visible.

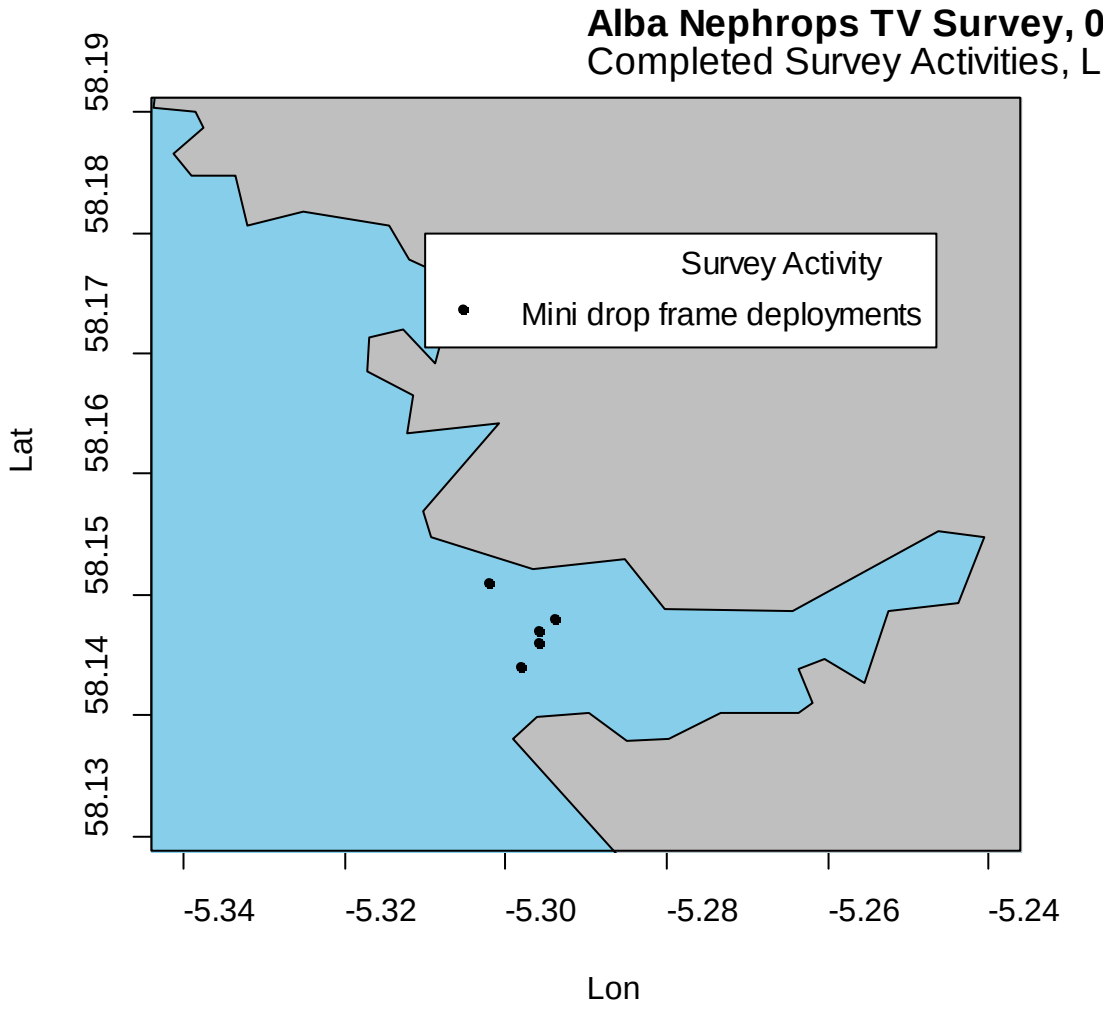

Figure 3: A plot of the area surveyed in Lochinver during survey 0123A, illustrating the activities undertaken during that part of the survey.