Hungry Humpbacks: Measuring seasonal foraging intensity at South Georgia

Final project report: 2025 South Georgia Field Season

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PROJECT OVERVIEW AND OBJECTIVES

A recent study estimated that over 30,000 whales, predominantly humpbacks (*Megaptera novaeangliae*), visit South Georgia waters in the summer months (Baines et al., 2021), making this United Kingdom Overseas Territory the highest-density UK hotspot for recovering whales. Since humpbacks are known to be major krill consumers in the Southern Ocean, the yearly presence of this many whales has management implications for the South Georgia government-managed krill fishery. For example, in the summers of 2018 and 2019, whales were estimated to consume 3.38-5.08 million tonnes of krill in South Georgia territorial waters (Baines et al., 2021). While the winter krill fishery occurs when many humpbacks are on their lower-latitude breeding grounds, there is evidence that some whales may be resident in SG waters well into winter months (Calderan et al., 2023; Kennedy et al., 2023).

To maintain sustainable Antarctic fisheries, CCAMLR conducts regional krill risk assessments (KRA), integrating spatial data relating to krill stocks, predator foraging and krill fisheries into summer and winter data-layers. In the western Antarctic Peninsula (WAP), ~73% of krill consumed by higher predators in summer was estimated to go to whales, showing their impact (Warwick-Evans et al., 2022). The KRA requires summer and winter data on whale abundance, distribution and krill consumption rates. Krill consumption estimates vary widely (Baines et al., 2021; Savoca et al., 2021) and are mostly derived from summer feeding or whaling data. However humpback whale tagging studies in the WAP found that foraging rates declined 51% across the feeding season from summer to winter (Nichols et al., 2022). Additionally, humpback feeding rates are known to be demographically-specific. Therefore, applying standardized summer

consumption rates to wintering whales can substantially overestimate total krill consumed, if whale age, sex, and/or behaviour is not considered.

The overall objective of the Hungry Humpbacks project is to quantify humpback whale demography and foraging rates at South Georgia using established proxies: body-shape (condition) and size (using UAV photogrammetry measurements), diving rates (using satellite tags) and epigenetically measured age, providing seasonal, demographically-specific krill consumption estimates for the KRA, and generating tracking-based winter habitat use models to enhance the fishery management capacity of the Government of South Georgia and the South Sandwich Islands (GSGSSI).

SEASON SUMMARY

The 2025 summer field season was conducted from the King Edward Point (KEP) base on South Georgia Island. The scientific team left the Falkland Islands on January 17th aboard the M/V *Pharos* and arrived in South Georgia on the night of January 22nd. The team conducted single-person cetacean watches on the southbound transit on an opportunistic basis when weather and vessel operations were suitable.

Between January 23rd and 30th, the team prepared the survey gear, familiarized themselves with KEP base protocol, and participated in small-boat training conducted by the BAS boating team. Small-boat training included man-overboard and other emergency drills, assessment of individual boat driving capacity, and familiarisation with KEP boating standard operating procedures. The first whale survey from KEP took place on February 6th, due to inclement weather prior to that date (see Appendix I for a daily events summary). Three team members (AK, EB, JK) boarded the R/V Pharos on March 13th for transport to the Falkland Islands. Two members (SM, NL) left KEP on April 9 on the RRS Sir David Attenborough transiting to the South Orkney Islands during April 11-13 and arriving in the Falklands April 17.

There were five scientific team members working on the project in 2025. Additional assistance was provided by the two BAS boat team members stationed at KEP, plus an occasional rotating crewmember from BAS personnel at the KEP station. All data collection was carried out under permit RAP 2024_039 Issued by the GSGSSI following review and approval of all data collection approaches by the BAS Animal Welfare and Ethics Review Board (review #1114).


80°W
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Brazil
South Atlantic Ocean
Uruguay
Argentina
Falkland Islands
(Islas Malvinas)
South Georgia Island
(Islas Georgias del Sur)
Scotia Sea
Weddell Sea
Antarctic
Peninsula

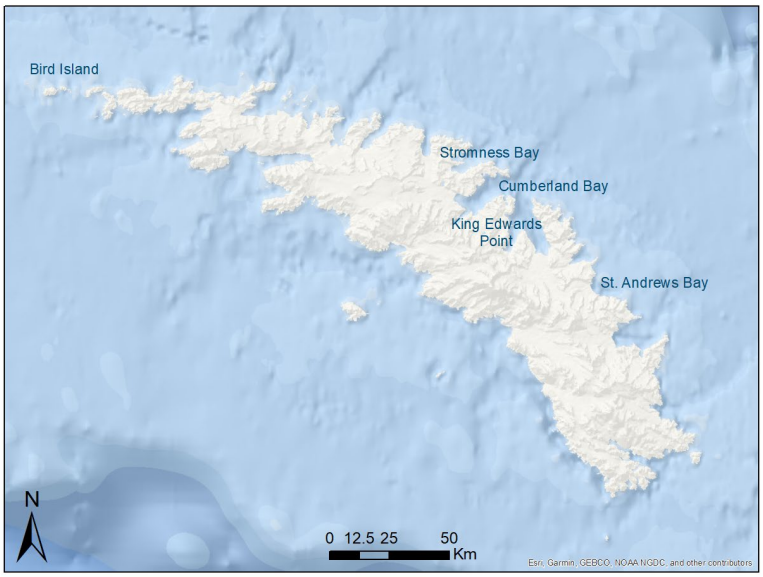
Bird Island
Stromness Bay
Cumberland Bay
King Edwards
Point
St. Andrews Bay
N
0 12.5 25 50
Km
Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 1: *Top*: A map showing the location of South Georgia Island within the South Atlantic Ocean. *Bottom*: A close view of the island, including the location of major landmarks.

METHODS

Visual Observations and Photographic Identification:

The BAS jet boats M/V *Pipit* or M/V *Prion* (used on an alternating schedule to distribute engine hours evenly between the two boats) were the primary observation and support vessels for the field operations. The rigid-hulled inflatable boat (RIB) *Sooty* was equipped with a specially designed tagging/biopsy platform and was always used on survey days as the primary biopsy, photo-identification, and tagging vessel.

Visual observations were carried out from the jet boat by one observer standing at an elevated piloting station on the port side of the outer deck of each jet boat, plus at least one additional observer stationed on the starboard side at deck level. Start/end of day, weather, sightings data, and observer effort were recorded from the jet-boat only. Observations were conducted opportunistically from *Sooty* whenever possible, yet their low clearance and exposure to weather did not allow for standardized observations.

When cetaceans were sighted, data were recorded on species identity, group size (minimum, maximum and likely "best" number of individuals). Sightings where species identification was not possible were classified to the lowest taxonomic level possible. Identification photographs were collected for all species whenever possible, depending on weather and distance from shore.

Biopsy sample collection:

Skin and blubber biopsy samples, for genetic, isotopic, hormone and transcriptome analyses, were collected using small (5cm), stainless steel biopsy darts deployed from a crossbow (Lambertsen, 1987). Biopsy collection took place using the crossbow from a custom-built platform on the front of the rigid inflatable boat designed specifically for this project. After a biopsy attempt, darts and/or samples were retrieved from the water either by hand or with a dip net. Depending on the length of the biopsy, skin and blubber samples were divided into 4 subsamples for genetics, stable isotope, hormone and transcriptome analysis, and stored in 95% ethanol (skin for genetic analyses) or frozen at -80°C (all other samples) at the King Edward Point research station for subsequent shipment to the British Antarctic Survey.

Aerial imagery:

An unmanned aerial vehicle (UAV; DJI Inspire 2) was used to collect aerial images of the dorsal side of surfacing humpback whales for body condition analysis. The UAV was launched from the back of the jet-boats and a laser range finder (attached to the UAV) was used to measure the exact altitude of the drone over the surfacing whale(s). The UAV was flown over the focal whale(s) at altitudes ranging from 20-50m. Video recordings of the whale(s) were made, and a still frame of each animal was extracted to create morphometric measurements. From each image, the body length (distance from the tip of the rostrum to the notch of the tail fluke) and widths (at 5%

increments along the body axis of the whale) were extracted, in pixels, and converted to absolute size (meters) using the measured altitude of the UAV together with the known focal length, sensor size and image resolution (Christiansen et al., 2018). The body length and width data were used to estimate the body volume of the whales, using the approach of Christiansen et al. (2019). The body condition of each measured whale was then calculated as the residual of the log-linear relationship between body volume and body length (Christiansen et al., 2018).

RESULTS AND DISCUSSION

Visual Survey:

South Georgia: Roughly 700km of visual transect data were conducted and 95 cetacean sightings were recorded during the field season (Fig. 2). Humpback whales were sighted on seven days for a total of 26 sightings of a an estimated best count of 62 (range: 59-69) individuals. Eight sightings of ten individual southern right whales, including two mom/calf pairs, were sighted over five days. There were three sightings of three individual Antarctic blue whales (over two days), three sightings of seven fin whales (over 2 days), and four sightings of four minke whales (over two days). Please see Supplemental Materials I for a full account of sightings data.

South Orkneys (Signy and Coronation Islands): A best estimate of 24 humpback whales were observed and fluke photos of roughly 11 individuals were collected (Fig. 3). Aerial images from two southern right whales were collected. Two southern right whales and six humpback whales were biopsied.

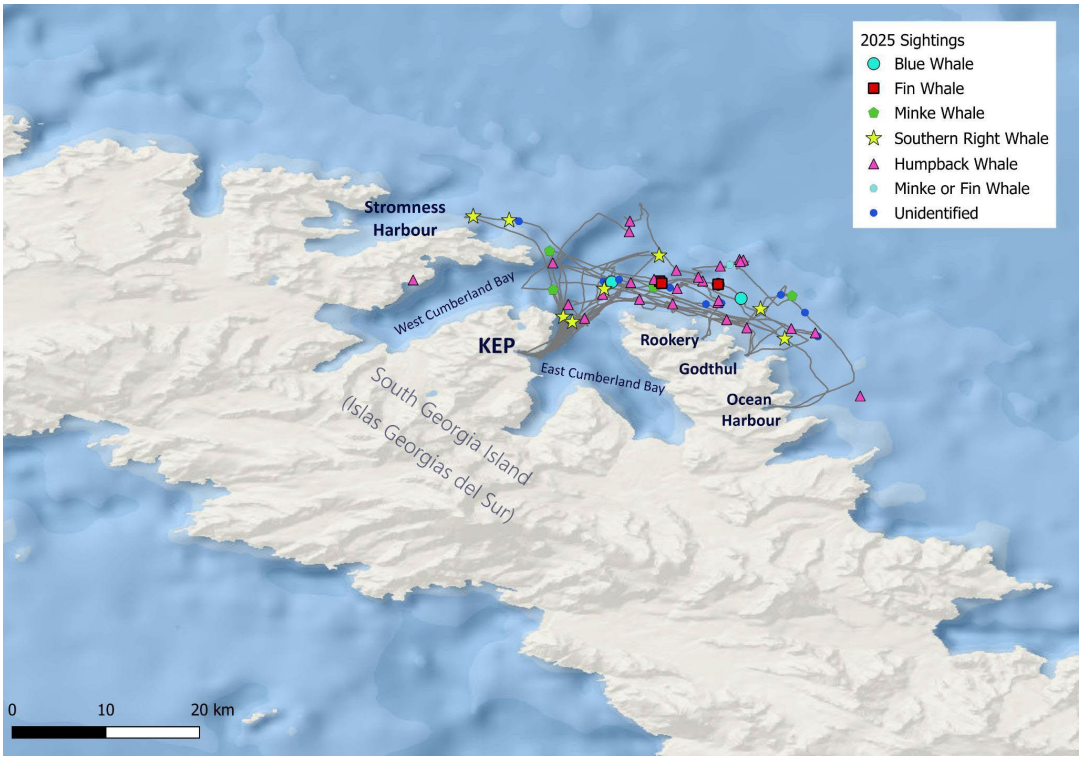

Figure 2. Cetacean sightings and vessel trackline (gray lines) from the Hungry Humpbacks 2025 South Georgia summer field season.

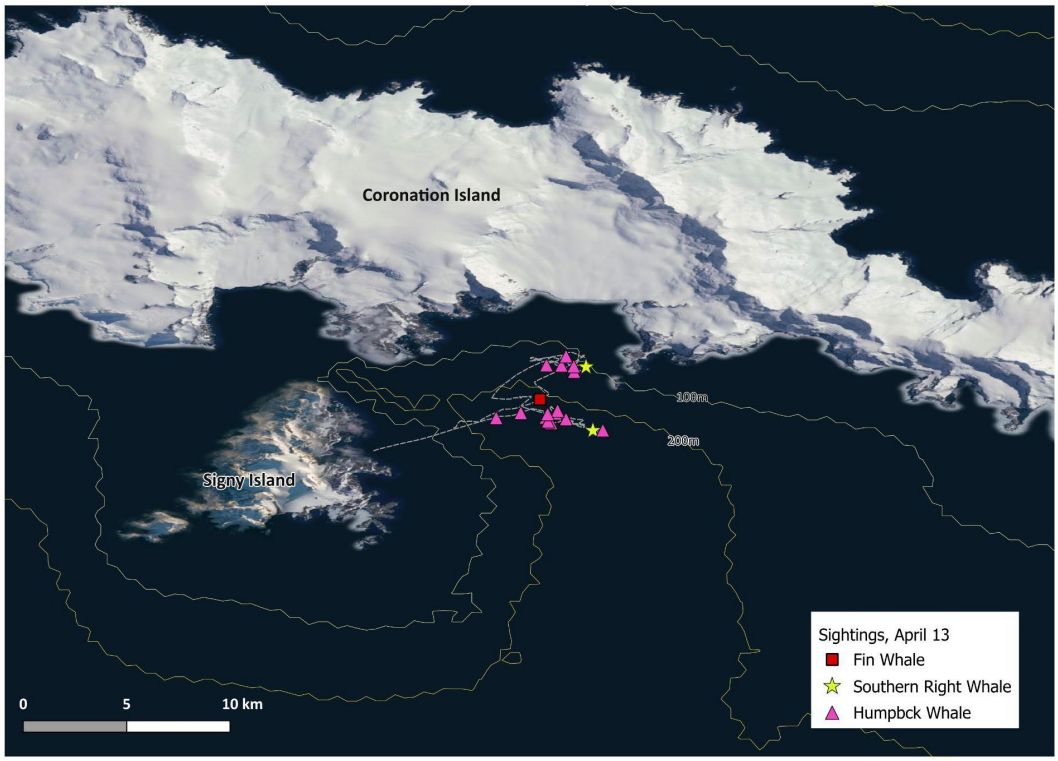

Figure 3. Cetacean sightings and vessel trackline (gray dotted line) off Coronation and Signey Islands on April 13 2025. 100m and 200m contours are shown. .

Photo-identification (Photo-ID):

In all, approximately 2,000 cetacean images were collected during this field season. Of the 10 SRW sighted during this survey, we were able to capture high-quality vessel and/or aerial images of eight individual southern right whales. We captured vessel-based images from six individuals and seven aerial ID images (not necessarily the same individuals). One SRW was not photographed due to extreme weather conditions. Fluke images of at least 36 individual humpbacks were also collected. Right whale images have been compared within the existing SGRW catalogue and also with the catalogues from right whale calving grounds in Argentina, Brazil and South Africa. One match was made from photos of a SRW collected on June 22, 2020 at Bird Island and resighted on April 5th, 2025 (with a calf) just outside the entrance to Cumberland Bay. Humpback whale fluke images have been submitted to HappyWhale.com for comparison with their global catalogue.

Biopsy sampling:

Overall, biopsy sampling was successfully attempted 29 times on seven individual southern right whales, and 22 individual humpback whales (Table 2). With the exception of one humpback and two right whale samples, all samples were large enough for subsampling into two skin and two blubber subsamples for subsequent analysis. Photo identification images and aerial

photogrammetry images were collected for 59% and 48% of these individuals, respectively. Genetic, isotope and transcriptomic work will be conducted at the British Antarctic Survey and University of Auckland. Hormone analyses will be carried out at the Sea Mammal Research Unit at the University of St Andrews.

Table 2. The total number of individuals biopsied and the number of independent biopsy samples taken across individuals for two species of mysticete whales in SG and SO waters.

Scientific name	Common name	Total biopsies	Total individuals
Eubalaena australis	Southern right whale	7	7
Megaptera novaeangliae	Humpback whale	22	22

Aerial imagery collection:

UAV flight operations occurred on 8 of the survey days. A total of 23 UAV flights were conducted. Aerial images of 32 humpback whales and 7 southern right whales were obtained (Fig. 4). Most images were collected during calm seas with good water visibility (low turbidity), thus resulting in good quality images suitable for morphometric measurements (Fig. 4). Biopsy samples (see previous section) were obtained from 14 of the measured whales (10 of the humpbacks and 4 of southern right whales).

Figure 4: Example aerial images of (A) a humpback whale and (B) a southern right whale, showing the measurement locations.

Appendix I: Daily Survey Summaries

DAILY SUMMARY OF EVENTS, HUNGRY HUMPBACKS PROJECT

Jan 16: Board Pharos, overnight in Stanley, FI

Jan 17. Pharos departs Stanley at 13:00.

Jan. 18-21: Transit to South Georgia. Weather did not allow for watchstanding during the transit. Beaufort 7 to 8, 2 to 3m swell.

Jan. 22: Alongside KEP wharf at 09:00. Biosecurity checks, station tour, unpacking and gear setup.

Jan 23: More gear set-up and survey prep. Medical onboarding and first aid kit familiarization. Photo-ID training with EB.

Jan. 24: More gear set-up. Finalized rigging on Sooty.

Feb. 06: PIPIT and SOOTY depart mid-day after Ladybird team pick-up in Husvik. Roughly 20 humpbacks and 1 juvenile right whale in Cumberland bay between Jason Island and Right Whale Rocks. Six humpbacks and one right whale biopsied. **Total hours used: 5.5**

Feb. 09: Pipit and Sooty depart early. Long day of survey with very few whales. Many blows seen very far offshore. 3 minke sightings near Cumberland bay. 6 unidentified whale and 1 humpback sighted. No biopsies collected. Large swell at the end of the day. **Total hours used: 7.5**

Feb. 15: Pipit and Sooty depart early. Catabatic winds in Cumberland bay plus lots of glacial ice made for a very difficult morning–humpbacks seen but it was too rough to biopsy or drone for the most part. Headed south and the weather improved. 16 humpbacks and 2 minkes sighted. 5 biopsies of humpbacks collected. **Total hours used: 7.75**

Feb. 19: Prion and Sooty depart at 10:15 am. Bright and sunny day, low wind, but very high swell (2-3m) outside the mouth of West Cumberland. The swell was too high to safely launch and recover the drone. The boats surveyed to just offshore of Godthul before turning back. No sightings recorded. **Total hours used: 2.6**

Feb. 22: Pipit and Sooty depart at 09:10, immediately encounter a fog bank at the mouth of Cumberland Bay. Wait 40 mins to see if it dissipates. Back to KEP by 10:10, but on standby until 14:30. Called the day at 14:30. **Total hours used: 1**

Feb. 24: Pipit and Sooty depart at 08:30. Low overcast skies turn to fog as we head south. Vis drops from 8km to 2km or less near Godthul. One Bm and one Bp sighted but immediately lost in the fog. The team heads in to Godthul to switch out RIB crew. Fog is very dense as we head

north, zero vis. One right whale sighted near Right Whale Rocks but immediately lost in fog. No images or biopsies collected. **Total hours used: 4**

Feb. 27: AK had cancelled boating for the day, yet Prion and Sooty depart (13:30) at the suggestion of Glyn and Martin, who had been at Sappho point and said the weather looked good. The weather was actually terrible–Beaufort 5, 1 to 1.3m swell. We turned around and came back. No sightings.
Total hours used: 1

March 2: Prion and Sooty depart at 08:30. Sunny but choppy at first, then very large swell. Cruise ship reports some whales further offshore than the area we were searching, so we head offshore and see 2 large unidentified whales. Then we see 2-3 individual humpbacks milling around nearshore. The swell was too high for biopsy and too high to keep an eye on the whales, making tracking basically impossible. We collected 1 drone measurement and one fluke photo from humpbacks.
Total hours used: 4

March 7: Prion and Sooty depart at 09:30. Sunny but high swell with short period and confused seas. Lots of whales seen between RWR and Godthul, but it was not possible to fly the drone. 20+ humpbacks seen plus a handful of fin whales and a blue whale. 13 fluke images and 5 humpback biopsies collected. **Total hours used: 4.5**

March 8: Prion and Sooty depart at 16:56 after a report from Martin on the Pharos of a number of whales seen near RWR and cleared visibility. We rushed out and found a mom/calf pair of right whale. Drone images and a biopsy of the calf collected. **Total hours used: 1**

March 15: A southern right whale was sighted by Kelvin from Carse House in the kelp beds near the shoreline. Sue radioed us, and we attempted to take ID photos from shore. After discussions with Sally; Nico, Bob Pratt, and Stephanie went out in RIB Molly to photo ID and biopsy samples only due to rain, windy, and choppy conditions staying in the Cove only. Photo ID#s and a small skin sample were collected. **Total hours used: 1**

March 16: Amy, Jo and Eva leave on the Pharos.

March 29: Prion and Sooty depart at 11:53 in the morning after foggy conditions. Overcast but winds less than 10 knots to start with, but then became more than forecasted. Surveyed south 1.5 miles offshore as the fog was lingering. SS 4-5 when one humpback was sighted off Ocean Harbor entrance. The drone malfunctioned and only had a brief look at the whale. Due to increasing wind and swells, we decided to turn north and back to KEP. **Total hours used: 4**

April 05: Prion and Sooty departed at 12:28 with the best conditions of the season; SS 0-2 all afternoon with 1m swell or less. Four southern right whales were sighted, two in the area of Right Whale Rocks. The other was a mother and calf pair just south of Stromness Bay entrance. Drone, photo-ID, and biopsy of one adult, drone of the m/c pair, and biopsy of the

calf. No humpbacks were sighted but two UNID whales with tall blows in the distance towards Stronmess Bay. **Total hours used: 4.5**

April 09: Nico and Steph leave KEP on the SDA.

April 13: Nico, Steph, and Bird Island team members George Day and Codie Wardlow depart the SDA on the workboat Erbus at 9:23 in SS 2 and low swell, with SS 4-5 at times before dropping again in areas close to shore. Approximately 22 humpback whales and two southern right whales were photo-IDed. Two southern right whales and six humpback whales were biopsied with four whales having drone images. Effort ended at 14:45 due to increased wind conditions. **Total hours used: 5.25**

Supplemental Material I: Sightings data for Hungry Humpbacks summer 2025 field season.

DATE	TIME	Latitude	Longitude	Daily SGT #	SPECIES	# BEST	#HIGH	# LOW
6/2/2025	13:15	-54.25	-36.46	1	EA	1	1	1
6/2/2025	13:54	-54.25	-36.44	2	MN	1	1	1
6/2/2025	14.1	-54.24	-36.45	3	MN	4	5	4
6/2/2025	14:47	-54.23	-36.42	4	MN	4	3	3
6/2/2025	15:32	-54.23	-36.39	5	MN	2	2	2
6/2/2025	16:27	-54.24	-36.35	6	MN	1	2	1
6/2/2025	17:17	-54.20	-36.47	7	MN	7	10	6
9/2/2025	8:22	-54.22	-36.47	1	BA	1	1	1
9/2/2025	9:09	-54.19	-36.47	2	BA	1	1	1
9/2/2025	9:34	-54.22	-36.37	3	BA	1	1	1
9/2/2025	9:45	-54.24	-36.32	4	UNK	1	1	1
9/2/2025	11:44	-54.23	-36.25	5	UNK	3	3	3
9/2/2025	11:53	-54.25	-36.23	6	UNK	2	2	2
9/2/2025	13:59	-54.25	-36.30	7	MN	1	1	1
15/02/2025	8:30	-54.17	-36.40	1	MN	3	3	3
15/02/2025	8:53	-54.16	-36.40	2	MN	3	3	3
15/02/2025	9:50	-54.20	-36.35	3	MN	1	1	1
15/02/2025	10:34	-54.20	-36.31	4	MN	3	3	3
15/02/2025	11:15	-54.20	-36.30	5	BA/BP	1	1	1
15/02/2025	11:18	-54.19	-36.29	6	MN	1	1	1
15/02/2025	11:27	-54.20	-36.29	7	MN	4	4	4
15/02/2025	12:26	-54.20	-36.29	8	MN	1	1	1
15/02/2025	13:19	-54.23	-36.24	9	BA	1	1	1
24/02/2025	9:39	-54.22	-36.31	1	BM	1	1	1
24/02/2025	9:39	-54.22	-36.31	2	BP	1	1	1
24/02/2025	9:57	-54.23	-36.29	3	BM	1	1	1
24/02/2025	11:31	-54.24	-36.27	4	EA	1	1	1
2/3/2025	9:58	-54.27	-36.22	1	UNK	2	2	2

DATE	TIME	Latitude	Longitude	Daily SGT #	SPECIES	# BEST	#HIGH	# LOW
6/2/2025	13:15	-54.25	-36.46	1	EA	1	1	1
6/2/2025	13:54	-54.25	-36.44	2	MN	1	1	1
6/2/2025	14.1	-54.24	-36.45	3	MN	4	5	4
6/2/2025	14:47	-54.23	-36.42	4	MN	4	3	3
6/2/2025	15:32	-54.23	-36.39	5	MN	2	2	2
6/2/2025	16:27	-54.24	-36.35	6	MN	1	2	1
6/2/2025	17:17	-54.20	-36.47	7	MN	7	10	6
9/2/2025	8:22	-54.22	-36.47	1	BA	1	1	1
9/2/2025	9:09	-54.19	-36.47	2	BA	1	1	1
9/2/2025	9:34	-54.22	-36.37	3	BA	1	1	1
9/2/2025	9:45	-54.24	-36.32	4	UNK	1	1	1
9/2/2025	11:44	-54.23	-36.25	5	UNK	3	3	3
9/2/2025	11:53	-54.25	-36.23	6	UNK	2	2	2
9/2/2025	13:59	-54.25	-36.30	7	MN	1	1	1
15/02/2025	8:30	-54.17	-36.40	1	MN	3	3	3
15/02/2025	8:53	-54.16	-36.40	2	MN	3	3	3
15/02/2025	9:50	-54.20	-36.35	3	MN	1	1	1
15/02/2025	10:34	-54.20	-36.31	4	MN	3	3	3
15/02/2025	11:15	-54.20	-36.30	5	BA/BP	1	1	1
15/02/2025	11:18	-54.19	-36.29	6	MN	1	1	1
15/02/2025	11:27	-54.20	-36.29	7	MN	4	4	4
15/02/2025	12:26	-54.20	-36.29	8	MN	1	1	1
15/02/2025	13:19	-54.23	-36.24	9	BA	1	1	1
24/02/2025	9:39	-54.22	-36.31	1	BM	1	1	1
24/02/2025	9:39	-54.22	-36.31	2	BP	1	1	1
24/02/2025	9:57	-54.23	-36.29	3	BM	1	1	1
24/02/2025	11:31	-54.24	-36.27	4	EA	1	1	1
2/3/2025	9:58	-54.27	-36.22	1	UNK	2	2	2

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