

# **Rdum tal-Madonna rat control project**

**December 2006 - March 2007**

## **Final Report to BirdLife Malta & RSPB**

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**Front cover illustration:** rock pool on the South Cliffs of the Rdum tal-Madonna SPA

## 1. Introduction

Rat control at the Rđum tal-Madonna Special Protected Area (SPA) was carried out as part of BirdLife Malta's ongoing project to protect the Yelkouan shearwater, *Puffinus yelkouan* (EU Life Project LIFE06/ NAT/ MT/ 000097, SPA Site and Sea Actions saving *Puffinus yelkouan* in Malta). These cliff-nesting birds are known to be at great risk from rat predation, with annual losses of eggs and chicks between 40 and 100%. Around one-third of Malta's 1500 breeding pairs of *P. yelkouan* nest at this site, making it an obvious focal point for conservation efforts (references in EU Project Proposal). The relatively small size of the SPA (75.3ha), and that it is surrounded by the ocean on three sides, make it a good site for rat control. The aim of the project was to remove rats from the main part of the site and then, using a network of regularly inspected permanent bait stations, to detect and destroy any rats moving into the area. Following a preliminary site visit in November 2006 a detailed project proposal and risk assessment for the rat control work was prepared (Varnham 2006), which provided the basis for the work described in this report. The intensive phase of the rat control work began in December 2006, continuing until the beginning of March 2007.

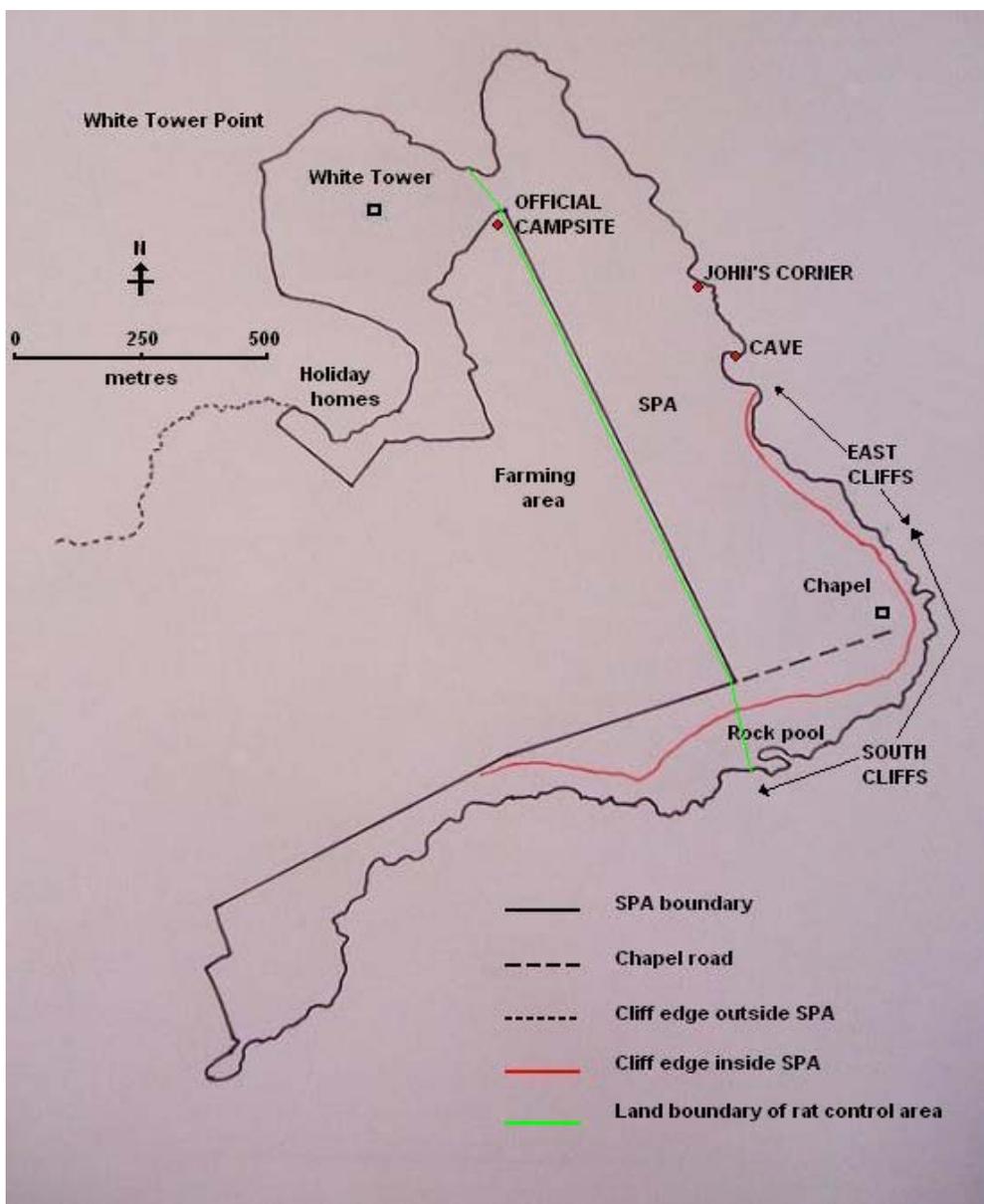


Figure 1: map of the Rđum tal-Madonna Special Protected Area, showing the rat control area.

## 2. Methods

### 2.1 Choosing the area of operation

The initial project proposal details plans for carrying out rat control over an area of approximately 76.5ha, including most of the designated SPA area (see Varnham 2006 for further details). Following further investigation in December 2006, we proposed amending the area of operation to exclude the holiday homes in the Northwest part of the site and the whole of the White Tower point (figure 1). This, we felt, decreased the amount of bait needed, avoided areas of highest risk to non-target species and also considerably simplified the proposed ongoing checks of the permanent bait stations. Following the acceptance of this amendment by BirdLife Malta and the RSPB, the area of operation was reduced to approximately 58ha and the shape of the site was greatly simplified. The land boundary of the rat control area, where permanent control would need to be the most intensive, was reduced from approximately 2000m to approximately 1250m.

### 2.2 Setting up the baiting grid

Work began in December 2006 marking out the 30 x 30m baiting grid on the plateau. This was done by two project staff, each with a compass, and a 30m tape measure. A series of parallel lines, running north-south, were marked out across the site at 30m intervals. These lines were marked every 30m, thus creating a 30 x 30m grid. Each point was marked clearly with red and white flagging tape and a unique identifying number and letter combination (e.g. A1, A2, A3 etc.). This work took approximately ten days to complete.

Marking bait station points on the South Cliff area was done without a grid, due to the shape and steep, rocky nature of this part of the site. The South Cliffs were accessible on foot, but only from one point (just above the rock pool marked on figure 1). Instead of using a grid we marked out a series of approximately parallel lines running along the coast and set stations at 20m intervals along these lines. The stations were always set in locations likely to be attractive to rats and/ or at narrow points where they would be especially likely to take a particular route, e.g. narrow channels between two large rock outcrops. Other parts of the site, the East Cliffs, John's Corner and the cave, could only be reached by using specialist equipment – climbing ropes in the case of the East Cliffs and John's Corner, while cave could only be reached by kayak. Appropriate climbing bolts and the glue needed to secure them were chosen following detailed research and discussion with local and international climbing experts (see figure 2). Rope work at the East Coast Cliffs and John's Corner was always carried out by experienced climbers. Stations on the East Cliffs, John's corner and the cave were positioned ad hoc, wherever a good position could be found, likely to be attractive to rats but also protected from the elements. Stations in the cave were harder to set, as the site was only accessible by kayak and then only in appropriate sea conditions. An experienced kayaker carried out all the work around the cave. Across the whole site, a total of 569 bait stations were set.



**Figure 2: Fixing the climbing bolts.** Holes were drilled into the rock with an HSS drill, using a small vacuum cleaner to extract dust from the holes. The glue was left to set for 24 hours before use.

### 2.3 Baiting

The next phase of the project began in early January 2007 when bait stations were set at each of the previously marked points. We used specially designed bait stations, PROTEXX™ (figure 3), bought from a German pest control company, Urbanguard, as no similar stations were available at comparative prices on Malta. These robust plastic stations had been used extensively before by assistant project leader Guntram Meier on similar projects, with good results. As well as providing protection from the weather and most non-target species, the stations also had a cryptic opening mechanism, which made the stations very difficult to open by people not aware of the mechanism. In addition, special measures were taken to secure the bait stations in parts of the site most frequently used by campers and picnickers. We used two methods to secure the stations – specially designed anchors, also bought from Urbanguard, and strong plastic cable ties, bought from local hardware stores. The anchors, plastic structures fixed onto strong wires, were driven into the soil using a metal pole (see figure 4). The ends of the wires were then threaded through a small hole in the base of the bait station and screwed securely into a second plastic component resembling a cotton reel. This method proved remarkably strong, even in the shallow soil found on the site. We found about 15cm to be the minimum soil depth needed to anchor stations securely, though the anchors had to be driven deeper to give a secure hold in sandy or friable soils. A total of 117 stations were fixed with anchors and 165 with cable ties. Other stations, almost all in the seldom-visited rocky centre of the site were secured under rocks, pieces of wood and other local materials. Each station also displayed a clear warning sticker advising of the contents, asking people not to touch the stations and to keep pets and children away. Warning signs in English and Maltese explaining the project and asking people not to touch the bait stations were also prominently displayed across the site (see appendix 1).



**Figure 3 (left):** One of the plastic bait stations used in the project. A metal skewer fixes the purple bait blocks into place, shown here alongside a white non-toxic monitoring block.

**Figure 4 (right):** A bait station anchor being hammered into place. The anchor wires will later be threaded through a hole in the bottom of the bait station (left foreground)

Following confirmation by Malta's Pesticide Control Board of the legality of using brodifacoum in these circumstances, poisoning began on January 13<sup>th</sup> 2007. Over the course of two days, two 20g blocks of wax based rat bait (Facorat™ Wax Blocks made by I.N.D.I.A. Industrie Chimiche S.p.A., Italy, containing 0.005% of the anti-coagulant brodifacoum) were put in each station, except for those only accessible by climbing, which received four blocks. The bait blocks were threaded onto metal skewers that clipped in place, and could not fall out of the stations even if they were shaken violently. The stations were checked over the course of the following two days, and new bait added as necessary. During these bait checks we recorded presence of rat sign (droppings and/ or rat teethmarks in the wax bait blocks), signs of non-target species taking the bait (droppings and/ or characteristic marks left in the bait), and the number of new bait blocks added. As we were concerned about interference with the bait stations, both in terms of risks to public safety and also as a potential threat to the success of the project, we also recorded whether the stations had been interfered with in any way. This ranged from rocks being moved from around stations, to their being smashed or stolen. The bait stations were checked a total of 13 times over the next 5 weeks, each 'round' taking two to three days to complete.

A number of other techniques were also used to target rats. Two alternative bait formulations produced by the same company were used on some occasions – 20g sachets of paste-based bait (Zagor Pasta™) and a grain based formulation (Facorat Complex™), which we sealed inside small plastic bags in quantities of approximately 40g. All formulations contained 0.005% brodifacoum as well as bitrex, a bitter tasting substance designed to deter humans but undetectable by rats. The paste sachets were used from round 6 onwards, when one sachet was placed in each station to provide an alternative poison formulation to rats that, for any reason, may not have taken wax blocks. Moist formulations such as pastes may be more attractive to rats in some circumstances especially where water is limited. Rats can also vary in their tastes and it was therefore considered useful to offer a variety of methods to ensure that the whole population is targeted. Particular care was taken with the grain-based bait, as it was potentially a higher risk to non-target species. Small mammals and granivorous birds would be more likely to consume grains than the larger and harder to handle wax blocks. It was therefore sealed in small plastic bags before use, each bag containing a slip of paper warning not to touch and that the contents were poisonous, written in both Maltese and English. High quality grain is known to be one of the most attractive foodstuffs for rats, hence its use in many bait formulations including the wax blocks used in this project. However it is also very attractive to many non-target species. To protect non-target species, bags of grain bait were used only rarely, towards the end of the project in stations where rat sign persisted or had newly appeared.

In addition to using bait inside the bait stations, some was also thrown into parts of the site otherwise inaccessible to project staff (including the climbers). Only blocks were thrown, as the other two formulations were considered more attractive to non-target species. Since bait was only thrown into inaccessible areas, mostly onto small ledges on the East Coast cliffs and rock crevices on the South Coast cliffs, it was not judged to a risk to humans and dogs. Rabbits, small mammals and possibly some omnivorous birds may have been at increased risk, but any losses are likely to be quickly recovered through increased breeding success in the absence of rats. Throwing bait was absolutely essential to the success of the project, as there was no other way of targeting rats living on rock ledges and at the foot of the East Coast cliffs. However, appreciating the additional risks to non-target species, this was only done for a two-week period between 13<sup>th</sup> and 26<sup>th</sup> January (rounds 0 to 5) when rat activity was at its highest.

Once rat numbers had declined to very low levels in the rest of the site, a different method was used to target otherwise inaccessible areas. This involved attaching bait blocks to fishing line and thin wire and throwing them onto cliff ledges and rock crevices (figure 5). These 'monitoring lines' had two advantages over simply throwing the bait, in that the lines could be pulled up and the blocks inspected for rat sign, and also that bait was used in much smaller quantities than for throwing. However, a big disadvantage was that coverage was much reduced, as it was impossible to get these monitoring lines to many parts of the site, such as the foot of the East Coast cliffs (approximately 100m high) or several of the rock crevices that had been previously baited. Despite this drawback, 18 monitoring lines have been left in place and should continue to provide valuable information about the presence or absence of rats at parts of the site.

Non-toxic wax monitoring blocks (figure 6) have also been produced and are available for use in the long term monitoring phase. These blocks, consisting of ordinary candle wax mixed with flavouring, can be used anywhere that wax poison blocks are currently used and have been used successfully on a number of similar projects. They are completely safe for non-target species, yet still perform the monitoring role of was poison blocks – that is, to provide an attractive and stable medium for showing up rat teethmarks. These blocks were made in the last few days of the project and left out for up to four nights in three separate locations, all outside the poisoning site. No rat sign was detected using the blocks (a total of 26 blocks were used across the three sites) but it is impossible to say whether this was due to a lack of rats, or to rats avoiding the blocks. It would be useful to carry out further trials with these bait blocks in areas where rats are known to be present, in order to test their acceptance by rats more fully. It may be necessary to increase the amounts of flavouring in the wax blocks or to experiment with other flavourings. Two varieties of flavouring have been used so far, cocoa powder and sardine oil.



**Figure 5 (left): Bait blocks for long-distance monitoring.** The blocks are first threaded onto a piece of thin wire, then tied to a length of fishing line.

**Figure 6 (right): Non-toxic wax monitoring blocks.** These are made by pouring melted candle wax and flavouring into ice-cube trays. Metal loops are pushed into the soft wax enabling the blocks to be secured on bait station skewers or lengths of fishing line.

#### 2.4. Trapping

Trapping was carried out opportunistically around sites of known or suspected rat activity from 29<sup>th</sup> Jan to 14<sup>th</sup> February. Live capture (tomahawk) traps and snap traps were both used, baited with either peanut butter or fish-based baits. Live capture small mammal traps (trip traps) were also used occasionally, baited with peanut butter. We aimed to catch small mammals (mice and shrews) to find out more about which species were present at the site.

#### 2.5. Training

The new site warden, Matthew Borg Cardona, was given extensive training in all aspects of the rat control work. Despite his being appointed relatively late in the rat control project, he accompanied project staff on several full rounds of bait station checks and the subsequent rounds of permanent station checks. He took more and more responsibility on successive rounds until, by the last round, he was taking full charge – locating stations, identifying signs, deciding whether or not to replace bait, recording data and later entering this data into the Excel spreadsheet designed for the purpose. As well as all aspects of the routine bait station checks, he was also trained in setting snap traps, a task which is likely to become a key part of future rat control work at the site.

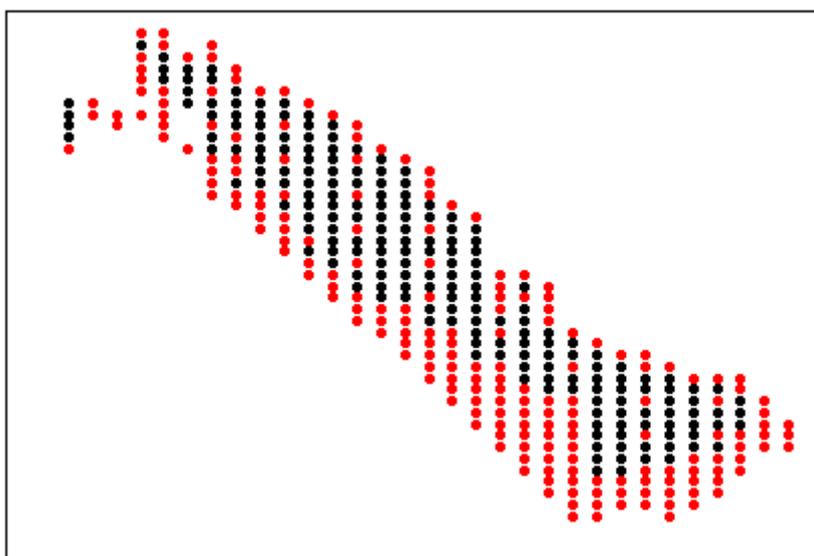
A second Maltese worker, Bernard Bonnici, was also trained in basic rat control techniques. Bernard is a highly experienced climber and kayaker and supplied invaluable skills to the project. Our own climbing expert, Nicole Lohrmann, worked closely with Bernard on the rope-access areas throughout the project, teaching him about bait station placement, identifying rat and non-target species sign, and data recording. In addition to training these two long-term workers, an open morning was held for BirdLife Malta staff from the office and from other reserves. Four members of staff came to visit the project to see the site and how the rat control work was carried out. They each had a chance to check bait stations, and were shown the kinds of sign left by rats and non-target species.

#### 2.6. Setting up network of permanent bait stations

Following the main poisoning phase just under half of the bait stations were collected in, leaving 302 stations and 18 monitoring lines to become the basis of the permanent rat control work.

Figure 7 shows the position of stations left in place on the SPA plateau (further stations were left in place on the East and South Cliffs, John's Corner, the cave, the Campsite and adjoining fields). The permanent stations were left in places where rat re-invasion was considered the most likely. Hence, they are most densely distributed along the road marking the western SPA boundary, where there is nothing else to stop rats from entering from the adjoining farming area. Extra stations were also set along this boundary road, in between existing ones. Another dense concentration of stations were left around the road leading to the chapel, another area where rats could enter the site easily (rats, like many mammals, tend to follow linear landscape features such as roads). A further line of stations was left in place along the eastern edge of the plateau, on the edge of the cliffs. Although little rat activity was found here after the first few rounds, the shearwaters nest on these cliffs and these stations could provide a valuable early warning of rat presence in this sensitive area. Additional stations were set along the edge of the official campsite on the northwest of the plateau. Finally, a small number of stations were left in the centre of the plateau and in the official campsite and adjacent fields.

Stations left in place on the South Cliff follow a similar pattern, with stations most densely distributed around the western land boundary of the rat control area end. There is also another line of stations further along, at a point where the cliffs form a relatively narrow bottleneck, thus forcing any newly arriving rats to travel very close to the stations set here. All stations were left in place on the East Cliffs and John's Corner, as these stations are also very close to the shearwater nesting sites. Further changes may be made to the distribution of permanent stations over time, depending on the patterns of rat activity detected. The current distribution errs very much on the side of caution, though it should still be possible to check this many stations in a single day's work.

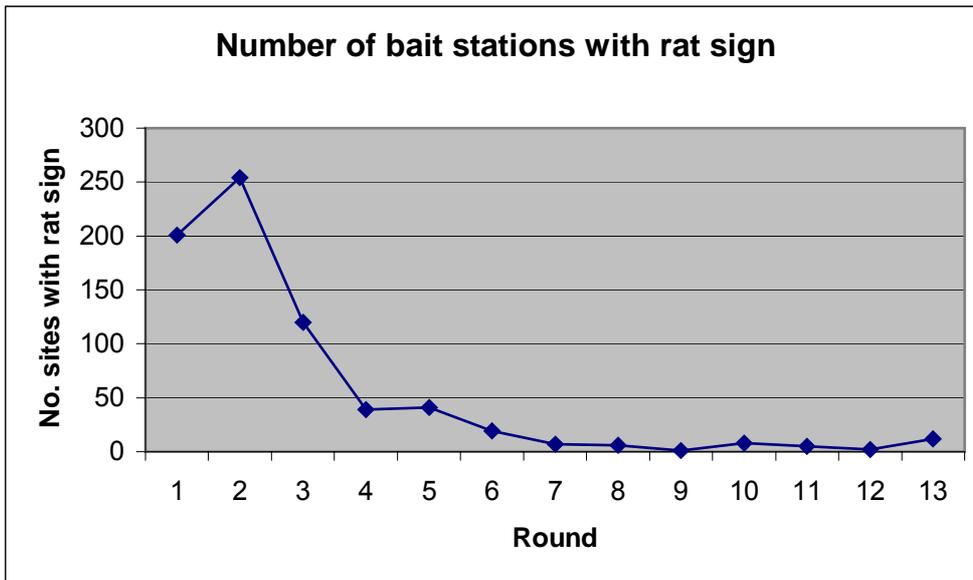


**Figure 7: Permanent bait stations on the main plateau.** The red dots show bait stations left in place, while black dots show those that were collected in. The vertical lines of dots run north-south, north being at the top of the figure.

### 3. Results

#### 3.1. Rat activity

Rat activity at the site fell into two main types - eradicating rats already living in the site, and targeting newly arriving rats from outside the control area. There is likely to be some overlap between these types of activity, but figure 8 shows that the 'eradication phase' lasted approximately 21 days (rounds 1-8). This is typical of the kind of rat activity curve obtained from rat eradication projects using 30 x 30m grids. The immigration of rats from elsewhere on the site probably also peaked during these three weeks, as rats living nearby entered the site in response to the declining density of rats in the control area. With this part of the population now also likely to be gone, new immigration will continue, its rate likely to be largely influenced by the weather and available food supply.



**Figure 8: Number of bait stations showing signs of rat activity over time**

Detailed information on the distribution of rat activity over time is shown in appendix 2. Note that figures in this appendix only include stations on the main plateau (407 bait stations out of a total of 569), where they were arranged on a 30 x 30m grid and hence could be given X-Y co-ordinates easily. Stations not set in a grid format, i.e. those on the campsite, fields, East and South Cliffs, are not shown on these figures.

Figure 9 shows the typical signs of rat activity detected during the project. Droppings were found more frequently early in the poisoning phase, and were not found at all after round 6 (16 days into the poisoning phase).



**Figure 9: Signs of rat activity.** The picture on the left shows the characteristic teethmarks left by rats and also the typical shape of partly eaten bait blocks. The right hand picture also shows rat droppings.

Only a very small number of dead rats were found during the poisoning phase, but this is quite usual. Anti-coagulant poisons act slowly, usually causing a gradual slowdown in the rats' activity before death, which often occurs in their nests or burrows. Consequently, few bodies are usually recovered. In this case we found six rat corpses, between 20<sup>th</sup> January and 22<sup>nd</sup> February. All were black rats, *Rattus rattus*. There were two adult males, two adult females and two individuals too decomposed to distinguish their sex. All rat corpses were buried as deeply as possible at the site, in accordance with the bait manufacturers' instructions.

### 3.2. Non-target species activity

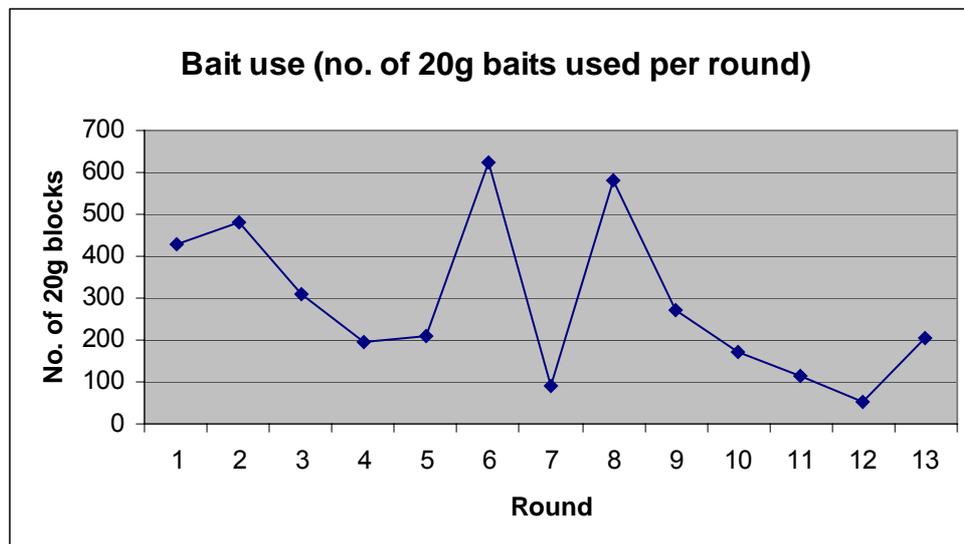
Non-target species activity was also recorded during the bait station checks. Non-target species were found to have eaten bait in 1935 out of 6743 bait station checks (28.69%). The commonest non-target species were molluscs, accounting for 70.65% of non-target species records (1367 out of 1935 records were for this taxon). The next most abundant group were Carabid beetles, accounting for a further 458 records (23.67% of non-target species records), followed by ants (78 records, or 4.03%) and mice and/or shrews (32 records, or 1.65%). Table 1 shows the incidence of non-target species activity in more detail. The exact amount of bait consumed by non-target species was not recorded, but was very generally very small. Ants, beetles, mice and/or shrews typically took very small amounts of bait, in the region of 1-5%, while heavy mollusc activity could result in losses of up to 10% over a period of several days. Other species, such as woodlice, crickets and spiders, were sometimes found inside the stations, but only those actually taking the bait were recorded.

**Table 1: Incidence of non-target species activity.** The figures in the first column show the number of times each taxon was recorded in a bait station, and also these figures expressed as a percentage of the total number of non-target species records. The second column shows the percentage of the total number of bait station checks in which each non-target species was found (from a grand total of 6743 bait station checks).

Non-target species	No. of times recorded	Percentage of times found in bait stations
molluscs	1367 (70.65%)	20,27%
mice and/or shrews	32 (1.65%)	0,47%
Carabid beetles	458 (23.67%)	6,79%
ants	78 (4.03%)	1,16%

### 3.3. Bait choice

We found the wax block baits to be the most useful as they performed the dual role of being palatable to rats and being an effective monitoring tool of rat activity. The teethmarks left in the wax blocks provided a clear and relatively unambiguous indication of rat activity that remained stable over time. Blocks with suspected rat teethmarks could be handled and carried around without destroying the marks. Damage to the paste sachets on the other hand, was much harder to interpret. The soft paste rarely showed clear signs of what had damaged it and was too fragile to bring in for a second opinion. The grain based bait was used only in a very small number of stations towards the end of the poisoning project. It is only believed to have been taken by rats on one occasion and this is only ascribed to rats because of teethmarks found in wax blocks also present in the station. So, while the two alternative bait types may well be palatable and effective for rat control, the additional information available from using wax blocks makes them the best choice for this kind of project. Figure 10 shows the number of 20g baits (blocks and sachets) used on each of the 13 rounds. This includes all baits replaced in stations as well as those thrown into inaccessible areas.



**Figure 10: Bait use over time.** The peak on round 6 was caused by adding a paste sachet to each station on that round. The peak on round 8 was caused by replacing all sachets with more than a very small amount of bait take and also replacing all wax blocks showing signs of weather, mollusc or beetle damage. The final peak, on round 13, was due to replenishing the bait in a number of the stations that were to become part of the permanent grid.

#### *3.4. Human activity at the site*

Despite high levels of human activity at the site, interference with the bait stations remained fairly low, with only 11 stations stolen and a similar number damaged beyond use during the five-week intensive poisoning phase. This low figure is probably due largely to the extremely effective anchor system used to fix the stations to the ground in areas with high human activity. So, although low-level interference was fairly widespread, especially in the illegal camping area in the south-west of the site, most people were not sufficiently curious about the stations to go to the trouble of pulling them up or breaking them open. The benefits to those who did were extremely limited (i.e. two blocks of poison and a broken bait station), which probably discouraged repeat offenders.

The main problem connected with the continued high numbers of visitors to the site is that of rubbish, with large amounts of food waste being left in the site after picnics and camping trips (figure 11). This was always particularly bad at weekends and I would often collect two or three bin-bags full of food waste from the illegal camping area on a Monday morning. This problem is likely to get worse over the coming months as the warmer weather attracts more visitors. Significant amounts of human and dog excrement are also found in parts of the site, notoriously in the part of the plateau south of the chapel road. As well as being a health hazard for fieldworkers and general visitors, this increases the likelihood of rats picking up and transmitting diseases throughout the site.



**Figure 11: Food waste left at the site.** Discarded bread, fruit peel and the remains of barbecues were very common, along with glass bottles (often broken) and plastic plates.

#### *3.5. Trapping*

We trapped for a total of 28 trap-nights with tomahawk traps and 62 trap-nights with snap traps (a trap-night is one trap out for one night). No rats or other non-target species were caught during this time. Small mammal traps were set for a total of 44 trap-nights but, again, no small mammals or other species were caught. Trapping did not begin until 29<sup>th</sup> Jan, after the rat population had crashed so it is not particularly surprising that no rats were caught. Small mammal activity (as shown by teethmarks in bait blocks) was low throughout the whole of the poisoning phase, suggesting either a low density of small mammals, that they were not attracted to the bait, or some combination of the two. If small mammals are indeed at low densities, and/ or are not attracted to feeding in plastic structures (such as bait stations or trip-traps), then it is also not surprising that none were caught in the relatively few trap nights fitted into the project.

#### 4. Future of the rat control project

The regular checks of the permanent bait stations have now become the backbone of the project and will need to continue indefinitely. We have good data concerning rat activity from January to March 2007 but at present no idea how this will change over the seasons. The quantity of food waste left at the site, the availability of alternative natural food sources within the site and in the neighbouring farming area is likely to vary considerably throughout the year. The regular checks of the permanent bait stations will build up a detailed picture of rat activity across the seasons and across the site. Based on this information, the intensity and pattern of rat control activity can be continually reviewed and adapted to maximise effectiveness. A manual has been produced for the warden, containing information on various rat control activities, such as guidelines for when, where and how to set snap traps, when to replace bait in bait stations, how to record data etc. A copy of this manual is included in appendix 3.

#### 5. Recommendations

- a. *Continuing bait station checks* – These are absolutely vital for the long-term success of the project. The site warden has been trained in carrying out bait station checks on the plateau and South Cliffs. Stations on the East Cliffs and John's Corner, which are only accessible by climbing with ropes, have so far been checked by Bernard Bonnici. Bernard has been an extremely reliable and competent worker, and possesses all the necessary specialist skills for the climbing and kayaking work. I strongly recommend keeping him on for future bait station checks in these parts of the site. It would also be extremely useful for the site warden to have a small digital camera provided by the project, so that any unusual marks in bait blocks or other signs can be photographed and sent to me or other relevant authorities as soon as possible.
- b. *Dealing with alternative sources of food* - This is currently the biggest threat to keeping the site rat free. The large amounts of food waste left around the site will attract rats from elsewhere in the site and, by providing an alternative to the poison bait, could allow them to become re-established. The problem of food waste needs to be tackled at two levels. Firstly, site users need to be strongly discouraged from leaving food waste at the site. This could be done through information signs and/ or the personal intervention of the site warden as he interacts with site users. Secondly, any food waste still left at the site needs to be actively searched for, collected and disposed of away from the site, all as quickly as possible after it is left. The question of whether or not to provide rubbish bins at a natural site is always a difficult one. While providing bins can encourage site users to put food waste in them, it also discourages them from taking their waste with them and disposing of it away from the site, which is the preferred outcome. In addition, bins need to be maintained (to ensure they are not left overflowing, or their contents become accessible to rats) and emptied regularly. Personally, I would recommend placing a few bins at the site at the present time, as the notion of getting all users to take their rubbish away with them seems improbably optimistic in the short term. If bins are used, they should be steel or at least very thick plastic, so that they can't be chewed through by rats. They need to have close fitting lids, perhaps attached by a length of chain to the bin so that they are not easily lost or stolen. Bait stations could be incorporated into the bins (perhaps underneath them) as long as this can be done without unacceptable risks to dogs.

In addition to food sources left by human visitors to the site, there are also natural food sources that could cause problems for some parts of the year. There are a number of fig trees on the site that were already carrying small unripe fruit when I left Malta in early March. When ripe, these will provide a locally abundant food source for rats, and may well be taken in preference to the bait. I suggest keeping a close eye on fig trees and other fruit bearing trees and shrubs, such as *Opuntia*, looking for rat sign and, where safe to do so, placing additional bait stations and snap traps around fruiting plants. Bear in mind that rats may not be entering bait stations around fruiting plants, so just looking for teethmarks in bait blocks inside stations may not be sufficient to detect rats in these places.

- c. *Continued communication.* The new site warden, Matthew Borg Cardona, has made an excellent start to his work on the rat control part of his job, showing an aptitude for the different skills required. To support him in this work I am very happy to maintain communication with him, reviewing the bait station data as it is collected and answering any questions that may arise. While the long-term future of the project is entirely in BirdLife Malta's hands I am keen to help in any way possible to guarantee its success. The budget contains provision for three return visits of one week each to be made over the course of the project. While these are provisionally scheduled to take place annually from 2008 to 2010, they can be made at any time, perhaps in response to emergencies if necessary.

## **6. References**

Project proposal, SPA Site and Sea Actions saving *Puffinus yelkouan* in Malta (EU Life Project LIFE06/ NAT/ MT/ 000097)

Varnham, K. J. (2006) Options for long-term control of rats at Rdum tal-Madonna, Malta: Feasibility study, risk assessment and project plan. Unpublished report to BirdLife Malta and RSPB.

## **7. Acknowledgements**

I would like to thank my excellent co-workers Guntram Meier and Nicole Lohrmann for their hard work, good humour and company, and also Bernard Bonnici and Matthew Borg Cardona for their help with fieldwork at the site. I would also like to thank all the staff of BirdLife Malta, Mark Day and Jane Devitt of the RSPB, and John J. Borg for all their invaluable help.

## Appendix 1: Text of warning signs displayed at the site



# WARNING

## Rat control project in progress

Between January 4<sup>th</sup> and February 28<sup>th</sup> 2007 essential rat control work will be carried out in the Rdum tal-Madonna Special Protection Area. This project aims to prevent rats from damaging local wildlife and will improve the site.

The project will use rat poison (brodifacoum, a poison widely used in Malta) fixed inside secure bait stations that will be checked regularly by project staff.

**The poison is also toxic to people and dogs. Please do not touch the stations, or allow children or pets to do so.** Rats feed from the stations, so touching them may be a potential health risk. If you would like more information, please call 79938652.

# TWISSIJA

## Progett Kontroll tal-Firien

Mill-4 ta' Jannar 2007 sat-28 ta' Frar 2007 se jkun ghaddej progett biex jinqerdu l-firien mill-inhawi ta' l-iRdum tal-Madonna, Sit ta' Protezzjoni Specjali. L-iskop tal-progett huwa li titwaqqaf il-hsara li ssir mill-firien lill-fawna indigena, kif ukoll biex titjeb il-kwalità tas-sit.

Wagt dan il-progett qed jintuza l-Brodifacoum, velenu tal-firien komuni f'Malta. Il-velenu huwa maghluq f'numru ta' zoni li jservu ta' lixka ghall-firien, li jieklu l-velenu u jmutu. **Ghalhekk jekk joghgbok tmissx dawn iz-zoni ta' lixka u thallix tfal jew annimali domestici jersqu lejhom.**

Haddiema tal-progett qed jiccekkjaw regolarment dawn iz-zoni. Ghal aktar taghrif, cempel 79938652.

In partnership with:

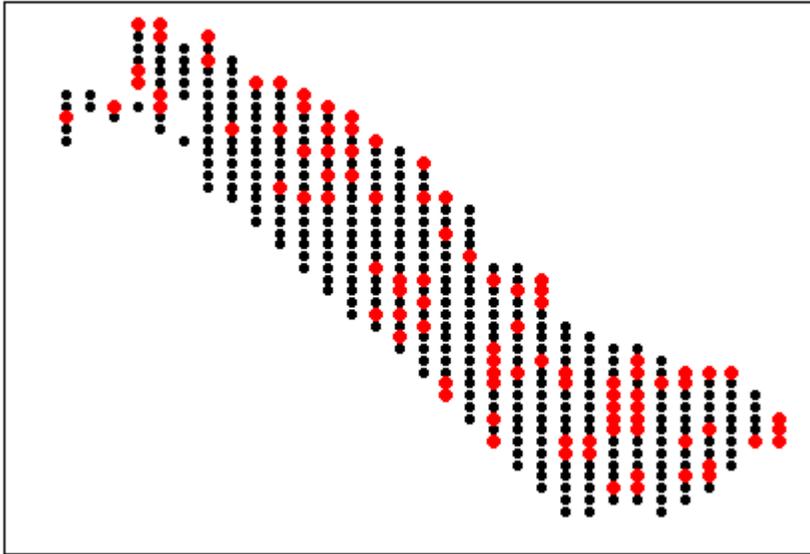


Co-funded by:

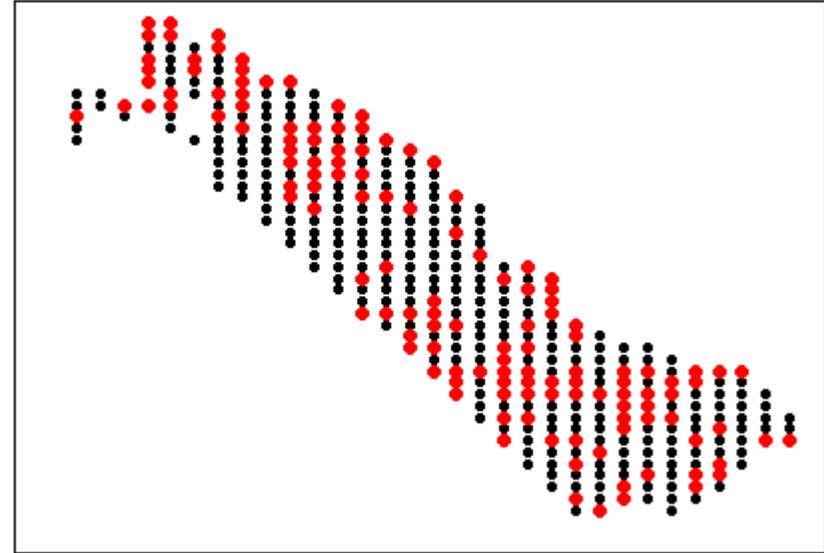


### Appendix 2: Distribution of rat activity on the plateau

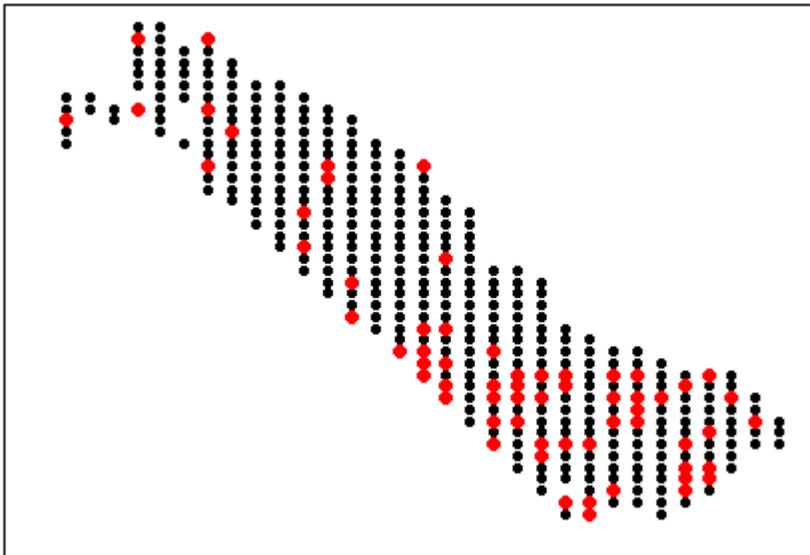
Each dot corresponds to a bait station on the 30 x 30m grid (thus excluding stations on the cliffs and elsewhere). Red dots indicate stations where rat sign was detected on each round, while black dots show stations with no rat sign. Stations that were not checked on a particular round have no dot.



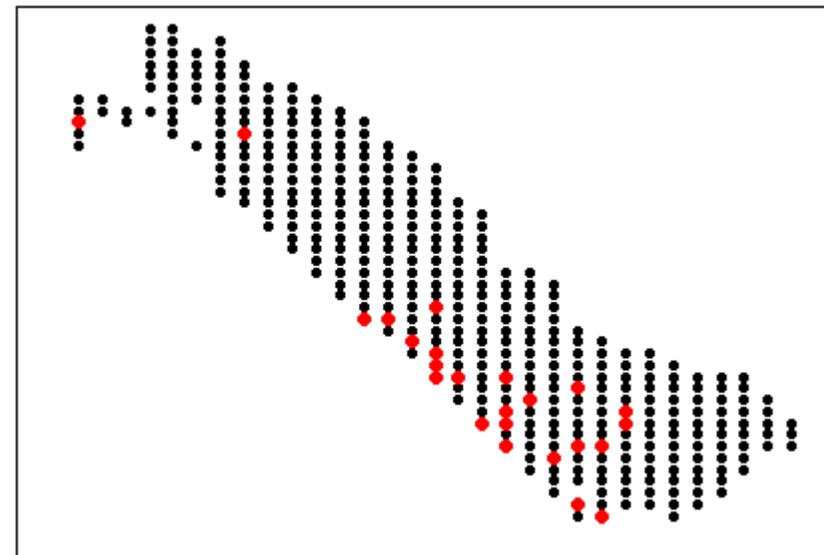
Round 1 15<sup>th</sup>-16<sup>th</sup> January



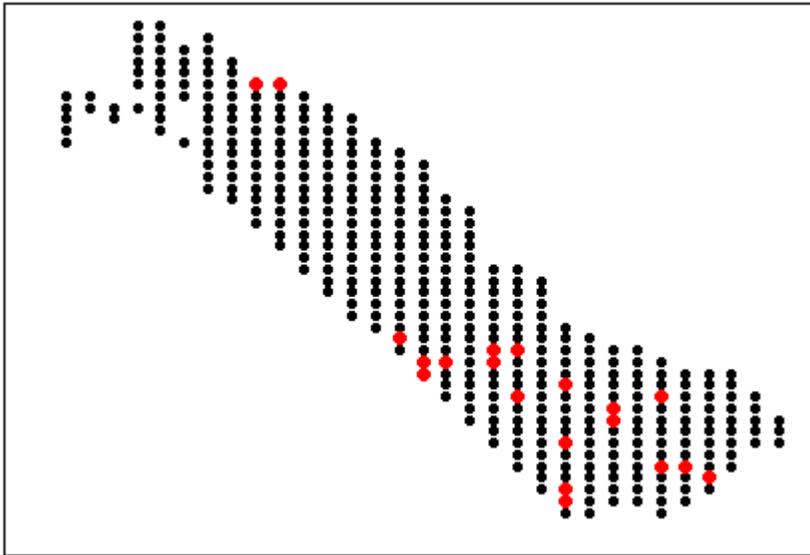
Round 2 18<sup>th</sup>-19<sup>th</sup> January



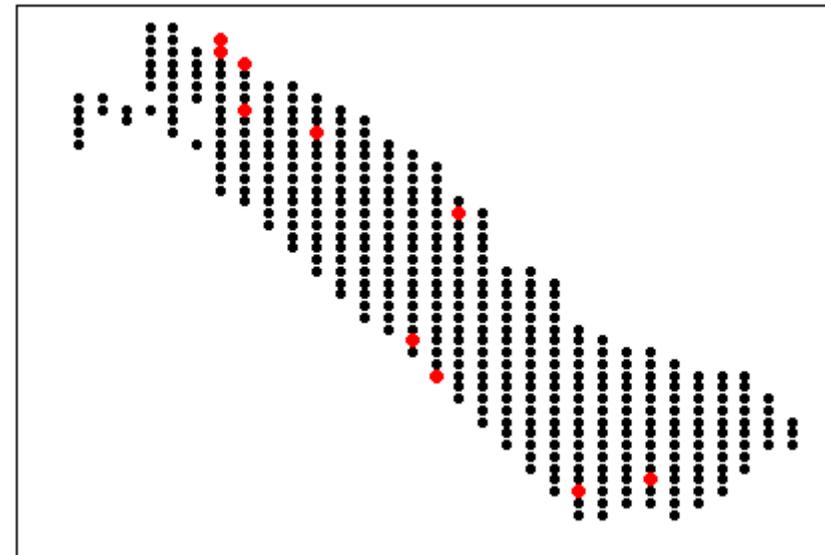
Round 3 20<sup>th</sup>-21<sup>st</sup> January



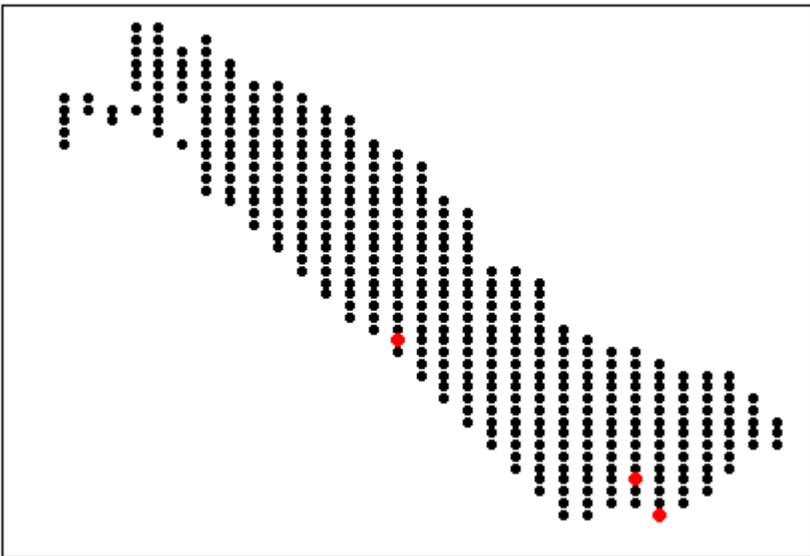
Round 4 22<sup>nd</sup>-23<sup>rd</sup> January



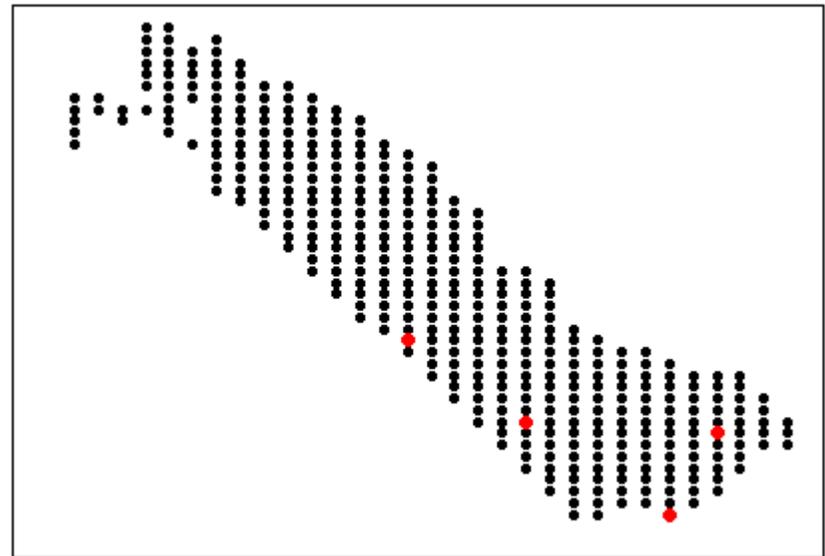
Round 5 25<sup>th</sup>-26<sup>th</sup> January



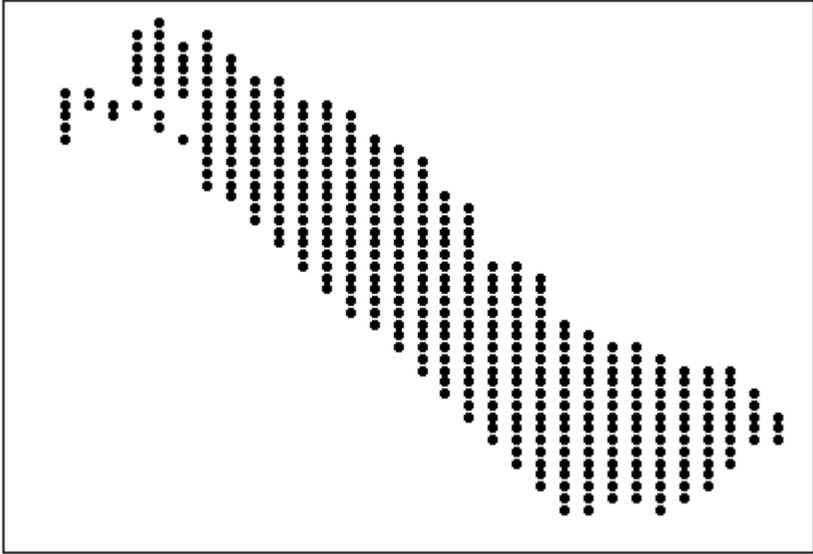
Round 6 27<sup>th</sup>-28<sup>th</sup> January



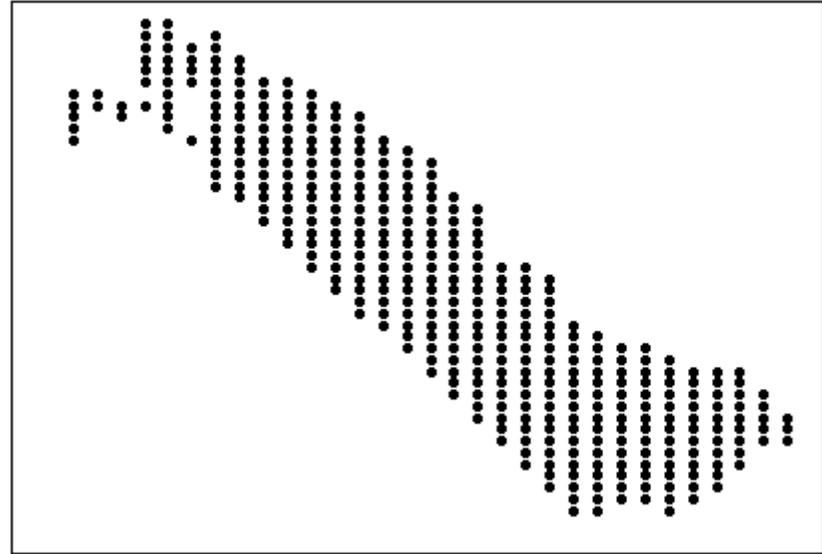
Round 7 29<sup>th</sup>-30<sup>th</sup> January



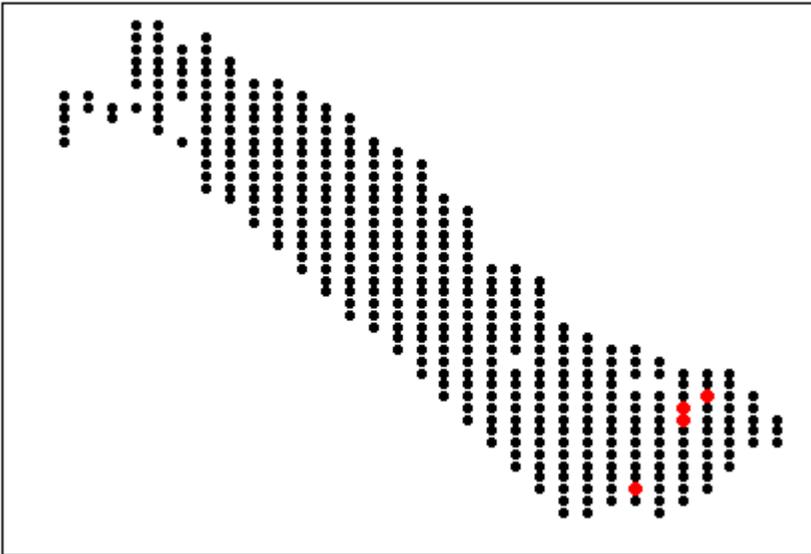
Round 8 1<sup>st</sup>-2<sup>nd</sup> February



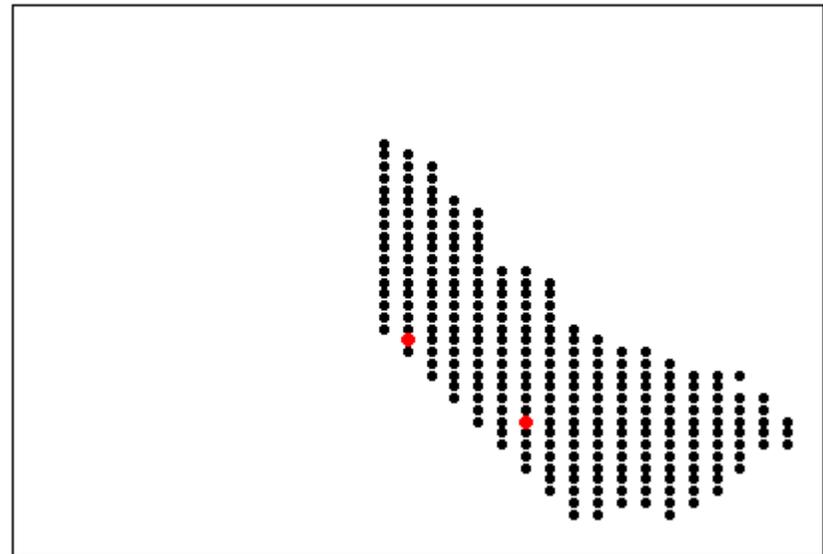
Round 9 5<sup>th</sup>-6<sup>th</sup> February



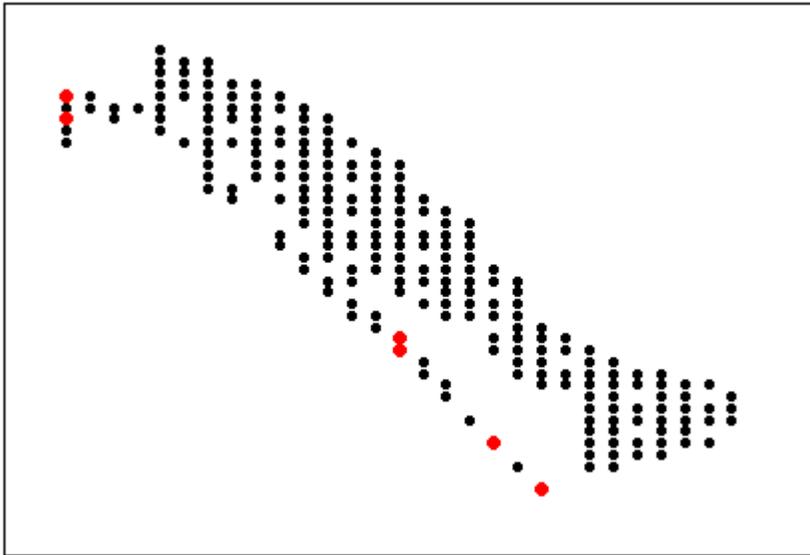
Round 10 7<sup>th</sup>-8<sup>th</sup> February



Round 11 9<sup>th</sup>-10<sup>th</sup> February



Round 12 12<sup>th</sup>-13<sup>th</sup> February



Round 13 15<sup>th</sup>-19<sup>th</sup> February

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**1. Permanent station checks**

**Positioning and maintaining the stations**

Make sure that each station is stable and doesn't wobble, as this will deter rats. Make sure that any rocks on top of the stations are secure and won't fall off. The entrance holes should be clear of debris and vegetation (keep an eye out for fast-growing plants and those with prickly leaves). Rats prefer moving along the edges of landscape features such as walls and rocks and tend to avoid open spaces. So, where possible, the stations should be positioned to take advantage of this – with the flat side of the station along the linear feature.

**How often to check the stations**

Most of the permanent stations should be checked weekly – the A-line and stations adjacent to it, the B-line and the main part of the South Cliffs (everything except the CA6-CA7a&b-CA8-CB7-CC1 stations)

The rest of the stations should be checked every two weeks to start with. It may be possible to reduce this to every four weeks later on, depending on how much rat activity is found in the rest of the stations. The stations to check fortnightly/ monthly are: the 'interior grid' (i.e. every third station on lines M, P, S, V, Y, B, E & H), the short line on the South Cliffs (CA6-CA7a&b-CA8-CB7-CC1) the East Cliff, John's Corner and the cave under B33 (the old U19).

**Data collection**

For each station, record the data described in appendix 1 ('filling in the bait station data'): presence of rat sign, presence of sign of non-target species (but only those consuming the bait), number of new blocks added, whether the station has been interfered with (if so, specify how). In the case of rat sign, also record what this sign was (droppings and/ or toothmarks, or other sign), and approximately how much bait had been taken by rats. The data can either be recorded into a notebook, or straight onto the data sheets shown in appendix 2. A couple of very obvious points - pencils are better than pens when doing fieldwork, as they still work when it's wet, and it's always worth taking a spare.

**What to do with non-target species**

Remove any non-target species from the stations if they are a) eating the bait (so far this list includes snails, slugs, ground beetles and crickets) or, b) could make the station less attractive for rats – e.g. spiders spinning sticky webs. If possible, relocate the animals you remove as far from the station as you can.

**Minimising risks to non-target species**

While invertebrates are not at risk from the bait, it is poisonous to mammals and birds. There has been some bait eaten by mice and/ or shrews, which is likely to have killed at least some of them, but this has not happened on a large scale. The other mammals present at the site – hedgehogs, rabbits and possibly weasels – are unlikely to enter the bait stations themselves and take bait directly (though rabbits are probably taking bait from some of the monitoring lines on the East Cliffs). There is a potential, though small, risk of secondary poisoning of mammals or birds through their eating invertebrates (or even mice or shrews) that have themselves eaten the bait. The use of secure bait stations is the main way in which the project minimises the risks to non-target species. Collecting and safely disposing of any poisoned animals (especially rats, but also other animals or birds found dead at the site) is another effective way of reducing the risks to non-target species. Always record when a dead bird or animal is found – date, location (preferably nearest grid point), and whether or not there is any sign of its having eaten poison (e.g. presence of blue droppings or blue material inside the body cavity, signs of bleeding). All animals suspected of dying from anti-coagulant poisoning should be buried or burned, in accordance with the manufacturer's instructions (I've been burying poisoned rats at the site).

## **Health and safety**

The manufacturers of the bait recommend wearing gloves when handling it. I'd also point out that rats are known to be carriers of a large number of diseases capable of affecting humans, from salmonella to Q fever. Rats are likely to pick up disease organisms from human excrement at the site (especially in the illegal camping area), and traces of these will be left on any bait stations they touch. Rat urine and saliva are also dangerous and can contain the organisms capable of causing disease. It is impossible to tell whether a rat has visited a bait station until it is opened. If this is done with bare hands, disease organisms have probably already been transferred by the time rat sign is found inside. Rats may have been standing and urinating on top of stations as well as inside them. When touching bait stations, bait, or any possibly contaminated equipment (e.g. field notebooks and pencils) for any reason, I strongly recommend wearing protective waterproof gloves and either washing hands thoroughly or using antiseptic hand gel before eating, drinking, answering mobile phones etc.

## **When to change bait**

The bait should be changed when it starts to look unappealing, for example if it has a lot of snail damage or is wet or mouldy. A certain amount of beetle or cricket damage is less of a problem, as long as the blocks are otherwise undamaged. The rule of thumb is to consider whether the bait would look and smell appetising to a rat. The actual length of time bait stays in good condition will vary across different parts of the site, so this judgement will have to be made every time a bait station is opened. Bait will probably stay in good condition for several weeks in most parts of the site, but perhaps not so long in more densely vegetated areas, where the bait may be more prone to damage from damp, mould and molluscs. The bait blocks on the monitoring lines will also probably need to be changed fairly often as most of them are exposed to the weather. It is fine to change one block at a time if necessary, as long as there is always at least one good block in the station.

Blocks should also be replaced if they show signs of teethmarks from rats, rabbits, mice or shrews. Any blocks with mammal teethmarks should be brought in and replaced with fresh bait. If there is any doubt about what the teethmarks belong to, take a photograph and send it to me.

## **2. Other activities**

### **a. Picking up rubbish**

This is a fairly nasty job at times but is absolutely essential for the continued protection of the shearwaters. Picnic leftovers and other food waste (e.g. apple cores, banana skins, food wrappers, cans and used paper plates with residues of food, discarded sandwiches etc.) provide a high quality alternative source for newly arriving rats. For the rat baiting programme to work, it is vital that our poison bait is the first, and most attractive, food that any new rat comes across. Any leftover food must be picked up and either removed from the site or put in a secure-rat proof bin. I'd suggest putting rat proof bins (with close fitting lids) out at the site (preferably steel, but possibly very strong plastic), though you will also need to decide how to dispose of the rubbish left in these bins. Ultimately, site users should be educated to take their litter home with them, but in the meantime it is important that there are rat-proof bins at the site. To make sure that food waste can always be collected in as soon as it's found, I'd recommend always carrying a supply of strong plastic bin liners and a few pairs of disposable gloves. Since rats may already have been feeding on the rubbish, the same precautions should be taken as for touching bait stations – make sure hands are washed or cleaned with antiseptic gel before eating, drinking or answering mobile phones.

### **b. Snap trapping**

As with bait stations, snap traps need to be carefully positioned to maximise the chances that rats will go into them. Traps should be set on a level surface so that they don't wobble when a rat steps onto them. These snap traps are very easy to arm and quite sensitive – just push down the metal bar sticking up from the trap, until it locks under the black plastic clip at the back. To protect non-target species, traps should be set as close to nightfall and checked as soon after sunrise as possible. Any traps that are still set when they are checked in the morning need to be disarmed.

This can be done by tapping a thin stick on the corner of the plate around the bait compartment. Avoid using a big stick in the middle of the plate as this puts a lot of pressure on the middle of the bar, which is the weakest part. Traps can be baited with any strong smelling and palatable bait, such as peanut butter or mashed sardines. Take care to squash the bait right down inside the round bait compartment, filling it approximately to half full – this prevents rats from simply flicking it off the top of the trap without having to step on the plate and assures a immediate kill due to the extended position of the individual's neck.

Snap trapping is an extremely powerful tool for removing rats moving into the protected site. If a station shows signs of actual or suspected rat activity, especially for those places two or more stations in from the edge of the site, and where less than a lethal dose of poison has been taken (i.e. around 1 block). In these cases, I suggest setting three or four pairs of traps around the affected bait station, each pair set underneath one of the plastic covers. Snap traps should always be tied to something solid to prevent injured rats dragging the traps away, or predators from dragging away the dead rat and the trap. The traps should be baited, placed on the ground back to back with the baited ends outermost, carefully armed and the plastic cover positioned on top of them. They should be set in places likely to be attractive to rats, e.g. in narrow runways through undergrowth or along linear features such as walls and big rocks. When siting snap traps, think for a moment about how a rat is likely to be moving around in that particular site.

Ideally, any dead rats should be weighed, measured, sexed and identified to species. Unfortunately, due to a lack of dead rats, I haven't been able to teach Matthew how to do this. Instead, take a digital photo of the rat clearly showing the head (especially the ears) and the length of the tail relative to the head and body. These characteristics are the easiest way of distinguishing between the two species of rats that might be found at the site (black rats, *Rattus rattus* and brown rats, *Rattus norvegicus*). Any rats trapped at the site should be disposed of in the way described above for poisoned rats, as it is possible that these rats have also eaten poison and thus present a secondary poisoning risk.

## **Appendix 1 of warden's manual:**

### **Notes on filling in the bait station data spreadsheet & sample field datasheet**

#### **Filling in the bait station data**

The Excel spreadsheet has 13 columns for each 'round'. Some rounds will include all the stations, others will exclude the East Coast stations or the central grid stations, which do not need to be checked as often as the others.

#### **Date:**

The day or days on which each round was completed (e.g. 24<sup>th</sup> February 2007, or 3<sup>rd</sup>-4<sup>th</sup> March 2007). The exact format of the data doesn't matter as long as it's clear.

#### **Data to do with rats (blue column headings):**

##### *Rat sign*

This is the most important column. There are three possible entries for the cells in this column:

0: if the station (or fishing line) was checked and no rat sign was found

1: if the station (or fishing line) was checked and definite or suspected rat sign was found

Or, if the station or fishing line could not be checked for any reason (e.g. couldn't find it, or it had been removed), the leave the cell blank. Only use '0' for stations that have been checked and are free of rat sign.

If there is a '0', go on to the section about non-target species

If the cell is left blank then explain why in the 'comments' column at the end (e.g. 'couldn't find', 'station gone', 'line broke and reset')

If there is a '1' for any station, then further information is needed by filling in one of the next three columns.

Once all the data for the round has been filled in, add up the number of sites with rat sign by using the 'Autosum' function on the Excel toolbar (the button with  $\Sigma$  on it). This figure can then be typed into the appropriate column on the sheet called 'Rat & bait graphs', which will then automatically be added to the relevant graph.

#### **Rat droppings**

Score '1' in this column if rat droppings are found in or around at the station. If not, leave the column blank.

#### **Rat teethmarks**

Score '1' in this column if definite rat teethmarks are visible in the bait. If not, leave the column blank. Replace any bitten bait blocks with fresh ones (and remember to fill in the 'number of blocks added' in the appropriate column)

#### **Suspected rat teethmarks**

Score '1' in this column if suspected rat teethmarks are visible in the bait. In this case, bring in the bait block and if possible send me a digital photo of it. If no suspected rat teethmarks then leave this column blank.

#### **Amount gone (rats only)**

If rat sign has been recorded (i.e. if there is a '1' in the rat sign column) then fill in the amount of bait gone in this column. This can range from 0 (where no bait has been taken at all, but droppings are present), through 0.001 if the blocks only have one toothmark, to 2 if the whole lot of bait has been taken. If all the bait has gone but there are no droppings or other conclusive sign of rats, score this as a '1' in the suspected rat teethmarks column, a '2' in the 'amount gone' column and explain further in the 'comments' column. Don't include bait taken by species other than rats.

### **Data to do with non-target species (purple column headings):**

#### **Any non-target species?**

This section is for any species, other than rats, that are taking the bait. Score a '1' in this section if any other species are seen in or around the station. Because bait is not replaced following light damage by snails or beetles, only record these species if they are known to have taken bait since the last time the station was checked (generally this means finding them in the station). This helps prevent over-recording the incidence of these non-target species.

If a '1' is entered in this column, then specify what type of non-target species it was from the following five choices (some stations may have more than one type of non-target species – in this case, fill in as many of the five columns as needed):

#### **Molluscs**

Score '1' in this column if slugs and/ or snails are known to have taken bait since the last time it was checked (usually this will only be if they are found in the station).

#### **Carabid beetles**

Score '1' in this column if Carabid (ground) beetles are known to have taken bait since the last time it was checked (usually this will only be if they are found in the station).

#### **Mice or shrews**

Score '1' in this column if mouse or shrew teethmarks are seen on the bait, or their droppings are found in the stations (if in doubt, take a digital photo and send it to me). Replace with fresh bait any bait blocks with mouse or shrew teethmarks (and record the 'no. of blocks added' in the appropriate column).

#### **Ants**

Score '1' in this column if ants are known to have taken bait since the last time it was checked (usually this will only be if they are found in the station).

#### **Other**

Score '1' in this column if any other species is found to have taken the bait (N.B. don't record invertebrates if there is no evidence they are eating the bait – e.g. spiders or earwigs). Specify what kind of animal is taking the bait in the 'comments' column.

Again, use the 'Autosum' function to get a total for each type of non-target species and add these numbers to the page entitled 'Non-target graphs'

### **Other columns (black column headings):**

#### **No. of blocks added**

Record the number of bait blocks added to each station or fishing line (N.B. need not record zeros). This includes all bait added – e.g. to replace blocks eaten by rats, blocks that have gone mouldy, blocks on fishing lines where the previous ones have got stuck and been lost etc.

Use the 'Autosum' function again to add up the number of blocks used, and add this to the appropriate column on the 'Rat & bait graphs' page.

#### **Interfered with?**

Score '1' in this column if the station or fishing line shows signs of human interference. Specify the nature of this disturbance in the 'comments' column (e.g. 'anchor pulled up', 'station overturned', or 'fishing line removed').

#### **Comments**

Use this column for any supporting information needed to explain the data. Try and be accurate, but brief.

Please email me the data after each round. If you have any questions about the data, however small, feel free to contact me at any time ([kjvarnham@btopenworld.com](mailto:kjvarnham@btopenworld.com)).

### Sample field datasheet

Round no:		Date:
Point	Previous ID	Notes
<b>A LINE</b>		
A1 PM	(WB5)	
A2 PM	(H20)	
A3 PM	(WA1)	
A4 PM	(H19)	
A5 PM	(WA2)	
A6 PM	(PM1)	
A7 PM	(H18)	
A8 PM	(PM2)	
A9 PM	(H17)	
A10 PM	(PM3)	
A11 PM	(H16)	
A12 PM	(H15)	
A13 PM	(H11)	
A14 PM	(H12)	
A15 PM	(H13)	
A16 PM	(H14)	
A17 PM	(PM4)	
A18 PM	(PM5)	
A19 PM	(G2)	
A20 PM	(G1)	
A21 PM	(PM6)	
A22 PM	(PM7)	
A23 PM	(F13)	
A24 PM	(PM8)	
A25 PM	(PM9)	
A26 PM	(E2)	
A27 PM	(E1)	
A28 PM	(PM10)	

A29 PM	(D15)	
A30 PM	(D16)	
A31 PM	(PM11)	
A32 PM	(C2)	
A33 PM	(C1)	
A34 PM	(PM12)	
A35 PM	(B17)	
A36 PM	(B18)	
A37 PM	(A2)	
A38 PM	(PM13)	
A39 PM	(A1)	
A40 PM	(PM14)	
A41 PM	(PM15)	
A42 PM	(Z2)	
A43 PM	(Z1)	
A44 PM	(PM16)	
A45 PM	(PM17)	
A46 PM	(Y18)	
A47 PM	(Y19)	
A48 PM	(PM18)	
A49 PM	(X2)	
A50 PM	(PM19)	
A51 PM	(X1)	
A52 PM	(PM20)	
A53 PM	(PM21)	
A54 PM	(W19)	
A55 PM	(PM22)	
A56 PM	(PM23)	
A57 PM	(V20)	
A58 PM	(PM24)	
A59 PM	(U1)	
A60 PM	(PM25)	
A61 PM	(T19)	
A62 PM	(PM26)	

A63 PM	(PM27)	
A64 PM	(PM28)	
A65 PM	(PM29)	
A66 PM	(PM30)	
<i>PLATEAU</i>		
Kch1		
Kch2		
Kch 3		
Kch4		
Kch5		
Kch6		
Kch6-7 Line		
Kch7		
Kch8		
L6		
L7		
L8		
L9		
L9 Line		
M1		
M9		
M10b		
M11		
N8		
N9		
N10		
N11		
N12		
N12 Line		
O1		
O11		
O12		
O13		
O14		

O14 Line		
P11		
P12		
P13		
P14		
Q12		
Q13		
Q14		
R13		
R14		
R15		
R16		
S1		
S2		
S3		
S4		
S5		
S6		
S7		
S8		
S15		
S16		
S17		
T11		
T12		
T13		
T14		
T15A		
T15B		
T16		
T17		
U2		
U3		
U4		

U5		
U6		
U7		
U8		
V13		
V14		
V15		
V16		
V17		
V18		
V19		
W14		
W15		
W16		
W17		
W18		
X3		
X4		
X5		
X6		
X7		
Y15		
Y16		
Y17		
Z3		
Z4		
Z5		
A3		
B16		
C3		
D13		
E3		
E4		
F10		

F11		
F12		
G4		
G5		
G7		
J6		
J7		
J8		
<b>CLIFF EDGE</b>		
B1	K1	
B2	K2	
B3	K3	
B4	K3.5	
B5	K4	
B7	K6	
B8	J1	
B9	J2	
B10	I5	
B11	H1	
B12	H2	
B13	G12	
B14	G13	
B15	F1	
B16	E15	
B17	D1	
B18	C17	
B19	B1	
B20	B2	
B21	A17	
B22	Z18	
B23	Y1	
B24	Y2	
B25	Y3	
B26	X18	

B27	W1	
B28	V1	
B29	V2	
B30	V3	
B31	V4	
B32	U18	
B33	U19	
B34	T1	
B35	T2	
B36	T3	
B37	T4	
B38	S14	
B38 Line 1	S14 Line 1	
B38 Line 2	S14 Line 2	
B38 Line 3	S14 Line 3	
B38 Line 4	S14 Line 4	
B39	R1	
B39 Line	R1 Line	
B40	Q1	
B41	P1	
B41 Line	P1-Q1 Line	
B42	P2	
B43	O10	
B44	N1A	
B45	M8	
B45 Line	M8 Line	
B46	L1	
B47	L2	
<i>INTERIOR GRID</i>		
M3		
M6		
P5		
P8		
S11		

V7		
V10		
Y6		
Y9		
Y12		
B4		
B7		
B10		
B13		
E6		
E9		
E12		
H5		
H8		
<i>SOUTH CLIFFS</i>		
CA25		
CA26		
CA27		
CA28		
CA29		
CA30		
CB23		
CB24		
CB25		
CB26		
CB27		
CB28		
CB29		
CC14b		
CC15		
CC16		
CC17		
CC18		
CC19		

CC20		
CD1		
CD2		
CD5		
CE1		
CE1 Line		
CE2		
CE3 Line		
CE4		
CE5		
CA6		
CA7a		
CA7b		
CA8		
CB7		
CC1		