Rats to the Rescue: Results of the First Tests on a Real Minefield

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Rats to the Rescue: Results of the First Tests on a Real Minefield

The study in this article showed that using rats to evaluate mine risk is a very promising mine-detection method. When three rats were used to evaluate a contaminated area, the success rate was 95 percent, showing that rats can be a speedy and cost-effective means of mine detection.

Methods

Weather during the test period was variable with rain on the first day (13 Nov. 2003) and sun during the other days (14–18 Nov. 2003).

Each box was evaluated by three rats according to the method as described in “Preliminary Results on the Use of Cricetomys Rats as Indicators of Buried Explosives in Field Conditions.”1 Testing was done early in the morning (between 5 and 8 a.m.). After that, temperatures became too high for the rats to operate. Within each box, rats walked parallel lanes 0.5 metre (2 feet) wide and all relevant behaviour was recorded on a test sheet.

The five boxes had a total area of 427.5 square metres (511 square yards) and were divided in subunits of 0.5 square metre (5 square feet). We used letters to distinguish between strong marking behaviour (“S” for scratching the soil or “B” for biting the soil for a long time) and weak indications (“s” for a short scratch or “b” for a short bite) of the rats. Using these recorded indications, a risk value was calculated for each subunit ranging from 0 (i.e., no indications in that and surrounding subunits by the three different rats) up to 6 (i.e., all rats indicated that particular subunit). “S” and “B” indications were scored as 2 while “s” and “b” indications were given a score of 1. An example of how values were calculated for each subunit is given in Figure 1. The risk value of the central subunit is equal to the score of the central subunit divided by two plus the scores of the surrounding subunits divided by 16.

Using this method, each subunit had a risk score and they were divided into the five classes shown in Table 1.

Table 1: Five classes of risk scores.

<table>
<thead>
<tr>
<th>Class</th>
<th>Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0-1</td>
</tr>
<tr>
<td>3</td>
<td>2-3</td>
</tr>
<tr>
<td>4</td>
<td>4-5</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 1: Example of how the risk value for the central subunit is calculated.

Figure 2: Box A, Box B, Box C, Box D, Box E. Grids showing rat indications for each test box and risk maps based on these indications.

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According to this ranking, subunits were given different colours and maps were constructed for each box (results of each box are given in Figure 2). After the rats tested the boxes, each box was inspected and cleared by an MgM deminer using a metal detector and manual prodding. All objects found by the deminer (mines, bullets, fragments, etc.) were mapped in the same way as shown in Figure 2.

**Results**

Table 2 summarizes the results of the evaluation by the rats done on the five boxes in comparison with what was found by the manual deminer. All mines present in the boxes were indicated by the rats and were located in the subunits that were categorized as risk class 4 (one mine) and 5 (19 mines). Of the 20 mines present, 12 were visible due to erosion of the soil. Although clearly visible, the rats did not indicate the mines directly, but rather detected them all within a distance of 1 metre (3 feet). When the rats found a covered mine, they marked the exact spot by scratching directly over the mine.

In total, seven rats were used to evaluate the five boxes. There were experienced rats (Johan, Julie, and Josse), and the others were young trained rats (Gilgamesh, Lothar, Respect, and Sargon). At least two experienced rats tested each box. Table 3 gives the success scores and number of false positive indications of the individual rats. Indications within 1.25 metres (4 feet) of bullets, mine fragments, or detonator pins were not considered as false positives as it is not clear for the moment if these particles were really indicated because of explosive residue on them (they will be tested to determine this). As can be seen from Table 2, there is an obvious marking behaviour by the rats for those items.

<table>
<thead>
<tr>
<th>Box</th>
<th>Mines</th>
<th>Percent</th>
<th>Subunits with Mines</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>20</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>30.0</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>10.0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100.0</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Box</th>
<th>Fragments</th>
<th>Percent</th>
<th>Subunits with Fragments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>120</td>
<td>60.0</td>
<td>120</td>
</tr>
<tr>
<td>B</td>
<td>60</td>
<td>30.0</td>
<td>60</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>15.0</td>
<td>30</td>
</tr>
<tr>
<td>D</td>
<td>20</td>
<td>10.0</td>
<td>20</td>
</tr>
<tr>
<td>E</td>
<td>10</td>
<td>5.0</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>220</td>
<td>110.0</td>
<td>220</td>
</tr>
</tbody>
</table>

Table 2: Summary of the test results of *Cricetomys* rats evaluating five boxes on a real minefield in Limpopo, Mozambique.
were indicated by the rats (87 percent), while other items scored less frequently (fragments = 53 percent, bullets = 33 percent).

With the exception of Sargon, all rats scored relatively well (mean = 63.3 percent) with very few false positive indications (mean = 0.8 indications per 100 square metres) for the major markings S+B and 1.6 for all markings S+B+s+b).

It should be noted that many of the false positive indications given by different rats were clustered, which might indicate an explosives-contaminated spot.

Although the individual success score might seem low, the overall score on the C, D and E boxes (those containing mines) was 100 percent after three rats evaluated a box (see Figure 5).

Figure 5: Mean success score of the sequence of three rats that tested the five boxes.

<table>
<thead>
<tr>
<th>Boxes tested (area)</th>
<th>Success score</th>
<th>False positives S+B/100m²</th>
<th>False positives S+B+s+b/100m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johan A – C – E (265sq m)</td>
<td>9/16 = 56.3%</td>
<td>0.75%</td>
<td>0.75%</td>
</tr>
<tr>
<td>Julie B – C – D – E (362.5sq m)</td>
<td>15/20 = 75.0%</td>
<td>0.28%</td>
<td>3.00%</td>
</tr>
<tr>
<td>Josse B – C – E (262.5sq m)</td>
<td>10/16 = 62.5%</td>
<td>1.14%</td>
<td>1.53%</td>
</tr>
<tr>
<td>Gilgamesh A (65sq m) No mines</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Lothar A – D (165sq m)</td>
<td>4/4 = 100%</td>
<td>2.42%</td>
<td>3.64%</td>
</tr>
<tr>
<td>Respect B (67.5sq m) No mines</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Sargon D (100sq m)</td>
<td>1/2 = 0.0%</td>
<td>1.00%</td>
<td>1.00%</td>
</tr>
</tbody>
</table>

The mean time for a rat to inspect a box was 32 minutes/100 square metres (120 square yards), so when a box was inspected by three rats, this was done in 96 minutes. When we include handling and exchanging animals, the total average time to evaluate one 100-square-metre box (120 square yards) was about 116 minutes.

Conclusions

The test area was a very dense minefield with 20 mines within an area of less than 30 square metres (36 square yards). Besides the mines, the area was highly contaminated with all kinds of war materials (bullets, detonator pins, mine fragments, etc.), which were also often indicated by the animals, especially the detonator pins. After these rats evaluated a box, all mines present in that box were scored.

The construction of risk maps based on the indications of the animals seems to be a very useful tool as 95 percent of the mines were found in the highest calculated risk area and the other mines in the second highest risk area. Using this method, more than 95 percent of the mines were found in the highest calculated risk area and the other mines in the second highest risk area. Using this method, more than 95 percent of the mines were found in the highest calculated risk area and the other mines in the second highest risk area. Using this method, more than 95 percent of the mines were found in the highest calculated risk area and the other mines in the second highest risk area.


If you find errors in the Journal of Mine Action or disagree with anything we have published, please send your comments in a “Letter to the Editor” via email to Lois Carter Fay at editormaic@gmail.com.

We apologize to Faiz Mohammad for this error and thank him for letting us know about it.

If you find errors in the Journal of Mine Action or disagree with anything we have published, please send your comments in a “Letter to the Editor” via email to Lois Carter Fay at editormaic@gmail.com.

The editorial staff of the Journal goes to great effort to make sure that what is printed in our magazine is accurate, properly documented and unbiased. However, in Issue 9.1 there were two errors for which we feel we must apologize.

Editor’s Note: Some countries and mine action organizations are arguing the use of the term “mine free,” whereas others are opposing the term “mine safe” or “impact free.” “Mine free” connotes a condition where all landmines have been cleared, whereas the terms “mine safe” and “impact free” refer to the condition in which landmines no longer pose a credible threat to a community or country.

LBC System Allows Remote Disposal, Bathrild [from page 89]

Turner and Williams [from page 93]

Rats to the Rescue: Results of the First Tests on a Real Minefield, Verhagen, F. Weetjens, Cox, B. Weetjens and Billet [from page 100]

Mines Action Support Group Update, October 2005. MASH Newsletter [from page 85]

Endnotes


6. 1 centile equates equal approximately 4 inches.

7. Fractured sand is sand that has been pulverized by explosive forces, with silica dust as the main by-product of this process.

8. RTO AT/081 refers to the RTO Recommended Practice 081, Instrumentation for Impact Tests (MAR90): It provides standards for the performance of equipment in impact tests.


13. 1 g = 9.8 m/s².

QB Hits a Homered: Landmine-Detection Systems Based on Quadrupole Resonance Technology Show Progress, Turner and Williams [from page 93]

Endnotes


3. In collaboration with INSYS Ltd. in the United Kingdom.


12. 1 square metre is approximately equivalent to 1.2 square yards.

13. 1 g = 9.8 m/s².

14. Fractured sand is sand that has been pulverized by explosive forces, with silica dust as the main by-product of this process.


16. "Impact Free" connotes a condition where all landmines have been cleared, whereas the terms “mine safe” and “impact free” refer to the condition in which landmines no longer pose a credible threat to a community or country.


20. "Impact Free" connotes a condition where all landmines have been cleared, whereas the terms “mine safe” and “impact free” refer to the condition in which landmines no longer pose a credible threat to a community or country.