# SADC REGIONAL PROGRAMME FOR RHINO CONSERVATION

# RHINO 2.0

## *Bayesian Mark Recapture Population Estimation Report: Single Simulation Run*

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COOPERAZIONE ITALIANA
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WWF
SPECIES SURVIVAL COMMISSION
AFRICAN RHINO SPECIALIST GROUP

## PUBLICATION CREDITS:


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## ABOUT the SADC Regional Programme for Rhino Conservation:


The Programme is funded by the Italian Ministry of Foreign Affairs, Directorate General for Development Cooperation (Project AID 5064).


The Programme is contracted to CESVI and implemented through a regional consortium which comprises:

- The Secretariat of the Southern Africa Development Community (SADC)
- IUCN-ROSA (The World Conservation Union - Regional Office for Southern Africa)
- The IUCN African Rhino Specialist Group
- WWF-SARPO - (World Wide Fund for Nature - Southern Africa Regional Programme Office)
- CESVI (Cooperazione e Sviluppo)

The ***Programme goal*** is to contribute to maintain viable and well distributed metapopulations of Southern African rhino taxa as flagship species for biodiversity conservation within the SADC region.

The ***Programme objective*** is to implement a pragmatic regional rhino strategy within the SADC region following the acquisition of sound information on, firstly, the constraints and opportunities for rhino conservation within each range state and secondly, the constraints and opportunities for rhino metapopulation management at the regional level.

## DISCLAIMER



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**PROGRAMME WEB SITE:** We invite you to vist our web site : www.rhino-sadc.org

# RHINO 2.0

## Bayesian Mark Recapture Population Estimation Report
## Single Simulation Run

**Simulation Date:** 22 March 2004

**Simulated Population**

**Population before Special Events**

| | Number of Animals | |
|---|---|---|
| | **Non TH (Normal)** | **Trap-Happy (TH)** |
| ID independent animals with 0 dependent | 25 | 0 |
| ID independent animals with 1 dependent | 20 | 0 |
| ID independent animals with 2 dependents | 0 | 0 |
| Clean independent animals with 0 dependent | 10 | 0 |
| Clean independent animals with 1 dependent | 5 | 0 |
| Clean independent animals with 2 dependents | 0 | 0 |

Giving population of 45 ID independents (45 normal +0 trap-happy) with 20 dependents and 15 Clean independents (15 normal + 0 trap-happy) with 5 dependents and a total independent population of 60 and a total dependent population of 25 and overall population of 85.

Prior to the insertion of special events a total of 90 non TH sightings were simulated (average sighting number per animal of 1.50) with each TH happy animal "seen" on average 0.00 times more than usual (mean of 0.00 times each) giving an additional 0 TH observations.

As sightings have been simulated of TH ID Independent animals RHINO has simulated an additional 0 TH clean independent animals with 0 dependent sightings based on the assumption that the same proportion of sightings of clean animals will also be of TH animals. Of the 10 clean independent animals with 0 dependents it is estimated that approximately 0 are TH animals. This gives a total number of observations of 90.

**Special Events inserted in the middle of the simulated dataset**

| | |
|---|---|
| Change from dependent to independent: | 0 |
| Clean independent (one dependent) introductions: | 0 |
| Clean independent (one dependent) marked: | 0 |
| Clean independent (zero dependents) deaths: | 0 |
| Clean independent (zero dependents) introductions: | 0 |
| Clean independent (zero dependents) marked: | 0 |
| ID independent (one dependent) introductions: | 0 |
| ID independent (one dependent) removals: | 0 |
| ID independent (zero dependents) deaths: | 0 |
| ID independent (zero dependents) introductions: | 0 |
| ID independent (zero dependents) removals: | 0 |

**Population after Special Events**

As a result of the special events the population has changed to:

45 ID independents.
15 Clean independents.
Total independent population of60.

20 ID dependents.
5 Clean dependents.
Total dependent population of 25.

Overall population of 85.

A further 90 non TH sightings were simulated (average sighting number per animal of 1.50) with each TH happy animal "seen" on average 0.00 times more than usual (mean of 0.00 times each) giving an additional 0 TH observations. This gives a total number of post special event observations of 90 and a grand total of 180.

**Sampled Sightings**

| | |
|---|---|
| Total Number of Sightings: | 180 |
| Number of sightings of ID Independent animals: | 134 |
| Number of sightings of ID Independent animals with one dependent: | 67 |
| Number of sightings of ID Independent animals with two dependents: | 0 |
| Number of sightings of Clean Independent animals: | 46 |
| Number of sightings of Clean Independent animals with one dependent: | 11 |
| Number of sightings of Clean Independent animals with two dependents: | 0 |

**Frequency Distribution of Sightings**

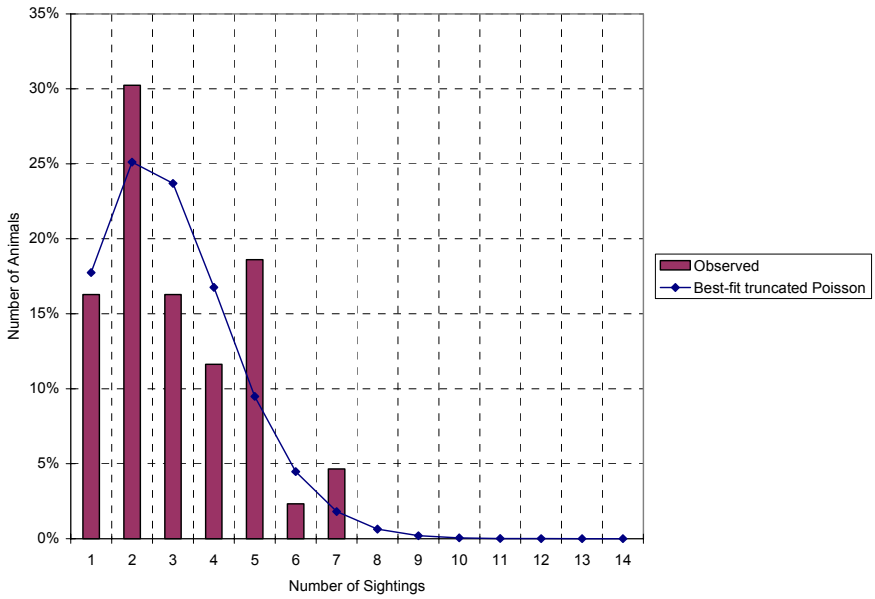

**Figure:** Frequency distribution of sightings of ID independent animals that were present throughout the sighting period. The fitted truncated Poisson distribution (mean *2.83* [LS Fit]) is also shown.

The critical trap-happy cut-off level was set at the *99*% level.

*0* trap-happy animals were excluded prior to the analysis
*0* observations of trap-happy animals were dropped from the analysis

## Identifiable Independent Population Estimate

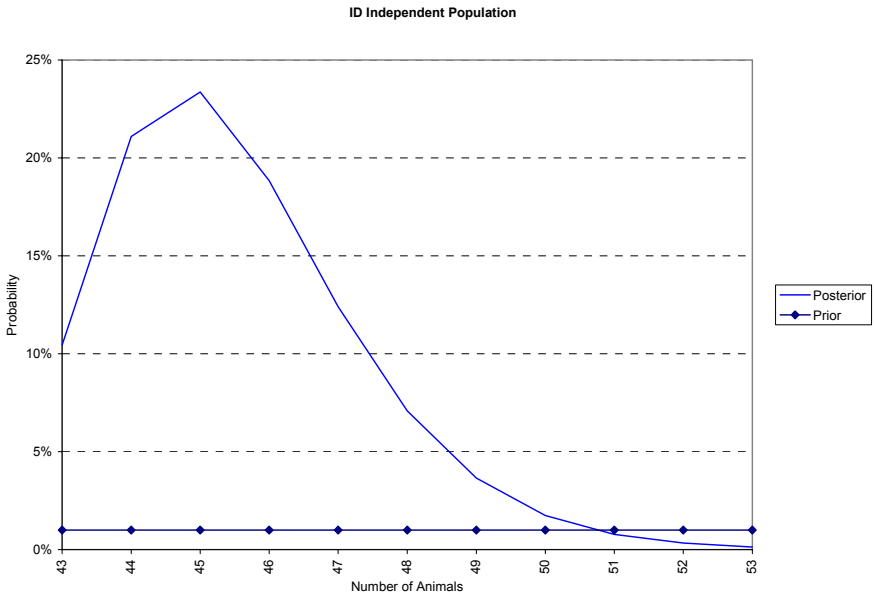


**Figure:** Probability distribution of total ID independent population (i.e. adjusted to include *0* trap happy animals dropped from mark-recapture calculations). Mode: *45*, Mean: *45.55* (recommended), Median: 45, *90*% CPI: *43 to 48*
Prior probabilities (i.e. probabilities at the start of mark-recapture analysis) are shown with the diamond shaped marker. These were calculated from user defined uninformative priors with minimum number: *1* and maximum number: *100*

Minimum number of different ID individuals at start of run = *43*
Minimum number of different ID individuals at end of run = *43*

**Summary statistics**
Mode = *45* Median = *45* Mean = *45.55*
*90*% Posterior Credible Interval = *43 to 48*
Skewness = *4.48* Peakedness = *.05*

The estimated observation number/animal = *2.98*

**Suggested measure of use**
The MEAN should be used in this case as on average it is likely to be relatively unbiased (1% positive bias at sighting frequency of 2.67 and a 0.6% negative bias with a sighting frequency of 5.00).; whereas on average the median and mode will probably be slightly negatively biased.

Based on simulation modelling, with an average sighting frequency of 2.67 – 3.33, and a population where half the animals are identifiable, 90% of the time mean estimates could be expected to vary around the true population size by as much as –9% to –7% below and +7 to+2% above the true population size.

On average, with a sighting frequency 2.67 – 3.33 per animal, you will have seen about 93% to 96% of the animals in the population. Once sighting frequencies have risen to 5.0 then you will have seen almost all the animals in the population (99%).

**Suggestions to improve your estimate**
To get a more precise population estimate you must increase your sample size by either analysing your data over a longer time period, or by collecting more data. In both cases you will then increase the mean observation number/animal. Ideally you want to aim to get 2+ sightings per animal.

You can also increase the precision of your overall population estimates in future by marking more animals.

## Clean Independent Population Estimate

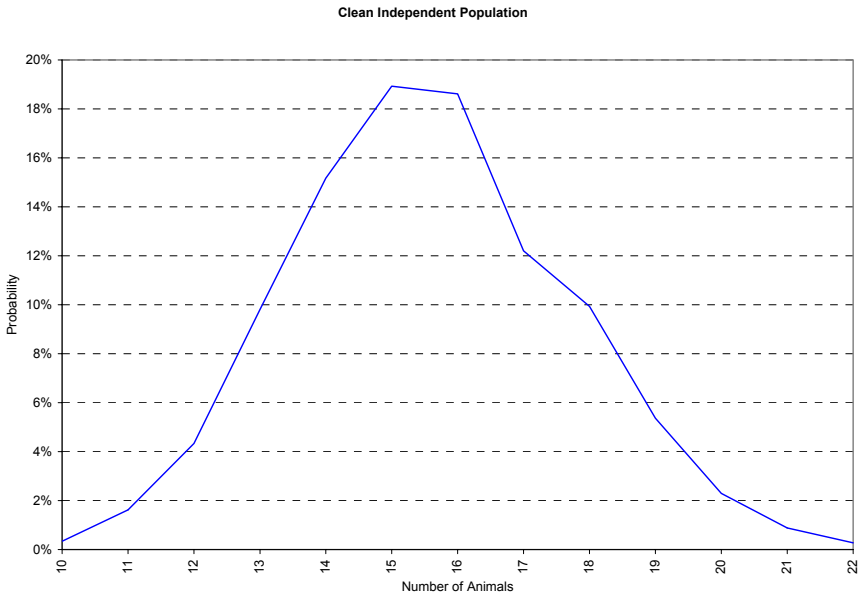


**Figure:** Probability distribution of clean independent population**.** Mode: *15*, Mean: *15.58*, Median: *15*, *X_Clean* CPI% CPI: *12 to 19.*

User defined known minimum clean independent population size: *Not Known*

**Summary statistics**
Mode = *15* Median = *15* Mean = *15.58*
*X_Clean* CPI% Posterior Credible Interval = *12 to 19*
Skewness = *1.58* Peakedness = *.03*

**Suggested measure of use**
The 'Median' is the best measure of central tendency.

## Independent Population Estimate

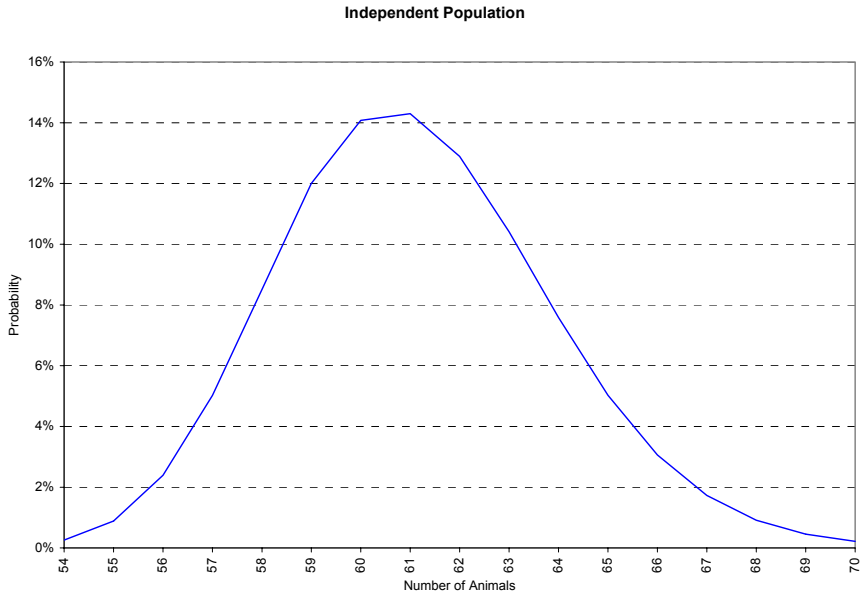


**Figure:** Probability distribution of total independent population (ID + clean). Mode: *61*, Mean: *61.13*, Median: *60*, *90* % CPI: *56 to 66*

**Summary statistics**
Mode = *61* Median = *60* Mean = *61.13*
*X_Ind* CPI% Posterior Credible Interval = *56 to 66*
Skewness = *1.65* Peakedness = *.01*

**Suggested measure of use**
The 'Median' is the best measure of central tendency.

## ID Dependent Population Estimate

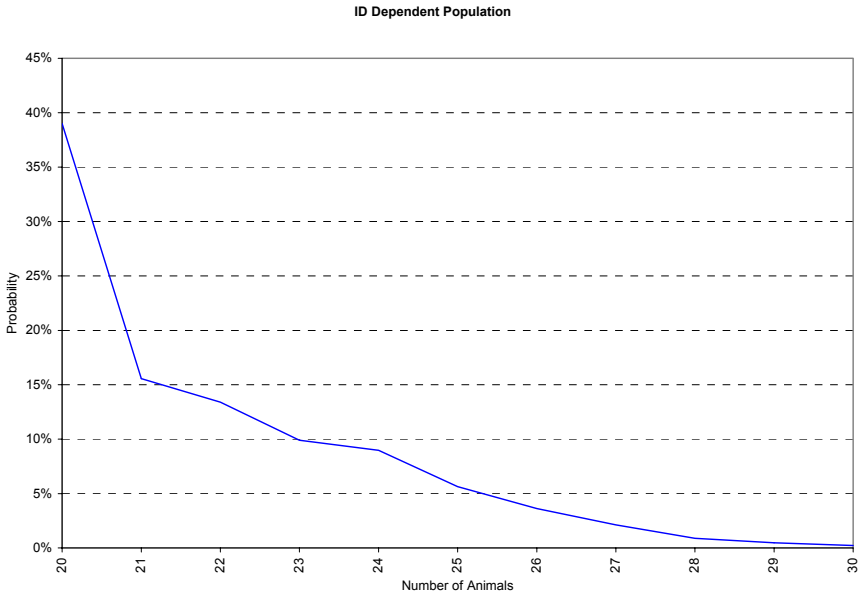


**Figure:** Probability distribution of ID dependent population. Mode: *20*, Mean: *21.88*, Median: *21*, *90* % CPI: *20 to 26.*

**Summary statistics**
Mode = *20* Median = *21* Mean = *21.88*
*90* % Posterior Credible Interval = *20 to 26*
Skewness = *4.50* Peakedness = *.07*

**Suggested measure of use**
The 'Median' is the best measure of central tendency.

## Clean Dependent Population Estimate

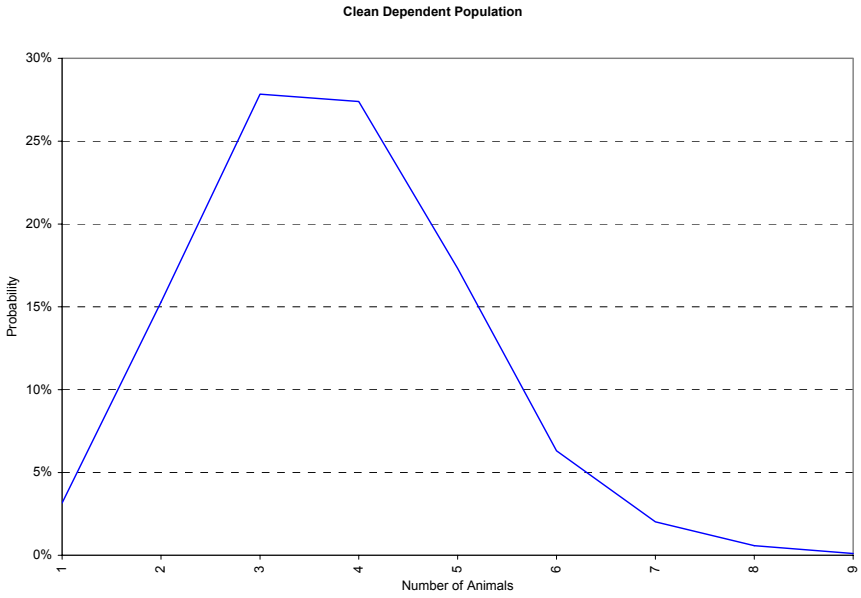


**Figure:** Probability distribution of ID dependent population. Mode: *3*, Mean: *3.71*, Median: *3*, *90* % CPI: *1 to 6.*

**Summary statistics**
Mode = *3* Median = *3* Mean = *3.71*
*90* % Posterior Credible Interval = *1 to 6.*
Skewness = *1.30* Peakedness = *.06*

**Suggested measure of use**
The 'Mode' is the best measure of central tendency.

## Dependent Population Estimate

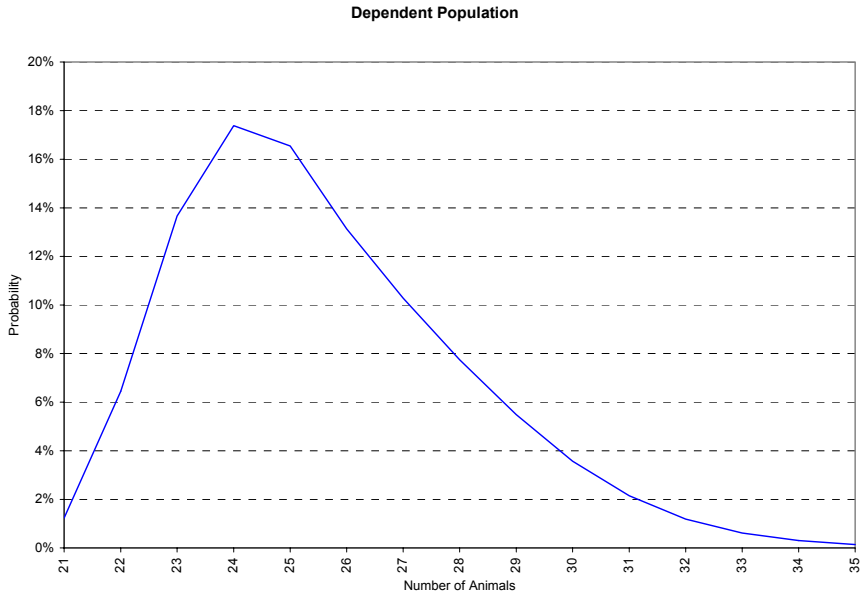


**Figure:** Probability distribution of dependent total population. Mode: *24*, Mean: *25.59*, Median: *25*, *90* % CPI: *22 to 30.*

**Summary statistics**
Minimum number of dependents of identifiable independents: *20*
Minimum number of dependents of clean independents: *1*

Mode = *24* Median = *25* Mean = *25.59*
*90* % Posterior Credible Interval = *22 to 30*
Skewness = *1.37* Peakedness = *.02*

**Suggested measure of use**
The 'Median' is the best measure of central tendency.

## Total Population Estimate

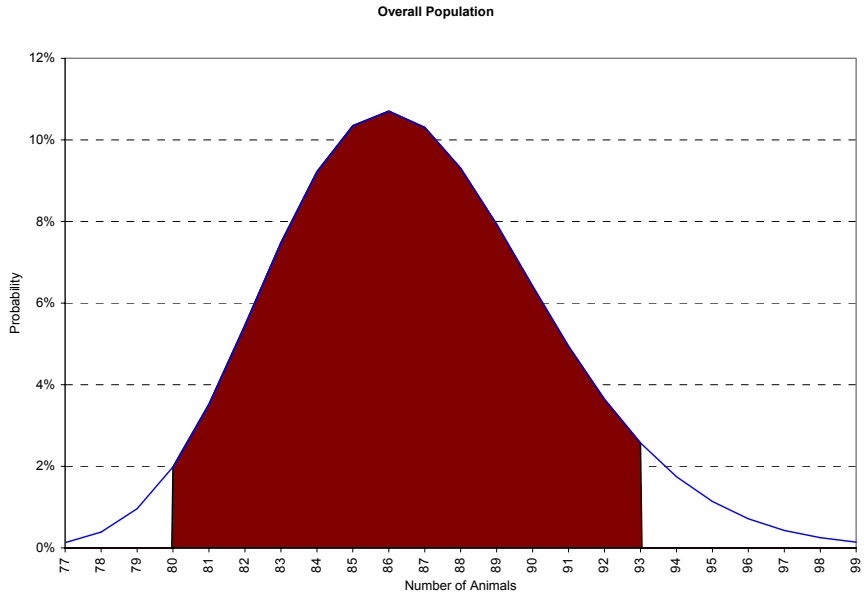


**Figure:** Probability distribution of total population Mode: *86*, Mean: *86.72* (recommended), Median: *86*, *90* % CPI: *80 to 93*.

**Summary statistics**
Mode = *86* Median = *86* Mean = *86.72*
*90* % Posterior Credible Interval = *80 to 93*
Skewness = *1.47* Peakedness = *.01*

**Suggested measure of use**
The 'Median' is the best measure of central tendency.