

FINAL REPORT

**DISTRIBUTION AND DYNAMICS OF TIGER AND PREY POPULATIONS IN
MAHARASHTRA, INDIA
(YEAR-1 SURVEYS)**

**SAVE THE TIGER FUND
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(Year-1 Surveys)

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CONTENTS

Executive summary	4
Acknowledgements	4
Introduction	6
Personnel and Institutional involvement	6
Research activities and accomplishments	7
Training and capacity building	9
Preliminary results	10

DISTRIBUTION AND DYNAMICS OF TIGER AND PREY POPULATIONS IN MAHARASHTRA, INDIA (YEAR-1 SURVEYS)

FINAL REPORT

Executive Summary

In India, tigers are distributed over 300,000 square kilometres of area and Maharashtra is one of the important tiger range states in the country. The state has an impressive variety of wildlife habitats and has a potential tiger habitat of about 6,000–9,000 square kilometres. The state has implemented several positive measures to improve the status of wildlife and its habitat in Maharashtra. However, there is no reliable information on the current distributional range of tiger populations in Maharashtra and any measures of their relative abundance in order to adaptively react to their management needs. There is a need to monitor tiger and prey populations in a few select habitats with potentially viable breeding tiger populations in Maharashtra to ensure their long-term survival. This project aims at establishing benchmark estimates and monitoring three critical, productive tiger and prey populations in three of the high potential areas (Tadoba, Melghat and Pench) of the state. This project will also help to provide a valid base for the scientific management of these areas, as well as to evaluate to what extent tigers, prey and habitat are responding to the conservation interventions which are being implemented under other projects.

During the reporting period, field surveys have been completed at all the three high priority tiger habitats of the state. Major accomplishments include first-ever abundance estimates of tiger and prey populations using rigorous methods for Tadoba, Melghat and Pench; training of Maharashtra state Forest Department staff and local volunteers; and identification of two highly motivated local NGO volunteers for long term collaboration and monitoring. Field activities specifically included camera trap surveys (Tadoba: 60 trap locations, 715 trap nights; Melghat: 60 trap locations, 896 trap nights; Pench: 60 trap locations, 715 trap nights), line transect surveys (Tadoba: 36 lines, 1088 km; Melghat: 25 lines, 771 km; Pench: 30 lines, 894 km) and sign encounter surveys (Tadoba: 24 routes & 286 km in scat encounter surveys and 136 pellet plots in pellet count surveys). A total of 4 slide talks/field demonstrations were held in addition to 7 field workshops wherein 82 local volunteers and 77 departmental staff participated in these training activities.

Acknowledgements

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We are thankful to the Forest department of Maharashtra for giving us the permission and the requisite cooperation in carrying out this study. We thank the Ministry of Environment and Forests (Directorate of Wildlife Preservation) and the Directorate of Project Tiger, Government of India, for providing all support to carry out this study. We

are especially indebted to the Chief Wildlife Warden of Maharashtra state, the Field Directors of Tadoba, Melghat and Pench Tiger reserves and the Deputy Conservators of Forests of all the three study sites for their cooperation and support in the field.

We acknowledge the logistical and field support received from Tiger Research And Conservation Trust, Nagpur; Envirosearch, Pune; Centre for Wildlife Studies, Bangalore and Wildlife First, Bangalore. We also thank all the senior volunteer-instructors from CWS, local NGO volunteers and the Department field staff who enthusiastically participated in the field surveys and assisted in data collection.

DISTRIBUTION AND DYNAMICS OF TIGER AND PREY POPULATIONS IN MAHARASHTRA, INDIA (YEAR-1 SURVEYS)

FINAL REPORT

1. Introduction

In India, tigers are distributed over 300,000 square kilometres of area and Maharashtra is one of the important tiger range states in the country. The state has an impressive variety of wildlife habitats and has a potential tiger habitat of about 6,000–9,000 square kilometres. The state has implemented several positive measures to improve the status of wildlife and its habitat in Maharashtra. However, there is no reliable information on the current distributional range of tiger populations in Maharashtra or any measures of their relative abundance in order to adaptively react to their management needs. There is a need to monitor tiger and prey populations in a few select habitats with potentially viable breeding tiger populations in Maharashtra to ensure their long-term survival.

Earlier studies by the Principal Investigator have identified several high-priority tiger-conservation areas in the country and have gathered baseline ecological information on tiger and prey populations in several high-potential tiger habitats across India. These studies have also suggested several methodologies for effective monitoring of tiger and prey populations over large regions and at multiple scales. The present project proposal is a step towards implementing these ideas by actually monitoring tiger and prey populations at multiple scales in the state of Maharashtra.

This project aims at establishing benchmark estimates and monitoring three critical, productive tiger and prey populations (Tadoba, Melghat and Pench) in Maharashtra. While substantial progress has been achieved earlier in the long-term work at Nagarhole in developing techniques suitable for monitoring absolute abundances in high-density tiger and prey populations, a lot more work is needed for developing methods for index surveys and spatial mapping of tigers and prey over a larger region. Furthermore, over the last five years, techniques such as distance sampling and capture-recapture sampling have undergone major technical advances. In collaboration with cutting edge leaders in these fields, Jim Nichols (at USGS) and Distance development team (at University of St. Andrews), this project intends to add new survey design protocols and trend detection methods to the tool kits of tiger conservationists.

2. Personnel and Institutional involvement

The Centre for Wildlife Studies, Bangalore, which is the chief implementing agency of all WCS projects in India, is administering the project. Wildlife Conservation Society, New York (WCS-NY) is providing the services of Principal Investigator, in addition to the funding, logistic and technical support. The Rhinoceros and Tiger Conservation Fund (RTCF) of US Fish and Wildlife Service and Save The Tiger Fund (STF) of National Fish and Wildlife Foundation have provided funding for the first year surveys in

Maharashtra. The project is being implemented with the co-operation of the Maharashtra State Forest Department and permissions from Chief Wildlife Warden of the state.

3. Research activities and accomplishments

Field Site: Tadoba-Andhari Tiger Reserve

1. Extensive field surveys were carried out to map the study area using GPS. The features mapped included forest road/trail network, human settlements within the reserve, water tanks/reservoirs and other management aspects such as check gates, anti-poaching camps, fire huts etc.

2. A benchmark sample survey of tiger and prey abundance has been completed in Tadoba-Andhari Tiger Reserve in Maharashtra, Central India. After detailed reconnaissance surveys, a study area of 367 km² was selected for intensive sampling. Fifty-nine camera trap locations were sampled for a total of 706 trap nights during December 2001–February 2002. Subsequently, field data has been tabulated, camera trap films have been processed, photo cataloguing of all camera trap pictures and individual identification of tigers ‘captured’ in the camera trap have been completed. We obtained 29 sets of tiger photo captures which were used to build capture histories of each individual tiger for analysis under capture-recapture framework. One set of camera trap photographs, a map depicting the survey design and a spreadsheet consisting of capture details were shared with the Forest Department.

3. As a result of our association with the Distance Sampling group at University of St. Andrews, we were able to pioneer (in India) the new line-transect sample survey designs using DISTANCE 4.0. We collected line-transect data using a new survey design with square sampler geometry and automated survey design features developed in consultation with Len Thomas and Samantha Strindberg. The work included laying and marking of 36 square samplers in the study area with each transect covering a distance of 4 km. Field surveys were conducted during March 2002. Data from cumulative sampling efforts of 1088 km have been used to estimate prey densities at Tadoba.

4. Camera trap surveys were continued for the second successive year in Tadoba using the same 60 trap locations that were established during the previous year. The field operations were carried out during December 2002–January 2003, and a total of 715 trap nights were spent to obtain the capture-recapture data. Tabulation of camera trap data, processing of film rolls, photo cataloguing and identification of photo-captured tigers has also been completed during July 2003. We obtained 44 sets of tiger photo captures which were used to build capture histories of each individual tiger, and detailed analysis under capture-recapture framework is in progress.

5. Sign encounter surveys were conducted at Tadoba Andhari Tiger reserve during February 2003 to obtain indices of relative abundance of both tigers and their prey. The field surveys included scat encounter surveys for tigers and other sympatric large carnivores and dung / pellet count surveys for prey species. A total of 24 sampling routes

were identified to obtain scats of tigers, leopards and dholes, which together accounted for a cumulative sampling effort of 286 km. 136 pellet plots, each measuring 50×2 m, were laid over 36 square samplers that were used for transect surveys, and dung/pellets of seven prey species were counted in these plots.

Field Site: Melghat Tiger Reserve

1. Extensive GPS field surveys were carried out in March–May 2002 to map the study area. Forest interior road/trail network, human settlements within the reserve, water tanks/reservoirs and other management aspects such as check gates, anti-poaching camps, fire huts, etc. were mapped. These overlays were used on a GIS platform to finalise sampling design for estimating tiger and prey abundance in Melghat.
2. A benchmark camera trap survey of tiger abundance was completed at Melghat Tiger Reserve in Maharashtra. 60 trap locations were selected after detailed reconnaissance surveys and we sampled for a total of 896 trap nights to obtain capture-recapture estimates. We carried out field surveys in Melghat during March–June 2002. Subsequently, field data has been tabulated, camera trap films have been processed, photo cataloguing of all camera trap pictures and individual identification of tigers ‘captured’ in the camera trap have been completed. We obtained 28 sets of tiger photo captures which were used to build capture histories of each individual tiger for analysis under capture-recapture framework. One set of camera trap photographs, a map depicting the survey design and a spreadsheet consisting of capture details were shared with the Forest Department.
3. Using the new automated survey design features in DISTANCE 4.0, prey densities were estimated at Melghat Tiger Reserve in Maharashtra. The sampling design consisted of 25 spatial replicates of square sampler geometry. The marking and laying of line transects in this rugged terrain took nearly five months and the field data was collected during April –May 2003. A total of 771 km of sampling effort was spent to derive prey densities.

Field Site: Pench Tiger Reserve

1. GPS field surveys were carried out in October–November 2002 to map the study area. Forest interior road/trail network, human settlements within the reserve, water tanks/reservoirs and other management aspects such as check gates, anti-poaching camps, fire huts etc were mapped. These overlays were used on a GIS platform to finalise sampling design for estimating tiger and prey abundance in Pench.
2. A benchmark camera trap sample survey of tiger abundance has been completed in Pench Tiger Reserve in Maharashtra, Central India. After detailed reconnaissance surveys in October 2002, a study area of about 280 km² was selected for intensive sampling. 60 camera trap locations were sampled for a total of 715 trap nights during November–December 2002. Tabulation of camera trap data, processing of film rolls, photo cataloguing and identification of photo-captured tigers has also been completed during

June 2003. We obtained 31 sets of tiger photo captures which were used to build capture histories of each individual tiger for analysis under capture-recapture framework.

3. A new survey design with square sampler geometry using the automated survey design features in DISTANCE 4.0 has been implemented to estimate prey densities in Pench. The fieldwork included laying and marking of 30 transect lines and field data collection, which was carried out during December 2002–March 2003. The line transects survey included eight temporal replicates together accounting for a cumulative sampling effort of 894 km.

4. Training and capacity building

Training and local capacity building is one of the major goals of the project. To meet this goal, we carried out the following training activities during the reporting period.

1. Four research assistants (Arjun Gopaldaswamy, Raghavendra Mogaroy, Narendra Patil and Bharath Sundaram) were recruited and trained in all the field techniques used in this project. They have gained proficiency and are now capable of doing all the field work after the sampling protocols are delineated by the PI and Co-PI for each site.

2. We have also identified and trained two highly motivated local NGO volunteers - Harshawardhan and Poonam Dhanwatey from Nagpur and Prachi Mehta and Jayant Kulkarni from Pune. These keen wildlife enthusiasts will work as our long-term collaborating local partners in Maharashtra. Five young and motivated local field assistants (two from TRACT, an NGO based in Nagpur, and three from Panna Tiger project based in Panna, Madhya Pradesh) were also trained in the line-transect and camera trap field operations.

3. We conducted a training camp to demonstrate camera trap technique for tiger surveys to the field staff and officials of Maharashtra State Forest Department at Tadoba. A slide talk was also held to the senior officials of the Forest Department at the department headquarters in Nagpur.

4. We organized two field-training workshops at Tadoba during March 2002 on the use of sampling based methods for monitoring large prey and predator populations. 13 field staff from Forest department and 12 volunteers from local NGOs participated in these workshops, each of one-week duration. 12 senior instructors from Centre for Wildlife Studies assisted in field training. Four more field-training workshops (two each in Pench and Melghat) were conducted during March–May 2003. 32 field staff from Maharashtra State Forest Department and 40 NGO volunteers participated in these workshops. 17 senior instructors from Centre for Wildlife Studies assisted the research team in field training. A training workshop was also conducted at Tadoba in February 2003 on the use of index-based surveys for monitoring tiger and prey populations. Thirty-two field staff from the Forest Department and 30 volunteers from local NGOs participated in scat encounter and pellet count surveys.

5. A slide talk and field demonstration of the camera trap technique was held in May 2002 for the staff of Melghat Tiger reserve at Semadoh interpretation Centre at Melghat.

6. A field demonstration of the camera trap technique was conducted during November 2002 to the visiting park officials of Pench Tiger Reserve at Pench.

7. Consultant Dr. Len Thomas from the DISTANCE development group at University of St. Andrews, Scotland, visited the Centre for Wildlife Studies, and discussions were held on the sampling design for the long-term monitoring of prey populations in key sites of Karnataka and Maharashtra. The co-principal investigator also underwent training and participated in the DISTANCE sampling workshops held at the University of St. Andrews, Scotland.

8. A field trip to Melghat was organized during May 2002 to the collaborating team from Columbia University to explore and discuss potential methods for tiger habitat mapping.

5. Preliminary Results

The process of data exploration and analysis usually takes a long time in a three-year study like this one and is necessarily followed by scientific peer review and publication. We are currently exploring ways of improving the data analysis procedures. Hence, the results presented here must be considered as preliminary until they are peer reviewed and published. We expect these results to change marginally before they are published in the peer-reviewed scientific literature. We are providing these preliminary results at the request of the Chief Wildlife Warden and field directors of the reserves who enthusiastically cooperated with us in carrying out this study in their respective areas.

Tadoba-Andhari Tiger Reserve

Tadoba Andhari Tiger reserve is the oldest national Park in Maharashtra State and was declared a tiger reserve in 1995. The tropical deciduous forest of this region dominated by teak and bamboo support impressive mammalian fauna and is one of the prime tiger habitats of the state. The area is situated within Tiger Conservation Unit-44, one of the priority level III tiger conservation areas. The forests are connected with several adjoining protected and reserve forests together forming one of the largest blocks of contiguous forests of nearly 1500 sq. km in central India. The state forest department has also initiated several management interventions including the relocation of six interior villages within the tiger reserve to consolidate this tiger habitat. The study site was located in the better-protected north and central part of the reserve.

Results of camera trap studies

Total number of camera trap locations = 59

Sampling effort = 706 trap nights

Number of sampling occasions = 12

Camera trap polygon area = 205 sq. km.

Estimated sampled area including buffer = 367 sq. km.

Number of individually identified tigers = 10

Capture-recapture model used to estimate population size: M_h

Estimated animal density for tigers in the sampled area = 3.3 tigers/100 sq. km.

Results of Line Transect studies of principal prey species:

Total numbers and length of permanent transects: 36 lines, 144 km.

Sampler geometry: Square sampler

Sampling effort (total transect length walked): 1088 km.

Number of detections (sample size: n) and estimates of animal density for the principal prey species:

Species	n	Animal density (animals per sq. km)
Chital	110	3.2
Sambar	160	3.3
Muntjak	56	0.9
Chousingha	39	0.5
Gaur	62	1.8
Nilgai	48	0.7
Pig	63	2.6

Melghat Tiger Reserve

Melghat Tiger reserve is a part of an extensive tiger habitat along Satpura hill ranges that stretch across parts of Maharashtra and Madhya Pradesh States. It was declared a tiger reserve in 1974 and is the main catchment area for the river Tapti. The area is situated within Tiger Conservation Unit-28, one of the priority tiger conservation areas requiring immediate surveys to assess tiger population status. The forests are connected with several adjoining protected and reserve forests in Satpura hill ranges. The rugged topography and the contiguity of forests provide an excellent opportunity for the long-term conservation of tiger populations. The state forest department has recently completed the relocation of two interior villages within the tiger reserve and has initiated several management interventions to consolidate this tiger habitat. The study site was located in the better-protected south-central part of the reserve.

Results of camera trap studies:

Total number of camera trap locations = 60

Sampling effort = 896 trap nights

Number of sampling occasions = 15

Camera trap polygon area = 203 sq. km.

Estimated sampled area including buffer = 360 sq. km.

Number of individually identified tigers = 15

Capture-recapture model used to estimate population size: M_h

Estimated animal density for tigers in the sampled area = 6.7 tigers/100 sq. km.

Results of Line Transect studies of principal prey species:

Total numbers and length of permanent transects: 25 lines, 97.2 km.

Sampler geometry: Square sampler

Sampling effort (total transect length walked): 771.2 km.

Number of detections (sample size: n) and estimates of animal density for the principal prey species:

Species	n	Animal density (animals per sq. km)
Sambar	138	2.7
Muntjak	47	0.6
Chousingha	46	0.5
Gaur	61	1.0
Pig	22	0.5

Pench Tiger Reserve

Pench Tiger reserve is a typical representation of the floral and faunal wealth along Satpura-Maikal hill range. The Government of Maharashtra declared the area as Pench National Park in 1975 and the Government of India declared it as a Tiger Reserve in 1999. This area is also contiguous with the tiger reserve under the same name in Madhya Pradesh on its eastern fringes and together forms a high potential tiger habitat in central India. The tropical moist deciduous forests in this reserve are dominated by natural teak. The area is situated within the Tiger Conservation Unit-31 and has been identified as a level I priority area for tiger conservation. The state forest department has initiated the relocation of villages within the tiger reserve to consolidate this tiger habitat and

management initiatives such as total banning of fishing within the tiger reserve have helped reduce the anthropogenic pressures. The study site was located in the better-protected central part of the reserve.

Results of camera trap studies:

Total number of camera trap locations = 60

Sampling effort = 715 trap nights

Number of sampling occasions = 12

Camera trap polygon area = 112 sq. km.

Estimated sampled area including buffer = 270 sq. km.

Number of individually identified tigers = 14

Capture-recapture model used to estimate population size: M_h

Estimated animal density for tigers in the sampled area = 7.3 tigers/100 sq. km.

Results of Line Transect studies of principal prey species:

Total numbers and length of permanent transects: 30 lines, 112 km.

Sampler geometry: Square sampler

Sampling effort (total transect length walked): 894 km.

Number of detections (sample size: n) and estimates of animal density for the principal prey species:

Species	n	Animal density (animals per sq. km)
Chital	171	5.8
Sambar	248	5.9
Chousingha	76	1.1
Gaur	34	0.8
Nilgai	36	0.5
Pig	50	2.0