FUTURE TREND OF TIGER POPULATION IN SIMILIPAL TIGER RESERVE

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Introduction

Data on Similipal from 1989 to 1995 indicated that while there was an increase in human population inside the Tiger Reserve area, the Tiger and Leopard population were more or less stable (Prusty and Singh, 1996). It was then cautioned, if the trend continued a 'population crash must be expected as imminent'.

In the present paper we have used additional data resulting from Tiger population estimates for the year 1997 and have conducted a series of statistical regressions to determine the veracity of the caution about the Tiger population trend propounded in Prusty and Singh, 1996.

Methods

Data : Two kinds of data have been used in this analysis. These are the Tiger population estimates from the year 1972 to 1997, and the human population figures for the years 1971, 1981 and 1991 (Table 1).

Assumptions : The following assumptions have been made during analysis of raw data :

(1) Beyond the year 1991, human population grows at the trend as observed during the census period 1971 to 1991.

(2) Growth of human population is at equal rates during individual years for any decennial period.

(3) Tiger population for years when census was not conducted is equal to the number recorded during the previous estimate.

(4) The estimate of Tiger population for the year 1972 was not correct because it is stated that the entire area of Tiger Reserve was not covered.

(5) The Tiger number in the Reserve is a function of at least two factors as follows :

(a) Increase in population is due to natality and management input.
(b) Decrease in population is due to mortality because of natural as well as man-made causes. The man-made causes can be expressed as a direct reflection of human population within the limits of the Reserve.

(6) For calculation of 'Multiple Regression' the independent variables are the management years and human population, and the dependent variable is the number of Tigers expressed as population-growth percentage.

Key : The key to certain codes used in the text, tables and regressions is as below :

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Table 1

Observed Trend of Tiger Population in Similipal Tiger Reserve

Year	Mgmt Year	1/M_Year	Obsvd T_no.	Obsvd T_G%	Obsvd. H_no.
1971	0				7131
1972	1	1	17		7282
1973	2	0.5	17		8433
1974	3	0.333333	17	0	7584
1975	4	0.25	30	76	7736
1976	5	0.2	46	53	7887
1977	6	0.166667	56	22	8038
1978	7	0.142857	56	0	8189
1979	8	0.125	65	16	8340
1980	9	0.111111	65	0	8492
1981	10	0.1	65	0	8643
1982	11	0.090909	65	0	8806
1983	12	0.083333	65	0	8969
1984	13	0.76923	81	25	9132
1985	14	0.071429	81	0	9295
1986	15	0.066667	89	10	9458
1987	16	0.0625	89	0	9621
1988	17	0.058824	89	0	9784
1989	18	0.055556	93	4	9947
1990	19	0.052632	94	1	10110
1991	20	0.05	96	2	10273
1992	21	0.047619	95	-1	
1993	22	0.045455	95	0	
1994	23	0.043478	95	0	
1995	24	0.041667	97	2	
1996	25	0.04	97	0	
1997	26	0.038462	98	1	

Key : H_no = Human population inside Similipal Tiger Reserve.
M_year = Management year commencing from 1972.
SEE = Standard Error of estimate.
T_no = Tiger population inside Similipal Tiger Reserve.
T_G% = Tiger Population rate (%) of growth.

H_no = Human population inside Similipal Tiger Reserve.

M_year = Management year commencing from 1972.

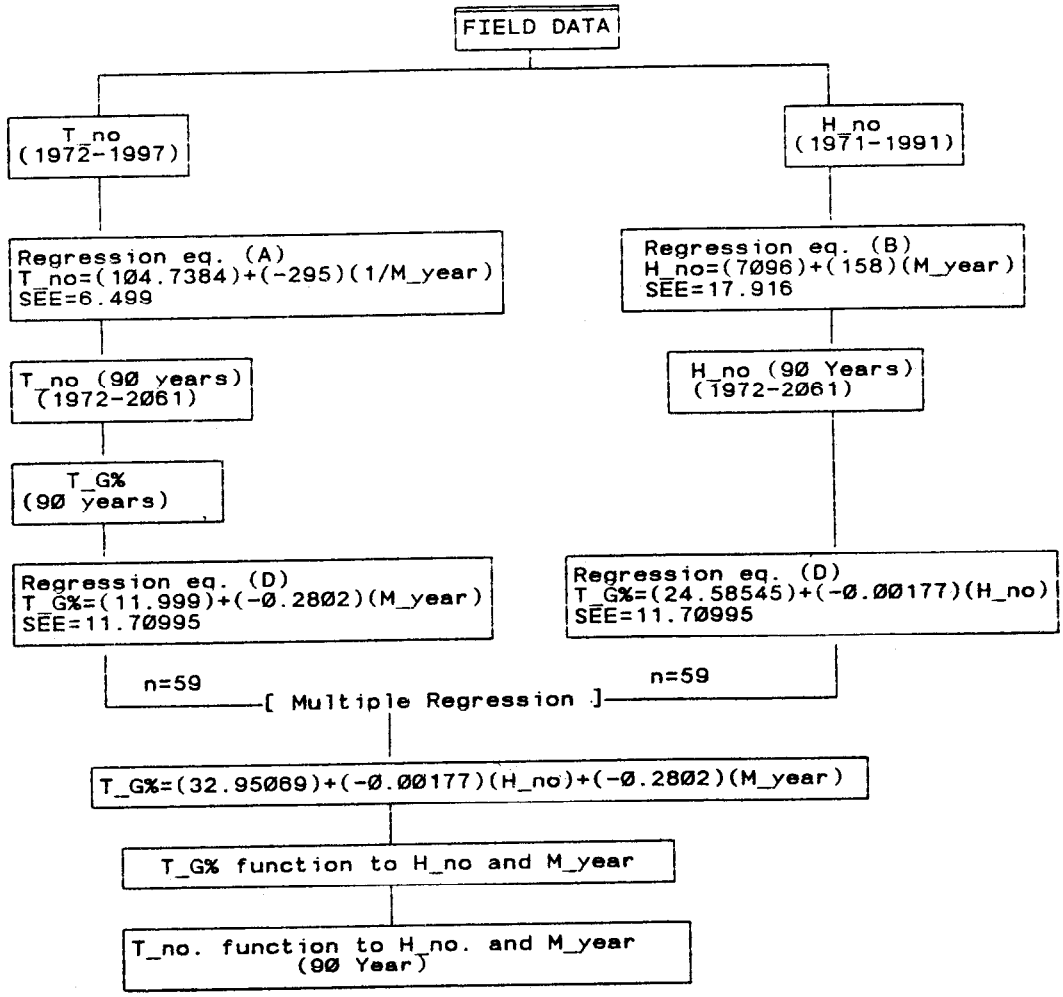
SEE = Standard Error of Estimate.

T_no = Tiger population inside Similipal Tiger Reserve.

T_G% = Tiger Population rate (%) of growth.

Goodness of Fit : Before computer-based

Fig. 1



Flow chart of Analysis

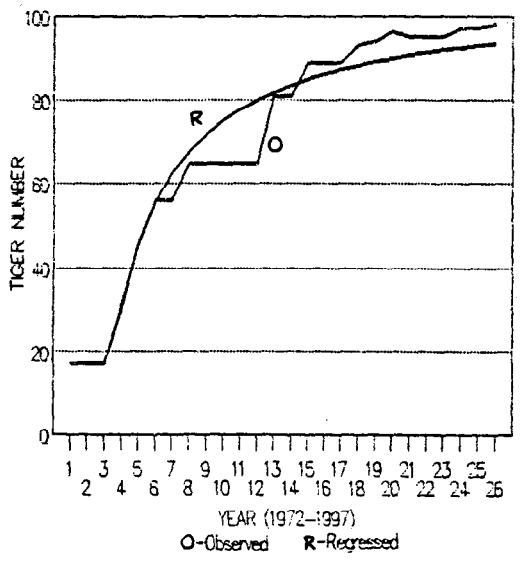
regressions were determined the data on Tiger population estimates from 1974 (Table 1) were plotted against M_year and it was found that out of various options the regression of the type "Y = a + b/X" fitted the best, when Y is T_no and X is M_year.

Flow chart of analysis : The various actions carried out for analysis of field data and calculation of regression equations for projections are given in Fig. 1. Regression equations were calculated using computer spreadsheets under "QUATRO" in a PC486. Projections have been made upto the 90th year of the project.

Results

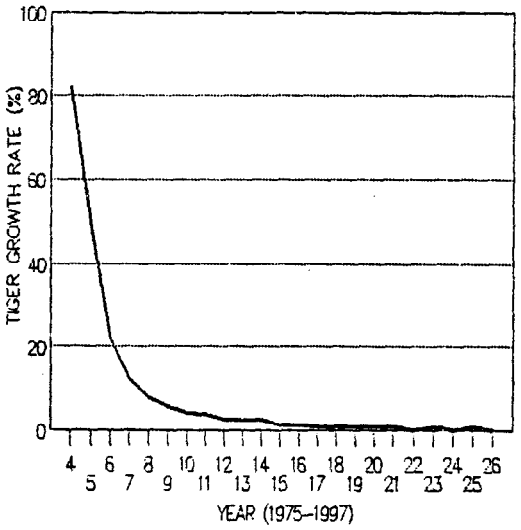
1. Field data on Tiger numbers for the period 1974-1997 (Table 1) indicated that

Fig. 2



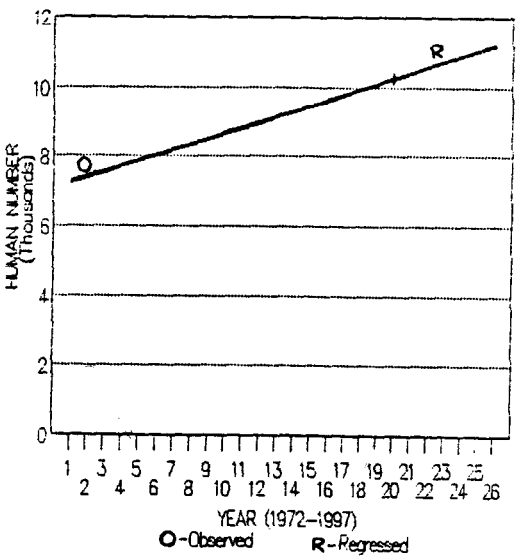
Number of Tigers in STR
T_No upon M_year (1972-1997)

Fig. 3



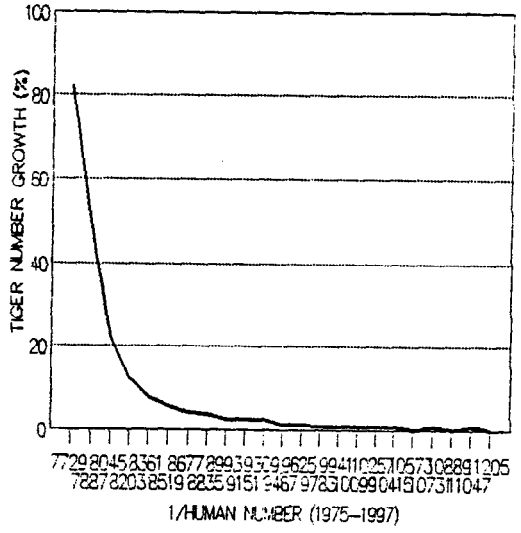
Tiger No. growth rate %
in STR during 1975-1997

Fig. 4



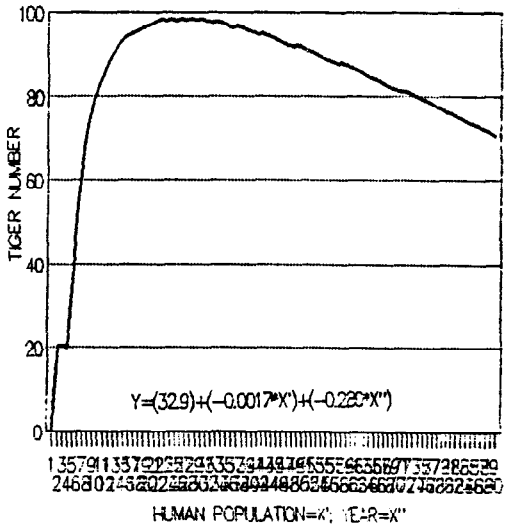
Human Number (1972-1997) in STR

Fig. 5



Tiger number growth rate upon Human
Number in STR

Fig. 6



Projected numbers of Tigers in STR (1972-2061)

recently the observed number of Tigers was stable (Fig. 2). This is because of a decreasing trend in the rate of growth of the population (Fig. 3).

2. The relationship between management year (M_year) and Tiger number (T_no.) (Fig. 2) followed the regression :

T_no = (104.7384) + (-295) (1/M_year);
SEE=6.499..... Regression eq. (A)
and T_G% = (11.999) + (-0.2802) (M_year);
SEE = 11.70995 .... Regr. eq. (B).

3. The human population continued to rise (Table 1; Fig. 4) against year within the following regression :

H_no = 7096 + 158 (M_year);
SEE = 18 ..... Regression eq. (C)

4. The T_G% declined against rise in H_no. (Fig. 5) and obeyed the following regression :

T_G% = 24.58545 + (-0.00177) (H_No.);
SEE = 11.70995..... Regr. eq. (D)

5. By using data from Table 2 a multiple regression of the following nature was obtained (Fig.6).

T_G% = (-32.95069) + (-0.00177) (H_no) + (-0.2802) (M_year) ..... Regr. eq. (E).

6. From data on T_G% the T_No were determined to indicate the trend of Tiger population upto the 90th year (Table 2, Fig. 6).

Discussions

Prusty and Singh (1996) propounded that in Similipal Tiger Reserve the area where intense human activities exist, and which Tigers normally avoid, had increased. Based on this it was suspected that the extent of area occupied by a fixed number of Tigers had reduced. That is, the ecological density of Tiger in Similipal had decreased. It was also stated that population crash can be expected to occur in an 'isolated' insularised population where there is 'inbreeding depression' (Frankel and Soule, 1981).

Mathematical regressions carried out in this paper further substantiates the earlier contention that even if management inputs are kept continued, if the human population continues to exist and rise inside Similipal Tiger Reserve the population of Tiger shall decline. At the present rate of human population growth the Tiger population shall start declining after the year 2008, if not earlier. Shifting of all 65 villages from Similipal Tiger Reserve is extremely difficult, if not impossible, and

Table 2

Regressed Trend of Tiger Population in Similipal Tiger Reserve

Year	M_year	Regressed values			Multiple regression	
		T_no.	T_G%	H_no.	T_G%	T_No.
1	2	3	4	5	6	7
+/-SEE		6	11.7	18		
1972	1	17	0	7255	19.82914	0
1973	2	17	0	7413	19.26928	20
1974	3	17	0	7571	18.70942	20
1975	4	31	82	7729	18.14956	20
1976	5	46	48	7887	17.5897	36
1977	6	56	22	8045	17.02984	54
1978	7	63	13	8203	16.46998	65
1979	8	68	8	8361	15.91012	73
1980	9	72	6	8519	15.35026	78
1981	10	75	4	8677	14.7904	83
1982	11	78	4	8835	14.23054	86
1983	12	80	3	8993	13.67068	89
1984	13	82	3	9151	13.11082	90
1985	14	84	2	9309	12.55096	92
1986	15	85	1	9467	11.9911	94
1987	16	86	1	9625	11.43124	95
1988	17	87	1	9783	10.87138	95
1989	18	88	1	9941	10.31152	96
1990	19	89	1	10099	9.75166	97
1991	20	90	1	10257	9.1918	97
1992	21	91	1	10415	8.63194	98
1993	22	91	0	10573	8.07208	98
1994	23	92	1	10731	7.51222	98
1995	24	92	0	10889	6.95236	98
1996	25	93	1	11047	6.3925	98
1997	26	93	0	11205	5.83264	98
1998	27	94	1	11363	5.27278	98
1999	28	94	0	11521	4.71292	98
2000	29	95	1	11679	4.15306	98
2001	30	95	0	11837	3.5932	98
2002	31	95	0	11995	3.03334	98
2003	32	96	1	12153	2.47348	97
2004	33	96	0	12311	1.91362	98
2005	34	96	0	12469	1.35376	97
2006	35	96	0	12627	0.7939	97
2007	36	97	1	12785	0.23404	96
2008	37	97	0	12943	-0.32582	97
2009	38	97	0	13101	-0.88568	96
2010	39	97	0	13259	-1.44554	96
2011	40	97	0	13417	-2.0054	95
2012	41	98	1	13575	-2.56526	95

Contd...

1	2	3	4	5	6	7
2013	42	98	0	13733	-3.12512	95
2014	43	98	0	13891	-3.68498	94
2015	44	98	0	14049	-4.24484	94
2016	45	98	0	14207	-4.8047	93
2017	46	98	0	14365	-5.36456	93
2018	47	98	0	14523	-5.92442	92
2019	48	99	1	14681	-6.48428	92
2020	49	99	0	14839	-7.04414	92
2021	50	99	0	14997	-7.604	91
2022	51	99	0	15155	-8.16386	91
2023	52	99	0	15313	-8.72372	90
2024	53	99	0	15471	-9.28358	90
2025	54	99	0	15629	-9.84344	89
2026	55	99	0	15787	-10.4033	89
2027	56	99	0	15945	-10.9632	88
2028	57	100	1	16103	-11.523	88
2029	58	100	0	16261	-12.0829	88
2030	59	100	0	16419	-12.6427	87
2031	60	100	0	16577	-13.2026	87
2032	61	100	0	16735	-13.7625	86
2033	62	100	0	16893	-14.3223	86
2034	63	100	0	17051	-14.8822	85
2035	64	100	0	17209	-15.442	85
2036	65	100	0	17367	-16.0019	84
2037	66	100	0	17525	-16.5618	83
2038	67	100	0	17683	-17.1216	83
2039	68	100	0	17841	-17.6815	82
2040	69	100	0	17999	-18.2413	82
2041	70	101	1	18157	-18.8012	81
2042	71	101	0	18315	-19.3611	81
2043	72	101	0	18473	-19.9209	80
2044	73	101	0	18631	-20.4808	80
2045	74	101	0	18789	-21.0406	79
2046	75	101	0	18947	-21.6005	78
2047	76	101	0	19105	-22.1604	78
2048	77	101	0	19263	-22.7202	77
2049	78	101	0	19421	-23.2801	77
2050	79	101	0	19579	-23.8399	76
2051	80	101	0	19737	-24.3998	76
2052	81	101	0	19895	-24.9597	75
2053	82	101	0	20053	-25.5195	74
2054	83	101	0	20211	-26.0794	74
2055	84	101	0	20369	-26.6392	73
2056	85	101	0	20527	-27.1991	73
2057	86	101	0	20685	-27.759	72
2058	87	101	0	20843	-28.3188	72
2059	88	101	0	21001	-28.8787	71
2060	89	101	0	21159	-29.4385	71
2061	90	101	0	21317	-29.9984	70

the growth of existing human population is an inevitable phenomenon. Therefore, it is possible that the growth-trend for Tiger population can be delayed from going negative by (a) restricting the use-area by existing human population, and (b) by enhancing the measures for habitat improvement.

Acknowledgements

We are grateful to the Principal Chief Conservator of Forests (Wildlife) and Chief Wildlife Warden, Orissa for providing the scope to study the population of Tiger in Similipal Tiger Reserve. The staff of STR and participating NGOs determined data on Tiger population and Shri Sudipta Ranjan Ram assisted in computer analysis.

SUMMARY

Data on Tiger population estimates from 1972 to 1997 have been analysed along with human population from 1971 to 1991 to regress the status of Tiger population in Similipal Tiger Reserve by the year 2061. Assumption has been made that the rate of growth of human population continues at the rate seen upto 1991. During observation years 1974-1997, the per cent rate of growth of Tiger population followed a declining trend which becomes negative after the year 2008, in spite of continuance of managerial inputs at the present level. For calculation of 'Multiple Regression' the independent variables were considered to be the management years and human population, and the dependent variable was the per cent growth rate for number of Tigers in the Reserve. The work substantiates earlier findings that the Tiger population in Similipal Tiger Reserve is a population threatened by growth of human population. Restriction of use-area by inhabiting human population and enhancing measures for habitat improvement are suggested to possibly delay the anticipated negative trend of growth of Tiger population.

सिमलीपाल बाघ संरक्षित वन में बाघों की संख्या की भविठय प्रवृति

एस०एस० श्रीवास्तव व एल०ए०के० सिंह

सारांश

सन् 2061 तक सिमलीपाल बाघ संरक्षित वन में बाघों की वर्तमान संख्या में प्रतीप गति लाने के लिए 1971 से 1991 तक मानवों की संख्या को साथ रखकर बाघों की 1972 से 1997 तक की बाघों की संख्या के अनुमानों के आँकड़ों का विश्लेषण किया गया है। इसमें यह अभिधारणा स्वीकार की गई है कि मानवों की संख्या आगे भी उस दर से बढ़ती रहेगी जितनी वह 1991 तक बढ़ती दिखाई पड़ी है। 1974-1997 के प्रेक्षण वर्षों में बाघों की संख्या की प्रतिशत दर में घटते जाने की प्रवृति दिखाई पड़ी जो वर्तमान स्तर पर प्रबन्धकीय निवेश करते रहने के बावजूद सन् 2008 तक ऋणात्मक हो गई 'बहुचर प्रतीपायन' के अनुसार गणना के लिए स्वतन्त्र चरों के रूप में प्रबन्ध वर्षों तथा मानवों की संख्या को लिया गया तथा पराश्रित चर के रूप बाघों के संरक्षित वनों की संख्या की प्रतिशत वृद्धि दर को लिया गया। इस शोधकार्य से सिमलीपाल बाघ संरक्षित वन की बाघ संख्या के विषय में किए गए पूर्व अन्वेषणों की पुष्टि होती है कि मानवों की संख्या बढ़ने से वहाँ के बाघों की संख्या खतरे में पड़ रही है। बाघों की संख्या वृद्धि में संभावित ऋणात्मक प्रवृति में, हो सके तो, विलम्ब लाने के लिए वहां बसने वाले मानवों द्वारा उपयोग किया जाना वाला क्षेत्र घटाकर कम करना तथा प्राकृतावास में सुधार लाने के लिए और अधिक उपाय करना सुझाए गए हैं।

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