Phone No. 02320-239376, 239375 Email ycegvp89@gmail.com Website www.http//yashguru.edu.in
Daulat Vishwast Sanstha's
Yashwantrao Chavan College, Halkarni,
Tal. Chandgad, Dist. Kolhapur-416 552, Maharashtra, India
Accrediated by NAAC at the B level
In-Charge PRINCIPAL- Dr. P. Y. Nimbalkar M.A., M.Phil., Ph.D.

Date: ०६.05.2019

CERTIFICATE

This is to certify that, a research project entitled "Assessment of Amphibian Biodiversity and their Conservation Status in Chandgad Taluk (Kolhapur), Sahyadris of Southern Maharashtra" sanctioned under Rajiv Gandhi Science and Technology Commission, Mumbai Scheme through Shivaji University Kolhapur during the academic year 2017-18 is executed in our Zoology department by Dr. N. C. Hiragond. The part of the Research Project Report thereof not been previously presented for any diploma or degree.

Dr. N. C. Hiragond
Principal Investigator
RGST Research Project
Department of Zoology
Yashwantrao Chavan College,
HALKARNI - 416 552.

Dr. P. Y. Nimbalkar
I/C PRINCIPAL
Yashwantrao Chavan College
Halkarni 416 552
Tal.Chandgad,Dist.Kolhapur

Yashwantrao Chavan College HALKARNI Seal Tal. Chandgad, Dist. Kolhapur

ACKNOWLEDGEMENT

I undersigned Dr. N. C. Hiragond wish to extend my sincere thanks to our College Management, the Principal, Faculty members and Supporting staff for their co-operation and help in implementing the research project entitled "Assessment of Amphibian Biodiversity and their Conservation Status in Chandgad Taluk (Kolhapur), Sahyadris of Southern Maharashtra"sanctioned under Rajiv Gandhi Science and Technology Commission, Mumbai Scheme through Shivaji University Kolhapur.

I thank the Range Forest Officer, Chandgad Range, Chandgad and the Range Forest Officer, Patne Range, Patne, of Chandgad taluk, Kolhapur Division for allowing me to do the field work in forest area and their co-operation in implantation of the above said research project.

I wish to thank Dr, K. N. Nikkam, Assistant Professor in Zoology of R. B. Madhkholkar College, Chandgad for his support and joining me during the field work. I extend my thanks to Prof. A. S. Bagwan Assistant Professor of Chemistry and Prof. A. S. Jadhav Assistant Professor of Chemistry for their moral support and encouragement. I thank Miss Jyoti M. Aihole Assistant Professor of Zoology for her co-operation and support.

I wish to note down my thanks to my friend Nagesh Vannur of Belagavi and my students Mr. Sagar Maruti Chikhalkar, Ramachandra Bhosale, Shubham Chandekar, Pandu Varpe, Nitin Awadan, Akash Kamble, Ankush More, Somanath Mane and others for their help and joining me during regular field work.

Finally, I wish to thank my wife Sunanda and my son Samrudh for their co-operation, moral support and allowing me to do night field work.

(Dr. N. C. Hiragond)
Principal Investigator
RGST Research Project
Department of Zoology
Yashwantrao Chavan College,
HALKARNI - 416 552.

9. Signatures of the Internal Monitoring Committee

Dr. N. C. Hiragond
Principal Investigator
RGST Research Project
Department of Zoology
Yashwantrao Chavan College,
HALKARNI - 416 552.

I/C PRINCIPAL
Yashwantrao Chavan College
Halkarni 416 552
Tal.Chandgad,Dist.Kolhapur
and Chairman Internal Monitoring Committee, RGSTC Research Project, Yashwantrao Chavan College, Halkarni

Name of the Internal Monitoring Committee Member	Signature
1. Prof. A. S. Bagwan Head, Science Faculty, Yashwantrao Chavan College, Halkarni	
2. Shri D. G. Rakshe, Range Forest Officer, Chandgad Range, Chandgad, Dt. Kolhapur	
3. Shri M. N. Parab, Range Forest Officer Patne Range, Patne, Chandgad taluk, Dt. Kolhapur	

RGSTC Research Project Final Report

1. Name of the Project : An Assessment of Amphibian Biodiversity and their Conservation Status in Chandgad Taluk (Kolhapur), Sahyadris of Southern Maharashtra
2. Reference No : RGSTC/SUK/SRP/SL-04/2016-17 dated 23.03.2017
3. Total Grant Sanctioned : Rs. 5,06,438.75
4. Total Grant Released : Rs. 5,06,439.00
5. Name of the Principal Investigator : Dr. N. C. Hiragond

Yashwantrao Chavan College,
Halkarni – 416 552,
Tq. Chandgad, Dt. Kolhapur
Cell No: 09449626499, 9403470559

1. Introduction:

The Indian subcontinent comprises of 405 amphibians, of which 364 are anurans, two species are of Salamander and 39 are caecilians. Among these amphibians 239 are found in the Western Ghats representing many genera (Dinesh *et al.*, 2017), that amounts to 59% of amphibians found in India. Recent studies (Biju & Bossuyt, 2003, 2005abc, 2006; Gururaj, *et al*, 2007; Giri, *et al.*, 2003; Gower, *et al*, 2008) show that, there are still several new species waiting to be discovered. Studies on behavioral ecology of anuran tadpoles revels that,

the morphological variations of tadpoles are correlated with their microhabitat selection, oral armature & food habits (Duellman & Trueb, 1986; McDiarmid & Altig, 1999; Hiragond & Saidapur, 2001). Studies also documented to show that, the anuran tadpoles respond to chemical & visual stimuli (Saidapur & Girish, 2000; Saidapur, *et al.*, 2009). However, the most of the tadpoles of Indian anurans are still undescribed. Morever, for those already described, descriptions are usually not complete thus making it difficult to develop diagnostic & identification keys (Hiragond & Saidapur, 1999; Hiragond, *et al.*, 2001; Saidapur, 2001). Therefore, the studies on ecologically correlated morphological features, behavioral studies, biodiversity and taxonomy on Amphibians are essential.

The Western Ghats of Indian Subcontinent represents one of the hot spot for rich biodiversity in the world. The study area Chandgad taluk (15° 55' 60 N, 74° 23' 0 E) in Kolhapur district of Southern Maharashtra is a part of Western Ghats. It is located around 800 m asl and temperature ranging from 14.75 to 36.10^{o} C. The annual rain fall ranges 3000 to 5000 mm/year. The study area consist several temporary ponds, puddles, lakes and agricultural fields. The study area is also traversed by several temporary streams and perennial Hiranykeshi, Ghathaprabha and Tamrapani Rivers. There are no attempts made to document the amphibian biodiversity in Chandgad taluka. The data available with forest department shows 2 species of toad i.e. *Bufo melanostictus*

(Duttaphrynus melanostictus) and Bufo stomaticus (*Duttaphrynus stomaticus*) & few species of frogs *Philautus* sp. (Bush frog), *Polypedates maculatus, Rana cynophlyctis* (*Euphlyctis cyanophlyctis*), *Rana hexadactylus* (*Euphlyctis hexadactylus*), *Rana tigerina* (*Hoplobatracus tigerinus*), *Rana limnocharis* (*Limnonectus limnocharis*), *Rana malabarica* (*Hydrophylax malabaricus*), *Rana curtipes* (*Clinotarsus curtipus*), *Rana aurantiaca* (*Sylvirana aurantiaca*) & *Rana breviceps* (*Tomopterana breviceps*) are found. Hence, an attempt is made to record the biodiversity of Amphibians in Chandgad taluka of Kolhapur district.

2. Materials and Methods:

We have made regular field visits to different parts of the Chandgad taluka in Kolhapur district of Southern Maharashtra for documentation of Amphibians. The survey was conducted from the last week of May 2017 to February 2019. We have made field survey during early in the morning and sometimes late evening. Survey was mainly done by visual encounters method. Amphibians are intensively searched along the edges of streams, temporary water bodies, puddles, ditches, in agricultural fields, grasslands, under leaf litter, in forests floors, on tree trunks, under stones, logs, rock crevices, decaying vegetation etc. We tried to identify the egg mass, tadpoles, froglets and adult frogs in the nature itself. The Amphibians identified in the nature were released after taking some images by D5300 and D7200 Nikon Camera. The unidentified

tadpoles and frogs in the field were brought to the laboratory and tried to identify by referring the reference books (Vasudevan & Sondhi, 2010; Daniels, 2011; Gururaj, 2012; Porab, *et al.*, 2014; Ganesh, 2015) and research articles (Daniel, 1963ab, 1975; Daneils, 1997abc; Dutta, 1997; Bhatta, 1998; Hiragond & Saidapur, 1999; Hiragond, *et al.*, 2001; Saidapur, 2001; Sajjan, *et al.*, 2017). Later, they were released to the nature. We also identified some of the frogs based on their calls during the breeding season in late evening. We identified some of the frogs based on their tadpole morphology (McDiarmid & Altig, 1999; Hiragond & Saidapur, 1999; Hiragond, *et al.*, 2001; Saidapur, 2001; Hiragond, 2002; Altig & Mc Diarmid, 2015). We have recorded the temperature and P^H of water in the place of egg masses encountered. We have used the stereo zoom dissecting microscope for the observation of morphological details of some tadpole and caecilian for their identity. We used the insect nets to collect the tadpoles from the streams and ponds. In the field, in most of the times the tadpoles collected from the ponds and streams were released immediately after observations for their identification. The status of threatened category of amphibians is adopted from IUCN Red List of Threatened Species (2019) and Wikipedia (2019).

3. Results and Discussion:

As per the plan we have made regular field trips to the different parts of the study area in Chandgad taluka. During our regular field visits we found

several egg clutches of *Microhyla ornate, Clinotarsus curtipus, Hylarana temporalis, Duttaphrynus melanostictus, Hoplobatrachus tigerinus* and some unidentified egg masses. We also observed the tadpoles of *H. temporalis, D. melanostictus, C. curtipus, M. ornate, H. tigerinus, E. cynophlyctis, P. maculatus* and some unidentified tadpoles in their natural habitat like ponds, puddles, streams. We have sighted several adult frogs in their natural habitats namely *C. curtipus, H. temporalis, D. melanostictus, Sphaerotheca breviceps, Hylarana malabarica, H. tigerinus, Duttaphrynus scaber, M. ornate, M. rubra, Rhacophorus malabaricus* , *Indirana beddomii* etc enlisted in table 1. During the rainy season we encountered several newly metamorphosed frogs of *H. temporalis, C. curtipus, D. melanostictus, H. tigerinus, E. cynophhlyctis, M. ornate. D. melanostictus.* We also encountered one Caecilian which was brought to the laboratory for further observation. It belongs to *Gegenophis* genus. Its species name is yet to be confirmed.

At presently we identified 24 Amphibian species belonging to 15 genus were documented during above said survey. The detailed checklist of Amphibians of the study area is listed in table 1. Table 2 shows the number of amphibian species representing the individual genus. We are also trying to confirm the identity of few more unidentified anuran species documented during the above said survey period, which are not included in table 1. The only caecilian collected from the field is identified up to the genus level. Further

observations are continued to confirm its species. We are contacting experts in the field to identify its species. I also wish to do some more field visits during coming rainy season to get some more caecilians to confirm its identity and for further studies. Among the total amphibians documented in the present studies the *Pseudophilautus amboli* belongs to Critically Endangered category, *Uperodon mormorata* belongs to Endengered category, *Duttaphrynus parietalis* and *Indosylvirana temporalis* belongs to Near Threatened category, *Fejervarya brevipalmata* falls under data deficient category, rest of the amphibians documented belongs to Least Concerned category of IUCN conservation status (IUCN, 2019, Wikipedia, 2019). The IUCN assessment is not available for *Clinotarsus curtipus* frog.

Padhye and Ghate (2012) enlisted a total of 53 amphibian species from Maharashtra. Sajjan *et al.,* (2017) documented 30 amphibians from Sangli district of Maharashtra. Dinesh *et al.,* (2017) enlisted 32 amphibians from the Goa state. Our findings show that, the Chandgad taluka of Kolhapur district is rich in amphibian diversity and consists almost 45% of the amphibians found in Maharashtra, 75% of the amphibians found in Goa state and 80% of the amphibians found in Sangli district of Maharashtra.

In most of the times I found difficulty in identification of egg masses and tadpoles in nature. I feel that, separate studies are needed to collect the egg clutches and tadpoles from the nature for their developmental studies and to

confirm their identity. Since, the caecilians are very rare and burrowing in habitat, it is difficult to find them in their natural habitat. Therefore, studies are also needed to concentrate on diversity and development of Caecilians in the study area.

We found some larvae in rice paddy fields of the study area. They seem to be larvae of Caecilians. They were brought to the laboratory and maintained for some time in aquariums with partial mud and partial water. But we could not succeed in rearing them in the laboratory. Their identity is also yet to be confirmed. Hence, further studies are needed on Amphibians in the study area which may update the amphibian checklist of the study area and open a window to continue further research on Amphibian developmental biology and behavioral studies.

Manuscript under Preparation:

1. Some studies on Amphibian Diversity of Chandgad taluka in Kolhapur district of Southern Maharashtra, India

Table 2 Showing the number of Amphibian species representing the individual genus

Sl. No.	Name of the genus	Number of species representing
1	*Duttaphrynus*	04
2	*Hoplobatracus*	02
3	*Euphlyctis*	01
4	*Fejervarya*	02
5	*Microhyla*	02
6	*Rhacophorus*	01
7	*Polypedates*	01
8	*Pseudophilautus*	01
9	*Indosylvirana*	01
10	*Hydrophylax*	01
11	*Uperodon*	04
12	*Sphaerotheca*	01
13	*Clinotarsus*	01
14	*Indirana*	01
15	*Gegenophis*	01
	Total	**24**

Some images of Frogs, Toads, Caecilian Egg mass and Field trip

1. *Hylarana temporalis*

2. *Polypedates maculates*

3. *Rhacophorus malabaricus*

4. *Duttaphrynus scaber*

5. *Sphaerotheca breviceps*

6. *Hydrophylax malabaricus*

7. *Hoplobatracus tigerinus*

8. *Duttaphrynus melanostictus*

9.Fejervarya limnocharis

10**.** *Pseudophilautus amboli*

11. *Euphlyctis cyanophlyctis*

12. *Ramanella mormorata*

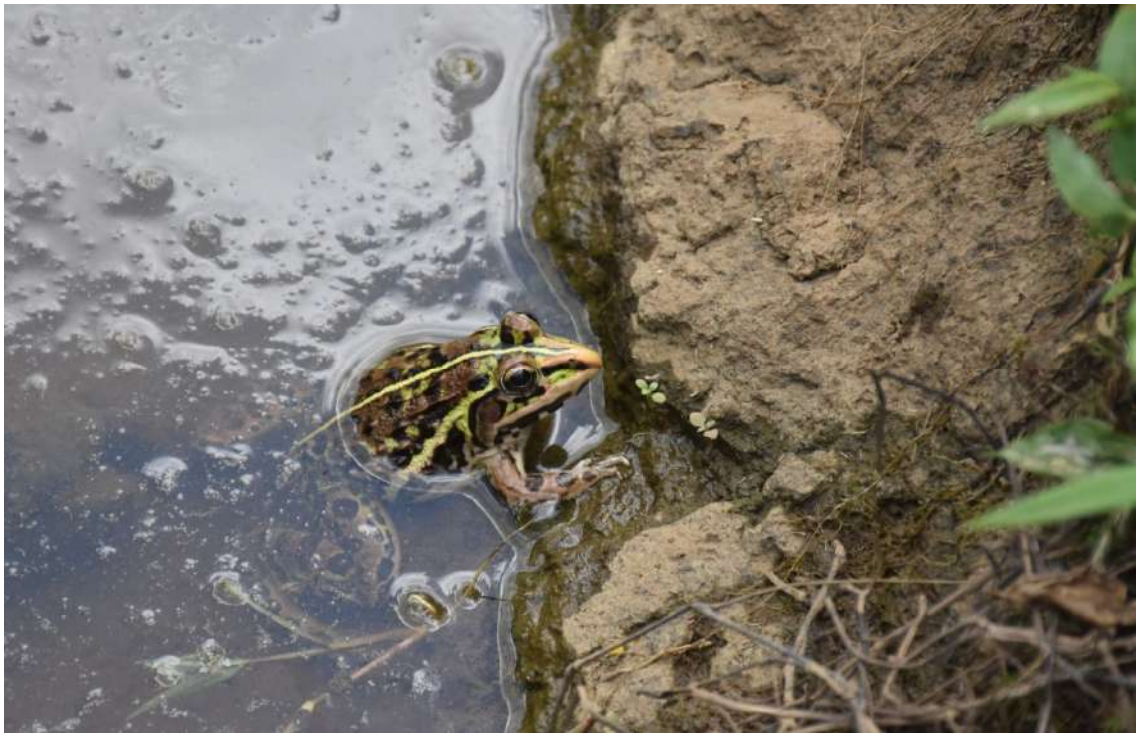
13. *Limnonectus brevipalmata*

14. Uperodon systoma

15.Indirana beddomii

16. Caecilian - Gegenophis sp

Froglet of *Hoplobatracus tigerinus*



Microhya ornata / *Microhya rubra* frog's Egg mass

Egg mass of *Polypedates maculates*

Egg mass of *Clinotarsus curtipus*

Image showing Dr. N. C. Hiragond (PI) and Students with Forest department officials

Paddy Field Habitat

Slow Moving Stream Habitats

Searching for Amphibians

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7. Equipments Purchased

Following are the Permanent Equipments Purchased, got accession numbers and placed in Zoology Department of our college for regular use

1. Stereo Zoom Dissecting Microscope
2. D 7200 Nikon Camera and Accessories
3. Electronic Balance

4. Field Thermometer
5. Field PH Meter
6. UPS
7. Four Aquariums to maintain tadpoles and caecilians.
8. External Hard Disc

8. Reference Books Purchased

Following are the Reference books purchased, got accession numbers from our college library and placed in the department of Zoology for regular reference work

1. Ex Situ Management f Amphibians (2015)
   By Brij Kishore Gupta, Benjamin Taply, Karthiikeyan Vasudevan and Matt Goetz

2. An Illustrated Guide To Common Indian Amphibians and Reptiles (2015)
   By S. R. Ganesh

3. Handbook of Larval Amphibians of the United States and Canada (2015)
   By Ronald Altig and Roy W. McDiarmid

4. Tadpoles. The Biology of Anuran Larvae (1999)
   By Roy W. McDiarmid and Ronald Altig

5. Biology of Amphibians (1986)
   By William E. Duellman and Linda Trub Illustrated by Linda Trueb

9. Signatures of the Internal Monitoring Committee

Dr. N. C. Hiragond
and Chairman Internal Monitoring
Committee, RGSTC Research Project,
Yashwantrao Chavan College, Halkarni

Name of the Internal Monitoring Committee Member **Signature**

1. Prof. A. S. Bagwan Head, Science Faculty,
   Yashwantrao Chavan College, Halkarni

2. Shri D. G. Rakshe, Range Forest Officer,
   Chandgad Range, Chandgad, Dt. Kolhapur

3. Shri M. N. Parab, Range Forest Officer
   Patne Range, Patne, Chandgad taluk, Dt. Kolhapur

4. Table 1 Showing the Check list of Amphibians of Chandgad taluka in Kolhapur district of Southern Maharashtra

Sl. No.	Common Name	Scientific Name	Habitat	IUCN Red List Status
1	Ferguson's Toad	*Duttaphrynus scaber*	Ground dwelling, inhabits under the rocks, the grasslands, forest floors, nearby human habitations, nearby temporary water bodies. Also found on the edges of slow moving water bodies. Prefers moist and dark places	LC
2	Asian Common Toad	*Duttaphrynus melanostictus*	Ground Dwelling, inhabits under the rocks, agricultural fields especially paddy fields, grasslands, nearby human habitations, nearby temporary water bodies, on the edges of slow moving water bodies. Prefers moist and dark places	LC
3	Ridged Toad	*Duttaphrynus parietalis*	Ground dwelling, found under the rocks, nearby water tanks, forest floor in leaf litter, along the edges of temporary water bodies and slow moving water bodies, agricultural fields, gardens	NT
4	Marbled Toad	*Duttaphrynus stomaticus*	Ground dwelling, shelter under the rocks, plantations, agricultural fields, forest foliages, nearby water bodies	LC

5	Indian Bull Frog	*Hoplobatracus tigerinus*	Nocturnal, Aquatic, found nearby fresh water bodies, agricultural fields, plantations, grasslands, paddy fields, swamps, puddles. Retreats underground in marshy substratum. Usually resides on the edges of temporary water bodies. Some times on the edges of slow moving water bodies	LC
6	Jerdon's Bull Frog	*Hoplobatrachus crassus*	Nocturnal, Aquatic, found nearby and on the edges of temporary fresh water bodies, swamps, puddles, along the stream edges, grasslands, paddy fields, forest floor, human habitations. Retreats underground in marshy substratum,	LC
7	Skittering Frog	*Euphlyctis cyanophlyctis*	Aquatic, found nearby and inside the temporary water bodies, puddles. Even in small cement water tanks, on the edges of slow moving streams agricultural paddy fields etc	LC
8	Indian Cricket Frog	*Fejervarya limnocharis*	Nocturnal, found nearby temporary water bodies, agricultural paddy fields, forest floors in vegetations, nearby human habitations, moist places, in leaf litter.	LC
9	Pegu Wart Frog	*Fejervarya brevipalmata*	Nocturnal, found nearby temporary water bodies, grasslands, agricultural paddy fields, nearby human habitations, moist places.	DD

10	Ornate Narrow-Mouthed Frog	*Microhyla ornata*	Nocturnal, found nearby temporary water bodies, ground dwelling, often sheltering underground beneath the leaf litter, stones, crevices, grasses. Sometimes found around human habitations, prefers moist places covered with grass, leaves	LC
11	Red Narrow-Mouthed Frog	*Microhyla rubra*	Nocturnal, found nearby temporary water bodies, ground dwelling, often sheltering underground beneath the leaf litter, stones, crevices, grasses. Sometimes found around human habitations, prefers moist places covered with grass, leaves	LC
12	Malabar Gliding Frog	*Rhacophorus malabaricus*	Arboreal, found on tree branches and on leaves along the streams and in evergreen forest, on leaf litter, on rocks along the streams, in plantations and evergreen forest, Occasionally found around nearby human habitations	LC
13	Indian Tree Frog	*Polypedates maculates*	Arboreal, found on tree branches and on leaves along the streams and in forest. Sometimes found around the human habitations on the walls, inside the houses, inhabited the evergreen forest.	LC
14	Amboli Bush	*Pseudophilautus*	Arboreal, found on tree branches and on leaves in evergreen	CR

	Frog	*amboli*	forests and in agricultural fields, also observed on trees branches and leaves in human habitations of villages nearby forests	
15	Bronzed Frog	*Indosylvirana temporalis*	Nocturnal, Stream breeding frog. Found along the streams on rocks and on the edges of streams. Sometimes observed in agricultural fields and in plantations nearby streams	NT
16	Fungoid Frog	*Hydrophylax malabaricus*	Nocturnal, found nearby agricultural fields, plantations, evergreen forests and nearby temporary water bodies, along the edges and on the rocks in slow moving water bodies	LC
17	Marbled Ramanella Frog	*Uperodon mormorata.*	Nocturnal, ground dwelling, found nearby temporary water bodies, agricultural paddy fields, moist places, tree holes, tree bases in leaf litter, evergreen forest.	EN
18	Marbaled Balloon Frog	*Uperodon systoma*	Nocturnal, Burrowing form, ground dwelling, found nearby temporary water bodies, agricultural paddy fields, forest floor, gardens, often sheltering underground, inside the rock crevices,	LC
19	Indian Balloon Frog	*Uperodon globulosum*	Nocturnal, ground dwelling, found nearby temporary water bodies, agricultural paddy fields, forest floors, often sheltering underground	LC

20	Sri Lankan Painted Frog	*Uperodon taprobanicus*	Burrowing form. Ground dwelling, often sheltering underground. Found nearby temporary water bodies, puddles, forest floor, and moist places. Sometime found in tree holes and trunks	LC
21	Indian Burrowing Frog	*Sphaerotheca breviceps*	Burrowing , found in agricultural fields, open forests, plantations and nearby temporary water bodies, human habitations.	LC
22	Bicoloured Frog	*Clinotarsus curtipus*	Nocturnal, Stream breeding frog. Found along the streams on rocks and on the edges of streams. Sometimes observed in agricultural fields nearby streams.	ANA
23	Beddome's Leaping Frog	*Indirana beddomii*	Terrestrial, found nearby water sources, slow moving streams, rocky crevices, moist grassland, forest floor, leaf litter, in agricultural fields.	LC
24	Caecilian	*Gegenophis sp*	Under the Rocks and below the loose Agricultural fields	-

Abbreviations Used: ANA – Assessment is not Available, LC – Least Concerned, EN – Endangered,

NT- Near Threatened, CR- Critically Endangered, DD – Data Deficient