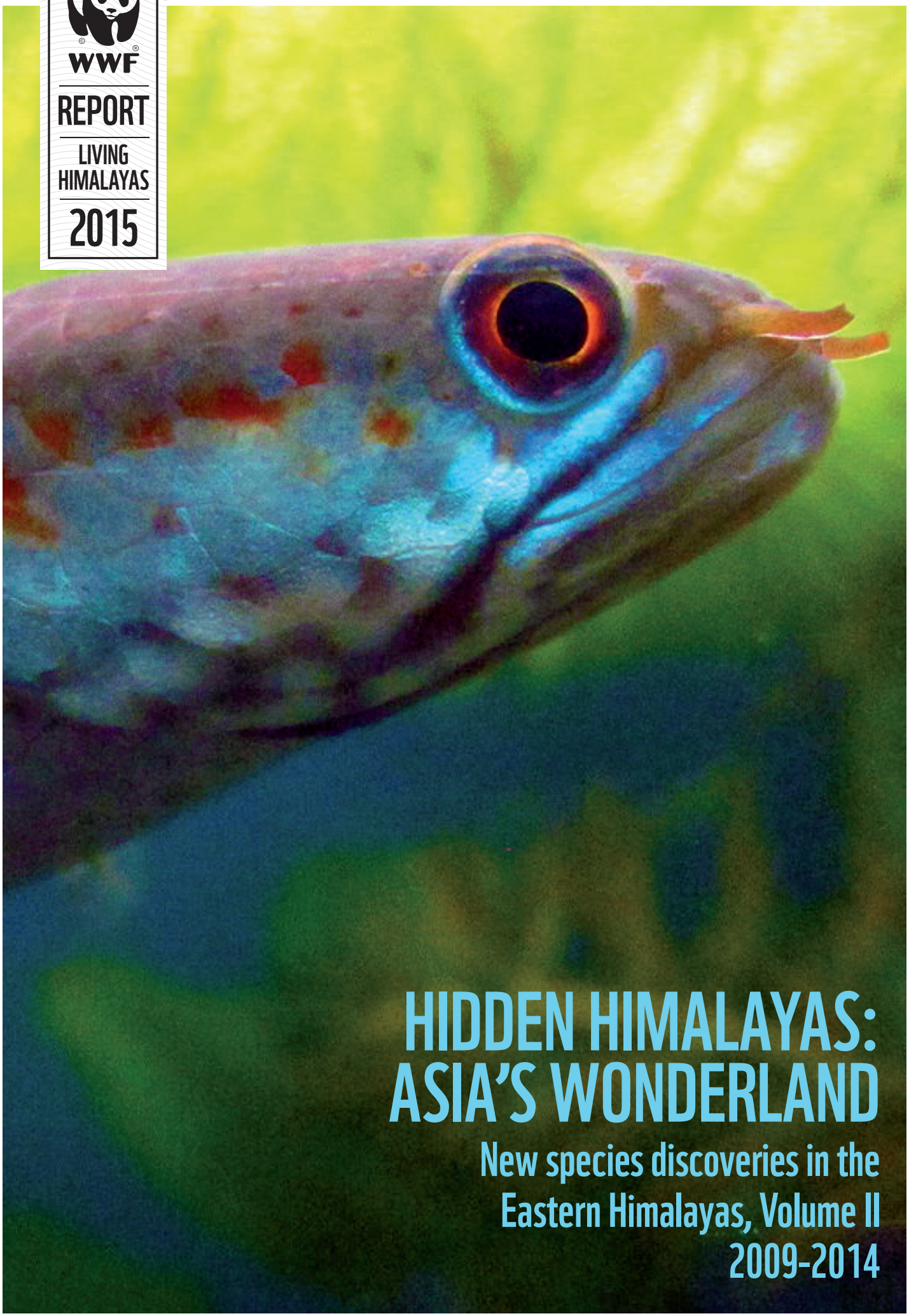
WWF

REPORT

LIVING HIMALAYAS

2015



HIDDEN HIMALAYAS: ASIA'S WONDERLAND

New species discoveries in the Eastern Himalayas, Volume II 2009-2014

WWF is one of the world's largest and most experienced independent conservation organisations, with over 5 million supporters and a global network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by: conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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(WWF Living Himalayas Initiative).

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Front cover
A new species of dwarf snakehead fish *(Channa andrao)*
© Henning Strack Hansen

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MINISTER

ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
Tashichhodzong
Thimphu:Bhutan

FOREWORD

Minister for Agriculture and Forests, Bhutan

The importance of the Eastern Himalayas as a biodiversity hotspot is well known. Endowed with exceptionally rich flora and fauna, the region is truly a conservation jewel. Therefore, to learn that 211 new species have been discovered in the Eastern Himalayas between 2009 and 2014 further enhances that reputation.

The Royal Government of Bhutan is truly delighted to know that at least 15 of the new species were found in Bhutan alone. This is indeed an indication of how much there is still to be explored and found from our incredible region.

The Eastern Himalayas is not just an important place for its natural wonders and rare wildlife but the local people's traditions, lifestyles and livelihoods have been shaped by the environment here. Its snowcapped mountains and forests, that feed our perennial rivers, are a lifeline to millions of people and are critical to the economies of the countries that share the region.

However, this treasure trove of ours is also a region most at risk from climate change. It is adversely impacting the Himalayas' biodiversity and ecosystem services through increased temperature, extreme floods, droughts and storms as a result of shifting weather patterns. With the risk of climate change coupled with increasing human pressures and threats, we must continue to enhance monitoring of the Himalayan ecosystem and equip ourselves with tools to adapt to the impacts of climate change. We need to come together to conserve this shared natural heritage. We must ensure that there is balance between development and conservation.

I, on behalf of the Royal Government of Bhutan, would like to express support for WWF and its efforts to safeguard the Eastern Himalayas' incredible biodiversity and natural resources.

I would also like to commend the many scientific explorers who have ventured into the unknown and made significant contributions to increasing our knowledge of the Eastern Himalayas.

Yeshey Dorji
Minister
Ministry of Agriculture and Forests
Royal Government of Bhutan
Thimphu: BHUTAN

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Government of Nepal
Ministry of Forests & Soil Conservation
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Foreword

A global biodiversity hotspot, the Eastern Himalayas is one of the world's biologically richest areas. Very few places on earth can match its breathtaking splendor and its diverse array of flora and fauna. Its rich natural resources provide a source of livelihoods for many both within and outside the region.

Therefore, the discovery of 211 new species between 2009 and 2014 adds to our appreciation of the region's immense value. With more than 60 of these new species discovered in Nepal, it further validates the vast natural richness of our Eastern Himalayas.

While we are still enriching our knowledge of the Eastern Himalayas through such discoveries and scientific research, the ecosystems within the region continue to provide several vital contributions to our economies and lives. Its forest and perennial rivers ensure continued access to water, energy, food and livelihoods for half a billion people. Thus, preserving the Eastern Himalayas' incredible biodiversity and natural resources is critical not only for Nepal but for the whole of South Asia.

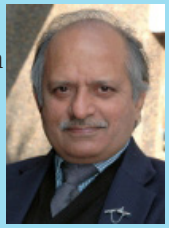
However, our region is also gravely threatened by climate change. We are already experiencing extreme floods, droughts and storms. As these impacts of climate change increase, the existing free ecosystem services may be affected adversely.

Hence, we must work together to ensure that regional mechanisms are in place to respond to climate change. We must recognize the importance of the Eastern Himalayas and continue to enhance monitoring of the Himalayan ecosystem, and equip ourselves with tools to adapt to the impacts of climate change. We must conserve our shared natural heritage.

The Ministry of Forests and Soil Conservation will continue to support WWF's efforts to conserve the rich biodiversity and natural resources of the Eastern Himalayas. I would also like to congratulate the scientific explorers who continue to make significant contributions to increasing our knowledge of the Eastern Himalayas.

Mahesh Acharya
Minister

Messages from the Living Himalayas



The Eastern Himalayas is home to a staggering number of species including some of the most charismatic fauna. I am excited that the region continues to surprise the world with the nature and pace of species discovery.

I have the privilege to serve an organization that has, over the last four decades, played an important role in some of the most exciting conservation contributions in this region. The conservation complex panning Nepal, Bhutan and Northeastern India, serves as a home for populations of millions species, known and unknown . At the same time, these ecosystems continue to provide a source to find new natural wonders, discoveries of which grow every decade.

Over 550 new species have been discovered from the Eastern Himalayas over the last 15 years. 211 of these were discovered between 2009 to 2014 . There are a number of opportunities for the three countries' governments to work individually and together to ensure that the role of natural capital, the primary source of growth, is adequately included in decision-making and development planning. Since the Eastern Himalayas, represent economies that are growing and developing, it is imperative to ensure that the existing biodiversity is protected and there are healthy ecosystems are maintained across the conservation mosaic. Efforts to bring together governments and partnerships and scientific inputs must continue in parallel.

As always, WWF will continue to work with the governments and other partners, as it has for over four decades in the Eastern Himalayas.

Ravi Singh
Chairman of WWF Living Himalayas Initiative
Secretary General & CEO, WWF-India

"The discovery of 211 new species from one of the most biologically rich regions of the world is a celebration of the amazing gift of nature. With discovery, comes the important responsibility to continue protecting and caring for these precious gift that this world has been blessed with. This is yet another reason why the world must come together to give voice to the voiceless, to build a future where humanity can continue to live in harmony with nature. We thank all involved in the study, for sharing their knowledge, transcending boundaries for the good of our only planet, we call home."

- Dechen Dorji, Country Representative, WWF Bhutan

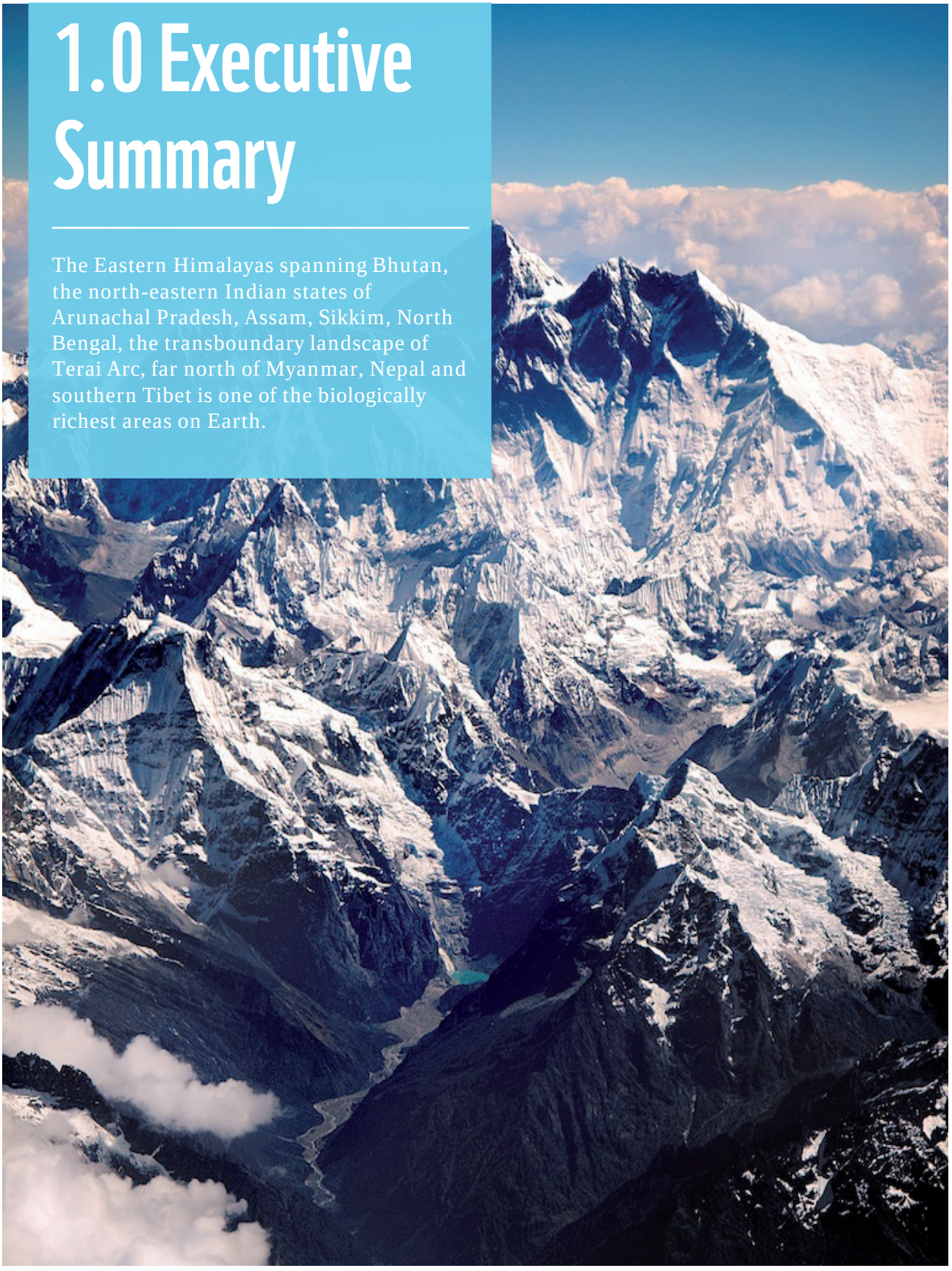
"The Eastern Himalayas – home to the water towers of Asia, some of the world's most iconic species, and biologically and culturally diverse landscapes – brings together governments, conservationists and communities in Bhutan, India and Nepal under a common conservation purpose. The new species discovered in the Eastern Himalayas is testimony of the rich biodiversity of the region which till today remains to be fully explored. It also underscores the need to work together, even stronger, both within and beyond national borders to help conserve the natural riches of this landscape."

- Anil Manandhar, Country Representative, WWF Nepal

Contents

1.0 Executive Summary

The Eastern Himalayas spanning Bhutan, the north-eastern Indian states of Arunachal Pradesh, Assam, Sikkim, North Bengal, the transboundary landscape of Terai Arc, far north of Myanmar, Nepal and southern Tibet is one of the biologically richest areas on Earth.



©Michael Foley

The awe-inspiring Himalayas

Location of the Eastern Himalayas in South Asia

The Eastern Himalayas includes four of the Global 200 ecoregions, critical landscapes of international biological importance, and is home to more than 10,000 plant species, 300 mammal species, 977 bird species, 176 reptiles, 105 amphibians and 269 freshwater fish. The region also has the highest density of the Bengal tiger and is the last bastion for the charismatic greater one-horned rhino.

The rugged and largely inaccessible landscape of the Eastern Himalayas, however, hides the real extent of the region's biodiversity, with extraordinary new species continuing to be discovered year-on-year.

Between 2009 and 2014, at least 211 new species have been discovered in the Eastern Himalayas, 34 new species finds on average every year for the last six years (see Appendix). The discoveries include 133 plants, 39 invertebrates, 26 fish, 10 amphibians, one reptile, one bird and one mammal.

New orchid species *(Bulbophyllum nepalense)*

This report celebrates these unique and fascinating species discoveries, as well as known species found in this vibrant region. It also highlights the many vital habitats that face growing pressures as a consequence of unsustainable development in the region. Despite protection efforts, in the last half-century, this area of South Asia has faced a wave of pressures as a result of population growth and the increasing demand for commodities by global and regional markets. The host of threats include forest destruction as a result of unsustainable and illegal logging, agriculture, unsustainable fuel wood collection, overgrazing by domestic livestock, poaching and wildlife trade, mining, pollution and poorly planned infrastructure. The region is also among the most vulnerable to global climate change, which will amplify the impacts of these threats.

According to Conservation International, only 25% of the original habitats remain intact.

Many of WWF's established priority conservation landscapes are being impacted by the current unsustainable development in the Eastern Himalayas, and so we consider that a new layer of strategic action is needed to augment our longstanding field projects.

New frog species *(Leptobrachium bompu)*

By promoting a shared sustainable development vision, WWF believes that real progress can be made in tackling huge poverty-impacting issues in the Eastern Himalayas such as climate change, deforestation, the illegal wildlife and timber trade, poor infrastructure development, and thereby secure the livelihoods, subsistence and fresh water essential to millions of people throughout the region.

Only a concerted focus and a shared vision can maintain a living Himalayas, for people and nature, whether discovered or yet to be discovered.

2.0 Introduction: Eastern Himalayas, Asia's Wonder Land

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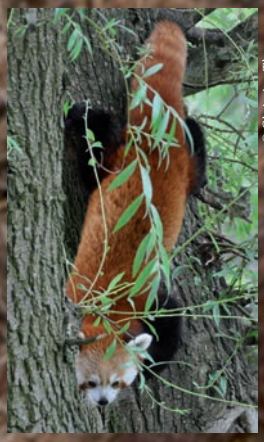

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Charismatic characters (from top to bottom): Asian elephant, red panda, Greater one-horned rhino and snow leopard

© Swati Sani

The Eastern Himalayas comprise 17 landscapes for the Bengal tiger *(Panthera tigris tigris)*, Asia's largest carnivore, with the densest population of Bengal tigers in the world.

The Eastern Himalayas encompasses Nepal, the transboundary landscape of the Terai Arc, all of the Kingdom of Bhutan and the northern Indian states of Arunachal Pradesh, Assam and Sikkim. In addition, this unique frontier region of South Asia further seeps into North Bengal, the far north Myanmar as well as southern Tibet. (Figure 1)

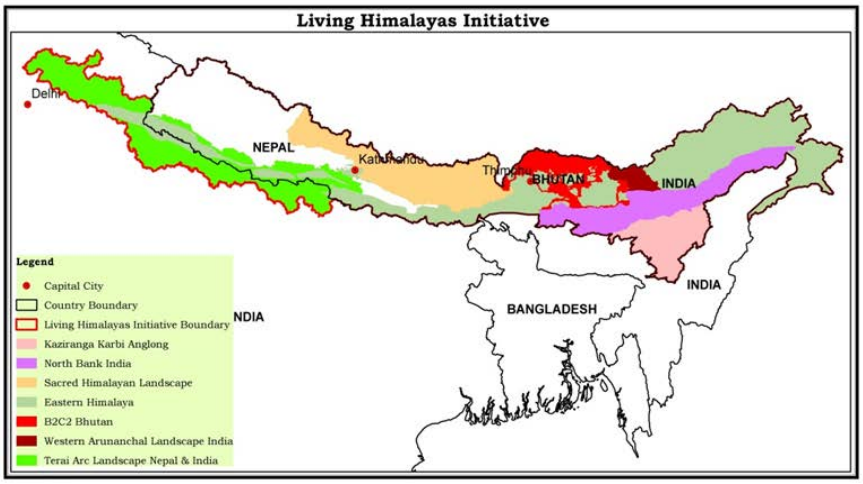
The awesome Eastern Himalayas form part of the 3000km-long Himalayan mountain range and comprise all of the world's tallest peaks. This remarkable "abode of snow" (Sanskrit) was violently thrust out of the Earth by a colossal tectonic eruption that saw India and Eurasia crash together 40-50 million years ago. The largest peak in this incredible chain is the fearsome Mount Everest at a formidable 8,848metres high. From the roof of the world, this colossus peers down over Asia. Today, the continuous shifting of tectonic plates continues to add height to the Himalayas further skyward.

This breathtaking natural 'wall' separates the lowlands of the Indian subcontinent from the highest Plateau on earth, creating a land of striking contrasts. The dynamic climate and altitudinal environmental conditions have crafted some of the natural world's most magnificent landscapes in close geographic proximity, from the world's highest mountains and several of the deepest crevasses, to lush rainforest and temperate forests, enveloping savannas and serene alpine meadows.

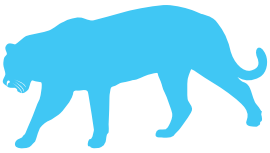
The Himalayas are the source of four of the world's major rivers - the Indus, the Ganges and the Brahmaputra and Mekong. These 'distant feeders', provide most of Asia with its source of fresh water, pouring life from its peaks through arteries in every direction that is vital for all living things on Earth. When considering the impact of these rivers on wider remaining Asia Pacific which now accounts for over half of the world's population, nearly 40% of global gross domestic product (GDP) and 3.96 billion in 2013, comprising 55% of the global total[1], these crucial habitats are simply irreplaceable in the function they provide to the global economy.

A land of wonder, the Eastern Himalayas is shared by a wealth of different cultures and faiths including Buddhism, Hinduism, Christianity and animism. The diverse populations of several countries here have lived inextricably linked to the natural resources the Eastern Himalayas has provided for thousands of years. The communities the region plays host to have thrived here, with their very customs, lifestyles and livelihoods shaped by their distinctive environment. The Himalayan cultures continue to be deeply dependent on the environment today for their future economic prosperity and development.

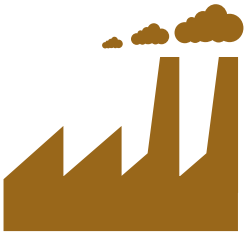
Figure 1. Wonder Land: Map of the Eastern Himalayas showing key landscapes



Source of freshwater for 1 billion people



30% of all plants and reptiles and 40% of all amphibians are unique to the region



Indian Himalayas hold amount of carbon roughly equal to total annual Asian carbon emissions from fossil fuels

Land of diversity

The curious genesis of the Eastern Himalayas explains many of its wonders. The remarkable mountains form the roof of Asia and even here in this sometimes hostile and inhospitable of terrains, many unique species can be encountered. Icons of Asia, such as the big cat of the high Himalayas, the snow leopard, call this northern region home. The Eastern Himalayas also shelters red pandas, black bears, wolf, golden langurs, blue sheep, and a diverse assemblage of alpine ungulates, like takins.

In the shadow of this extreme landscape lies an altogether different world of wonder. The world's northernmost tropical rainforests can be found in the Eastern Himalayas[2] and nearly half of the flowering plants[3] and bird species known from India[4]. The plant life of tropical Arunachal Pradesh (India) is considered among the most diverse in the world, ranking second only to equatorial regions like Sumatra in Indonesia and greater than Borneo, Brazil and Papua New Guinea[5].

Importantly, the lowland region comprises 17 landscapes for the Bengal tiger[6], Asia's largest carnivore, with the densest population of Bengal tigers in the world. The Eastern Himalayas are also the last bastion for the charismatic greater one-horned rhino, which once enjoyed a range spanning the entire length of the Himalaya foothills, from Pakistan to Myanmar[7] but is now restricted to India and Nepal.

Hence, the Eastern Himalayas is one of the biologically richest areas on Earth. Locked within this global biodiversity hotspot[8] are four Global 200 ecoregions[9], critical landscapes of international biological importance, four World Heritage sites, two Endemic Bird Areas[101], and several global centres for plant diversity[11]. The Himalayas harbour at least a staggering 10,000 plant species, from tropical to temperate, from alpine to tundra; 300 mammal species, 977 bird species, 176 reptiles, 105 amphibians and 269 types of freshwater fish[12]. A third of all plants and reptiles are endemic, as are 40% of all amphibians[13].

In addition to this, between 1998-2008 in the Eastern Himalayas at least 354 new species were described new to science for the first time in their existence.

[1] Endemic refers to a species that is exclusively native to a specific geographic range and found nowhere else.

Source: WCS/IUCN/IUCN Red List

Forest leading to foreboding mountainous terrain, Arunachal Pradesh, Eastern Himalayas

3.0 Hidden Himalayan highlights: Uncovering six years of new discoveries

A century ago, many parts of the world remained unknown and undiscovered. Historically, the rugged and largely inaccessible landscape of the Eastern Himalayas has made biological surveys in the region extremely difficult. As a result, wildlife has remained poorly surveyed and there are large areas that are still biologically unexplored.

New monkey species, *Rhinopithecus strykeri*, captured in a biological drawing reminiscent of those created by early explorers recording life on Earth for the first time.

"For scientists and explorers it is a very exciting time to be alive"

- Terry Garcia, National Geographic's Chief Science and Exploration Officer, Bhutan, 2014

Many believe that the 21st century is the greatest age of exploration because technology is opening doors once believed permanently closed, including in the fields of archaeology and palaeontology[14].

In the Eastern Himalayas, the topographic complexity, including steep mountains and valleys, has also forged isolated islands of habitat. According to scientists, large areas of intact forests, rivers and thousands of isolated streams, separated by mountain massifs, high ridges and valleys, could support populations of species cut off from one another, giving rise to genetic differences among populations, a step toward the evolution of endemic species. Scientists believe that these pockets could harbour globally threatened species, and further still, many undiscovered species, including mammals, reptiles and amphibians, some of which could qualify for globally threatened status but have been missed in surveys to date[15].

As this report highlights, further new species have continued to be encountered, documented and officially described as new since this time.

Scientists continue to endeavour to take on the challenge of documenting the natural world regardless of the terrain and other obstacles they may be presented with. For example, as recent as July 2014 a team explored further the habitats of the Bhutan-Manas landscape in the Eastern Himalayas and uncovered 55 species that had not been previously recorded. The species comprised 20 amphibian species and 35 reptile species. It is surveys such as this that will invariably and ultimately highlight new species that are previously unknown and have not been encountered anywhere[16].

Many species groups have been inadequately studied and the real extent of the biodiversity of the Eastern Himalayas is undoubtedly underestimated. This is reflected in the remarkable level of new life discovered in the region over the past 6 years by dedicated scientists as this report shows. Some of these species have evolved and survived for centuries, and their full glory is only just being unearthed. Some are so unique and charismatic that scientists are often at a loss as to how to classify them.

Some 133 plants, 39 invertebrates, 26 fish, 10 amphibians, one reptile, one bird and one mammal have been discovered over the past 6 years in the Eastern Himalayas. The new finds include a new shy bird species, Himalayan pitviper *(Protobothrops himalayansus)*, miniature 'dracula fish' *(Danionella* dracula*)* and dwarf 'snake head' fish *(Channa Andrao)*, snub-nose monkey *(Rhinopithecus strykeri)*, strikingly blue-eyed frog *(Leptobrachium Bompu)*, and 133 plants from a diverse assemblage, including 15 beautiful orchids. The botanical discoveries derive from some 35 different plant families. In total, an extraordinary 211 new finds have been identified.

These charismatic new species should once-again draw renewed international attention to the valuable biodiversity of this globally important region, frequently overlooked for its natural biological wealth. The impressive number of new species is greater than the total number of species discovered on Borneo over a similar period[II].

[II] The WWF report, Borneo's Lost World (2005), showed that between 1994 and 2004, 361 new species were identified on Borneo over a 10 year period.

4.0 Unique discoveries in focus – a closer look

In total 133 plants, 39 invertebrates, 26 fish, 10 amphibians, one reptile, one bird and one mammal have been discovered over the past 6 years in the Eastern Himalayas. Here we look at some of the more unique discoveries.

(Impatiens lohitensis)

New orchid species
(Bulbophyllum nepalense)

+ 133

ONE HUNDRED AND THIRTY-THREE NEW PLANTS WERE DISCOVERED IN THE EASTERN HIMALAYS BETWEEN 2009-2014

SPECTACULAR ORCHID DISCOVERIES

NEPAL AND ASSAM, INDIA

A plethora of new plant species have been found in the Himalayan landscape.

Both the mountainous and tropical 'veneer' of the Himalayas hide a vast botanical world. This can be found extending across the Eastern Himalayas, in the form of an alluring landscape that has yielded 133 new plant discoveries described for the first time and recorded in the Eastern Himalayas in the last 6 years. This equates to 22 new species every year for the past 6 years[17]. The new plant species include plants from over 35 different plant families, ranging from families of flowering plants, aromatic plants celery, carrot or parsley family, cashew family, ferns, daisy or sunflower family, sedges, spurge, pea or bean family, shrubs, orchids, poppies and pines, bananas, nettles and heather, herbs and rose families. The plant discoveries account for the largest proportion of the new species finds.

Among the more beautiful flowering plants are the splendid orchids. The new discoveries of plants include a range of species but the orchids are among the most glorious!

Bulbophyllum nepalense was for the first time reported from Nepal. The new species was collected from Shivapuri National Park, Kathmandu at an altitude of 2300 m asl. The species has oblong dorsal sepals, the elliptic petals and oblong decurved ligulate lip with narrow pseudobulbs, the falcate, acute-acuminate lateral sepals, and two strips of papillae or short hairs on the adaxial side of the lip, close to the margins[18].
Ione kipgenii was discovered by Kishor led research team of Centre for Orchid Gene Conservation of the Eastern Himalayan Region during a survey in the forests of the region. http://manipurupdate.com/worlds-newest-gingerorchids-discovered-in-manipur/

Orchids have long been the subject of intense scientific interest and at times, emotional obsession[19].

> ***When a man falls in love with orchids, he'll do anything to possess the one he wants. It's like chasing a green-eyed woman or taking cocaine. . . it's a sort of madness***
>
> ***- The Orchid Thief, By Susan Orlean's***

Vibrant blue Dwarf 'Walking' Snakehead fish

(CHANNA ANDRAO) - WEST BENGAL, INDIA

© FLICKR

The discovery of *Channa andrao*, new species, from Lefraguri swamp, West Bengal, raises the number of snakehead species endemic to the Eastern Himalaya biodiversity hotspot to ten, representing almost one third of the known species in the genus. This makes the Eastern Himalayas a centre of diversity for snakeheads.

The new species can be distinguished from all other species of snakeheads by its colour pattern, its number of vertebrae, dorsal and anal fin rays, and lateral-line scales[20]. Snakeheads are valued food fishes in their native habitats. Thirty-six species are currently recognized within the genus *Channa*. The new species *C. andrao* has so far been collected only at its type locality in West Bengal.

Snakeheads are primitive fish. They are air breathers: despite the fact that they have gills, if they are denied access ro the surface they die from oxygen starvation Some are important food fish in the countries in which they are found. Snakeheads are ambush predators. They prefer to target their prey from below, often lunging upwards from the bottom to grab fish and other creatures. Dwarf snakeheads are common in forest areas and seem to prefer the clear water of shallow streams, pools and swamps.

All snakeheads are solitary predators, subsisting on a diet of smaller fish and invertebrates. Certain other attributes of this species also seem more snake-like than fish-like: incredibly, this snakehead fish is able to breath atmospheric air and can even survive on land for up to four days. Its movements on land may appear more cumbersome than a smoothly slithering snake, but this species can writhe and wriggle its way up to ¼ mile on wet land between bodies of water. Because of its aggressive traits, *National Geographic* has dubbed snakehead fish as "Fishzilla". Such is their reputation, there has even been a Hollywood film made of snakeheads![21]

Each spawning-age female can release up to 15,000 eggs at once. Snakeheads can mate as often as five times a year. This means in just two years, a single female can release up to 150,000 eggs . The genus can grow to 1.2m maximum length and are important in aquaculture and commonly used in rice-fish farming.

Its discovery reemphasizes the significance of the mountain regions of the Eastern Himalaya as a biodiversity hotspot for freshwater fishes[22]. The exploration of more remote areas of the Indian, Nepalese, and Myanmar mountain ranges will undoubtedly yield additional new snakehead species in the future according to scientists[23].

A unicorn (of sorts) does exist!

(KOPONENIUS UNICORNIS) - NEPAL

© K. Makarov

© K. Makarov

Big little discoveries: These small creatures have a large role in Himalayan ecology...

There have been at least 39 new invertebrate discoveries from the Eastern Himalayas region in the last 6 years. There have likely been many more than this; probably numbering in their hundreds over the past six years, and more still will be awaiting official scientific description.

Although it is difficult to accurately measure the number of discoveries for the largest group of species, it is not difficult to assess the contribution they make to the natural world. The smallest creatures have the largest role in ecology. Invertebrates play a crucial role in the natural food web of many other species; they perform a role upon which all other players in the web of life literally depends.

New invertebrate discoveries in the Eastern Himalayas include new moths, millipedes, beetles, flies and wasps; the smallest of creatures at first glance but ultimately essential to the health of today's ecosystems. The new discoveries span all the countries of the Eastern Himalayas and include some unique and important species.

The millipede, *Koponenius unicornis*, for example at first glance seems insignificant but this unique animal represents the first westernmost indigenous representatives of Haplodesmidae reported from the Himalayas of Nepal and India. Its 19 body segments are unique among millipede species. Therefore its discovery has made an important contribution to science and its knowledge base which in turn forms a foundation to many "responses" in how we approach our use of nature and its conservation and the threats it faces in today's modern world. The species name unicornis refers to the protruding "column" found underneath the species.

Even more significant, the discovery signals the identification of an entirely new genus! The species belongs to the newly established genus, *Koponenius gen. nov.*, together based on a similar species collected, *K. biramus sp. nov.*, from Nepal also officially described in 2014[24].

Further new invertebrates include a number of flies. Gnats and caddisflies initially formed the majority of new species when researching new invertebrate discoveries. Flies are an important food source for many other creatures. One particularly diligent and dedicated Finnish scientist described 14 gnats. Although among the smallest of creatures, all species have their role to play in Himalayan ecology.

+ 39

NEW INVERTEBRATES SPECIES WERE DISCOVERED IN THE EASTERN HIMALAYAS

Example of *Mycomya* species

© Dr. Rauno Väisänen

Dr. Väisänen has a PhD in zoology from the University of Helsinki (1984). He has published more than hundred peer-reviewed scientific papers in biosystematics, ecology, forest zoology, entomology, ecotoxicology and conservation biology.

As the Director of Natural Heritage Services (NHS) at Metsähallitus since 1995, he is in charge of the management of the protected areas system in Finland (altogether about four million hectares on lands and three million hectares of waters). He has been actively involved in the work of international organisations such as IUCN, EUROPARC Federation, Eurosite, PAN Parks and WWF.

Unfinished business: Seven new mosquito species discovered in the Eastern Himalayas

After almost 30 years of hiatus from scientific research, Dr. Rauno Väisänen - a Finnish taxonomist and Director of Natural Heritage Services at Metsähallitus (a state enterprise that manages most of Finland's protected areas) - experienced a year of remarkable achievement in 2013.

Discovering even one new species is exciting. Imagine discovering seven!

That's what Dr. Väisänen did. He discovered seven new mosquito species in the Eastern Himalayas thus, taking the total number of scientifically documented mosquito species in the region from 42 to 49.

He named one of the new species as *Mycomya jeti* - after the abominable snowman of the Himalayas - the Yeti and another one after his wife's first name, Mycomya anneliae.

Discovery of new species do not happen overnight. It was after persistent request from his friend and colleague, Dr. Pekka Viljamaa, who encouraged Dr. Väisänen to go revisit and complete his over 30-year-old research.

Speaking on the significance of the discoveries, Dr. Väisänen said such discoveries helped people to understand the kind of world we live in and therefore, it was important to know what these species are, what they do and how they have evolved. "This knowledge creates the conditions for ecological and evolutionary studies. It is important information when planning how to manage natural forests, logging or the establishment of new protected areas," he said.

For the seven new species that he discovered, the data were derived from a Swedish expedition to Myanmar in 1934, a 1967 Canadian expedition to Nepal and a Japanese research group in Nepal in 1971-72. He said that data collection, processing and sorting are easy but actual taxonomic research requires time, patience and hard work.

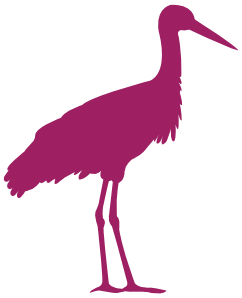
Dr. Väisänen says that there would still be a lot of undiscovered species in the Eastern Himalayan region. He said that documenting them is the first step toward understanding the full richness and diversity of life on earth.

Let's see what more surprises await us in the Eastern Himalayas!

Hiding in plain sight: A distant relative (and a shy forest-dweller) makes an appearance!

(ELACHURA FORMOSA) - INDIA, NEPAL, BHUTAN, MYANMAR

Distribution of the new species *(Elachura formosa)*



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ONE NEW BIRD SPECIES WAS DISCOVERED IN THE EASTERN HIMALAYAS

© Ramki Sreenivasan Conservation India

Almost a thousand birds grace the Himalayas, a unique natural region on the 'roof' of the world and closely associated with the sky. In the Eastern Himalayas close to 1,000 species have been recorded when surveyed, which roughly equates to a staggering one tenth of all known bird species of the world. One in ten species of birds are found here!

Scientists are always striving to provide a good account of what is present in a given area and to provide an accurate picture and representation of the species that inhabit the various ecoregions of the extraordinary Eastern Himalayas. The search for new species continues and there will undoubtedly be some new finds in the coming years.

The spotted Elachura or spotted wren-babbler *(Elachura formosa)* found in thick undergrowth in the dense forests of the Eastern Himalayas provided evidence that it was distinct from the babblers and part of a basal lineage (one that diverged early) with no other close living relatives within the passerine bird clade Passerida[III]. This led to the creation of a new family, Elachuridae, to accommodate just one species (a monotypic taxon) a new species of bird was discovered as a result in 2014![25] The spotted Elachura measures 10 cm including its short tail. It is brown above and white below. It is dark brown all over, with rufous wings and tail. It also has white speckles all over its body, shifting to black barring on its wings and tail.

Elachura formosa belongs to a unique family of birds which contains no other known species. According to researchers, the *Elachura* males have an unusual high-pitched song, unlike those of other Asian birds. Scientists investigating families within the Passerida group of birds also discovered the spotted wren-babbler, whose natural habitat is subtropical or tropical mountain forests.

The study was undertaken by researchers from the Swedish University of Agricultural Sciences in Uppsala and the Chinese Academy of Sciences in Beijing. Professor Per Alstrom, from the University of Agricultural Sciences, said "This single species is the only living representative of one of the earliest off-shoots within the largest group of [perching birds], which comprises [around] 36% of the world's 10,500 bird species." Alstrom described *Elachura* as "extremely secretive and difficult to observe, as it usually hides in very dense tangled undergrowth in the subtropical mountain forests." He added: "However, during the breeding season, when the males sing their characteristic, high-pitched song, which doesn't resemble any other continental Asian bird song, it can sometimes be seen sitting on a branch inside a bush."

According to Alstrom, the bird had been previously overlooked because it resembles wrens and wren-babblers. He explained: "This similarity is apparently either due to pure chance or to convergent evolution, which may result in similar appearances in unrelated species that live in similar environments - some wren-babblers can be neighbours to the *Elachura*." Researchers were able to identify the species by analysing the molecular differences in the DNA of Elachura, which revealed their evolutionary heritage.

Previously, this method was used to probe evolutionary patterns in neotropical birds through DNA barcodes, which compared Argentinian birds and their patterns of genetic diversity to those of North American birds[26].

[III] In the past it was included in the babbler genus *Spelaeornis* as *S. formosus*, but molecular phylogenetic studies in 2014 proved that it should be classified as a new species altogether.

A striking blue-eyed frog

(LEPTOBRACHIUM BOMPU) - ARUNACHAL PRADESH, INDIA

© Chintan Sheth

There have been 10 new amphibian discoveries in the Eastern Himalayas over the past 6 years. All ten form a diverse chorus of frogs from a range of habitats.

A new species of *Leptobrachium* was discovered during this period. Among the 27 species of *Leptobrachium* there is a remarkable variety of eye colouration. In many species, the lower two-thirds of the eye is darkly coloured, while the upper third is a bright, contrasting colour, such as yellow, scarlet, blue or pale green.

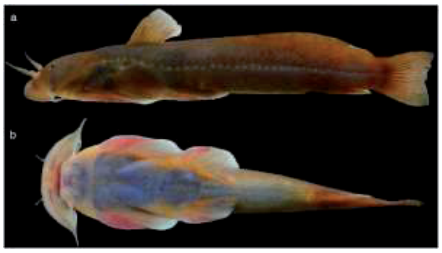
Sanjay Sondhi of the nature conservation Titli Trust and Annemarie Ohler of the Muséum National d'Histoire Naturelle in Paris recently described *L. bompu*, a new species from India that has a striking greyish-blue iris with a vertically oriented black pupil[27].

L. bompu has black bands on its limbs, feet, digits and upper lip, as well as irregular dark markings on its dorsal surface. Additionally, its skin is distinctly wrinkled. The genus was once divided into species that have horny spines on the upper lip and those that, like *L. bompu*, do not. Recent studies, however, indicate that neither of these groups shares a unique ancestor. Arunachal Pradesh, where the new Indian species was discovered, is the second most heavily forested state in India. It has a good deal of intact habitat, with more than 80% of its land mass forested, steep topology, and marked gradients in precipitation. Like neighbouring areas, this landscape (the Eaglenest wildlife sanctuary) remains poorly studied for most taxa, including its herpetofauna,and is certain to continue to yield surprising new species. In fact, the first new bird species found in India in more than 50 years was discovered here just a few years ago, and a new macaque species of monkey.

The species measures about 47mm, was discovered during heavy rains in the Eaglenest wildlife sanctuary near the Bampu campsite, after which it is named. The little frogs were located under leaf litter along a stream at an altitude of about 2,000m. They were heard calling near the stream for a distance of only 150m up- and downstream. The frogs were docile, found sitting in a crouched position and easily picked up. When disturbed their crawling behaviour was laborious. The males are eager singers, with a loud croaking "kek-kek-kek-kek" call, which continued even after they had been captured and placed in a bag[28].

The first endemic fish species to Bhutan

(PARACHILOGLANIS BHUTANENSIS) - BHUTAN



© D.B. Gurung

Parachiloglanis bhutanensis

© D.B. Gurung

The Khalingchhu stream - location of the discovery in Bhutan

Bhutan is critical for the freshwater of the region as many of the rivers start in the kingdom. During a recent collaborative research project of documenting fish diversity in the country, researchers from the College of Natural Resources (CNR), Bhutan and Saint Louis University, USA, discovered a new species of torrent catfish from Khalingchhu in the eastern part of Bhutan[29,30]. It is the first endemic fish species to Bhutan, found nowhere else in the world according to Professor Dr. Dhan Bahadur Gurung, one of the leading scientists. The fish was named *Parachiloglanis bhutanensis* in honor of the country in which it is endemic to.

"The common name, Khaling Torrent Catfish is in reference to the village of Khaling, through which flows the stream where it was discovered". The researchers discovered the catfish about 1 km east of the village of Khaling.

The endemic fish has flat body with broad, blunt and rounded head, rising at roughly a 45-degree angle from snout to point vertical with eye. The fish measures 101mm from the tip of snout to the end of tail. Researchers also recorded the fish as having other features such as thick and leathery fins. The ventral view of the mouth and snout resembles the shape of a hammer or bell, one of the body parts that makes it an interesting fish. Such a shape is due to the posterior flap of tissue connecting maxillary barbel to mouth.

The newly discovered endemic fish is known from Khalingchhu stream and an adjacent, unnamed stream in the headwaters of the Dangmechhu River, in the Brahmaputra drainage.

Like its sibling species, the newly discovered fish is known to adhere to the bottom side of boulders, favouring areas of cascades and white water rather than pools. "They were associated with large rocks with deep undercut areas versus rocks with only small refuge from the current", writes the researchers. They also described the two streams in which they were found as having clear, cold-water, sourced from mountain springs, precipitation runoff, and snowmelt.

The streams are found to have little algal growth and frequent high-flow events. "This species is adapted to a high-velocity environment with adhesive striations on the leading rays of the paired fins for clinging to rocks and an inferior mouth adapted for scraping algae and invertebrates from the substrate".

They described the discovery as very important milestone in conserving fish diversity of Bhutan. They pointed out that due to its small range and low density, as well as the highly stochastic and increasing nature of floods and droughts in streams of this region, *P. bhutanensis* may be a species of conservation concern.

With the new discovery, the number of fish diversity recorded in Bhutan has increased to 93 species from the previous record of 52. With few more unidentified taxa, which are yet to be determined, the diversity of fishes found in Bhutan will exceed 100. However, climate change and a number of major hydropower projects being developed around country will have direct impact on the fish diversity and its population structure.


© D.B. Gurung

The catch of a lifetime

In early 2014, Professor Dr. Dhan Bahadur Gurung and his colleague Ryan Thoni from the Saint Louis University, USA were travelling to East Bhutan to document the country's rich fish biodiversity. Little did they know that they would end up discovering a new fish species in a small stream in Khaling village under Trashigang district.

"We saw this small Khalingchhu river and decided to check its aquatic diversity," said Dr. Gurung, who works as a professor and dean of academic affairs at Bhutan's College of Natural Resources (CNR) in Lobesa.

"We took out our equipment and got into the water and within 30 minutes, we spotted a catfish that was clearly unlike any other species of its kind," said Dr. Gurung adding that their unique discovery was confirmed within a week.

He said that usually torrent catfish were found in lower altitudes. So, discovering a new species of torrent catfish at a high altitude was beyond their wildest dreams. The new species is endemic to Bhutan, which means that it is not found anywhere else in the world.

Dr. Gurung and his team named the catfish as *Parachiloglanis bhutanensis* in honour of the country. "This is an exciting find and further adds to the rich floral and faunal diversity of Bhutan and the whole Eastern Himalayas," he said

But these habitats and the rich diversity are under growing threat, according to Dr. Gurung. The region's rich terrestrial and aquatic habitats are under increasing threat due to impacts of climate change and rapid development activities such as hydropower and other construction projects.

"Discovery of these new species reaffirms the need to strengthen conservation of freshwater ecosystems and maintain connectivity to sustainably manage our unique diversity," said Dr. Gurung.

Dr. Gurung emphasized the need for protect Bhutan's rich aquatic diversity especially with his team still confident about finding five to seven more new fish species in the country. "We have already submitted the samples for peer review and to identify the category," he said.

Dr. Dan Bahadur Gurung has been a biologist for over 30 years. He started extensive research on freshwater ecosystems and fish diversity from 2012.

A rare endemic horned frog

(MEGOPHRYS ANCRAE) ARUNACHAL PRADESH, INDIA

Scientists recently encountered a new charismatic frog in the remote forests of the northeast Indian states of Arunachal Pradesh. *Megophrys ancrae*[35], is a so-called 'horned frog' although its horns are in fact elongated upper eyebrows.

Megophrys are one of nine genera currently in the Megophryidae (commonly known as the litter frogs) family of frogs. These frogs are native to the warm southeast of Asia, from the Himalayan foothills eastwards, south to Indonesia and the Greater Sunda Islands in Maritime Southeast Asia, and extending to the Philippines. As of 2014 it encompasses 180 species of frogs divided across nine genera. These frogs are notable for their camouflage, especially those that live in forests, which often look like dead leaves. The camouflage is accurate to the point of some having skin folds that look like leaf veins, and the horned frogs have sharp projections extending past the eye and nose, which disguise the frog shape and confuse would-be predators.

Megophryids range in size from 2 to 12.5 cm in length. The adults' tongues are noticeably paddle-shaped. Their tadpoles can be found in a variety of waters, but especially ponds and streams. The tadpoles are extremely diverse in form because of the variety of habitats they inhabit.

The natural habitats of the species is Its natural habitats are subtropical or tropical moist montane forests and rivers.

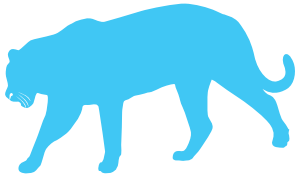
The new species is known from low and mid elevations within two large protected forests in Arunachal Pradesh. Scientists say that the amphibian fauna of the area has been poorly studied to date. Specifically, the species was identified in Deban, Namdapha National Park and Tiger Reserve, Changlang district, Arunachal Pradesh state, northeast India. Known only from this area near the Myanmar border at elevations of 330 to 790 m. The importance of this protected area as an area of known high amphibian endemicity is emphasized by the small proportion of its land area afforded government protection, raising concerns about the future conservation of its species.

Critically endangered monkey has no nose

(RHINOPITHECUS STRYKERI) - FAR NORTH MYANMAR

© Martin Aveling/Fauna & Flora International

© Martin Aveling/Fauna & Flora International



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ONE NEW MAMMAL SPECIES WERE DISCOVERED IN THE EASTERN HIMALAYAS

The Eastern Himalayas has tigers, rhinos, elephants, snow leopards, clouded leopards, and other iconic Asian mammals. Furthermore, recent research suggests that 50% of small mammal diversity in the region has yet to be discovered[31].

Very few mammal species are discovered each year, especially not large mammals. However over the last few years a biological expedition in this global biodiversity hotspot resulted in the discovery of a new “sneezing monkey”[32].

The remote Eastern Himalayan region of the far north Myanmar, with its rugged mountains and extensive forest cover, is one of the region’s last truly wild places, and the location of one highly significant and exciting large mammal finds in recent years.

The local people of Myanmar know it well. Scientists first learned of “Snubby” - as they nicknamed the species - from hunters in Myanmar’s forested, remote, and mountainous (Himalayan) Kachin state in early 2010. Locals claim that the black and white monkey is very easy to find when it is raining because the monkeys often get rainwater in their upturned noses causing them to sneeze. To avoid this evolutionary inconvenience, snub-nosed monkeys spend rainy days sitting with their heads tucked between their knees.

Only recently encountered by a team of conservationists from Fauna & Flora International (FFI) and People Resources and Conservation Foundation (PRCF), little is known about the monkey’s behaviour in the wild, its distribution range, or its value to local communities. Not surprisingly, this species is likely to be classified as critically endangered due to its restricted range and significant hunting pressures. The illustration below is the only representation of a scientifically observed specimen to this date.

Researchers working in Northern Myanmar have recently made the first photographs of the recently discovered Myanmar snub-nosed monkey[33].

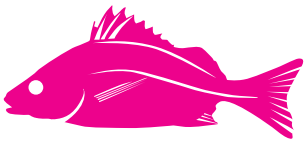
A joint team from FFI, Biodiversity And Nature Conservation Association (BANCA) and People Resources and PRCF, caught the monkey on camera traps placed in the high, forested mountains of Kachin state bordering China.

As with most of Asia’s rare mammals, the snub-nosed monkeys are threatened by habitat loss and hunting.

In 2011, a population was discovered in Lushui County, Yunnan, China[34].

DRACULA FISH

(DANIONELLA DRACULA) - FAR NORTH MYANMAR



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TWENTY-SIX NEW FISH SPECIES WERE DISCOVERED IN THE EASTERN HIMALAYAS

Fish represent the largest group of vertebrates and while the majority of fish are found in oceans almost as many can be found in freshwater habitats. These species are often unique to the habitats in which they are found. Each area of freshwater is effectively an island cut off by land all around it, so creatures that these are home to live here and often nowhere else. Therefore because of the conditions they are found in new fish finds are exceptional.

Scientists continue to strive to explore the poorly studied or understood fish fauna of the Eastern Himalayas.

As a result of ambitious expeditions undertaken by scientists, in area ranging from Himalayan mountains to subtropical lowlands and from east to west throughout the region, scientists have described 26 different species of fish between 2009 to 2014. The new fish highlighted by surveys and laboratory studies in the world's institutions have added to our knowledge of the distribution and ecology of fishes in the important environments of South Asia and include a number of new characters.

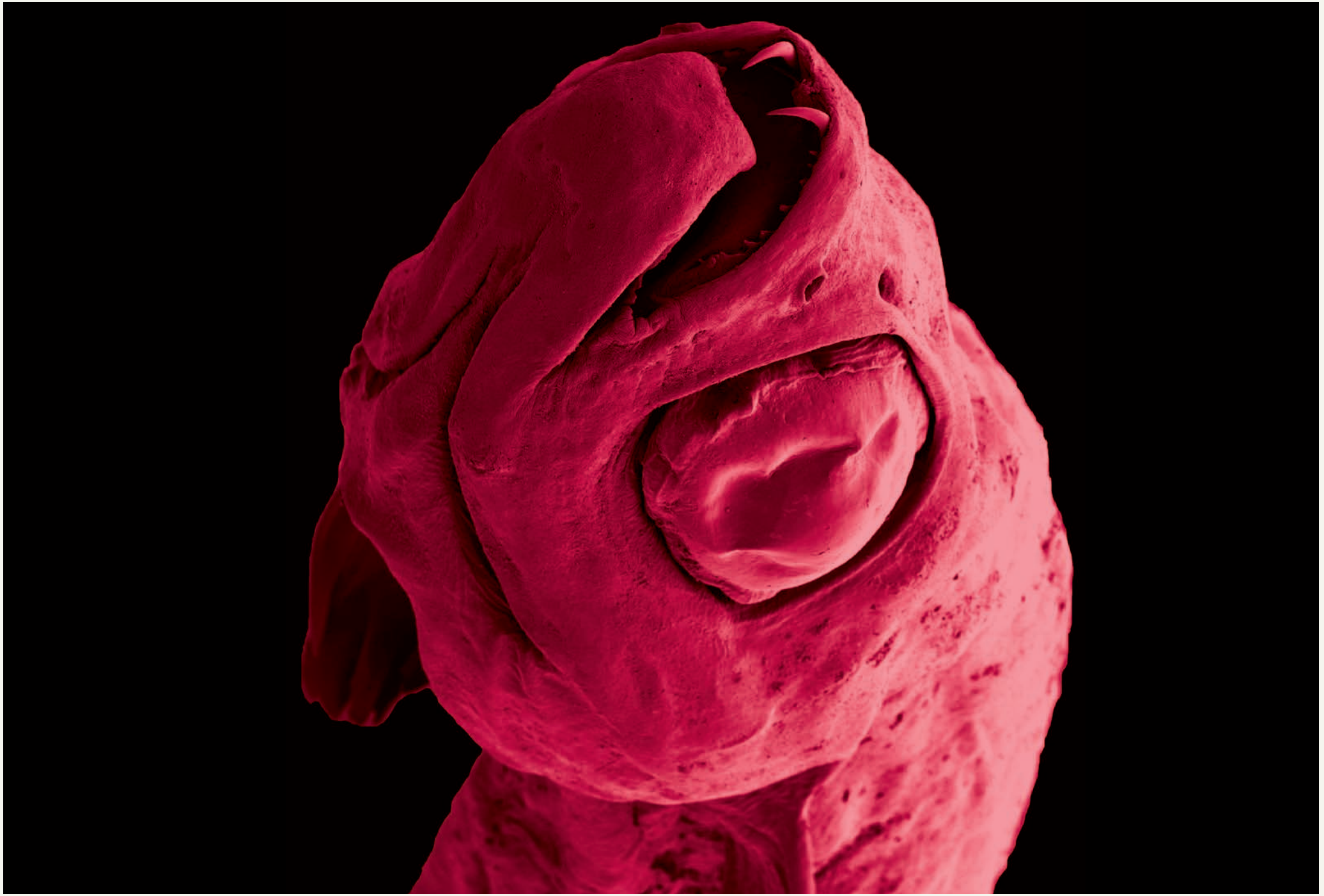
The world's largest continent is home to a wealth of aquatic animals. Among them are some of the most unique freshwater fish on the planet.

Discovered in a small stream in the Eastern Himalayan region of far north Myanmar, the "Dracula minnow" *(Danionella dracula)* is one of the most unique newly described species of 2009[38]. There is one fundamental difference between this species and its brethren in the Danionella genus: the presence of fangs – yes, fangs! - at the front of each jaw. Although the evolutionary cause of these aggressive-looking pointed teeth is unknown, they appear to be part of the skeleton of fish in this species. The species is also extraordinary for being largely translucent and miniature with a maximum length of 16.7mm long.

The species was aptly named Dracula, after the fanged Count Dracula in Bram Stoker's novel. Much about this unique species is still unknown, including its full range and endangered status. Despite the fact that it was found in high numbers in a small stream, it is yet hard to distinguish whether this unique species is endemic to a single ecosystem within Myanmar, or spread throughout the region as a whole.

Danionella dracula was awarded the accolade as one of "The Top 10 New Species" described in 2009 by The International Institute for Species Exploration at Arizona State University and an international committee of taxonomists[39].

This unique discovery certainly establishes the Eastern Himalayas as one of the frontiers for new species discoveries of this kind on our planet.



A Survey of India - exploration yields new bananas and impatiens in the Eastern Himalayas

(ARUNACHAL, PRADESH, INDIA)

In 2013 it was reported that a team of the Arunachal Pradesh Regional Centre of the Botanical Survey of India (BSI) discovered six new plant species in the northeast of the country. Three of the species were new wild bananas, while one of the other three species is that of a wild balsam and the other two are of Colocasia[40]. The discovery of these three banana species has raised the number of banana species to 23 in India and to 73 in the world. The new Colocasia species, have increased known numbers to 16.

The team was led by Dr Rajiv Gogoi. The wild balsam (a relative of the Demdeuka) discovered by Dr Gogoi and Dr Souravjyoti Borah in the Lohit district of Arunachal Pradesh has been named *Impatiens lohitensis*. The second species discovered by the team is that of a wild banana, which has been named – *Musa markkui*, after renowned banana scientist Markku Häkkinen. A third new species was named *Musa puspanjaliae* after Dr Gogoi's mother.
Again in December, 2012, Dr Gogoi discovered in West Kameng district another wild banana and named it *Musa kamengensis* R. Gogoi & M. Häkkinen.

The discovery of these plant species has once again proved the ecological importance for this region of the Eastern Himalayas (NE India), one of the biodiversity hotspots of the world. In this age of climate change – the phenomenon that has caused much trepidation among the environmentalists. The discovery of six species has once again proved the vast biodiversity stock of northeast India. But rapid urbanisation, construction of major roads and other developmental activities are posing serious threats to such rare species[41].

© R. Gogoi & S. Borah.

Impatiens lohitensis

© R.Gogoi & S.Borah

Musa markkui

A bejeweled lance-headed pit viper

(PROTOBOTHROPS HIMALAYANSUS) - TIBET, NORTHER SIKKIM, INDIA, WESTERN BHUTAN

The hiss of a new serpent emanates from the labyrinthine Himalayas...

A new pitviper emblazzened with an ornate yellow, red and orange pattern, at first glance looks like a carefully crafted piece of jewellery. Despite its' dazzling appearance, this bejeweled reptile has only been discovered in the Eastern Himalayas in the past few years.

The Himalayan lance-headed pit viper *(Protobothrops himalayansus)* as it has been named is believed to be a new addition to the Asian pitviper genus Trimeresurus[36]. This group of snakes predominately inhabit trees and have prehensile tails. Their diet includes rodents, lizards, amphibians and birds, but some have been observed feasting on fellow pitvipers. Their venom is toxic to humans and the toxicity of this varies among the different pitviper species. Some 35 species have been recognized to date across South and Southeast Asia.

The new species differs from other species its genus by having a relatively large body 1.5m long.; relatively large body size (total length up to 1510 mm); dorsal head uniform dark brown, laterally a reddish-brown obscure postocular streak. All these physical traits differentiate the snake from its congeners.

The handsome new species has a striking pattern of bands along the length of its body; dorsum of trunk and tail olive, with distinct black edged red brown transverse bands across the body and tail; and eye from bright brown and reddish brown to mildly brown.

It was found in locations in Jilong County, southern Tibet, and Chungthang, northern Sikkim, India, with the new species also being observed in the Haa Valley in western Bhutan. A further elusive species of pitviper is still awaiting official scientific description. Found in Sango Papum Pare, Arunachal Pradesh, India[37]. B.B. Bhatt, from the state Forest Institute, who has documented 76 of the 140 species of snakes found in Arunachal Pradesh, said the most striking feature of the newly-found species was its egg-producing capacity.

It can lay a clutch of 20 to 30 eggs — a phenomenon hitherto unknown to scientists. Scientists have encountered individuals that chose death by killing themselves by using their own fangs, much to the surprise of Bhatt who has been watching reptile behaviour since 2000 in the forests of the Northeast and north India. This behavior might be isolated to the star-crossed lovers, a male and female, that scientists disturbed.

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ONE NEW REPTILE WAS DISCOVERED IN THE EASTERN HIMALAYAS

© Liang Zhang

5.0 Threats to the Himalayas

Only 25% of the original habitats in the Eastern Himalayas remain intact[42]. The natural landscape of the region is currently facing a wide range of threats and pressures, with climate change assessed as by far the most serious, followed by mining, oil and gas projects, road construction and construction of new dams.

Invasive species, impact of tourism, water pollution, and illegal hunting, fishing, dams and logging are also among the most serious current issues.

Climate Change - Already experiencing more extreme floods, droughts and storms as a result of shifting weather patterns.

Climate change will profoundly affect the Eastern Himalayan region's biodiversity and ecosystem services, and as a result the millions of people who depend on them. The region is already experiencing more extreme floods, droughts, and storms as a result of shifting weather patterns. As the impacts of climate change increase, 'free' ecosystem services including food, timber and nontimber forest products, water, pharmaceuticals, energy (hydropower, biomass fuels), carbon sequestration and climate regulation, purification of water and air, may be affected adversely.

Furthermore, these threats extend to areas established to protect biodiversity. Sanctuaries set aside for elephants, big cats and other wildlife connected by carefully considered and established corridors and of the region's natural world heritage sites are facing significant threat due to inadequate conservation or protection.

Illegal logging, habitat loss and fragmentation

For the species that inhabit the Eastern Himalayas, increasing pressures mean that as a result today more and more are officially becoming classified as vulnerable, endangered or critically endangered according to IUCN (International Union for Conservation of Nature). For example, India is home to about 12% of the world's endangered plant species. Other countries in the region have similar alarming statistics. A booming wild species trade industry means that Agarwood from the northeast and rare herbs and plants from the Himalayan region are in demand with smugglers who harvest and trade the species on the international markets[43].

Among the important globally-threatened mammals are Asia's three largest herbivores - the Asian elephant, the greater one-horned rhinoceros and the wild water buffalo - and its largest carnivore, the tiger. The region is also home to snow leopard, Ganges river dolphin and several large birds such as vultures, adjutant storks and hornbills.

Rapid infrastructure development

Loss of biodiversity coupled with a lack of knowledge of species diversity (ie. Establishing and documenting what exists in the region) and full understanding of the value of natural capital deals a double blow for the future of the region's species. Of the estimated 12 million organisms believed to exist on Earth, only around 2 million have been named scientifically, and at least half of them are at risk of becoming extinct within the remainder of the 21st century.

In Bhutan alone, there are an estimated 200,000 organisms, excluding bacteria, and so far only about 12,000 have been identified. Land use change and climate change are threatening to destroy species before they can be understood, so there is an urgent need to move quickly and understand all that is out there.

The human cost is also severe. The environment is the base for all human development, so while the impact on wildlife is taking its toll, the once plentiful resources and cultural treasures available to people have continued to decline. In the long term, this will transform livelihoods, the availability of essential food and freshwater, and ultimately exacerbate poverty in the region. Little will change unless environmental protection and development are mutually supportive.

In a bid to protect the region's rich diversity of flora and fauna, WWF is calling for significant additional conservation measures to be introduced and implemented to preserve the habitats and extraordinary biodiversity of the region. WWF believes that real progress can be made in tackling the pressing issues in the Eastern Himalayas, like global warming, deforestation, the illegal wildlife and timber trade and the need for sensitive infrastructure development. At the same time, good environmental management will help increase livelihood options and help secure food and freshwater availability for millions of people throughout the region. This in turn, will address the poverty that underpins so many of the current demands on the landscape.

The distinctive fur pelt of the snow leopard on display

Rainforest landscape in the shadow of the Eastern Himalayas. The region is blessed with an extraordinary level of diversity.

6.0 Solutions do exist

The findings of this report raise important questions, not least "How to navigate the daunting development challenges facing the Eastern Himalayan region while committing to preserve the region's natural heritage?" The Eastern Himalayas is at a crossroads. Governments can decide whether to follow the current path towards fragile economies that do not fully account for environmental impacts, or take an alternative path towards greener, more sustainable economic development.

Preserve natural capital
restore damaged ecosystem, halt the loss of habitats, significantly expand protected areas.

Sustainable economic development
Manage resources sustainably through approaches such as sustainable hydropower development, valuation of natural capital, landscape and species conservation, climate change adaptation, and sustainable financing mechanisms.

To achieve a balance between conserving what is unquestionably some of the world's most important biodiversity and ensuring that natural resources are used sustainably to support economic development.

Stronger regional collaboration at the broader, ecosystem scale; and a common vision for conservation and sustainable use of biodiversity and natural resources.

The central importance of the region's shared natural resources cannot be overstated. The economic and social development of the Eastern Himalayan region depends on the continued productivity of its inter-connected ecological systems. Only intact, healthy, and diverse natural ecosystems can provide resilience to ensuing climate change while ensuring continued access to water, energy, food, commodities and livelihoods for over 300 million people. One important step the governments of the region can take is to transition into a "green economy".

The concept of a green economy is a model for sustainable development that takes into account the global economic benefits of biodiversity. It represents a major economic transformation and a paradigm shift in how we think about sustainable economic development. It is already happening in the Eastern Himalayan region, but not fast enough. Governments must step up their investments into green sectors, create the necessary national regulatory frameworks, and implement these via policies across the Eastern Himalayas. Only this can allow the region's countries to address complex, regional-scale issues like habitat loss and fragmentation, unsustainable natural resource use, and climate change. Addressing these challenges requires stronger regional collaboration at the broader, ecosystem scale; countries cannot effectively solve these problems thinking only within their own borders.

Regional collaboration needs high level political support. It also needs to be formalized through regional agreements that are supported by integrated and effective policy coupled with investments. Such agreements should seek to bring countries closer together around a common vision for conservation and sustainable use of biodiversity and natural resources. It should seek to achieve a balance between conserving what is unquestionably some of the world's most important biodiversity and ensuring that natural resources are used sustainably to support economic development.

WWF is actively involved in supporting the countries of the Eastern Himalayas' progress towards a green economies that value ecosystems and the services they provide to the millions of people in the region. Through approaches such as sustainable hydropower development, valuation of natural capital, landscape and species conservation, climate change adaptation, and sustainable financing mechanisms, WWF will continue to develop and support programmes in the region that help secure a brighter future for the region's biodiversity, including its rich array of species – those that we already know, and those still waiting to be discovered.

The changing geography of the Eastern Himalayas

7.0 Appendix

New species from the Eastern Himalayas, 2009-2014

Methodology

WWF has only included new discoveries that have been described in peer-reviewed scientific journals in this report. The new species were identified by scientists from a number of institutions around the world, including museums, universities, government departments and non-governmental organisations. WWF was involved in the discovery of some of the new finds. In addition, WWF assisted scientists from other institutions by organising research permits, helping with logistics, and identifying research locations.

This report presents a list of new species. The list was informed by a variety of expeditions and data retrieved from official and respected scientific databases, appendices, reports and peer-reviewed scientific journals. It was then further informed and refined through correspondence and advice received directly from scientists that discovered the species and further informed by experts in their fields.

The list is not an exhaustive record of new species found in the Eastern Himalayas between 2009 and 2014. Undoubtedly, some species will have been unintentionally overlooked. In addition, it should be noted that many other species that may eventually turn out to be new to science will have been encountered and collected in the Eastern Himalayas over the past six years. These species may currently be awaiting official scientific recognition. For scientific credibility, these species have not been included in the list.

PLANTS

SPECIES	SCIENTIST(S)	YEAR	TERRITORY
Amomum sabuanum	V.P.Thomas, Nissar & U.Gupta	2014	Sikkim
Bambusa nairiana	P.Kumari & P.Singh	2009	Assam
Corydalis biflora	Lidén, M.K.Pathak, Chowlu & B.Saikia	2013	Sikkim
Corydalis meyori	Lidén, R.Mili & B.Saikia	2013	Arunachal Pradesh
Cotoneaster hedegaardii	J.Fryer & B.Hylmö	2009	Nepal
Cotoneaster milkedandaensis	J.Fryer & B.Hylmö	2009	Nepal
Dendrocalamus manipureanus	H.B.Naithani & N.S.Bisht	2010	Assam
Eria sikkimensis	Bajrach. & K.K.Shrestha	2009	Sikkim
Herminium hongdeyuanii	Raskoti	2013	Nepal
Ione kipgenii	Kishor, Chowlu & Vij	2012	Assam
Liparis langtangensis	Raskoti & Ale	2014	Nepal
Meconopsis bhutanica	Tosh.Yoshida & Grey-Wilson	2012	Bhutan
Meconopsis lamjungensis	Tosh.Yoshida, H.Sun & Grey-Wilson	2012	Nepal
Pandanus martinianus	Nadaf & Zanan	2012	Arunachal Pradesh
Aconitum bhutanobulbilliferum	Kadota	2010	Bhutan
Agrostis pendryi	Paszko	2014	Nepal
Amischotolype dolichandra	Duist.	2012	Assam
Amomum carnosum	V.P.Thomas & M.Sabu	2012	Assam
Amomum dampuianum	V.P.Thomas, M.Sabu & Lalramngh.	2013	Assam
Amomum mizoramense	M.Sabu, V.P.Thomas & Vanchh.	2013	Assam
Amorphophallus bognerianus	Sivad. & Jaleel.	2009	Arunachal Pradesh
Archidendron arunachalense	S.S.Dash & Sanjappa	2011	Arunachal Pradesh
Archidendron nielsenianum	S.S.Dash & Sanjappa	2011	Arunachal Pradesh
Asplenium lacinioides	Fraser-Jenk., Pangtey & Khullar	2011	Sikkim
Astragalus lobbichleri	Podlech	2009	Nepal
Astragalus paroensis	Podlech	2010	Bhutan
Astragalus pseudorigidulus	Podlech	2009	Nepal
Axyris mira	Sukhor.	2011	Nepal
Bambusa dampaeana	H.B.Naithani, Garbyal & N.S.Bisht	2010	Assam
Bambusa manipureana	H.B.Naithani & N.S.Bisht	2010	Assam
Bambusa mizorameana	H.B.Naithani	2009	Assam
Begonia nuwakotensis	S.Rajbh.	2010	Nepal
Begonia panchtharensis	S.Rajbh.	2010	Nepal
Begonia shilendrae	Rekha Morris & P.D.McMillan.	2012	Arunachal Pradesh
Begonia taligera	S.Rajbh.	2010	Nepal
Berberis karnaliensis	Bh.Adhikari	2012	Nepal
Berberis pendryi	Bh.Adhikari.	2012	Nepal

PLANTS

SPECIES	SCIENTIST(S)	YEAR	TERRITORY
Berchemia jainiana	Pusalkar & D.K.Singh	2009	Assam
Bhutanthera fimbriata	Raskoti	2012	Nepal
Blumea sonbhadrensis	S.Narain , Lata & Juhi Singh	2008	Himachal Pradesh
Boehmeria listeri	Friis & Wilmot-Dear	2010	Bhutan / Sikkim
Boehmeria manipurensis	Friis & Wilmot-Dear	2010	Assam
Boesenbergia hamiltonii	Mood, S.Dey & L.M.Prince	2013	Assam
Boesenbergia kingii	Mood & L.M.Prince	2013	Sikkim / Assam
Bulbophyllum cherrapunjeense	Barbhuiya & D.Verma	2014	Assam
Bulbophyllum manabendrae	D.K.Roy, Barbhuiya & Talukdar	2014	Assam
Bulbophyllum nepalense	Raskoti & Ale	2013	Nepal
Capsicum assamicum	J.Purkay. & Lok.Singh	2012	Assam
Carex sanjappae	M. Bhaumik & M. K. Pathak	2011	Arunachal Pradesh
Cephalostachyum mishimianum	H.B.Naithani	2014	Arunachal Pradesh
Chrysosplenium arunachalense	Bhaumik	2014	Arunachal Pradesh
Cleistanthus nokrensis	B.Singh	2014	Assam
Codonopsis campanulata	HONG De-Yuan	2014	Nepal
Codonopsis reflexa	HONG De-Yuan	2014	Nepal
Codonopsis vadsea	S.S.Dash & A.A.Mao	2011	Arunachal Pradesh
Colocasia boyceana	Araceae. R. Gogoi & S. Borah	2013	Arunachal Pradesh
Colocasia dibangensis	R. Gogoi & S. Borah,	2013	Arunachal Pradesh
Corydalis arcuata	M.K.Pathak, Chowlu, B.Saikia & Lidén	2013	Arunachal Pradesh
Corydalis stenophylla	B.Saikia, Chowlu, M.K.Pathak & Lidén	2013	Sikkim / Arunachal Pradesh
Cotoneaster bumthangensis	J.Fryer & B.Hylmö	2009	Bhutan
Cotoneaster encavei	J.Fryer & B.Hylmö	2009	Nepal
Cotoneaster hicksii	J.Fryer & B.Hylmö	2009	Bhutan
Cotoneaster yalungensis	J.Fryer & B.Hylmö	2009	Nepal
Crotalaria shuklae	A.P.Tiwari & A.A.Ansari	2014	Uttar Pradesh
Dactylicapnos arunachalensis	Lidén & M.K.Pathak	2014	Arunachal Pradesh
Dactylicapnos cordata	Lidén	2010	Nepal
Dactylicapnos odontocarpa	Lidén	2010	Nepal
Dactylicapnos platycarpa	Lidén	2010	Bhutan
Dendrobium sessanicum	Apang	2012	Arunachal Pradesh
Dendrobium tamenglongense	Kishor, Y.N.Devi, H.B.Sharma, Tongbram & Vij	2013	Assam
Dysphania bhutanica	Sukhor.	2012	Bhutan
Dysphania himalaica	Uotila	2013	Nepal
Embelia arunachalensis	R.K.Choudhary, R.C.Srivast. & Arup K.Das	2009	Arunachal Pradesh
Epigeneium arunachalense	A.N.Rao	2010	Arunachal Pradesh
Eria gloensis	D. K. Agrawala and Paul Ormerod	2014	Arunachal Pradesh
Gaultheria kamengiana	S.Panda & Sanjappa	2009	Arunachal Pradesh
Hedychium nagamiense	Sanoj, M.Sabu & V.P.Thomas	2011	Assam
Herpetospermum operculatum	Pradheep, K.; Pandey, A.; Bhatt, K.C.; Nayar, E.R.	2014	Sikkim / Assam
Heteropanax dhruvii	R. C. Srivastava,	2010	Arunachal Pradesh
Himalaiella lushaiensis	Chen YS,	2014	Assam
Impatiens badrinathii	Pusalkar & D.K. Singh,	2010	Nepal
Impatiens lohitensis	Gogoi & Borah	2013	Arunachal Pradesh
Impatiens recticalcarata	S.Akiyama	2009	Nepal
Iris ramsayi	T.Hall & B.Mathew	2013	Arunachal Pradesh
Kobresia paramjitii	Jana, H.J. Noltie, R.C. Srivast & Ambarish Mukherjee	2014	Sikkim
Kobresia vibhae	Jana, R.C.Srivast & Manas Bhaumik	2014	Arunachal Pradesh
Larsenianthus arunachalensis	M.Sabu, Sanoj & Rajesh Kumar	2010	Arunachal Pradesh
Larsenianthus assamensis	S.Dey, Mood & S.Choudhury	2010	Assam
Leptopus nepalensis	B.Adhikari, R.P.Chaudhary & Ghimire	2010	Nepal
Lindera sanjappae	Bhaumik, M.K.Pathak & Chakrab.	2009	Arunachal Pradesh
Lindera varmae	M.K.Pathak, Bhaumik & Chakrab.	2009	Arunachal Pradesh
Meconopsis autumnalis	P.A.Egan	2011	Nepal
Meconopsis bulbilifera	Tosh.Yoshida, H.Sun & Grey-Wilson	2012	Nepal / Sikkim
Meconopsis manasluensis	P.A.Egan	2011	Nepal
Murdannia assamica	Nampy & A.Ancy	2012	Assam
Musa argentii	Gogoi & Borah	2014	Arunachal Pradesh
Musa arunachalensis	A.Joe, Sreejith & M.Sabu	2013	Arunachal Pradesh
Musa cylindrica	A.Joe, Sreejith & M.Sabu	2014	Assam
Musa kamengensis	Gogoi & Häkkinen	2013	Arunachal Pradesh
Musa markkui	Gogoi & Borah	2013	Arunachal Pradesh
Musa puspanjaliae	Gogoi & Häkkinen	2013	Arunachal Pradesh
Neillia velutina	Pendry	2010	Nepal
Neolitsea sanjappae	M.K.Pathak, Bhaumik & Chakrab.	2009	Arunachal Pradesh
Neottia chandrae	Raskoti, J.J.Wood & Ale	2012	Nepal
Neottia confusa	Bhaumik	2012	Arunachal Pradesh
Neottia dihangensis	Bhaumik	2012	Arunachal Pradesh
Ornithochilus cacharensis	Barbhuiya, B.K.Dutta & Schuit.	2012	Assam
Panax sokpayensis	Shiva K.Sharma & Pandit	2009	Sikkim
Panisea panchaseensis	Subedi	2011	Nepal / Sikkim / Assam
Pedicularis yamazakiana	R.R.Mill	2011	Nepal
Pinus ravii	R.C.Srivast.	2013	Arunachal Pradesh
Poa hideaki-ohbae	Rajbh.	2013	Nepal
Prunus gongshanensis	J.Wen	2012	Bhutan / Nepal
Prunus harae	H.Ohba & S.Akiyama	2010	Bhutan
Prunus singalilaensis	H.Ohba & S.Akiyama	2010	Nepal / Sikkim

	SPECIES	SCIENTIST(S)	YEAR	TERRITORT
PLANTS	*Prunus taplejungnica*	H.Ohba & S.Akiyama	2010	Nepal
	Prunus topkegolensis	H.Ohba & S.Akiyama	2010	Nepal
	Pternopetalum arunachalense	Bhaumik & P.Satyanar.	2013	Arunachal Pradesh
	Rhododendron mechukae	A.A.Mao & A.Paul	2013	Arunachal Pradesh
	Rhododendron titapuriense	A.A.Mao, K.N.E.Cox & D.F.Chamb.	2013	Arunachal Pradesh
	Rhynchotechum gracile	B.M.Anderson	2013	Assam / Arunachal Pradesh / Assam
	Rubus hapoliensis	G.D.Pal	2013	Arunachal Pradesh
	Saxifraga assamensis	Wadhwa	2009	Arunachal Pradesh
	Sorbus karchungii	Rushforth	2010	Bhutan
	Sorbus sharmae	M.F.Watson, V.Manandhar & Rushforth	2010	Nepal
	Strobilanthes borii	J.R.I.Wood	2009	Assam
	Strobilanthes parvifolia	J.R.I.Wood	2009	Arunachal Pradesh
	Sunipia nepalensis	Raskoti & Ale	2011	Nepal
	Thunbergia nepalensis	Bh.Adhikari & J.R.I.Wood	2013	Nepal
	Toxicodendron bimannii	Barbhuiya	2013	Assam
	Vaccinium amakhangium	S.Panda & Sanjappa	2009	Assam
	Zingiber kangleipakense	Kishor & Škorničk.	2013	Assam
	Zingiber meghalayense	Sushil K.Singh, Ram.Kumar & Mood	2013	Assam
				TOTAL: 133
INVERTEBRATES	*Bittacus coheri*	Wesley J. Bicha	2011	Nepal (Terai)
	Eubasilissa sikkimensis	Sajad H. Parey & Malkiat S. Saini	2012	Lachung (Sikkim)
	Kisaura golitarensis	Manpreet Singh Pandher & Malkiat Singh Saini	2014	Sikkim
	Kisaura holiensis	Manpreet Singh Pandher & Malkiat Singh Saini	2014	India (Uttarakhand)
	Kisaura holzenthali	Manpreet Singh Pandher & Malkiat Singh Saini	2014	India (Uttarakhand)
	Kisaura morsei	Manpreet Singh Pandher & Malkiat Singh Saini	2014	India (Uttarakhand)
	Koponenius biramus	Sergei I. Golovatch & Didier Vandenspiegel	2014	Nepal/India
	Koponenius unicornis	Sergei I. Golovatch & Didier Vandenspiegel	2014	Nepal/India
	Lathrolestes lidae	Alexey V. Reshchikov	2011	Nepal
	Lathrolestes peisseli	Alexey V. Reshchikov	2011	Nepal
	Lathrolestes roerichi	Alexey V. Reshchikov	2011	Nepal
	Lepidostoma dirangense	Malkiat S. Saini & Sajad H. Parey	2011	Arunachal Pradesh, India
	Mycomya aix	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya alticola	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya banteng	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya cissa	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya ducula	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya goral	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya irena	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya jeti	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya kaa	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya naja	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya niltava	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya pitta	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya sachak	Rauno Väisänen	2013	Nepal/Myanmar
	Mycomya sanar	Rauno Väisänen	2013	Nepal/Myanmar
	Notodonta dedmazai	Alexander Schintlmeister	2013	Bhutan
	Owadaglaea dominiki	Balázs Benedek , Robert Borth & Aidas Saldaitis	2012	Myanmar
	Owadaglaea kulmani	Balázs Benedek , Robert Borth & Aidas Saldaitis	2012	Nepal
	Owadaglaea michelleae	Balázs Benedek , Robert Borth & Aidas Saldaitis	2012	Myanmar
	Pristosia glabella	Joachim Schmidt & Matthias Hartmann	2009	Nepal
	Pristosia nepalensis	Joachim Schmidt & Matthias Hartmann	2009	Nepal
	Pristosia similata	Joachim Schmidt & Matthias Hartmann	2009	Nepal
	Pseudopostega brevicaudata	Jonas Rimantas Stonis , Andrius Remeikis & Virginijus Sruoga	2013	Nepal
	Rhyacophila kisszoltani	Otto Kiss	2013	Nepal
	Rhyacophila sajadi	Malkiat S. Saini & Lakhwinder K.	2012	Indian Himalayas
	Rhyacophila steinmanni	Otto Kiss	2013	Nepal
	Superodontella gladiator	Mikaël Agolin, Céline Houssin & Louis Deharveng	2009	Nepal
	Urodeta noreikai	Virginijus Sruoga & Jurate De Prins	2013	Nepal
				TOTAL: 39
FISH	*Aborichthys cataracta*	Arunachalam, M., M. Raja, P. Malaiammal and R.L. Mayden	2014	Arunachal Pradesh
	Aborichthys verticauda	Arunachalam, M., M. Raja, P. Malaiammal and R.L. Mayden	2014	Arunachal Pradesh
	Aborichthys waikhomi	Kosygin, L.	2012	Arunachal Pradesh
	Badis singenensis	Geetakumari, K. and K. Kadu	2011	Arunachal Pradesh
	Balitora eddsi	Conway, K.W. and R.L. Mayden	2010	Nepal
	Barilius pectoralis	Husain, A.	2012	Uttarakhand
	Channa andrao	Britz, R.	2013	West Bengal
	Danio flagrans	Kullander, S.O.	2012	Myanmar
	Danio tinwini	Kullander, S.O. and F. Fang	2009	Myanmar
	Danionella dracula	Britz, Conway & Rüber	2009	Myanmar
	Danionella priapus	Britz, R.	2009	West Bengal
	Devario anomalus	Conway, K.W., R.L. Mayden and K.L. Tang	2009	West Bengal / Bangladesh
	Garra arupi	Nebeshwar, K., W. Vishwanath and D.N. Das	2009	Arunachal Pradesh
	Garra kalpangi,	Nebeshwar, K., K. Bagra and D.N. Das	2012	Arunachal Pradesh
	Glyptothorax dikrongensis	Tamang, L. and S. Chaudhry	2011	Arunachal Pradesh
	Glyptothorax pantherinus	Anganthoibi, N. and W. Vishwamanath	2013	Arunachal Pradesh

FISH	*Oreichthys crenuchoides*	Schäfer, F.	2009	West Bengal
	Oreoglanis majusculus	Linthoingambi, I. and W. Vishwanath	2011	Arunachal Pradesh
	Parachiloglanis bhutanensis	Thoni, R.J. & Gurung, D.B.	2014	Bhutan
	Pethia aurea	Knight, J.D.M.	2013	West Bengal
	Physoschistura dikrongensis	Lokeshwor, Y. and W. Vishwanath	2012	Arunachal Pradesh
	Physoschistura yunnaniloides	Chen, X.-Y., M. Kottelat and D.A. Neely	2011	Myanmar
	Pseudolaguvia assula	Ng, H.H. and K.W. Conway	2013	Nepal
	Pseudolaguvia spicula	Ng, H.H. and Lalramliana	2010	Bangladesh / N India
	Schistura obliquofascia	Lokeshwor, Y., A. Barat, J. Sati, A. Darshan, W. Vishwanath and P.C. Mahanta	2012	Uttarakhand
	Turcinoemacheilus himalaya	Conway, K.W., D.R. Edds, J. Shrestha and R.L. Mayden, 2011	2011	Nepal
				TOTAL: 26
AMPHIBIANS	*Amolops indoburmanensis*	Dever, Fuiten, Konu, and Wilkinson	2012	Kachin, Myanmar.
	Leptobrachium bompu	Sanjay Sondhi & Annemarie Ohler	2011	Arunachal Pradesh
	Megophrys ancrae	Mahony, Teeling, and Biju	2013	Arunachal Pradesh
	Megophrys megacephala	Stephen Mahony, Saibal Sengupta, Rachunliu G. Kamei & S.D. Biju	2011	Assam
	Minervarya chilapata	Annemarie Ohler, Kaushik Deuti, Stéphane Grosjean, et al.	2009	West Bengal
	Polypedates assamensis	Mathew and Sen	2009	Assam
	Polypedates subansiriensis	Mathew and Sen	2009	Arunachal Pradesh
	Rhacophorus subansiriensis	Mathew and Sen	2009	Arunachal Pradesh
	Theloderma baibengensis	Jiang, Fei, and Huang	2009	Arunachal Pradesh
				TOTAL: 9
REPTILES	*Protobothrops himalayanus*	Hujun et al.	2013	Southern Tibet (China) and Sikkim (India). The new species was also observed from the Haa Valley in western Bhutan.
				TOTAL: 1
BIRDS	*Elachura formosa (Spotted Wren-Babbler)*	Alström et al.	2014	Bangladesh, Bhutan, China, India, Myanmar, Nepal
				TOTAL: 1
MAMMALS	*Rhinopithecus strykeri*	Geissmann et al.	2010	Northern Kachin State, Northeastern Myanmar
				TOTAL: 1

GRAND TOTAL: 210

8.0 References

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Eastern Himalayas in numbers

211
New species have been discovered in the Eastern Himalayas between 2009-2014

34
New species finds on average every year for the last six years

17
landscapes for the Bengal tiger, Asia's largest carnivore, are located in the Eastern Himalayas. Snow leopards, rhinos and elephants are also icons of the region

25%
of the original habitats in the region remain intact today

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To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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