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With the recent increase in global awareness of the need to conserve tigers, there is renewed hope for restoring and rehabilitating tigers in their natural homes. Science and technology are helping us with new and innovative ways to save tigers. An insight on the occasion of the International Tiger Day on 29 July.

Is The Tiger Burning Bright?

OF the hundreds of thousands years that tigers inhabited this planet their existence has never been in so much peril as in the last hundred years. At the beginning of the twentieth century, their numbers were estimated to be about 100,000. But soon with large-scale cutting down of forests for agriculture and industrialisation, poaching of tigers for commercial gains, and increasing human-animal conflicts the numbers started dwindling. It is estimated that there were only around 3890 wild tigers in the world in 2016.

Tiger experts campaigned that unless the tiger was prevented from going into oblivion, forest ecosystems would

collapse. And world leaders soon realised that there was an urgent need to rescue tigers from the brink of extinction. It was out of this realisation that at the world's first Tiger Summit in St. Petersburg, Russia in 2010 it was decided to celebrate 29 July every year as the International Tiger Day to spread awareness about the urgent need to conserve tigers. Although global awareness in this regard has been considerably increased of late, efforts of much larger magnitude are required considering the depredation that these majestic species have suffered at the hands of humans.

Science and technology have been playing an increasingly important role in enhancing our understanding about tigers

and their conservation. From developing sophisticated techniques to study tigers in the wild to constructing theoretical models to understand tigers better, scientists have been enriching our knowledge about the complex issues concerning tiger conservation.

Advances in science have led to several refinements in the theories and techniques used in tiger research. While on the one hand a variety of sophisticated techniques helped in the precise collection of data about tigers in the wild, on the other hand advanced scientific modelling techniques helped in better analysis of this data and better understanding of the tiger as an important link in the complex web of life on earth.



Top: A camera trap with motion detector on top, lens in the middle and flash on the bottom
 Top Left: a Sumatran tiger caught on the camera (it destroyed three camera traps in one weekend)

Left: Radio collared tigers



Data Collection Techniques

Some of the data collection techniques that have been pioneered in the recent past include camera trapping and radio telemetry.

Camera trapping: In the early 1900s, Frederick W. Champion pioneered camera trapping in India. The camera trapping technique is common in tiger research due to its accuracy, relative ease and low cost. It uses remote cameras placed at strategic positions. The cameras are equipped with motion sensors that get activated when there is movement and multiple photographs are captured at the moment. This technique involves very little human interference and is useful in determining behavioural and activity patterns of animals and in recording animal migrations. With today's advanced digital camera photos can be sent directly to a computer.

Radio telemetry: In the 1960s, the technique of radio telemetry was developed by the Craighead brothers and continues

today with the use of Global Positioning System (GPS)-based research. They used radio collars for tracking tigers in the wild and probing their secret lives. The collar is usually fitted around the neck of the tiger under study. It is equipped with a small radio transmitter and a battery. The radio signals transmitted by the collar can be tracked from up to 5 km. Different collars employ different sensors to recognise different movement activities, temperature and even mortality.

The rapid development of GPS collar technology in the 1990s revolutionised wildlife research by facilitating improved data collection about tiger movements and ecology. These collars are able to give the GPS location of the tiger wearing it as well as its speed and direction. They facilitate data collection from greater distances, 24 hours a day, even during bad weather and without disturbing the tiger. The collected data may be transmitted via a scientific satellite system and may be downloaded by users. The users can analyse the data using custom software. For example, the tiger's

location may be plotted in near real-time or at a later time using this software.

Modelling Techniques

The predator-prey models help us understand the relation between tiger populations and the prey populations on which they survive. These models are based on the Lotka-Volterra equations.

For instance, capture-recapture models are used to make realistic estimates of the whole tiger populations. Using the camera traps, tigers are differentiated as individuals on the basis of their unique stripe patterns. The number of individuals in the first sample is multiplied by the number in the second sample and the resulting number is then divided by the number of individuals who are common to both the samples. The quotient is an estimate of the total population in the study area. With more than two samples the calculations become more complicated and are performed with special computer programs developed for this purpose.

Many software programs are available today for facilitating tiger research. These include: (i) 'Distance' used to model visual detection probabilities and estimate the individual density, (ii) 'Capture' used to derive estimates of capture probability and tiger abundance at a site using different



Tiger Facts

- Tigers' brain weighs over 300 gm – the largest brain of all carnivores except the polar bear. So, they have a better memory than any other animal, including humans. Tigers' short-term memory alone lasts about thirty times longer than that of humans.
- Tigers have binocular vision equipping them with depth perception like humans. The eyes of the tiger are situated on the front of their head, which helps in the 3D perception. They have a wide, rounded pupil, large anterior chamber and a large lens that allows maximum light to enter and a mirror-like structure behind the retina that reflects light back into the eye for a second time to produce a brighter image. They also have more rods than cones enabling better night vision – about six times better than that of humans. It helps them in hunting during night.



- Tigers can achieve speeds of about 49–65 km/hour in short bursts, horizontal leaps of up to 10 m and vertical jumps up to 5 m. They are also strong swimmers and may cross rivers up to 7 km across and up to 29 km in a day.



- Stripes of tigers are like fingerprints in humans; no two tigers have the same pattern.
 - The tiger's roar can be heard up to 3 km. The roar is made using the hyoid apparatus, which refers to the bones associated with the larynx.
- Tigers are often unsuccessful in hunting. Only one in ten tiger hunts is successful.
 - Tigers scratch trees and use their urine to mark their territories.

models, and (iii) 'Fstat' used to estimate and test gene diversities and statistics.

In the paper, 'Population and prey of the Bengal Tiger *Panthera tigris tigris* in the Sundarbans, Bangladesh' (*Journal of Threatened Taxa*, 4(2): 2370–2380, February 2012), Khan presented results of the research conducted from 2005 to 2007 on Bengal Tigers using camera traps and distance sampling surveys. With the help of 829 photographs of different species obtained from the Katka-Kochikhali site during the survey period and using the capture software, they estimated the tiger density in the area covered by camera-trap survey as 4.8 tigers/100 km².

Gour *et. al* also studied the patterns of dispersal and philopatry (the tendency of an organism to stay in or habitually return to a particular area) of tigers in the Pench tiger reserve, Madhya Pradesh (doi: 10.1371/journal.pone.0066956, July 2, 2013). They used non-invasively obtained genetic data to establish the presence of 28 tigers within this area. They collected a total of 306 fresh carnivore faecal samples from the core area and extracted the DNA from these samples. The tiger-positive samples were further analysed. This research has important implications for better management of habitats and interconnecting corridors in the cause of saving tigers.

Conservation Challenge

The highly endangered status of tigers has been caused mainly due to habitat shrinkage, decline in prey species, poaching for medicinal and cultural value and the ever-increasing requirements of the ever-expanding human population.

Tigers have been recklessly hunted and poached all over the world to serve the ulterior pleasures and greed of humans. In colonial India, tigers were hunted on a large scale by the British as well as the royal families just for pleasure and prestige. One of the main reasons for the interest of British in killing tigers was that it symbolised the imperial identities desired by them.

In some countries like China, tigers were perceived as a threat to human life and tiger killers were hailed as heroes. In 1959, Mao Zedong declared South China tigers as enemies of man and encouraged their eradication.



Tiger Population (2016)

Bangladesh	106	China	>7	Thailand	189	Nepal	198
Bhutan	103	India	2,226	Laos	2	Russia	433
Cambodia	0	Indonesia	371	Malaysia	250	Vietnam	<5

[en.wikipedia.org/wiki/Tiger, Scientific American, 10 April 2016]



Tiger Myths

It is believed that tiger parts have multiple medicinal properties. However, these beliefs are not based on any scientific studies. Some of the myths are as follows.

- Tiger parts are useful in the treatments for arthritis and digestive problems.
- The tail of the tiger, ground and mixed with soap to create an ointment, can be used in treating skin cancer.
- Burnt tiger hair can be used to drive away centipedes.
- Mixing the brain of a tiger with oil and rubbing the mixture on one's body can cure laziness and acne.
- One can possess strength and courage by wearing a tiger's claw as jewellery or carrying it in a pocket and by consuming a tiger's heart.
- Small bones in a tiger's feet can be tied to a child's wrists to cure convulsions.

The trading of tiger parts in China has also grown into a major black market industry because of its lucre. By 1977, a tiger skin in an English market was considered to be worth US\$ 4,250. Poachers could earn a fortune just by selling a few tiger skeletons.

In Russia also local authorities worked heavily to exterminate tigers. The armies based in Vladivostok nearly wiped out the local Siberian tigers. As a result the Siberian tigers very rarely died of old age;

they were killed before they reached this stage. By 1940, the population of Siberian tigers in Russia reduced to just about 40. Tigers could be hunted legally in the Soviet Union until 1947.

With increasing global awareness about the need to save tigers there have been worldwide efforts to salvage this situation. The Soviet Union started anti-poaching controls and instituted a network of protected zones that led to a rise in the tiger population. In 1988, China passed the

Law on the Protection of Wildlife, listing the tiger as a Category I protected species. In 1993, China banned the use of tiger parts in traditional Chinese medicine. By 2004, international conservation organisations launched successful environmental propaganda campaigns in China against the Tibetan tiger skin trade. In 2006, the Dalai Lama also preached against the use of products of wild animals, which brought about a positive change in people's attitude towards conservation.



The **Bengal tiger**, also called the Indian tiger, is the most common subspecies found in India, Nepal, Bangladesh and Bhutan.



The **Indo-Chinese tiger** is one of the smallest tiger subspecies. They inhabit southern China, Laos, Vietnam, Cambodia, Malaysia, Thailand and eastern Burma.



The **Sumatran tiger** is the smallest living tiger subspecies. They are found only on the island of Sumatra, part of Indonesia.



The **Amur tiger** or the **Siberian tiger** is the largest living subspecies. They are found near the Amur region of Siberia, north-eastern China and North Korea.



The **South China tiger** is the most critically endangered subspecies. They are native to South Central China.



The **Malayan tiger** was identified as a distinct subspecies in 2004. They are found in the southern part of the Malay Peninsula.

The Terai-Arc Landscape programme started working towards improving tiger habitats in Nepal and northern India. The corridors were built to promote dispersion of tiger populations to facilitate the enhancement of the gene pool for tigers.

That tiger conservation was truly being taken seriously across the world was revealed by the fact that tiger was declared the national animal by Bangladesh, India, Malaysia and South Korea. Finally, in 2010, a summit called the International Tiger Conservation Forum was held in Russia to discuss efforts to save the tiger. This meeting led to contributions totalling \$127 million from the governments involved in supporting tiger conservation.

As a result of the many programmes and conservation measures round the world, the population estimates showed increase for the first time after the decline started at the beginning of the 20th century. The number increased from 3200 in 2011 to 3890 in 2015.

Though these numbers do not look impressive, they are better compared to

the low numbers reached worldwide just a few decades back. This was possible due to the worldwide conservation efforts. It is heartening that India, which has the maximum population of tigers in the world, has also been a pioneer in these efforts. In a Statement of Concern issued by Tiger Biologists on 15 April 2016 concerning the status of tigers, India's conservation efforts have been lauded:

“There is no doubt that wildlife managers in parts of India and even in specific reserves in South East Asia and Russia have made commendable conservation efforts, leading to recoveries in specific tiger populations. India has invested massively in recovering several tiger populations over the last four decades. This has been possible because of strong political, administrative and public support rarely matched anywhere else.

Such sporadic tiger recoveries should be monitored using statistically robust camera trap or DNA surveys. Rigorous scientific studies in India, Thailand and Russia demonstrate this can indeed be done.

[Statement of Concern by Tiger Biologists (<https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/8872/Statement-of-Concern-by-Tiger-Biologists.aspx>)]

In India, the estimated tiger population of 40,000 tigers at the turn of the 20th century reached its nadir at about 1827 in 1972. In this year, ‘Project Tiger’, the first major conservation effort was launched. It turned out to be one of the most successful conservation ventures in modern history. Today, there are 27 Project Tiger wildlife reserves in India, covering an area of 37,761 sq km.

A recent study shows that tigers in the India subcontinent retain much of their genetic viability, which is a factor of critical importance in the recovery and

Extinct Subspecies

- The **Javan tiger** was exclusively found in Java, Indonesia and went extinct in the early 1980s. It was hunted to extinction, although its number was dwindling due to habitat loss to coffee and rubber plantations.
- The **Caspian tiger** was found in sparse forest habitats west and south of the Caspian Sea around the 1950s. It went extinct due to its extensive hunting as well as hunting of its prey.
- The **Balinese tiger** was exclusively found in Bali in Indonesia and went extinct in the early 1930s. It was hunted to extinction due to its cultural status as evil.

survival of tigers and this is giving India, even, more incentive to preserve this magnificent animal.

From Scientific Knowledge to Scientific Wisdom

The success of a conservation initiative for a particular area is decided by the size of the protected area, its biodiversity, tiger population in that area, connectivity of the area to buffer zones, funding, and public and local community support. However, it is not the scientific knowledge alone but the wisdom of using that knowledge that matters for the overall success of these measures.

We need to realise that it was humans who disturbed the harmony with which tigers lived in their natural homes for the past several centuries. Humans have proved to be the tiger's biggest predator. They have often killed tigers to serve their own selfish motives.

Sometimes tiger killing is justified citing examples of man-eating tigers. However, it is a well-known fact that such examples are rare and tigers do

Global Conservation Organisations

- The Convention on International Trade in Endangered Species of Wild Fauna and Flora has declared all trade in tiger parts as illegal.
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora has done a pioneering work at international level in tiger conservation.
- In July 2006, Panthera, a conservation organisation, collaborated with the Wildlife Conservation Society to form Tigers Forever that plans to increase the number of tigers by eliminating human threats and monitoring tiger and prey populations. Panthera also started a project, 'The Tiger Corridor Initiative', which plans to link protected core populations of tigers with one another using corridors that will provide safe passage for tigers.
- Save the Tiger Fund, founded in 1995, participated in several conservation efforts towards mitigating the human-tiger conflict, protecting tiger habitats, researching tiger ecology, monitoring tiger populations, and educating locals on the importance of saving the tiger.
- The World Wildlife Fund, started in 1961, granted \$38,000 to the Smithsonian Institution to study the tiger population of the Chitwan Sanctuary in Nepal. It allowed scientists to successfully use radio-tracking devices for the first time in 1973. In 2001, it spurred progress towards the ambitious goal of creating wildlife corridors linking 11 protected areas between Nepal's Royal Chitwan National Park and India's Corbett National Park.
- The Global Tiger Initiative, founded in June 2008, is an alliance between governments created to save wild tigers from going extinct.
- The Global Tiger Recovery Program works for effective management and restoration of tiger habitats and elimination of poaching and illegal trade of tiger parts.

not normally view humans as prey; they don't kill for sport, ego or greed and thus maintain the forest's natural balance. Most of the cases of man-eating tigers arise because of a lack of the tiger's normal prey species due to habitat loss and when tigers cannot fulfil their needs due to old age, infirmity or missing teeth.

We are the biggest threats to tigers – the solution for their future also lies in our own hands. When we talk of saving tigers, it is not just the tigers but also the whole ecosystem that thrives out there. It also means saving the trees, tall grasses, and vegetation that provides natural shelter and cover to tigers and the large number of other animals on which tigers depend for food.

With the recent increase in global awareness of the need to conserve tigers, there is a renewed hope for restoring and rehabilitating tigers in their natural homes. Science and technology are helping us with new and innovative ways to save tigers. But what will matter most is our sincere commitment to protecting tigers and their natural habitats until they are removed from the list of endangered species.

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