

The death of nearly one million common murre birds that washed ashore of Alaska during 2015-2016 was brought on by a severe and longlasting marine heat wave. A new study published in PLOS ONE says the marine heat wave squeezed out the bird's fish food supply in the Pacific.



An article in Science explores how Mars, which had abundant water on its surface, lost most of it over various seasons. The researchers found that water can reach the upper atmosphere most efficiently when Mars is in the warmest part of its orbit. This

must have controlled how the

red planet lost its water.



Benefits of exercise University of Michigan researchers found that a protein sestrin which naturally occurs in the body mimicked the benefits of exercise in flies and mice. Their findings can help us understand and address muscle wasting due to aging, for instance. The study was published in Nature

TB diagnostic test developed in India has high accuracy, says WHO

Truenat can be used as an initial tool for diagnosing TB at primary, community health centres

In a Rapid Communication published on January 14, the World Health Organization (WHO) had mentioned that the India-made Truenat MTB, a molecular diagnostic test to diagnose pulmonary and extrapulmonary TB and rifampicin-resistant TB, has high diagnostic accuracy.

Truenat MTB has "high diagnostic accuracy as initial test to diagnose TB and to sequentially detect rifampicin resistance", says the WHO Communication. Truenat MTB will be used as an initial test to diagnose TB thus replacing sputum smear microscopy

Truenat is developed by the Goa-based Molbio Diagnostics. The company was provided with technical assistance and resources by the Foundation for Innovative New Diagnostics (FIND) to help commercialise Truenat. Indian Council of Medical Research (ICMR) had assessed and validated the diagnostic tool.

Truenat will be cheaper per test than Xpert. The equipment and cartridges cost more in the case of Xpert," says Balaram Bhargava, Director-General of ICMR. "Truenat is robust and most suited for Indian conditions."

"With its better sensitivity, Truenat can be used as the initial tool for TB diagnosis," says Prof. Bhargava.

Besides others, a multicentric, prospective field evaluation study was carried out in four countries - India, Ethiopia, Peru, Papua-New Guinea – involving 744 parti-



Competitive edge: Truenat has been found to have sensitivity and specificity comparable with the currently used molecular diagnostic test.

cipants, with final results on bacteriological culture.

Higher sensitivity

While sputum microscopy has only about 50% sensitivity, Truenat has been found to have higher sensitivity and specificity. According to WHO, the overall sensitivity of the Truenat MTB assay is 83% and specificity is 99%. In the case of Truenat MTBPlus, which uses two targets to diagnose TB bacteria, the sensitivity increases to 89% and the specificity is

In comparison, Xpert, which is also a molecular diagnostic test and has been widely used across the world, the sensitivity is 85% and specificity is 98%.

In cases where the sample is found to be positive for TB, tests can be done to know if the TB bacteria are already resistant to rifampicin, a drug used as part of first-line TB treatment. Truenat MTB-RIF test for knowing rifampicin resistance has 93% sensitivity and 95% specificity. According to the WHO,

the accuracy to diagnose TB using Truenat and Truenat MTB Plus is comparable with Xpert and Xpert Ultra. Likewise, the accuracy to detect rifampicin resistance using Truenat MTB-RIF is comparable with Xpert and Xpert

Beats smear microscopy Based on data available from around 230 TB diagnosing units located in primary health centres and community health centres in Andhra Pradesh, scientists at the Chennai-based National Institute of Epidemiology found Truenat had better ability to diagnose more TB positive cases. "Compared with smear microscopy, there was 30% more number of positive cases diagnosed after Truenat was implemented in the 230-odd units," says Manoj V. Murhekar, Director of NIE.

Battery operated

"Instead of smear microscopy, Truenat can be used as an initial and point-of-care tool for diagnosing TB," says Dr. Murhekar. "Since not much expertise is needed to carry out the test, it can be used in peripheral units such as public and community health centres."

While Xpert needs reliable electricity supply and airconditioning, Truenat is battery operated and portable and so can be used in remote places. Truenat takes about 25 minutes to extract the DNA and another 35 minutes for TB diagnosis. Testing for rifampicin resistance takes an hour and is done only if the sample tests positive for TB. In the case of Xpert, it takes two hours to complete the TB diagnosis and test for rifampicin resistance.

Compared with a one ml of sputum sample required in the case of Xpert, only 0.5 ml sputum sample is needed for Truenat. In the case of TB positive samples, the actual bacterial load in 1 ml of sputum sample is given, while Xpert provides only a qualitative result.

The main cost advantage while using Truenat will be in the manner the tests are carried out. Only when samples test positive for TB will the test for rifampicin resistance be carried out in the case of Truenat. This is unlike Xpert where both TB diagnosis and rifampicin resistance test are done at one go. Hence the use of reagents may be reduced, and this will help make the testing cheaper when Truenat is

Also, a peripheral-level TB test using Truenat will reduce the delay in diagnosis and when combined with improved treatment initiation rates will fare better compared with district-level Xpert testing. After all, early diagnosis and treatment initiation will help reduce TB transmission and incidence.



Looming threat: Intensifying agricultural practice and

Eastern Ghats: land use policies, climate change hit endemic plant habitats

ASWATHI PACHA

the Eastern Ghats, spread across Odisha, Telangana, Andhra Pradesh, Karnataka and Tamil Nadu, are home to unique ecosystems. Though it has over 450 endemic plant species, the region remains one of the most exploited and degraded ecosystems of India. With intensifying agricultural practices, urbanisation and pressures from mining and deforestation, the precious habitat of endemic and rare, endangered and threatened (RET) species could be reduced, even leading to species loss, notes a new study.

The broken hill-ranges of

The study team looked at available plant species data and identified 22 endemic species recorded from over 250 locations and 28 RET species recorded from nearly 800 locations in the Eastern Ghats. They then studied the soil, land use, anthropogenic activities and climate changes in these areas. They used simulations to predict how the area will change by 2050 and 2070.

The results published in *Environmental Monitoring*

and Assessment show that

by 2050 the total human population in the Eastern Ghats region is expected to reach 2.6 million, raising pressure from anthropogenic activities. There will be a demand for land for food, road and other activities leading to encroachments and threat to the habitats of endemic and RET species. Parth Sarathi Roy from Centre for Earth, Ocean and Atmospheric Sciences, University of Hyderabad explains that unsupervised tourism also affects the distribution of these species. "Ecotourism with regulatory guidelines is a positive way to educate and promote conservation. The highly threatening human activities in the Eastern Ghats area are mining, urbanisation/settlements, dam construction, firewood collecand agricultural expansion," he adds in an email to The Hindu. Prof. Roy is one of the lead auth-

The endemic species were found to be distributed in the core areas of the forests - Kalahandi, Mahendragiri, Nallamalai-Seshachalam, Kolli and Kalrayan hill forests. On the other hand, the rare, endangered and threatened species were distributed not only in the core areas but also in the periphery of the forests, thus taking a greater hit from anthropogenic disturbances.

The mean temperature and rainfall were all crucial for the plant species and simulations showed that the temperature is likely to increase by 1.8 degree Celsius by 2050 to 1.98 degree Celsius by 2070. The rainfall is also projected to increase by 113 millimetre by 2050 and 160 millimetre by 2070.

Climate change effect

The team adds that the regional or local climate change (warming) has led to frequent prolonged non-rainy days, increased number of days with maximum and minimum temperatures resulting in loss of soil moisture and soil degradation. These factors have also contributed to the occurrence of frequent forest fires, eliminating regeneration of the less-frequent endemic species in the forest.

Studies from across the globe have shown that the tropics are losing more plant biodiversity than other regions, stressing the need for urgent conservation strategies. The team adds that more studies and setting up species inventories to identify and record species can help on conservation efforts.

"It is of utmost importance that biodiversity conservation initiatives of Ministrv of Environment, Forest and Climate Change of Government of India and State forest departments focus on the Eastern Ghats to protect declining habitats of endemic and RET species. The boundaries of national parks and sanctuaries should be redefined based on the richness of endemic and RET species," says lead author Reshma Ramachandran from the University of Hyderabad.

Stray dogs may have a natural ability to understand human gestures

PRESS TRUST OF INDIA

Communications.

Stray dogs have the natural ability to understand human gestures, and respond to some cues better than the others, according to a study which may help improve our relationship with the cain the journal Frontiers in Psychology, said free-roaming dogs, which have never lived with human companions, are capable of following pointing cues to locate food rewards.

For the first time, researchers, including those from the Indian Institute of Science Education and Research (IISER) Kolkata, tested 160 adult stray dogs across several Indian cities.

In the study, the scientists placed two covered bowls on the ground – one containing chicken, and another with just the scent of the food. Then a second experimenter, who didn't know which bowl had food, pointed at one of the bowls.

we would bend down and take the pointing finger very close to the bowl so that a dog could understand that we're trying to point to that bowl. And there we had actually seen that only 50% of the dogs could understand, perhaps because some of the dogs were apprehensive that the human is trying to attack them," study co-author Anindita Bhadra from IISER Kolkata told Press Trust of India.

She said the 50% of dogs which approached the experimental set up comfortably were assessed further.

Distal pointing

"In another case, while standing upright, I put my hand out, pointing at the Dr. Bhadra explained.

In distal pointing, she added, there are two kinds. "One is dynamic pointing, where I put my hand out with one finger pointing, and continued to hold it for a minute. And the other one is called momentary distal pointing, in which I point just for a couple of seconds, and then don't giveany

cues," she explained. In both dynamic and momentary pointing, the study noted that about 80% of the dogs, which could approach the experimental set-up, were able to follow the cues and get the food reward.

Based on the experiment, Dr. Bhadra and her team, believe that stray dogs knew points to an object, suggesting that their ability to pick up cues from humans could be a natural trait.

The researchers speculate that stray dogs pick some gestures, and don't follow some, perhaps due to the typical way in which people in India provide food to freeroaming dogs. "While this has not been extensively tested, it is likely that dogs are more accustomed to humans throwing a piece of food away from themselves as a response to begging, or to a human dropping food on the ground and moving away," the researchers write in the

"However, though the proximal pointing cue is confollow from a completely anthropomorphic perspective to an untrained dog, this might be a more difficult situation, with an unfamiliar human constantly pointing at the container, and thereby being in very close proximity to the food source," they

If a bowl they had pointed at turned out to be empty, the researchers said that the adult dogs were less likely to follow the pointing cue again.

Dog personalities

Based on these observations and earlier studies, the researchers said, humans inadvertently play a role in shaping the personalities of stray Dr. Bhadra and team suggest that the study may provide insights on how humans influence the behaviour of dogs on the streets, and help in better management of dog-human conflicts which commonly occur in India's urban areas.

The findings also solve important pieces of the puzzle of what made dogs special for human domestication thousands of years ago, the researchers said.



Question Corner

Geometry of lines

Q Why do two parallel lines appear to meet at an infinite distance?

A KABIR H. BISWAS College of Health & Life

Hamad Bin Khalifa University Doha, Qatar

In flat space, two parallel lines never meet, however, they appear to meet at very distances for the same reason due to which objects appear smaller when they are at a distance than when they are closer. In order to understand this, we may consider that the space between the two lines are filled with thin but equal sized objects (another set of infinitely large number of lines) perpendicular to the lines themselves. Now,

when we look at the perpendicular lines, the size of those lines decreases due to an increase in the angle of vision. Therefore, one of those lines that is located infinitely farther from the observer will appear to be a point object and this, the distance the between the parallel lines appear to be zero.

This week's questions

Q Why are people with high blood pressure discouraged from doing exercises that involve lifting weights (isotonic)? What is the mechanism by which aerobics, walking and swimming help in reducing blood pressure?

Q What is the best way to increase battery life - charge them only when they have almost drained or when it drops below a certain percentage?

Readers may send their questioncorner@thehindu.co.in

IIT Bombay efficiently removes heavy metals from water

The nanostructure showed 80-90% adsorption efficiency for arsenic, chromium, cadmium, mercury

R. PRASAD

Simultaneously removing heavy metals such as arsenic, chromium, cadmium and mercury from waste water with very high efficiency now appears possible, thanks to the work of researchers at the Indian Institute of Technology (IIT) Bombay. The carbon-based nanostructure that the team fabricated shows 80-90% adsorption efficiency for all the four heavy metals studied.

No electricity is required for the nanostructure to remove heavy metals from water as it allows for gravity-driven purification of the water. The nanostructures can be recycled and reused multiple times. While there is an initial drop of about 8% after the first cycle, the efficiency remains constant at 75-85% in the subsequent cycles. The carbon nanostructure is able to adsorb the heavy metals in the wide range of pH conditions - pH 2 to 13. The results were published in the

Materials. To fabricate the carbonbased nanostructure shaped like a marigold flower, the

journal ACS Applied Nano



the nanostructure with mild acid, says Ananya Sah

team led by Chandramouli Subramaniam from the Department of Chemistry at IIT Bombay used dendritic fibre nanosilica spheres as template. The nanostructure is obtained through a singlestep process of chemical vapour deposition followed by removing the silica template.

Marigold-like stucture "What we get is a marigoldlike nanostructure made of

carbon that has high specific surface area, optimal porosity and pore volume. The nanostructure has 15-20% micropores (less than 2 nanometre) and 80-85% mesopores (2-50 nanometre)," says Prof. Subramaniam. "The reason it shows very high adsorption efficiency is its hydrophilic [water-loving nature] nature that allows for extensive and rapid interaction between the heavy metal-containing water and the carbon nanostructure." Also, unlike activated carbon, the surface area of our nanostructure is easily accessible for heavy metals. So the adsorption is high.

When the water containing the heavy metals comes in contact with the nanostructure, majority of adsorption first takes place in the micropores. "It is energetically more favourable for the heavy metals to bind to the nanostructure in the micropores. Once the micropores get saturated then the heavy metals are captured by the mesopores," says Maku Moronshing from IIT Bombay and one of the first authors of the paper.

For the four heavy metals to get adsorbed on the nanostructure the water has to be in contact with the nanostructure for at least 32 seconds. The team used a 1 cm long column of the nanostructure to make sure that minimum contact time is maintained.

Recovering heavy metals "Since the heavy metals chemically react and bind to the surface of the nanostructure, they do not leach back into the water. They can be recovered by treating the nanostructure with mild acid (hydrochloric acid and nitric acid)," says Ananya Sah from IIT Bombay and the other first author of the paper.

"The heavy metals have greater affinity for acid and so they leach out into the acid. This allows us to reuse the carbon nanostructure multiple times," says Prof. Subramaniam. There is about 10% drop in efficiency after the first cycle as the metals trapped in the micropores do not get leached out when treated with acid. But there is complete recovery of metals trapped in the mesopores.

ors of the paper.

The team tested the ability of the structure to adsorb heavy metals in industrial effluent over a range of pH conditions (pH 2-13). The industrial effluent was simulated by mixing 100 ppm of each metal. "Adsorption was as effective as the test case for all the four heavy metals. At very acidic pH of 2, some metals did not get adsorbed. But between pH 5-10 the adsorption was very good for

all the four metals," he says. Most of the adsorbents known are effective against either one or two heavy metal ions. Even the chemisorptive scavenging ones need to have longer treatment column as they need to be multifunctionalised adsorbents. Also, the inlet pressure has to be more. However, the carbon nanostructure was able to scavenge all four metals simultaneously without the need for these.

Feathers grew differently on dinosaurs and birds

REUTERS

A fossil of a fierce little Chinese dinosaur dubbed the "dancing dragon" that lived 120 million years ago is showing scientists that feathers grew differently on dinosaurs than on birds

Wulong's fossil, unearthed in Liaoning Province in northeastern China, includes a complete skeleton as well as soft tissues like feathers rarely preserved in such detail. At the end of its long, bony tail – fused into a stiff rod -were two very long feathers.

"Here is an animal that has all kinds of signals of being a juvenile, outside its bones, inside its bones, in its joints," said San Diego Natural History Museum paleontologist, and study author, Ashley Poust. "And it has long, isolated plumes extending from its alreadyvery-long tail. This is quite different from living birds and tells us that these decorative feathers preceded adulthood in dinosaurs."