CHEMWATCH

Bulletin Board

Contents

NOV. 19, 2021

(click on page numbers for links)

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HAZARD ALERT

GOSSIP

CURIOSITIES

CHEMWATCH
Bulletin Board
Contents
NOV. 19, 2021

TECHNICAL NOTES

ASIA PACIFIC

Philippine government tights regulations on highly toxic cadmium and hexavalent chromium

2021-11-08

The Government of the Philippines has imposed new policies tightening regulations on the industrial uses of cancer-causing cadmium and hexavalent chromium to protect human health and the environment.

The toxics watchdog group EcoWaste Coalition, which actively participated in the consultative processes, welcomed the new regulations targeting substances belonging to the Philippine Priority Chemicals List (PCL), which enumerates chemicals determined by the authorities to potentially pose unreasonable risk to public health, workplace, and the environment.

Through separate Chemical Control Orders (CCOs) published last month, the Department of Environment and Natural Resources (DENR) directed persons or entities engaged in the importation, manufacture, distribution and industrial use of cadmium and its compounds, as well as hexavalent chromium (or chromium VI) compounds, to register with and obtain importation clearance from the Environmental Management Bureau (EMB).

The "CCO for Cadmium and Cadmium Compounds" was published on October 22 and will take effect on November 6, while the "CCO for Chromium VI Compounds" was published on October 26 and will enter into force on November 10. Both CCOs were signed by DENR Secretary Roy Cimatu last May 6.

Both CCOs were signed by DENR Secretary Roy Cimatu last May 6.

Concerned persons or entities are required to comply with the requirements pertaining to importation, manufacturing, handling, transport, treatment, storage and disposal as per DENR Administrative Order 1992-29, which provides for the Implementing Rules and Regulations of Republic Act No. 6969, also known as the "Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990." They will also be required to submit chemical management, emergency and contingency plans, conduct workers' safety training, as well as conform to the provisions of the Globally Harmonized System (GHS) of classification and labeling of chemicals.

"We welcome the CCO regulating industry use of cadmium as this can contribute to safeguarding the health of workers and the general public

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 19, 2021

from the adverse effects of exposure to this highly toxic element," said Thony Dizon, Chemical Safety Campaigner, EcoWaste Coalition.

"As the CCO does not cover cadmium and cadmium compounds in batteries, ceramics, cosmetics, electronics, jewelry, plastics, toys and others, we hope other regulatory agencies will adopt and/or enforce health-protective controls or restrictions on the cadmium content in products and materials under their jurisdiction to protect consumers and the environment," he added.

"We also see the promulgation of the chromium VI CCO as a positive step that will hopefully lead to the replacement of this compound in industrial processes, especially when feasible and non-toxic alternatives have been identified," Dizon also said.

In a position paper submitted to the Environmental Management Bureau (EMB) in March 2017, the EcoWaste Coalition cited prohibitions on Cr(VI) in other countries. For example, the REACH Regulation of the European Chemicals Agency banned the use of Cr(VI) for surface treatment by September 2017. REACH refers to the regulations on the Registration, Evaluation, Authorization and Restriction of Chemicals in the European Union (EU). The EU likewise phased out corrosion-resisting paint additives in January 2019.

Under the CCO, the use of Cr(VI) will be "strictly regulated" in activities relating to the manufacture of pigments, inks, textile dyes, protective coatings and paints, stainless steel, and electronic equipment or electroplating. The strict regulation will also apply to the operation of laboratory facilities and tanneries.

The DENR through the EMB may develop a phase-out plan for uses of cadmium and chromium VI in consultation with other agencies and stakeholders as stated in the CCOs.

Read More

Pressenza, 8 November 2021

https://www.pressenza.com/2021/11/philippine-government-tightens-regulations-on-highly-toxic-cadmium-and-hexavalent-chromium/

APVMA Gazette No. 22, 2 November 2021

2021-11-02

- PDF (656 KB) | DOCX (178.21 KB)

- PDF (656 KB) | DOCX (178.21 KB)

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Contents

Content last updated:

2 November 2021

Content last reviewed:

2 November 2021

URL: https://apvma.gov.au/node/93341

APVMA, 2 November 2021

https://apvma.gov.au/node/93341

Removing an Inventory listing following evaluation

2021-11-11

An evaluation for benzene, 1,1'-oxybis-, pentabromo derivative (pentabromodiphenyl ether; CAS number 32534-81-9) was completed under Part 4 of the *Industrial Chemicals Act 2019 (IC Act)*.

Public consultation was conducted as part of this evaluation.

The evaluation statement was published on the 22 October 2021.

For the reasons set out in the evaluation statement (refer to page 7/ paragraph 7 – page 8/paragraph 2), the Executive Director was not satisfied that the risks to human health or the environment from the introduction or use of pentabromodiphenyl ether can be managed within existing regulatory frameworks.

The evaluation statement was published on the 22 October 2021.

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 19, 2021

Accordingly, the Executive Director will remove pentabromodiphenyl ether from the Australian Inventory of Industrial Chemicals (Inventory) on 10 December 2021 in accordance with s95 of the IC Act.

Read More

Australian Government Department of Health, 11 November 2021

https://www.industrialchemicals.gov.au/news-and-notices/removing-inventory-listing-following-evaluation

AMERICA

Why 'hazard based' agricultural chemical regulation doesn't work

2021-11-11

In many ways, various governments have passed regulations with a "one size fits all" mentality. More often than not, however, this approach wrongly limits consumer choice, and more importantly creates tremendous externalities which are often left unaddressed. Our goal is to highlight instances where the "one size fits all" approach has failed consumers and explain why.

Our goal is to highlight instances where the "one size fits all" approach has failed consumers and explain why.

Concern over glyphosate in food has become a major topic the last couple of years and has gained a lot of media attention in a recent study where they found that organic beers and wines contained small traces of glyphosate – a pre-harvest herbicide and harvest aid used on cereal crops like wheat, oats and vegetable seed oils like canola and sunflower. However, the U.S. Environmental Protection Agency's safety limit for glyphosate is 100 times greater than the amounts found in the beer and wine samples, and thus, the risk of human contamination is extremely low. Nevertheless, policymakers want to ban glyphosate which would reduce crop yields and make beer and wine even more expensive.

You probably heard about the "Beepocalypse" – the catastrophic scenario in which declining honeybee population is caused by pesticides. However, honeybees aren't actually declining but increasing. Occasional

reductions in honeybee populations are multifactorial, but varrora mites and the viruses they carry are likely the leading drivers, nutrition being another big factor. According to a USDA bee researcher: "If there's a top ten list of what's killing honey bee colonies, I'd put pesticides at number 11" . By creating a "one size fits all" regulation and thus banning pesticides, policymakers could make the mite problem worse which would actually harm honey bee colonies instead of protecting them.

Read More

Consumer Choice Center, 11 November 2021

https://geneticliteracyproject.org/2021/11/11/why-hazard-based-agricultural-chemical-regulation-doesnt-work/

EPA revises mercury inventory reporting rule to remove reporting exemption

2021-11-10

On November 8, 2021, the U.S. Environmental Protection Agency (EPA) published a final rule revising the regulations associated with persons who must report data to the mercury inventory established under the Toxic Substances Control Act (TSCA). 86 Fed. Reg. 61708. The revisions implement an order issued by the U.S. Court of Appeals for the Second Circuit on June 5, 2020, that vacated the exemption at 40 C.F.R. Section 713.7(b)(2) for persons who import pre-assembled products that contain a mercury-added component. As a result, such persons are now required to report pursuant to 40 C.F.R. Section 713.7(b). EPA states that the rule is effectuating the vacatur ordered by the Second Circuit by making necessary amendments to the corresponding text in 40 C.F.R. Section 713.7(b). The final rule will be effective on **December 8, 2021**. EPA states in its November 2, 2021, press release that the final rule "offers impacted communities adequate notice of the amended reporting requirements, as the deadline for reporting 2021 data is **July 1, 2022**." EPA will update the mercury inventory reporting rule compliance guide and other supporting materials to reflect these new reporting requirements.

The final rule will be effective on December 8, 2021.

As reported in our June 25, 2018, memorandum, "EPA Publishes Final Reporting Requirements for TSCA Mercury Inventory," the mercury rule and its reporting requirements apply to any person who manufactures

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 19, 2021

(including imports) mercury or mercury-added products, or otherwise intentionally uses mercury in a manufacturing process (including processes traditionally not subject to TSCA, such as for the manufacture of pharmaceuticals and pesticides).

Read More~sTSCA Blog, 10 November 2021

http://www.tscablog.com/entry/epa-revises-mercury-inventory-reporting-rule-to-remove-reporting-exemption

Your herbs and spices might contain arsenic, cadmium, and lead

2021-11-09

CR tested 126 products from McCormick, Trader Joe's, Whole Foods, and other popular brands. Almost a third had heavy metal levels high enough to raise health concerns.

Open a drawer or cabinet in any kitchen in the U.S., and you're likely to find several jars of dried herbs and spices.

Jessica Clark, a mother of two from Lincoln, Neb., says she uses them so often that she buys in bulk and mixes her own blends. Erica Burger of Carmel, Ind., says she became "hooked" on a 21-spice mixture—so much so that she now uses it in all sorts of dishes. "This is so flavorful, I use less salt in general," she says. And Joey Davis, who grew up in San Diego, "where Mexican food is on every corner," and whose Jamaican wife "puts habanero in everything, including cucumber salad," says that in his home, "you can't imagine any dish without spices and herbs."

"This is so flavorful, I use less salt in general," she says.

For many of us, herbs and spices play a large role in our cooking and in our family's lives. A recipe may call for just a pinch or three of cumin, cayenne, and garlic powder, but what would your grandmother's arroz con pollo be without them? And what about your secret Simon & Garfunkel fish rub—you know, the one with parsley, sage, rosemary, and thyme?

Yes, those seasonings really can add spice to our lives, filling our kitchens with tempting aromas and creating memories of people and places linked to special meals. But along with the flavor and memories, herbs and spices could add something less savory to your diet: potentially dangerous heavy metals.

That's according to Consumer Reports' tests of 15 types of dried herbs and spices used in a variety of cuisines. We looked at 126 individual products from national and private-label brands, such as Great Value (Walmart), La Flor, McCormick, Penzeys, Spice Islands, and Trader Joe's. Read more about how CR tested herbs and spices (PDF).

Read More

CR. 9 November 2021

https://www.consumerreports.org/food-safety/your-herbs-and-spices-might-contain-arsenic-cadmium-and-lead/

After years of delays, Southern California's new smog regulation promises to save lives

2021-11-10

The new regulation is expected to prevent nearly 400 premature deaths over the next 15 years.

Across the globe, the amount of pollution you breathe is highly dependent on where you live. This is apparent in Southern California, where the combination of dust, sulfur oxides, and nitrogen oxides known as smog has been on the rise over the last two decades. Between 2010 and 2017, Southern California experienced a 10 percent increase in deaths related to smog, hitting communities of color across the Southern Los Angeles and Inland Empire regions the hardest.

On Friday, however, as world leaders gathered in Glasgow, Scotland, to discuss efforts to curtail climate change, a 13-member regulatory board in Southern California approved a major new rule, known as Refinery Rule 1109.1, that could dramatically clean the region's air.

Decades in the making, the regulations will require 16 facilities, including 12 oil refineries located in Los Angeles, San Bernardino, and Orange Counties, to install pollution controls on outdated equipment, most notably heater and boiler systems, by 2031. The rule was under consideration because the air district had failed to meet federal smog standards, and also because the state's environmental justice law, AB 617, targeted cleaning up the air in industry-adjacent communities across the state.

Passed in 2017, AB 617 directs local air districts to speed up refinery retrofits to cut pollution and also work with community members to develop emission reduction plans. Local air quality regulators faced

Between 2010 and 2017, Southern California experienced a 10 percent increase in deaths related to smog, hitting communities of color across the Southern Los Angeles and Inland Empire regions the hardest.

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 19, 2021

pressure to pass the refinery rule under both provisions of AB 617. The rule comported with the law's mandate to hasten refinery upgrades, and communities included the passage of the rule as a priority in their emissions reduction plan.

The new pollution control equipment will reduce harmful air pollutants — particularly nitrogen oxides, or NOx — by as much as 8 tons every day. The South Coast Air Quality Management District passed the rule unanimously after two hours of public comment and deliberation on Friday morning.

"This is a critical ruling and moment," said Julia May, a senior scientist at the environmental justice group Communities for a Better Environment. "You can't completely clean these industries up — they're inherently dirty — but in the meantime of a transition away from them, this is part of what we can do to require them to not put out these health-harming pollutants into communities."

Read More

Grist, 10 November 2021

https://grist.org/regulation/southern-california-smog-rule-scaqmd-wilmington-refineries

EUROPE

London's River Thames, now home to sharks, seals and sea horses, is no longer 'biologically dead'

2021-11-12

Some 60 years ago, parts of the River Thames were declared biologically dead. But the famous waterway that cuts through London has been revived and is now home to hundreds of wildlife species, such as sea horses and sharks.

The latest State of the Thames report, released by the Zoological Society of London on Wednesday, found that cleanup efforts over recent decades have brought down levels of chemicals such as phosphorus and conserved salt marshes for birds and fish, making the river "home to myriad wildlife as diverse as London itself."

The report also highlighted many challenges the Thames faces, including rising water temperatures and sea levels due to climate change.

The report also highlighted many challenges the Thames faces, including rising water temperatures and sea levels due to climate change. For instance, summer temperatures in parts of the river have increased an average of 0.19 degrees Celsius (0.34 degrees Fahrenheit) each year since 2007, researchers found. Even slight alterations in seasonal heat may upset the river's ecosystem and erode living habitats.

The researchers also found elevated nitrate concentration that threatens water quality. Much of London's drinking water comes from the river.

Among modern cities, the Thames hasn't always been a model for successful environmental protection. It became heavily polluted during the Industrial Revolution as toxic runoffs from tanneries and human waste found their way to the river. The "Great Stink" of 1858, caused in part by human sewage flowing into the Thames, forced the British Parliament to build better wastewater disposal systems.

But even in 1959, oxygen levels in the Thames had dropped so low that the British Natural History Museum declared it biologically incapable of sustaining marine life. At around this time, authorities began investing in better sewage treatment facilities and better monitoring key environmental indicators, sparking a turnaround.

Read More

The Washington Post, 12 November 2021

https://www.washingtonpost.com/world/2021/11/11/sharks-thames-river-london/

New EU research project investigates possible combination effects of chemicals in the womb

2021-11-03

Already during pregnancy, the unborn child is exposed to many different chemical compounds. Up to now, however, mainly individual substances have been tested for potential health risks. A European team with the participation of the Federal Institute for Risk Assessment (BfR) is breaking new ground here. The "Panoramix" research project is inter alia looking into whether mixtures of different substances have harmful effects on unborn and developing children that are not adequately covered by the existing assessment system. The project, led by the Technical University of Denmark, will run for four years and is supported by the European Commission through the Horizon 2020 programme with €4.4 million. Panoramix does not involve animal testing. In the project, extracts from drinking water, food and umbilical cord blood, are inter alia examined for possible harmful effects using in vitro methods that do not involve animal experiments. The focus is on effects that impair the child's development of the nervous system or reproductive ability before and also after birth. Samples, in which the in vitro tests indicate an effect, are analysed further and the substances in the sample that contribute most to a possible health hazard are identified. The information obtained in this way will inter alia be compared with data obtained in the "Odense Child Cohort" project. The aim of this long-term project is to study environmental influences on early child development. Between 2010 and 2012, blood samples were taken from the parents of over 2500 pregnancies at the University Hospital in the Danish municipality of Odense. The development of the children born from these pregnancies has been monitored medically ever since.

The project, led by the Technical University of Denmark, will run for four years and is supported by the European Commission through the Horizon 2020 programme with €4.4 million.

Read More

BFR, 3 November 2021

https://www.bfr.bund.de/cm/349/new-eu-research-project-investigates-possible-combination-effects-of-chemicals-in-the-womb.pdf

INTERNATIONAL

Methane action: Tackling a warming planet

2021-11-05

Despite what we know about the consequences of letting our planet warm, the world hasn't done enough to cut greenhouse gas emissions. Now we are up against the clock. To limit climate change to 1.5°C, the world needs to almost halve greenhouse gas emissions. In just eight years.

We need fast-acting solutions that bring deep cuts to emissions to have any chance of doing so. As the IPCC has clearly said, we need methane emission reductions.

Methane in the atmosphere is over 84 times more potent than carbon dioxide over a twenty year time horizon. But it does not linger as long as carbon: just 10-12 years. So, actions to cut methane emissions can yield

To limit climate change to 1.5°C, the world needs to almost halve greenhouse gas emissions. In just eight years.

quick reductions in the rate of warming, while also delivering air quality benefits.

In fact, the Global Methane Assessment, from UNEP and the Climate and Clean Air Coalition, found that low cost-actions could almost halve anthropogenic methane emissions. Proven measures could shave 0.28 degrees Celsius from the forecasted rise in the planet's average temperature by 2050.

We have seen the world increasingly take this message on board.

The US- and EU-led Global Methane Pledge is a welcome effort. Over 100 countries are aiming to knock 30 per cent off methane emissions in the fuel, agriculture and waste sectors by 2030. The fossil fuel industry has the highest potential for reductions, much of it at no net cost. Wasted methane could be used as natural gas to fuel power plants or homes.

Read More

UNEP, 5 November 2021

https://www.unep.org/news-and-stories/speech/methane-action-tackling-warming-planet

Roadmap to net zero: delivering science-based targets in the apparel sector

2021-11-12

The World Resources Institute (WRI) and the Apparel Impact Institute (Aii) introduce "Roadmap to Net Zero," a report and guide calling for the system-wide collaboration needed to reduce GHG emissions of the apparel and footwear industry by 45% at minimum by 2030 and to zero by 2050.

By identifying six interventions in materials and production, the report offers a map to prioritize decarbonization efforts within the industry. These six interventions deliver more than 60% of the necessary reductions to align with the 1.5-degree Celsius scenario.

1. Maximizing material efficiency.
2. Scaling sustainable materials and practices.
3. Accelerating the development of innovative materials.
4. Maximizing energy efficiency.

CHEMWATCH
Bulletin Board
Regulatory Update
NOV. 19, 2021

5. Eliminating coal in manufacturing.
6. Shifting to 100% renewable electricity.

A seventh intervention, to advance the circular economy, undergirds both materials and production.

Read More

All, 12 November 2021

https://apparelimpact.org/roadmap-to-net-zero-report-2021/

By identifying six interventions in materials and production, the report offers a map to prioritize decarbonization efforts within the industry.

Publication of draft recommendations to the list of substances subject to authorisation (Annex 14) for UK REACH – invitation to submit comments

2021-11-11

In line with the UK REACH work programme 2021-22, at the end of August HSE published draft recommendations for substances for inclusion in Annex 14.

Two substances are included in the draft first recommendation:

- disodium octaborate
- dicyclohexyl phthalate (DCHP)

Interested parties are invited to submit comments on these substances by 30 November.

Read More

UK HSE, 11 November 2021

https://content.govdelivery.com/accounts/UKHSE/bulletins/2fb389e

OECD QSAR toolbox applications for REACH and beyond

2021-11-12

Webinar date

30 November 2021 11:00 - 13:00 EET

Summary

The webinar presents the experience of different stakeholders using the QSAR Toolbox. After a status overview given by OECD, ECHA will present how the QSAR Toolbox results are used and assessed in different REACH processes. The webinar will continue with presentations from academia (Danish Technical University, DTU) and governmental organisations (Italian National Institute of Health, ISS; Environment and Climate Change Canada,

CHEMWATCH
Bulletin Board
REACH Update
NOV. 19, 2021

Interested parties are invited to submit comments on these substances by 30 November.

ECCC; National Institute of Technology and Evaluation, NITE Japan) about their uses of the QSAR Toolbox.

The OECD QSAR Toolbox is a free software for screening and assessing chemical substances that uses computational methods as an alternative to animal testing. It is used worldwide by over 25,000 users such as regulatory authorities, industry, academia, and non-governmental organisations. The Toolbox is developed by ECHA and OECD.

The webinar will be published on our home page on 30 November at 11:00 Helsinki Time (EET, GMT +2). Q&A will be open until 13:00 Helsinki Time. You can send your questions by joining the Q&A session here.

You can also send questions in advance to ECHA experts and participants: *qsar-toolbox(at)echa.europa.eu*.

Read More

ECHA, 12 November 2021

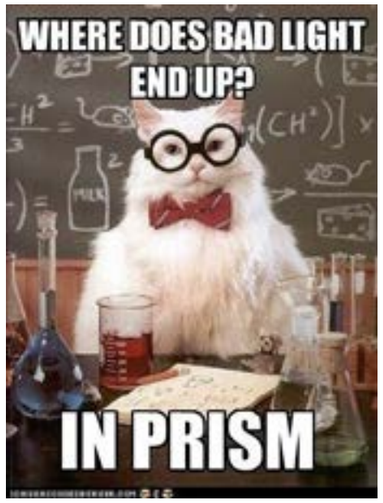
https://echa.europa.eu/-/oecd-qsar-toolbox-applications-for-reach-and-beyond

Janet's Corner

NOV. 19, 2021

Prism

2021-11-19



https://www.siliconrepublic.com/science/science-week-puns-chemistry-jokes-memes

CHEMWATCH
Bulletin Board

Hazard Alert

NOV. 19, 2021

Chlorine Dioxide

2021-11-19

Chlorine dioxide is a chemical compound with the formula ClO_2. [1] It is a synthetic, green-yellowish gas with a chlorine-like, irritating odour. Chlorine dioxide is a neutral chlorine compound, which is very different from elementary chlorine, both in its chemical structure as in its behaviour. Chlorine dioxide is a small, volatile and very strong molecule. In diluted, watery solutions it is a free radical. At high concentrations it reacts strongly with reducing agents. Chlorine dioxide is an unstable gas that dissociates into chlorine gas (Cl_2), oxygen gas (O_2) and heat. When it is photo-oxidised by sunlight, it falls apart. The end products of chlorine dioxide reactions are chloride (Cl-), chlorite (ClO-) and chlorate (ClO_3-). At –59°C, solid chlorine dioxide becomes a reddish liquid. At 11°C chlorine dioxide turns into gas. It is 2 - 4 times denser than air. As a liquid, chlorine dioxide has a bigger density than water. One of the most important qualities of chlorine dioxide is its high water solubility, especially in cold water. It does not hydrolyse when it enters water; it remains a dissolved gas in solution. Chlorine dioxide is approximately 10 times more soluble in water than chlorine. Chlorine dioxide can be removed by aeration or carbon dioxide. [2]

Chlorine dioxide is a chemical compound with the formula ClO2.

USES [3]

The major use of chlorine dioxide is as a bleach in a number of industries: in cleaning and de-tanning of leather, and as a bleaching agent for wood pulp, fats and oils, cellulose, flour, textiles, and beeswax. Chlorine dioxide is registered as a bactericide, fungicide and algaecide. It is used to disinfect human drinking water systems, commercial water-cooling tower systems, and metal cutting fluids. It may also be used to disinfect dairy farm animals and milking equipment, in eating establishments and food processing/handling areas and around the house. It is used extensively in Europe for disinfecting drinking water, and its use there is increasing as well as in North America and Australia, as an alternative to chlorine due to lesser problems with disinfection by-products. Furthermore, it is an approved food additive in Australia (No. 926).

IN THE ENVIRONMENT [4]

Chlorine dioxide is a very reactive compound and breaks down quickly in the environment. In air, sunlight rapidly breaks down chlorine dioxide into chlorine gas and oxygen. In water, chlorine dioxide quickly forms chlorite.

Chlorite in water may move into groundwater, although reactions with soil and sediments may reduce the amount of chlorite reaching groundwater. Neither chlorine dioxide nor chlorite build up in the food chain.

SOURCES OF EMISSION & ROUTES OF EXPOSURE

Sources of Emission [3]

- Industry sources: Paper and allied products industries; textile mills; chemical industries: food processing industries; drinking water treatment plants; and commercial water-cooling tower systems.
- Diffuse sources: Residues from food and drinking water that have been treated with chlorine dioxide.
- Natural sources: Because of the nature of its high chemical reactivity, it is unlikely to occur naturally.
- Consumer products: Possibly in some disinfectants and bleaches.

Foods and drinking water that have been treated with chlorine dioxide

Routes of Exposure [3,4]

Chlorine Dioxide can be absorbed into the body by inhalation, ingestion of food that has been treated with chlorine dioxide, or skin contact. Chlorine dioxide is added to drinking water to protect people from harmful bacteria and other microorganisms. Most people are exposed to small amounts of chlorine dioxide and chlorite by drinking treated water. In addition, Individuals who are employed at pulp and paper mills, municipal water treatment facilities, and other facilities that use chlorine dioxide and chlorite as a disinfectant may have high exposures to chlorine dioxide and chlorite (ions or salts).

HEALTH EFFECTS [2,4]

Acute Effects

Acute exposure of the skin to chlorine that originates from the decomposition of chlorine dioxide, causes irritations and burns. Eye exposure eyes to chlorine dioxide causes irritations, watering eyes and a blurry sight. Chlorine dioxide gas can be absorbed by the skin, where it damages tissue and blood cells. Inhalation of chlorine dioxide gas causes coughing, a sore throat, severe headaches, lung oedema and bronchio spasma. The symptoms can begin to show long after the exposure has taken place and can remain for a long time.

CHEMWATCH
Bulletin Board
Hazard Alert
NOV. 19, 2021

Chronic Effects

Chronic exposure to chlorine dioxide causes bronchitis.

Development and reproduction

Chlorine dioxide is thought to have effects on reproduction and development. However, there is too little evidence to ground this thesis. Further research is required.

Mutagenity

The Ames test is used to determine the mutagenity of a substance. The Ames test uses Salmonella bacteria that are genetically modified. No bacterial colonies are formed, unless they come in contact with a mutagenic substance that alters genetic material. Tests show that the presence of 5-15 mg/L ClO_2 increases the mutagenity of water. It is difficult to prove the mutagenity of chlorine dioxide and chlorine dioxide by-products, because the substances are biocides. Biocides usually kill the indicator organisms that are used to determine mutagenity.

Carcinogenicity

There are no studies on cancer in humans exposed to chlorine dioxide. Based on inadequate information in humans and in animals, the International Agency for Research on Cancer (IARC) and the EPA have determined that chlorine dioxide are not classifiable as to human carcinogenicity.

SAFETY [5]

First Aid Measure

- Inhalation: Remove victim from area of exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. If patient finds breathing difficult and develops a bluish discolouration of the skin (which suggests a lack of oxygen in the blood - cyanosis), ensure airways are clear of any obstruction and have a qualified person give oxygen through a facemask. Apply artificial respiration if patient is not breathing. Seek immediate medical advice.
- Skin Contact: If spilt on large areas of skin or hair, immediately drench with running water and remove clothing. Continue to wash skin

and hair with plenty of water (and soap if material is insoluble) until advised to stop by the Poisons Information Centre or a doctor.

- Eye Contact: If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre or a doctor, or for at least 15 minutes. Continue to wash with large amounts of water until medical help is available.
- Ingestion: Immediately rinse mouth with water. If swallowed, do NOT induce vomiting. Give a glass of water. Seek immediate medical assistance.

Exposure Controls & Personal Protection

Engineering Controls

Ensure ventilation is adequate and that air concentrations of components are controlled below quoted Workplace Exposure Standards. If inhalation risk exists: Use with local exhaust ventilation or while wearing suitable mist respirator. Keep containers closed when not in use.

Personal Protective Equipment

The selection of PPE that should be used is dependant on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors. The recommended personal protective equipment includes:

- overalls,
- chemical goggles,
- full face shield,
- elbow-length impervious gloves,
- splash apron or equivalent chemical impervious outer garment, and
- rubber boots.
- If inhalation risk exists, wear air-supplied mask meeting the requirements of AS/NZS 1715 and AS/NZS 1716.
- Always wash hands before smoking, eating, drinking or using the toilet.
- Wash contaminated clothing and other protective equipment before storage or re-use.

CHEMWATCH
Bulletin Board
Hazard Alert
NOV. 19, 2021

REGULATION [3,6]

United States

OSHA: OSHA Permissible Exposure Limit (PEL):

- General Industry: 0.1 ppm, 0.3 mg/m^3
- Construction Industry: 0.1 ppm, 0.3 mg/m^3 TWA

ACGIH: American Conference of Governmental Industrial Hygienists Threshold Limit Value (TLV): 0.1 ppm, 0.28 mg/m3 TWA; 0.3 ppm, 0.83 mg/m3 STEL

NIOSH: National Institute for Occupational Safety and Health: Recommended Exposure Limit (REL): 0.1 ppm TWA; 0.3 ppm STEL

Australia

Australian Drinking Water Guidelines (NHMRC and ARMCANZ, 1996): Maximum of 1 mg/L (i.e. 0.001 g/L)

Safe Work Australia: Maximum time weighted exposure (TWA) level: 0.1 ppm 0.28 mg/m^3 and Maximum short term exposure level (STEL): 0.3 ppm 0.83 mg/m^3

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Rich countries still don't want to pay their climate change tab

2021-11-11

Climate change has a central injustice: The parts of the world that contribute the least to global warming stand to suffer the most as temperatures climb.

Rising sea levels, hotter heat waves, and more frequent torrential downpours disproportionately hammer low-lying coastal areas, islands, tropics, and deserts that are home to people who historically haven't burned that much coal, oil, or natural gas. The slow and acute impacts of climate change are already destroying homes, forcing migrations, and taking lives, particularly in countries that have few resources to begin with. According to the United Nations Office for the Coordination of Humanitarian Affairs, the most vulnerable countries to climate change include Haiti, Myanmar, Mozambique, Zimbabwe, and the Bahamas.

Meanwhile, major producers and consumers of fossil energy, like the United States, have become the wealthiest countries in the world. That wealth also means more government and private resources to respond to a warming world, whether by building infrastructure to withstand higher tides, managing forests to reduce severe wildfires, or compensating citizens for their flood-ruined homes.

That inequity is the undercurrent of the United Nations' ongoing COP26 climate negotiations in Glasgow, Scotland. The meeting is an opportunity for major polluters and those suffering from the effects to sit across from one another — and the countries bearing the brunt of global warming say that addressing this central injustice must be at the core of any climate agreement. Otherwise, hopes of reaching concordance on other key climate issues could fall apart.

vox.com, 11 November 2021

https://www.vox.com

The slow and acute impacts of climate change are already destroying homes, forcing migrations, and taking lives, particularly in countries that have few resources to begin with.

Rare 'cotton candy' lobster was a 1-in-100 million catch

2021-11-12

A Maine lobsterman recently made a one-in-a-hundred-million catch when he pulled up a rare lobster with a bright blue, speckled shell, the color of fairground cotton candy.

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

The lobsterman, Bill Coppersmith, caught the so-called cotton candy lobster on Nov. 5 in Casco Bay, an inlet of the Gulf of Maine. "Bill and his crew were extremely excited," said Mark Murrell, CEO of the seafood company Get Maine Lobster, for which Coopersmith is a contract fisherman. Coppersmith named the baby-blue crustacean Haddie, after his granddaughter, and he quickly alerted Get Maine Lobster of the catch, Murrell told Live Science in an email.

Cotton candy lobsters are certainly a rarity, although it's unclear exactly how many exist in the wild, according to National Geographic. That said, the whimsically colored crustaceans turn up about once every four to five years, Michael Tlusty, associate professor of sustainability and food solutions at the University of Massachusetts Boston, told National Geographic.

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"It is so rare, there's only 1 in 100 million caught," Murrell said in a recent video about Haddie. Coopersmith, who has been a lobsterman for 40 years, has caught two other rare lobsters in the past, one white and one orange, Murrell told Live Science. He named those colorful crustaceans after his grandchildren as well.

Lobsters get their color from a pigment and antioxidant called astaxanthin, and the shape of this compound changes when other proteins bind to it, according to National Geographic. When you cook lobster, the chemical bonds holding proteins to the pigment break, freeing astaxanthin throughout the lobster's shell and skin, and making the animal appear bright red, Nature reported.

But in live lobsters, some proteins grab hold of astaxanthin and contort the molecule so much that the twisted version absorbs and reflects different wavelengths of light; the reflected wavelengths give the pigment its color. Binding to certain proteins makes astaxanthin appear blue, other proteins make it look yellow and any free-floating astaxanthin in the lobster looks red, National Geographic reported.

The mix of these many colors usually gives lobsters their mottled, burnt orange and brown appearance, but every once in a while, a cerulean lobster like Haddie crops up.

This drastic shift in coloration may stem from the lobster having unusually low astaxanthin levels, due to a diet that's low in the compound; this could happen if the lobster mostly fed on bait fish, rather than the typical

lobster diet of astaxanthin-rich crab and shrimp. If that's the case, what little astaxanthin the lobster consumed would have to primarily bind with proteins that cause the pigment to look blue, to give the animal that cotton candy color. Or alternatively, the lobster's color could be the result of a genetic quirk that alters the proteins that bind to the pigment, thus changing its apparent color, according to National Geographic.

Whatever the cause of her opal-like coloration, Haddie the lobster has found a new home at the Seacoast Science Center in Rye, New Hampshire. "This is a beautiful lobster, and we want to preserve it," Murrell said in the company's recent video.

Why not release Haddie back into the Gulf of Maine? "According to the Maine Lobstermen's Community Alliance, lobsters with rare coloring may be at a disadvantage and more visible to predators, since their normal coloring helps them blend in with the environment," Murrell told Live Science. "Therefore, Get Maine Lobster donated her to the Seacoast Science Center, where she can hang out with other lobsters and be as safe as can be."

Editor's note: This article was updated on Nov. 12 at 1:30pm in order to attribute quotes to Mark Murrell, rather than Katie Oross, a Get Maine Lobster representative. The original article was published at 7:00am the same day.

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livescience.com, 12 November 2021

https://www.livescience.com

Cop26: the goal of 1.5C of climate heating is alive, but only just

2021-11-14

So, with the final deal settled, does Cop26 look like a success or failure? The unsatisfactory answer is both, but it's more the latter than the former.

In relative terms, the agreements and deals made by the 196 nations in Glasgow nudged the world a little closer towards the path to keeping global temperature rises below 1.5C and avoiding the worst of the climate crisis's impacts.

Before Cop26, firm pledges to cut emissions by 2030 pointed to 2.7C of global heating – a catastrophe.

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

But in absolute terms, there is still a mountain to climb. Before Cop26, firm pledges to cut emissions by 2030 pointed to 2.7C of global heating – a catastrophe. After, the figure is 2.4C – still a catastrophe.

Longer term promises to go to net zero emissions, notably by India, might possibly restrict heating to 1.8C by the end of the century, but lack the concrete plans to be credible. And 1.8C still means immense suffering to people and the planet.

The key agreements sealed in Glasgow essentially kick the can down the road. Big emitting nations with feeble plans to cut emissions must return in a year to improve them – that is how 1.5C can be said to still be alive. The $100bn a year to pay for clean energy in developing countries promised a decade ago for 2020 will not be delivered until 2023.

Worst of all, a deal to compensate nations for the heatwaves, storms and floods that are already hitting the most vulnerable people was booted into a talking shop. There is currently just $2m in that "loss and damage" fund – a pittance.

The climate emergency is a slow motion disaster and our escape was only ever going to be in slow motion too – remaking a world that has run on fossil fuels cannot happen overnight, particularly in the face of lobbying by rich vested interests.

But the world has been kicking the climate can down the road for three decades now. The Cop26 deal means the next 18 months will truly be make or break.

There are positives to build on. The 196 nations are now firmly fixed on the 1.5C target demanded by the science. For the first time, nations are called on to "phase down" coal and fossil fuel subsidies in a Cop text. As extraordinary as that sounds, it is a landmark that Russia, Saudi Arabia and others tried to erase, although it is regrettable India had the language watered down from "phase out" at the last minute.

Deals on ending the razing of forests by 2030, cutting emissions of methane – a powerful greenhouse gas – and making green technology like electric cars the cheapest option globally are all encouraging, even if the pact to end sales of fossil fuel powered cars stalled, with the major markets and manufacturers failing to sign up.

An end to international finance for coal power will also dent emissions and some of the most outrageous loopholes in proposed rules for a global carbon market rules were closed – but not all, and cheats may yet prosper.

Other negatives included the initiative claiming to put the world's financial institutions – which bankroll the fossil fuel industry – on a green path but it represented tiny steps.

The reaction of countries to the Glasgow deal is calibrated by the imminence of the threats they face and the resources they have to cope. The US said it was "a very important step forward". Aminath Shaunam, the delegate from the fast-disappearing island state of the Maldives, said: "This deal does not bring hope to our hearts. It will be too late for the Maldives. [We] implore you to deliver the resources we need in time."

UN climate summits are more complex these days, according to Saleemul Huq, a COP veteran from Bangladesh: "We now have to deal with two climate change problems: the old one of preventing catastrophic impacts for everyone if we go above 1.5C and a new one of dealing with the loss and damage already happening due to the increase already of 1.1C."

Cop26 could have and should have achieved more. So why did it not? The Covid pandemic made the essential diplomatic leg work ahead of the summit hard to conduct. The pandemic also curtailed the protests by millions of young people, whose voice and moral authority was so powerful.

The host, the UK, may not have helped build the trust required to land a strong deal by cutting overseas aid in the run up, for which it was called out in the halls of Glasgow. Failing to join an alliance to phase out oil and gas at its own summit and planning a new oil field at home cannot have helped either.

In the closing hours of Cop26, countries repeatedly said they were accepting weaker proposals than they wanted in the "spirit of compromise". But there is no compromising with the science of global heating. UN secretary general António Guterres said in Glasgow that the goal of 1.5C was "on life support". It still is.

theguardian.com, 14 November 2021

https://www.theguardian.com

Rising temperatures overcook bumblebees' brunch

2021-11-10

Bumblebees pollinate many of our favorite foods, but their own diet is being upset by climate change, according to a new UC Riverside study.

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

There's a sweet spot where floral nectar that bees eat has just the right balance of microbes like bacteria and yeast in it. Hotter weather can upset the balance, endangering the bees' health and potentially, our own.

A new study in the journal Microbial Ecology examines the effects of these nectar composition changes on an American bumblebee. Without bumblebees, who perform a type of pollination that honeybees do not, it would be difficult to mass produce food crops like tomatoes, blueberries, peppers, or potatoes.

"Micro changes in floral nectar may alter the way bees forage and look for food, affecting their health and in turn, potentially affecting human health, by reducing the availability of fresh foods," said UCR entomologist and study lead Kaleigh Russell.

Bumblebees do enjoy nectar with some microbes in it, but too much of a good thing can deter them, Russell said.

Hotter weather can upset the balance, endangering the bees' health and potentially, our own.

With even a small increase in temperature, microbes' metabolism speeds up, causing them to reproduce more and eat up a higher percentage of the sugars in the nectar. "Less sugar means the nectar could be less palatable for our pollinators," Russell said.

To test the bumblebees' taste preferences, Russell made nectar in a laboratory. Some was sterile and some contained microbes, and she grew both at a lower and a higher temperature.

The lower temperature, 80.6 degrees Fahrenheit, represents the average springtime high for Riverside in 2017. The higher temperature, 89.6 F, corresponds with what the predicted average temperature will be at the end of the century due to climate change.

A clear preference for some level of microbes was evident even when the nectar contained less sugar. However, the bees only went for this less sugary nectar containing a moderate amount of microbes at the cooler temperature. They did not prefer the nectar with too many microbes, as well as the nectar with no microbes at all.

It isn't yet clear why the bees have such specific preferences. Russell speculates that bacteria or yeast may help bees digest sugars in the nectar. Another theory is that the microbes produce secondary metabolites that aid in bee health.

What is clear is that it isn't likely that an increase in average temperatures will have a positive effect on bumblebees.

"We could see shifts in the locations of bee communities, since they leave when they can't find the food they like or need," Russell said. "We might also see a decline in overall pollinator populations."

For concerned readers with gardens, Russell recommends growing native plants that have not been treated with insecticide. "That's the best thing someone could do right now to help bumblebees," she said.

phys.org, 10 November 2021

https://www.phys.org

Ancient assassin spider, feared extinct after fires, has been discovered on Kangaroo Island

2021-11-17

An ancient species of spider, feared extinct after devastating bushfires tore through Kangaroo Island in the summer of 2020, has been found alive.

Key points:

- An adult female and a juvenile were found
- They were found in a small patch outside their known range
- The species recovery is still tenuous and will be up against genetic bottlenecks and habitat loss

The assassin spider, also called the pelican spider (Zephyrarchaea austini), was only known to live in the Western River Regional Protection Area on Kangaroo Island.

That area was razed in the massive bushfire that burnt through more than 200,000 hectares of bush and farmland across the island nearly 2 years ago.

But two individuals — a female and a juvenile — have been found in a small patch of leaf litter, according to Jessica Marsh, an honorary research associate at the South Australian Museum.

While the researchers are keeping the exact location under wraps, it was outside the previous known range of the spider on Kangaroo Island, Dr Marsh said.

"It was amazing! We'd been searching since the fires. [We] had just about given up hope.

"It was amazing! We'd been searching since the fires. [We] had just about given up hope.["]

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

"These spiders don't disperse far, so it's very unlikely they've moved there before the fires."

The discovery was made at the end of September, but the announcement was delayed until DNA testing could confirm it was the same species of assassin spider.

The spider dates back to the Jurassic period, and is called an assassin for the way it hunts other spiders.

It's considered to play a crucial role as a regulator of spiders within the food web.

Given that the spider has been found outside its known range, Dr Marsh said her team would keep expanding their search, which has been funded by the Landcare Led Bushfire Recovery Grants Program.

"I'm not confident that we've got all of them," she said.

"I think there may be other pockets out there and we'll keep searching."

She said the focus at this stage would be on locating and protecting any more populations if they find them, but that they may consider intervening to assist in recovery, such as through captive breeding, down the track.

Recovery, if it happens, will be slow

The discovery of a juvenile is a promising sign that breeding has happened since the bushfires.

But recovery of the species is still extremely tenuous.

It's likely the population has gone through what is known as a genetic bottleneck.

There will likely be far less genetic diversity between the remaining spiders than in the previous population, meaning if a new population is able to establish, it could be less resilient to stressors.

And there are other challenges to its recovery, Dr Marsh said.

"There are several things that aren't on their side.

"Low dispersal is a key one. And the habitat they live in, it's going to take a long time for that habitat to regrow."

The spiders are habitat specialists, living in dense vegetation along creek lines.

Where they have been discovered is in some very small remaining pockets of that habitat, Dr Marsh said.

"It shows us how important those little pockets are," she said.

"It give us hope but, it's also a warning sign."

Only about a third of invertebrate species in Australia have been described by science, according to Dr Marsh.

Many may be threatened or have already gone extinct without us identifying them or understanding their ecosystem functions.

"There is a massive amount [of species] that are under threat," she said.

"We're not talking about extinction in isolation. When it's more species and more land lost, we may start to notice."

abc.net.au, 17 November 2021

https://www.abc.net.au

In the food system and beyond, plastics are the problem

2021-11-17

Plastics, as we all know, are central to our food system and to our economy. Each year more plastics get made from raw materials, and each year more enter the environment or end up in landfills. The EPA estimates that in 2018 (the most recent year for which data is available), only about 14 percent of plastic was recycled, which means that the other 86 percent either becomes litter, landfill, or burned for energy—and needs to be replaced with new virgin plastics next year.

The Story of Plastic is an Emmy Award-winning documentary first released in 2019 and currently streaming online through the Discovery Network. Created by the Story of Stuff Project, the documentary shines an uncomfortable but much-needed light on the impacts of the plastic industry on people and ecosystems, and our reliance on plastics in the food system and elsewhere.

"Ninety percent of the dialogue is about 10 percent of problem," explains Stiv Wilson, the co-director of the Peak Plastic Foundation and the creator and producer of the documentary. "But most of the coverage focuses on

"Ninety percent of the dialogue is about 10 percent of problem," explains Stiv Wilson, the co-director of the Peak Plastic Foundation and the creator and producer of the documentary.

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

downstream problems of packaging and waste," such as the communities around plastic production facilities (such as "Cancer Alley" in Louisiana)."

"It's our goal to use story to elevate people working at the front line, tell the stories from a perspective of lived experience of harm, and create intersections and bridges for people from different walks of life to be a part of the overall narrative shift, so we can transform power and engage with this issue more systematically."

Civil Eats spoke with Wilson earlier this month to learn more about the size and shape of the plastic problem, how the pandemic reshaped the plastic landscape, and how food fits into the puzzle.

Food is a part of the problem—you've mentioned that consumer goods packaging represents about 50 percent of all plastic packaging—but that's not all. Can you say more about that?

One of the issues with plastic pollution is that, living in a privileged, rich country, you may hear about the problem writ large, but if you are going to the grocery store, and you're buying things [that are almost inevitably in plastic packaging], and you dispose of them—whether in the garbage or even in recycling—you wouldn't think you're part of the problem. You're not exporting waste personally, you're not littering. Most consumers aren't aware that people literally died [from the toxic chemicals emitted into their neighborhoods from plastic-producing factories] so they could have that potato chip bag.

Our goal is to shift the narrative so people understand the full life cycle of plastics and make more informed choices. Ultimately, we want to move away from this material, since we see plastic as the vehicle of globalization and capitalistic growth.

"Most consumers aren't aware that people literally died so they could have that potato chip bag."

In terms of food and beverage packaging specifically, how much of the global plastic industry does that represent?

Packaging in all consumer goods is approaching 50 percent. That's the sector of growth and a lot of that is food packaging. That's how Procter & Gamble, Johnson & Johnson, Nestlé, and other conglomerates are selling their products in the developing world and opening markets: By selling smaller amounts that are on a lower price point [but require as much if not more packaging per ounce].

So now, all kinds of products—from soy sauce to shampoo to coffee—are all coming in these [multi-layer] single-serve packages that are fused materials, which makes them nearly impossible to recycle from an economic standpoint; it costs more to actually process them than the end product is worth.

And the economics don't work because the infrastructure doesn't exist to do it at scale, or to do it cost-effectively?

The infrastructure for [some] recycling doesn't exist, because it's not profitable to do it. Recycling was never meant to address a waste stream this large. And for 40 years, the plastics industry has said the solution to plastic pollution is recycling. But if recycling was actually cutting down on the amount of plastic being made, they wouldn't be promoting it—they full well know recycling isn't cutting into their profits from virgin plastics.

There is a massive pivot by the oil and gas industry underway, shifting from fossil fuels for energy and transportation to plastics. And I fear that climate advocacy is not tracking this bait and switch.

"Recycling was never meant to address a waste stream this large. The plastics industry says the solution to plastic pollution is recycling—but if it was actually cutting down on the amount of plastic being made, they wouldn't be promoting it."

On a related but tangential note, how has the pandemic affected plastic use?

The industry has for years promoted this message of sterility—that "if it's in plastic, it's clean." And leaving aside for a moment the fact that that's not anywhere close to true, I do think that they preyed on a lot of people's fears by saying that plastic was a way to save them from COVID. And so there was a rollback of a lot of [plastics-reduction] policies. And I saw across my entire movement how so much was undone in a second, after it took years to build and get passed into policy.

How long will it take to rebound from the COVID plastics boom?

Well actually, the last legislative season across this country was probably the most prolific in terms of plastic regulation. It seems like [2020 represented] a swing and a miss from the plastics industry. Although there are implications for a lot of global economies, in the U.S. we haven't fully swallowed that pill, we went back to regulating plastics pretty quickly. We saw a concept called extended producer responsibility, or EPR, which essentially means that companies are now going to be on the hook in

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

certain states for end of life management costs. It's no longer enough for a company to say "I made a recyclable piece of packaging, now it's up to you, the taxpayer, to manage it and make sure it's recycled." Maine recently passed a substantial bill that is going to make industry pay for waste management.

We also saw more regulation on problematic materials like Styrofoam, and some legislatures passed bills that said you can't put the recycling symbol on something if it's not going to be recycled; it has to actually get recycled if you're going to put the arrows on it.

Essentially, what we saw in the legislative season in many places was shifting the narrative around whose responsibility it is to manage this stuff and dispelling a lot of myths about what happens to it.

How do you see these policies affecting individuals as they shop for food?

Some of it won't be readily in plain sight for the average consumer, it just means that when you dispose of this stuff that the company that made it will have to pay for systems to manage it. And in some ways that's a double-edged sword, right?

"What we saw in the legislative season in many places was shifting the narrative around whose responsibility it is to manage plastic waste and dispelling a lot of myths about what happens to it."

Because industry now has a talking point that says, "We don't have to change what we produce, because we're managing it." Manufacturers and industry are going to fight this every step of the way, because policy is only as good as its implementation, and so the fight is now going to shift to stopping the implementation.

For the consumer, I think you're going to start seeing more packaging solutions on the shelves for companies that can get access to venture capital and scale more sustainable systems for delivery. I think you're gonna see more reuse systems, more subscription systems, more milkman kind of systems.

Have you seen any examples of successful adoption of those kinds of systems in the marketplace?

Absolutely. There's been a scalability challenge, but some companies are really doing a good job as early adopters.

The New Orleans Saints football team, their stadium is moving to a reuse model, or a truly biodegradable model. And that's the kind of market scale

that we need to get to for that stuff to be competitive. That kind of project also normalizes a different system. If you're a fan, and you're going to see a football game, and you want to drink a beer and eat a hot dog, what you really don't want in that moment is to get a lecture about your choices hurting turtles or being unsustainable. But if your beer just comes in a cup that can be reused, or is truly biodegradable, then you don't really have to change anything. Those kind of systems aren't [saying] that you've done something wrong; they're normalizing a new way.

Are there any other notable examples of success, or signs of progress?

Certainly, in the younger generation–some of the most breathtaking and amazing organizing against plastic disposables is being done at the college campus level in the U.S., where you're building an institutional system for managing waste and generating less of it. It's being adopted at scale by student bodies. I find that incredibly heartening because you're not just changing the waste footprint of an institution, you're also normalizing it for a student populace that's going to go out and expect that level of efficiency in the larger world.

One of the most amazing organizations out there is the Post Landfill Action Network—they're doing this at scale, intersectionally: It's not just white privileged kids who care about turtles, it's environmental justice communities who care about people's lived experiences, and they're all working on this, together.

This interview has been edited for length and clarity.

civileats.com, 17 November 2021

https://www.civileats.com

Deadly and massive 'Megaspider' found in Australia has fangs that can puncture a fingernail

2021-11-17

What has eight legs and fangs powerful enough to bite through a human fingernail? "Megaspider," an enormous funnel-web spider that was recently captured in Australia.

The Australian Reptile Park (ARP) in New South Wales is a public zoo that also houses a collection of funnel-web spiders; keepers milk the spiders for their venom, which is then processed to create anti-venom. This particular spider was donated by an anonymous benefactor and arrived last week at the park in a plastic tub as part of a weekly collection from spider drop-off points near Sydney, the Central Coast and Newcastle, ARP representatives said on Nov. 11 in a statement.

Even seasoned spider keepers were astonished by the spider's size, according to the statement.

Even seasoned spider keepers were astonished by the spider's size, according to the statement. The giant arachnid measured just over 3 inches (8 centimeters) from foot to foot — most funnel-web spiders are typically between 0.4 and 2 inches (1 and 5 cm) wide — and its curved fangs were 0.8 inches (2 cm) long. PLAY SOUND

"In my 30+ years at the Park, I have never seen a funnel web spider this big," Michael Tate, an ARP education officer, said in the statement. Park keepers promptly named the sizable arachnid female "Megaspider," but they don't know where she was found or who captured her; she had been boxed up in a Tupperware container without any labels or information about her captor, and there were no clues to connect her to any of the drop-off sites along the route, according to the statement.

"We are really keen to find out where she came from in hopes to find more massive spiders like her," Tate said.

Funnel-web spiders — which comprise about 40 species in the genera Hadronyche and Atrax — live in eastern Australia, and some species deliver a bite so toxic that it can kill an adult human within 15 minutes, according to the Australian Museum. All funnel-web spider species have glossy, nearly hairless bodies that vary in color from brown to deep black, and they have eight eyes arranged in two rows of four eyes each. The spiders are active year-round and live in burrows in moist, cool habitats, surrounding their tunnel openings with a network of silk strands. When a passing insect or other animal touches the silk, the vibrations alert the spider in the burrow, according to the Australian Museum.

ARP is Australia's only source of raw funnel-web spider venom for anti-venom serum production, according to the park statement. Keepers milk the spiders weekly and then ship the venom to a lab in Melbourne that produces the anti-venom by injecting very small doses into rabbits, so that the animals develop antibodies. These antibodies in the rabbits' blood can then be processed into a serum that neutralizes the venom's toxins in humans, according to NPS MedicineWise, an Australian nonprofit funded by the national Department of Health.

Since the ARP program began in the 1950s, its anti-venom is estimated to have saved 25,000 Australians who were bitten by funnel-web spiders, and the antidote still saves approximately 300 lives each year.

Recent rainy weather and intense humidity in eastern Australia has created highly favorable conditions for the continent's funnel-web spiders, according to the statement. Members of the public who wish to safely collect spiders for the anti-venom program are advised to exercise extreme caution, by using glass jars (which the spiders can't climb or jump out of once they've been captured) and wearing protective clothing, such as gardening gloves and long pants, according to the New South Wales Department of Planning, Industry and Environment.

The park is especially interested in supersize arachnids like Megaspider, which have bigger reservoirs of venom for the milking program, Tate said.

"If we can get the public to hand in more spiders like her, it will only result in more lives being saved due to the huge amount of venom they can produce," he said.

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livescience.com, 17 November 2021

https://www.livescience.com

A mineral found in a diamond's flaws contains the source of some of Earth's heat

2021-11-11

When it comes to knowing what actually lies deep inside the Earth, diamonds are a geologist's best friend.

A tiny bit of rock trapped inside a diamond is now opening a brand-new window into what the planet's lower mantle looks like. Inside the diamond is a newly identified silicate mineral dubbed davemaoite that can only have formed in Earth's lower mantle, researchers report November 12 in Science. It's the first time that scientists have managed to definitively prove that this type of lower mantle mineral — previously just predicted from laboratory experiments — actually exists in nature. The team named the mineral for well-known experimental high-pressure geophysicist Ho-kwang (Dave) Mao (SN: 3/16/04).

The diamond bearing the telltale mineral inclusion came from a Botswana mine and formed at depths greater than 660 kilometers, the upper boundary of Earth's lower mantle. Using analytical techniques including X-ray diffraction, X-ray fluorescence imaging and infrared spectroscopy, mineralogist Oliver Tschauner of the University of Nevada, Las Vegas,

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

and colleagues identified the chemical makeup and structure of the new mineral, pegging it as a type of calcium silicate perovskite.

Scientists had previously estimated that about 5 percent to 7 percent of the lower mantle must be made up of this mineral, Tschauner says. But it's fiendishly difficult to directly observe such deep-Earth minerals. That's because minerals that are stable in the intense pressures of the lower mantle — which extends all the way to 2,700 kilometers below Earth's surface — begin to rearrange their crystal structures as soon as the pressure lets up.

Even the planet's most common mineral, a lower mantle magnesium iron silicate known as bridgmanite, was largely theoretical until 2014, when it was discovered to have naturally occurred within a meteorite that had slammed into Australia with a force that generated crushing, deep mantle-like pressures in the rock (SN: 11/27/14). To date, bridgmanite is the only other high-pressure silicate mineral confirmed to exist in nature.

Scientists had previously estimated that about 5 percent to 7 percent of the lower mantle must be made up of this mineral, Tschauner says

Diamonds act like time capsules, locking in the original mineral forms on their journey to the surface. The discovery of davemaoite is not only a confirmation of its existence, but it also reveals the location of some sources of heat deep inside Earth. Although it's a calcium silicate mineral, davemaoite is also host to a rogue's gallery of different elements that sneak into its crystal structure. That includes radioactive elements such as uranium, thorium and potassium, as well as rare-earth elements. Such radioactive elements have long been thought to produce about a third of the heat circulating in the lower mantle (the other two-thirds is left over from the planet's original formation 4.55 billion years ago). By identifying the chemical makeup of davemaoite, researchers can now confirm where those elements reside.

That's because the Botswana diamond also contained a high-pressure form of ice as well as another high-pressure mineral known as wüstite (SN: 3/8/18). The presence of those inclusions helped narrow down the rough pressures at which the davemaoite might have formed: somewhere between 24 billion pascals and 35 billion pascals, Tschauner says. It's hard to say exactly what depth that corresponds to, he adds. But the discovery directly links heat generation (the radioactive materials), the water cycle (the ice) and the carbon cycle (represented by the formation of the diamond itself), all in the deep mantle, Tschauner says.

Another intriguing aspect of this new mineral is that it's surprisingly rich in potassium compared with laboratory predictions, says Sang-Heon Shim, a geophysicist at Arizona State University in Tempe. Most experimental

efforts to create the mineral came up with "nearly pure calcium silicate perovskite," Shim says. Scientists can only speculate right now what the source was for the extra potassium, but this unexpected composition hints that the lower mantle may be a more motley mix than thought, with complexity difficult to predict from lab studies alone.

sciencenews.org, 11 November 2021

https://www.sciencenews.org

Lost' Adélie penguin wanders nearly 2,000 miles off-course, ends up on New Zealand beach

2021-11-17

An Adélie penguin that washed up on a rocky New Zealand beach — nearly 2,000 miles (3,218 kilometers) from its home in Antarctica — last week, has been released back into the wild, experts say.

Nicknamed "Pingu" by locals, after the claymation children's cartoon, the disoriented bird was found waddling around the beach at Birdling Flat on Nov. 10 and was swiftly taken to the Christchurch Penguin Rehabilitation for treatment, according to NBC News. New Zealand's Kaikoura Wildlife Hospital indicated in a Facebook post that Pingu was "underweight and dehydrated," but that the young penguin, which rehabbers determined to be between 1 and 2 years old, was recovering strength on a diet of "fluids and fish smoothies." PLAY SOUND

The next day, the little bird made its way safely back into the water with a bellyful of fish for the long trip home, the New Zealand Department of Conservation said.

Pingu is only the third individual of its species ever spotted in New Zealand. The first was a dead specimen that washed ashore in 1962, CBS News reported. The second, a live penguin, landed in the Kaikoura region in 1993, according to New Zealand Birds Online.

Pingu is only the third individual of its species ever spotted in New Zealand.

Adélie penguins are one of five penguin species that live exclusively in Antarctica and its surrounding islands. They typically stand around 27.5 inches (about 70 centimeters) tall and weigh between 8.5 and 12 pounds (3.8 and 5.4 kilograms). Like other penguins, they live on a diet of fish, squid and krill, and they have been known to travel up to 185 miles (297.7 km) — not 2,000 miles — to secure a meal, according to World Atlas.

Scientists aren't sure exactly why Pingu traveled all the way to New Zealand. But they think that food supply and climate change may have

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

played a role. Penguins sometimes stray off course "when the waters warm up because the fish usually go into deeper, cold waters. And so there's no fish around," Thomas Stracke of Christchurch Penguin Rehabilitation, who helped bring in Pingu, told The Guardian.

Aside from making fish scarce, increased temperatures can wreak havoc on the sea ice that Antarctic penguins need to raise their young. Research from NASA and the University of Delaware, published in 2016 in the journal Scientific Reports, indicates that under current climate change trends, 60% of Adelie penguin populations may be in serious decline by the end of the century.

"All species of penguin are like marine sentinels," Philip Seddon, a zoologist at Otago University in New Zealand, told The Guardian. "When they're doing badly, they're giving us an early signal — canaries in coalmines — an early signal that things are not good."

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https://www.livescience.com

Despite deals, plans and bans, the Mediterranean is awash in plastic

2021-11-11

- The Mediterranean is considered to be one of the world's most polluted bodies of water due to waste disposal problems in many countries bordering the sea, as well as the intensity of marine activity in the region.

- There are several existing policies and treaties in place aimed at regulating plastics and reducing plastic pollution in the Mediterranean, but experts say more international cooperation is needed to tackle the problem.

- Citizen science organization OceanEye has been collecting water samples to measure the amount of microplastics present in the surface waters of the Mediterranean.

MARSEILLE, France — Pascal Hagmann lowered a manta trawl — a ray-shaped, metal device with a wide mouth and a fine-meshed net — off the side of his sailboat and into the blue waters off the coast of Marseille, France. Then he motored around at 3 knots. The manta trawl skimmed

"This is the point that I think is really frightening," Hagmann said. "This pollution is just everywhere."

along the surface, taking in gulps of seawater and catching whatever was floating inside it.

"Maybe there will be [plastic], maybe not, you never know," Hagmann, founder and CEO of the Swiss citizen science NGO OceanEye, told me in September as he steered his 40-foot (12-meter) sailboat, Daisy. "It depends on the surface currents and also on the weather forecast."

After 30 minutes, Hagmann and Laurianne Trimoulla, OceanEye's communication manager, tugged the manta trawl back on board. They took it apart and inspected the net.

"This blue here definitely is one," said Trimoulla, pointing with the end of a screwdriver at a small piece of plastic. "And then there is a film — packaging wrap."

Back at harbor, Hagmann went below deck to look at the sample under a microscope. He gestured to the eyepiece. "Have a look," he said.

I squinted through the lens. There was a collage of plankton, blue threads of plastic fishing line, and white and green plastic particles. Some of these were nurdles, raw plastic pellets used as feedstock to manufacture an array of plastic products, from drink bottles to plastic bags to car parts.

"This is the point that I think is really frightening," Hagmann said. "This pollution is just everywhere."

The Mediterranean is considered to be one of the most polluted bodies of water in the world, with hundreds of tons of plastic blowing into the sea, mainly from land, every single year. One study published in 2015 in PLOS ONE put the amount of plastic pollution in the surface waters of the Mediterranean on par with what's found in the accumulation zones of the five subtropical ocean gyres, including a collection of debris in the North Pacific gyre that's known as the Great Pacific Garbage Patch.

A number of governments and intergovernmental organizations are trying to address this issue with policies and treaties that would hold companies and nations responsible for the plastic they use, transport and discard. But as of yet, none of these efforts seem to be stemming the tide of plastic steadily pouring into the Mediterranean.

'Plastic trap'

About 20% of the plastic swirling around the Mediterranean comes from the vessels that crisscross the sea year-round, as well as from fishing and aquaculture activities, according to a 2018 WWF report. The other 80%

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

comes from the land, the report says. Mercedes Muñoz, who manages activities related to plastic pollution at the IUCN, a global conservation authority, said the land-based plastic pollution is largely due to inconsistent waste management schemes.

"The collection of municipal solid waste is still a significant issue in most south Mediterranean countries," Muñoz told Mongabay in an interview via phone and email. "Only a few countries have reached full waste collection coverage."

For instance, one study found that Lebanon, which has 225 kilometers (140 miles) of Mediterranean coastline, only properly disposes of 48% of its waste. The rest is dumped outside landfills or burned, and as a result, much ends up in the sea. A 2018 NPR report even found that developers in Lebanon have been deliberately dumping thousands of tons of trash into the sea as a way to reclaim land from the ocean.

Turkey is known to be the biggest contributor to plastic pollution in the Mediterranean, allowing about 144 metric tons to enter the sea every day, according to the WWF report.

Once plastic has entered the Mediterranean Sea, it tends to stay there because of the sea's semi-enclosed shape and the currents that only move water out via a deep-water layers. It's a "plastic trap," as the WWF report puts it.

Plastic will also change shape, breaking into smaller and smaller pieces. Any fragment smaller than 5 millimeters, about three-sixteenths of an inch, is considered a microplastic. Some of these microplastics will remain in the surface waters, while others will drift through the water column, travel with the currents and settle on the seafloor.

"The concentration [of plastic pollution] in the Med is pretty bad," Lucile Courtial, executive director of Monaco-based NGO Beyond Plastic Med, told Mongabay in a phone interview. "If we don't act on it, it will [become] much worse."

A 2020 report released by the IUCN, to which OceanEye contributed data, suggests that the Mediterranean has already accumulated nearly 1.2 million metric tons of plastic. A recent United Nations report says that 730 metric tons of plastic waste end up in the Mediterranean Sea every single day, and that plastic could outweigh fish stocks in the near future. However, some experts say there is an ongoing need for more data

to understand if plastic pollution in the Mediterranean is increasing or decreasing.

The WWF report also suggests that plastic pollution is costing the EU fishing fleet about 61.7 million euros ($70.7 million) every year because of a "reduction in fish catch, damage to vessels or reduced seafood demand due to concern about fish quality."

'Gaps in the whole chain'

One of the most rigorous agreements in place to address the global issue of plastic pollution is the Basel Convention, the U.N. treaty formulated in 1989 to regulate the international shipment of hazardous waste. In 2019, an amendment to the Basel Convention added plastic to the other kinds of waste the convention regulates, with changes scheduled to take effect in 2021.

Rolph Payet, executive secretary of the Basel, Rotterdam and Stockholm conventions, said the amendment allows countries to holds companies accountable for any plastic they transport or trade through the enactment of national laws and norms.

"We identify gaps in the whole chain because some people are saying, 'Yes, we are disposing, we are doing very well,'" Payet told Mongabay in September at the IUCN Congress in Marseille. "But then we find the bottles in the ocean, right? So this will help to narrow down where the problems are and help … companies be more accountable in terms of their waste."

However, a major gap in the effectiveness of the Basel Convention is the fact that the United States has not yet joined the Basel Convention, despite being a major exporter of hazardous waste, including plastic, worldwide. Right now, the U.S. is the only major nation that has not implemented the Basel Convention.

Payet said that the U.N. plans to use OceanEye's data, as well as other global data sets, to help establish a baseline for the amount of plastic in the Mediterranean that can be used in the future to determine if the Basel Convention is having a positive impact on the regulation of plastic. However, he added that it may take a few years before these effects can be seen since countries are still working to implement the new rules.

Another policy aiming to address the issue of plastic pollution in the Mediterranean is the Regional Plan on Marine Litter Management (RPML), which was adopted by contracting parties to the Barcelona Convention, including the European Union, in 2013. In short, the plan legally requires

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

parties to "prevent and reduce marine litter and plastic pollution in the Mediterranean" and to remove as much existing marine litter as possible.

Then there's the European Union's recent ban on many kinds of single-use plastics, including cotton bud sticks, cutlery and beverage stirrers, as part of the EU's transition to a "circular economy." When EU member states cannot ban these items, they need to implement an "ambitious and sustained reduction," according to the directive.

But are countries abiding by these policies and enforcing them? Courtial said these are tricky questions to answer.

"In general, we need regulations and guidelines and these kinds of treaties so that countries actually try to [achieve] the goals that are there," she said. "The main problem … is that there is no real way of enforcing the countries to actually respect it, and implement the different actions or activities."

Courtial added that it's difficult to coordinate an effort between the 22 countries bordering the Mediterranean Sea, especially as the countries are in different stages of economic development.

"Some of the countries have more problems trying to feed their people, so dealing with plastic waste is really not a priority," she said. "That's what makes it really difficult."

Experts are placing a lot of hope in a possible U.N. treaty that would legally require parties to address the entire life cycle of plastics, from production to disposal.

Muñoz says this treaty would be a "great step forward and very needed" since there needs to be more international cooperation on the issue.

"We always say that the Earth is just one big ocean," she said. "What happens on one side will probably have some impact on another part. So we need international commitments that are aligned and they're working together to reduce the problem."

But the U.N. treaty has yet to come to fruition — and it is also not clear how effective it would be at stopping plastic from spilling into the Mediterranean.

'That's why we carry on'

While research shows that the Mediterranean holds a considerable amount of plastic, some experts say more data is needed to fully

understand the complexities of the issue. For instance, Hagmann said there's still not enough data to understand how plastic pollution is dispersed across the Mediterranean and how the levels of pollution might change over time.

The need for this data is what motivated Hagmann to repurpose his recreational sailboat to become a citizen science vessel 10 years ago, and start cruising through the Mediterranean with a manta trawl to collect samples from the water's surface. He also recruited a network of volunteers operating 10 other vessels to gather additional plastic pollution data, not only in the Mediterranean, but also in the Arctic and Atlantic.

Hagmann, who has an engineering background, says OceanEye's mission is to contribute data to intergovernmental organizations that are monitoring plastic pollution and actively working on solutions. Already, OceanEye's data have been used by the European Commission, United Nations and the IUCN in their databases and reports.

Hagmann and his volunteers focus on surface trawls, using the sampling protocol formulated by environmental scientist Marcus Eriksen, co-founder of the California-based plastic pollution research institute 5 Gyres.

In June and July, Hagmann and a small crew sailed Daisy around the Adriatic Sea, taking some data samples near coastlines and others in open water, depending on weather conditions and cargo routes. Then, in September, immediately following the IUCN Congress in Marseille, the OceanEye crew sailed through the central Mediterranean to collect additional samples. So far, only the samples from the Adriatic expedition have been processed at OceanEye's lab in Geneva.

Hagmann said the processed samples contain "particularly high concentrations of plastic" of more than a million particles weighing 1,000 grams per square kilometer, or about 91 ounces per square mile. But the final results, he said, still need further interpretation and analysis by outside experts.

"We provide the data … and then it's [out of] our hands," said Trimoulla of OceanEye. But she said she's optimistic that the organization's work will have a positive effect, arguing that the more data they provide to various bodies, the bigger the impact these bodies can muster.

CHEMWATCH
Bulletin Board
Gossip
NOV. 19, 2021

"That's why we carry on," she said. "We have to."

news.mongabay.com, 11 November 2021

https://www.news.mongabay.com

Researchers have unlocked the secret to pearls' incredible symmetry

2021-11-10

For centuries, researchers have puzzled over how oysters grow stunningly symmetrical, perfectly round pearls around irregularly shaped grains of sand or bits of debris. Now a team has shown that oysters, mussels and other mollusks use a complex process to grow the gems that follows mathematical rules seen throughout nature.

Pearls are formed when an irritant gets trapped inside a mollusk, and the animal protects itself by building smooth layers of mineral and protein — together called nacre — around it. Each new layer of nacre built over this asymmetrical center adapts precisely to the ones preceding it, smoothing out irregularities to result in a round pearl, according to an analysis published October 19 in the Proceedings of the National Academy of Sciences.

"Nacre is this incredibly beautiful, iridescent, shiny material that we see in the insides of some seashells or on the outside of pearls," says Laura Otter, a biogeochemist at the Australian National University in Canberra.

A pearl's symmetrical growth as it lays down layers of nacre relies on the mollusk balancing two basic capabilities, Otter and her colleagues discovered. It corrects growth aberrations that appear as the pearl forms, preventing those variations from propagating over the pearl's many layers. Otherwise, the resulting gem would be lopsided.

Additionally, the mollusk modulates the thickness of nacre layers, so that if one layer is especially thick, subsequent layers will be thinner in response (SN: 3/24/14). This helps the pearl maintain a similar average thickness over its thousands of layers so that it looks perfectly round and uniform. Without that constant adjustment, a pearl might resemble stratified sedimentary rock, amplifying small imperfections that detract from its spherical shape.

The researchers studied keshi pearls collected from Akoya pearl oysters (Pinctada imbricata fucata) at an eastern Australia coastal pearl farm. They used a diamond wire saw to cut the pearls into cross sections, then polished and examined the gems using Raman spectroscopy, a nondestructive technique that allowed them to characterize the pearls' structure. For one of the pearls showcased in the paper, they counted 2,615 layers, which were deposited over 548 days.

A pearl's symmetrical growth as it lays down layers of nacre relies on the mollusk balancing two basic capabilities, Otter and her colleagues discovered.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

The analysis revealed that fluctuations in the thicknesses of the pearls' layers of nacre exhibit a phenomenon called 1/f noise, or pink noise, in which events that appear to be random are actually connected. In this case, the formation of nacre layers of different thicknesses may appear random, but is actually dependent on the thickness of previous layers. The same phenomenon is at work in seismic activity: The rumbling of the ground seems random, but is actually connected to previous recent seismic activity. Pink noise also crops up in classical music and even when monitoring heartbeats and brain activity, says coauthor Robert Hovden, a materials scientist and engineer at the University of Michigan in Ann Arbor. These phenomena "belong to a universal class of behavior and physics," Hovden says.

This is the first time that researchers have reported "that nacre self-heals and when a defect arises, it heals itself within a few [layers], without using an external scaffolding or template," says Pupa Gilbert, a physicist studying biomineralization at the University of Wisconsin–Madison who wasn't involved with the study. "Nacre is an even more remarkable material than we had previously appreciated."

Notes Otter: "These humble creatures are making a super light and super tough material so much more easily and better than we do with all our technology." Made of just calcium, carbonate and protein, nacre is "3,000 times tougher than the materials from which it's made of."

This new understanding of pearls, Hovden adds, could inspire "the next generation of super materials," such as more energy-efficient solar panels or tough and heat-resistant materials optimized for use in spacecraft.

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https://www.sciencenews.org

A judge temporarily halts baby powder cancer lawsuits against Johnson and Johnson

2021-11-10

A federal bankruptcy judge in North Carolina agreed Wednesday to temporarily halt roughly 38,000 lawsuits against Johnson & Johnson that claim the company's baby powder was contaminated with cancer-causing asbestos.

"J&J gets a 60 day stay of litigation... but that's all."

But Judge Craig Whitley only delayed the cases for 60 days. He also ruled that the case should be heard in New Jersey, where J&J is headquartered, and not in North Carolina.

"This is a major setback for J&J," said Adam Levitin, a bankruptcy expert at Georgetown University, writing on Twitter. "J&J gets a 60 day stay of litigation...but that's all."

Johnson & Johnson faces an avalanche of lawsuits linked to claims that traces of asbestos in its baby powder caused ovarian cancer and mesothelioma. The company announced in November last year that its talc powder would be removed from shelves in the U.S. and Canada.

J&J and LTL wanted the baby powder lawsuits frozen during a case review that could take years

Last month, J&J used a controversial legal maneuver known as the "Texas Two-Step" as part of an attempt to limit its legal liability.

First, the company created a new subsidiary called LTL in Texas and shoved all its baby-powder-related liability into the new company.

Then the new firm LTL quickly filed for bankruptcy in North Carolina, a federal bankruptcy venue seen as favorable for this kind of maneuver because of earlier rulings.

J&J and LTL also requested that the tsunami of baby powder lawsuits be frozen while the bankruptcy case is reviewed, a process that could take years.

On Wednesday, the U.S. Senate Judiciary Committee sent a letter to J&J urging the company to drop the bankruptcy maneuver.

"We urge you to immediately reverse course so that tens of thousands of consumers can have their fair day in court," the letter said.

Lawmakers also demanded the company answer a series of questions about its legal strategy.

From the outset, the federal judge assigned to the case has signaled skepticism about elements of J&J's bankruptcy bid. On Wednesday, Judge Whitley sent the case to New Jersey and granted only a limited, two-month stay of lawsuits.

J&J didn't respond to NPR's request for comment, but the company's new subsidiary LTL sent a statement expressing disappointment.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

"Although we believe this case was properly venued in North Carolina, we will continue to work with all parties to seek an efficient and equitable resolution," the statement read.

LTL also maintained once again that, "Johnson's Baby Powder is safe, does not contain asbestos and does not cause cancer."

The 60-day delay allows a new judge taking over to "get up to speed on the issues"

Andy Birchfield, an attorney at Beasley Allen who represents many of the plaintiffs suing J&J, praised Wednesday's rulings.

"This matter logically belongs in New Jersey where J&J is headquartered and where more than 30,000 victims seek justice," Birchfield said in a statement.

Birchfield described the 60-day delay of lawsuits as a "time out," which will allow a new judge taking over the case to "get up to speed on the issues."

This case comes as a growing number of bipartisan lawmakers have condemned use of bankruptcy courts by non-bankrupt firms and billionaires to block lawsuits.

"Another giant corporation is abusing our bankruptcy system to shield its assets and evade liability for the harm it has caused people across the country," Sen. Elizabeth Warren, D-Mass., tweeted last month.

nrp.org, 10 November 2021

https://www.npr.org

You can't hide from your cat, so don't even try

2021-11-12

Your cat is probably keeping track of where you are, even if your feline friend isn't in the same room with you and can't see you.

Scientists recently learned that domestic cats create "mental maps" that tell them where nearby humans are located, based on where sounds are coming from. The researchers tested cats by playing recordings of human voices calling the cats' names; they then played those recordings again, only this time through a speaker in a different place, so that the same sounds came from farther away.

The cats acted surprised when the familiar voice came from a location that they didn't expect, based on what they had already heard. This suggests

Scientists recently learned that domestic cats create "mental maps" that tell them where nearby humans are located, based on where sounds are coming from.

that cats spatially orient their unseen human companions using audio cues — a cognitive ability that was previously unknown in felines.PLAY SOUND

Knowing that something continues to exist even if it's out of sight (as the cats demonstrated in their responses) is called object permanence, and it's a test that researchers use to measure animal intelligence. Human infants typically begin to develop object permanence when they're around 8 months old, and this ability becomes more refined when babies reach 10 to 12 months old; at that stage, babies can find hidden objects, and they begin to realize that their parents and caregivers don't disappear just because they can't be seen, according to the Mayo Clinic.

Prior research has demonstrated object permanence in primates such as chimpanzees (Pan troglodytes), bonobos (Pan paniscus), gorillas (Gorilla gorilla) and orangutans (Pongo pygmaeus); and in nonprimates such as Eurasian jays (Garrulus glandarius), bears (Melursus ursinus and Helarctos malayanus euryspilus), dogs (Canis lupus familiaris) and cats (Felis catus), scientists reported Nov. 10 in the open-access journal PLOS One.

For the new study, they decided to test cats using audio signals because cats are known for their exceptional hearing and are capable of finding hidden prey under conditions of low visibility. "Indeed, cats appear to be good at inferring physical and social presence from sounds," the authors wrote.

Previously, study lead author Saho Takagi, a doctoral candidate at Kyoto University in Japan, found that when cats heard the sounds of their owners' voices, they then expected to see their owners' faces. In other studies, cats have also shown that they can distinguish between familiar and unfamiliar human voices and that they can locate hidden objects. So "it seems plausible that cats should be able to mentally map others' locations based on vocalizations," the scientists said in the study.

For their experiments, they placed cats into three groups; each group was split in two depending on where the cats lived, either at cat cafés or in domestic homes. Cat groups listened to a different combination of sounds: Group one heard recordings of caregivers or strangers calling their names; group two listened to sounds of other cats; and group three heard random electronic noises.

The researchers then played the sounds in two passes: first through a speaker near a door that was close to the cats, and then through a speaker next to a door or window that was farther away. Observers noted how

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

surprised the cats seemed by the seemingly unexplained "teleportation" of the sounds from one place to another, rating their level of surprise on a scale of 0 (not at all surprised) to 4 (very surprised). Signs of their surprise included staring toward the voice's "original" position, moving their ears and heads, looking around them or moving about the room, according to the study.

Overall, the cats showed the most surprise when their owner's familiar voice appeared to "teleport." This suggests that the cats formed a mental image of their unseen owners and mapped their locations based on where they first heard the voice, "showing evidence of socio-spatial cognition," the researchers reported.

Being able to form a mental picture of the outside world "is an important feature in complex thinking," and these findings offer new insights that could inform future studies of feline cognition, the study authors concluded.

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The cutest way to fight climate change? Send in the otters

2021-11-04

OFF THE COAST of California lies an underwater forest of giant kelp, a kind of seaweed that grows to 100 feet tall at the rate of a foot a day. Just as a terrestrial forest sucks carbon dioxide out of the air, all that rapidly growing seaweed soaks up carbon from the water, playing an incredibly important role in climate mitigation. "With kelp goes a huge amount of carbon," says Chris Wilmers, an ecologist at the University of California, Santa Cruz. "As a general rule, kelp forests are much more productive than most terrestrial forests, in that they're churning through carbon much more quickly."

But since the 18th century, California's kelp forest has been steadily mowed down by purple urchins, thanks to the massacre of their natural predator—the sea otter—hunted for its one-of-a-kind fur. (Unlike other marine mammals, sea otters don't rely on copious amounts of blubber for insulation, but instead on densely packed hairs. At their thickest, they

"As a general rule, kelp forests are much more productive than most terrestrial forests, in that they're churning through carbon much more quickly."

have a million of them per square inch.) Over the last few centuries, otter numbers in California crashed from 20,000 to 50.

Without otters patrolling the kelp, the native urchin population balloons. The spiky invertebrates actually switch up their foraging strategy, from hiding in rock crevices and waiting for detritus to come to them to boldly venturing out and chowing down. "Once the otters are not present, those urchins can overrun the area, and it turns into what's called an 'urchin barren,'" says Jess Fujii, the sea otter program manager at the Monterey Bay Aquarium. "And you really won't see anything else except rocks and hard substrate covered in urchins." Parts of the West Coast have seen a 10,000 percent increase in urchins in recent years, and California has lost 95 percent of its kelp forests.

So since 2002, the aquarium has been on a mission to bring back the otters with the cutest adoption program in the world. Sea otter moms in captivity take in orphaned pups—often left parentless thanks to great white sharks, which bite but don't actually eat otters, since sharks prefer blubber to fur. The new moms teach the pups how to do sea otter things—like clean themselves, float on their backs, and use rocks to crack open sea urchins on their bellies. "We're not hand-feeding them and imprinting them on humans—they're learning how to be an otter from an otter," says Fujii. "Some of these animals come in when they're only a day old. They don't have any notion of what home used to be."

When the adoptees are ready, Fujii's team sets them loose in the coastal habitats of California. Each is tagged and monitored closely for the first two weeks to make sure they're getting along fine. (Along with observational surveys in Monterey Bay, tagging helps scientists conduct censuses of the otter population.) If not, they're brought back in and returned to otter school. But the team found that the 37 adopted otters released between 2002 and 2016 have survived just as well as if they'd grown up fully in the wild. The reintroduced otters go on to reproduce and make more otters. Thanks in part to this first-of-its-kind program, the sea otter population along the California coast has swelled to 3,000.

A sea otter is a ravenous ecosystem engineer of the highest order. To stay warm and healthy, they eat a quarter of their body weight a day, repeatedly diving to the seafloor to gather urchins, crabs, and bivalves like clams. "By having to eat as much as they do in order to survive in their environment, they have really drastic impacts on those habitats, and they're overwhelmingly positive," says Fujii. (Another program further

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

up the California coast has tried bringing back a different kind of "urchin slayer"—human divers.)

Keeping the urchin population in check preserves the kelp, which is vital for the ecosystem in two main ways. First, the forest is a habitat for fish, which are the food source for birds and other marine mammals, like sea lions. Second, the seaweed is part of what scientists call a "blue carbon" ecosystem, meaning a coastal or marine area that sequesters carbon. (Other areas include wetlands and mangroves.)

But it's tricky to quantify exactly how much carbon a healthy kelp forest gobbles up. A redwood tree, for instance, grows to be massive over hundreds of years, locking away lots of carbon over long timescales. (Unless it catches on fire, in which case the carbon goes back into the atmosphere.) Things are more in flux underwater. All manner of critters, including sea urchins, are nibbling on kelp—and pooping out the carbon. Plus, the churning sea breaks off bits of the forest, which fall to the seafloor and decompose, releasing stored carbon. So a kelp forest constantly decays and grows back, sequestering and releasing carbon all the while.

It's hard to be sure how long the carbon stays trapped. "The fate of all this kelp is not well understood," says Wilmers. "Imagine that all that stuff that's sloughing off is simply sinking to the deep ocean and isn't going to come back up again for like 1,000 years. That's a much more significant carbon sequestration benefit than just sloughing off and immediately decomposing and going right back into the atmosphere."

With that uncertainty in mind, Wilmers has done some estimates of the potential carbon benefits of healthy otter populations farther north on the Pacific coast, between the Canadian border and the tip of the Aleutian islands. If a kelp forest grows well, and half the carbon it absorbs is sequestered in the deep sea, it'd be the equivalent of canceling the emissions from 5 million automobiles. Even if just 1 percent of the carbon stays sequestered in the depths, that would be equal to the emissions from 100,000 cars.

In Monterey Bay, the otters don't only protect the kelp. They also venture up the Elkhorn Slough, a large tidal marsh, where they encourage the growth of eelgrass, another coastal plant that sequesters carbon—although the otters affect the plant in a more indirect way. The otters eat crabs, which in turn eat invertebrates like sea slugs, which eat the algae that grows on the eelgrass. Reducing the number of crabs preying on the slugs actually helps the eelgrass because when the slugs remove the algae, it keeps the plants clean, which allows them to absorb more

sunlight. Thanks to the return of the otters, the amount of eelgrass in Elkhorn Slough has jumped 600 percent in the last three decades.

A mangrove or a tidal marsh like Elkhorn Slough traps loads of carbon. "They're removing carbon dioxide at rates that are up to 10 times as fast as we see in terrestrial systems on a per area basis," says Emily Pidgeon, vice president of ocean science and innovation at the nonprofit Conservation International. "They bury it in the soil below them, and it basically gets locked away for millennia. And so you end up with these very deep, rich stores of carbon in these ecosystems much denser—and hence, with larger amounts of carbon—than you see in forests."

Restoring marshland plays other crucial roles in the ecosystem, says Aimee David, vice president of ocean conservation policy strategy at the Monterey Bay Aquarium. "We need these habitats for the services that they provide for us: buffering from storms, food production, filtered water quality," she says. "That is a great role that otters have played in the Elkhorn Slough estuary, which is one that is notorious for being at the epicenter of a lot of different industrial uses, including agriculture."

Healthy ecosystems also support sustainable fisheries, providing livelihoods for community members. And the sea otters in Monterey have the added benefit of being very cute, which brings in tourists and their money. These kinds of knock-on benefits are why conservationists are increasingly campaigning for blue carbon-related nature-based solutions: restoring ecosystems to fight climate change. Everyone wins—the locals, the climate, the ecosystem. Well, maybe not the sea urchins and crabs. But they won't be missed.

wired.com, 4 November 2021

https://www.wired.com

Animals of the future

2021-11-09

IN JUNE OF this year, not long before the midwinter solstice, catastrophic floodwaters draining from the Gippsland Plain, in southeastern Australia, left in their wake an otherworldly phenomenon: Translucent spider silk, extending half a mile in some places, trailed over riverbanks, roadsides, and fields, rising into glistening spires atop highway signs and shrubbery. On once-humdrum stretches of road, drivers pulled over to stare, take pictures. When a breeze ran through the membrane, it rippled with the fluency of a tide surging in a mangrove swamp. Light trembled on

A mature sheetweb is rarely bigger than a contact lens; the spiderlings are best made out with a magnifying glass.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

the sodden turf beneath. How improbable that something so delicate, sensuous even, might remain after something so destructive.

To spot the creatures responsible, you would have had to draw close. Sheetweb spiders—constellations of them—clustered in a cosmos of their own froth and protein. A mature sheetweb is rarely bigger than a contact lens; the spiderlings are best made out with a magnifying glass. On days of ordinary weather, millions live in the earth, but when threatened by inundation, the spiders abandon their belowground niches. Each fashions a single thread, a streamer, to function as an emergency airlift. Lofted up by atmospheric currents, and possibly by electrostatic crackle too, the spiders sail on the tips of their lines toward higher terrain, alighting, in time, on fence posts or treetops or ascending farther still. In 2011, a pilot reported crossing paths with clumps of spiders at 2,000 feet. In a departure from habit—wingless as they are—the sheetwebs fly. The tracers of their mass decampment, a strand of silk for every spider, settle on a scale so vast, so uniform, the result looks less like the work of animals than like something mythological or architectural: a mysterious Christo at work, festooning the landscape.

The weather in Gippsland is changing, as is true everywhere. The variability of the region's climatic extremes has become more pronounced since the 1960s: hotter hot spells, fiercer floods. Scientists foresee longer dry periods split by downpours of worsening severity. When sheetwebs appear, we would do well to view them as a premonition of a future we are failing to avert. That which elevates the spiders out of crisis—their ribbons of silk—attests to how deeply they are, in fact, enmeshed in a nature that grows more chaotic. Weaving is the way arachnids make themselves at home in the world, their webs functioning as dormitories, trip wires, and traps for prey. But as the sheetwebs spin silk to flee an inhospitable habitat, their webs are flotsam from an evacuation.

Though evolution has endowed these tiny asterisks of life with a flight instinct, and an ingenious strategy for extricating themselves from disaster, the spiders cannot stay aloft forever. When the sheetwebs drifted back down in Gippsland, that was not the end of their emergency. Not until after the waterlogged soil dried out did they shrink once more into their myriad hideaways. In countryside mauled by storms, with land submerged below rising rivers, we will see more of the spiders, it seems, for they cannot escape us. And should waters recede too slowly, they may be doomed. If we can set aside our anxious wonder, perhaps we may see in the sheetwebs' adaptive resources, and their limits, the challenges that await in the quest to acclimate to crisis.

HOW TO INHABIT a world in profound transformation? In this era of climate-change anguish, all field biology might be said to be underpinned by that question. The answers emerging from studies of the animal kingdom shed light not only on the capacity of individual species to accommodate less favorable conditions, but on the guide rails that will govern whether, and how, every life form on the planet will be remade as the coming decades unfold. Conservation movements have historically coalesced around vanishing animals (whether African elephants, Bengal tigers, or monarch butterflies), but a significant line of research in the natural sciences has pursued a different concern: What must animals do now to persist?

Two new books on this subject—Hurricane Lizards and Plastic Squid, by Thor Hanson, an independent conservation biologist, and A Natural History of the Future, by Rob Dunn, an ecologist at North Carolina State University—explore the startling ways in which, short of extinction, fauna (and flora) are responding to cascading changes wrought, in varying degrees, by humankind. They direct their attention not to large mammals imperiled by dwindling wilderness, but to an assortment of minifauna: reptiles, fish, birds, insects, and even—particularly in Dunn's writing—microbes. Synthesizing a wealth of recent findings, both books open trapdoors onto the vivid lives of other beings in hopes of giving humans a close-grained understanding of our role in habitat change and the varieties of adaptation that may be in store for our species too.

Hanson's subtitle, The Fraught and Fascinating Biology of Climate Change, clues us in to the author's goal of spotlighting strategies that permit animals to withstand (perhaps even to exploit) environments in transition. Right away he makes clear that vulnerabilities to change are not evenly distributed: Miseries hovering on the horizon for our species have already arrived for creatures that are susceptible to finer fluctuations of conditions, or that have lower thresholds of tolerance. Yet animals are not all equally entrenched in their existing habits and habitats. Some demonstrate surprising plasticity of behavior, geographic range, and even appearance. A remarkable few have evolved resilience in the face of disasters that human communities already experience as ruinous.

Conditions don't have to be lethal, Hanson notes, to be consequential. To a sun-basking reptile—a "heliotherm" that regulates its internal temperature by scampering in and out of the shade—high heat is an acute stressor. Hotter weather hasn't killed fence lizards outright, but when these wriggly reptiles are forced to shelter for almost four daylight hours or longer, they

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

hunt fewer insects, consume fewer calories, and cease reproducing, so their populations wink out all the same.

Other lizard species have demonstrated an extraordinary capacity to expand the breadth of the extremes they can inhabit by revamping their bodies. For anole lizards living on the Turks and Caicos Islands, in the Caribbean—an archipelago wracked by ever more severe weather—the solution to enduring hurricanes lay underfoot, literally. Researchers have documented lizards evolving heritably longer front limbs and larger toe pads on their forefeet, the better to grip onto anchor points when buffeted by gales that damage buildings, uproot trees, and fell electricity poles. The lizards have transmogrified—engineers might say "ruggedized"—to hold their ground in a nature that is more capricious today than at any time in their past.

Our mental models of climate change portray the process as ambient and inanimate—manifest in the air and ocean, in melting ice and multiplying dunes. By contrast, the anole lizards' story is disquieting in its intimacy. It suggests that the legacy of extreme weather is legible in the flesh too, that physical appendages can be recast by hurricanes, over generations. As human actions alter the atmosphere in ways that guarantee more frequent and severe windstorms, in some sense we could be said to have become indirectly responsible for what some animals are, their very shape. Call to mind the Platonic ideal of a lizard—bony, bronze, and flick-tongued, on the sand of a deserted beach. Do we now have a hand, so to speak, in its feet?

The climate has always driven evolution, of course. The surprise, Hanson points out, is how fast some animals are modified by their surroundings—and in pulses of sudden, lasting change, not by increments. Speckled wood butterflies are developing stronger wing muscles as their borderlands in Scotland warm up and move northward, opening territory to those butterflies best able to cover the distance. Male collared flycatchers on Sweden's Gotland Island are becoming less ornamented as temperatures climb. Fluffy white forehead patches on the birds (a feature of courtship displays) have perhaps become too burdensome: Males with striking plumes get drawn into more confrontations with rivals, and in hotter weather that competition expends reserves of energy to their detriment. Male three-spined sticklebacks (fish) likewise have grown duller. A flush of bright scales, hitherto enticing to female sticklebacks, proves a fruitless adornment in waters clouded by algal blooms.

In the soot-soiled cities of the Industrial Revolution, peppered moths famously evolved to be darker in color, less visible to birds that sought to eat them. When the air grew clearer, lighter moths prevailed again. Likewise today, where once-durable snowpack has become transient and patchy in Finland, a once predominantly gray species of owl trends toward brown plumage, better camouflage in a tawny domain. Air pollution is still at work here, though it is not smog that dims the owls. Carbon emissions beget snowmelt by way of milder winters. Between the natural selection of adaptive traits and the artificial selection of desirable characteristics (that is, animals domesticated by humans), genetic variation in the wild is today subject to the inducements and penalties introduced by manufactured conditions.

theatlantic.com, 9 November 2021

https://www.theatlantic.com

How are caterpillars are their poo making climate change worse?

2021-11-08

Caterpillars are an unrecognised driver of carbon emissions, according to a new study.

Scientists at the University of Cambridge focused on mass outbreaks of leaf-guzzling caterpillars and discovered that they were having a harmful effect on the environment.

The little creatures are known for being 'hungry' (as the popular children's book says) and it turns out this is very accurate. They can eat an enormous amount during a life cycle stage that typically lasts several weeks. Some consume 27,000 times their body weight during their lifetime.

But the problem is caterpillars eat so many leaves that they reduce the amount of plants there are to absorb CO2 from the atmosphere.

And that's not all. As well as their leaf-munching habits, their poo emits carbon dioxide-releasing bacteria once the leaves come out the other end - so it's a double whammy.

Their poo releases carbon dioxide-releasing bacteria.

Many caterpillars live by lakes and when their poo or "frass" (the technical term for caterpillar excrement) washes into the water, it acts as a fertiliser for certain microbes which release carbon dioxide into the air.

Some consume 27,000 times their body weight during their lifetime.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

"These insects are basically little machines that convert carbon-rich leaves into nitrogen-rich poo. The poo drops into lakes instead of the leaves, and this significantly changes the water chemistry, " says senior author of the paper, Professor Andrew Tanentzap, at the University of Cambridge's Department of Plant Sciences.

"We think it will increase the extent to which lakes are sources of greenhouse gases."

'From a climate perspective, they're pretty bad'

The study, published in Nature, found that in years with insect outbreaks, the leaf area of forests was reduced by an average of 22 per cent. At the same time, nearby lakes contained 112 per cent more dissolved nitrogen.

To get their results, researchers combined 32 years of government data from insect outbreak surveys and lake water chemistry in 12 lake catchments across Ontario, Canada. This is believed to be the most extensive study ever undertaken into how insect outbreaks impact freshwater carbon and nitrogen dynamics.

"It's just amazing that these insects can have such a pronounced effect on water quality," says Sam Woodman, a researcher in the University of Cambridge's Department of Plant Sciences and first author of the report.

"From a climate perspective, they're pretty bad - yet they've been completely overlooked in climate models."

euronews.com, 8 November 2021

https://www.euronews.com

Beans may be the 'food of the future', but U.S. farmers aren't planting enough

2021-11-15

In the early days of the pandemic, when uncertainty about the future was palpable, many Americans instinctively prepared for the worst by stockpiling one food in particular: beans. It makes sense—whether dried or canned, black, pinto, or kidney, beans are affordable, healthy, and last almost indefinitely without refrigeration. And they are just as well-suited for a moment of climate crisis as they are to a global public health emergency.

The legumes use water efficiently and leave nitrogen in the soil for the next crop, reducing the need for synthetic fertilizer.

They are also an excellent source of protein, and on average, a serving results in about one-tenth of the greenhouse gas emissions compared to a serving of beef. The legumes use water efficiently and leave nitrogen in the soil for the next crop, reducing the need for synthetic fertilizer. The United Nations even declared 2016 the International Year of Pulses, calling pulses (a category that includes beans, peas, and lentils) the "food of the future."

Cult-favorite heirloom bean company Rancho Gordo was already seeing a major uptick in demand in the winter of 2019, thanks to the Instant Pot craze and the popular cookbook Cool Beans, said founder Steve Sando. Then, when the pandemic hit, Sando said the company had six-week wait times for orders and ultimately doubled its sales in 2020.

Now, a year and a half later, beans are still in demand, but American farmers are not lining up to plant them. In 2021, farmers harvested 300,000 fewer acres of beans compared to 2020.

The change is partially attributable to market forces and to increasing extreme weather related to climate change, factors that are also intertwined. And while some say changes in planting and yields are normal and part of the drop is due to overplanting in previous years, others in the industry are worried about the future of beans and whether they'll be able to continue to source an adequate supply to keep American pantries stocked. Historically, the U.S. has imported a very small volume of beans, with significant production here for domestic supply and exports.

"It's a little bit troubling in the long term to see where this shakes out," said Mark Kirsten, who is the president of the trade group California Bean Shippers Association and runs a wholesale bean business in Lodi, California, that has been in his family for decades.

On the flipside, Tony Roelofs, vice president of the pulse division at Oregon-based Columbia Grain International, is confident that the steady rise in legume consumption over the last 20 to 25 years will push production in the right direction. If he's right, it could move the food system toward a more climate-friendly future. "As we continue to grow our population on a worldwide level and water supply and arable land demand continue to be problematic . . . pulse crops have a great spot," he said. "It's cheaper protein and it's more environmentally friendly protein."

The Commodity Crop Effect

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

Since the 1970s, per capita consumption of legumes has more than tripled in the U.S. overall, with Americans steadily eating more black beans and black-eyed peas, according to the U.S. Department of Agriculture (USDA). Production, however, hasn't followed a linear upward trend. Between the 2012 and 2017 there was a slight uptick in acres planted, but after a peak in 2017 and 2018, production fell drastically in 2019, shot back up in 2020, and dropped again in 2021. (These statistics don't include chickpeas or lentils, which have seen more significant growth in acres planted over the past decade but also dipped down in recent years.)

Depending on the variety, beans are grown in many different states across the country. In a given year, Camellia, a fourth-generation bean company based in New Orleans, might get its limas from growers on the West Coast, black-eyed peas from the South, red kidneys from the middle of the country, and pintos from the Dakotas, said Vince Hayward, CEO of Camellia.

"Every year it's a comparison between corn prices, wheat prices, or soybean prices, and farmers make an educated decision on what they need to grow to support their farms and their families."

Hayward and every other industry source contacted for this article said that a major increase in prices for commodity crops was the biggest factor affecting supply. When those prices rise, farmers make less space to plant dry beans (other than soybeans, the majority of which are not eaten by people). "Every year it's a comparison between corn prices, wheat prices, or soybean prices, and farmers make an educated decision on what they need to grow to support their farms and their families," Hayward explained. This year, the price differential was more extreme.

In the northern Plains states, high prices for corn and soy, along with other market forces that favor those commodities, have also led to farmers plowing up grassland to plant those crops. In September, the USDA projected 2021 average prices for corn and soybeans—$5.45 and $12.90 per bushel, respectively—to be the third-highest since 1960. Depending on a few factors, black beans might command three times as much per bushel compared to corn, but corn yields are so high, farmers could make double or more per acre.

"That just makes it very tough for specialty crops," said Tom Harmon, general manager of Jack's Bean Company, a Holyoke, Colorado-based company that aggregates red kidney and pinto beans from about 30 growers annually in Colorado, Nebraska, and Kansas. "We have to [offer]

a pretty high price to be able to compete . . . when [farmers] can grow a conventional crop that's much easier."

At Rancho Gordo, Sando was frustrated by this push and pull of the commodity system, in which yields per acre dominate the conversation, so he has mostly worked outside of it, creating direct long-term relationships with farmers who grow for Rancho Gordo every year. But as he attempts to meet increasing demand, it can still be difficult to convince new farmers to plant heirloom varieties since the yields can be even lower than they are for conventional beans.

"We have really good farm relationships, but still, they're not enough, and that's what we constantly work on," said Sando. "This year, we did a 20-acre test farm near Lodi so we could show potential farmers what we're doing and that it isn't voodoo. There's this old-school mentality [that says] each acre has to produce so many pounds . . . but the end result is we pay more and we charge more and everybody wins. Our [beans] are more expensive, but they're still pennies per serving."

Compared to corn or soybeans, dry beans are also much riskier, Harmon said. Timing, harvest, and the machinery required are all more complicated, and whereas weather damage to a corn crop may not matter so much if that corn is headed for a silo to be fed to animals, kidney beans headed for a clear bag displayed on supermarket shelves cannot be destroyed or damaged by extreme weather like hailstorms.

And while Harmon said, anecdotally, storms haven't gotten worse in his region over the last several years, extreme weather conditions have significantly affected production elsewhere, adding to the risks growers face and likely adding to the list of reasons they might choose to plant a higher-priced corn crop rather than risk a loss.

Extreme Weather Gets Worse

"The weather is a little more extreme than what we're used to," Hayward observed. "It's either too wet or too dry."

The data backs up his assertion. According to the National Oceanic and Atmospheric Administration, 2020 and 2021 have seen the most "billion-dollar weather events," storms that cause a billion dollars or more in damage, in history. And a third of the damage has happened in the past five years.

Dry conditions hit bean farmers especially hard this year. "It's certainly one of the worst droughts we've ever experienced in North Dakota," said

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

Columbia Grain's Roelofs. Drought also devastated North America's oat fields this year, leading to the smallest harvest ever.

"If farmers only have a certain amount of water, the question is: Where am I going to use it? And beans aren't going to fall at the top of that list most of time."

Water scarcity was even worse in California, where the past 12 months were the driest in a century, partially due to higher temperatures caused by climate change. Kirsten said that for farmers in the southern part of the state, water was in especially short supply, and when farmers have to plant fewer acres in order to conserve, they make the choice to plant higher value crops on those limited acres.

"In California, beans are not at the bottom of the list, but they're certainly not the top-tier crops," he said. And while beans require less water than many other crops and serve the rotational purpose of fixing nitrogen in between other higher value crops like tomatoes, he said, farmers may not be thinking that far ahead when resources are scarce year after year. "If they only have [a certain] amount of water, the question is: Where am I going to put it? And beans aren't going to fall at the top of that list most of time."

Everyone in the industry said that these weather disruptions, high commodity prices, and some small pandemic-related shocks like increased trucking demand have combined to squeeze supply in a major way. But they don't agree on how long these issues will last. Hayward and Kirsten both expressed serious concern about the future, while Harmon and Roelofs were more optimistic.

Either way, they'll try to convince more farmers to plant beans, especially since demand doesn't seem to be waning. While Rancho Gordo's Steve Sando thought the extreme uptick in sales in 2020 might have been due entirely to panic buying, sales in 2021 were only down 4 percent from that peak, he said, suggesting appetites are still strong.

Rancho Gordo farmers in Mexico lost crops due to terrible flooding this year, and Sando worries about extreme heat and droughts that could impact his growers in California, but in that context, he hopes farmers will increasingly want to plant beans, for the nitrogen-fixing potential and the pods that get spit back out into the fields as green manure. When he first set out to sell heirloom beans, he often wondered why more American farmers weren't growing more, considering how delicious, healthy, environmentally friendly, and affordable they are.

"It turns out there's a whole world of reasons why [they don't], but I've been super lucky and . . . I didn't like that reality, so I created my own," he said. "There are so many horrible things that come down the pike, and you have to just do your best and carry on as if there is going to be a next summer."

civileats.com, 15 November 2021

https://www.civileats.com

Why don't people have tails?

2021-11-15

Tens of millions of years ago, the common ancestors of humans and all other primates had tails. Many modern primates, such as monkeys and lemurs, still have tails, but as primates diversified and evolved, the ancestors of modern humans, as well as apes such as chimps and bonobos — our closest primate relatives — ditched their tails entirely.

Why did some primates keep their tails, while humans and apes didn't? Tail loss is thought to be part of the backstory for humans evolving to be bipedal, but precisely how we lost our tails is a question that scientists have long sought to answer.

Recently, researchers uncovered a genetic clue about why humans have no tails. They identified a so-called jumping gene related to tail growth that may have leaped into a different location in the genome of a primate species millions of years ago. And in doing so, it created a mutation that took our tails away.

PLAY SOUND

As it happens, humans DO still have tails — when we're embryos. Tails are a trait that can be traced back to Earth's first vertebrates, so when human embryos develop, we briefly have tails — vertebrae included — during the earliest stages of our growth, as do all animals with backbones. But after about eight weeks, most embryonic human tails completely disappear. They are lost through a process known as apoptosis, a type of programmed cell death that's built into the development of multicellular life, scientists wrote in 2008 in the journal Nature.

After that, the only remnant of these lost tails in humans is about three or four vertebrae that form the coccyx, or tailbone.

Why did some primates keep their tails, while humans and apes didn't?

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

Sometimes human babies are born with tails, though this is exceptionally rare. These vestigial protrusions are embryonic leftovers and are usually pseudo tails rather than "true tails," according to a study published in 2012 in the Journal of Indian Association of Pediatric Surgeons. Skin-covered pseudo tails contain muscle, nerves, blood vessels and connective tissue, but they lack bones and cartilage and are not connected to the spinal cord, as true tails would be.

But how did humans become tailless? For Bo Xia, a doctoral candidate at New York University's (NYU) Grossman School of Medicine, that conundrum has been a source of fascination since childhood, he told Live Science in an email. Xia is researching the genetic mechanisms of human development, disease and evolution. He is also the lead author of a new study identifying a genetic "smoking gun" for how humans lost their tails; the findings were published September 2021 on the preprint server bioRxiv and have not been peer reviewed.

"I wondered about it when I was a young kid, seeing [that] almost all kinds of animals have a tail — but not me," Xia said. Following a recent tailbone injury, Xia decided to investigate the seat of the problem more closely, to learn how evolution had stripped humans and apes of their tails.

The earliest known tailless ancestor of humans and apes is a primate genus called Proconsul, which lived in Africa during the Miocene epoch (23 million to 5.3 million years ago) and had no sign of caudal vertebrae — the bones found in tails. But tail loss is thought to have originated even earlier: about 25 million years ago, when the hominoid lineage of humans and apes diverged from Old World monkeys, Xia and his co-authors wrote in the study.

They compared genetic data from six species of hominoids and nine species of monkeys, looking for differences that could be linked to the presence or absence of tails. One likely candidate emerged in a short piece of DNA called an Alu element — a type of DNA that can jump from one place in the genome to another and affects protein production — tucked away in the gene TBXT, which regulates tail development. This mutation was present in the genomes of apes and humans, but not in those of monkeys.

The researchers then used the gene-editing technology CRISPR to replicate this mutation in the TBXT gene in mice; the genetically modified animals sported tails that varied in length, from normal to no tails at all. While the mutation did affect their tails, it wasn't an on/off switch; this told the scientists that other genes in primates also played a part in our total

taillessness. However, the appearance of this mutation "was likely a critical event" in disrupting tail production, study co-author Itai Yanai, director of NYU's Institute for Computational Medicine and a professor in the Department of Biochemistry and Molecular Pharmacology, told Science.

Tail ups and downs

Apes and early humans may have benefitted from losing their tails as it helped them transition to two-legged walking, an evolutionary development that coincided with being tail-free, the researchers reported.

But primates that kept their tails benefitted in other ways, as these appendages perform a variety of helpful functions, said Michelle Bezanson, a professor of anthropology at Santa Clara University's College of Arts and Sciences in California. Bezanson, whose research covers primate behavior and locomotion, was not involved in the new study.

"Tails may be extended during leaping and aid in orienting the body through the air and in preparation for landing," she told Live Science in an email. "They aid in balance/stabilization while moving, foraging and even sleeping," and can brace the body against a surface while the animal is hanging from its back legs, she added.

A primate's tail can sometimes also serve as a tool. For example, white-faced capuchins (Cebus capucinus) use their tails "to sop up water in a tree hole and then drink the water from the fur, almost like a sponge," Bezanson said. Primates may also snuggle up to their tails as pillows, huddle under them for warmth, or even use them during social behavior.

"One of my favorite things to observe is when a young monkey uses its prehensile tail to grasp onto their mother's body or her tail," Bezanson said. Monkeys may also tug on each others' tails during play, and South American titi monkeys in the Callicebus genus intertwine tails with their mates as a show of affection, Live Science previously reported.

With these myriad possibilities for tail tasks, it's almost enough to make a tailless human feel like they're missing out. Is there any chance that people could one day have tails again? Unfortunately, we lost our tails so long ago that regaining them is likely beyond our grasp, Xia said. Tail loss took place about 25 million years ago, long before our species, Homo sapiens, walked the Earth. Over the many millions of years that followed, the genetic playbook for tail development in our lineage ceased to function, and all the pieces that were required for tails to develop have long since been lost.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

"Even if we correct the specific genetic mutation that we found in our manuscript, we still may not be able to re-develop such a structure," Xia said.

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https://www.livescience.com

Brain fog: Short-term exposure to pollution impacts memory, research finds

2021-11-16

Even short-term exposure to air pollution can have a measurable impact on brain function, especially memory, new analysis has revealed.

Researchers from the University of Queensland and Carnegie Mellon University in the United States made the discovery by looking at the performance of more than 100,000 people who used a "brain training" phone app.

They then matched the performances with data about the air quality in their location on the days they used the app.

One of the lead authors, Andrea La Nauze from UQ's School of Economics, said they found a clear correlation between areas with higher levels of pollution and poorer performance in the app.

"There is existing research which shows pollution affects the cognitive ability of young people and older people and we wanted to test whether that was also true of people in the 'middle' who make up the bulk of the workforce," Dr La Nauze said.

"We found the effects are larger for younger people, so for someone under 30 we find the effect of a high-pollution day is the equivalent of ageing about 15 years in terms of cognitive ability."

On average the researchers found exposure to high levels of fine particulate matter (particles less than 2.5 microns in size) caused a player to drop by almost six points in a 100-point scale where 100 represents the score of the top 1 per cent of cognitive performers.

Dr La Nauze said they found the effect dwindled as people got older, and people over 50 did not display much noticeable decline in cognitive ability on high pollution days compared with days with lower pollution levels.

One of the lead authors, Andrea La Nauze from UQ's School of Economics, said they found a clear correlation between areas with higher levels of pollution and poorer performance in the app.

She said they also found memory seemed to be particularly affected out of seven cognitive functions targeted by the study, which also included verbal ability, attention, flexibility, maths ability, speed and problem-solving.

That had implications, Dr La Nauze suggested, for the types of work which could be affected by high pollution levels.

"That's short-term working memory, so in particular when we're thinking about productivity it's going to be people who rely on short-term memory for their work, people like nurses, teachers, doctors and so on," she said.

"It wouldn't necessarily affect people who work in fields like agriculture or manufacturing where something like attention is going to be the most important determinant of their productivity."

The findings come after the World Health Organisation changed its air quality guidelines in September this year, lowering the acceptable levels of pollution significantly.

Dr La Nauze said the stronger guidelines were a good thing, but even at levels equivalent to the new revised WHO standards they were still seeing cognition effects from pollution.

The researchers looked at data from US-based users of the app Lumosity, but Dr La Nauze said the findings have a lot of relevance for Australia, especially with large-scale bushfires becoming more common.

"Fundamentally it comes down to government policy – reducing vehicle emissions, targeting sources of air pollution such as bushfires and revising air-quality standards," she said.

"Air-quality standards in Australia and around the world should take into account the cognitive effects and their downstream productivity impacts."

The study has been published in the journal National Bureau of Economic Research.

brisbanetimes.com.au, 16 November 2021

https://www.brisbanetimes.com.au

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

Researchers map the impact of human sewage on coastlines around the world

2021-11-11

Researchers have mapped the discharge of global wastewater — treated, septic, and raw sewage — into coastal ecosystems in what they say is the finest detail yet.

And the numbers are intimidating.

Key points:

- Researchers found just 25 watersheds contribute half of the total wastewater nitrogen to the world's oceans
- Meat-heavy diets are a significant factor in nitrogen levels
- High nitrogen levels can lead to algal blooms

Scientists from the University of California and Columbia University calculated the volume of nitrogen and faecal indicator organisms entering the ocean from about 135,000 watersheds around the world.

A watershed is an area of land, often bounded by hills or mountains, that drains all the water from that land to a common outlet such as a river.

They found that just 25 watersheds contribute nearly half of all wastewater nitrogen, with the Yangtze River in China contributing 11 per cent of the world's total.

The researchers calculated that, in 2015, around 6.2 million tonnes of nitrogen entered coastal waters from human wastewater.

The researchers calculated that, in 2015, around 6.2 million tonnes of nitrogen entered coastal waters from human wastewater.

This was about 40 per cent of the nitrogen that agricultural runoff would normally feed into coastal waters.

The watersheds that released the most nitrogen from wastewater were located in Korea, India and China.

However, in terms of the overall contribution of nitrogen to coastal ecosystems, the United States was responsible for the third-highest level behind China and India.

Just under a third of the wastewater-generated nitrogen reaching our oceans globally was from untreated sewage, with treated and septic making up the rest.

While treating sewage removes solid and some organic matter, nitrogen is still present in treated wastewater.

The research is published today in the scientific journal PLOS ONE.

High meat diets equal high nitrogen

To get these figures, the researchers combined data on population density, wastewater treatment, and diet, down to a resolution of 1-square-kilometre grids, for watersheds worldwide.

The most surprising variable that changed the volume of nitrogen discharge was the amount of meat in local diets, lead author and postdoctoral researcher Cascade Tuholske from Columbia University said.

"As someone who studies food systems, the most surprising result to me was the contrast between the Yangtze [China] and Brahmaputra River [Tibet, India, Bangladesh] in terms of nitrogen inputs," Dr Tuholske said.

"The Yangtze added far more nitrogen to coastal waters than what would be expected."

One possible solution to reduce nitrogen loads in wastewater would be to cut down on our meat consumption, he said.

"The more burgers we eat, the more nitrogen we poop, the worse outcomes for coastal habitats.

"This suggests to me that diets in China have shifted far faster to animal-based protein than diets in India."

Why ocean nitrogen levels matter

Elevated nitrogen levels can lead to algal blooms, which can in turn deplete oxygen levels in water as that algae decomposes, according to Megan Huggett, a marine and coastal ecosystem ecologist from the University of Newcastle.

"It can lead to decomposition of algal cells, which can deplete oxygen and lead to fish kills," said Dr Huggett, who wasn't involved in the study.

"[Wastewater] also brings in things like herbicides and pesticides into the system, and plastics of course."

The researchers also estimated the potential exposure of coral reefs and seagrass beds to elevated nitrogen due to wastewater.

CHEMWATCH
Bulletin Board
Curiosities
NOV. 19, 2021

They found that more than half of the world's coral reefs and nearly 90 per cent of seagrass beds experience some elevated nitrogen from human sources.

According to Dr Huggett, some research has actually shown that seagrass beds can help mitigate the impacts of sewage and pathogen loads on nearby reefs.

That's an example of an ecosystem service, and makes a case for why these ecosystems should be conserved, she said.

The Oceania region, which includes Australia, Papua New Guinea and our Pacific neighbours, had the lowest overall nitrogen inputs to coastal ecosystems, according to the research.

That's partly to do with lower population densities, but Dr Huggett says Australia has quite good wastewater treatment.

"I think Australia does a pretty good job," she said.

"A new State of the Environment report [which includes wastewater data] will be released later this year or early next year, so that'll be one to watch."

Today's research found that around half of all watersheds globally had no human wastewater incursion.

The researchers hope their findings can help inform conservation measures, but Dr Tuholske says there's one thing everyone can do to help the problem.

"A shift to plant-based diets can lead to healthier reefs and seagrasses, not just by reducing fertiliser and runoff from feedlots, but also from our own excrement."

abc.net.au, 11 November 2021

https://www.abc.net.au

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Bulletin Board

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NOV. 19, 2021

(NOTE: OPEN YOUR WEB BROWSER AND CLICK ON HEADING TO LINK TO SECTION)

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