

Topic → A Helmholtz resonator

- **A Helmholtz resonator** is a device that resonates at a specific frequency due to the interaction between the mass of air in a neck (or opening) and the elasticity of the air in an enclosed cavity. It's named after Hermann von Helmholtz, who studied acoustic resonance.
- **How It Works:**
- A Helmholtz resonator is typically shaped like a bottle or a sphere with a narrow neck. When sound waves enter the neck, they cause the air inside to oscillate. This system behaves similarly to a mass-spring system:
 - The air in the neck acts like a moving mass.
 - The air in the cavity acts like a spring due to its compressibility.
 - When the frequency of the incoming sound matches the natural resonance of this system, the air vibrates strongly, amplifying that frequency



When you clap, where does the sound come from?

Privali Prakash

What are the odds you clapped your hands in the last 24 hours? Probably very high. Clapping is a common activity for people – so common that we take the sound it makes for granted. But do you know where that sound comes from?

In a study recently published in *Physical Review Research*, researchers used real-life and experimental

data and theory to find the answer.

At the heart of the sound is a Helmholtz resonator – a device that produces sound by trapping and vibrating air within a cavity. When you push air into or out of it, the air molecules oscillate and create sound of a particular frequency. This is also why blowing over the aperture of an open bottle produces a whistling sound.

The researchers said the

air enclosed between the palms is the cavity in a Helmholtz resonator. In an experiment, they deposited dry baby powder into a palm cavity to render the airflow visible. Then as the hands clapped, the researchers tracked airflow behaviour, acoustic signal, cavity pressure, and soft material deformation.

The team found that the first and strongest jet of air was heard at the first impact of the two palms, after

which the jet dissipated. They recorded a few secondary and tertiary jets as well but they created little sound. This established the clapping sound was caused by air flowing between the palms, not by the palms' vibration. Each clapping sound dissipated in about 10 ms.

Palm shapes

Not all claps were the same. The team found that different palm shapes

made different sounds. The frequency, and therefore the pitch, increased as the shape changed from cupped to palm-palm to palm-finger contact.

Claps by some individuals also had two distinct frequency peaks: a lower one associated with the Helmholtz resonator and the higher one with sound from the finger grooves, when the fingers met the receiving hand. These grooves acted like a pipe

open at one end, and the sound was made by air vibrating inside.

Because people clap differently and because fingers can bend to different degrees while clapping, the real-life sound peaks varied from theory.

The team also reported that though the extent of skin deformation didn't affect the frequency much, it could still affect the sound's intensity and how long it lasted.

Prelims Fact

The Shi's Star Catalogue is China's oldest star catalogue. Researchers analysed 118 stars to reveal two distinct observational periods in its pages: around 355 BC and 125 AD.



Shi's Star Catalogue in China world's oldest, says study

The Shi's Star Catalogue is China's oldest star catalogue. Researchers analysed 118 stars to reveal two distinct observational periods in its pages: around 355 BC and 125 AD. Their findings suggest the Catalogue's original observations date to the 'Warring States' period in China's history and that updates were added during the Eastern Han dynasty, possibly in the time of the philosopher and statesman Zhang Heng. Thus, the study confirmed that Shi's Star Catalogue is the world's earliest known star catalogue.

Prelims Fact

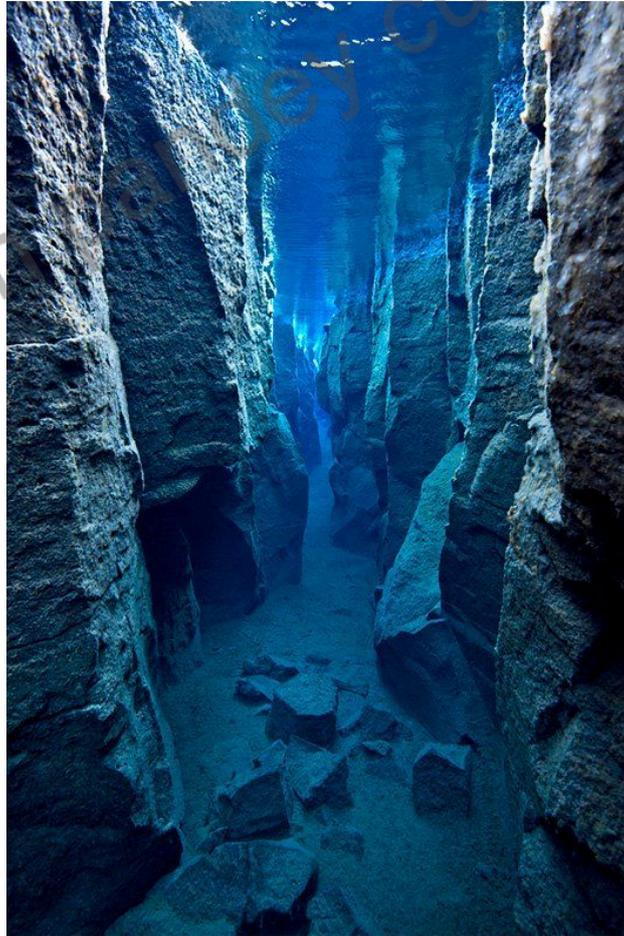
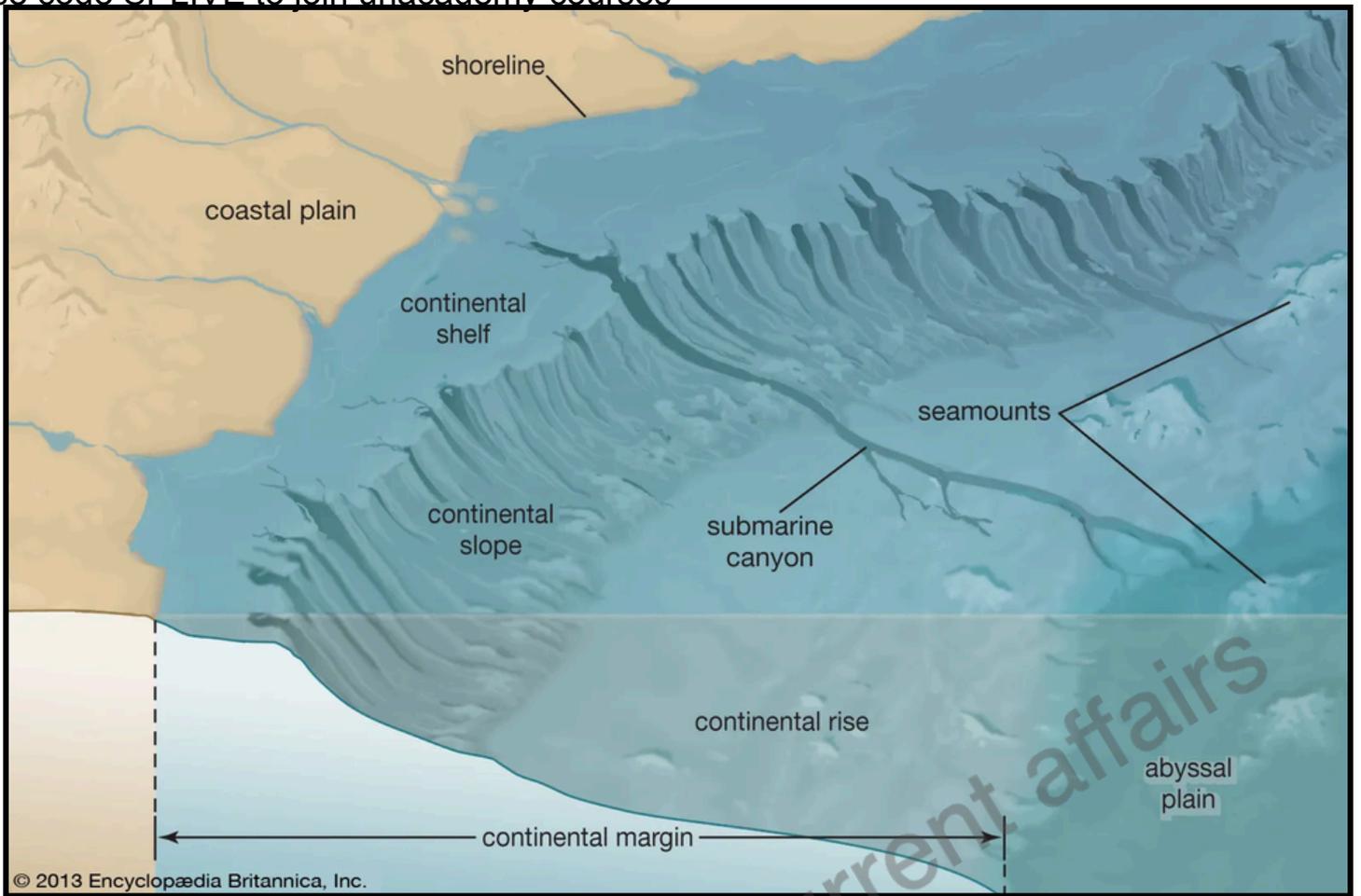
- underwater canyons transporting microplastics into the deep sea



Submarine canyons move microplastics to deep sea

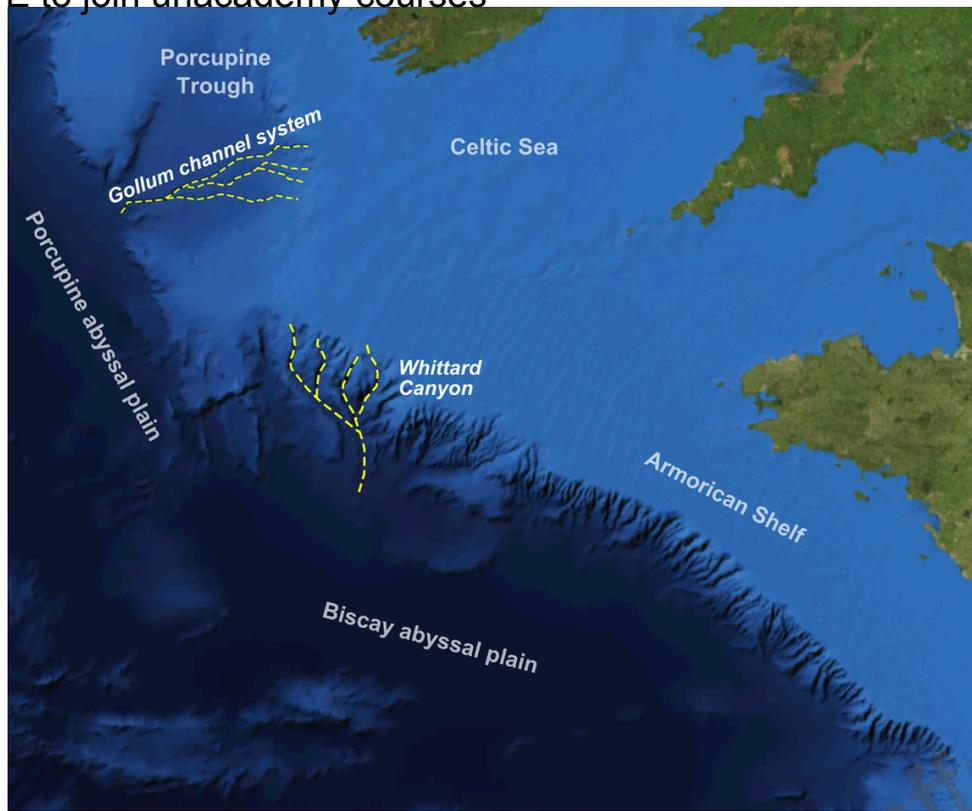
A study in *ACS Environmental Science & Technology* has reported the first direct evidence of turbidity currents, a.k.a. submarine avalanches, in underwater canyons transporting microplastics *en masse* into the deep sea. Researchers used hydrodynamic monitoring and sediment sampling in the Whittard Canyon off Ireland to find that even canyons not fed by rivers could transport pollutants to depths of more than 3 km. The same currents also move nutrients and nurture deep-sea biodiversity.

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□ Mapping - Whittard Canyon → Ireland

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Topic → What is the total allowable catch?

- The total allowable catch (TAC) is a limit on the total quantity of fish that fishers can catch in a particular area.
- It's usual for agencies and governments worldwide that have jurisdiction over fisheries or fish stock in seas, oceans, lakes, etc. to impose a TAC to prevent fishers from catching and removing too many fish from the water body



Question Corner

Fishing limit

What is the total allowable catch?

The total allowable catch (TAC) is a limit on the total quantity of fish that fishers can catch in a particular area. It's usual for agencies and governments worldwide that have jurisdiction over fisheries or fish stock in seas, oceans, lakes, etc. to impose a TAC to prevent fishers from catching and removing too many fish from the water body. TACs are important so that the fish population in a water body can maintain a minimum size every year that allows it to sustain itself. Without a TAC, overfishing can remove too many fish, leaving behind

too few for the population to sustain itself.

Another TAC was recently in the news in an escalating dispute involving the U.S. and Russia. Last month, a U.S. judge blocked the import of Patagonia toothfish caught in the South Atlantic Ocean. Since 2021, Russia has refused to admit a TAC for this species in this area set by the Commission on the Conservation of Antarctic Marine Living Resources. The rejection forced all other countries on the Commission to set their own limits.

Readers may send their questions / answers to questioncorner@thehindu.co.in

Topic - Microgravity increases core body temperature

- “Micro-” means “very small,” so microgravity refers to the condition where gravity seems to be very small.
- In microgravity, astronauts can float in their spacecraft – or outside, on a spacewalk. Heavy objects move around easily.
- For example, astronauts can move equipment weighing hundreds of pounds with their fingertips. Microgravity is sometimes called “zero gravity,”

On the trail of body heat

In the microgravity of space, thermoregulation faces significant challenges



Exiting station: An astronaut taking part in a spacewalk. NASA

1 An important factor that determines an astronaut's well-being on space journeys is thermoregulation: their body's capacity to maintain a stable internal temperature

2 IIST Thiruvananthapuram researchers have used a model to find that "microgravity consistently increases core body temperature, with fluid shifts playing a crucial role in thermal balance"

3 Microgravity environments affect the human body's bones, muscles, the heart, the immune system, metabolism, even individual cells

4 Some of the resulting complications can be severe, so space agencies and astronauts continuously monitor a spacefarer's body temperature

5 The model simulates "the effects of microgravity on thermoregulation, including blood redistribution, reduced blood volume, changes in metabolism, and alterations in bone and muscle mass"

Topic ---> Caste Census

What are the key objectives of caste count?

Why is the BJP government's decision a surprise? What are the challenges the exercise will throw up? What are the complexities? What will it mean for the reservation ceiling? Which are the States that have already conducted a caste enumeration?

risivella.jeebaraj

The story so far:
The Union Cabinet has decided that the next Census will include questions on caste to its enumeration of India's population, for the first time in almost a century. The decision, a reversal of the ruling Bharatiya Janata Party's (BJP) stance so far, comes ahead of the crucial Bihar elections, and throws up myriad challenges.

Have Indians been counted by caste before?
When the British first started counting India's population in 1881, caste data was included in the information gathered. For the next half-century, the decennial censuses collected caste information. The last time that data was published was from the 1931 census, which counted 447 castes and sub-castes across the country. Though the wartime 1941 census also collected data on individual castes, it was never released. After India gained independence, the government decided to avoid the question of caste in the census, only counting Scheduled Castes and Tribes (SCs/STs).

In his report on the 1931 census, then-Census commissioner J.H. Hutton dismissed the arguments of those who did not wish to collect caste and religion data on the grounds that they could perpetuate divisions, noting that "the census cannot, however, hide its head in the sand and like the proverbial ostrich, but must record accurately as possible facts as they exist." He trucked down previous British attempts to list a hierarchy of castes, in accordance with their perceived ranks in society, instead choosing to see occupations as the basis of classification, though this did not account for the fluidity of

caste identities and the variations in caste names across time and geographies. The 1931 census data was also the basis for reservation efforts half a century later; its finding that 52% of the country's population belonged to castes later grouped under the Other Backward Class (OBC) category became the basis of the Mandal Commission's recommendation for a 27% quota for OBCs in education and government jobs.

In 2011, the Union Ministry of Rural Development kicked off a different kind of caste-counting exercise as part of its Socio-Economic and Caste Census (SECC). The data collected was meant to be used for research and policy making and to effectively design and implement development and welfare schemes. Though parts of the data were published in 2016, the raw data on specific caste populations was not included. As the SECC left its questions on caste open-ended rather than making them choose their caste from a set list, respondents often entered their surnames, meaning that the SECC enumerators counted more than 46 lakh different castes.

Have individual States counted castes?
At least three States have conducted caste censuses. Bihar Chief Minister Nitish Kumar led the effort to survey the State's caste break-up in 2023, finding that OBCs and Extremely Backward Classes (EBCs) accounted for more than 63% of the State's population, stirring the political pot with demands for higher representation for these castes in politics, education, and employment. The Congress rode to power in Telangana in 2023, partly on the basis of its promise to conduct a caste survey, which was published in 2024 and showed that backward classes make up more than 56% of the State's population. Karnataka's caste survey was also commissioned by a Congress government, in Chief Minister Siddaramaiah's first term in 2015. The results, however, were published only a decade later, and showed that the State's OBC population stood at almost 70%.

What will this data be used for?
Apart from its use in academic research and policy making, the key import of caste data from a public and political viewpoint is what changes it will drive in affirmative action or reservation policies. The 27% OBC quota for education and government jobs was set on the basis of a projection from the 1931 census; a new caste count could well upend those estimates. In Karnataka, for instance, where the caste survey found that the OBC population is significantly higher than estimated, there have

State from 22% to 58%. The clamour for more reservation, backed by caste population data, is also likely to lead to a challenge of the Supreme Court-mandated 50% cap on reservation.

What is the context for this decision?
The BJP-led government's decision came as a surprise given that the demand for a caste census has been a major plank of the Opposition's poll campaigns. The BJP has long resisted the demand, accusing the Congress of using caste to divide Indians. Minister of State for Home Nityanand Rai even responded to questions in Parliament insisting that there were no plans to include caste in the next Census, terming it a "matter of policy".

The Bihar caste survey, however, set off a political tinderbox that carried over into the 2024 general election campaign. The Opposition, in its campaign for social justice, also stoked fears among sections of voters that the BJP was seeking a large majority in order to be able to remove reservations and amend the Constitution, which led to lower vote counts for the BJP in many constituencies.

The decision to conduct a caste count "steals the thunder" from the Opposition's campaign just ahead of the Bihar Assembly elections, where it is sure to become a poll issue. The BJP is seeking to reframe the narrative, claiming that the Congress is all talk and no action, as it had never conducted a caste census at the national level while in power at the Centre. Though the Opposition is seeking to claim credit for pressuring the government into taking this decision, it is also pivoting to the logical next step, of demanding that reservations be hiked in response to the caste census findings, seeking to breach the Supreme Court's 50% cap.

What is the timeline for implementation?
The catch in the Centre's announcement is that no dates have yet been notified for the next Census. The last Census was held in 2011, with the 2021 Census being delayed indefinitely, initially due to the COVID-19 pandemic. The addition of a caste component involves more work for Census officials.

The next step will be to draft a code-directory of castes to be used in the Census. Unlike the SECC, which had an open-ended query on the respondent's caste, the Census is likely to provide a drop-down list of castes for respondents to choose from. How castes will be listed is a thorny political question, given that the Centre and States have differing, and often contentious OBC lists. Linguistic and regional diversity in caste names, splitting of castes into sub-castes over time, and disagreements on whether specific castes fit into SC, OBC, or general categories, are likely to complicate the process. Religion adds another factor into the mix, with questions about how non-Hindu groups will be recognised and whether they will



Counting more: Bihar Congress president celebrates with supporters the

Caste Census in India: A Historic Reversal and Its Implications

For the first time in nearly a century, the Indian government has decided to reintroduce **caste enumeration** into the **national Census**, .

Historical Context

- **Colonial Era:** Caste data was collected from 1881 to 1931; the last full caste data was published in **1931**.
- **Post-Independence:** Successive governments chose to only enumerate **Scheduled Castes (SCs)** and **Scheduled Tribes (STs)** to avoid deepening social divisions.
- The **Mandal Commission (1980s)** used the 1931 data to justify **27% reservation for OBCs**, a move still foundational to current affirmative action policies.

The Socio-Economic and Caste Census (SECC)

- 2011, the Union Ministry of Rural Development initiated the Socio-Economic and Caste Census (SECC).
- This exercise aimed to gather data for policy-making and welfare schemes.
- However, the raw data on specific caste populations was never fully released, leading to confusion and frustration.

State-Level Caste Surveys

- Several states have taken matters into their own hands, conducting caste surveys to better understand their demographics.
- For instance, Bihar's recent survey revealed that OBCs and Extremely Backward Classes (EBCs) make up over 63% of the population, igniting demands for increased representation.



Implications of the Caste Census

Academic and Policy Uses

- The inclusion of caste data in the Census is not just a bureaucratic exercise; it has profound implications for academic research and policy-making.
- Understanding caste demographics can help tailor development programs and welfare schemes more effectively.

Challenges Ahead

Implementation Timeline

- While the decision is monumental, the timeline for implementation remains unclear.
- The last Census was conducted in 2011, and the 2021 Census was delayed due to the pandemic.
- Adding a caste component will require significant logistical planning.

Complications in Caste Classification

- One of the major challenges will be how to classify castes. The diversity of caste names, regional variations, and the contentious nature of OBC lists will complicate the process.
- Additionally, how non-Hindu groups will be recognized remains a pressing question.

Conclusion

- The decision to include caste in the next Census is a watershed moment for India.
- It opens the door to a more nuanced understanding of the country's demographics and could reshape social policies for years to come.

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- However, the road ahead is fraught with challenges, and how these issues are navigated will be crucial in determining the impact of this decision.

GS Paper 1 – Indian Society

Q How does caste continue to influence Indian society despite constitutional provisions against discrimination?

Discuss in light of recent caste census developments.

(250 words)

GS Paper 2 – Governance, Constitution, Polity, Social Justice

Q The caste census has been projected as a tool for social justice. Do you agree? Discuss with reference to affirmative action and reservation policies.

(250 words)

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