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Source: The Hindu | **GS-3:** Biotechnology, Drug Discovery, Biodiversity

Quality elementary teachers are vital to lives of children, nation-building: top court

Krishnadas Rajagopal

NEW DELHI

The Supreme Court on Thursday emphasised the importance of educating elementary school teachers, saying the development and lives of children, and even the future of the nation, depend on the quality of training given to these educators.

“Though free and compulsory elementary education to all children aged 6 to 14 years has now attained the status of an enforceable fundamental right, we have not bestowed on teacher education the attention that it deserves... The development of a child, or for that matter, the life of a child is integrally connected to the role of an elementary school teacher,” Justice P.S. Narasimha, heading a Division Bench, observed.



The court said there was no value higher than development of students' mind and character.

The top court observed that there was no human resource or value higher than the development of a student's mind and character. “Therefore, the elementary school teachers have the most important role in nation-building and as such, they have to be treated with utmost respect and care,” the court said ahead of Teachers' Day celebrations on September 5.

The top court referred to judicial precedents that five duty-bearers safeguard the fundamental right to elementary education recognised in the Right to Education (RTE) Act, 2009. They include the government, the local authority, the neighbourhood school, the parents/guardians, and finally, the teacher.

Justice Narasimha added the sixth and seventh duty-bearers – teacher education institutions (TEIs), as defined under Section 2(e) of the National Council for Teacher Education Act, and the National Council for Teacher Education (NCTE) itself.

“The Council is also to ensure that the TEIs imparting teacher education function effectively, efficiently and conduct their affairs with integrity,” Justice Narasimha observed.

11. भारत में उच्च शिक्षा की गुणता को अंतर्राष्ट्रीय स्तर पर प्रतियोगी बनाने के लिए उसमें भारी सुधारों की आवश्यकता है। क्या आपके विचार में विदेशी शैक्षिक संस्थाओं का प्रवेश देश में उच्च और तकनीकी शिक्षा की गुणता की प्रगति में सहायक होगा? चर्चा कीजिए।

The quality of higher education in India requires major improvements to make it internationally competitive. Do you think that the entry of foreign educational institutions would help improve the quality of higher and technical education in the country? Discuss.

12½

- Q18.** स्कूली शिक्षा के महत्त्व के बारे में जागरूकता उत्पन्न किए बिना, बच्चों की शिक्षा में प्रेरणा-आधारित पद्धति के संवर्धन में निःशुल्क और अनिवार्य बाल शिक्षा का अधिकार अधिनियम, 2009 अपर्याप्त है। विश्लेषण कीजिए। (250 शब्दों में उत्तर दीजिए)

The Right of Children to Free and Compulsory Education Act, 2009 remains inadequate in promoting incentive-based system for children's education without generating awareness about the importance of schooling. Analyse.

(Answer in 250 words) 15

18. राष्ट्रीय शिक्षा नीति 2020 धारणीय विकास लक्ष्य-4 (2030) के साथ अनुरूपता में है। उसका ध्येय भारत में शिक्षा प्रणाली की पुनःसंरचना और पुनःस्थापना है। इस कथन का समालोचनात्मक निरीक्षण कीजिए। (उत्तर 250 शब्दों में दीजिये)

National Education Policy 2020 is in conformity with the Sustainable Development Goal-4 (2030). It intends to restructure and reorient education system in India. Critically examine the statement. (Answer in 250 words)

15

1. Quality Elementary Teachers: Foundation of Nation-Building

Source: The Hindu

Subject: GS-2 — Education | Fundamental Rights | Governance | Human Resource Development

Context: The Supreme Court has emphasised that **elementary-school teachers are central to realising the Right to Education**, because the development of children's minds and character ultimately determines the quality of human capital and nation-building.

1. Education as a Constitutional Right

- **Article 21A:** Guarantees free and compulsory education to children aged 6–14 years as a Fundamental Right; inserted by the **86th Constitutional Amendment Act, 2002**.

- **Article 45:** Directs the State to provide **early childhood care and education for children below six years**.
- **Article 46:** Requires promotion of the educational and economic interests of **Scheduled Castes, Scheduled Tribes and weaker sections**.
- **Article 51A(k):** Makes it a **Fundamental Duty of parents/guardians** to provide opportunities for education to children aged 6–14 years.
- **RTE Act, 2009:** Gives statutory effect to Article 21A and establishes the framework for **free and compulsory elementary education**.

2. Why the Elementary Teacher Is Central

- **From access to learning:** The constitutional guarantee is not fulfilled merely by enrolling children; it requires **meaningful and quality learning**.
- **Foundation of human capital:** Elementary education develops **literacy, numeracy, reasoning, values and character**, which form the basis of later education and employability.
- **Nation-building:** The Supreme Court observed that there is no human resource more valuable than the development of a student's **mind and character**, making elementary teachers crucial to nation-building.
- **Current scale:** UDISE+ 2024–25 records **1.01 crore teachers** across school education, showing the enormous scale at which teacher quality can influence India's human-capital outcomes.

3. Right to Education Requires a Shared Responsibility

The effective delivery of Article 21A cannot rest on the teacher alone. The Supreme Court identifies **seven duty-bearers**:

- **Government** — policy, financing and institutional support.
- **Local authorities** — implementation at the grassroots.
- **Neighbourhood schools** — accessible and inclusive schooling.
- **Parents/Guardians** — ensuring children's participation.
- **Teachers** — quality teaching and holistic development.
- **Teacher Education Institutions (TEIs)** — preparing competent teachers.
- **National Council for Teacher Education (NCTE)** — regulating and maintaining standards in teacher education.

4. Teacher Quality Requires Strong Teacher Education

- **Professional preparation:** Teachers need sound subject knowledge, pedagogy, classroom skills and continuous professional development.
- **NCTE's role:** The **National Council for Teacher Education**, established under the **NCTE Act, 1993**, regulates teacher education and seeks to maintain standards.
- **Institutional accountability:** Teacher Education Institutions must function effectively and with integrity; regulatory oversight is therefore essential for maintaining teacher quality.
- **Minimum qualifications:** **Section 23 of the RTE Act** provides for prescribed minimum qualifications for teachers, linking teacher competence with the effective delivery of the right to education.

5. **The Way Forward — From Universal Schooling to Quality Learning**

- **Strengthen teacher education:** Improve the quality of pre-service training and continuous professional development.
- **Recruitment and deployment:** Fill vacancies and ensure **equitable distribution of teachers**, particularly in disadvantaged and remote areas.
- **Accountability with support:** Combine performance assessment with mentoring, resources and professional autonomy rather than relying only on punitive mechanisms.
- **Learning outcomes:** Shift the focus from **enrolment and infrastructure alone to foundational literacy, numeracy and holistic development**.
- **Whole-of-system approach:** Government, schools, parents, teachers, TEIs and regulators must work together because **quality education is a shared constitutional responsibility**.

• POLICY

Inside Jharkhand & Bihar's 25-year Sone river dispute

Santosh Singh

Patna, September 3

THE 25-YEAR-OLD dispute between Bihar and Jharkhand over the sharing of Sone river water was resolved on Monday with the signing of an inter-state memorandum of understanding under which Bihar will receive 5.75 million acre-feet (MAF) and Jharkhand 2 MAF of water. The agreement is expected to pave the way for long-delayed irrigation, reservoir and river-linking projects in drought-prone regions of both states.

What is the history of the Sone river dispute?

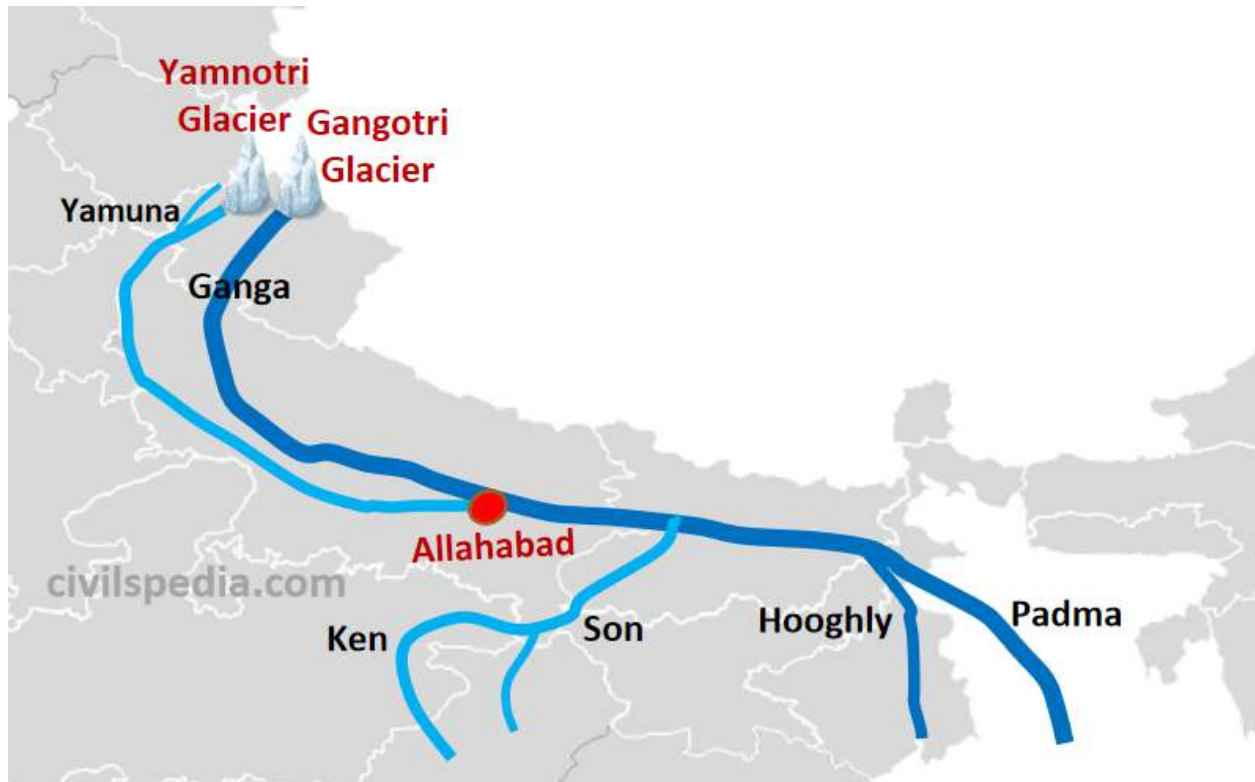
The Sone flows generally northward from its upper catchments in Madhya Pradesh, passing through Uttar Pradesh and along the Jharkhand-Bihar boundary before joining the Ganga in Bihar (*see map*). In November 2000, when Jharkhand was carved out of Bihar, the new state inherited the major upper catchment areas and tributaries while lower riparian agricultural hubs remained in Bihar.

But the core of the dispute traces back to the 1973 Bangsagar Agreement, a tripartite agreement involving Madhya Pradesh and Uttar Pradesh, under which undivided Bihar was allocated 7.75 MAF of Sone water out of the total basin yield. After Bihar's division, no binding formula existed to split that 7.75 MAF allocation between Bihar and the newly formed state of Jharkhand.

While various committees attempted mediation over the last two decades, talks repeatedly stalled over reservoir height, land submergence, and volumetric splits.

How did the two states arrive at a consensus?

Under the pact, the two states agreed that Bihar will receive 5.75 MAF of Sone water while Jharkhand will re-



2. Bihar–Jharkhand Sone River Water Dispute: 25-Year Dispute Resolved

Source: The Indian Express

Subject: GS-2 — Inter-State Relations | Cooperative Federalism | Water Governance
GS-3 — Water Resources | Irrigation

Context: Bihar and Jharkhand have resolved their **25-year-old dispute over sharing Sone River water** through an inter-State Memorandum of Understanding (MoU), allocating **5.75 million acre-feet (MAF) to Bihar** and **2 MAF to Jharkhand**.

1. Sone River — Geographical Profile

- **Origin:** The Sone originates near **Amarkantak in the Maikal Highlands**, at about 640 m elevation.
- **Course:** It is a **Peninsular, east-flowing river**, moving through **Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Jharkhand and Bihar** before joining the Ganga.

- **Length:** Approximately **881 km**.
- **Confluence:** The Sone joins the **Ganga at Maner in Bihar**, around **16 km upstream of Patna**. It is a **right-bank tributary of the Ganga**.
- **Important tributaries:** **Rihand, Kanhar, North Koel, Gopad, Banas, Ghagher, Johilla and Mahanadi** form important tributary systems of the Sone basin.
- **Basin significance:** Its basin supports extensive **irrigation and agriculture**, particularly in south Bihar and adjoining areas of Jharkhand.

2. **Origin of the Bihar–Jharkhand Dispute**

- **1973 Bansagar Agreement:** Madhya Pradesh, Uttar Pradesh and undivided Bihar agreed to share Sone waters, with **7.75 MAF allocated to Bihar**.
- **Creation of Jharkhand (2000):** Jharkhand inherited much of the **upper Sone catchment and tributary system**, while major downstream irrigation infrastructure remained in Bihar.
- **Core issue:** There was no mutually accepted mechanism for dividing Bihar's earlier **7.75 MAF entitlement** between Bihar and the newly created Jharkhand.
- **Why it persisted:** Negotiations repeatedly stalled over **water allocation, reservoir levels, land submergence and rehabilitation**.

3. **2026 Settlement — What Has Changed?**

- **Water sharing:** Bihar — **5.75 MAF** | Jharkhand — **2 MAF**.
- **Indrapuri Barrage:** The agreement facilitates fuller utilisation of the **Indrapuri Barrage (Sone Barrage)** in Rohtas, which feeds the Sone canal network.
- **Bihar:** Additional water will strengthen irrigation in the **Shahabad–Magadh agricultural belt**, including Rohtas, Bhojpur and adjoining districts.
- **Jharkhand:** The agreement enables development of canal networks in the **drought-prone Palamu and Garhwa regions**.
- **Land and rehabilitation:** Specified reservoir levels and rehabilitation provisions aim to **minimise land submergence and displacement**.

4. **Why the Settlement Matters**

- **Water and food security:** More reliable irrigation can improve agricultural productivity and rural livelihoods.

- **Drought management:** Better water availability in drought-prone areas strengthens regional resilience.
- **Infrastructure development:** The settlement removes a major obstacle to **irrigation, reservoir and river-management projects**.
- **Cooperative federalism:** Demonstrates how **negotiation and consensus-building** can resolve long-running inter-State resource disputes.
- **Balanced approach:** A durable settlement must balance **upstream development, downstream irrigation, land rights, rehabilitation and environmental concerns**.

Rajnath releases new framework for defence diplomacy

The Hindu Bureau

NEW DELHI

Defence Minister Rajnath Singh on Thursday released *Raksha*, a comprehensive strategic framework outlining India's road map and vision for defence diplomacy and global defence partnerships over the next 10 years.

The document seeks to strengthen India's strategic engagement with friendly nations by aligning national security objectives with proactive international cooperation. It lays down an actionable vision aimed at promoting long-term stability, strengthening partnerships, and advancing India's role in an evolving global security

defence partnerships, expanding joint military exercises, and enhancing capacity-building initiatives with friendly countries.

A major focus of the framework is also on promoting indigenous defence exports under the Make-in-India initiative. It seeks to position India as a reliable global defence manufacturing partner by expanding international cooperation around indigenously developed defence technologies.

Maritime security forms another important pillar of the framework, with emphasis on strengthening India's role as a net security provider and first responder in the Indian Ocean Region. The road map under-

3. Raksha: India's New Framework for Defence Diplomacy

Source: The Hindu

Subject: GS-2 — International Relations | Defence Diplomacy | Strategic Partnerships
GS-3 — Defence & Security | Defence Manufacturing

Context: Defence Minister **Rajnath Singh** released **Raksha**, a comprehensive **10-year strategic framework** setting out India's vision and roadmap for defence diplomacy and global defence partnerships.

1. What is Defence Diplomacy?

- **Meaning:** Use of **defence and military cooperation as an instrument of foreign policy** to build trust, protect national interests and contribute to regional and global security.
- **In practice:** It includes **defence partnerships, military exercises, training, capacity-building, intelligence cooperation, defence technology cooperation and defence exports**.
- **Strategic purpose:** It enables India to strengthen partnerships **without relying only on traditional diplomatic channels**, while improving its own defence capabilities.

2. Raksha — Vision and Strategic Objectives

- **National security + international cooperation:** Align India's national-security objectives with proactive engagement with friendly countries.
- **Long-term partnerships:** Build durable bilateral and multilateral defence relationships rather than limiting cooperation to military purchases.
- **Global security role:** Strengthen India's position as a responsible security partner in an evolving global security environment.
- **Capacity-building:** Use training, military exchanges and joint exercises to enhance the capabilities and interoperability of partner countries.

3. Defence Diplomacy as a Tool of India's Defence Industry

- **Make in India:** Promote **indigenous defence production and exports** as an important component of external engagement.

- **Defence exports:** Position India as a **reliable global defence-manufacturing partner**, moving from a predominantly buyer-oriented approach towards greater participation as a supplier.
- **Technology cooperation:** Expand international partnerships around **indigenously developed defence technologies**, creating opportunities for co-development and industrial cooperation.
- **Strategic benefit:** Defence exports can simultaneously generate **economic value, technological learning, diplomatic influence and strategic partnerships**.

4. **Maritime Security and the Indian Ocean Region**

- **Net Security Provider:** A major focus is strengthening India's role as a **net security provider and first responder in the Indian Ocean Region (IOR)**.
- **Regional stability:** Defence cooperation with maritime partners can help maintain **peace, stability and security** in the Indian Ocean.
- **Why important for India:** The IOR is vital for India's **trade, energy flows, connectivity and national security**, making maritime partnerships an important part of defence diplomacy.

5. **Significance for India's Foreign Policy**

- **Strategic autonomy:** Wider defence partnerships reduce excessive dependence on any single external partner.
- **Trust and influence:** Military-to-military engagement creates **strategic trust and diplomatic influence**.
- **Self-reliance:** Defence diplomacy can support **Atmanirbhar Bharat** by linking foreign partnerships with domestic manufacturing and technology.
- **Regional security:** India's defence capabilities can be used not only for national defence but also for **capacity-building, humanitarian assistance, disaster response and maritime security**.
- **Global role:** It supports India's transition from a **security consumer to a security contributor**.

ISRO launches advanced imaging satellite EOS-05

India's first dedicated imaging satellite will provide real-time imagery from about 36,000 km above earth; ISRO breathes easy after successful mission in the wake of back-to-back failures

Hemanth C.S.
BENGALURU

The Indian Space Research Organisation (ISRO) on Friday successfully launched its advanced earth observation satellite EOS-05 aboard the Geosynchronous Satellite Launch Vehicle (GSLV-F17).

The GSLV, on its 19th flight, placed the 2,367-kg EOS-05 into the intended sub-geosynchronous transfer orbit (Sub-GTO) about 18 minutes after lifting off from the second launch pad of the Satish Dhawan Space Centre in Sriharikota at 2.55 a.m.

The EOS-05 is India's first imaging satellite designed to monitor earth from geosynchronous orbit, about 36,000 km above earth.

"I am very happy to announce that the GSLV-F17 vehicle has successfully and precisely injected the advanced earth observation satellite EOS-05 into the intended and required orbit," ISRO Chairman V. Narayanan said.

He said this was the 107th launch from the spaceport in Sriharikota and the 19th mission of the GSLV.

"The first launch of the GSLV-D1 was done with a payload of 1,536 kg. From that, we have gradually im-

EOS-05 is India's first dedicated imaging satellite placed in the geosynchronous orbit, about 36,000 km above the earth



EOS-05 replaces the EOS-03 satellite lost in the unsuccessful GSLV-F10 mission in August 2021

Eye in the sky



Wonder awaits: A child watches the EOS-05 launch through binoculars. PTI

At 2,367 kg, EOS-05 is the **heaviest satellite** launched by the GSLV

Key purposes: Near real-time imagery will aid agriculture, environment monitoring, and disaster management

■ **Strategic data** from the geo platform will support "national activities"

Lifespan: The satellite has an operational life of **nine years** and is equipped with multi-band operating capabilities

■ This is the **19th GSLV mission** and the 107th launch from Sriharikota



■ **3-stage, 51.7 metre GSLV,** with its third stage being cryogenic, has a lift-off mass of 420.5 tonnes

proved the performance of this vehicle by optimising the structural mass and improving the propulsion systems. Today, we have injected the heaviest satellite, a 2,367-kg satellite, using this launch vehicle," he added.

Dr. Narayanan said that once operationalised, EOS-05 would become In-

dia's first dedicated imaging satellite operating from the geosynchronous orbit, providing important strategic data for the country.

'Operating perfectly'

"From the satellite data, we confirm that all the valves are operating perfectly, the solar panel is deployed, and the health of

the satellite is perfectly all right. In the coming days, we will raise the orbit and take it to the required orbit and place the satellite in the geo platform for national activities," Dr. Narayanan said.

The EOS-05, dubbed an "eye in the sky", will provide real-time imagery, helping sectors such as agriculture, environment and disaster management.

A huge relief

The successful launch comes as a huge relief for ISRO, which has not carried out a launch since the failure of the PSLV-C62 mission carrying the EOS-N1 earth observation satellite on January 12, 2026.

The space agency, following the back-to-back failures of the PSLV-C62 in January 2026 and the PSLV-C61 on May 18, 2025, had taken a cautious approach and refrained from carrying out further launches.

Though seven missions, including the GSLV-F17/EOS-05 mission, had been scheduled to take place in the first quarter of 2026, ISRO did not launch any satellites during the period.

The successful launch of the 2367-kg EOS-05 also puts behind the failure ISRO had encountered in August 2021 with the GSLV-F10/EOS-03 mission.

4. ISRO's GSLV-F17 Successfully Launches EOS-05

Source: Press Information Bureau (PIB)

Subject: GS-3 — Science & Technology | Space Technology | Earth Observation

Context: On 4 September 2026, the Indian Space Research Organisation (ISRO) successfully launched **GSLV-F17** from the **Second Launch Pad at Satish Dhawan Space Centre, Sriharikota**, placing **EOS-05** into its intended **Sub-Geosynchronous Transfer Orbit (Sub-GTO)**. EOS-05 is India's **first imaging satellite designed to operate from a geosynchronous orbit**.

1. GSLV-F17 — India's Evolving Launch Capability

- **GSLV:** The **Geosynchronous Satellite Launch Vehicle** is a three-stage launcher using **solid, liquid and cryogenic propulsion**, designed to place heavier satellites into high-energy orbits.
- **19th GSLV flight:** GSLV-F17 marks the **19th flight of the GSLV programme** and the **107th launch from Sriharikota**.
- **Heaviest GSLV payload:** The mission carried approximately **2,367 kg**, making it the **heaviest payload carried by GSLV so far**.
- **Indigenous cryogenic stage:** The use of an indigenous cryogenic upper stage demonstrates India's growing capability in **advanced propulsion technology**.

2. EOS-05 — India's First Geosynchronous Imaging Satellite

- **Type:** Advanced **Earth-observation satellite** developed by ISRO.
- **Unique feature:** EOS-05 is India's **first dedicated imaging satellite designed to operate from geosynchronous orbit**, approximately **36,000 km above Earth**.
- **Sub-GTO:** GSLV-F17 initially placed the satellite into a **Sub-Geosynchronous Transfer Orbit**; the spacecraft will subsequently undertake orbital manoeuvres to reach its operational orbit.
- **Persistent observation:** Operating from geosynchronous orbit allows the satellite to maintain a **continuous or near-continuous view of a broad region**, unlike conventional low-Earth Earth-observation satellites that repeatedly pass over a location.

- **Applications:** Earth-observation data can support **agriculture, water resources, forestry, environmental monitoring, urban planning, disaster management and strategic requirements.**

3. Significance of the Mission

- **New Earth-observation capability:** Adds a different orbital capability to India's existing Earth-observation architecture, most of which operates from **low-Earth or sun-synchronous polar orbits.**
- **Strategic data:** The satellite is expected to provide important **strategic Earth-observation data**, strengthening India's independent geospatial capabilities.
- **Disaster management:** Persistent observation can improve monitoring of **large-scale natural disasters and rapidly changing situations.**
- **Developmental applications:** Satellite imagery strengthens **resource mapping, agricultural monitoring, environmental assessment and infrastructure planning.**
- **Space-sector ecosystem:** The mission reflects growing **ISRO-industry collaboration**, which is expanding India's capabilities across the wider space ecosystem.
- **Technological advancement:** The successful deployment of a heavier payload demonstrates continued improvement in **GSLV's structural, propulsion and payload-carrying capabilities.**

'UN Convention on the Law of the Sea is still the constitution of oceans'

'We have 172 countries which are parties to UNCLOS; this is near universal; even though the U.S. is not a party, it regards UNCLOS as the authoritative law of the sea,' says the Magsaysay award winner; he adds that Iran, which has blockaded the Strait of Hormuz, is not a party to the conventions, but the regime of transit passage has become part of customary international law and is binding on Tehran

INTERVIEW Tommy Koh M. Kalyanaraman Among the Ramon Magsaysay award winners this year was Tommy Koh. Born in 1937 and educated as a lawyer and a legal scholar, Mr. Koh chaired a pivotal negotiating committee of the Third United Nations Conference on the Law of the Sea. In 1982, as presi-	dent of the entire conference, Mr. Koh led more than 150 nations to adopt the UN Convention on the Law of the Sea (UNCLOS), which has been in the news because of many disputes that have arisen including Strait of Hormuz. What do you think the award, especially the recognition of your role in UNCLOS, signifies? It is an endorsement of my work to build a world governed by law and not by force.	You took over the presidency of UNCLOS III in 1980, inheriting nearly a decade of negotiation. What were the hardest compromises you had to broker in the final years before the 1982 signing? The biggest challenge was the Reagan Administration's radical demands on seabed mining which were rejected by the developing countries. [U.S. President Ronald Reagan changed the stance of the U.S. taken	 during the Jimmy Carter era. He objected to UNCLOS Part XI's treatment of the deep seabed as the "common heritage of mankind" that he saw as going against free enterprise and	private-property norms.] The U.S. never ratified the Convention despite the 1994 Part XI fix. Many other nations such as Iran haven't either. Is there a case for UNCLOS IV so all nations are onboard? We have 172 countries which are parties to UNCLOS. This is near universal. Even though the United States is not a party, it regards UNCLOS as the authoritative law of the sea.	Do you think the Malacca-Singapore straits are a model for resolving the Strait of Hormuz crisis? Or do you think status quo before the war is the best solution for the world, if not for Iran? The priority is to end the war. Before the war there was no trouble in the Strait of Hormuz. Do the Malacca-Singapore straits provide transit rights to warships and	submarines? Iran seems to be very keen on not allowing that. Iran is not a party to UNCLOS. However, the regime of transit passage has become part of customary international law and is binding on Iran. Given current EEZ (exclusive economic zone) and seabed disputes – South China Sea, Indian Ocean boundary questions – do you think UNCLOS's core architecture is	holding up? It is still the "constitution" of the world's ocean. Countries dub some ships as dark fleet and take punitive, material action against them including in the high seas. Do you agree with that? This is a big problem for the International Maritime Organization (IMO). It is at the IMO that we should try to tackle this problem.
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5. UNCLOS: The "Constitution of the Oceans"

Source: The Hindu

Subject: GS-2 — International Relations | International Law | Maritime Security

Context: With disputes involving the **Strait of Hormuz**, **Exclusive Economic Zones (EEZs)** and **freedom of navigation**, the continuing relevance of the **United Nations Convention on the Law of the Sea (UNCLOS)** has come into focus. UNCLOS currently has **172 parties**, making it near-universal.

1. **UNCLOS — What Is It?**

- **UNCLOS:** Adopted in **1982** and entered into force in **1994**, it provides the comprehensive legal framework governing oceans and seas.
- **“Constitution of the Oceans”:** It establishes rules for **territorial waters, EEZs, continental shelves, navigation, marine resources, environmental protection and dispute settlement**.
- **Maritime Zones:** Coastal States can claim a **12 nautical mile territorial sea** and an **EEZ up to 200 nautical miles**, subject to UNCLOS rules.

2. **Freedom of Navigation — Transit Passage**

- **Transit Passage:** Ships and aircraft have the right to pass through **straits used for international navigation**, ensuring uninterrupted international maritime traffic.
- **Strait of Hormuz:** Even though **Iran is not a party to UNCLOS**, the principle of transit passage is argued to have become part of **customary international law**, making it binding more broadly.
- **Malacca–Singapore Straits:** Their functioning demonstrates how internationally recognised navigation rules can facilitate commercial and strategic movement through important chokepoints.

3. **Why UNCLOS Matters for Maritime Security**

- **EEZ Disputes:** Provides the legal framework for determining coastal-State rights over marine resources and economic activities.
- **South China Sea & Indian Ocean:** UNCLOS provides the basic legal architecture for maritime boundary claims, resource rights and navigation.
- **Dispute Settlement:** Provides mechanisms for peaceful resolution of maritime disputes rather than unilateral use of force.
- **Marine Environment:** Establishes obligations for protecting and preserving the marine environment and regulating activities at sea.

4. Emerging Challenges

- **Non-Party States:** The **United States and Iran are not parties**, creating questions about treaty participation, although important UNCLOS principles may operate as customary international law.
- **Strategic Chokepoints:** Disruptions in the **Hormuz and other major straits** can affect global energy and trade flows.
- **Exclusive Economic Zone disputes:** Overlapping maritime claims continue to create tensions in regions such as the **South China Sea and Indian Ocean**.
- **“Dark Fleet”:** Ships operating with limited/disabled tracking or unclear ownership create challenges for **maritime safety, sanctions enforcement and environmental accountability**.

Toxic pond in Haryana village puts rare turtles at risk

Ashok Kumar
GURUGRAM

For years, the pond at Kajalheri village in Haryana's Fatehabad was a safe haven for hundreds of rare turtles. Today, the same waters are forcing them to flee for their lives.

The Shri Guru Gorakhnath Community Reserve, notified by the Haryana government in 2019, is home to an estimated 150-200 Indian softshell, red-crowned roofed and Indian peacock turtles. But the sanctuary has allegedly turned into a toxic habitat because of untreated sewage and neglect by the authorities.

The species found here enjoy the highest level of statutory protection under Schedule I of the Wildlife (Protection) Act, on a par with tigers and rhinoceroses. They are also listed as



The reserve is home to an estimated 150-200 softshell, red-crowned roofed and Indian peacock turtles. SPECIAL ARRANGEMENT

threatened species on the IUCN Red List.

Critical issues

Environmentalists said the contaminated water is causing skin lesions, fungal infections and blindness among softshell turtles. With the pond becoming increasingly foul and polluted, the turtles have begun leaving the reserve and crossing agricultural fields and roads in search

of cleaner water. Many have allegedly been crushed by vehicles while attempting to reach the nearby Kishangarh canal.

Wildlife conservationist Vaishali Rana has sought the registration of a criminal case under the Wildlife (Protection) Act against wildlife officials, Kajalheri panchayat functionaries and members of the reserve management committee. She has accused

them of allowing deliberate sewage discharge into the turtle habitat and failing to comply with directions issued by the Gurugram Chief Conservator of Forest (Wildlife) following an inspection in January.

The problem does not end with polluted water. In the absence of proper fencing, stray dogs reportedly enter the reserve and dig up turtle nests to eat the eggs, while cattle brought into the pond trample nesting banks and destroy eggs. The turtles are also at risk of being crushed.

A senior wildlife official acknowledged the problems but attributed the delay in remedial measures to a shortage of funds. The department's action plan includes diverting sewage away from the pond, erecting fencing and creating raised mounds where turtles can safely lay

their eggs. The official said the work would begin after the monsoon once funds are released.

Official apathy

The locals, meanwhile, allege that the crisis is the result of official apathy rather than a lack of resources.

Satpal Kajal, a resident, alleged that funds allocated earlier were diverted to other projects because of a nexus between the panchayat and wildlife officials. He said chemical-laden waste from the village had polluted the pond, forcing the turtles towards the canal. "There is enough land to create a separate pond to divert the toxic waste," he said, adding that complaints had also been made to then Wildlife Minister Kanwar Pal Gujjar during the previous government, but no action followed.

6. Toxic Pond in Haryana Puts Rare Turtles at Risk

Source: The Hindu

Subject: GS-3 — Environment & Ecology | Biodiversity | Wildlife Conservation

Context: The **Shri Guru Gorakhnath Community Reserve at Kajalheri village, Fatehabad, Haryana**, is witnessing severe habitat degradation due to polluted pond water, threatening a rare turtle population.

1. **Kajalheri — An Important Turtle Habitat**

- **Community Reserve:** Notified by the Haryana Government in **2019** to protect local wildlife habitat.
- **Turtle population:** Estimated **150–200 turtles**.
- **Three species found:**
 - Indian Softshell Turtle
 - Red-crowned Roofed Turtle
 - Indian Peacock Softshell Turtle
- **Legal protection:** The turtles receive the **highest level of statutory protection under Schedule I of the Wildlife (Protection) Act**; the species are also listed as threatened on the IUCN Red List.

2. **Why Are the Turtles at Risk?**

- **Water pollution:** Untreated sewage and chemical-laden waste have made the pond toxic, causing **skin lesions, fungal infections and blindness** among softshell turtles.
- **Habitat displacement:** Deteriorating water quality is forcing turtles to leave the pond and move towards agricultural fields and roads in search of cleaner water.
- **Road mortality:** Turtles attempting to reach nearby **Kishangarh canal** face the risk of being crushed by vehicles.
- **Nesting disturbance:** Stray dogs destroy nests and eat eggs, while cattle entering the reserve **trample nesting banks and eggs**.

3. **Conservation and Governance Gaps**

- **Weak enforcement:** Authorities have allegedly failed to effectively prevent sewage discharge despite directions issued after an inspection.
- **Inadequate protection:** Lack of proper fencing allows cattle and stray dogs to enter the reserve and damage nesting areas.
- **Funding constraints:** Wildlife officials have attributed delays in remedial measures to shortage of funds, while locals have alleged poor utilisation of earlier allocations.

4. Conservation Measures

- **Sewage diversion:** Wastewater should be diverted away from the turtle habitat.
- **Fencing:** The reserve needs proper physical protection to prevent cattle and stray animals from entering.
- **Safe nesting areas:** Raised nesting mounds are planned to provide secure locations for turtles to lay eggs.
- **Effective governance:** Legal protection must be supported by **regular monitoring, pollution control, adequate funding and local participation.**

Indian researchers map colonial spider venom, find anti-cancer potential

Sarath Babu George
THIRUVANANTHAPURAM

A team of Indian researchers has produced the first comprehensive molecular and functional profile of the venom gland of *Stegodyphus sarasinorum*, a colonial spider species found across the Indian subcontinent, to identify numerous proteins and small molecules that could serve as promising leads for future drug discovery.

Published in Springer Nature's peer-reviewed, open-access journal *Scientific Reports*, the study identifies bioactive compounds associated with anti-cancer, antimicrobial and immune-related func-



Stegodyphus sarasinorum

tions, while also demonstrating that venom gland extracts can kill cancer cells under laboratory conditions.

The researchers caution that the findings require extensive validation before any clinical application.

Lead researcher A.P.

Ajay Kumar of the Department of Zoology at Sree Neelakanta Government Sanskrit College, Pattambi, Keralam, led the multidisciplinary study.

S. sarasinorum lives in permanent colonies, constructs communal silk nests and captures prey cooperatively. It is among a small number of permanently social spider species known worldwide, thereby making it an important model for studying spider behaviour and venom biology.

The analysis identified 31 protein components through transcriptomic profiling and 32 proteins through proteomic analysis. In addition Ultra High-

Performance Liquid Chromatography-Mass Spectrometry (UHPLC-MS) detected 81 metabolites, including amino acids, biogenic amines and organic acids to provide a detailed molecular inventory of the venom gland.

Cytotoxicity

To investigate the biological activity of these molecules, the researchers tested venom gland extracts against Dalton's Lymphoma Ascites (DLA) cancer cells in laboratory experiments. The extracts exhibited dose-dependent cytotoxicity, meaning that higher concentrations destroyed a greater proportion of cancer cells.

7. Indian Researchers Map Colonial Spider Venom, Find Anti-Cancer Potential

Source: The Hindu

Subject: GS-3 — Science & Technology | Biotechnology | Drug Discovery | Biodiversity

Context: Indian researchers have produced the **first comprehensive molecular and functional profile** of the venom gland of *Stegodyphus sarasinorum*, identifying several bioactive molecules with potential applications in **anti-cancer, antimicrobial and immune-related research**.

1. **Stegodyphus sarasinorum — The Spider Studied**

- **Species:** A colonial/social spider found across the **Indian subcontinent**.
- **Social behaviour:** It lives in **permanent colonies**, constructs **communal silk nests** and cooperatively captures prey.
- **Scientific importance:** Its unusual social behaviour and venom make it a useful model for studying **spider behaviour, venom biology and chemical diversity**.

2. **Mapping the Venom — What Researchers Found**

- **Transcriptomic profiling:** Identified **31 protein components** associated with the venom system by studying gene-expression information.
- **Proteomic analysis:** Identified **32 proteins**, providing information on the actual protein composition of the venom.
- **UHPLC-MS: Ultra-High Performance Liquid Chromatography–Mass Spectrometry** detected **81 metabolites**, including **amino acids, biogenic amines and organic acids**.
- **Overall significance:** The combined molecular analyses created a detailed **inventory of proteins and small molecules** present in the venom gland and helped identify compounds with possible biological activity.

3. **Anti-Cancer Potential**

- **Laboratory testing:** Venom-gland extracts were tested against **Dalton's Lymphoma Ascites (DLA) cancer cells**.
- **Cytotoxicity:** The extracts demonstrated **dose-dependent cytotoxicity** — as the concentration increased, a greater proportion of cancer cells were destroyed.
- **Drug-discovery potential:** Such bioactive venom molecules could serve as **leads for developing future therapeutic compounds**, including potential anti-cancer agents.
- **Important distinction:** The finding demonstrates **laboratory-level anti-cancer activity**, not an established cancer treatment.

4. Why Spider Venom Matters for Biotechnology

- **Chemical diversity:** Venoms contain numerous biologically active molecules that can interact with cells and biological pathways.
- **Drug discovery:** Identifying individual venom components allows researchers to investigate their **specific therapeutic properties**.
- **Multidisciplinary research:** The study combines **zoology, transcriptomics, proteomics, mass spectrometry and cancer-cell biology** to convert biodiversity into potential biomedical applications.
- **Conservation–science link:** Studying lesser-known species can reveal **biological resources with pharmaceutical value**, strengthening the scientific case for biodiversity conservation.

5. Limitations and Way Forward

- **Further validation:** The researchers caution that extensive testing is required before any **clinical application**.
- **Next steps:** Promising molecules need to undergo **isolation, mechanism-of-action studies, toxicity assessment and progressively rigorous preclinical and clinical testing**.
- **Research opportunity:** India can further explore its **rich biodiversity as a source of novel biomolecules** while ensuring sustainable and ethical research.