Outbreak Reports

A Poisoning Outbreak Caused by Paralytic Shellfish Toxins in the Absence of Visible Red Tides — Zhanjiang City, Guangdong Province, China, February 2026

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Summary

What is already known about this topic?

Gonyautoxins (GTXs) are a family of paralytic shellfish toxins (PSTs). PST poisoning is traditionally attributed to toxin-producing algae during red tides, causing numbness, muscle paralysis, and dyspnea.

What is added by this report?

During February 8–11, 2026, an outbreak in Zhanjiang City was linked to GTXs in wild clams. The PST-producing dinoflagellate *Alexandrium catenella* was below red tide level, indicating shellfish poisoning can occur without visible blooms.

What are the implications for public health practice?

Routine toxin monitoring of wild-harvested shellfish is warranted regardless of algal bloom status. Case investigations, food tracebacks, and market recalls are essential for rapid responses.

ABSTRACT

Introduction: From February 8 to 11, 2026, suspected cases of shellfish poisoning emerged in four districts of Zhanjiang City. The investigators conducted on-site verification, detected gonyautoxins (GTXs) in *Soletellina acuta* samples, investigated the relevant sea areas, and launched emergency control measures.

Methods: Epidemiological methods were used to characterize the clinical and epidemiological features of these cases. Liquid chromatography–tandem mass spectrometry was used to determine the toxin content, and light microscopy was used to detect algal concentrations in seawater.

Results: Thirty-seven cases were included in this study. The predominant symptoms were orofacial and limb numbness (91.9%). Consumption of *S. acuta* meat was a risk factor (odds ratio =160.0, 95% confidence interval: 13.1–1,955.6). GTXs were detected in food samples of *S. acuta* reaching 0.1–27.7 mg saxitoxin equivalents/kg. The PST-producing dinoflagellate *Alexandrium catenella* was identified at a density of 9.09×10^3 cells/L, which is below red tide levels.

Conclusion: This outbreak was associated with GTXs in wild clams from a sea without red tides. Routine toxin monitoring of wild-harvested shellfish is warranted, even in the absence of visible algal blooms, to benefit both public health and the shellfish industry.

On February 9, 2026, the Zhanjiang Center for Disease Control and Prevention(CDC) reported a suspected foodborne disease cluster to the Guangdong Provincial CDC. Three patients presented with limb numbness, dizziness, and vomiting after consuming "shaluo" (*Soletellina acuta*). Eight additional cases were reported on the morning of February 10. A joint team of epidemiologists and laboratory experts conducted the outbreak investigation.

INVESTIGATION AND RESULTS

A probable case was defined as any person who had consumed *S. acuta* in Zhanjiang between February 7 and 12, 2026 and developed at least two of the following symptoms: perioral or limb numbness, dizziness, nausea, vomiting, abdominal pain, or dyspnea. Case findings were obtained through active surveillance, retrospective record reviews, and interviews with codiners. A mandatory reporting notice was issued on February 9.

Thirty-seven cases were identified. Numbness of the mouth, tongue, face, or extremities occurred in 34 (91.9%) patients; dizziness in 19 (51.4%); nausea in 10 (27.0%); vomiting in seven (18.9%); and abdominal pain in four (10.8%). One patient presented with muscle weakness and dyspnea.

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Cases were identified across four districts, Wuchuan (20, 54.1%), Suixi (13, 35.1%), Potou (3, 8.1%), and Chikan (1, 2.7%), primarily near township markets. All patients were local residents. The age range was 4–84 years, and 35.1% of the patients were male. The median incubation period was 3 h (range 0.5–10 hours). The outbreak lasted from February 8 to 11, 2026, peaking from February 9 to 10 (33/37, 89.2%) (Figure 1).

The consumption of *S. acuta* was the only common exposure among the 37 cases. Clams are prepared at home or in restaurants, mostly in the form of porridge or soup or by blanching. The case-control analysis included 33 patients who recalled their consumption amounts and 12 asymptomatic co-diners who shared the same meal exposure. Consumption of *S. acuta* meat was a risk factor [odds ratio (*OR*)=160.0, 95% confidence interval (*CI*): 13.1, 1,955.6]. Patients who consumed ≥10 clams were more likely to develop prominent symptoms than those who consumed <10 clams (*OR*=15.7; 95% *CI*: 2.3, 107.9). Four patients were unable to recall their consumption amounts.

Laboratory Testing

Laboratory testing focused primarily on the implicated food samples, because paralytic shellfish toxins (PSTs) are rapidly cleared from the human body. Seven food and 30 blood and urine samples were tested for PSTs and tetrodotoxins. For food samples, PSTs were extracted, purified, and analyzed using liquid chromatography–tandem mass spectrometry according to the National Manual for Food Contamination and Harmful Factor Risk Monitoring protocol (*1*). The saxitoxin-equivalent (STX eq) concentrations were calculated using the toxicity equivalency factors specified in the aforementioned manual. All available leftover and traceable food samples from the cases and implicated restaurants were collected and tested. Among these, three leftovers from the patients' homes, one from a restaurant, and three market-sold samples tested positive for gonyautoxins (GTXs), which are a group of PSTs (*2*) (Table 1 and Supplementary Figure S1, available at https://weekly.chinacdc.cn/). Tetrodotoxins were not detected in any of the samples.

Traceback and Environmental Investigation

The clams were purchased from multiple markets in Wuchuan, Potou, and Chikan. The supply chain led to two primary wholesalers who sourced clams from fishermen operating in the Yanggan River Estuary in Suixi County. On February 11, clams and seawater were collected from this estuary. The clams tested positive for GTX1–4 at a total concentration of 16.7 mg STX eq/kg. Light microscopy showed that *Alexandrium catenella*, which produces GTX1–4 (*2*), was the third most dominant species at densities below the red tide threshold (Table 2 and Supplementary Figure S2, available at https://weekly.chinacdc.cn/). *A. catenella* was identified by experienced taxonomists from Guangdong Ocean University and the Zhanjiang Ocean and Fishery Bureau, using conventional morphological methods (*3*). Molecular and electron microscopy confirmations were not conducted because of time and equipment constraints during the emergency field investigations.

On February 14, similar cases occurred in Hainan Province. The implicated *S. acuta* was traced to the Beihai Sea in Guangxi. GTXs were also detected in the leftover clams from these cases.

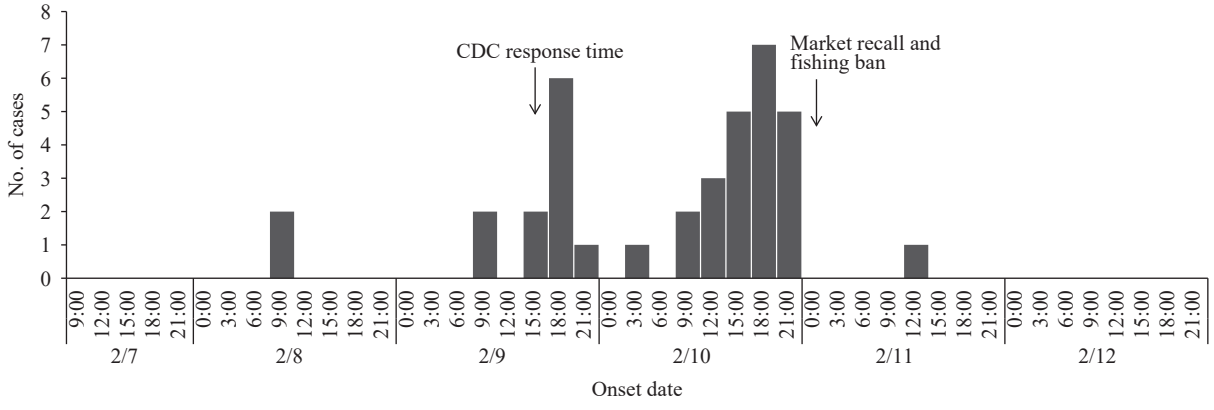

FIGURE 1. Epidemic curve of shellfish poisoning cases in Zhanjiang City, Guangdong Province, China, February 2026.

TABLE 1. GTX content in *Soletellina acuta* food samples collected during the shellfish poisoning outbreak in Zhanjiang, Guangdong Province, China, February 2026 (mg/kg).

Sample source	Sample description	GTX1	GTX2	GTX3	GTX4	STX eq
Patient 1's home	Leftover *S. acuta* meat	7.8	4.7	4.4	8.9	18.7
Patient 2's home	Leftover *S. acuta* meat	2.5	14.0	8.8	3.3	15.6
Patient 3's home	*S. acuta* meat boiled in soup	0.1	0.6	0.6	0.3	0.9
Implicated restaurant	Shelled *S. acuta* meat	12.3	5.6	4.5	14.5	27.7

Note: Restaurant samples were from the same batch of shelled clams consumed by other patients. All four samples were directly linked to poisoning cases. Additional *S. acuta* samples collected from local markets during the traceback investigation showed relatively low levels of GTXs (≤0.2 mg saxitoxin equivalents/kg). The detailed data for these samples are provided in the Supplementary Material (Supplementary Table S1, available at https://weekly.chinacdc.cn/).
Abbreviation: GTX=gonyautoxin; STX eq=saxitoxin equivalents.

TABLE 2. Densities of the top four dominant algal species in the Yanggan River Estuary, Zhanjiang.

Rank	Species	Cell densities (cells/L)	Red tide threshold (cells/L)	Toxigenic PST
1	*Skeletonema costatum*	4.34×10^4	1×10^7	No
2	*Thalassiosira rotula*	1.81×10^4	2×10^5	No
3	*Alexandrium catenella*	9.09×10^3	1×10^5	Yes
4	*Gonyaulax spinifera*	2.61×10^3	2×10^5	No

Abbreviation: PST=paralytic shellfish toxin.

PUBLIC HEALTH RESPONSE

Comprehensive control measures were implemented as part of the public health response. All *S. acuta* were removed from the shelves and sealed across the entire city, covering the entire supply chain. Public health education regarding shellfish poisoning was provided to seafood vendors, distributors, and catering staff.

Warning signs were installed on high-risk coasts, reminding fishermen to suspend the wild harvest. Surveillance and early warning systems have been enhanced through collaboration with local universities to ensure rapid traceability. The routine monitoring system for algal and shellfish toxins has been improved by increasing the scope and sampling frequency. No additional cases were reported after the intervention.

DISCUSSION

This outbreak was caused by the consumption of wild clams contaminated with GTX1–4, typical types of PST produced by *Alexandrium* species (*2*). Evidence included consistent neurotoxic symptoms with a median incubation period of 3 hours; a strong epidemiological association with clam meat consumption; the detection of GTXs in clams from leftovers, markets, and the estuary; and the identification of *A. catenella* in the estuary. PST levels in several clam samples exceeded China's regulatory limit of 0.8 mg STX eq/kg (*4*).

A. catenella, a producer of GTX1–4 (*2*), was detected in the Yanggan River Estuary, and the same toxins were found in leftover shellfish and wild *S. acuta*. The densities of toxic dinoflagellates were below the typical red tide threshold. Despite this, the clams accumulated high levels of GTXs. This highlights a limitation of the traditional paralytic shellfish poisoning (PSP) risk assessment, which infers risks from morphological identification and cell abundance of toxigenic algae. Emerging evidence suggests that algal cell density alone cannot accurately reflect toxin distribution (*5*). For instance, certain strains of *Alexandrium tamarense* can pose severe potential hazards even at 10^2–10^3 cells/L (*6*), and toxigenic and non-toxigenic strains may coexist, making it difficult to assess the risk based on species identification alone (*7*).

Moreover, bivalve biotransformation and bioaccumulation further contribute to the disconnection between algal abundance and shellfish toxicity. Low-toxicity components can be converted into highly toxic analogs after ingestion by shellfish, leading to increased toxicity in edible tissues (*8*). This indicates that the toxin composition, *in vivo* transformation, and bioaccumulation efficiency are critical determinants of the actual risk to consumers. Accumulating evidence suggests that marine algal toxins are no longer confined to red tide episodes; however, toxigenic species at low cell densities can still lead to toxin levels exceeding regulatory limits (*9*).

The Yanggan River Estuary, a semi-enclosed bay

with limited exchange, may retain toxigenic algae and toxins. Similar to the scenario in Tasmania, stratification from freshwater and temperature promotes toxin production at low cell densities (*10*). During this outbreak, the relatively high temperatures likely enhanced stratification, whereas nutrient runoff and cyst resuspension contributed to toxin persistence. These factors may have enabled toxin accumulation without visible red tides, which is consistent with the reported PSP without recognizable blooms (*5*).

Although the mechanisms were inferred from the literature and field observations, rather than direct experimental evidence, these findings highlight the importance of considering toxin risks beyond visible blooms, particularly for wild shellfish in high-risk areas, and should not be generalized to all shellfish. Case-control and exposure-response analyses were limited by the small sample size, which resulted in wide confidence intervals.

Routine PST testing of shellfish meat should be prioritized in high-risk estuaries, particularly for wild-harvested shellfish, regardless of algal density. Advisory signs at fishing ports should indicate that wild clams may contain toxins in the absence of visible red tides. Public education should emphasize that the absence of red tides does not guarantee the absence of toxins in wild shellfish, but should clarify that commercially farmed shellfish are generally safe. Risk communication should be tailored for different audiences to avoid unnecessary alarms and market disruptions. Such strengthened surveillance will protect both consumers and the shellfish industry. The rapid multisectoral response to this outbreak, involving a market ban, health warnings, and source tracing, was effective, with no further cases reported after February 14.

Conflicts of interest: No conflicts of interest.

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Ethical statement: This investigation was conducted immediately after the outbreak was reported on February 10. This investigation was conducted in response to an acute public health emergency; hence, it was exempt from ethical approval and informed consent.

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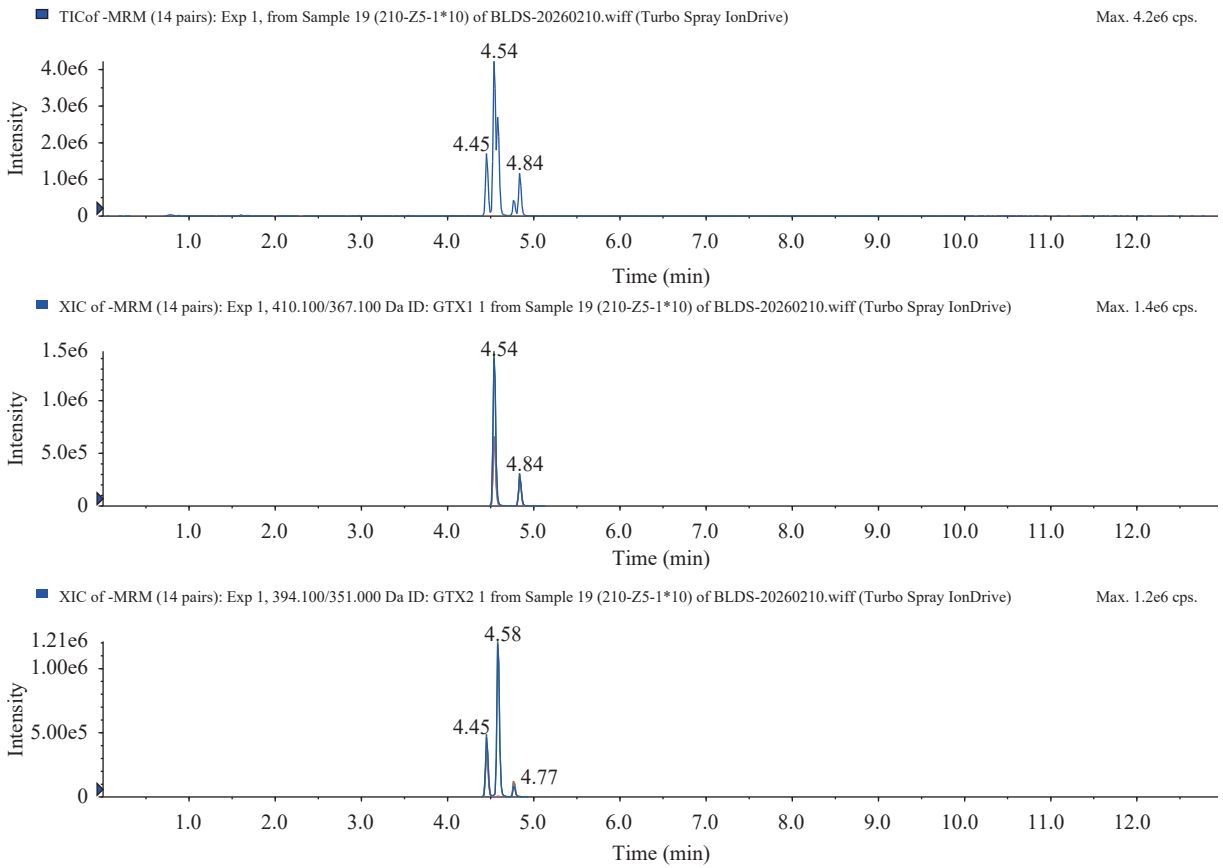
SUPPLEMENTARY MATERIALS

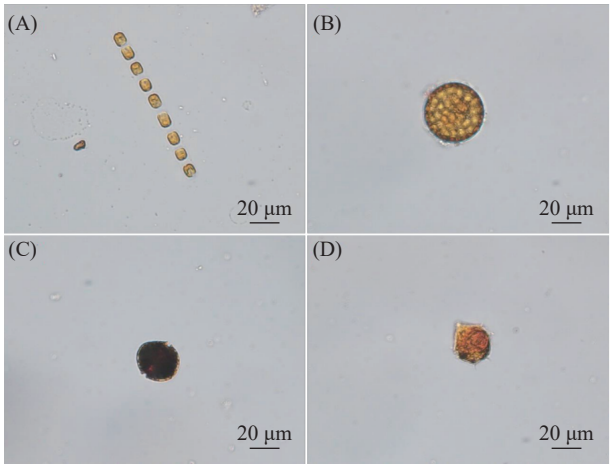
SUPPLEMENTARY TABLE S1. GTX content in additional *Soletellina acuta* samples collected from market stalls during the shellfish poisoning outbreak in Zhanjiang, Guangdong Province, China, February 2026 (mg/kg).

Sample source	Sample description	GTX1	GTX2	GTX3	GTX4	STX eq
Wuchuan stall 1	Shelled *S. acuta* meat	NA	0.2	0.1	NA	0.1
Wuchuan stall 1	Whole *S. acuta*	NA	0.2	0.1	0.1	0.2
Wuchuan stall 2	Whole *S. acuta*	NA	0.3	0.2	NA	0.2

Note: STX eq concentrations were calculated according to the National Manual for Food Contamination and Harmful Factor Risk Monitoring protocol using the toxicity equivalency factors for each GTX analog, as described in the main text.
Abbreviation: GTX=gonyautoxin; STX eq=saxitoxin equivalents; NA=not detected.



SUPPLEMENTARY FIGURE S1. Liquid chromatography–tandem mass spectrometry chromatograms of a shellfish sample testing positive for gonyautoxins. (A) Total ion chromatogram; (B) Extracted ion chromatogram (XIC) for gonyautoxin (GTX)1 and GTX4; (C) XIC for GTX2 and GTX3.
Note: Panel B represents multiple reaction monitoring (MRM) transition m/z 410.1/367.1; panel C represents MRM transition m/z 394.1/351.0.



SUPPLEMENTARY FIGURE S2. Light microscopy images of the dominant phytoplankton species in the Yanggan River Estuary. (A) *Skeletonema costatum*, (B) *Thalassiosira rotula*, (C) *Alexandrium catenella*, and (D) *Gonyaulax spinifera*.
Note: Scale bars =20 μm. Identification was based on morphological characteristics observed under a light microscope.