R7-B09 Mud and turbidity that keep entering from river mouths (the seaweed and seagrass beds and rocky-shore fishing grounds of the Wajima coast)

How much mud and turbidity keep entering the sea around the river mouths of the Wajima coast from the mountains that collapsed in the earthquake, what have they changed in the seaweed and seagrass beds and the rocky-shore fishing grounds, and what remedial work has begun?

Readers

Fishers and fishery cooperatives, local governments (staff in charge of fisheries, forests, rivers and ports), research institutes and others without specialist knowledge. Those who want to check, with figures and sources, where and how much the mud and turbidity entering around the river mouths of the Wajima coast have changed the seaweed and seagrass beds and the rocky-shore fishing.

Takeaways

1. In the 2024 Noto Peninsula Earthquake, many large slope collapses occurred in the mountains of Wajima City and Suzu City. In its fiscal 2024 evaluation, the national government stated that much of the collapsed sediment still remained on the slopes and in the valley bottoms. From there, mud goes out to the sea through the rivers after heavy rain. From July 2024 onwards, very fine mud settled on the seabed around the river mouths of Wajima. At the mouth of the Fukami River in the eastern part of Wajima City, the mud was up to 30 cm thick.
2. In the torrential rain of 21–22 September 2024, 121.0 mm of rain fell in 1 hour in Wajima. This is the highest value on record. Sediment flowed from the rivers into the sea, and off the mouth of the Tsukada River, rocky ground that had been exposed before the torrential rain was buried by sediment. At the mouth of the Fukami River, new mud containing many fragments of land plants lay on top of the fine mud of August.
3. Even when the mud is reduced by waves, it increases again with rain. In the Najimi district in the eastern part of Wajima City, mud 1 cm or more thick spread over 138 ha in the rainy season of 2024. The mud decreased from the autumn, but with the heavy rain of late summer 2025 it spread again to 63 ha. These figures are quoted from a survey report of which we could find no published version.
4. The mud, sediment and turbidity that entered from the river mouths are thought to be damaging the seaweed and seagrass beds and the rocky-shore fishing. The national government's White Paper on Fisheries also states that sediment that entered from places where mountain slopes collapsed has settled on fishing grounds and is hindering the fishing of the ama (women divers). At Kaiso, seabed covered by thin mud was in a state of small-scale barren ground (isoyake). Off the east of Wajima Port, beds that had grown densely before the earthquake had become sparse. In interviews with 32 fishers of Oku-Noto, 81% of the 31 who answered named "the decrease of resources due to turbidity and the accumulation of mud" as a problem. These 32 people include fishers on the Uchiura side and the Nanao Bay side.
5. Remedial work has begun to move, both in the mountains and in the sea. The national government is carrying out forest conservation works up to fiscal 2033 in 6 areas of collapsed mountains. What these works protect is stated to be houses, roads and the like. On 27 November 2025, the Forestry Agency, the Fisheries Agency and Ishikawa Prefecture held a liaison council for curbing the outflow of sediment to the seaweed and seagrass beds around Wajima Port. The council has decided that the forest conservation work sites thought to affect fishing grounds are to be restored early. A local activity group in Wajima has made a plan to clean away, from fiscal

	2026, the mud that has settled on rocks. However, we found no material showing how much the mud entering the sea will decrease.
After reading	When using the figures for the mud of the Wajima coast in documents or plans, state which material the value comes from, and the time, the place and the way of measuring. The ways of measuring include surveys of seabed mud, diving, underwater cameras, depth surveying and interviews. The area of mud in the Najimi district is quoted from a report of which no published version can be found, and is the value for the range where the thickness is 1 cm or more. Mud increases with rain and decreases with waves, so when comparing, also state the season and the rain before it.

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1. Key points

- In the 2024 Noto Peninsula Earthquake, many large slope collapses occurred in the mountains of Wajima City and Suzu City. In its fiscal 2024 evaluation, the national government stated that much of the collapsed sediment still remained on the slopes and in the valley bottoms. From there, mud goes out to the sea through the rivers after heavy rain. From July 2024 onwards, very fine mud settled on the seabed around the river mouths of Wajima. At the mouth of the Fukami River in the eastern part of Wajima City, the mud was up to 30 cm thick. [S6, S2, S1]
- In the torrential rain of 21–22 September 2024, 121.0 mm of rain fell in 1 hour in Wajima. This is the highest value on record. Sediment flowed from the rivers into the sea, and off the mouth of the Tsukada River, rocky ground that had been exposed before the torrential rain was buried by sediment. At the mouth of the Fukami River, new mud containing many fragments of land plants lay on top of the fine mud of August. [S5, S4, S2]
- Even when the mud is reduced by waves, it increases again with rain. In the Najimi district in the eastern part of Wajima City, mud 1 cm or more thick spread over 138 ha in the rainy season of 2024. The mud decreased from the autumn, but with the heavy rain of late summer 2025 it spread again to 63 ha. These figures are quoted from a survey report of which we could find no published version. [S1]
- The mud, sediment and turbidity that entered from the river mouths are thought to be damaging the seaweed and seagrass beds and the rocky-shore fishing. The national government's White Paper on Fisheries also states that sediment that entered from places where mountain slopes collapsed has settled on fishing grounds and is hindering the fishing of the ama (women divers). At Kaiso, seabed covered by thin mud was in a state of small-scale barren ground (isoyake). Off the east of Wajima Port, beds that had grown densely before the earthquake had become sparse. In interviews with 32 fishers of Oku-Noto, 81% of the 31 who answered named "the decrease of resources due to turbidity and the accumulation of mud" as a problem. These 32 people include fishers on the Uchiura side and the Nanao Bay side. [S21, S1]
- Remedial work has begun to move, both in the mountains and in the sea. The national government is carrying out forest conservation works up to fiscal 2033 in 6 areas of collapsed mountains. What these works protect is stated to be houses, roads and the like. On 27 November 2025, the Forestry Agency, the Fisheries Agency and Ishikawa Prefecture held a liaison council for curbing the outflow of sediment to the seaweed and seagrass beds around Wajima Port. The council has decided that the forest conservation work sites thought to affect fishing grounds are to be restored early. A local activity group in Wajima has made a plan to clean away, from fiscal 2026, the mud that has settled on rocks. However, we found no material showing how much the mud entering the sea will decrease. [S6, S21, S3]

2. What is happening

Japan and the world: mud that goes out to the sea from collapsed mountains, and its effects

After a large earthquake, much sediment can come out of collapsed mountains into rivers for many years. This is because the sediment of slopes that collapsed in the earthquake accumulates on the slopes and in the valleys, and is carried little by little into the rivers by later rain. A paper (2011) that studied the area around the epicentre of the Chi-Chi earthquake (Mw 7.6), which occurred in Taiwan on 21 September 1999, states, from maps of the landslides and records of the sediment carried in suspension in river water, that the removal of sediment after the earthquake exceeded 5 times the normal level at its maximum and returned to the level before the earthquake over about 6 years. What this paper measured was river sediment, and it did not study the effects on the living things of the sea. [S16]

Fine mud that settles on rocky ground can affect living things even when it is thin. In observations on rocky shores in the United Kingdom and laboratory experiments (a 2007 paper), even a layer of sediment about 1 mm thick lowered by 35% the feeding activity of a shellfish (a species of limpet) that eats the algae on rock surfaces. When fine mud reached 200 mg per 1 cm^2, feeding stopped and the shellfish died. The paper states that the effect of coarse sediment was smaller than that of fine mud. [S18]

In Japan too, turbidity and mud are regarded as one of the causes of the decline of seaweed and seagrass beds. The Fisheries Agency's guidelines on measures against barren ground (isoyake) (3rd edition, March 2021; barren ground [isoyake] means that seaweed and seagrass beds decline severely or disappear, so that almost no seaweed grows) state that, as harm to beds from river water entering the sea, attention is now given to the turbidity of the seawater and the settling of fluid mud (fine mud that collects on the seabed) rather than to changes in salinity, and that the effects of the settling of fluid mud and of turbidity when river water comes out in torrential rain, prolonged rain and the like are serious. On the other hand, they also state that when river water comes out, an effect of delivering nutrients is rather to be expected. The Fisheries Agency's guidelines on measures to prevent the loss of seaweed and seagrass bed resources (March 2009) state that even when fluid mud, or sand carried by waves, has only settled thinly on the seabed, the attachment of the seeds of seaweeds to rock is greatly hindered, and that in particular the seeds of Sargassum species (large seaweeds that form beds) attach to rock by thread-like roots, so that attachment becomes difficult when sand or the like becomes entangled. [S30]

Prefectural officials also name turbidity and mud as a cause. In a survey in which the Fisheries Agency asked the officials in charge in 39 prefectures in November 2021, 13 prefectures named "turbidity and the settling of fluid mud" as a cause (multiple answers allowed) of the decline of seaweed and seagrass beds compared with about 10 years earlier (7 in the survey of the previous year). The most frequent were "rise in seawater temperature" with 25, "grazing damage by herbivorous fish" with 23 and "grazing damage by sea urchins" with 20. The examples given of places where mud has increased are the surroundings of river mouths and places where waves have become calm because of artificial structures (Akita Prefecture), and the outflow of sediment from collapsed places (Fukui Prefecture). As measures against turbidity and fluid mud, the Fisheries Agency names raising the height of the bases on which seaweeds grow (blocks and the like) and giving them a shape on which mud does not readily collect. [S14]

Japan and the world: cases so far, and what was learned afterwards

In Japan, there is a case in which a national government body recognised that fine mud that had entered a shallow sea from a river was stirred up by winter waves and damaged seaweed. On the Kurobe River in Toyama Prefecture, Kansai Electric Power's Dashidaira Dam has, since December 1991, been releasing into the river the sediment that collected at the bottom of the dam (sediment flushing). Concerning the lawsuit brought by a

cooperative that had been farming wakame seaweed to the east of the river mouth and by gill-net fishers, the national government's Environmental Dispute Coordination Commission recognised, in its cause-determination ruling of 28 March 2007 (a procedure in which, at the request of a court, it judges what the cause of the damage is), that the wakame harvest had been poor from 1992 onwards because the sediment flushing had worsened the environment in which wakame grows. The judgement was that the mud that had settled in the shallow sea was stirred up by winter waves and became turbidity, attached to the wakame and hindered its growth, and also increased the small creatures that attach to wakame (amphipods and the like). It takes the view that the mud in the shallow sea is not there all year round and is washed away by around the spring of the following year. On the other hand, it did not recognise the fluctuations in the gill-net catch as being due to the sediment flushing. [S15]

In the Kaikōura earthquake (M 7.8), which occurred in New Zealand in November 2016, about 130 km of coast was uplifted (the value in this report). A survey of rocky shores 2.5–3.5 years after the earthquake (a 2021 report of the fisheries authority) states that gravel moved and accumulated, at times burying rocky ground widely and burying the living things that were there, and that the movement of sand and gravel can delay recovery by scouring rock surfaces and covering living things. One of the aims of this survey was to keep measuring the cover of sediment on the rocks as well, in order to find out whether sedimentation had increased for a long time because of the earthquake. [S17]

At Uchiura on the same Noto Peninsula, the mud immediately after the earthquake and after the torrential rain has been measured in succession (Iida Bay in Suzu City; outside the scope of this paper). According to an announcement by researchers of Kanazawa University (January 2025), the layer of mud on the seabed immediately after the earthquake (January–February 2024) was about 1 cm at most, and by August 2024 it had become thinner and the seabed was returning to its original sand. The announcement estimates that this mud was sediment that collapsed in the earthquake and entered the sea through the rivers. However, after the torrential rain of September 2024, in a survey on 13–15 January 2025, mud several cm or more thick had settled over a wide area at water depths of about 7–30 m, and the thickest was about 17 cm, at a water depth of about 10 m off the mouth of the Ukai River. [S13]

Table 1 Sediment that entered the sea from collapsed mountains and rivers, and what was learned afterwards (cases in Japan and abroad)

Case	What happened	How measured, and material	What was learned
1999 Chi-Chi earthquake (Taiwan)	Landslides, and the sediment carried by rivers, increased	Maps of the landslides and records of the suspended sediment of rivers (paper)	The removal of sediment exceeded 5 times the normal level at its maximum, and returned to the level before the earthquake in about 6 years
1991 onwards: sediment flushing at the Dashidaira Dam (Toyama Prefecture)	The sediment of the dam was released into the river, and mud settled in the shallow sea to the east of the river mouth	Cause-determination ruling of the national government's Environmental Dispute Coordination Commission (2007)	It recognised that mud stirred up by winter waves hindered the growth of wakame. It did not recognise that the fluctuations in the gill-net catch were due to the sediment flushing
2016 Kaikōura earthquake (New Zealand)	About 130 km of coast was uplifted, and gravel and sand moved	Survey of rocky shores up to 3.5 years afterwards (report of the fisheries authority)	Gravel sometimes buries rocky ground, and the movement of sand and gravel can delay recovery

Case	What happened	How measured, and material	What was learned
2024 Noto Peninsula Earthquake and tor - rential rain (Iida Bay in Suzu City; Uchiura)	After the torrential rain, a sandy seabed was covered by mud	Sampling of seabed mud (university announcement)	About 17 cm of mud at a water depth of about 10 m off the mouth of the Ukai River
2024 Noto Peninsula Earthquake and tor - rential rain (Wajima coast; Sotoura)	Fine mud settled around the river mouths	Diving, surveys of seabed mud, depth surveying, interviews	The "Region (Sotoura)" sections of this chapter

Note: The source of the mud and sediment (landslides, sediment flushing from a dam, gravel and sand of an uplifted coast), the quantity and the way of measuring differ from case to case, so the sizes of the values cannot be compared as they are (chapter 5). [S16, S15, S17, S13]

Region (Sotoura): collapsed mountains, and intense rain

Sotoura is the coast of the Noto Peninsula on the Sea of Japan side. In this paper, it refers to the coast of Shika Town, Wajima City (including Monzen, Hegurajima and Nanatsujima), and the northern coast of Suzu City as far as Jike. What this paper covers is the mud and turbidity that enter the sea of Sotoura through the rivers, every time there is heavy rain, from the mountains that collapsed in the earthquake. The 16 rivers for which the prefecture, treating them as rivers of Sotoura where the change in landform is large, revised ahead of others its assumed areas that would be under water in a flood include the following rivers that appear in this paper: the Hakka River, Nishifutamata River, Kawarada River, Tsukada River, Najimi River and Suzuya River of Wajima City, the Machino River of Wajima City and Noto Town, and the Suzu-Otani River of Suzu City. The Fukami River, which appears in this paper, is not among these 16 rivers. The materials that measured mud are mostly for the coast of Wajima City, and we found no material that measured the mud of river mouths on the coast of Shika Town or the northern coast of Suzu City. In Nanao Bay too, no material that measured turbidity or mud after the earthquake and the torrential rain has been found, and the turbidity of Nanao Bay is covered in R7-A05 "Turbidity and fluid mud in Nanao Bay". [S7]

In the earthquake of 1 January 2024, many large slope collapses (hillside collapses) occurred in the mountains of Wajima City and Suzu City. An announcement by researchers of Ishikawa Prefectural University (2025, the abstract of a lecture at an academic society), starting from the distribution of collapsed places that the Geospatial Information Authority of Japan read off immediately after the earthquake and re-reading it from the difference in landform measured by airborne laser before and after the earthquake, puts the collapsed places at about 6,000 and states that Suzu and the eastern part of Wajima had the most, at about 2,600 (Suzu includes the Uchiura side as well). The Forestry Agency states that large-scale hillside collapses occurred particularly in 6 areas, Okubo, Terayama-minami, Fugeshi and Kotokuji in Wajima City and Otani and Minamigata in Suzu City, and that the large amount of sediment that flowed out devastated many mountain streams (rivers that flow through mountain valleys). According to the caption of a photograph in a Forestry Agency material, the collapsed place in the Okubo area (Machino-machi, Wajima City) is about 42 ha (photograph of 29 May 2024). [S37, S6, S23, S7]

Much of the collapsed sediment remained on the slopes and in the valleys. The evaluation of the national government's project in fiscal 2024 states that much unstable sediment still lies on the collapsed slopes and in the valley bottoms downstream, and that, depending on the rain to come, the devastation may spread. A material (20 January 2025) of the committee set up by the Hokuriku Regional Development Bureau (Ministry of Land, Infrastructure, Transport and Tourism) to study measures against sediment disasters estimates, from the

difference in landform measured by airborne laser before the earthquake (September 2020) and after the torrential rain of September 2024, the unstable sediment remaining in the river basins at about 1.85 million m^3 for the Suzuya River, a tributary of the Machino River, and about 430,000 m^3 for the Tsukada River in Wajima City, and states that, with these as the target, erosion control (sabo) facilities will be placed to prevent sediment and floodwater from overflowing downstream. It states that the values may change with surveys to come. [S6, S24]

For the prefecture as a whole too, the damage to the mountains was large. According to a material of Ishikawa Prefecture (October 2025), sediment disasters occurred in the prefecture at 424 places in the earthquake and at 273 places in the torrential rain of September 2024. Forest land and forest conservation facilities (facilities that prevent landslides) were damaged at 340 places in the earthquake and at 38 places in the torrential rain. Of the rivers managed by the prefecture, 88 rivers were damaged in the earthquake and 38 rivers in the torrential rain. All of these are numbers in the material of Ishikawa Prefecture; they include the Nanao Bay side and other areas, and no breakdown by district is given. [S7]

That sediment disasters had become more likely to occur with rain was also recognised by the prefecture and the national government's meteorological office. On the day of the earthquake (1 January 2024), Ishikawa Prefecture and the Kanazawa Local Meteorological Office, stating that the ground had loosened, lowered the criteria for the sediment disaster alert information (information issued when the danger of a sediment disaster has risen because of heavy rain) for Wajima City, Shika Town and others to 70% of the normal level. Suzu City had already been operating at 70% since after the earthquake of June 2022. [S8]

In 2024, sediment entered the sea in the rainy season and in the torrential rain centred on 21–22 September. The preliminary report of the Japan Meteorological Agency (for the period 20–22 September) states that in Wajima 121.0 mm fell in the 1 hour up to 9:22 on the 21st and 412.0 mm in the 24 hours up to 8:10 on the 22nd. At the observation stations of Wajima and Suzu, the 1-hour and 3-hour rainfall and other values became the highest on record. The total for the 3 days (20–22 September) was 501.0 mm in Wajima, which was 234% of the normal rainfall for September. The report (March 2026; hereafter "the Doyukai report") of the Kanazawa Association of Corporate Executives (Kanazawa Keizai Doyukai), a business association, states that this torrential rain spread the collapses of mountain slopes and made rivers overflow, and that, following the earthquake, many houses and human lives were lost. A survey commissioned by the Fisheries Agency (March 2026) states that the torrential rain came before the removal of the sediment deposited by the earthquake had progressed, which led to great damage, and that large amounts of driftwood and sediment produced by the landslides and other effects of the torrential rain entered fishing ports. The recommendations (June 2025) of a study group of the Ministry of Land, Infrastructure, Transport and Tourism also state that the sediment and driftwood that the earthquake had produced mainly within the mountains flowed out in large quantities in the torrential rain of September 2024 as far as the lower reaches of rivers such as the Tsukada River. [S2, S5, S1, S11, S33]

Region (Sotoura): mud that settled around the river mouths (2024)

After the rainy season, very fine mud settled on the seabed around the river mouths of Wajima. A report in an academic journal (2025; hereafter "Ishikawa's report") by Ryoko Ishikawa (of the private office Wajima Seaweed Lab), who has studied the seaweed and seagrass beds and the ama fishing of Wajima, reports the results of surveys made with fishers, mainly ama, under the Fisheries Agency's support project for measures to restore fishing grounds. In the Najimi district in the eastern part of Wajima City, in late June 2024, ishimozuku (a kind of seaweed), which is harvested in summer, was growing as in a normal year at water depths of 3–6 m. However, when fishing began after waiting about 3 weeks for the rainy-season front to pass, most of the stands had disappeared, and the ishimozuku fishing of that year was stopped after 3 days. [S2]

Ishikawa's report, taking the cause to be mud that had entered from a river, surveyed the seabed in early August in the area of the mouth of the Fukami River, which is close to the fishing grounds of the Najimi district (this is a

different place from Fukami fishing port in Monzen). Cream-like mud of very fine grains had settled to a thickness of up to 30 cm, and the area where it was 1 cm or more thick extended to about 1 km from the river mouth (water depth 15 m). The mud attached to rocks and ishimozuku was so sticky that it could not be removed without rubbing by hand, and many Sargassum plants that had mud attached and had withered, and many turban shells that had died on the mud, were also seen. When the mud was looked at under a microscope, there were many fragments of land plants, which showed that it was mud that had come from the land. Ishikawa's report states that it is highly likely that the fact that the many landslides that occurred around the rivers at the time of the earthquake had not been repaired by the rainy season greatly increased the mud entering from the rivers. [S2]

Mud was found at many of the river mouths of Wajima. According to Ishikawa's report, when a survey of the seabed over the whole of Wajima City was begun, scheduled for mid-August to late September, there was a tendency in every district surveyed for mud to be extremely abundant near the river mouths. The torrential rain of September occurred when only Monzen-machi at the southern end remained, and the survey stopped. [S2]

Immediately after the torrential rain, sediment and driftwood surged onto the coast and into the ports. According to Ishikawa's report, when the coast from Wajimazaki to the Najimi district was viewed on 26 September, in every district driftwood had been washed up so as to fill the shoreline, and landslides had occurred. Large amounts of sediment, huge trees and the debris of houses had entered Nafune fishing port, which is near a river mouth, and even small boats could no longer leave. In the sea, the turbidity was strong and almost nothing could be seen. The mud taken in the area of the mouth of the Fukami River contained many fragments of land plants visible to the eye, and beneath it there was also the cream-like mud of August. Ishikawa's report states that new sediment may have been laid on top and the layer of mud may have become thicker. [S2]

The sediment of the torrential rain was also confirmed by depth surveying of the sea. The Japan Coast Guard and a research group of universities and others compared the water depths of Wajima Port before the torrential rain (May 2024) and after it (the survey of 8–23 May 2025 and others). Off the mouth of the Kawarada River, sediment accumulated and the water became shallower by up to a further 1.8 m from the depth after the earthquake. Off the mouth of the Tsukada River, rocky ground that had been exposed before the torrential rain was buried by sediment. The lack of water depth at Wajima Port and its restoration are covered in R7-B17 "The lack of water depth at Wajima Port (the largest fishing base in the prefecture) and its restoration", and where the dredged sediment goes is covered in R7-B18 "Where the dredged sediment of Wajima Port goes (a disposal site built in the sea and the creation of seaweed and seagrass beds)". [S4]

At Osawa in the west too, the fishing port was filled with sediment. In the surveying for the "Umi no Chizu" (map of the sea) project, which measured the bottom of the shallow sea by airborne laser, after the torrential rain (October 2024) the sediment that came out of the river had completely filled the inside of Osawa fishing port, and the valley in the seabed beyond it was also filled with a large amount of sediment (an article by the chairman of the Japan Hydrographic Association, which carried out the surveying). The filling of fishing ports and the movement of sandy beaches are covered in R7-B03 "Sandy beaches that keep moving even after the uplift, and the filling of fishing ports", and driftwood and debris are covered in R7-B15 "Driftwood, debris and large rocks remaining in fishing grounds and ports". [S10, S11]

At the prefecture's fisheries council (fiscal 2024) too, a member said that mud had settled several tens of cm deep on the coastal seabed and that he or she thought the fishing of abalone, turban shells and mozuku seaweed would be difficult. The material does not state which district this refers to. In response, the prefecture's secretariat answered that, as far as it had heard, there was no great change in the fishing grounds compared with the land, but that there were also places that had partly changed, and that surveys were needed. The date on which the council was held is not stated, but because the results of the first auction of snow crab were

reported at the same meeting, it is thought to have been held in or after November 2024, that is, after the torrential rain of September (this paper's reading). [S9]

Region (Sotoura): mud that decreases and then increases, and declining seaweed and seagrass beds (2025)

The extent of the mud changes greatly with the season and the rain. The Doyukai report is the report of a survey of the coasts of the Noto Peninsula that the Kanazawa Association of Corporate Executives carried out with a grant from The Nippon Foundation, and it shows, quoting from a separate survey report, the changes in the area over which mud 1 cm or more thick had settled in the Najimi district (Table 2). The mud spread over 138 ha in the rainy season of 2024, decreased from the autumn with the waves of low-pressure systems, and remained at a low level until the summer of 2025, when the rainy season had little rain. In the final figures of the Japan Meteorological Agency too, the amount of rain in the rainy season (June–July) in the Hokuriku region was large in 2024, at 117% of normal, and in 2025 it was 50% of normal, considerably less (this is the average for the Hokuriku region, not a value for Wajima alone). However, with the localised heavy rain that fell repeatedly in late summer (the report's wording is "guerrilla downpours"), it spread again to 63 ha. According to the preliminary report of the meteorological office, on 10 August 2025 daily rainfall of 199.0 mm was observed at Mii in Wajima City and of 167.0 mm at Monzen, and both were the highest values since observation began. For Wajima City and others, partly because of the effect of the rain from 6 August, sediment disaster alert information was issued. However, the Doyukai report does not state which day's rain it was that increased the mud at Najimi. [S1, S25, S19]

Table 2 Area over which mud 1 cm or more thick had settled in the Najimi district

Time	Area	Remarks
Summer 2024	138 ha	After the rainy season (value in the text)
Autumn 2024	A little over 40 ha	Read from a figure
Spring 2025	Around 10 ha	Read from a figure
Summer 2025	Around 10 ha	Read from a figure. After a rainy season with little rain
Autumn 2025	63 ha	After the localised heavy rain of late summer (value in the text)

Note: These are values that the Doyukai report quoted from the survey report on the seaweed and seagrass beds of Wajima (2026; no published version can be found) of the support project for measures to restore fishing grounds of the Ishikawa Prefecture wide-area activity organisation. This paper has not checked the quoted source. [S1, S25]

There is also a report that the sediment of the torrential rain of September 2024 dispersed offshore. The Doyukai report states that it has been reported that the sediment that entered the sea in the torrential rain spread offshore with the stormy seas caused by the seasonal wind and did not settle much on the coast (the origin of the report is not stated). It then states that, after the earthquake, the sediment of the landslides spread into the sea through the rivers, and that, in the stretch from Kaiso to Sosogi, it has been confirmed by more than one survey that mud is settling and the seaweed and seagrass beds are declining. The report states that, as long as mud keeps settling, the beds of the shallow sea cannot return, and it treats the repair of the collapsed mountain forests as an urgent task. [S1]

In the diving survey of June 2025, mud was found at Kaiso. The diving survey team of the Doyukai report, on 6–19 June 2025, at 5 points in Sotoura and 2 points in Uchiura, drew a line from the water's edge of before the earthquake to a water depth of 8 m and recorded the seaweeds, shellfish and the state of the seabed within 1 m on both sides of the line. At Kaiso in Monzen, Wajima City (19 June), at various places on the line, mud 1–2 mm

thick, thought to have come from the nearby Hakka River, covered the seabed, and those places were in a state of small-scale barren ground (isoyake). It states that, over the whole of the line, wakame, which dies back within 1 year, was abundant, and Sargassum species, which live for many years, were relatively few. The report states that, if the state in which mud readily settles continues, the places of barren ground may spread. At Kaiso there is no survey from before the earthquake, and no comparison with before can be made. However, according to Ishikawa Prefecture's seaweed and seagrass bed vision (March 2022), in the prefecture's survey before the earthquake (fiscal 2019), seaweed and seagrass beds had been confirmed down to a water depth of 20 m off the mouths of the Hakka River, thought to be the source of the mud at Kaiso, and of the Nigishi River (this is not the state on the line of the diving survey). The same vision named turbidity in the sea and the fluid mud that had settled as reasons for the decline of the beds of Uchiura, but did not name them as reasons for Sotoura (this paper's reading). [S1, S28]

Of the 5 points in Sotoura, Kaiso was the only one where the beds were said to have declined because of mud. In the same survey, at Wajimazaki (6 June) there were no places of barren ground on the line, and at Nagahashi, Kinoura and Noroshi in Suzu City, the decline of the beds is thought to be due to the tsunami or to winter waves (R7-B10 "The decline of the offshore-side seaweed and seagrass beds of the Sotoura coast of Suzu (tsunami or winter waves)"). [S1]

Off the east of Wajima Port, beds that had grown densely had become sparse. The satellite image analysis team of the Doyukai report looked at the seabed with an underwater camera from a boat in April–May 2025. It states that the way seaweeds were growing (growth condition) on the Wajima coast as seen with the underwater camera showed no great change overall compared with the survey before the earthquake (fiscal 2018–2019), while on the coast on the east side of Wajima Port, sediment had entered in the flood of September 2024, the sediment on the seabed was stirred up when there were waves so that turbidity continued, and the growth of the beds had become worse than before. At a point about 830 m from the shore, the proportion of the seabed covered by Sargassum species (cover) had fallen from 90% to 40%, and sand and gravel had collected on the seabed between the seaweeds. At a point about 1,480 m from the shore, in a bed where Sargassum species and kurome (a seaweed related to kajime) had covered 100% of the seabed, the Sargassum species had almost disappeared and only kajime was growing, at less than 5%. It states that there was almost no sand or gravel there, and that fluid mud appeared to remain on the rocks (all of these are a comparison of photographs of fiscal 2019 and fiscal 2025, and the explanation of them). The report expects that, if the sediment decreases offshore with the waves, seeds will arrive from the surrounding seaweeds and the beds will return naturally, while stating that, if the return is slow, the transplanting of parent seaweeds (the parent seaweeds that release seeds), the removal of fluid mud and the like will be needed. In addition, in the analysis of satellite images by the same team, the area of seaweed and seagrass beds in the Wajima district is 1,915 ha, 47.0% less than the 3,611 ha of the survey before the earthquake, and the decrease of the beds in deep places is stated to be large. These are not values divided by cause, and the decrease in the area of beds is covered in R7-B08 "Shallow seaweed and seagrass beds left dry by uplift, and the decrease in the area of beds on the Sotoura coast". [S1]

Region (Sotoura): the voices of fishers

In the interviews with fishers of Oku-Noto, the largest number of people named mud and turbidity as a problem. The fisheries survey team of the Doyukai report (team leader: Ryoko Ishikawa), from 20 October 2025 to 16 January 2026, interviewed 32 fishers who gather seaweed and shellfish in Oku-Noto (Wajima City, Suzu City, Noto Town and Anamizu Town), in the presence of fisheries staff of the prefecture, for about 1 hour to 1 hour and a half per person. The 32 people were selected, in consultation with the prefecture's staff, from people who had been fishing keenly since before the earthquake disaster. By place of residence, they are 16 people in Wajima City, 8 in Suzu City, 6 in Noto Town and 2 in Anamizu Town. In addition to fishers who live in Noto Town, which is in Uchiura, and in Anamizu Town, which faces Nanao Bay, people based on the Uchiura side of Suzu City are also

included (read from the figure of fishing bases), and the answers of the people of Sotoura alone are not shown. The answers are as in Table 3. [S1]

Table 3 Answers concerning mud and turbidity in the interviews with fishers of Oku-Noto

Question	Answer (proportion of the number of people who answered; multiple answers allowed)	Number who answered
Problems of the shellfish and seaweed gathering fishery (fishing that gathers seaweed and shellfish)	"The decrease of resources due to turbidity and the accumulation of mud", at 81%, is the most frequent. Next is "the increase in people leaving the work and the lack of successors" (a little over 60%, read from the figure)	31 people
Factors in the decrease of resources	"The inflow and accumulation of mud", at 58%, is the most frequent. Next are "warming" and "the loss of habitat due to the uplift of the seabed". "Turbidity of the seawater" is a little over 20%, read from the figure	31 people
Causes of the decrease in catch	"The decrease in the number of days of going out fishing", at 87%, is the most frequent. "The decrease of fishing grounds due to the accumulation of mud" is 60% or more. "Poor visibility due to turbidity" is a little over 20%, read from the figure	31 people
Requests	"Early restoration of fishing ports" and "measures against the inflow of mud" are the most frequent, at the same proportion (a little over 70%, read from the figure)	31 people

Note: From the results of the fisheries survey team of the Doyukai report. The 32 people are fishers of Wajima City, Suzu City, Noto Town and Anamizu Town, and include people on the Uchiura side and the Nanao Bay side. [S1]

Turbidity particularly affects pole fishing, in which the fisher looks down at the seabed from the boat through a glass-bottomed viewing box and takes the catch. According to the Doyukai report, a person who had been fishing for sea cucumbers in places deeper than a water depth of 10 m said that there were now almost no days on which the seabed could be seen. It states that, although the accumulation of mud and turbidity were seen after the earthquake as well, many people felt that they had become particularly bad after the torrential rain. The report also carries the voice of a fisher who said that at Kaiso in the spring of 2025 the wakame harvest was abundant, while the transparency was low because of river water and the fishing in which turban shells and abalone are speared while looking down at the seabed (mitsuki fishing) was difficult. [S1]

There is also another view, though it is held by few. In the question asking the reasons why the catch had increased (6 people answered), there were also people who named "the inflow of nutrients from the mountains", meaning that the landslides had carried, together with the turbid water, many of the nutrients that seaweeds need. The report treats this as a minority opinion. [S1]

The national government's white paper also takes up the sediment that has settled on fishing grounds. The White Paper on Fisheries for fiscal 2025 (Reiwa 7) (June 2026) states that, in the earthquake and the Oku-Noto heavy rain that followed, sediment entered from places where mountain slopes collapsed and settled on fishing grounds, and that the fishing of the ama is being hindered (for the national government's remedial work, see chapter 3). [S21]

In the summer of 2026 too, the effects were continuing. Kyodo News reported that the mozuku fishing of the ama was opened off Wajima on 1 July 2026, and states that seaweeds and shellfish have decreased greatly because of the inflow of sediment and the uplift of the seabed, and that the effects continue even now, 2 and a

half years after the earthquake (the scene on the opening day and ama fishing are in R7-B25 "The ama fishing of Wajima (numbers of people, resumption, and the passing on of skills)"). TV Kanazawa also reported on the same day that, because of the effects of the earthquake and the torrential rain, mud still lies on the seabed even now, and carries the words of the chairman of the Wajima ama fishing preservation and promotion association, that they are working very hard on the works in the mountains, but unless that is put right the mud will keep coming out for ever. [S12, S34]

Region (Sotoura): relationship to other issues

Mud and turbidity, overlapping with the uplift, are affecting the rocky-shore fishing grounds of Wajima. The coast of Sotoura was uplifted in the earthquake, and the shallow seaweed and seagrass beds were left dry (R7-B01 "Earthquake uplift on the Sotoura coast", R7-B08 "Shallow seaweed and seagrass beds left dry by uplift, and the decrease in the area of beds on the Sotoura coast"). "Wajima no Satoumi wo Mamoru Kai" (the group to protect the satoumi of Wajima), a local activity group that has protected the beds of Wajima, has been an activity group of a national government programme (the programme to bring out the multiple functions of fisheries) since 2013, and the beds for which it has concluded an activity agreement are 81 ha. The beds of this area are said to have disappeared on a large scale in the earthquake and torrential rain of 2024, and the group is reorganising its activities (R7-B26 "Rebuilding the local activities that protect the seaweed and seagrass beds of Wajima"). The mass die-off of abalone and turban shells is covered in R7-B13 "The mass die-off of abalone and turban shells, and the decrease in catch that continues for some years", ama fishing in R7-B25 "The ama fishing of Wajima (numbers of people, resumption, and the passing on of skills)", and the barren ground that has continued since before the earthquake in R7-B11 "Barren ground (isoyake) that has continued since before the earthquake, and the decline of the seaweed and seagrass beds of the offshore islands". [S3, S2]

3. Existing measures, and how they are assessed

Efforts on mud are divided into those carried out in the mountains and rivers, where the mud comes from, and those carried out in the sea, which the mud enters. The evaluations and plans of the works in the mountains and rivers that this paper looked at name houses, roads and the like as what is to be protected. However, at the liaison council of November 2025, the Forestry Agency, the Fisheries Agency and Ishikawa Prefecture have decided that the forest conservation work sites considered to affect fishing grounds are to be restored early ("In the mountains and rivers" in this chapter). The efforts on the sea side centre on surveying and on plans to remove mud. We found no material that measured how much the mud entering the sea had decreased and assessed the effect of the efforts.

In the mountains and rivers: forest conservation, erosion control, and restoration of rivers

The works to repair the collapsed mountains are carried out directly by the national government. In response to a request from Ishikawa Prefecture, the Forestry Agency is carrying out, in 6 areas of Wajima City and Suzu City, a directly managed forest conservation project for non-national forests (works to prevent landslides that the national government carries out, in place of the owners, in forests of the prefecture or of individuals) under a 10-year plan from fiscal 2024 to fiscal 2033. The main works are 31 facilities placed in valleys (stream works) and 135.8 ha of works on slopes (hillside works), and the total project cost is about 8.8 billion yen (including tax). The evaluation of the project states that, if left alone, the devastation may spread and sediment may flow out downstream, and it names, as what is to be protected, 607 houses, 1.8 km of national and prefectural roads, 9.0 km of city roads, 52.7 ha of farmland and others. Fishing grounds and seaweed and seagrass beds in the sea are not named among what is to be protected (this paper's reading). According to a national government material,

at 1 place in the Fugeshi area, emergency works to remove the soil at the top of the slope and shape it had been finished by 17 March 2025. [S6, S7]

River works and erosion control works are also progressing. The Hokuriku Regional Development Bureau (Ministry of Land, Infrastructure, Transport and Tourism) is repairing, in place of the prefecture, the Kawarada River, the Tsukada River, the Najimi River, the Machino River and its tributary the Suzuya River, and the Suzu-Otani River. At 5 places in the river systems of the Kawarada River, the Tsukada River and the Machino River, it is carrying out a project to put in place, following on from the emergency measures, erosion control facilities that prevent sediment disasters, intensively over roughly 5 years (material of October 2025). Of these, the river works and others on the Tsukada River, the Najimi River, the Machino River and the Suzu-Otani River are due to the torrential rain of September 2024. The prefecture states that, of the rivers it manages, it finished the emergency restoration of places where the flow was greatly obstructed and the like by before the rainy season of 2025. For example, on the Nishifutamata River in Wajima City, it removed the sediment and driftwood that had accumulated in the torrential rain and secured the cross-section through which the water flows. [S7]

The works are moving on to full-scale restoration. The national government stated that it would finish the emergency measures on the Tsukada River, the Suzu-Otani River and others by June 2025 and would start full-scale restoration in all of the river and erosion control projects by the end of November 2025 (announcement of 17 November 2025). On the location map in the same announcement, the national government is carrying out landslide measures at Ono, Fukami, Nafune and Shibuta along the sea in the eastern part of Wajima City, at Sosogi and elsewhere. From November 2025, the prefecture has been starting full-scale restoration in turn on the 22 rivers of high priority among the 45 rivers of the 2 cities and 2 towns of Oku-Noto (material of 21 May 2026; the number includes rivers of Noto Town and Anamizu Town). None of these states any relationship to the mud entering the sea. [S35, S36]

The national government's recommendations also call for looking at everything from the mountains to the river mouth as one continuous whole. The recommendations (June 2025) of the study group of the Ministry of Land, Infrastructure, Transport and Tourism state that, taking an overall view of the whole river basin from the mountains to the river mouth, erosion control dams (embankments that cross a river and stop sediment), facilities that stop driftwood and sediment retarding basins (places partway along a river that hold the sediment that has flowed down) should be put in place, and the proper management of forests should be promoted. However, they do not touch on the mud in the sea or on fishing grounds (this paper's reading). [S33]

The move to link the mountains and the sea has also only just begun. According to the national government's White Paper on Fisheries for fiscal 2025 (Reiwa 7), the Forestry Agency, the Fisheries Agency and Ishikawa Prefecture held the "liaison council for curbing the outflow of sediment to the seaweed and seagrass beds around Wajima Port" on 27 November 2025, shared the results of surveying how the sediment had settled and information on the places where mountain slopes had collapsed, and have decided that the forest conservation work sites considered to affect fishing grounds are to be restored early. We found no published material showing the proceedings of the council or which work sites these are. The Doyukai report states that measures against the inflow of mud need measures that go beyond the framework of fisheries, and that, from around the autumn of fiscal 2025, exchanges of information and the like with the forestry people who carry out the forest conservation works have also begun (neither material states whether this is the same move as the council in the white paper). The overall summary of the same report states that removing the mud of the wide seabed by human hands is extremely difficult, and that on the Noto Peninsula, where the exchange of seawater by the rise and fall of the tide is small, much depends on the rough waves of winter. For this reason, it states that it is necessary to put in order the source of the mud in the upper reaches of the rivers, that is, the collapsed mountain slopes, and to reduce the mud entering the sea. [S21, S1]

There is also a record of sea fishers joining the efforts on the mountain side. On 17 October 2026, the Forestry Agency's Ishikawa District Forest Office carried out an "initiative for forest regeneration through local co-creation" in Mii-machi, Wajima City, and more than 90 people, including fishery-related people such as ama and fishers, gathered acorns, planted seedlings and made seedbeds. The Forestry Agency states that it had fishery-related people take part as well because forests and the sea are linked by the river basin, and the recovery of forests leads to curbing the outflow of sediment and to improving the water environment. How much the mud entering the sea will decrease is not shown. [S22]

In the sea: surveying, and removing mud

The state of the fishing grounds has been surveyed by the fishers themselves. The surveys in Ishikawa's report were made under the Fisheries Agency's support project for measures to restore fishing grounds (a project that supports surveys, carried out by fishers and others, of changes in the landform of the seabed, in seaweed and seagrass beds and the like, and the removal of drifting objects and deposits, among other things), and the values for the area of mud at Najimi are also quoted from the survey report on the seaweed and seagrass beds of Wajima under this project. According to a material of the Fisheries Agency (November 2024), in Wajima City and elsewhere the activities of this project had been carried out since February 2024, and in Wajima City surveys of the fishing grounds in the sea and on land, surveys of turban shells and other species by ama, and the like had been carried out. According to the Doyukai report, this project was scheduled to end in fiscal 2025, and fishers have asked for it to be continued (R7-B24 "The income of fishers affected by the disaster, and the gap in support"). [S2, S31, S1]

The effort to remove mud is planned to begin from fiscal 2026. According to the report of a project commissioned by the Fisheries Agency (March 2026), the group to protect the satoumi of Wajima, as a result of discussing the effects of the earthquake disaster with specialists and the prefecture, plans to carry out anew, from fiscal 2026, the cleaning of the mud on rocks that has formed where sediment that entered from the land has settled 1 cm or more thick. It states that the new activities such as cleaning are to be monitored regularly while information is shared with specialists, the prefecture and the national government. This paper could not confirm whether the plan has actually gone ahead (the rebuilding of the group's activities is in R7-B26). [S3]

Among local plans, the Plan for Revitalising Fishing Communities (Hama Plan) (fiscal 2025–2029) of the Wajima regional fisheries revitalisation committee (Ishikawa Prefecture Fisheries Cooperative, Wajima City and Ishikawa Prefecture) states that fishers will survey the fishing grounds changed by the earthquake, remove drifting objects and deposits, and increase the landings of abalone and turban shells from ama fishing. Nothing is written about torrential rain or the mud that enters from rivers (this paper's reading). [S32]

The prefecture states that the fishing grounds need to be surveyed (chapter 2), and also names the difficulty of removing mud by machine. At the prefecture's fisheries council (fiscal 2024), the prefecture's secretariat answered that it considered it difficult to remove all the sediment using machines from the land, and that it was thinking of a response after the winter had passed. [S9]

Efforts in other regions, and proposals that have been put forward

In other regions too, there are attempts to remove fluid mud. The report of a project commissioned by the Fisheries Agency states, concerning the activity group of the Segawa district in Nagasaki Prefecture, that there is much fluid mud and the attachment and growth of the seeds of seaweeds is hindered, and that it is necessary to keep removing the fluid mud with a jet of water and to measure the thickness of the mud to confirm the effect. In the same report, a specialist who was asked about blocks on which mud collects and no bed forms advises that fluid mud readily collects when they are placed flat, and that they are less affected by fluid mud when placed upright. [S3]

There is also a case in which the fine soil that goes out from the land to the sea has been reduced by setting targets on both the land and the sea. Okinawa Prefecture made an ordinance to prevent the outflow of red soil and the like in 1994, and in its plan for fiscal 2013–2021 it set, on the sea side, "environmental conservation targets" measured by the amount of red soil and the like contained in the sand and mud of the seabed, and, on the land side, "outflow reduction target amounts". According to the final evaluation (September 2022), the amount of red soil and the like going out from the whole prefecture was estimated at 246,000 t a year in fiscal 2021, a decrease of 52,000 t a year (17.6%) from fiscal 2011. Of the 76 sea areas being monitored, those where the settling of red soil and the like had improved or was improving were 57 (75%), and those that reached the target were 38 (50%). The rate of achievement against the target amount of reduction on the land side in the monitored areas was 30%, and the prefecture states that the measures need to be continued. 80% of Okinawa's red soil and the like comes from farmland (fiscal 2021), and its source differs from mountains collapsed by an earthquake. [S29]

For Wajima too, proposals have been put forward. The Doyukai report states that it is also necessary to consider placing curtains to keep turbidity from spreading (silt fences) at the mouths of rivers with a large flow from early summer to autumn, when much mud enters. At the committee of the Hokuriku Regional Development Bureau touched on in chapter 2 too, on 26 January 2026, the question was asked whether fine sediment can be stopped by erosion control dams of the type that does not let water through, on the grounds that the geology of the upper reaches of the Suzuya River weathers and readily becomes fine, and, concerning the facility planned furthest downstream, the opinion was given that making a sediment retarding basin downstream of the planned position and catching the fine sediment is also conceivable (summary of proceedings; it is not stated whose opinion it was). This opinion does not touch on the mud entering the sea. The Japan Coast Guard states that it will reflect the water depths of Wajima Port after the torrential rain in the nautical charts (R7-B04 "The changed landform of the shallow sea, and the lack of maps and observations that fishers can use"). [S1, S24, S4]

Assessment of the efforts

We found no material that assessed the effect of the efforts by the amount of mud entering the sea. Nor did we find material showing the forest conservation work sites that were to be restored early at the liaison council of November 2025, or how the mud entering the sea changed afterwards. The evaluation of the national government's forest conservation project (fiscal 2024), by cost-benefit analysis (a method of converting the effect of works into money and comparing it with the cost), expects the total benefit to be about 27.7 billion yen (4.06 times the total cost), of which about 13.5 billion yen (about 49%) is the effect of preventing the outflow of sediment downstream (sediment outflow prevention benefit) and about 12.4 billion yen is the effect of preventing mountain disasters (mountain disaster prevention benefit). However, these effects are shown as amounts of money, and the quantity by which the mud entering the sea will decrease is not shown (this paper's reading). In the case of another region, Okinawa Prefecture has estimated the amount of red soil and the like going out from the land, kept monitoring the amount contained in the sand and mud of the seabed, and assessed the effect of its efforts ("Efforts in other regions, and proposals that have been put forward" in this chapter). The increase in river sediment after the earthquake continued for about 6 years in Taiwan (whether this applies to Wajima is not known), and at the Kurobe River the mud that had settled in the shallow sea was stirred up by winter waves, became turbidity and damaged the wakame (Table 1). In Wajima, the mud at Najimi has increased again with rain after being reduced by waves (Table 2). The summary by the fisheries survey team of the Doyukai report also states, concerning mud, that no solution that works in a short period has been found, and that it places its hopes on the cooperation with the forestry field that has only just begun. That mud can enter every time there is heavy rain until the works in the mountains progress is also consistent with the wording of the Forestry Agency's evaluation (this paper's view). [S21, S6, S29, S16, S15, S1]

4. What is changing

The mountains where the mud comes from, the rain and rivers that carry it, and the remedial work in the sea that receives the mud are each moving (as of 4 November 2026). Much of what is covered in this chapter consists of plans, policies and schedules of the national government and the prefecture.

Mountains and rain

The criteria for sediment disaster alerts are returning to the original level. Ishikawa Prefecture and the Kanazawa Local Meteorological Office changed the provisional criteria for Shika Town and others on 29 May 2025. The criteria for Wajima City and Suzu City were not changed at that time. In the announcement of 21 May 2026, they stated that from 28 May (reserve date 4 June) the provisional criteria for Wajima City, Shika Town and others would be ended and the provisional criteria for Suzu City would be changed. The reason is given as the result of examining the situation of sediment disasters and rain after the earthquake. In the meteorological office's preliminary report on the heavy rain of the end of August 2026 (as of 2 September), it is stated that Suzu City is the only one operating under provisional criteria. These criteria are for preparing for sediment disasters on land, and do not show the amount of mud entering the sea. [S8, S20]

The works in the mountains will continue for many more years. The Forestry Agency's forest conservation works run until fiscal 2033, and the intensive development of erosion control by the Ministry of Land, Infrastructure, Transport and Tourism is a plan of roughly 5 years. The Forestry Agency's Ishikawa District Forest Office states that, in this forest conservation project, 21 disaster restoration works were finished in the 2 years up to fiscal 2025 and 11 projects are scheduled for fiscal 2026 (announcement of 23 April 2026). We found no material showing an outlook for when, and how far, the mud of the mountains will decrease. [S6, S7, S23]

Intense rain has continued to fall since then. On 27 August 2026, record heavy rain fell on southern Noto in a linear rainband (developed rain clouds that form a line and keep bringing intense rain to the same place), and the Japan Meteorological Agency issued a heavy rain emergency warning for Shika Town and others within the scope of this paper. Near Shika Town, rain of about 100 mm in 1 hour was analysed (record short-time heavy rain information). We found no material showing whether mud entered the sea of Shika Town with this rain. [S20]

Developments in the sea and in fishing

- June–August 2024: At Najimi, the stands of ishimozuku, which had been as in a normal year in late June, almost disappeared after the rainy season, and fishing was stopped after 3 days. In early August, mud of up to 30 cm in the area of the mouth of the Fukami River. [S2]
- 21–22 September 2024: Torrential rain. 121.0 mm in 1 hour in Wajima. On 26 September, sediment, driftwood and debris in Nafune fishing port. [S5, S2]
- October 2024: In the additional surveying for the "Umi no Chizu" (map of the sea) project, the inside of Osawa fishing port and the valley offshore were filled with sediment. [S10]
- April–May and June 2025: Field survey and diving survey of the Doyukai report. The effects of mud and turbidity were recorded off the east of Wajima Port and at Kaiso. [S1]
- May 2025: The Japan Coast Guard surveyed Wajima Port. Off the mouth of the Kawarada River, the water was shallower by up to a further 1.8 m than after the earthquake (announcement of 19 September 2025). [S4]
- 10 August 2025: At Mii and Monzen in Wajima City, the daily rainfall was the highest value since observation began. [S19]
- Autumn 2025: After the localised heavy rain of late summer, the mud at Najimi spread to 63 ha. [S1]
- Around the autumn of fiscal 2025: Exchanges of information began with the forestry people who carry out the forest conservation works. [S1]

- 27 November 2025: The Forestry Agency, the Fisheries Agency and Ishikawa Prefecture hold the "liaison council for curbing the outflow of sediment to the seaweed and seagrass beds around Wajima Port". It was decided that the forest conservation work sites considered to affect fishing grounds are to be restored early. [S21]
- End of fiscal 2025: The national government's support project for measures to restore fishing grounds was scheduled to end. Whether it continued in fiscal 2026 could not be confirmed (R7-B24). [S1]
- March 2026: The Doyukai report (issued 24 March) and the report of the project commissioned by the Fisheries Agency are completed. [S1, S3]
- Fiscal 2026: The group to protect the satoumi of Wajima plans to begin cleaning the mud on rocks. [S3]
- 23 April 2026: The Forestry Agency announced that, in the forest conservation project in Oku-Noto, 21 works were finished in the 2 years up to fiscal 2025 and 11 are scheduled for fiscal 2026. [S23]
- 28 May 2026 (reserve date 4 June): The provisional criteria for the sediment disaster alert information for Wajima City are ended (announcement of 21 May). As of the end of August, Suzu City is the only one where provisional criteria remain. [S8, S20]
- 1 July 2026: Opening of the mozuku fishing of Wajima. The article stated that seaweeds and shellfish had decreased greatly because of the inflow of sediment and other factors. [S12]
- 27 August 2026: Heavy rain from a linear rainband. Heavy rain emergency warning for Shika Town and others. [S20]
- 17 October 2026: More than 90 people, including ama, fishers and others, took part in the forest regeneration initiative of the Forestry Agency's Ishikawa District Forest Office. [S22]
- Fiscal 2024–2033: The Forestry Agency's forest conservation project in Oku-Noto. [S6]

5. What is not yet known

Things for which there are no figures

- We found no figures showing how much mud is entering the sea over Sotoura as a whole. Nor did we find figures showing, river by river, the amount of sediment that has gone out to the sea. What the national government's materials contain is the amount of unstable sediment remaining in the river basins (about 1.85 million m^3 for the Suzuya River and about 430,000 m^3 for the Tsukada River; chapter 2), and how much of that will go out to the sea is not shown. The only figures that measured the thickness and extent of the mud around the river mouths are those for the mouth of the Fukami River (early August 2024) and the area in the Najimi district. Apart from these, there are the thickness of the mud thought to have come from the Hakka River, as seen by diving at Kaiso (1–2 mm, 19 June 2025), and a news report that gives about 1 cm in a survey of May 2025, for which the place surveyed is not stated. [S2, S1, S24, S27]
- We found no measured values of turbidity (turbidity level or transparency) around the river mouths of Sotoura. There are only the voices of fishers, what was seen by diving and with underwater cameras, and the statement in the overall summary of the Doyukai report that, in satellite images, turbid water was spreading from more than one river. [S1]
- We found no figures for the extent of the mud in 2026. The only thing that tells of the state of the mud on the seabed in 2026 is the news report (1 July 2026) that mud still lies on the seabed even now. The last value of the area at Najimi is for the autumn of 2025. [S1, S34]
- We found no material that measured the mud of river mouths on the coast of Shika Town or the northern coast of Suzu City.

- We found no figures showing how the catch has decreased because of mud. In the fall in the catch, the uplift, the damage to ports, the large number of days on which fishers could not go out, warming and other factors overlap, and there is no material that separates out only the part due to mud (the landings of the Wajima district are in R7-B22 "The fall in landings on the Sotoura coast (the delay in the Wajima district)"). [S1]
- The area of mud at Najimi is a value from the report of the Ishikawa Prefecture wide-area activity organisation quoted by the Doyukai report, and no published version of that report was found in the research for this paper (the references section of the Doyukai report does not state where it can be obtained either). [S1]

Limits to comparison

- The values of the thickness of the mud differ in the time, the place and the way of measuring. The maximum of 30 cm at the mouth of the Fukami River (early August 2024, survey of the seabed), the several tens of cm mentioned by a member of the prefecture's council (fiscal 2024, place not stated), the 1–2 mm at Kaiso (19 June 2025, diving), the about 1 cm given in a news report (survey of May 2025; place not stated), and, off the east of Wajima Port, the several cm of sand and gravel on the rocks and the about 10 cm of sand and gravel in hollows (April–May 2025, explanation of underwater camera photographs) are not values that compare the same thing. The values off the east of Wajima Port are for sand and gravel, not mud. The values for Najimi are the area of the range where the thickness is 1 cm or more. [S2, S9, S1, S27]
- The area at Najimi is a value for each season, and it changes greatly with the rain and waves before it (Table 2). The last value for 2025 is given as after the heavy rain of late summer in the text, and as autumn in the figure. [S1]
- The 32 people interviewed were selected from people who had been fishing keenly since before the earthquake disaster, and include 8 people who live in Noto Town, which is in Uchiura, and in Anamizu Town, which faces Nanao Bay. On the map of fishing bases in the report, there are also people based on the Uchiura side of Suzu City, so the people based on the Uchiura side and the Nanao Bay side are more than 8 (read from the figure). No fishers of Shika Town are included. The proportion for the people of Sotoura alone is not known. The proportions are values relative to the 31 people who answered the questions. [S1]
- For the decline of the seaweed and seagrass beds, besides mud, there can be causes such as the uplift, the tsunami, winter waves, warming (high water temperatures in summer are in R7-B12 "High water temperatures in summer (the shallow sea of Sotoura)") and animals that eat seaweed, and there is no material that measured them separately by cause. The comparison off the east of Wajima Port is a comparison of photographs from before the earthquake (fiscal 2019) and after it (fiscal 2025), and how the difference in the season in which they were taken was handled is not stated. [S1]
- The cases in Japan and abroad differ both in the source of the sediment (landslides, sediment flushing from a dam, gravel and sand of an uplifted coast) and in the way of measuring (Table 1).

Figures that disagree

- On how much of the sediment of the torrential rain remained on the coast, the materials take different views. Ishikawa's report (received March 2025) states that after the torrential rain of September new mud may have been laid on top of the old mud and the layer of mud may have become thicker, and is concerned that the worsening of the seabed will continue for a long time. At the same time, it also writes of the expectation that the mud will be washed out by the stormy seas of winter. On the other hand, the Doyukai report (March 2026) states that it has been reported that the sediment of the torrential rain spread offshore with the stormy seas caused by the seasonal wind and did not settle much on the coast. The state after the winter had passed also differs from material to material. The satellite image analysis team of the Doyukai report states that, in April–May 2025, on the coast to the east of Wajima Port, the sediment that had entered in the flood of September

2024 was being stirred up by waves and turbidity was continuing (chapter 2). The Hokkoku Shimbun (1 July 2025) reports that, when the chairman of the Wajima ama fishing preservation and promotion association looked at the fishing grounds in late June 2025, mud thought to have flowed in with the torrential rain of September of the previous year had settled on the seabed and there was almost no mozuku. Ishikawa TV (the same day) reports that, in a survey of May 2025, the thickness of the mud had decreased to about 1 cm (the place surveyed is not stated). It is thought that the mud was reduced by the winter waves but in some places remained until the early summer of 2025, and that the difference in views is due to the difference in the time and place of observation (this paper's view). The fact that the area at Najimi decreased from the summer to the autumn of 2024 and on to the spring of 2025 (Table 2) is consistent with the view of the Doyukai report. However, whether the value for the autumn of 2024 is from before or after the torrential rain of September cannot be told from the figure. [S2, S1, S26, S27]

- Within the Doyukai report too, the wording differs. The overall summary states that turbidity and deposits were not conspicuous at the points of the diving survey. On the other hand, the diving survey team recognises the accumulation of mud over the whole of the line at Kaiso. Also, the satellite image analysis team states that the way seaweeds were growing on the Wajima coast as seen with the underwater camera showed no great change overall, while stating that in the satellite images the area of seaweed and seagrass beds in the Wajima district had decreased by 47.0% (R7-B08). In the interviews of the fisheries survey team, 81% named mud and turbidity as a problem. The places, methods and times of the surveys differ. On the requests, the text and figure of the fisheries survey team give the 2 most frequent as "early restoration of fishing ports" and "measures against the inflow of mud", but the summary by the same team gives "measures against the inflow of mud" as the most frequent request (this paper followed the text and figure). [S1]
- The source quoted for the area of mud at Najimi is a report whose title says "fiscal 2024 (Reiwa 6), August–December", but the figure also contains values from the spring to the autumn of 2025. Because this paper was unable to obtain the quoted source, it could not confirm the reason. [S1]
- The start of the sediment flushing on the Kurobe River is written as December 1991 in the ruling of the Environmental Dispute Coordination Commission and as "from December 1993 onwards" in the overall summary of the Doyukai report. This paper used the value in the ruling. [S15, S1]

Reliability and the standpoint of the materials

Reliability differs from item to item. That the mountains of Wajima City and Suzu City collapsed on a large scale in the earthquake, and that much of the collapsed sediment still remained on the slopes and in the valleys as of fiscal 2024, is based on the evaluation of the national government's project and the materials on the works, and the reliability can be said to be high. The amount, river by river, of the unstable sediment remaining in the river basins (chapter 2) is an estimate from the difference in landform measured by airborne laser, and the material itself states that the values may change, so the reliability is medium. The rainfall of the torrential rain of September 2024, and the fact that Wajima Port became shallower because of the sediment of the torrential rain, are also based on the observations of the Japan Meteorological Agency and the surveying by the Japan Coast Guard and others, and the reliability can be said to be high. That the sediment of the torrential rain entered Osawa fishing port is something on which the photographs in the Fisheries Agency's report and the article on the surveying for the "Umi no Chizu" (map of the sea) project agree, and the reliability can be said to be high. The extent, namely that it completely filled the inside of the port and that even the valley in the seabed offshore was filled, is based only on the article by the chairman of the body that carried out the surveying, and the reliability is medium. That sediment that entered from places where mountain slopes collapsed has settled on fishing grounds and is hindering the fishing of the ama is written in the national government's White Paper on Fisheries (it does not state which survey this is based on), and it is also consistent with the surveying by the Japan Coast Guard and others showing that the sediment of the torrential rain settled off the river mouths, so

the reliability can be said to be high. That fine mud settled around the river mouths of Wajima after the rainy season of 2024, and its thickness (up to 30 cm at the mouth of the Fukami River), are based on the diving and seabed surveys of Ishikawa's report, and because the author's own text states that there are many subjective and qualitative data, the reliability is medium. The area of mud at Najimi is quoted from a report of which no published version can be found, and because this paper cannot check the original report, the reliability is medium to low. That mud and turbidity made the seaweed and seagrass beds decline is based on the observations and the comparison of photographs at Kaiso and off the east of Wajima Port and on the voices of fishers, and because it has not been measured separately from other causes, the reliability is medium to low. That, in the interviews, the largest number of people named mud and turbidity as a problem is certain as a result, but these are the answers of 32 people including the Uchiura side and the Nanao Bay side, and not the proportion for Sotoura as a whole. That remedial work has begun to move (the forest conservation works and the liaison council, and the plan-making of the group to protect the satoumi) is based on national government materials, and the reliability can be said to be high. The effect of the efforts in reducing the mud in the sea is not known, as there is no material that measured it.

Care is also needed over the standpoint of the materials. The surveys in Ishikawa's report and the source quoted for the area of mud at Najimi are both surveys of the seaweed and seagrass beds of Wajima under the national government's support project for measures to restore fishing grounds. Ryoko Ishikawa is also the leader of the fisheries survey team of the Doyukai report. For this reason, these cannot be said to be confirmations independent of each other. The report of the project commissioned by the Fisheries Agency contains a list of the people registered in fiscal 2025 as specialists who support the activity groups, and Ryoko Ishikawa and the leader of the diving survey team of the Doyukai report are also on it. It is not stated who the specialists were whom the group to protect the satoumi of Wajima consulted about the plan for cleaning the mud. The Doyukai report is the report of a survey carried out by a business association with a grant from The Nippon Foundation and the special cooperation of the Hokkoku Shimbun newspaper company (this paper also quotes articles of the Hokkoku Shimbun), with the prefecture's Fisheries Division and Fisheries Research Center taking part as observers, and it is not peer-reviewed. Ishikawa's report is a report in an academic journal (Fisheries Engineering), received on 27 March 2025 and accepted on 31 March. The research group of universities and others that obtained the water depths before the torrential rain (Kyushu University, World Scan Project, Hiroshima University and Kanazawa University) took part in the Japan Coast Guard's analysis of Wajima Port. The author of the article on the "Umi no Chizu" (map of the sea) project is the chairman of the Japan Hydrographic Association, which carried out the surveying. The number of places that collapsed in the earthquake (about 6,000) is a value from the abstract of a lecture at an academic society, and it is not peer-reviewed. The news reports (Hokkoku Shimbun, Ishikawa TV, TV Kanazawa and Kyodo News) convey briefly what fishers saw and said and the results of surveys, and the survey methods are not stated. The announcement on the seabed off Suzu, the ruling on the Kurobe River and the evaluation by Okinawa Prefecture were quoted as cases outside the scope of this paper. The cases of Taiwan and New Zealand studied the amount of river sediment and the movement of the gravel and sand of an uplifted coast, and did not measure the same thing as the mud of the river mouths of Wajima. This paper has not checked the origin of the report, quoted by the Doyukai report, that the sediment of the torrential rain spread offshore. The meteorological office's preliminary reports on heavy rain are preliminary reports whose figures may change later.

The publisher of this paper (SeatecHIROSHIMA Ltd.) runs a business that controls the attachment of living things by surface treatment of materials. This covers both preventing fouling from attaching (antifouling) and making it easier for eelgrass (a kind of seagrass) to take root for the restoration of seaweed and seagrass beds. It is also developing a system that identifies the positions of oyster rafts and informs ships of them. This paper does not cover the company's own technology or results. In chapters 2 and 3, this paper touches on plans and examples of efforts to bring back seaweed and seagrass beds, such as raising the height of the bases on which seaweeds grow and giving them a shape on which mud does not readily collect, the transplanting of parent seaweeds, the

removal of fluid mud and of the mud on rocks, and blocks placed in a way in which mud does not readily collect. The restoration of seaweed and seagrass beds overlaps with the publisher's field of business. The relationships with the organisations taken up in this paper and with organisations active in Sotoura are as follows (as of 4 November 2026; based on information the publisher has made public, the publisher's contracts and records, and the research for this paper). With Ishikawa Prefecture, there is the relationship of having been selected for the prefecture's (Commerce, Industry and Labour Department, Industrial Policy Division) "survey project for attracting start-ups to Noto" (fiscal 2025 [Reiwa 7]) (September 2025). In this project, specialists accompany and support the selected companies in drawing up business plans and building connections in Noto (according to the prefecture's announcement). The prefecture's Fisheries Division and Fisheries Research Center took part as observers in the survey for the Doyukai report that this paper quotes. In October 2026, in the "Start-up Business Plan Contest Ishikawa 2026" run by Ishikawa Prefecture and the public interest incorporated foundation Ishikawa Sunrise Industries Creation Organization, the publisher received the top entrepreneur award for a plan on the theme of Nanao Bay (according to the announcement on the Organization's website). The Organization's website states that this award comes with a subsidy, the free use for 3 years of a facility that rents rooms to newly founded companies, and other benefits. In Noto, the publisher has concluded non-disclosure agreements and is working together with Nanaibe LLC and Yamaguchi Suisan of Nanao City, Atsumasa Nakamura of Kanazawa University, and the Noto council for raising fisheries earnings. With the Ishikawa Prefecture Fisheries Cooperative (which also has branches in Sotoura; fishers of its Wajima branch took part in the surveys of Ishikawa's report, and in the interviews for the Doyukai report each branch was asked to cooperate), there is the relationship that the publisher secured a site for its demonstration through Nanaibe LLC, its partner in the collaboration. The publisher is not a member of the Noto council for raising fisheries earnings. The area in Ishikawa Prefecture with which the publisher has been involved is mainly Nanao Bay, and matters of Nanao Bay are covered in R7-A (Nanao Bay) of this series. In Sotoura (Shika Town, Wajima City, and the northern coast of Suzu City as far as Jike), the publisher is not active. Among the materials that this paper quotes, researchers of Kanazawa University took part in the Japan Coast Guard's analysis of Wajima Port and in the announcement on the seabed off Suzu. 1 of the members of the study group of the Ministry of Land, Infrastructure, Transport and Tourism that made the recommendations is also a person of the same university. The name of Atsumasa Nakamura does not appear among the authors of these materials, nor in the lists of the surveys or the list of members of the study group. With Hiroshima University, the publisher has participated since October 2025, as one company in a consortium, in a research centre of the university (JST COI-NEXT). Michio Imai, the publisher's co-representative CEO, has served since 1 November 2026 as a researcher (part-time) at a research institute of the same university (the institute for the future of ocean and maritime affairs) (concurrently with his post as the publisher's co-representative CEO). In addition, the publisher joined joint research under the Town & Gown initiative of Kure City and Hiroshima University (an initiative in which the city and the university work together) (the research period is October 2025 to August 2026, with the contract concluded in March 2026). This joint research is funded by a research grant from Kure City, and the publisher received an allocation of research funds from that grant (April 2026). It has also been selected for the research grant from Kure City for the 2nd year (from September 2026). In the Japan Coast Guard's analysis of Wajima Port that this paper quotes, Hiroshima University is in the research group that obtained the water depths before the torrential rain, but the name of the researcher who is the publisher's partner in the joint research does not appear in the Kanazawa University article that introduces this group. This paper does not use the data or results of this joint research. As for Nagoya University, the publisher's technology is supervised, in a personal capacity, by Kensuke Kuroda (representative of Nagoya Surface Technology; designated professor at the Institutes of Innovation for Future Society, Nagoya University). In the recommendations of the study group of the Ministry of Land, Infrastructure, Transport and Tourism, the chair is a person of the same university, but Kensuke Kuroda does not appear in the list of members. Apart from the above, there are no relationships between the publisher and the organisations taken up in this paper (national government bodies, the prefecture and the cities and towns, universities and research

institutes, the companies and organisations named in this paper, and others) or the organisations active in Sotoura (fisheries cooperatives, local groups and others) that would affect the content of this paper. Relationships here means transactions, funding, joint research, and officers or employees of the publisher concurrently serving as employees or officers of the organisation. This is the publisher's judgement, made after checking the information the publisher has made public, the publisher's contracts and records, and the research for this paper.

6. Sources

We examined materials that had been published by 4 November 2026. Focusing on materials of the national government and the prefecture, papers, and reports of research institutes and organisations, we used figures that were checked against the very materials listed as sources (the New Zealand report and the United Kingdom paper were checked in publicly available copies, and the TV Kanazawa news report in its distribution to a news site). Among the figures that the materials quote from other surveys, there are some that we have not checked back to the original material, and we have marked these "quoted" in the text. Values read from figures are marked "read from a figure". Reliability: A = laws and regulations, statistics, materials of the national government and the prefecture; B = papers, reports of research institutes that state their method; C = explanatory materials for general readers, descriptions by organisations, guidance with little statement of method; D = news reports.

ID	Material (publisher, year)	Type	Reliability	Where this material is used
S1	Kanazawa Association of Corporate Executives (Kanazawa Keizai Doyukai), special committee for the survey of the effects of the earthquake disaster on the coasts of the Noto Peninsula: Report of the fiscal 2025 (Reiwa 7) survey of the effects of the earthquake disaster on the coasts of the Noto Peninsula (in Japanese) (24 March 2026. Report of a survey by a business association. Grant from The Nippon Foundation and special cooperation of the Hokkoku Shimbun newspaper company. The prefecture's Fisheries Division and Fisheries Research Center were observers. Not peer-reviewed. The area of mud at Najimi is quoted from a report of the Ishikawa Prefecture wide-area activity organisation of which no published version can be found. This paper's "Doyukai report")	Report	C	Chapters 1–5
S2	Ryoko Ishikawa: On the changes in seaweed and seagrass bed resources accompanying the uplift of the Wajima coast in the Noto Peninsula Earthquake (in Japanese) (Fisheries Engineering 62(1), 2025. Received 27 March 2025, accepted 31 March. This paper's "Ishikawa's report")	Report	B	Chapters 1–5
S3	JF Zengyoren (National Federation of Fisheries Co-operative Associations) and others: Survey report of the fiscal 2025 (Reiwa 7) commissioned project to support measures for strengthening the productivity of fishing grounds and the multiple functions of fisheries (in Japanese) (a project commissioned by the Fisheries Agency, March 2026)	Report	A	Chapters 1–4
S4	Japan Coast Guard and Kanazawa University: The effects of last September's Oku-Noto heavy rain at Wajima Port made clear (in Japanese) (19 September 2025. Includes the announcement of the Japan Coast Guard); Kanazawa University: 2024 (Reiwa 6) Noto Peninsula Earthquake: detailed seabed landform data from after the earthquake disaster to be made widely available to the public (in Japanese) (18 October 2024. Introduction of the research group)	Observation	A	Chapters 1–4

ID	Material (publisher, year)	Type	Reliability	Where this material is used
S5	Japan Meteorological Agency: Heavy rain due to a low-pressure system and a front, 20 September to 22 September 2024 (Reiwa 6) (preliminary report) (in Japanese) (29 October 2024. A preliminary report, and the figures may change)	Observation	A	Chapters 1, 2, 4
S6	Forestry Agency: On the implementation of the directly managed forest conservation project for non-national forests in the Oku-Noto district (in Japanese) (Kinki Chugoku Regional Forest Office, 10 September 2024); individual sheet of the prior evaluation (Oku-Noto district) (in Japanese) (fiscal 2024 [Reiwa 6])	Evaluation	A	Chapters 1–4
S7	Hokuriku Regional Development Bureau and others: Materials of the 3rd information liaison meeting on the disaster restoration works for the 2024 (Reiwa 6) Noto Peninsula Earthquake and the Oku-Noto heavy rain (in Japanese) (10 October 2025. Reports of the Hokuriku Regional Development Bureau, the Forestry Agency's Ishikawa District Forest Office, Ishikawa Prefecture and others)	Meeting	A	Chapters 2–4
S8	Ishikawa Prefecture and Kanazawa Local Meteorological Office: provisional criteria for the sediment disaster alert information (announcements of 1 January 2024; 26 May 2025; 21 May 2026) (in Japanese)	Announcement	A	Chapters 2, 4
S9	Ishikawa Prefecture: Summary of the results of the fiscal 2024 (Reiwa 6) Ishikawa Prefecture fisheries promotion council (in Japanese) (the date it was held is not stated)	Meeting	A	Chapters 2, 3, 5
S10	Kato (Japan Hydrographic Association): The "Umi no Chizu" (map of the sea) PROJECT: towards the reconstruction of Noto (in Japanese) (Ocean Newsletter 593, 20 May 2025)	Explanatory	C	Chapters 2, 4, 5
S11	Fisheries Agency: Report of the fiscal 2025 (Reiwa 7) commissioned survey project for fisheries infrastructure development: study of disaster response measures in disasters on peninsulas and in remote areas (in Japanese) (March 2026)	Report	A	Chapters 2, 5
S12	Kyodo News: Ama of Wajima, Ishikawa: mozuku fishing opened; inflow of sediment and other effects of the disaster continue (in Japanese) (1 July 2026, website of the Kumamoto Nichinichi Shimbun)	News	D	Chapters 2, 4, 5
S13	Kanazawa University: Changes in the seabed environment off Suzu City due to the Oku-Noto heavy rain of September 2024 (in Japanese) (announcement text, 24 January 2025. A survey of Uchiura, outside the scope of this paper)	Explanatory	C	Chapters 2, 5
S14	Fisheries Agency, Fishing Ports and Grounds Development Department, Construction Division: On the state of efforts to create seaweed and seagrass beds that withstand high water temperatures (in Japanese) (material of the national council on measures against barren ground, 10 February 2023. The survey of the prefectures was in November 2021)	Material	A	Chapter 2
S15	Environmental Dispute Coordination Commission: Written ruling in the case, referred by a court, for determination of the cause of the fishery damage from sediment flushing at the Dashidaira Dam in the sea area at the mouth of the Kurobe River, Toyama Prefecture; announcement (in Japanese) (28 March 2007)	Ruling	A	Chapters 2, 3, 5
S16	Hovius et al.: Prolonged seismically induced erosion and the mass balance of a large earthquake (Earth and Planetary Science Letters 304, 2011)	Paper	B	Chapters 2, 3, 5

ID	Material (publisher, year)	Type	Reliability	Where this material is used
S17	Alestra et al.: Rocky reef impacts of the 2016 Kaikōura earthquake: extended monitoring of nearshore habitats and communities to 3.5 years (New Zealand Aquatic Environment and Biodiversity Report 253, 2021. Fisheries New Zealand. Checked in a publicly available copy)	Report	B	Chapters 2, 5
S18	Airoldi and Hawkins: Negative effects of sediment deposition on grazing activity and survival of the limpet Patella vulgata (Marine Ecology Progress Series 332, 2007. Checked in a publicly available copy)	Paper	B	Chapter 2
S19	Kanazawa Local Meteorological Office: Ishikawa Prefecture preliminary weather report on the heavy rain of 10 to 13 August 2025 (Reiwa 7) (in Japanese) (26 August 2025. A preliminary report as of 17:00 on 24 August, and the figures may change)	Observation	A	Chapters 2, 4
S20	Kanazawa Local Meteorological Office: Ishikawa Prefecture preliminary weather report on the heavy rain of 26 to 30 August 2026 (Reiwa 8) (in Japanese) (14 September 2026, revised 17 September. A preliminary report as of 14:00 on 2 September, and the figures may change)	Observation	A	Chapter 4
S21	Fisheries Agency: White Paper on Fisheries for fiscal 2025 (Reiwa 7), Part 1, Chapter 6 (4): Promotion of measures for recovery and reconstruction from the 2024 (Reiwa 6) Noto Peninsula Earthquake (in Japanese) (Cabinet decision of 5 June 2026. The page does not state the date of publication)	White paper	A	Chapters 1–5
S22	Forestry Agency, Kinki Chugoku Regional Forest Office, Ishikawa District Forest Office: Initiative for forest regeneration through local co-creation in the areas affected by the Noto Peninsula Earthquake and the Oku-Noto heavy rain (announcement, 7 October 2026); report on its implementation (in Japanese) (the page does not state a date)	Announcement	A	Chapters 3, 4
S23	Forestry Agency, Kinki Chugoku Regional Forest Office, Ishikawa District Forest Office: On the publication of the priority items of the Ishikawa District Forest Office for fiscal 2026 (Reiwa 8) (23 April 2026); directly managed forest conservation project for non-national forests: state of implementation (fiscal 2026 [Reiwa 8]) (in Japanese) (as of 30 October 2026)	Announcement	A	Chapters 2, 4
S24	Hokuriku Regional Development Bureau: Materials of the 6th meeting of the committee to study measures against sediment disasters in the Noto Peninsula Earthquake (20 January 2025. The amounts of unstable sediment are on pages 44 and 63 of the PDF. The values may change with future surveys); summary of proceedings of the 8th meeting of the same committee (in Japanese) (26 January 2026)	Meeting	A	Chapters 2, 3, 5
S25	Japan Meteorological Agency: Start and end of the rainy season of 2024 (Reiwa 6) (final figures) (2 September 2024); start of the rainy season and end of the rainy season of 2025 (Reiwa 7) (final figures) (in Japanese) (1 September 2025)	Observation	A	Chapter 2
S26	Hokkoku Shimbun: Breath-hold diving fishing of the ama of Wajima City begins; "I was able to enjoy the work"; mozuku limited to 20 kg per person (in Japanese) (1 July 2025)	News	D	Chapter 5
S27	Ishikawa TV: Baskets piled high with mozuku: ama fishing opened in Wajima; abalone and turban shell fishing at Hegurajima and elsewhere to continue being surveyed and scheduled to resume during July (in Japanese) (1 July 2025. The date on the page does not state the year, and it was taken to be 2025 from the day of the week and the text)	News	D	Chapter 5
S28	Ishikawa Prefecture: Ishikawa Prefecture seaweed and seagrass bed vision (in Japanese) (March 2022)	Plan	A	Chapter 2

ID	Material (publisher, year)	Type	Reliability	Where this material is used
S29	Okinawa Prefecture: Final evaluation of the Okinawa Prefecture basic plan for measures to prevent the outflow of red soil and the like (summary version) (in Japanese) (September 2022)	Evaluation	A	Chapters 3, 5
S30	Fisheries Agency: Guidelines on measures against barren ground (isoyake), 3rd edition, Chapter 3 (March 2021); guidelines on measures to prevent the loss of seaweed and seagrass bed resources (in Japanese) (March 2009)	Guidance	A	Chapter 2
S31	Fisheries Agency, Fishing Ports and Grounds Development Department: Noto Peninsula Earthquake: support for recovery and reconstruction (in Japanese) (explanatory material of the 22nd national meeting for the presentation of technical research on the development of fishing ports and fishing grounds, 7 November 2024)	Material	A	Chapter 3
S32	Wajima regional fisheries revitalisation committee: Plan for Revitalising Fishing Communities (Hama Plan) (fiscal 2025–2029 [Reiwa 7–11], 3rd period) (in Japanese) (made up of the Ishikawa Prefecture Fisheries Cooperative, Wajima City and Ishikawa Prefecture)	Plan	A	Chapter 3
S33	Study group on measures against flood damage and sediment disasters in the light of the earthquake and heavy rain on the Noto Peninsula (Ministry of Land, Infrastructure, Transport and Tourism): Recommendations on how measures against flood damage and sediment disasters should be, in the light of the earthquake and heavy rain on the Noto Peninsula (in Japanese) (June 2025)	Recommendations	A	Chapters 2, 3, 5
S34	TV Kanazawa: 2 and a half years after the Noto Peninsula Earthquake: "the ama fishing of Wajima" opened towards the rebuilding of livelihoods; new ama make their full debut (in Japanese) (1 July 2026, distributed to livedoor News. The original article on the TV Kanazawa website cannot be found)	News	D	Chapters 2, 5
S35	Hokuriku Regional Development Bureau, Noto Reconstruction Office: Full-scale restoration works to start on the river and erosion control projects relating to the 2024 (Reiwa 6) Noto Peninsula Earthquake and the 2024 (Reiwa 6) Oku-Noto heavy rain (in Japanese) (17 November 2025)	Announcement	A	Chapter 3
S36	Hokuriku Regional Development Bureau and others: Materials of the 4th information liaison meeting on the disaster restoration works for the 2024 (Reiwa 6) Noto Peninsula Earthquake and the Oku-Noto heavy rain (in Japanese) (21 May 2026. The restoration of the prefecture's rivers is a report of Ishikawa Prefecture)	Meeting	A	Chapter 3
S37	Yanai et al. (Ishikawa Prefectural University): The chain relationship between collapses caused by the earthquake and the occurrence of mudflows and debris flows caused by the torrential rain (in Japanese) (Proceedings of the fiscal 2025 (Reiwa 7) research presentation meeting of the Japan Society of Erosion Control Engineering, R2-003, 2025. The abstract of a lecture at an academic society, and not peer-reviewed)	Report	C	Chapters 2, 5

Related materials: R2 Seaweed and seagrass beds and the living things of the sea, R6 What is changing (why now), R7-A05 Turbidity and fluid mud in Nanao Bay, R7-B01 Earthquake uplift on the Sotoura coast, R7-B03 Sandy beaches that keep moving even after the uplift, and the filling of fishing ports, R7-B04 The changed landform of the shallow sea, and the lack of maps and observations that fishers can use, R7-B08 Shallow seaweed beds dried out by uplift, and the decrease in the area of seaweed beds in Sotoura, R7-B10 The decline of the offshore-side seaweed beds of the Sotoura coast of Suzu (tsunami or winter waves), R7-B11 Barren ground (isoyake) that has continued since before the earthquake, and the decline of the seaweed beds of the offshore islands, R7-B12 High water temperatures in summer (the shallow sea of Sotoura), R7-B13 The mass die-off of

abalone and turban shells, and the decrease in catch that continues for some years, R7-B15 Driftwood, debris and large rocks remaining in fishing grounds and ports, R7-B17 The lack of water depth at Wajima Port (the largest fishing base in the prefecture) and its restoration, R7-B18 Where the dredged sediment of Wajima Port goes (a disposal site built in the sea and the creation of seaweed and seagrass beds), R7-B22 The fall in landings on the Sotoura coast (the delay in the Wajima district), R7-B24 The income of fishers affected by the disaster, and the gap in support, R7-B25 The ama fishing of Wajima (numbers of people, resumption, and the passing on of skills), R7-B26 Rebuilding the local activities that protect the seaweed beds of Wajima, I1 List of assessments