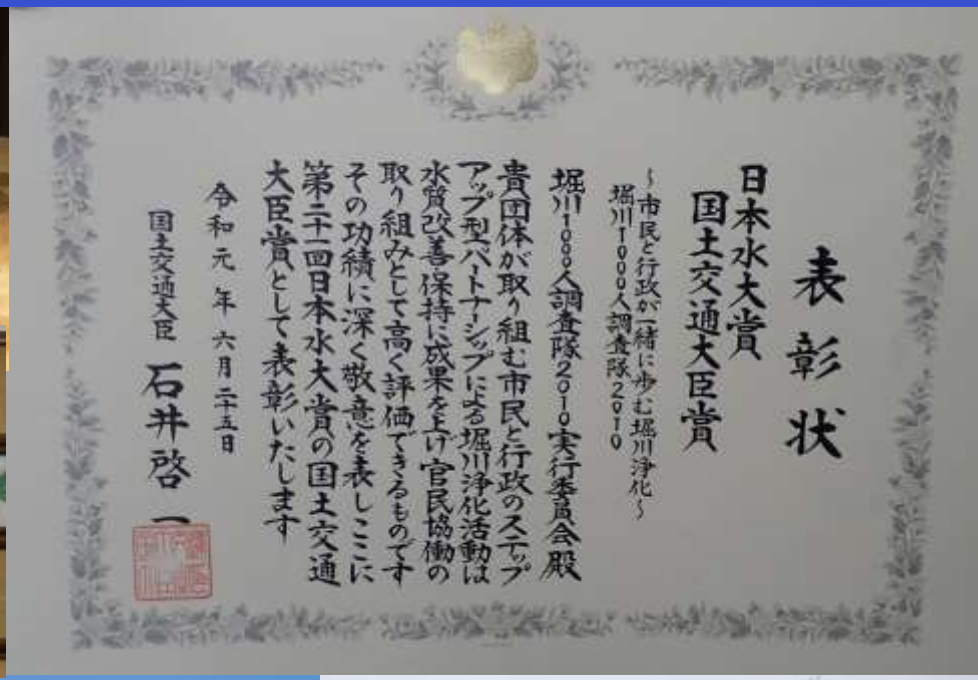
# Horikawa Sen-nin Chosatai 2010 （HSC）
# Summary meeting for the 25th stage

Place：
Nagoya Urban Institute
Conference room（11th floor）

表彰状

日本水大賞
国土交通大臣賞

～市民と行政が一緒に歩む堀川浄化～
堀川1000人調査隊2010

堀川1000人調査隊2010実行委員会殿

貴団体が取り組む市民と行政のステップアップ型パートナーシップによる堀川浄化活動は水質改善保持に成果を上げ官民協働の取り組みとして高く評価できるものですその功績に深く敬意を表しここに第二十四日本水大賞の国土交通大臣賞として表彰いたします

令和元年六月二十五日

国土交通大臣 石井啓一


The secretariat of Horikawa Sen-nin Chosatai 2010
Sep.28th.2019

# 1. Horikawa Sen-nin Chosatai 2010

## ～Transmission of Raw Water from Kiso River～

### 1.Purpose

To verify the clarification effects of TRWKR with citizens

(1) Develop to new clarifying measures
(2) Asses the influence on an ecosystem
(3) Sustain and enhance citizens' activities
(4) Develop citizens' awareness in the entire Horikawa River basin

### 2.Water source and Volume of transmission of raw water

(1) Water Source : Kiso River
(2) Volume of transmission of raw water : Maximum 0.4 m3/s

### 3.Pilot project period

(1) Evaluation and Survey term : About 5 years
(from Apr.2007 to Mar.2012)
(Including the term of follow-up survey and evaluation after the stop of TRWKR)
(2) TRWKR period : about 3 years
(from Apr.22nd.2007 to Mar.22nd.2010)

■Increase of Transmisson Volume from the Shonai River (additional pilot project)

### 1.Water source and Volume of transmission of raw water

(1) Water Source : Shonai River
(2) Transmission Usual 0.4m3/sec (maxium 0.7m3/sec)

### 2.Period of Increase

(1) Experiment Period : Oct.1st - Dec.31st.2010
(2) Period of Increased Transmision Volume : Oct.5th - Nov.2nd.2010

The formation of HSC (April.22nd.2007)
With a viewpoint and a sence of citizens, the survey of the clarification effect of TRWKR started


■ The survey from a viewpoint and a sence of citizens'
＊Clearness ＊Transparency ＊Color ＊Bubble ＊Smell
＊Garbage ＊Creatures, etc

The first Nagoya City Environmental Practice Prize, Feb.2012
Branch of contribution for Regional Environment Development Award for Excellence


Water Resource Contributor Awards
Minister of Land, infrastructure and Transportation) Aug.2016


# Transmission of Raw Water from Kiso River

## 3 years from April.22nd.2007(Stopped on March.22nd.2010)

To verify the clarification effects of TRWKR
Surveys during TRWKR period :
April.2007 ～ March.2010
Surveys after the stop of TRWKR period :
April.2010 ～ March.2012


Horikawa Sen-nin Chosatai
April.2007 ～ March.2012

- ■ Fixed Point Observation Groups Surveying effects of TRWKR
- ■ Free Survey Groups Researching Horikawa River by free themes
- ■ Horikawa Cheering Groups Cheering clarification of Horikawa

**The survey from a viewpoint and a sence of citizens**

Results of pilot project (Clarification effects of TRWKR)

- ■ It was confirmed that the water quality tended to improve during TRWKR between Sanage Bridge and Matsushige Bridge.
- ■ Network of citizens who wish for clarification and restoration of Horikawa River expanded.
- ■ Citizens' awareness of cleaning of the river was developed.

■ Role of Horikawa Sen-nin Chosatai
(Conclusions of Summary Meeting for the 10th Stage)

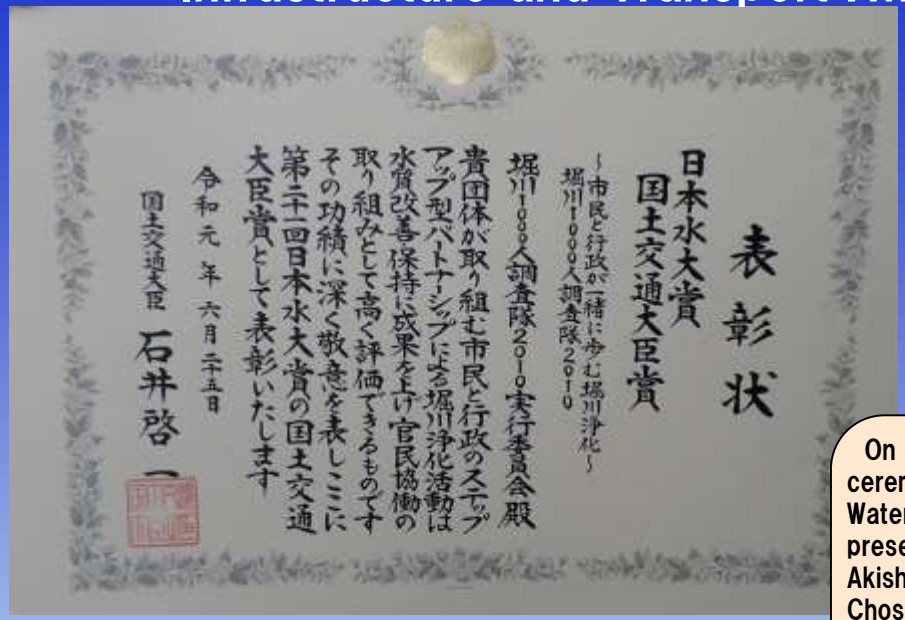
① More surveys should be implemented.

- •Continuity of investigation, clarification of the situation of the river, identification of cause of pollution in the river, are needed.
- •We improve our plan and take action against the pollution.
- •After that, citizens and public administration do what is possible to clean the river.

②There are many things that citizens can do.

- •We expand our partners who love Horikawa River and hope TRWKR again.
- •We deepen exchanges with people living in the basin of Kiso, Nagara, and Ibi River.
- •We check the effects of pollution removal from domestic wastewater and implement it in each house.

# Won the21st Japan Water Award Minister of Land, Infrastructure and Transport Award June 2019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令和元年六月二十五日

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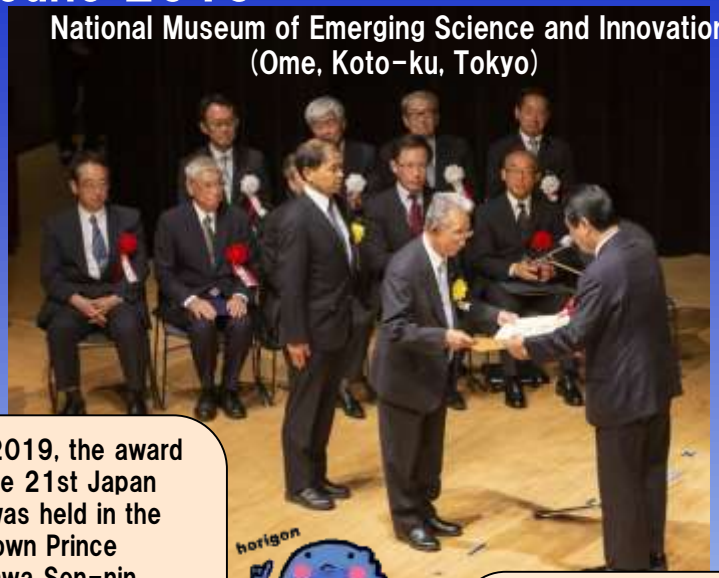
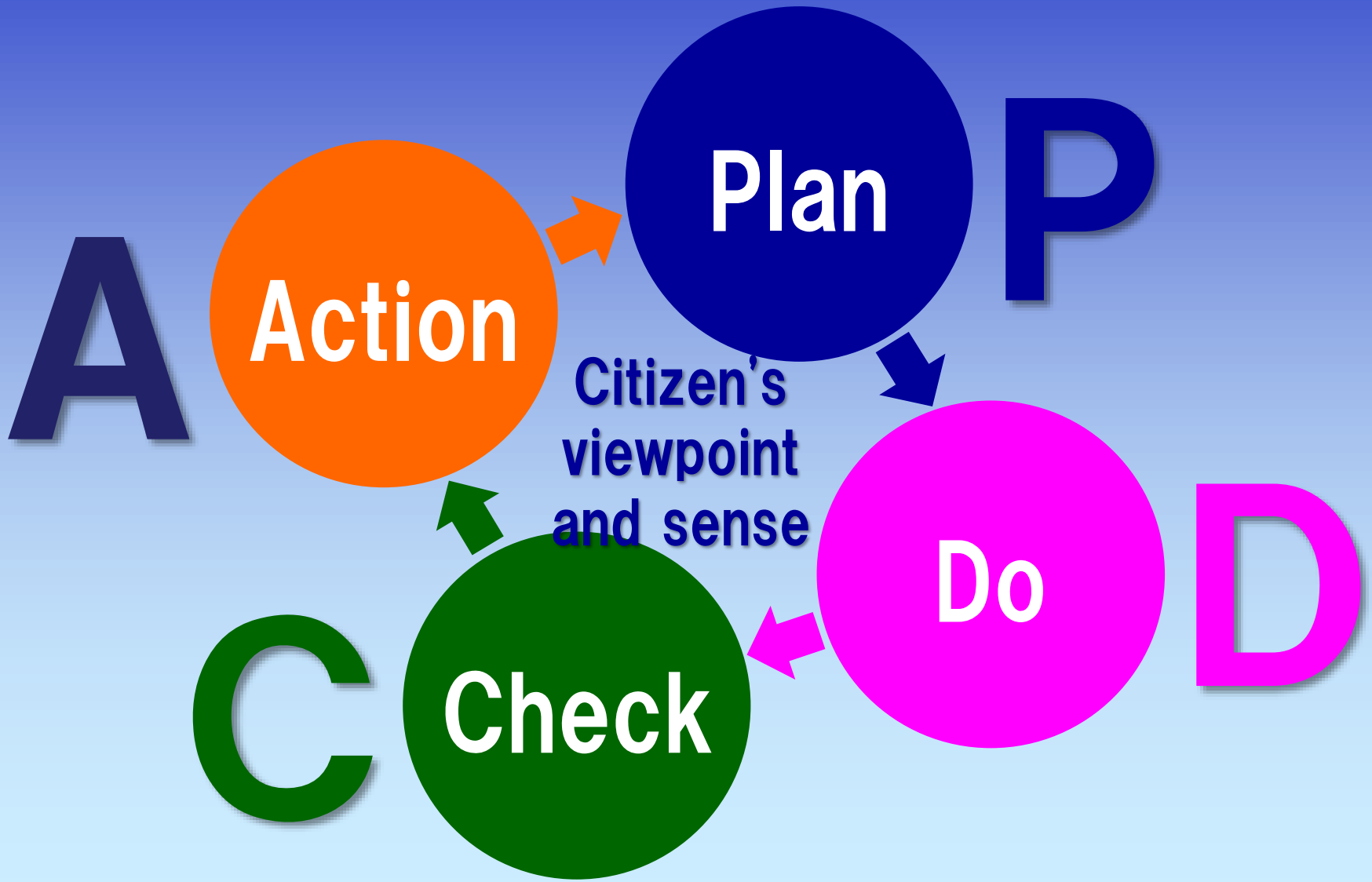

National Museum of Emerging Science and Innovation
(Ome, Koto-ku, Tokyo)

On June 25, 2019, the award ceremony for the 21st Japan Water Awards was held in the presence of Crown Prince Akishino. Horikawa Sen-nin Chosatai Executive Committee received the Minister of Land, Infrastructure, Transport and Tourism Award.

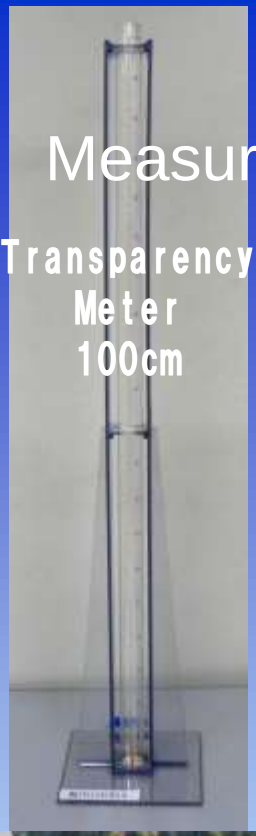
Horikawa Sen-nin Chosatai Executive Committee visited Mayor Kawamura to report on the Japan Water Award and Minister of Land, Infrastructure, Transport and Tourism award.

# Public-private academic collaboration step-up partnership



# Observation method at fixed-point

## Measurement of Transparency



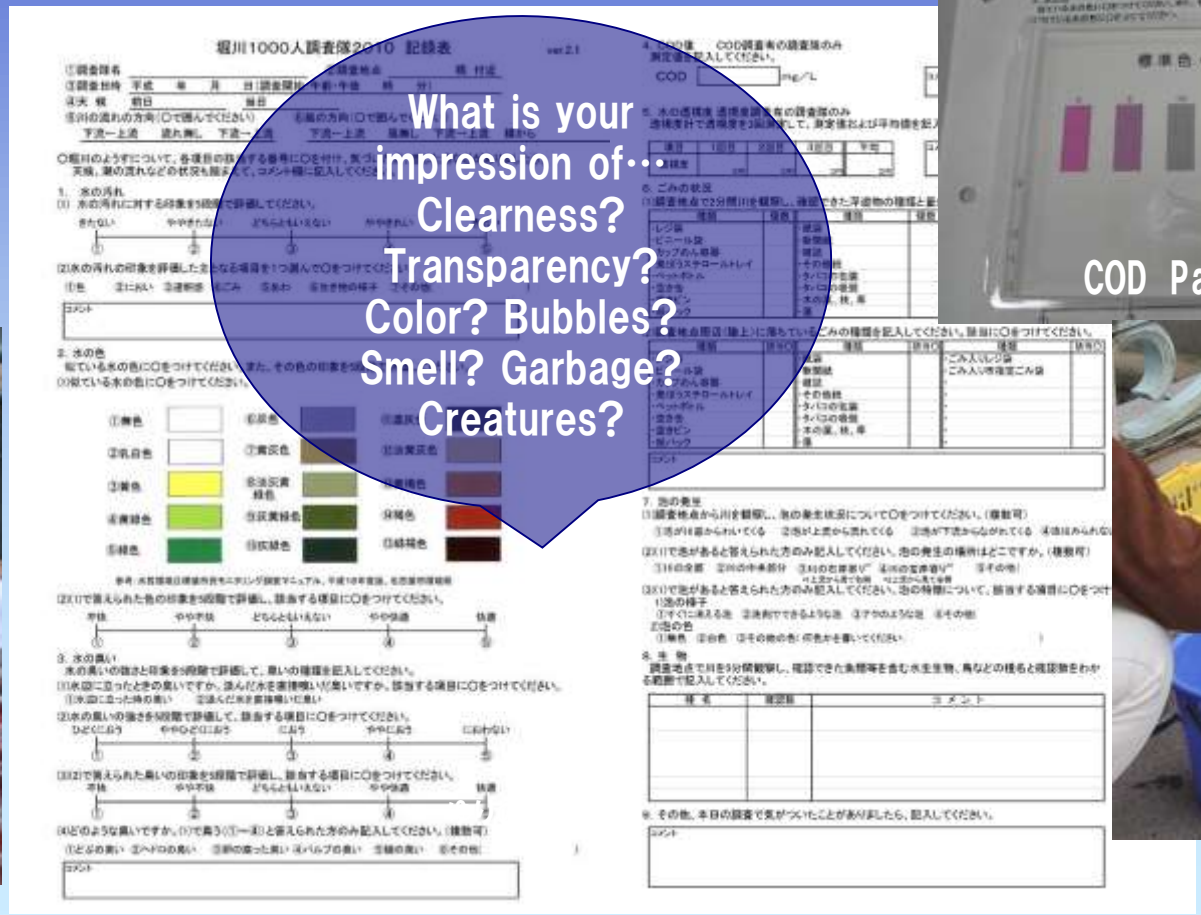
Transparency Meter 100cm

Photo: Shinko Survey Group


## Measurement of COD

COD: Chemical Oxygen Demand
This is an index of water contamination used for sea, lakes, and marshes.
It is an oxygen consumption required for oxidation of organic matters dissolved in ample water.
The higher COD, the more it is contaminated.

COD Pack Test




What is your impression of…
Clearness?
Transparency?
Color? Bubbles?
Smell? Garbage?
Creatures?

# Water Environment of Horikawa River

Area of basin: 51.9km$^2$
Length: 16.2km (Tidal effect section 13.6km)

Change in temperature, precipitation and hours of sunshine

Kiso River is our water source.

Cause of breeding of pphytoplankton, nitorogen and phosphorus are included in wastewater from houses, factories and stores.

The primary cause of water pollution is wastewater from houses, factories, and stores.

Wastewater is discharged after treatment in wastewater treatment plant.

After heavy rain, wastewater is discharged without treatment.

Shonai River
Privisional raw water transmission: 0.3m3/s

Wastewater Treatment Plant

Sanage Bridge

Motoiri Sluiceway

Tide Gate

▼High Tide

Horikawa River

Difference of water level is more than 2m between high tide and ebb tide.

▼Ebb Tide

Water level, direction of current and velocity are changed, by tide.

It has looked like red tide or blue tide.
In Nagoya Port and downstream of Horikawa, it is said that phytoplankton does over breeding and extinction, so water basin is polluted

Nagoya Port

Rising

Ise Bay

Groundwater, etc

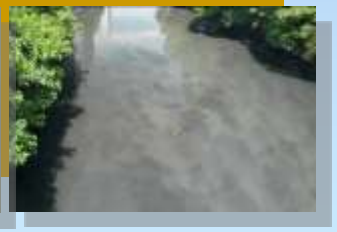
Sludge rises and floats.


Shimizu wakuwaku-sui


Red Tide


Blue Tide


Floating Sludge


Raised Sludge

# 2. Number of Participants of Horikawa Sen-nin Chosatai

(Horikawa Sen-nin Chosatai started accepting participation on 26th Mar.2007)

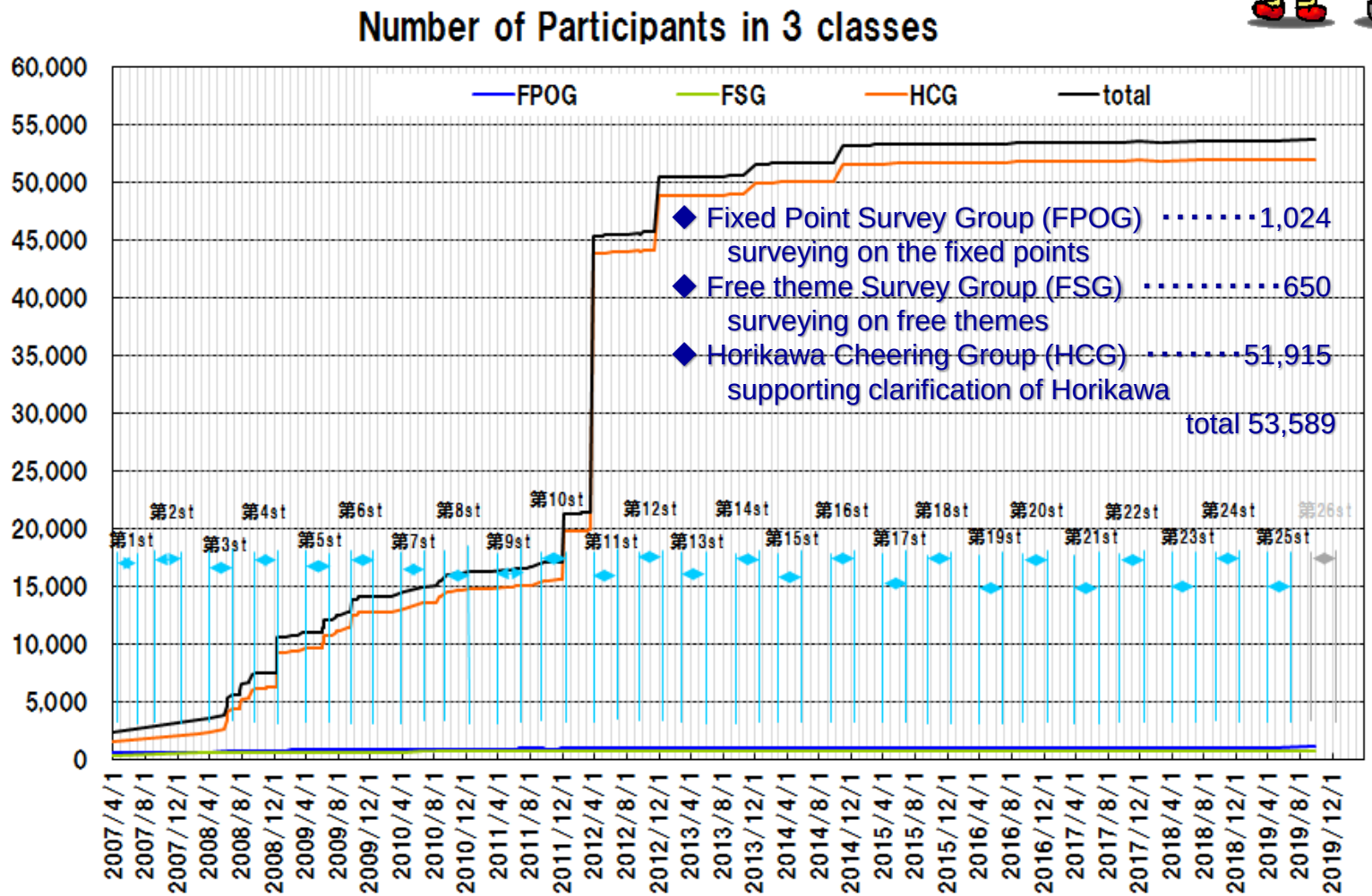
Network of citizens who wish for clarification and restoration of Horikawa River is growing.


## More than 50 thousand citizens' network

Horikawa, the Mother River of Nagoya, was polluted in rapid economic growth..
The citizens have rised to get the past back.


| | Start<br>22nd Apr.2007 | | Now<br>28th Sep.2019 |
|---|---|---|---|
| Fixed Point Observation Groups | 55 groups<br>497 persons | ⇨ | 106 groups<br>1,024persons |
| Free Survey Groups | 22 groups<br>234 persons | ⇨ | 40 groups<br>650 persons |
| Horikawa Cheering Groups | 88 groups<br>1,531 persons | ⇨ | 2,597 groups<br>51,915 persons |
| Total | 165 groups<br>2,262 persons | ⇨ | 2,743 groups<br>53,589 persons |


# Number of Participants


As of Sep. 28th, 2019

# 3. Survey Periods and Number of Reports

| Content | | Fiscal year | Survey Period | | | Reports | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Horikawa River | Shin-Horikawa River |
| Horikawa River Purification Social Experiment | With TRWKR 0.4 $m^3/s$ | 2007 | 1st stage | Spring~Early summer | Apr.22nd~Jun.30th | 258 | 258 | - |
| | | | Interval | | Jul.1st~Sep.7th | 134 | 134 | - |
| | | | 2nd stage | Autumn~Early Winter | Sep.8th~Dec.16th | 383 | 383 | - |
| | | | Interval | | Dec.17th~Mar.31st | 103 | 103 | - |
| | | 2008 | 3rd stage | Spring~Early summer | Apr.1st~Jun.30th | 245 | 245 | - |
| | | | Interval | | Jul.1st~Sep.27th | 64 | 64 | - |
| | | | 4th stage | Autumn~Early Winter | Sep.28th~Dec.16th | 152 | 152 | - |
| | | | Interval | | Dec.17th~Mar.31st | 100 | 100 | - |
| | | 2009 | 5th stage | Spring~Early summer | Apr.1st~Jun.30th | 145 | 145 | - |
| | | | Interval | | Jul.1st~Sep.26th | 54 | 54 | - |
| | | | 6th stage | Autumn~Early Winter | Sep.27th~Dec.16th | 120 | 120 | - |
| | | | Interval | | Dec.17th.~Mar.31st | 81 | 81 | - |
| | | 2010 | 7th stage | Spring~Early summer | Apr.1st~Jun.30th | 111 | 111 | - |
| | | | Interval | | Jul.1st~Sep.11th | 44 | 44 | - |
| | | | 8th stage | Autumn~Early Winter | Sep.12th~Dec.17th | 104 | 104 | - |
| | | | Interval | | Dec.18th~Mar.31st | 72 | 72 | - |
| | | 2011 | 9th stage | Spring~Early summer | Apr.1st~Jun.30th | 112 | 112 | - |
| | | | Interval | | Jul.1st~Sep.10th | 42 | 42 | - |
| | | | 10th stage | Autumn~Early Winter | Sep.11th~Dec.16th | 133 | 133 | - |
| | | | Interval | | Dec.17th~Mar.31st | 77 | 77 | - |
| Public-private academic collaboration step-up partnership | | 2012 | 11th stage | Spring~Early summer | Apr.1st~Jun.30th | 148 | 148 | - |
| | | | Interval | | Jul.1st~Sep.21th | 60 | 59 | 1 |
| | | | 12th stage | Autumn~Early Winter | Sep.22th~Dec.16th | 139 | 135 | 4 |
| | | | Interval | | Dec.17th~Mar.31st | 92 | 78 | 14 |
| | | 2013 | 13th syage | Spring~Early summer | Apr.1st~Jun.30th | 145 | 129 | 16 |
| | | | Interval | | Jul.1st~Sep.28th | 70 | 55 | 15 |
| | | | 14th stage | Autumn~Early Winter | Sep.29th~Dec.17th | 113 | 99 | 14 |
| | | | Interval | | Dec.18th~Mar.31st | 79 | 68 | 11 |
| | | 2014 | 15th stage | Spring~Early summer | Apr.1st~Jun.30th | 133 | 117 | 16 |
| | | | Interval | | Jul.1st~Sep.28th | 91 | 78 | 13 |
| | | | 16th stage | Autumn~Early Winter | Sep.29th~Dec.16th | 99 | 90 | 9 |
| | | | Interval | | Dec.17th~Mar.31st | 107 | 89 | 18 |
| | | 2015 | 17th stage | Spring~Early summer | Apr.1st~Jun.30th | 113 | 100 | 13 |
| | | | Interval | | Jul.1st~Sep.19th | 81 | 69 | 12 |
| | | | 18th stage | Autumn~Early Winter | Sep.20th~Dec.16th | 126 | 109 | 17 |
| | | | Interval | | Dec.17th~Mar.31st | 91 | 79 | 12 |
| | | 2016 | 19th stage | Spring~Early summer | Apr.1st~Jun.30th | 127 | 116 | 11 |
| | | | Interval | | Jul.1st~Sep.19th | 62 | 54 | 8 |
| | | | 20th stage | Autumn~Early Winter | Sep.20th~Dec.16th | 130 | 107 | 23 |
| | | | Interval | | Dec.17th~Mar.31st | 104 | 84 | 20 |

| Content | Fiscal year | Survey Period | | | Reports | | |
|---|---|---|---|---|---|---|---|
| | | | | | | Horikawa River | Shin-Horikawa River |
| Public-private academic collaboration step-up partnership | 2017 | 21st stage | Spring~Early summer | Apr.1st~Jun.30th | 129 | 100 | 29 |
| | | Interval | | Jul.1st~Sep.18th | 58 | 48 | 10 |
| | | 22nd stage | Autumn~Early Winter | Sep.19th~Dec.20th | 121 | 93 | 28 |
| | | Interval | | Dec.21st~Mar.31st | 80 | 67 | 13 |
| | 2018 | 23rd stage | Spring~Early summer | Apr.1st~Jun.30th | 180 | 107 | 73 |
| | | Interval | | Jul.1st~Sep.19th | 76 | 44 | 32 |
| | | 24th stgae | Autumn~Early Winter | Sep.20th~Dec.16th | 184 | 106 | 78 |
| | | Interval | | Dec.21st~Mar.31st | 108 | 67 | 41 |
| | 2019 | 25th stage | Spring~Early summer | Apr.1st~Jun.30th | 193 | 127 | 66 |
| | | Interval | | | | | |
| | | 26th stage | Autumn~Early Winter | Sep.20th~Dec.16th (plan) | | | |
| | | Interval | | | | | |
| Total | | | | | 5,773 | 5,156 | 617 |

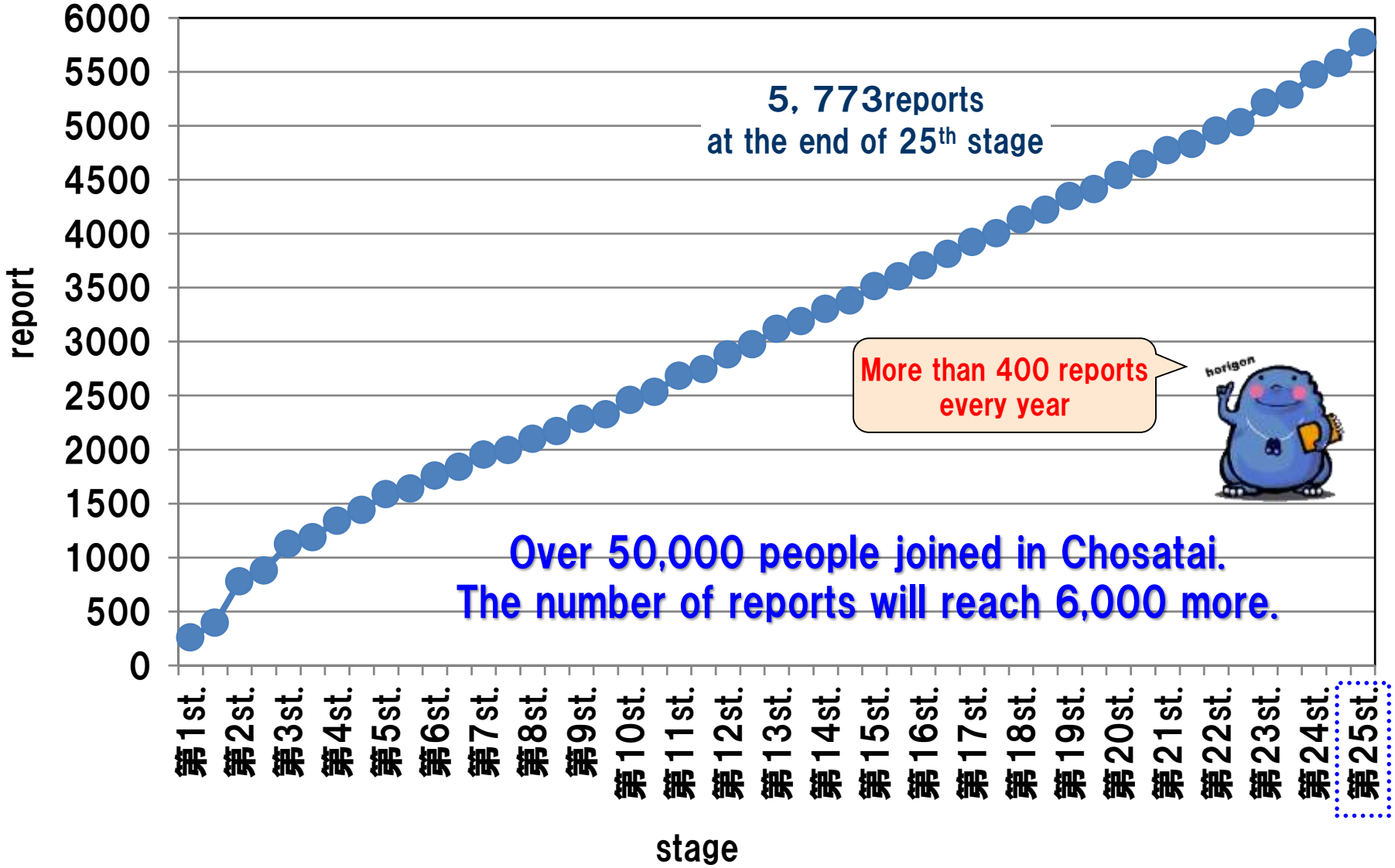
To date, 5773 reports have been reported. Of these, the number of reports for Shin-Horikawa River was 617.

In the 25th stage, there were 193 reports. Of these, 127 were reported for Horikawa River and 66 were reported for Shin-Horikawa River.

On average, more than 400 surveys are conducted every year in Horikawa River and Shin-Horikawa River.

Many citizens are continuously examining the actual water environment of Horikawa River and Shin-Horikawa River on a daily basis from the perspective and sense of the citizens.

# Number of Reports



# 4. Weather condition

data : The statistical information by Japan Meteorological Agency
Nagoya Local Meteorological Observatory
http://www.jma.go.jp/jma/menu/report.html

In the 25th stage (Apr.-Jun.), the weather changed every few days. And the temperature was a little high for spring or early summer. The rainfall was as the average. The rainy season started on July 7th as the average.

characteristic: the weather changed every few days.
It is often fine and high temperature.
The rainfall was as the average.

■Temperature

The average temperature was 19.2℃, higher than the average (18.7℃). In the average temperature by the month, it was higher in May than the average, as high in April and June.

■Rainfall

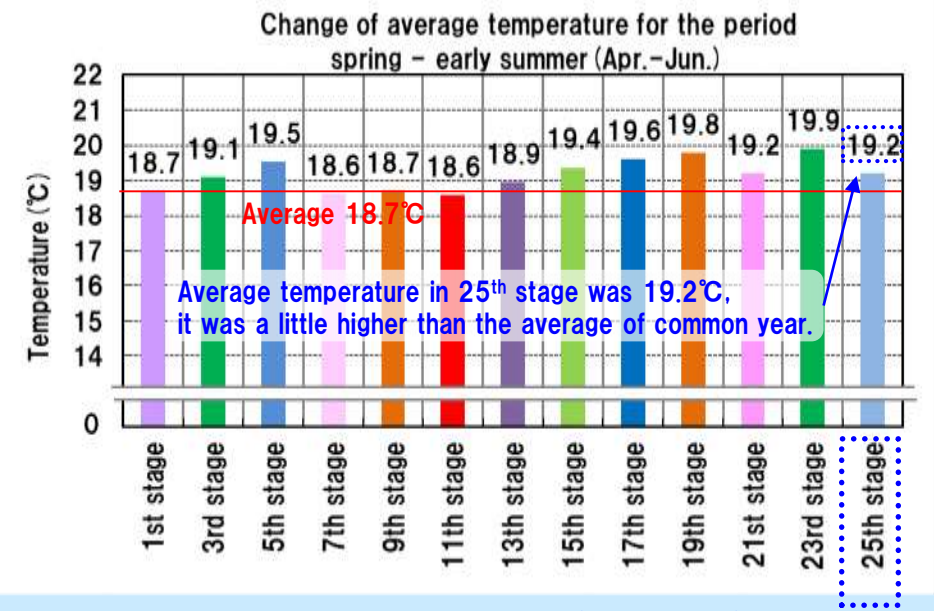
The rainfall was 145mm a month, as high as the average (160.8mm). In the rainfall by the month, it was as high in April and May as the average, less in June.

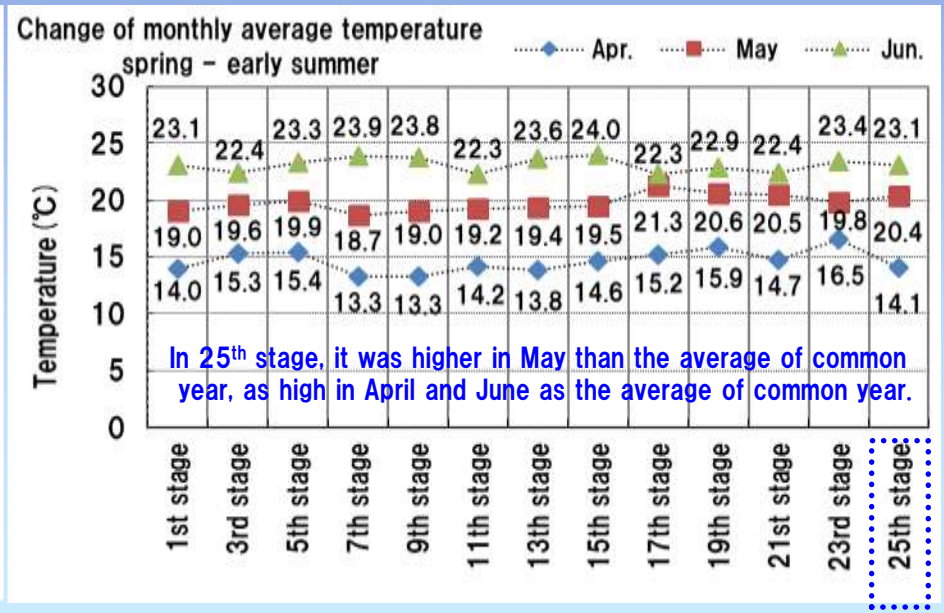
■Time of daylight

The time of daylight a month was 222 hours, 41 hours longer than the average. It was longer than the average in all month.

The average by Nagoya Local Meteorological Observatory

| Category | Rainfall (mm) | Temperature (℃) | | | Daylight (hour) |
|---|---|---|---|---|---|
| | Gross | Average | Highest | Lowest | Gross |
| Statistical period | 1981 ~2010 | 1981 ~2010 | 1981 ~2010 | 1981 ~2010 | 1981 ~2010 |
| years | 30 | 30 | 30 | 30 | 30 |
| Annual | 1535.3 | 15.8 | 20.7 | 11.9 | 2091.6 |
| Apr. | 124.8 | 14.4 | 19.9 | 9.6 | 196.6 |
| May | 156.5 | 18.9 | 24.1 | 14.5 | 197.5 |
| Jun. | 201.0 | 22.7 | 27.2 | 19.0 | 149.9 |
| Average | 160.8 | 18.7 | 23.7 | 14.4 | 181.3 |
| Sep. | 234.4 | 24.1 | 28.6 | 20.7 | 151.0 |
| Oct. | 128.3 | 18.1 | 22.8 | 14.1 | 169.0 |
| Nov. | 79.7 | 12.2 | 17.0 | 8.1 | 162.7 |
| Dec. | 45.0 | 7.0 | 11.6 | 3.1 | 172.2 |
| Average | 121.9 | 15.4 | 20.0 | 11.5 | 163.7 |



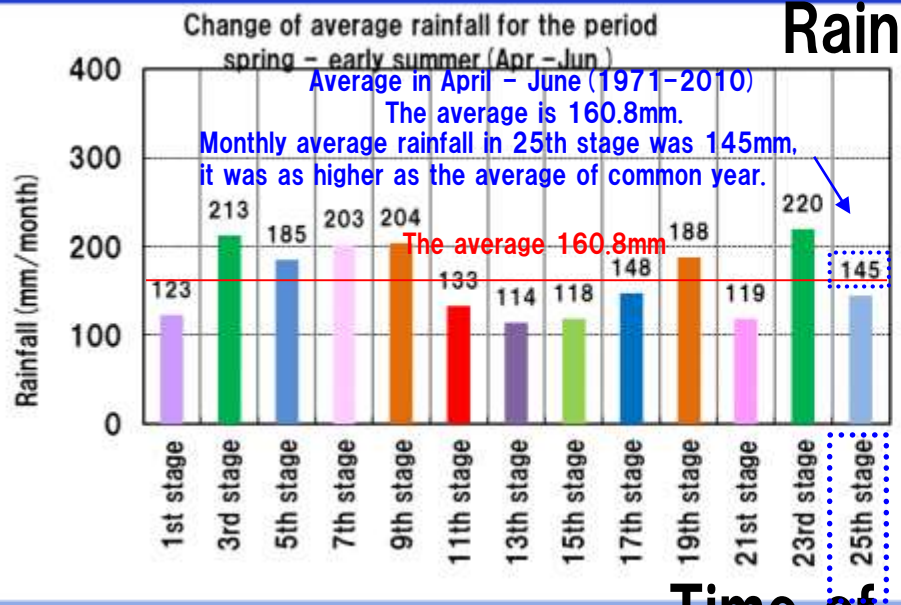



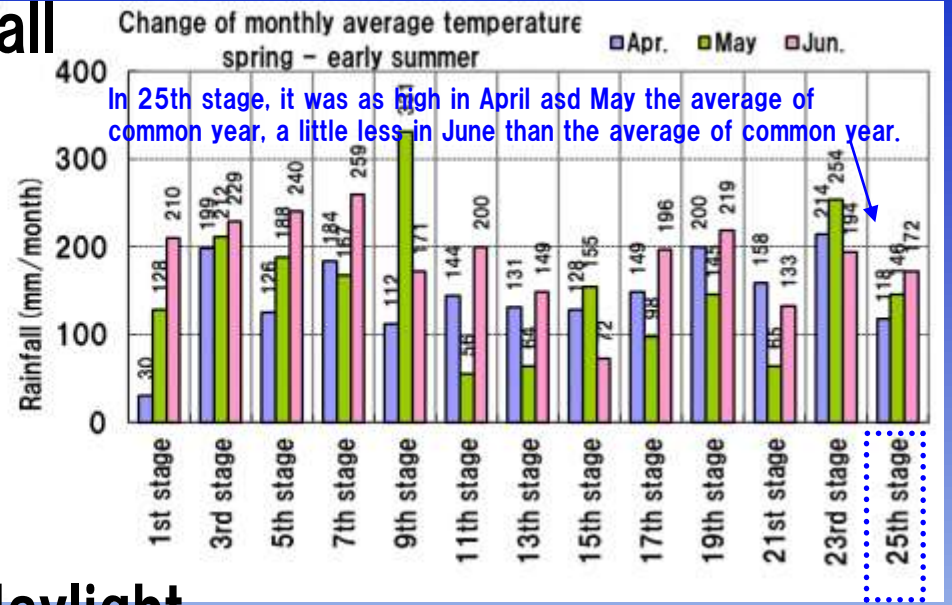

Average in April - June (1981-2010)
The average is 18.7℃.

# State of the weather

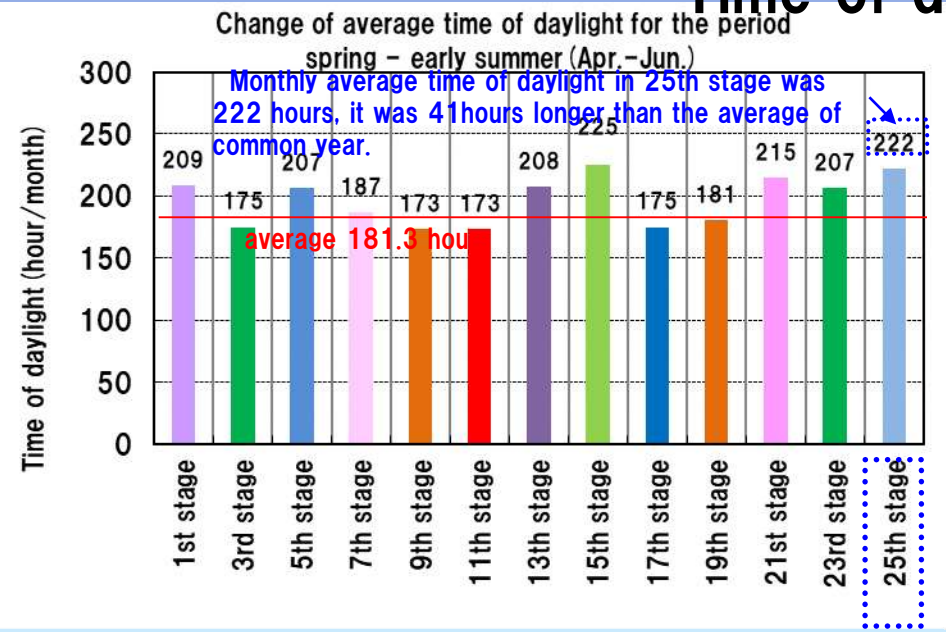
data : The statistical information by Japan Meteorological Agency
Nagoya Local Meteorological Observatory
http://www.jma.go.jp/jma/menu/report.html

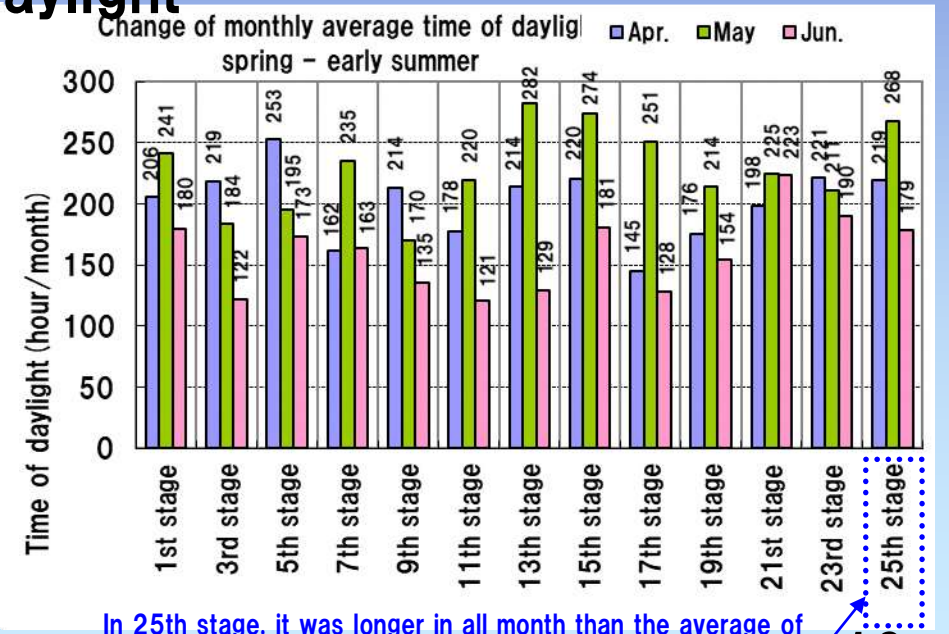
## Rainfall




## Time of daylight

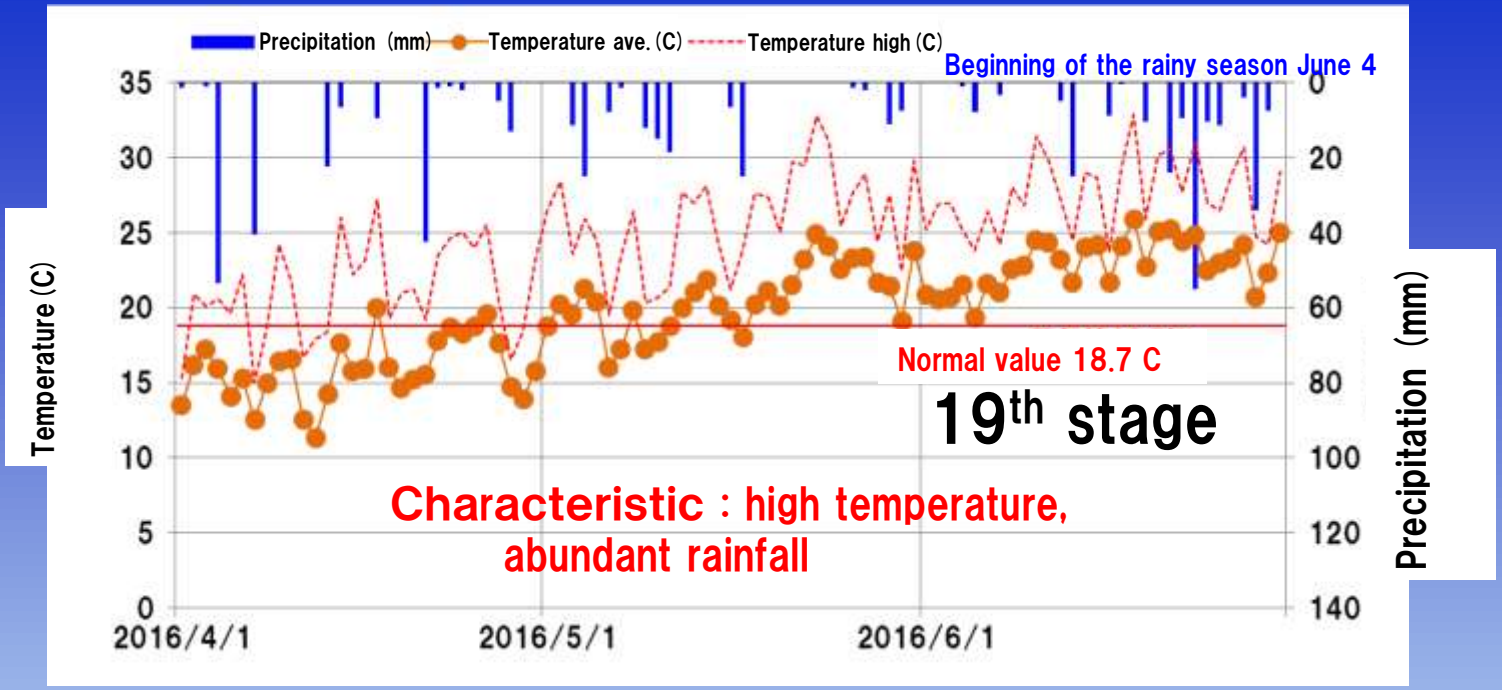


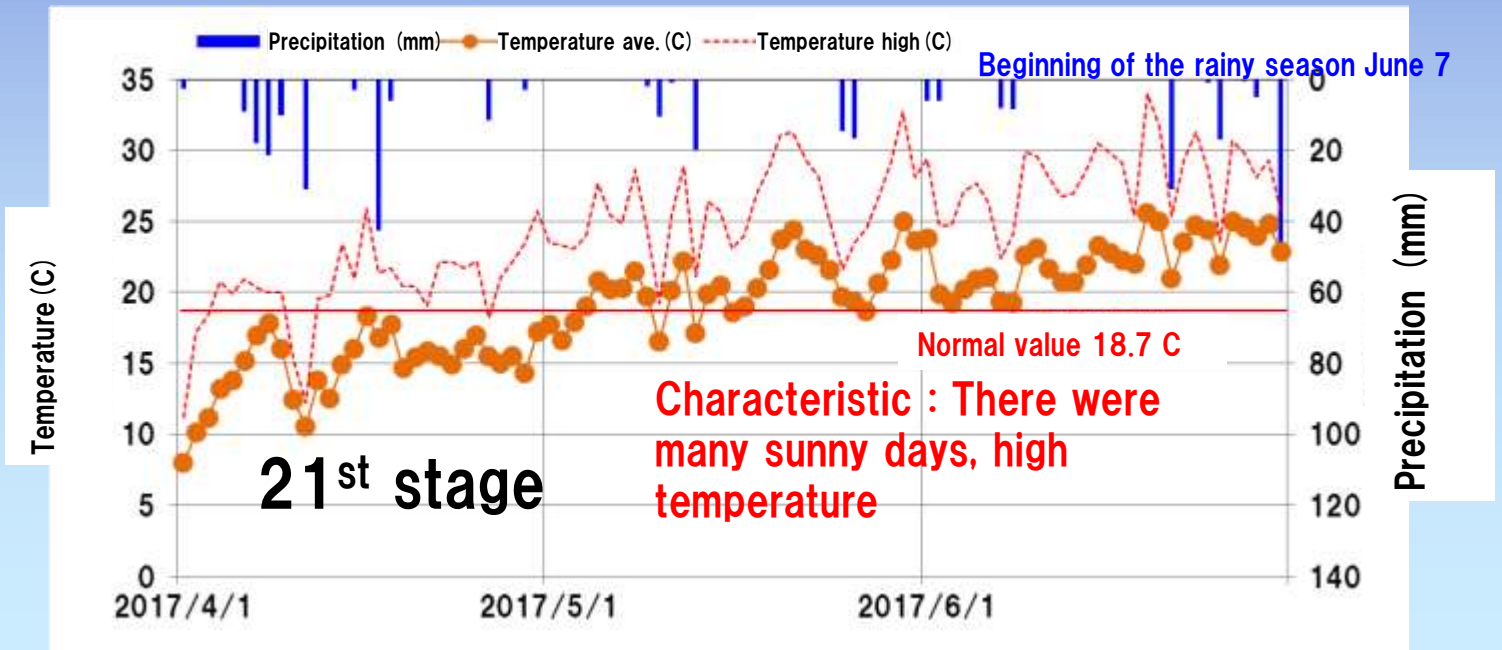




Average in April - June (1971-2010)
The average is 181.3 hours.

In 25th stage, it was longer in all month than the average of common year. Especially, it was more than 70 hours longer in May.

# ( reference ) Average daily temperature and precipitation



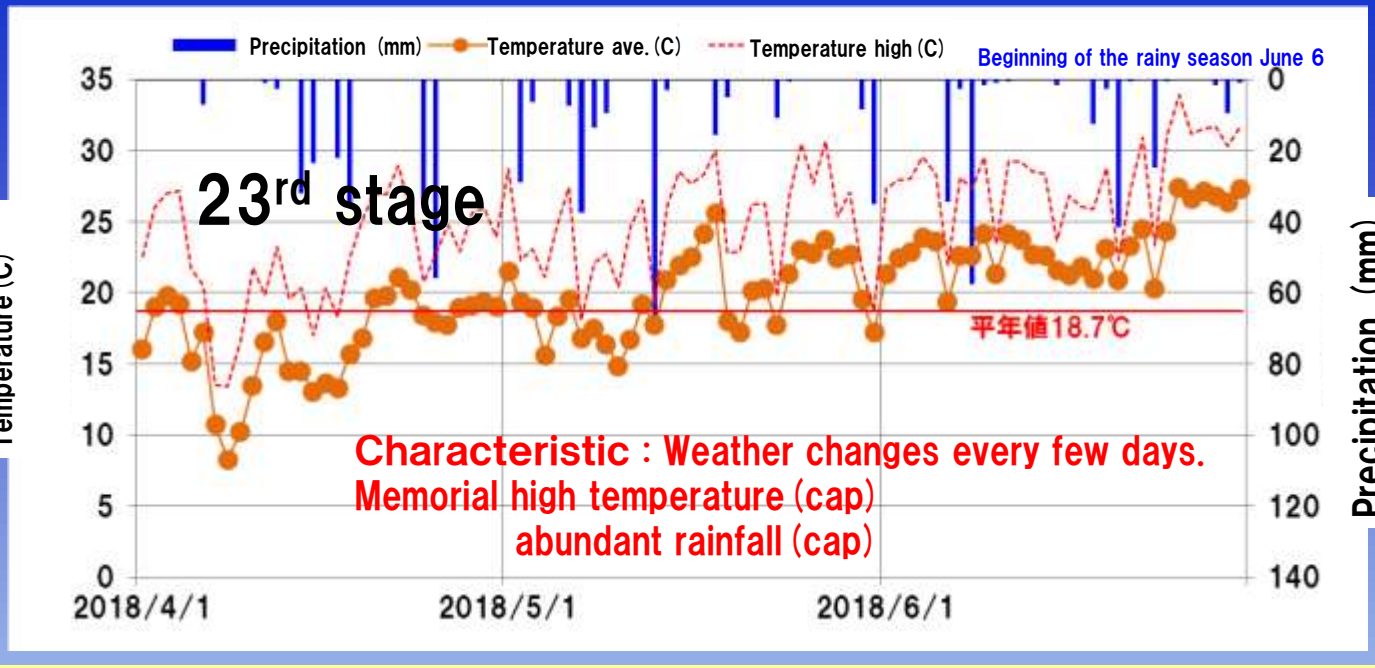



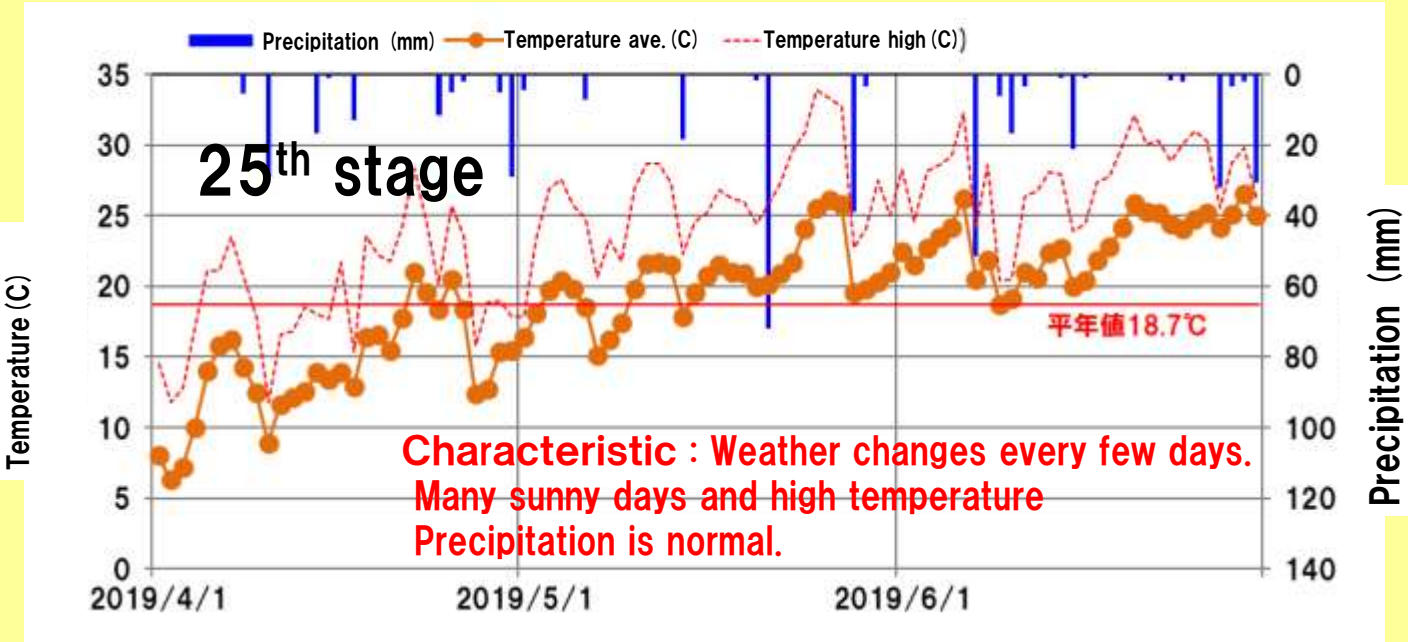

Note) Arrangement Characteristic of weather in target period

Average temperature
0.5 C over
->high temperature
-0.5 C under
->low temperature

Average precipitation (mm/month)
20mm/day over
->Heavy rain
-20mm/day under
->light rain

# ( reference ) Average daily temperature and precipitation

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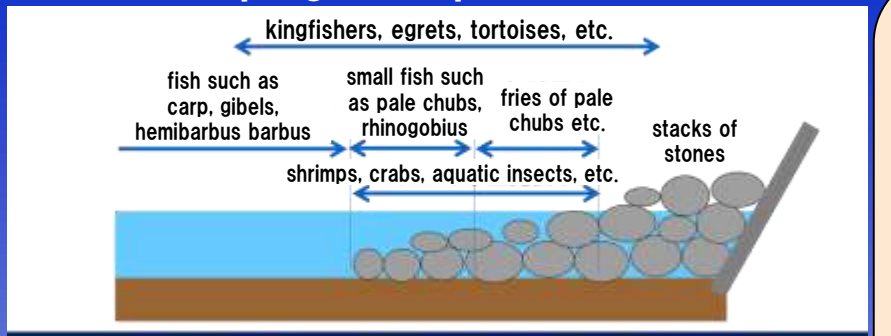
Average temperature
0.5 C over
->high temperature
-0.5 C under
->low temperature

Average precipitation (mm/month)
20mm/day over
->Heavy rain
-20mm/day under
->light rain

Weather overview 25th stage

Weather changes every few days, and there were many sunny days.
April temperature dropped due to cold. In May, warm air entered and the temperature became quite high.
The precipitation was normal in April and May.
There were many sunny days in June.
From May to June, the temperature was high and sunshine hours were longer.
The rainy season was on June 7, normal June 8

# ■ Shaping of Rapids and Pool




## ■ Rise of self-purification by food chain

dirt of water (organic substance, nitrogen, phosphorus)

↓

Algaes and microbes stick on stones with the dirt as nutrition.

↓

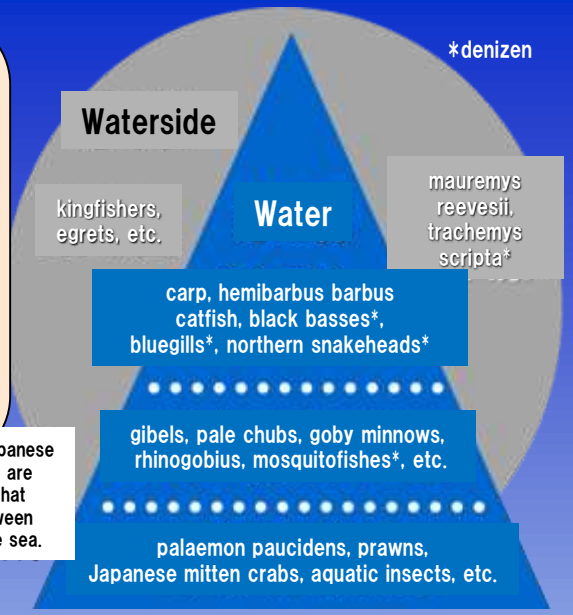
Small fish, shrimps, aquatic insects feed the algaes and the microbes.

↓

Big fish and birds prey the small fishes and aquatic insects.

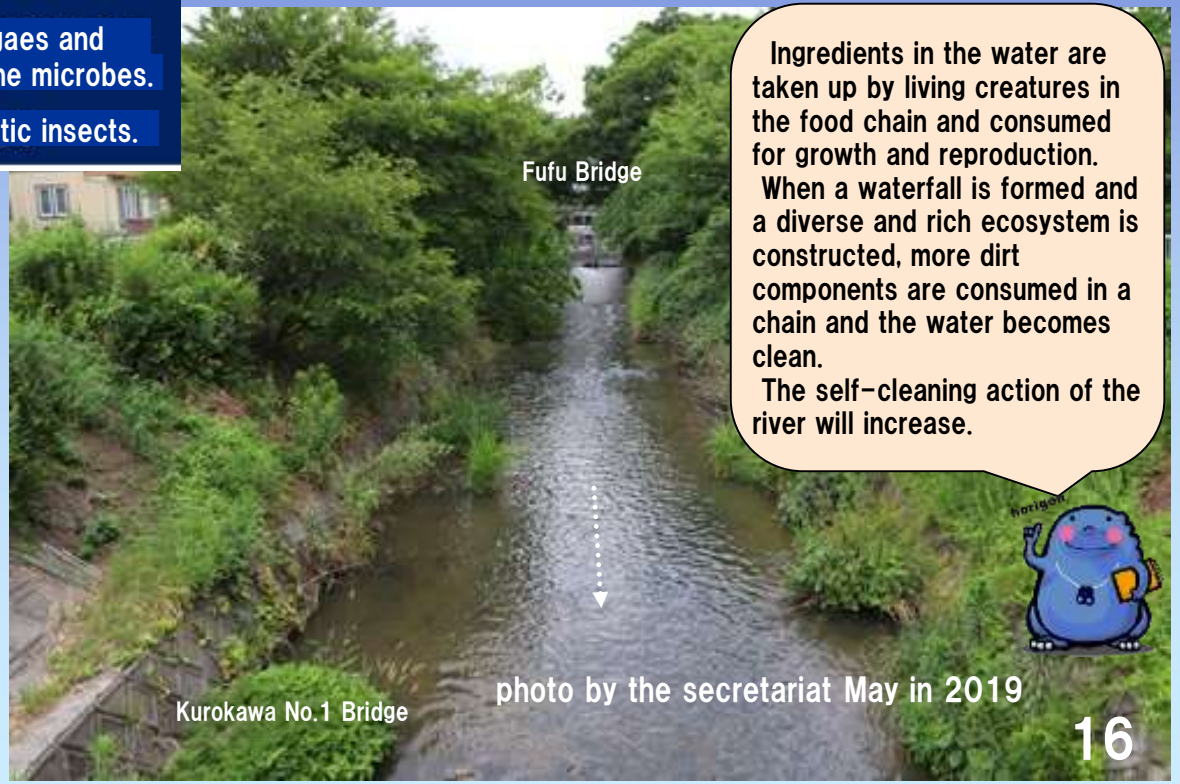
It was identified that various organisms breed and grow when rapids and pools were shaped.
It was a place of inhabiting and growing of creatures that prefer the environment, such as Oikawa, which has stones and moss. When winter comes, some ducks are waiting for spring here.


Prawns and Japanese mitten crabs are organisms that migrate between rivers and the sea.





Rapids and pools shaped in the past keep a diversity with change according to environment.




Ingredients in the water are taken up by living creatures in the food chain and consumed for growth and reproduction.
When a waterfall is formed and a diverse and rich ecosystem is constructed, more dirt components are consumed in a chain and the water becomes clean.
The self-cleaning action of the river will increase.

## Newly sand-cover construction

Bet. Sakura -Habashita Bridge

Jan.2015-Feb.2015,Dec.2017-Jan.2018




## Securement of a water source

(Using shallow ground water)

A well at upstream of Kinjyo Bridge

started its operation in Mar 2018


## Measures against smells at Shin-Horikawa River

(Dredging・Sand covering)

Downstream Dec.2017-May.2018

# 5. 25th stage survey report

## 5.1. Introduction ～Column～

### ～Column～ For the clarification and regeneration of Horikawa River

～Pilot project of the clarification of Horikawa River～;
we confirmed the clarification effect of TRWKR from April.2007 to March.2012

We confirmed that water quality between Sanage Bridge and Matsushige Bridge had been improved by TRWKR (0.4m3/sec.) in this five years. And in this period, we confirmed that garbage (artificial garbage: plastic type garbage etc.) were reduced. It is considered that because the citizen's awareness changed, and cleaning activity became active.

【Five years summary】
■We confirmed clarification effect of TRWKR between Sanage Bridge and Matsushige Bridge.
■Network of citizens wishing for clarification and regeneration of Horikawa River has expanded greatly.
■Citizen's awareness changed, and the cleaning activity became active.

## (1) Weather Condition

The weather changed every few days in April and May. But these have been many sunny. The temperature got cold and made a big change. But it got warmer and rised quite in May. The amount of rainfall stayed as usuall in April and May. These have been many sunny in June. Moreover, the temperature tended to be high and got more hours of sunlight from May to June. Rainy season was started on June 6.(Usually June 8th)

(Feature of weather in the 25th stage: Many fine weather and high temperature and average annual amount of rainfall)

## (2) New Measures for Water Quality Improvement

After the stop of water conduction from the Kiso River in March 2010, new measures for water quality improvement of Horikawa River have been implemented. Shallow and deep in upstream section of Sanage Bridge for improvement of self-purification function has been implemented since 2010. Also, advanced water treatment at Meijo Water Treatment Center was installed, and river rain-water reservoir for pollution control in right bank of Horikawa River was available in 2010.

Water conduction to Horikawa River (max. 4,000 $m^3$/day, Period: Apr.-Oct) using recycled waste water (advanced treatment/ membrane filtration method) of Moriyama Water Treatment Center) started since 2011.

Experiment of covering sand for water purification between the Naka Bridge and the Gojo Bridge started in Feb. 2015. The 8th well was dug in the upstream section of Kinjo Bridge in March 2017 and utilization of shallow ground water (0.01m3) started as new water source. (Utilization of shallow ground water has been implemented in 2004).

Furthermore, in reference to the results of the Horikawa River purification experiment with citizens which started in February 2015, covering sand was carried out for waterside environment improvement of Habashita Bridge to Gojo Bridge and Naka Bridge to Sakura Bridge in 2018.

Also, since deposition and exposure of sludge, air bubbles and cloudiness were confirmed in the Shin Horikawa River junction through citizen's survey, dredging and converting sand were carried out as measures against odors. Such a measures were also proceed in the upstream district since September 2018.

And then, new shallow and deep was formed upstream of the Kizune Bridge on the Horikawa River.

## (3) Change of the water quality of Horikawa River

The impression of the clearness of Horikawa River worsened after stopping water conduction from the Kiso River. However, after that, generally we can confirm the trend of improvement little by little from upstream though water quality sometimes deteriorated due to weather conditions, etc... Espeically, it was possible to confirm remarkable improvement trend regarding to "impression of water pollution", "transparency" and "scent" in the 25th stage.

The average transparency between Sanage Bridge and Oseko Bridge was more than 80 cm, and transparency between Asahi Bridge and Oseko Bridge was around 90 cm in particular.

In addition, "bubble from bottom of river" and "percentage of ditch-smell / mud-smell" decreased, so percentage of odorless increased to 75% between Sanage Bridge and Oseko Bridge.

As we mentioned above, some improvements were confirmed in the several clauses surveyed by citizen's viewpoints and senses, such as the condition of the riverbed, transparency (perspective), and scent, in the mid and downstream sections of Horikawa River in the 24th stage.

We think that reason of such a result is the change of public awareness for "purification & regeneration of Horikawa River", implementation of new water quality improvement procedure after water conduction, and maintenance of revetment including removal of sludge on the river channel.

# Impression of Water Clearness（Section Average）

## The ratio of “Clean”, “Slightly clean” and “Ordinary

（Note）Except the data between Minatoshin Brdg. and Oseko Brdg. for not enough data

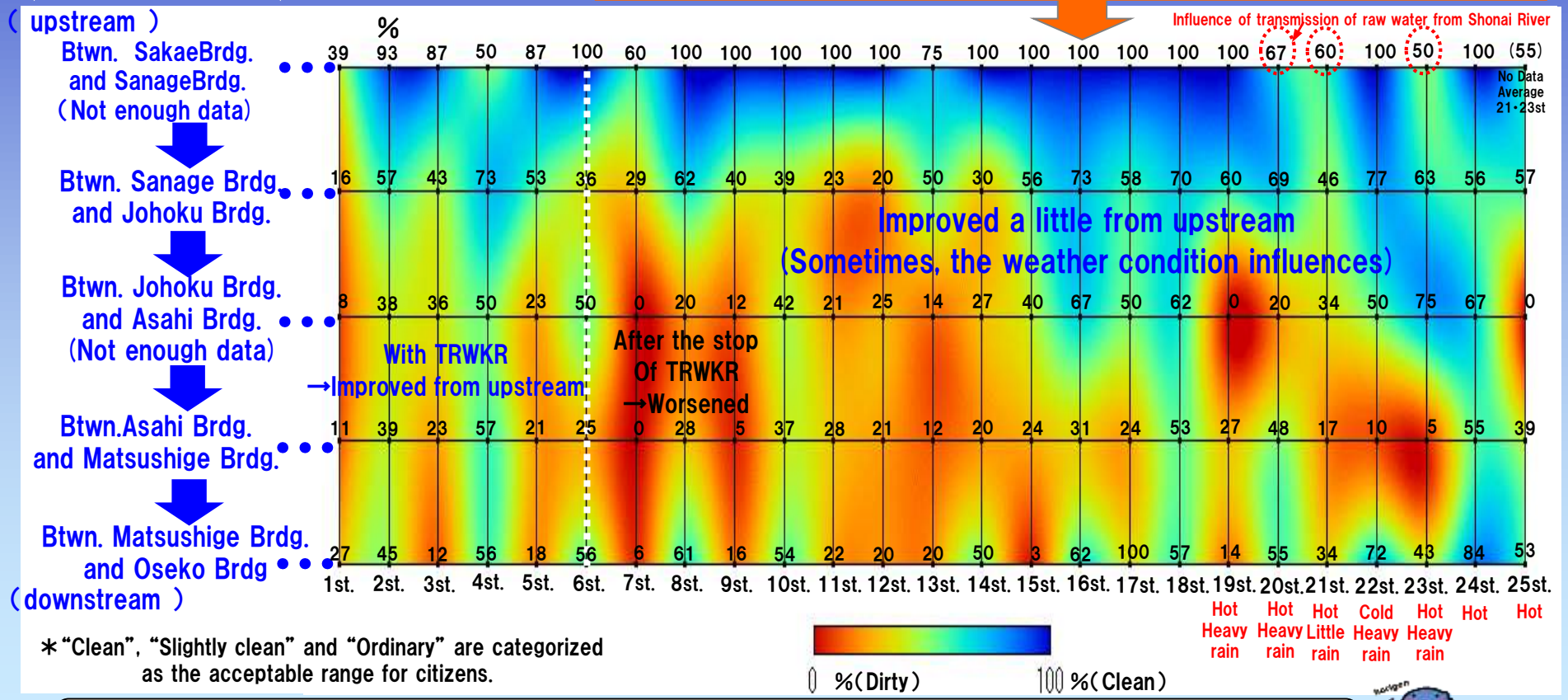
The 1st-6th stage : With TRWKR
No rain on the day and the previous day
The 7th-25th stage: No TRWKR
No rain on the day and the previous day

With TRWKR

**New Measures for Water Quality Improvement**

- Making shallows and deeps
- Making shallows and deeps
- Transmission of Raw Water from Shonai River
- Covered Sand
- Introduction of advanced water treatment at Meijo Water Treatment Center
- In-service of Horikawa Ugan Rain-water Reservoir for pollution control
- Utilization of reclaimed wastewater at Moriyama Water Treatment Center

## (Evaluation)



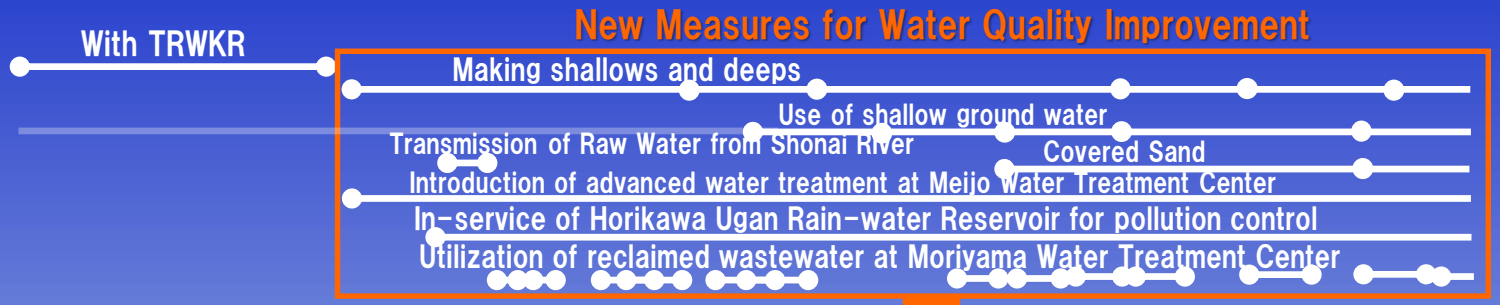

＊“Clean”, “Slightly clean” and “Ordinary” are categorized as the acceptable range for citizens.

Impression of water clearness could see the tendency of the improvement from upstream with TRWKR. But it worsened after the stop of TRWKR. After that, overall it improved a little from upstream. (sometimes it deteriorated by the weather condition.) It is thought that this is the effect by change in citizen consciousness and new measures for water quality improvement after the stop of TRWKR.

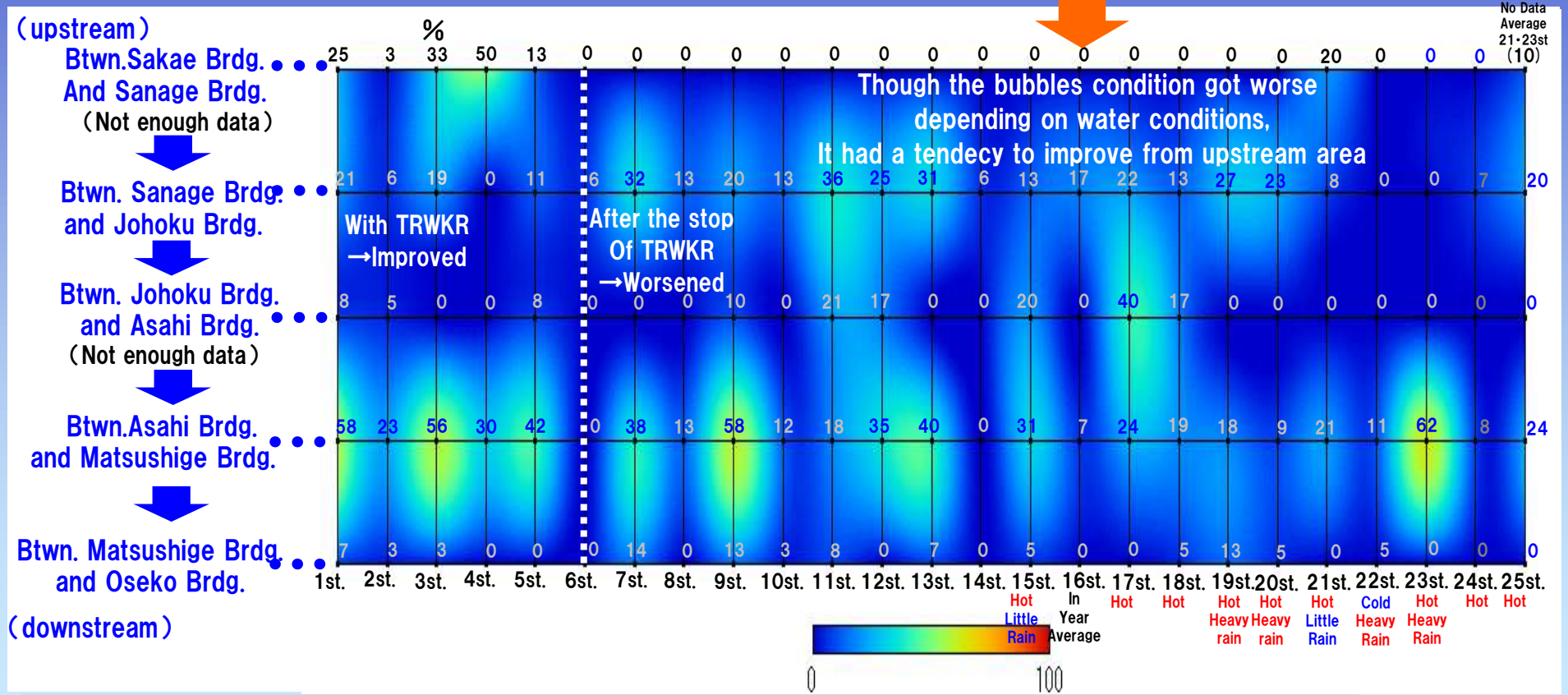
# Occurrence of bubbles from river bottom (Section Average)

Note)Except the data between Minatoshin Brdg. and Oseko Brdg. for not enough data

The 1st-6th stage : With TRWKR
No rain on the day and the previous day
The 7th-25th stage: No TRWKR
No rain on the day and the previous day




## (Evaluation)

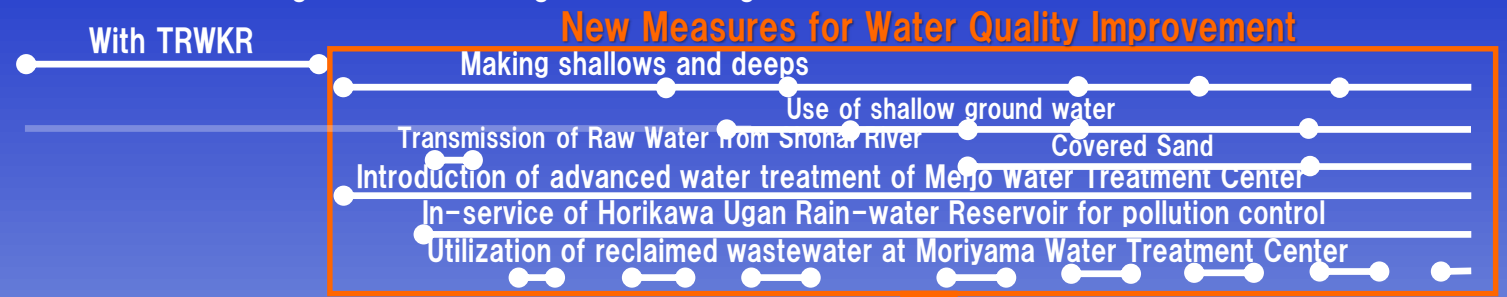



It is observed that bubbles from river bottom condition was improved with TRWKR and after TRWKR stopped, it got worse. After that, it had a tendency to improve while bubbles condition has fluctuated repeatedly although weather conditions sometimes made it worse. It is assumed that the change of public awareness and new measures for Water Quality Improvement after stop of TRWKR have effects on this. It seems that the condition of river bottom is gradually improved.

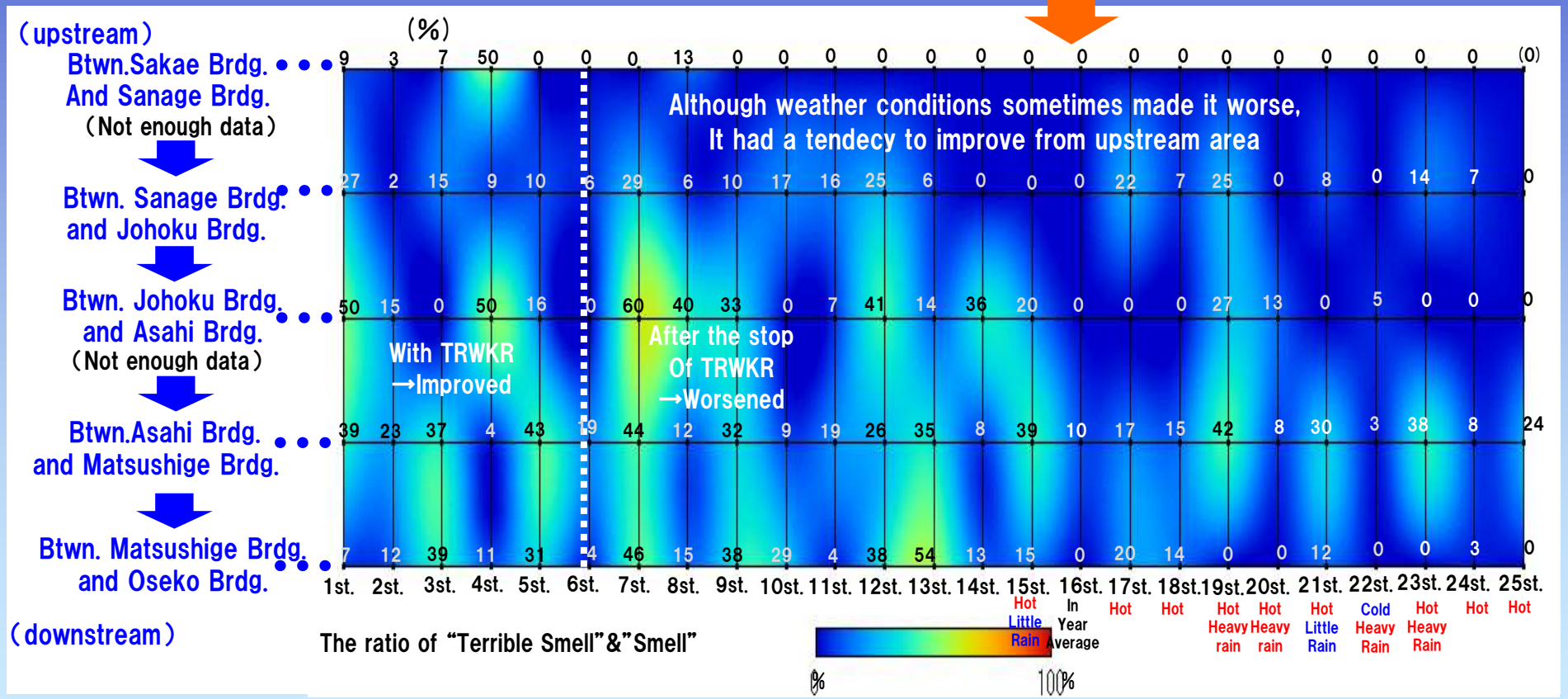
# The change of occurrence of smell
# (The ratio of "Terrible smell"&"smell" : Section Average)

Note)Except the data between Minatoshin Brdg. and Oseko Brdg. for not enough data

The 1st-6th stage : With TRWKR
No rain on the day and the previous day
The 7th-25th stage: No TRWKR
No rain on the day and the previous day



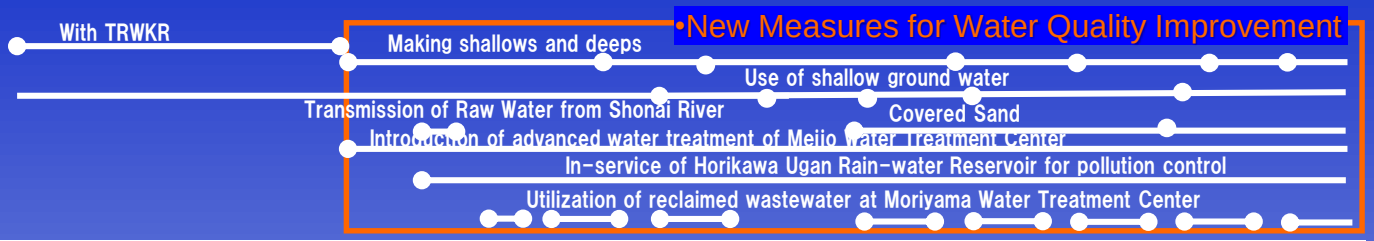

## (Evaluation)

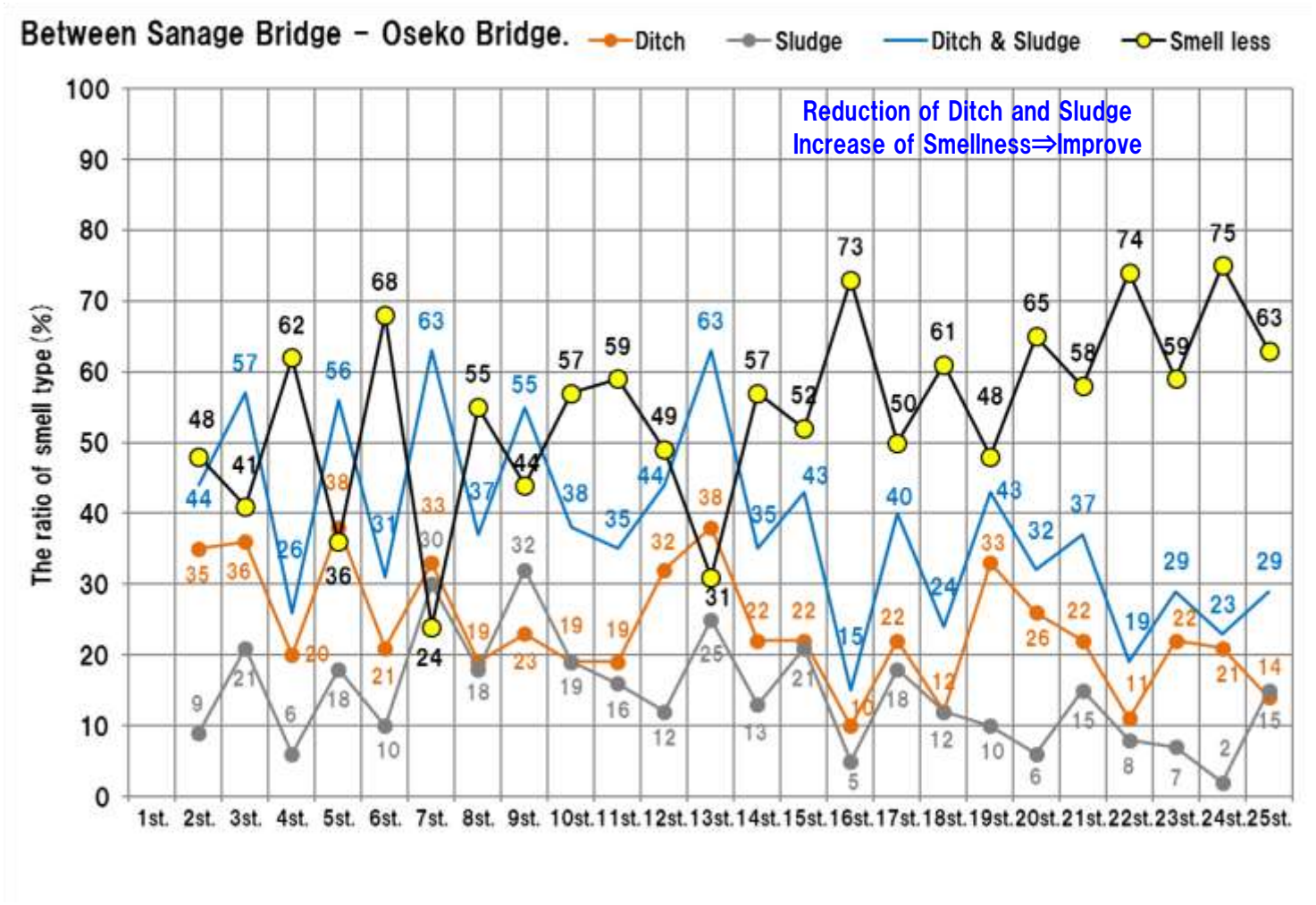



It is observed that the smell condition was improved with TRWKR and after TRWKR stopped, it got worse. After that, it had a tendency to improve while the smell has fluctuated repeatedly although weather conditions sometimes made it worse. It is assumed that the change of public awareness and new measures for Water Quality Improvement after stop of TRWKR have effects on this.

# The change of ratio about "Ditch・Sludge・Smell less"

The 1st-6th stage : With TRWKR
No rain on the day and the previous day
The 7th-25th stage: No TRWKR
No rain on the day and the previous day




■How the ratio of "Ditch・Sludge・Smell less" change?

After stop of TRWKR, the ratio of "Ditch・Sludge" decrease, the ratio of "smell less" increase (improvement) between Sanage Bridge and Oseko Bridge.

Considered the result of change of public awareness and the new water quality improvement measure.

# (4) Factors that worsen water quality between Asahi Bridge to Matsushige Bridge

We organized large amounts of data based on the section and tide in order to consider the factors influencing water quality, especially in the section between Asahi Brdg. to Matsushige Brdg. that runs through Nagoya's downtown.

We divide the section upper stream (Asahi Brdg.-Naya Brdg) and lower stream (Tennozaki Brdg-Matsushige Brdg) and tide higher and lower than average level.

According to the result 'Impression of water clearness' and 'COD' are worse, the score of 'Bubbles' and 'Smell' are higher and 'the color of sludge' was seen more often in the section between Asahi Brdg. to Naya Brdg. when it is low tide. (dimension D in the figure below)

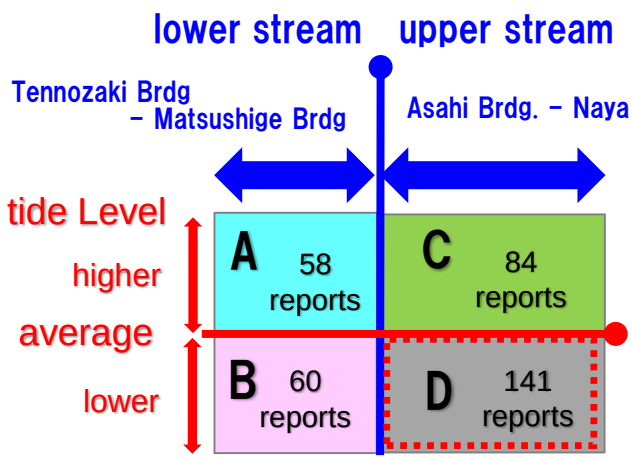
We consider that low tide stirs sludge on the riverbed and release bubbles. ($H_2S$ etc.)

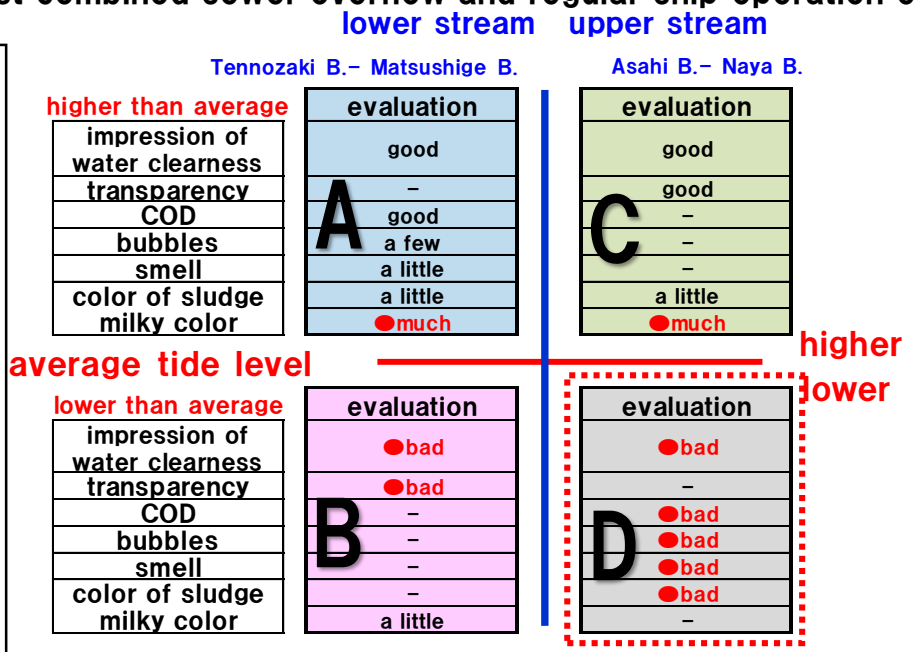
The following measures are required for cleaner Horikawa River.

- removing sludge after bank protection works between Asahi Brdg. to Naya Brdg.
- preventing sludge accumulating riverbed again
  (developing new water sources, measures against combined sewer overflow and regular ship operation etc.)

Organized data based on the section and tide level
Asahi Bridge to Matsushige Bridge

7th stage-25th stage (spring - early summer)
number of report : 343 no rain on the day and the previous day



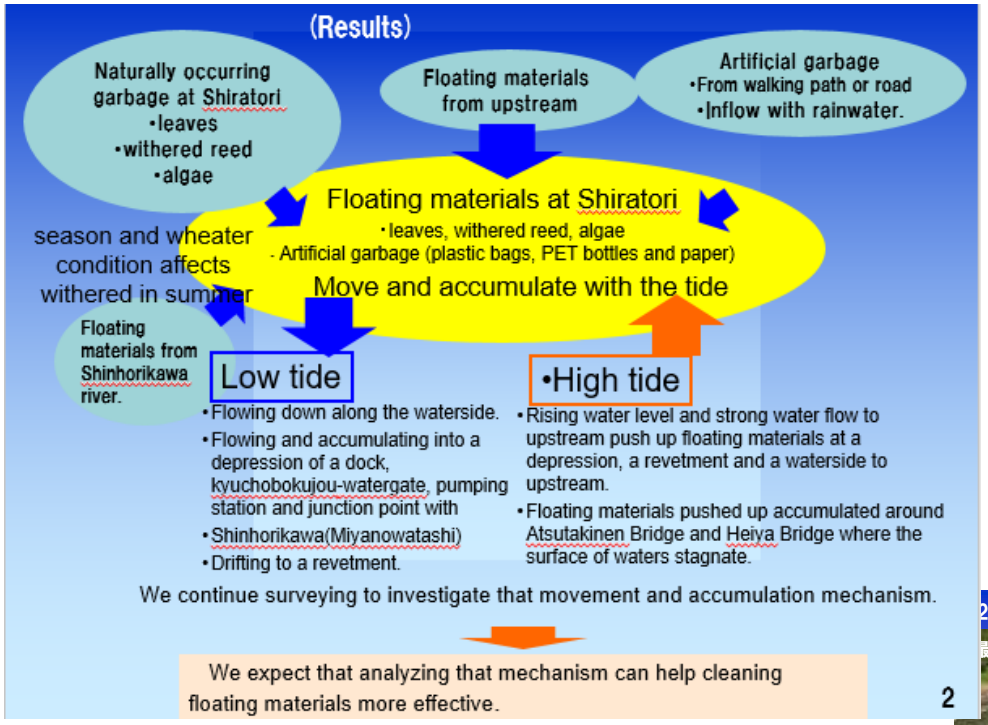




We need to pay attention to the sludge on the riverbed again for cleaner Horikawa River.

## (5) Movement and accumulation mechanizm of floating materials of Shiratori and Miyanowatashi.

According to civil survey, Floating materials at Shiratori and Miyanowatshi in Horikawa river moved and accumulated with the tide. People continue surveying to investigate that movement and accumulation mechanism. Floating materials at Shiratori are reaves, reed, algae, plastic bags, PET bottles and paper. We expect that analyzing that mechanism can help cleaning floating materials more effective.

**Chikyu club chosatai** (Ref:p.88)




**(REF:p.91～93) 調査実施日の潮位**


2019年7月31日～1日 (大潮)
地球倶楽部調査隊

2019年8月2日 (大潮)


# (Results)

**Naturally occurring garbage at Shiratori**
- leaves
- withered reed
- algae

**Floating materials from upstream**

**Artificial garbage**
- From walking path or road
- Inflow with rainwater.

## Floating materials at Shiratori

- leaves, withered reed, algae
- Artificial garbage (plastic bags, PET bottles and paper)

Move and accumulate with the tide

season and wheater condition affects withered in summer

**Floating materials from Shinhorikawa river.**

### Low tide

- Flowing down along the waterside.
- Flowing and accumulating into a depression of a dock, kyuchobokujou-watergate, pumping station and junction point with
- Shinhorikawa(Miyanowatashi)
- Drifting to a revetment.

### •High tide

- Rising water level and strong water flow to upstream push up floating materials at a depression, a revetment and a waterside to upstream.
- Floating materials pushed up accumulated around Atsutakinen Bridge and Heiya Bridge where the surface of waters stagnate.

We continue surveying to investigate that movement and accumulation mechanism.

We expect that analyzing that mechanism can help cleaning floating materials more effectively.

# (Hypothesis) Movement and accumulation of suspended substance

(Hypothesis) When the tide level difference is small

··· There is little movement and accumulation of suspended substance

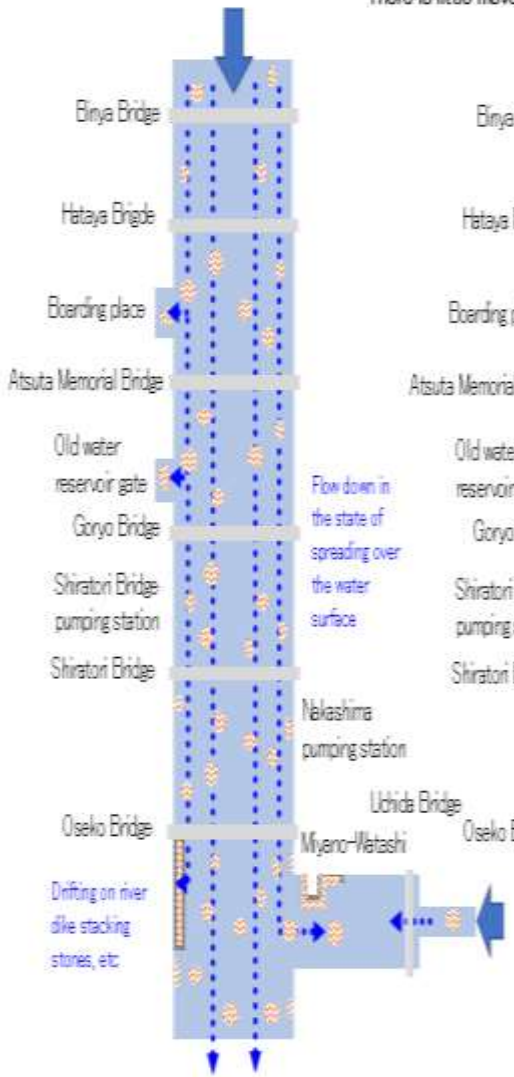



Fig.1 Ebb tide~low tide time

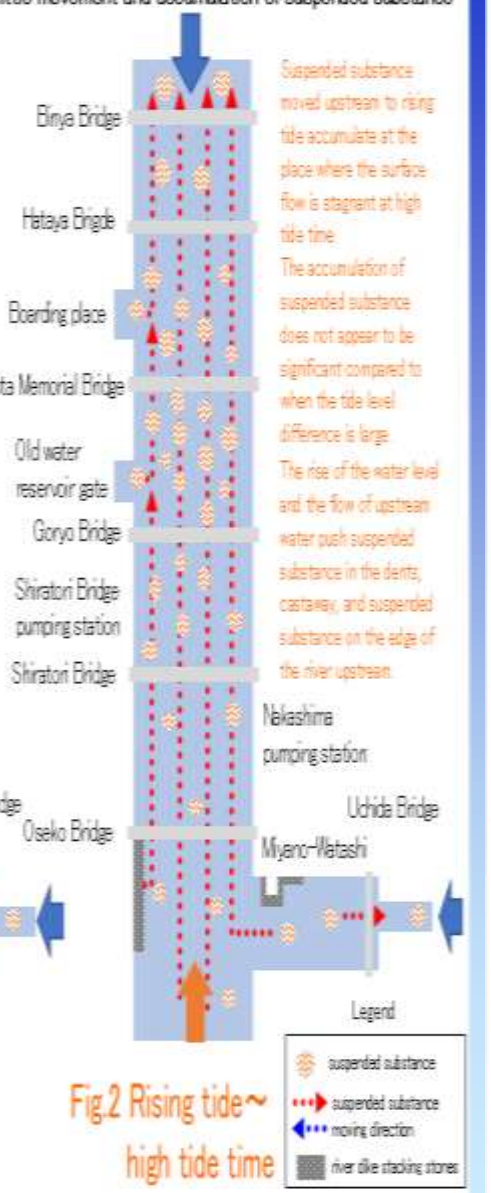



Fig.2 Rising tide~ high tide time

(Hypothesis) When the tide level difference is large ··· Suspended substance easily move and accumulate

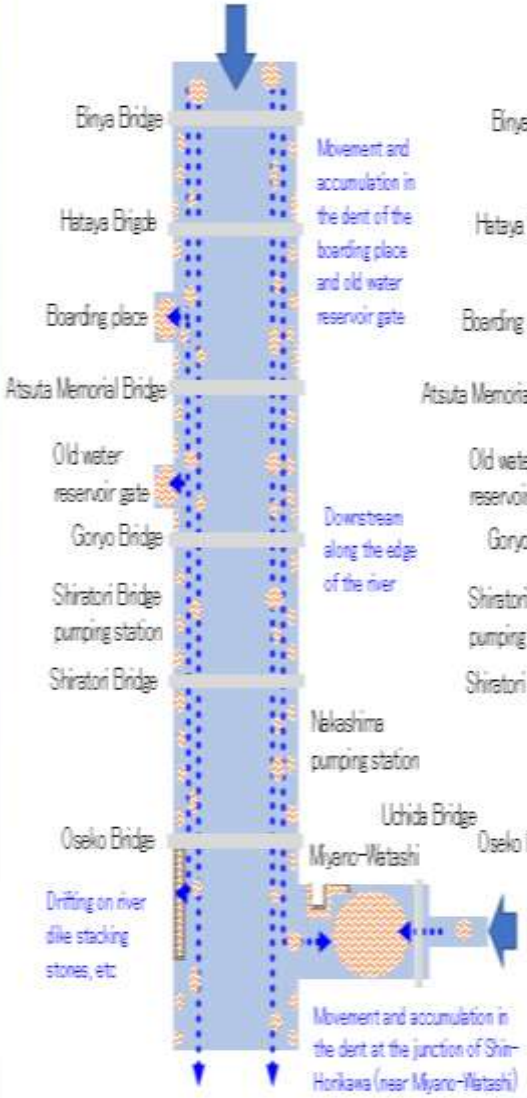



Fig.3 Ebb tide~low tide time

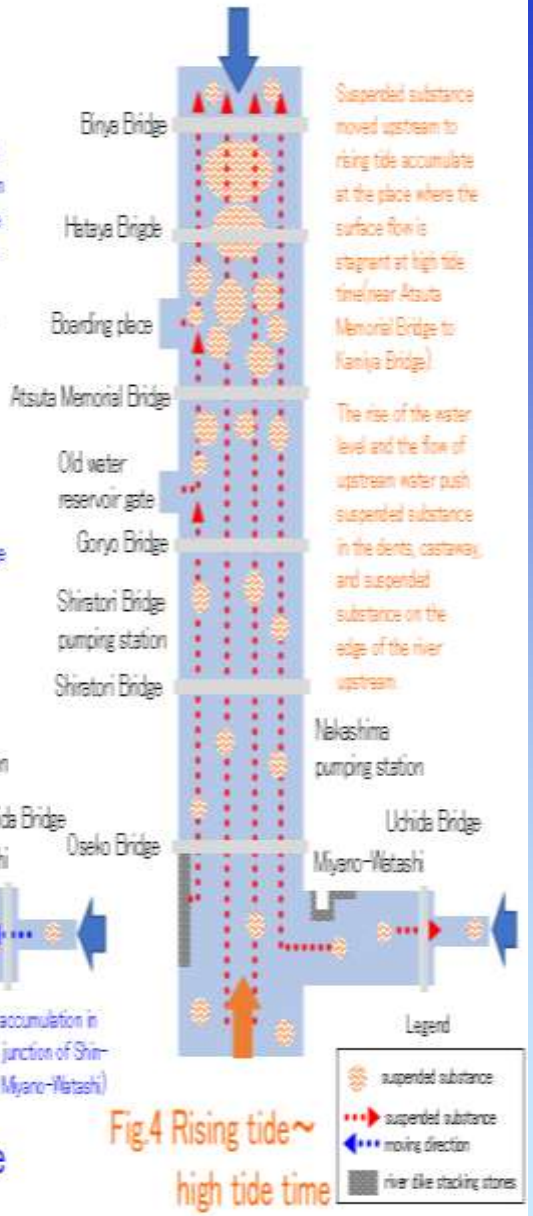


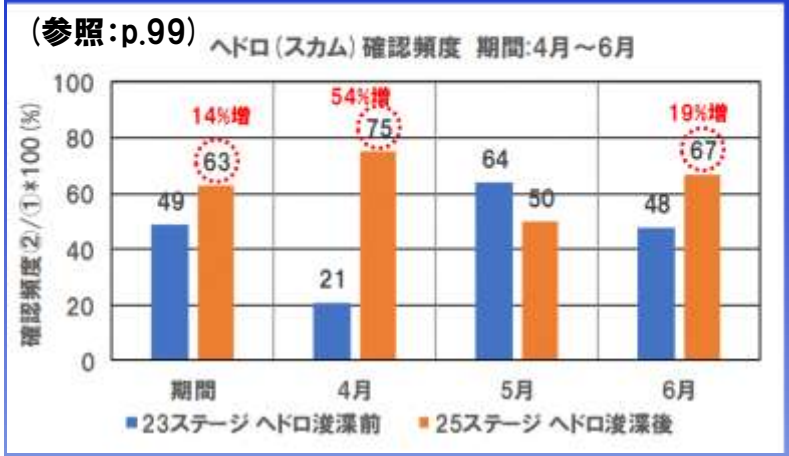

Fig.4 Rising tide~ high tide time

## (6) After removal of sludge in Shin-Horikawa River

The survey held in Shin-Horikawa River between Maizuru Bridge and Mukaida in the 23rd stage (Apr.-Jun. 2018, before removal of sludge) and the 25th stage (Apr.-Jun. 2019, after removal of sludge) shows that sludge was seen more frequently in the 25th stage (after removing sludge). Although more successive observation is needed to find the cause, it is being clear little by little field by survey of HSC. (ref:6.13、6.14_p.99～116)
Survey by citizens confirmed that "impression of water clearness" is significantly affected by sludge (scum) generated from organic matters and impurities along with rainwater flowed into the river from combined sewer during rainfall in upstream area of Shin-Horikawa River, of which water source is limited.

### ヘドロ(スカム)の確認頻度*

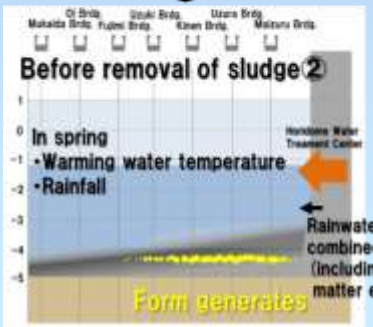
*市民調査の報告でヘドロ(スカム)が記録として確認できた調査数を整理
①調査数(回) ②ヘドロ(スカム)確認調査数(回)

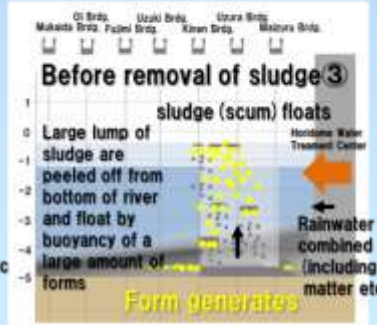



*Impurities: small wastes including wastewater including naturally originated wastes, cooking wastes, and toilet papers, etc.

### Before removal of sludge



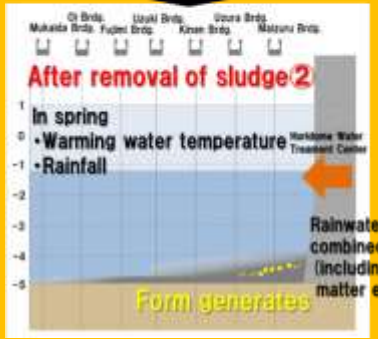


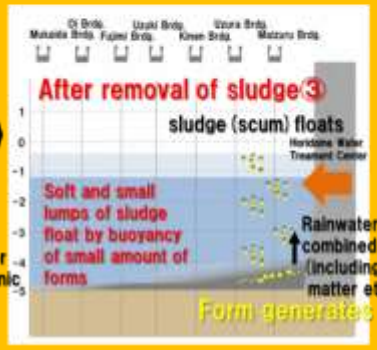



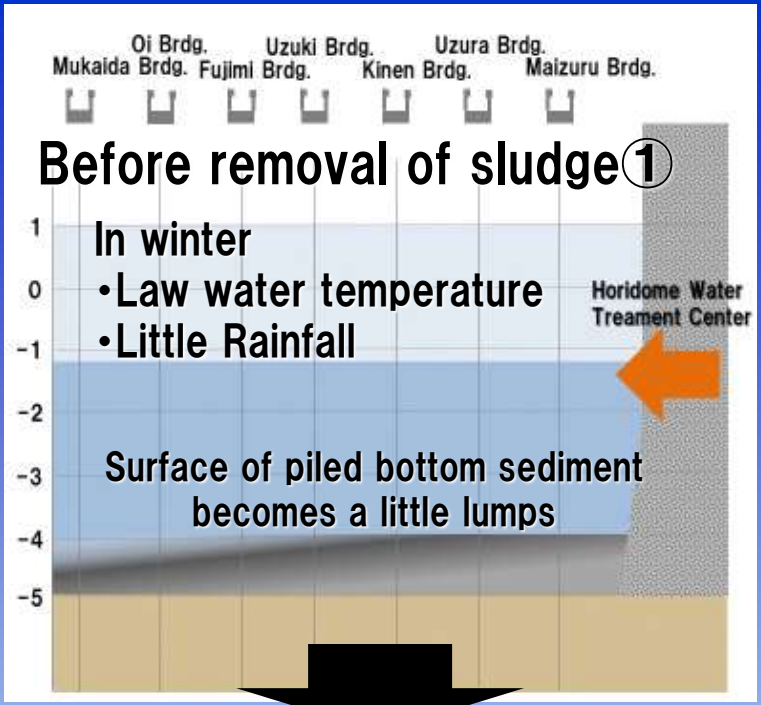

### After removal of sludge

(field survey)
Suimonken survey group, ecodoco survey group, Taiyu Const. survey group, Kokawasemi survey group

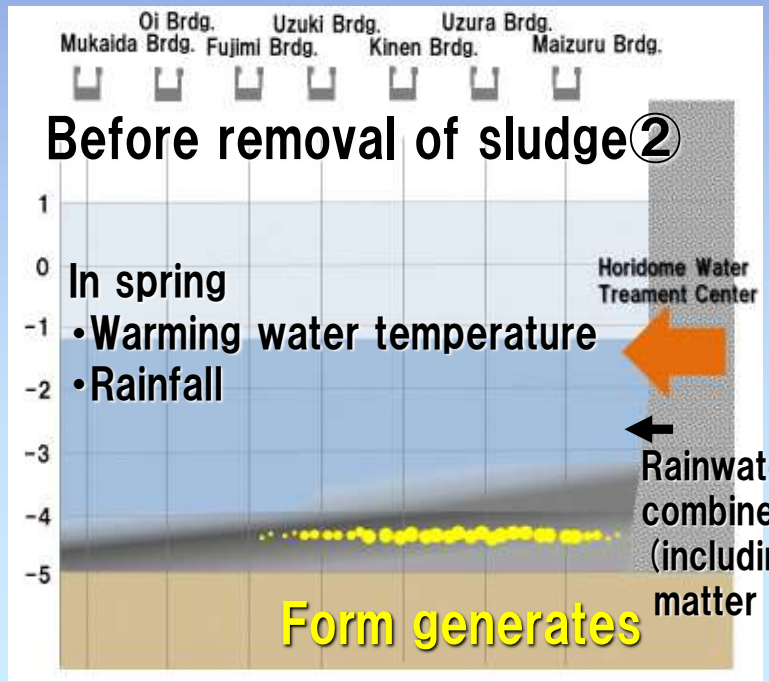


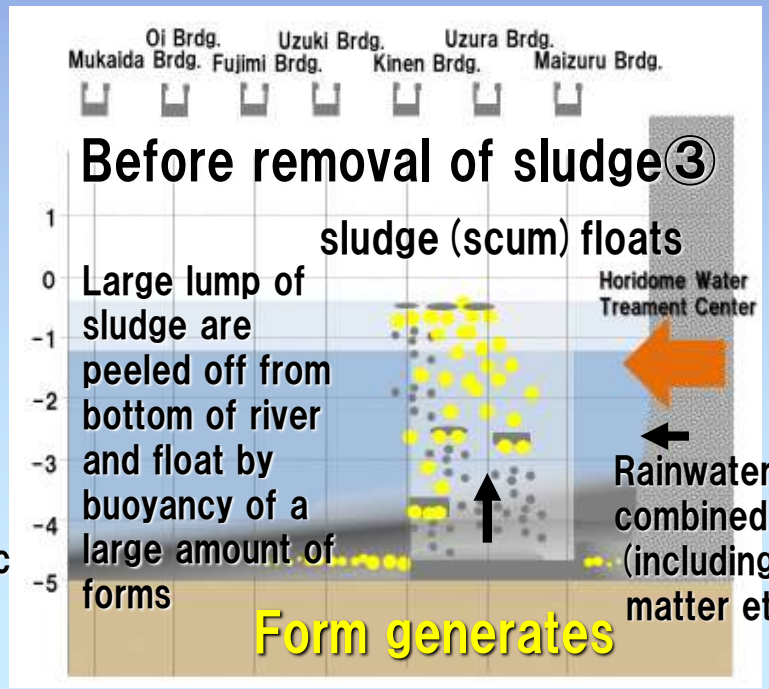


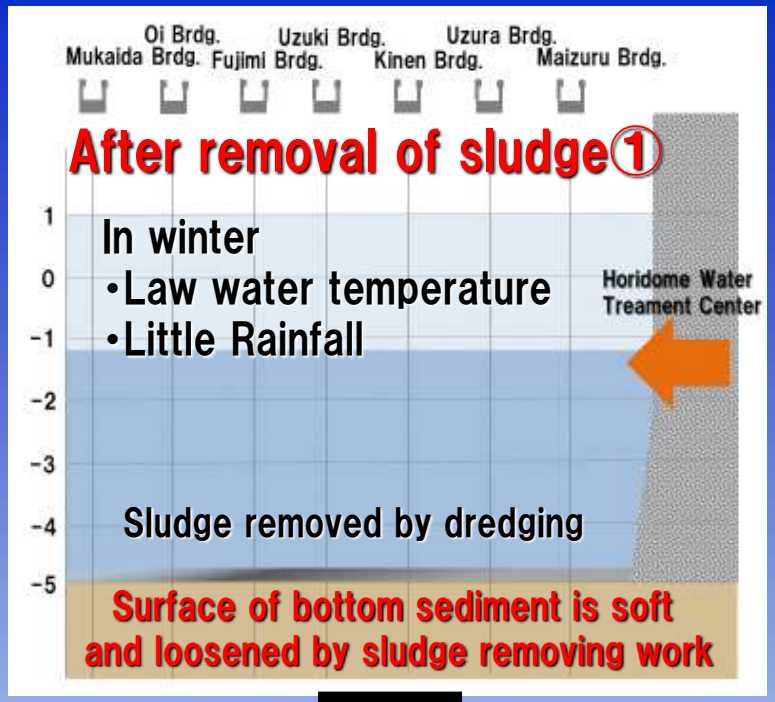




Oi Brdg.
Mukaida Brdg.
Fujimi Brdg.
Uzuki Brdg.
Kinen Brdg.
Uzura Brdg.
Maizuru Brdg.
Before removal of sludge①
In winter
•Law water temperature
•Little Rainfall
Horidome Water Treament Center
Surface of piled bottom sediment becomes a little lumps
1
0
-1
-2
-3
-4
-5

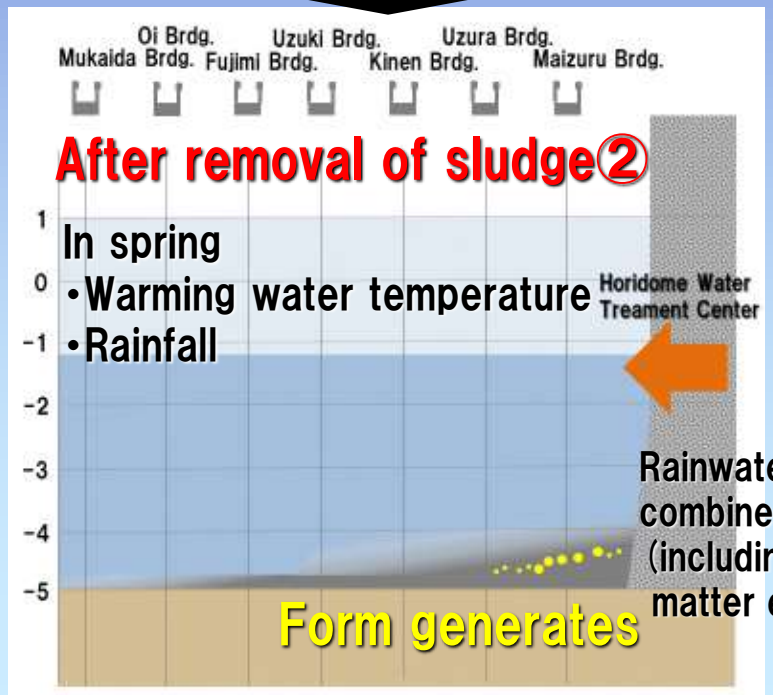

A large lump of sludge (scum) floats up to the river surface
2017 May 12 photo by secretariat

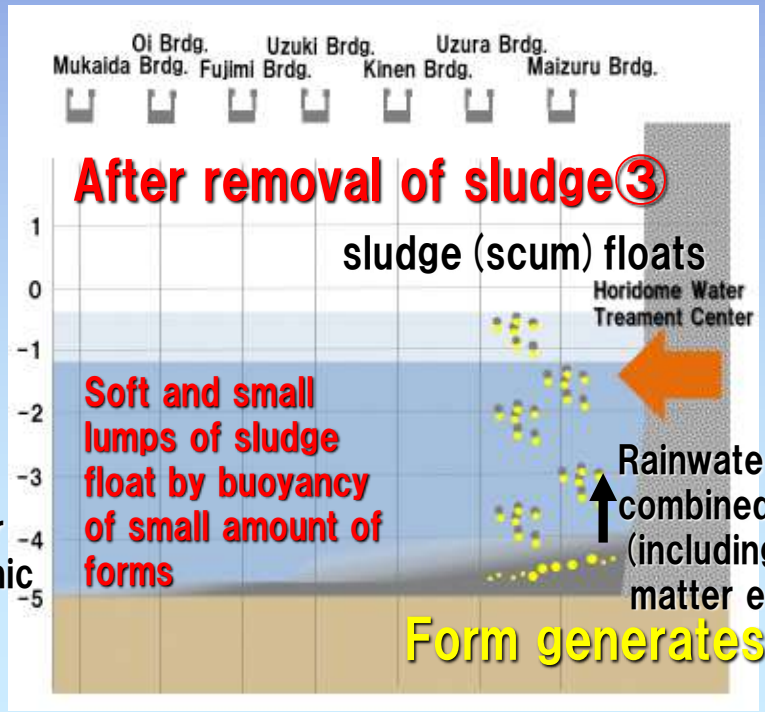

Oi Brdg.
Mukaida Brdg.
Fujimi Brdg.
Uzuki Brdg.
Kinen Brdg.
Uzura Brdg.
Maizuru Brdg.
Before removal of sludge②
In spring
•Warming water temperature
•Rainfall
Horidome Water Treament Center
Rainwater from combined sewer (including organic matter etc.)
Form generates
1
0
-1
-2
-3
-4
-5


Oi Brdg.
Mukaida Brdg.
Fujimi Brdg.
Uzuki Brdg.
Kinen Brdg.
Uzura Brdg.
Maizuru Brdg.
Before removal of sludge③
sludge (scum) floats
Large lump of sludge are peeled off from bottom of river and float by buoyancy of a large amount of forms
Horidome Water Treament Center
Rainwater from combined sewer (including organic matter etc.)
Form generates
1
0
-1
-2
-3
-4
-5


Oi Brdg.
Mukaida Brdg.
Fujimi Brdg.
Uzuki Brdg.
Kinen Brdg.
Uzura Brdg.
Maizuru Brdg.
After removal of sludge①
1
0
-1
-2
-3
-4
-5
In winter
•Law water temperature
•Little Rainfall
Horidome Water Treament Center
Sludge removed by dredging
Surface of bottom sediment is soft and loosened by sludge removing work


Small lumps of sludge (scum) floats up to surface of the river from April
April 19 2019 photo by secretariat


Oi Brdg.
Mukaida Brdg.
Fujimi Brdg.
Uzuki Brdg.
Kinen Brdg.
Uzura Brdg.
Maizuru Brdg.
After removal of sludge②
1
0
-1
-2
-3
-4
-5
In spring
•Warming water temperature
•Rainfall
Horidome Water Treament Center
Rainwater from combined sewer (including organic matter etc.)
Form generates


Oi Brdg.
Mukaida Brdg.
Fujimi Brdg.
Uzuki Brdg.
Kinen Brdg.
Uzura Brdg.
Maizuru Brdg.
After removal of sludge③
1
0
-1
-2
-3
-4
-5
sludge (scum) floats
Horidome Water Treament Center
Soft and small lumps of sludge float by buoyancy of small amount of forms
Rainwater from combined sewer (including organic matter etc.)
Form generates

We think that securing new water source, reduce of (soluble) organic matter and impurities flowing into the river during rainfall, and countermeasures to reduce sludge (ex. control of combined sewer overflow) are necessary to realize water quality improvement of Shin-Horikawa River。

(7) 10th Horikawa-river general survey (changes point of Horikawa-river vessel liner)

As the result from general survey, we found the trend that sediment on the riverbed was agitated and the impression of water stains will worsen temporarily, according to non-periodically operation of vessel.

Furthermore, if number of vessel operations increases, we hypothesized that impression of water stains might improve, because water of the Horikawa-river and riverbed sediments are agitated periodically, and oxygen continues to be supplied to the riverbed, improving the riverbed environment, and reducing bubbles, odors and cloudiness.

As the result from this survey, after passing of vessel between Naya-Bridge and Gojyo-Bridge (upstream section), we confirmed that rolling up of sludge, and bubbles from the riverbed. Especially, this trend was particularly noticeable in the ebb tide period of spring tide. (Depth is shallow)

On other hand, there was no remarkable change signal between the Matsushige Lock Gate and Tennozaki-Bridge (downstream section) such as that rolling up of sludge after passing of vessel. Estimated reason why we confirmed such a trend might be "sludge dredging" with revetment maintenance, and houseboats (but not periodically) operation etc. We compared the conditions of May 11 and May 25 at Gojyo-Bridge (at the time of neap tide). On May 11, sludge was rolled up and rotten-egg smell was confirmed, but it didn't on the May 25. The condition of the riverbed on May 25 may have improved due to twice vessel operation on the May 11 and May 18. During this general survey, we recorded a video that could prove part of the hypothesis which we mentioned above.

We, citizens, expect the effect of purifying and maintaining for water area by mud re-depositing on the bottom after sludge removal (during revetment maintenance etc.) and reducing sludge according to start periodical vessel operations.

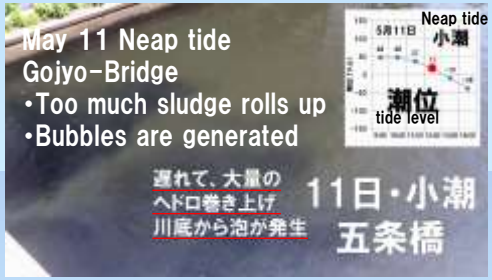
Due to non-periodical operation of vessel,
**the sediment on the riverbed are agitated and the impression of water stains is aggravation temporarily**

■ Momentary,
- Sludge rolls up
- Bubbles are generated
- Odor occurs (unpleasant smell of rotten eggs, sludge)

If the vessel operate periodically,
the sediment on the riverbed is agitated periodically,
**and impression of water stains is improved.**

■Periodically,
- Oxygen will be supplied to the water area
- Sediment at the riverbed (mud etc.) will be decreased
- Hydrogen sulfide etc. in the sediment will be released

## Rolling up of sludge around Gojyo-Bridge






# (Survey results)

① Naya Bridge～Gojyo Bridge (Upstream Section)
After passing of vessel, sludge rolling up and bubbles from the riverbed were confirmed.
→Especially, this trend in the spring tide is remarkable (the water depth is shallow)

② Matsushige Lock Gate～Tennouzaki (Down Stream)
Even when the vessel passed, significant changes such as rolling-up of sludge were not observed.
→Estimated reason why we confirmed such a trend might be "sludge dredging" during revetment maintenance, and houseboats (but not periodically) operation etc.

③ Comparison of the conditions of Gojyo bridge on May 11 and 25 (neap tide)
Sludge was rolled up, and rotten-egg smell was confirmed on May 11, but these problem were not confirmed on May 25.
→ Since vessel was operated on May 11 and May 18, condition of riverbed might be temporarily improved as of May 25th.

④ Bubbles occur in the wake
→ Same as 9th Survey (24th stage)

**According to non-periodically operation of vessel, the sediment on the riverbed was agitated and the impression of water stains will worsen temporarily**

■ Momentary,
- Sludge rolls up
- Bubbles are generated
- Odor occurs (unpleasant rotten-egg smell, sludge)

**If the vessel operate periodically, the sediment on the riverbed is agitated periodically, and impression of water stains is improved.**

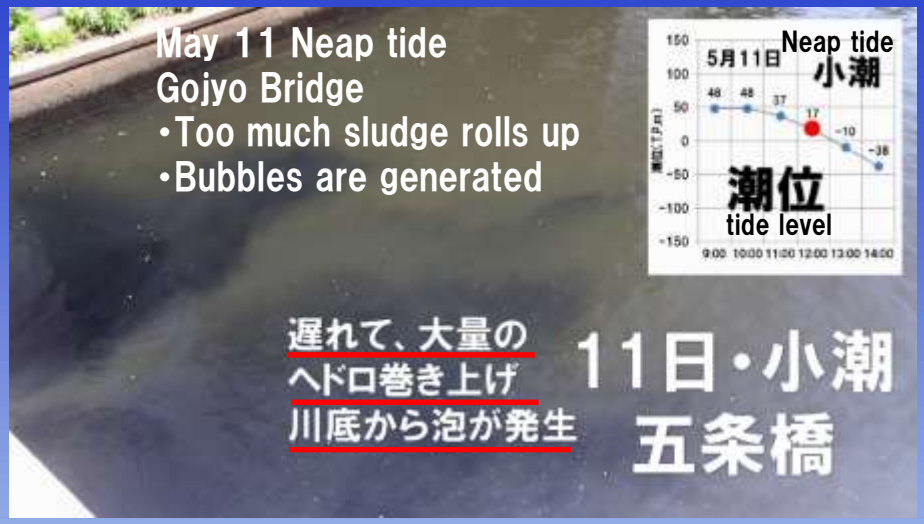
■Periodically,
- Oxygen will be supplied to the water area
- Sediment at the riverbed (mud etc.) will be decreased
- Hydrogen sulfide etc. in the sediment will be released

## (Summary)

If periodical vessel operation is available, it reduce the re-accumulate of mud on the riverbed and sludge, after removing the sludge (at the revetment maintenance).

**We can expect the effect of purification and keeping the environment of water area.**

# Rolling up sludge around Gojyo Bridge






(Hypothesis) Image of water quality improvement according to periodical vessel operation
(The riverbed environment improves, if frequency of vessel operations increases.)

Motoiri Sluiceway

Sanage Bridge

Naya Bridge Gojyo Bridge Asahi Bridge

## Current Status

The edge end that seawater reach

Freshwater

Seawater

Promotion of sedimentation

floating mud layer

The condition of riverbed of Horikawa-river

Reported by :Video Team, 3rd Survey Group Meeting


Subsidence of fine flotage in the water is promoted at the boundary between seawater and fresh water. Near the edge end that seawater reach of the Horikawa-river, its trend is shown prominently, and floating mud layer is created on riverbed.

Floating mud layer like gray dust is confirmed on the riverbed, and black sludge accumulates under it. Bubbles come from riverbed.


Naya Bridge Gojyo Bridge Asahi Bridge

Environment that fine flotage does not sink easily

Stirring of sludge + Oxygen supply

Stirring of sludge + Oxygen supply

Freshwater

Improvement

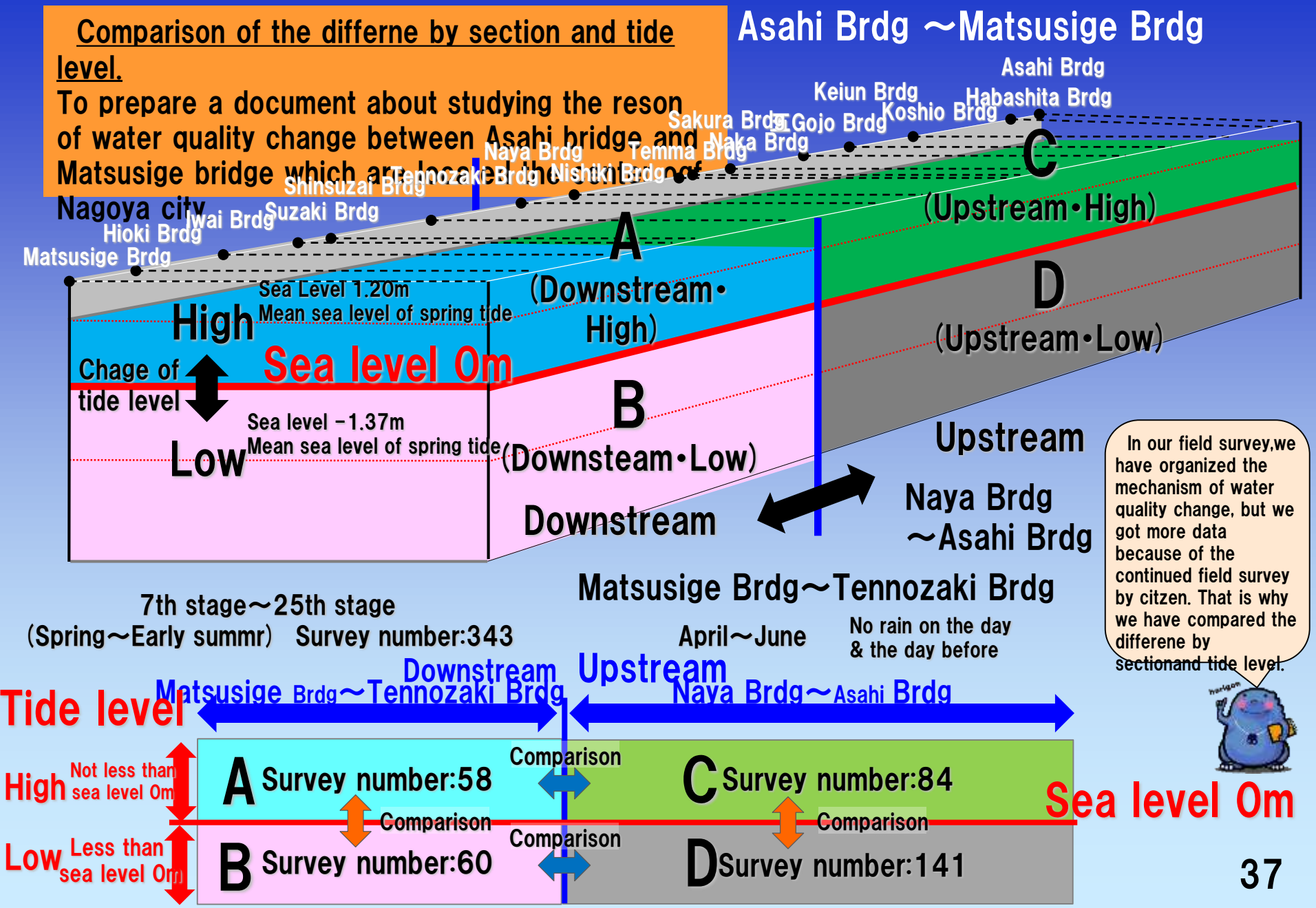
If frequency of vessel operation increases, water and sludge of the Horikawa-river are agitated periodically and oxygen is continuously supplied to the riverbed. And then, bubble, bad odor and muddiness will decrease, environment of riverbed will be improved. So, we believe that impression of water stains will improve.

If frequency of vessel operations increases, environment of riverbed is improved.

# 5.2. Consider of factor of water quority bitwen Asahi Matsusige

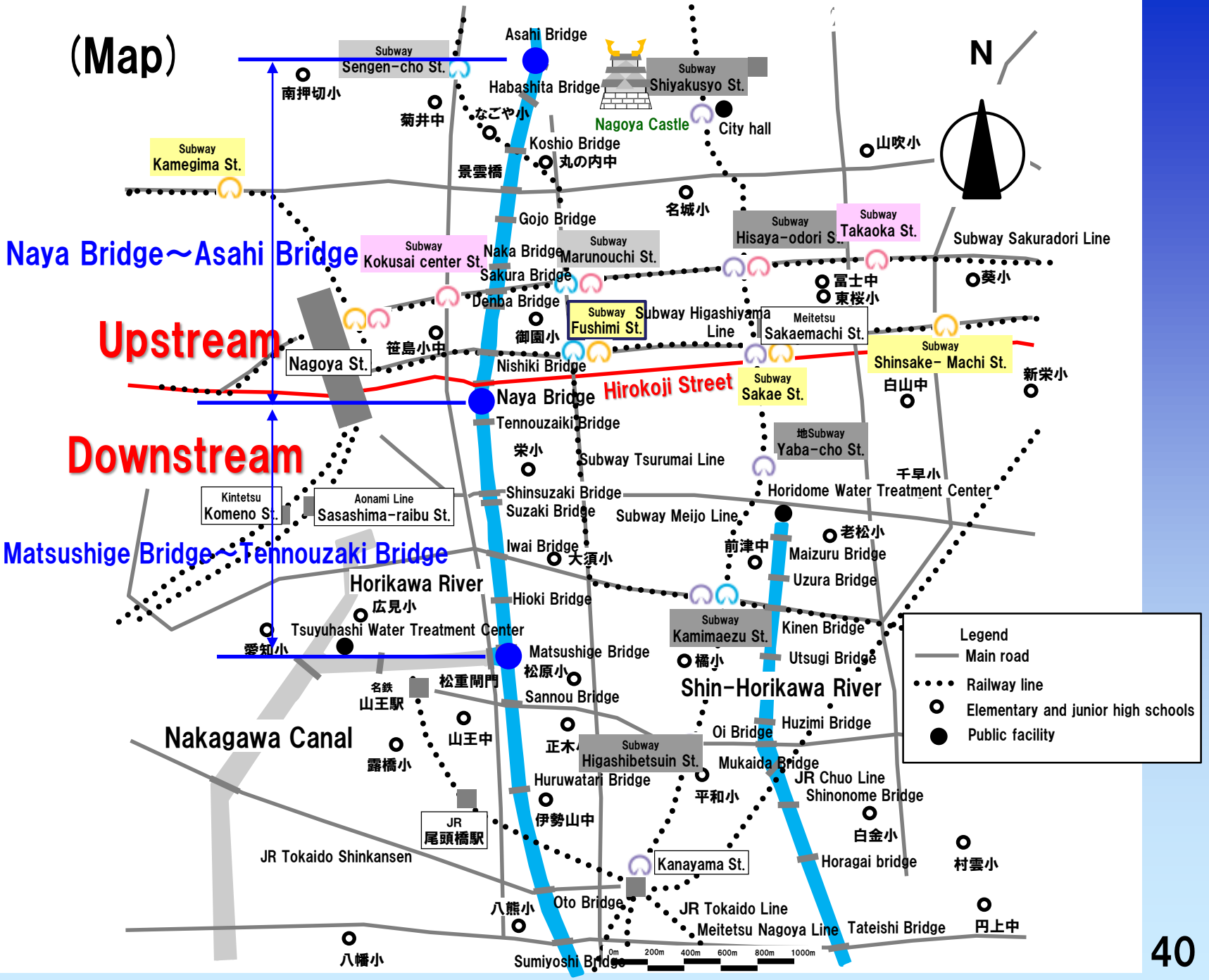
**Comparison of the differne by section and tide level.**

To prepare a document about studying the reson of water quality change between Asahi bridge and Matsusige bridge which are located in the center of Nagoya city.




In our field survey,we have organized the mechanism of water quality change, but we got more data because of the continued field survey by citzen. That is why we have compared the differene by sectionand tide level.

# (Map)


N
Naya Bridge～Asahi Bridge
Upstream
Downstream
Matsushige Bridge～Tennouzaki Bridge
Asahi Bridge
Habashita Bridge
Nagoya Castle
City hall
Koshio Bridge
Gojo Bridge
Naka Bridge
Sakura Bridge
Denba Bridge
Nishiki Bridge
Naya Bridge
Tennouzaiki Bridge
Shinsuzaki Bridge
Suzaki Bridge
Iwai Bridge
Hioki Bridge
Matsushige Bridge
Sannou Bridge
Huruwatari Bridge
Oto Bridge
Sumiyoshi Bridge
Hirokoji Street
Horikawa River
Nakagawa Canal
Shin-Horikawa River
Maizuru Bridge
Uzura Bridge
Kinen Bridge
Utsugi Bridge
Huzimi Bridge
Oi Bridge
Mukaida Bridge
Shinonome Bridge
Horagai bridge
Tateishi Bridge
Subway Sakuradori Line
Subway Tsurumai Line
Subway Meijo Line
Subway Higashiyama Line
JR Chuo Line
JR Tokaido Line
JR Tokaido Shinkansen
Meitetsu Nagoya Line
Subway
Sengen-cho St.
Shiyakusyo St.
Kamegima St.
Kokusai center St.
Marunouchi St.
Hisaya-odori St.
Takaoka St.
Fushimi St.
Meitetsu
Sakaemachi St.
Shinsake- Machi St.
Sakae St.
地Subway
Yaba-cho St.
Horidome Water Treatment Center
Kamimaezu St.
Higashibetsuin St.
Kanayama St.
Nagoya St.
Kintetsu
Komeno St.
Aonami Line
Sasashima-raibu St.
Tsuyuhashi Water Treatment Center
名鉄
山王駅
JR
尾頭橋駅
南押切小
菊井中
なごや小
景雲橋
丸の内中
名城小
山吹小
冨士中
東桜小
葵小
笹島小中
御園小
栄小
千早小
新栄小
白山中
老松小
前津中
大須小
広見小
愛知小
松原小
松重閘門
橘小
正木小
山王中
露橋小
平和小
伊勢山中
白金小
村雲小
八熊小
八幡小
円上中
Legend
Main road
Railway line
Elementary and junior high schools
Public facility
0m
200m
400m
600m
800m
1000m

# Mainly Point at Sea level 0m




# Mainly Point at Sealevel 0m




# (Survey Result)

If the tide level will be the low environment (the environment that the water depth is shallow),We have found out that "Dirty impression of water"and"COD"goes worse, "the bubble and smell"becomes a lot , and the color of the sludge course becomes a lot compared with other ones between Naya Bridge and Asahi Bridge.

(Comparative Arrangement)

Downstream | Upstream

Matsushige Bridge～Tennouzaki Bridge | Naya Bridge～Asahi Bridge

More than 0m of the level

| | A Evaluation | A tide level | A section | C section | C tide level | C Evaluation |
|---|---|---|---|---|---|---|
| Dirty impression of water | good | good | – | – | good | good |
| viscous visibility | – | good | ●bad | good | good | good |
| COD | good | good | good | ●bad | good | – |
| Bubble from a riverbed | little | | little | ●lot | little | – |
| smell | little | little | little | ●lot | little | – |
| color the sludge system | little | litte | – | – | little | little |
| the cloudy system | ●lot | ●lot | – | – | ●lot | ●lot |

Comparison

High

Low

0m of the level

Comparison

Less than 0m of the level

| | B Evaluation | B tide level | B section | D section | D tide level | D Evaluation |
|---|---|---|---|---|---|---|
| Dirty impression of water | ●bad | ●bad | – | – | ●bad | ●bad |
| viscous visibility | ●bad | ●bad | ●bad | good | ●bad | – |
| COD | – | ●bad | good | ●bad | ●bad | ●bad |
| Bubble from a riverbed | – | ●lot | little | ●lot | ●lot | ●lot |
| smell | – | ●lot | little | ●lot | ●lot | ●lot |
| color the sludge system | – | ●lot | little | ●lot | ●lot | ●lot |
| the cloudy system | little | little | little | ●lot | little | – |

Comparison

If the tide level will be the low environment (the environment that the water depth is shallow), ・・・

(Comparative Arrangement)

"Dirty impression of water"and"COD" goes worse, "the bubble and smell"becomes a lot , and the color of the sludge course becomes a lot.

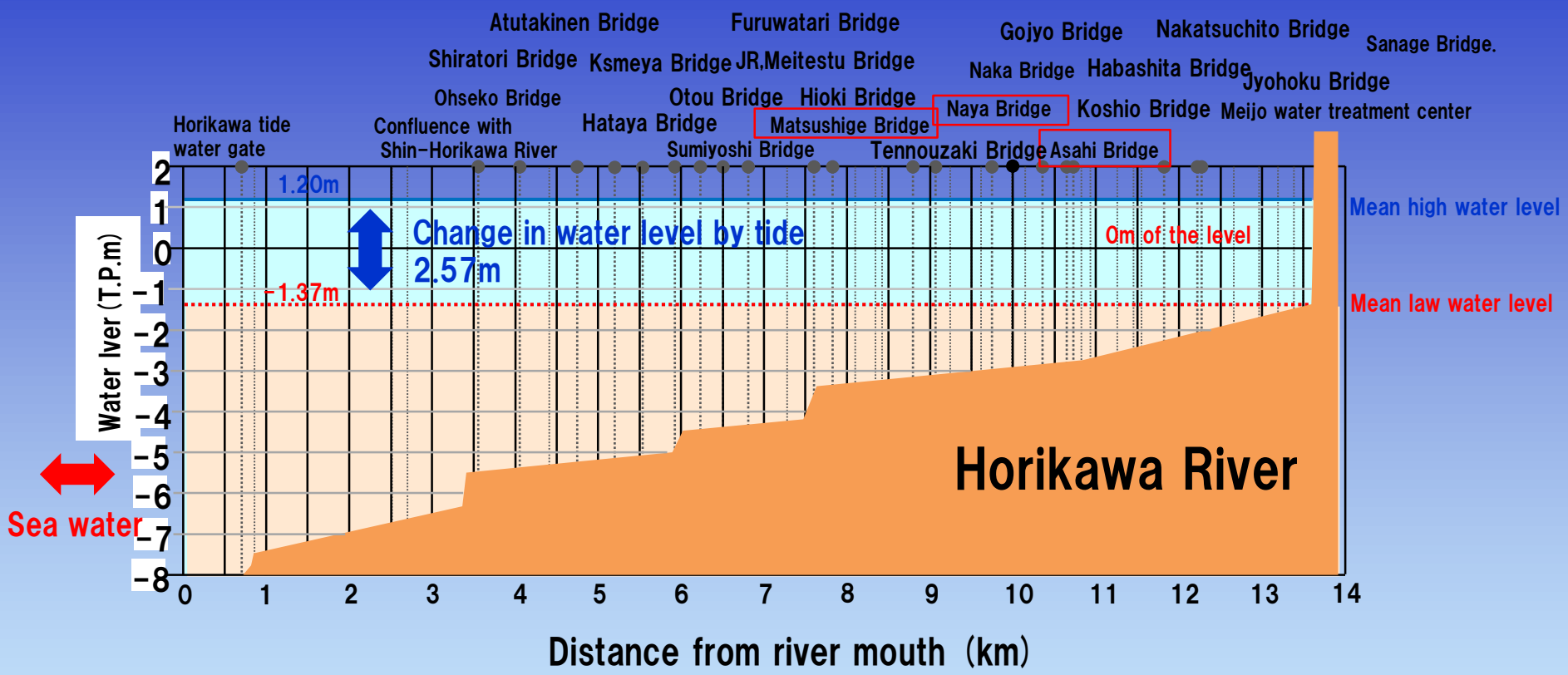
■ Sludge in a riverbed is related.

I'm thinking that it may be the sludge in a riverbed in curling and the environment that a generated bubble from the sludge (ex.Hydrogen Sulfide) tends to be released.

To achieve Horikawa's water quality improvement, we're thinking it's necessary to aim at existence of sludge in a riverbed once more between Naya Bridge and Asahi Bridge.

We're thinking specifically, the measure to remove the sludge with bank protection maintenance and to reduce re-accumulation between Naya Bridge and Asahi Bridge is needed. ※Examples of measures①Securement in the new water source②Promotion of improvement of conbined sewer system (ex.Horikawa left bank stormwater reservoir) ③Realization of regular service of the ship

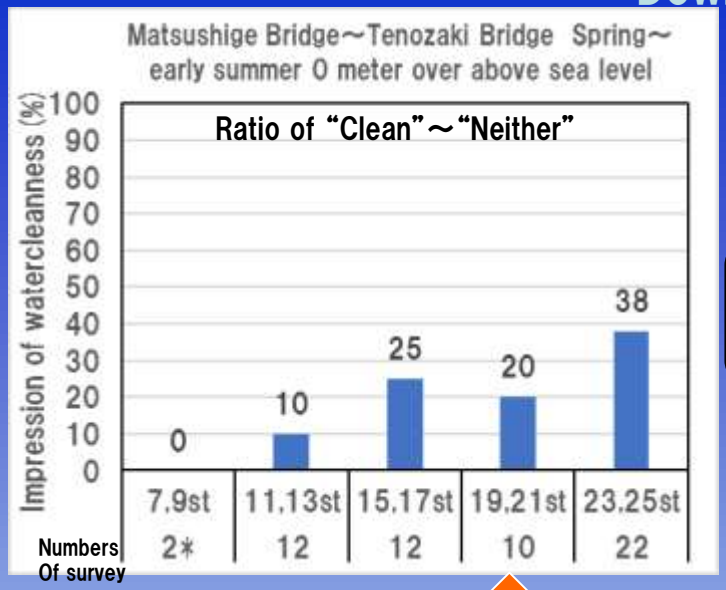
# (Reference materials) Vertical section-like shape of Horikawa River (Diagrammatical view)




Reference materials: Class A Shonai River water system Horikawa area River maintenance plan
p.43 Cross section of Horikawa River

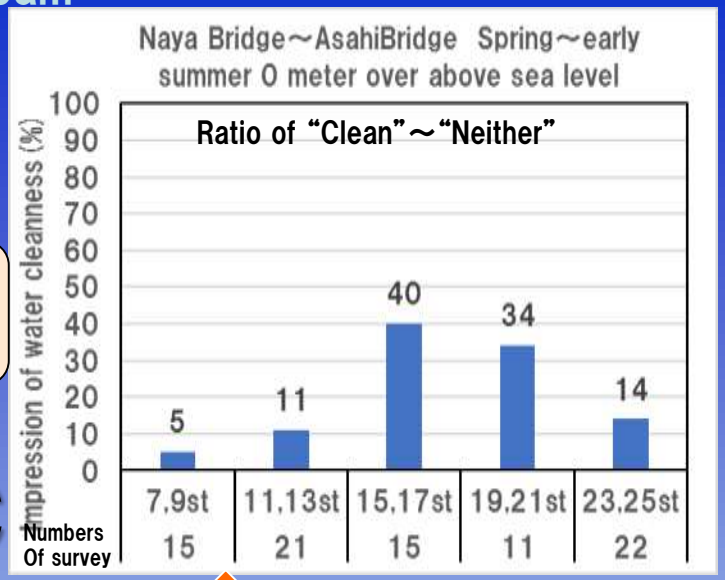
The height above the sea level …It is the height on the basis of sea level of Tokyo Bay. (T.P)
There are measuring the height, in Japanese land (elevation) based on average sea level in theTokyoBay.
Tokyo peil is abbreviated to T.P. Peil is the meaning of reference plane in Dutch.

Downstream Upstream




There is no remarkable tendency.

The impression in the area of 0 meter over above sea level is better than that of below 0 level.




A

C

Above

Below

good

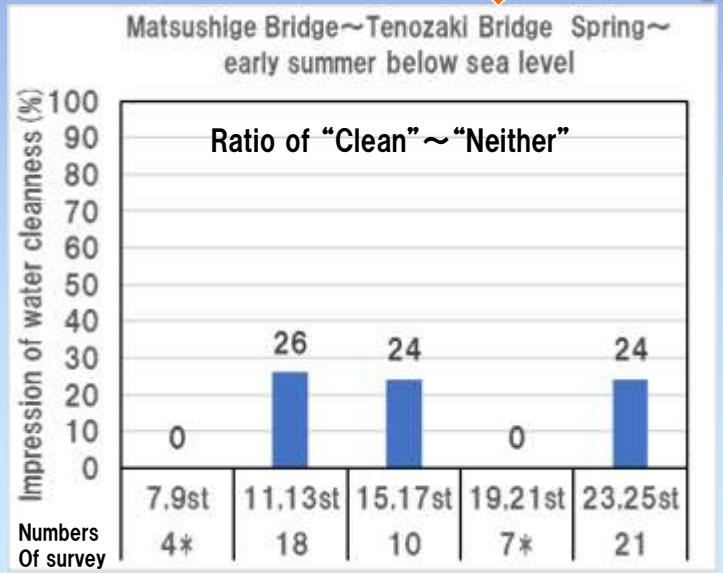
bad

0 m Sea level

Impression

good

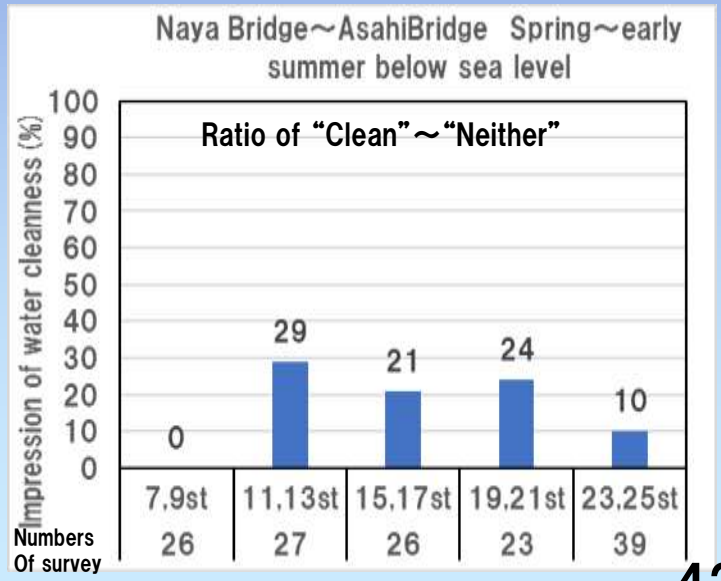
bad




B

D

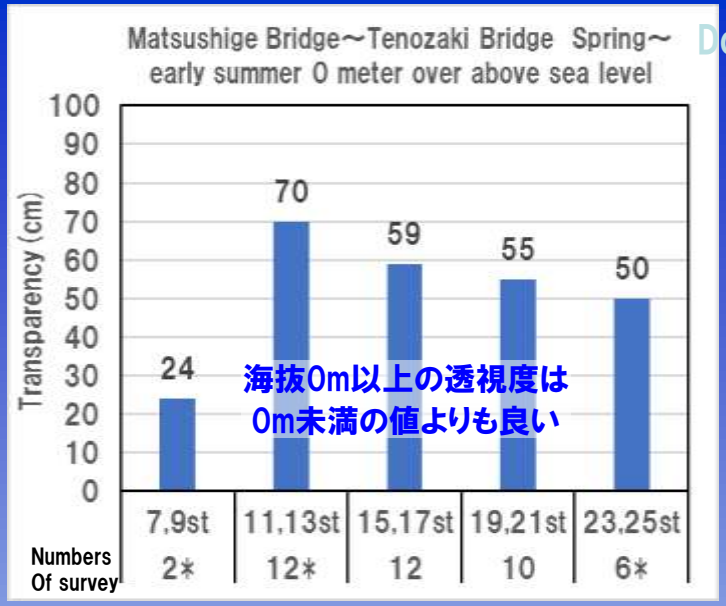
There is no remarkable tendency.



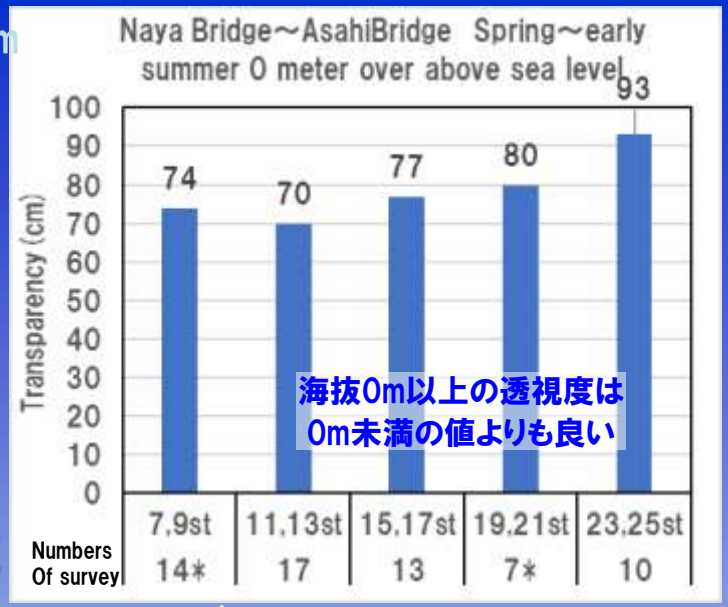

*short of data

Downstream Upstream

Bad Good




Transparency between Naya Bridge and Asahi Bridge is better than that of between Matsushige Bridge and Tenozaki Bridge.




A C

Above
Below

The Transparency in the area of 0 meter over above sea level is better than that of below 0 level

Good

0 m Sea level

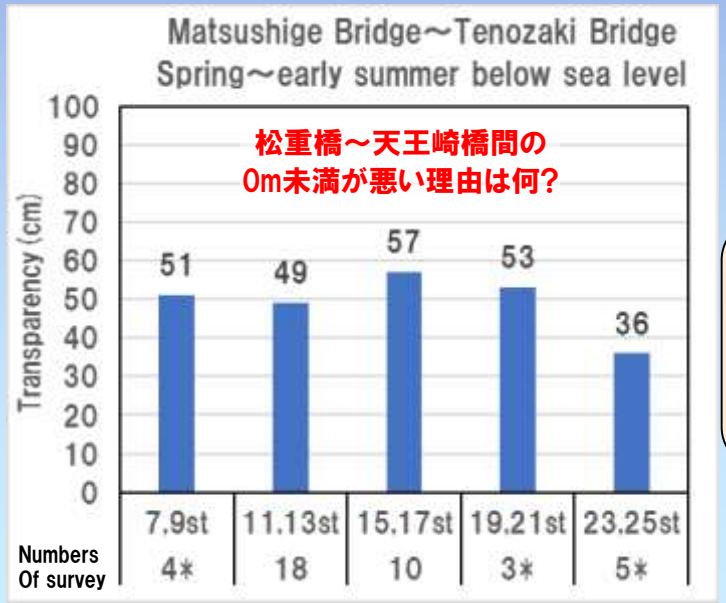
Good

Bad Transparency Bad

The Transparency in the area of 0 meter over above sea level is better than that of below 0 level

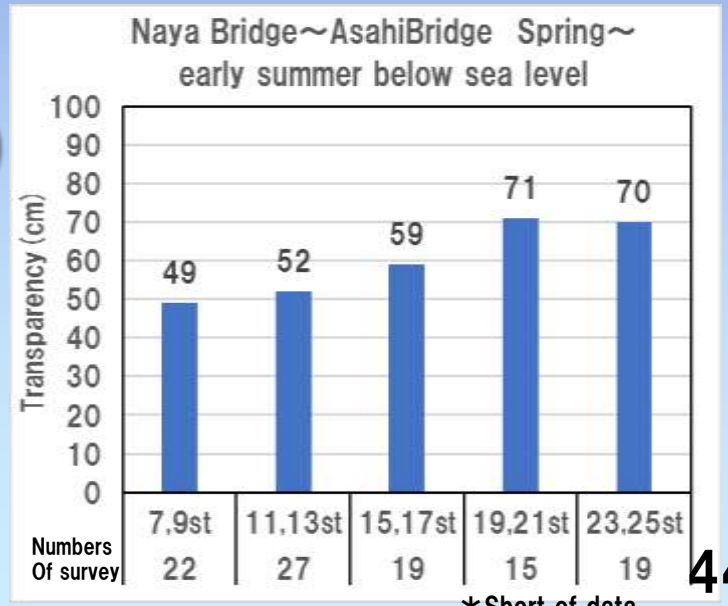
Bad Good

B D




The Transparency in the area of 0 meter over above sea level is better than that of below 0 level

Why is the transparency of the area below 0 meter sea level bad ?




*Short of data

Downstream Upstream

As a result of organizing the section between Naya Brdg. and Asahi Brdg. and between Matsushige Brdg. and Tennozaki Brdg., it was found that the COD at tide level of Om or higher is better than the COD of less than Om.

Good Poor

A C

High

Low

Good Om above sea level Good

Poor Poor

COD

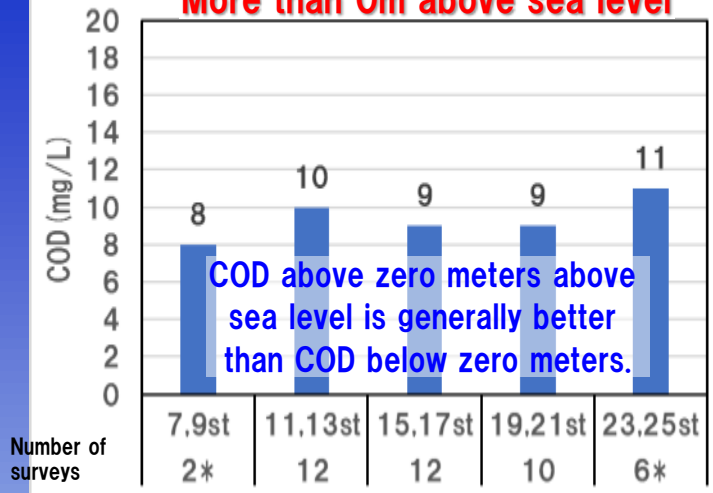
Good Poor

B D

We found that the COD below Om above sea level between Nayabashi Brdg. and Asahi Brdg. is high.

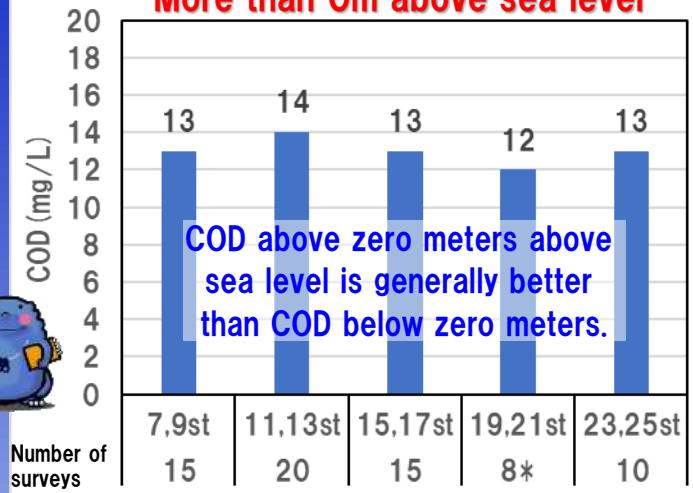
Matsushige Brdg.～Tennozaki Brdg.
Spring to early summer

More than Om above sea level



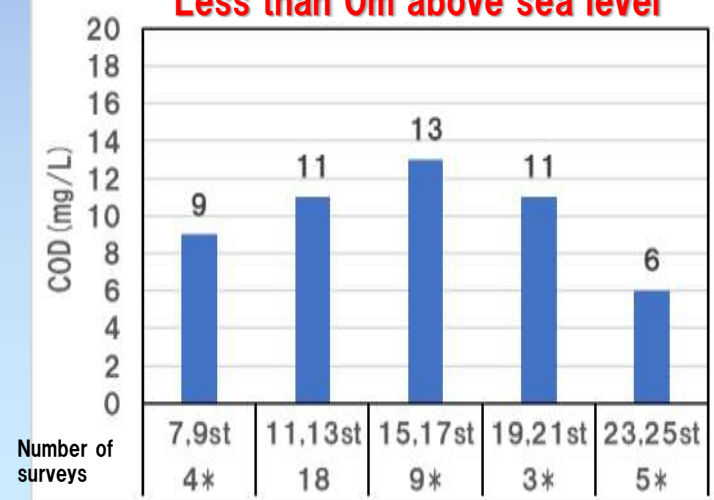

Naya Brdg.～Asahi Brdg.
Spring to early summer

More than Om above sea level



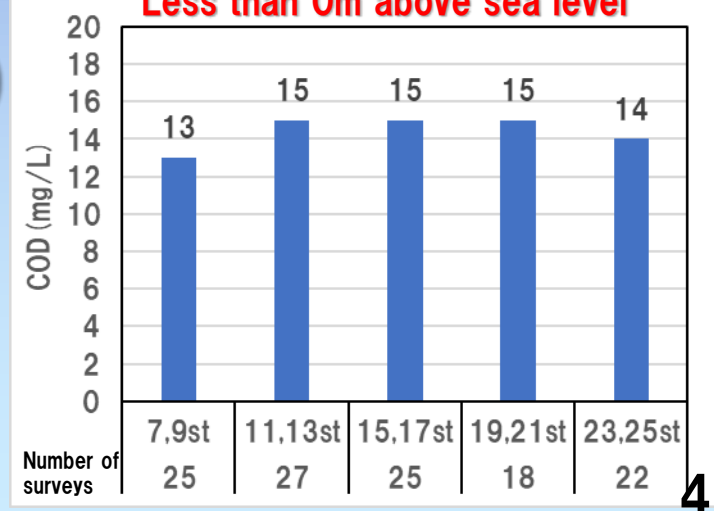

Matsushige Brdg.～Tennozaki Brdg.
Spring to early summer

Less than Om above sea level




Naya Brdg.～Asahi Brdg.
Spring to early summer

Less than Om above sea level




※Small number of surveys

Downstream Upstream

Few Many

A C

Few Many

Om above sea level

High

Low

Few Many Bubbles Few Many

B D

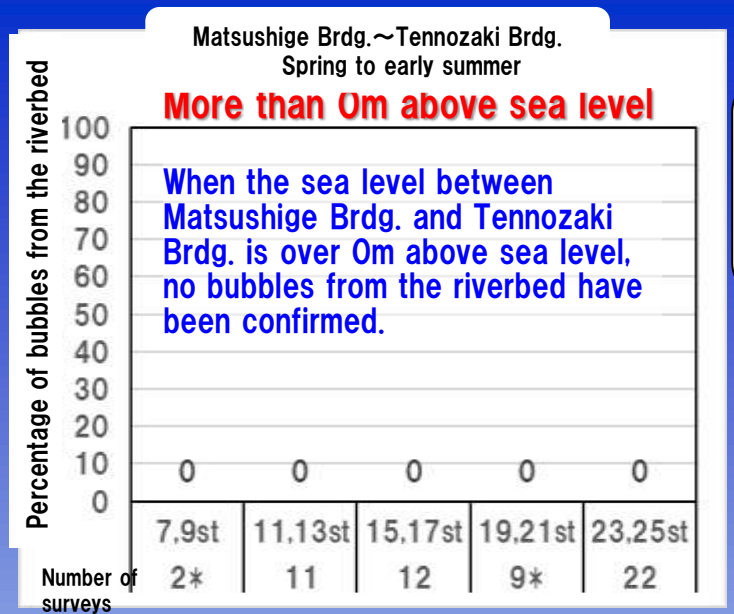
Few Many

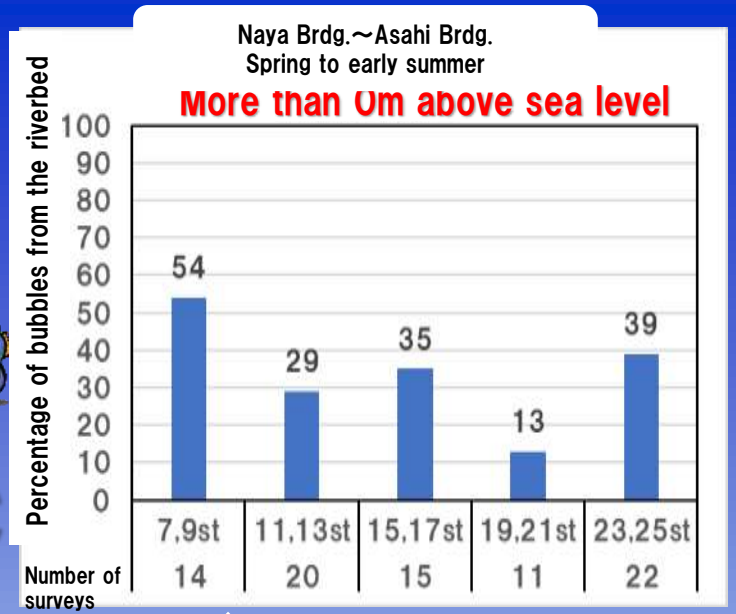
The number of bubbles from the riverbed between Matsushige Brdg. and Tennozaki Brdg. is less than that between Naya Brdg. and Asahi Brdg.

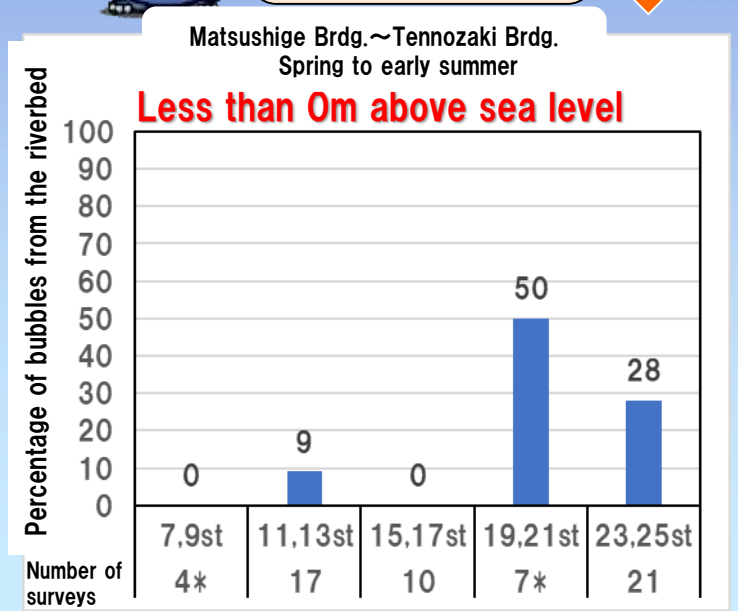
Bubbles from the bottom of the river above Om above sea level are less than bubbles from the bottom of the river below Om above sea level.

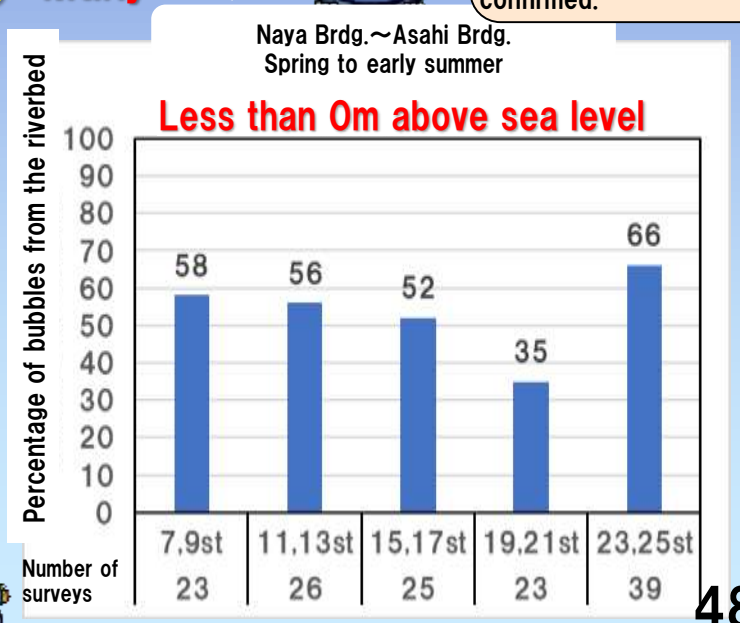
When the sea level is Om or higher, bubbles from the bottom of the river cannot be confirmed.

When the sea level was less than Om, there were many bubbles from the bottom of the river between Naya Brdg. and Asahi Brdg.




※Small number of surveys

Downstream Upstream

Few Many

A C

Few Om above sea level Few

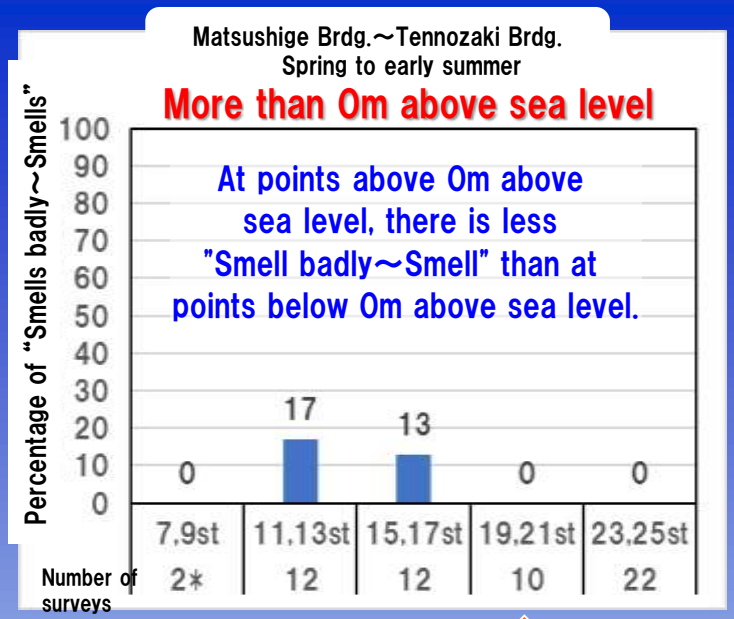
High

Low

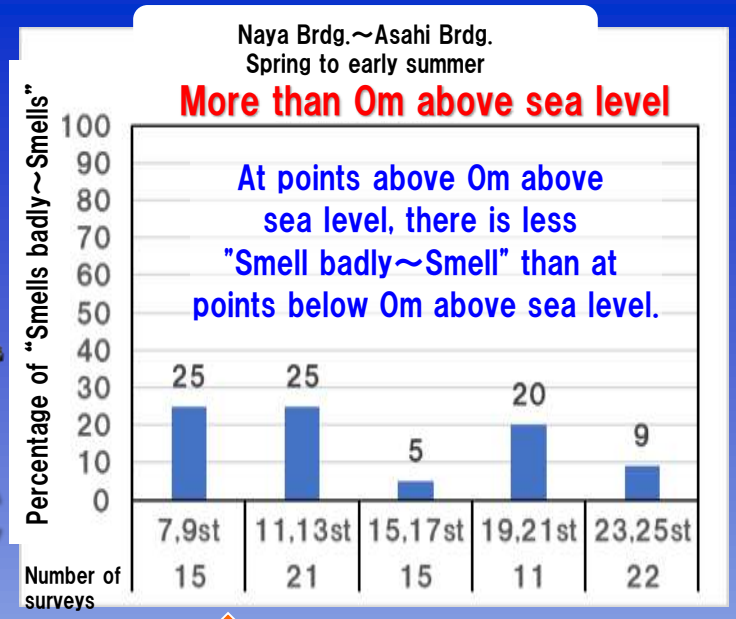
Many Smell Many

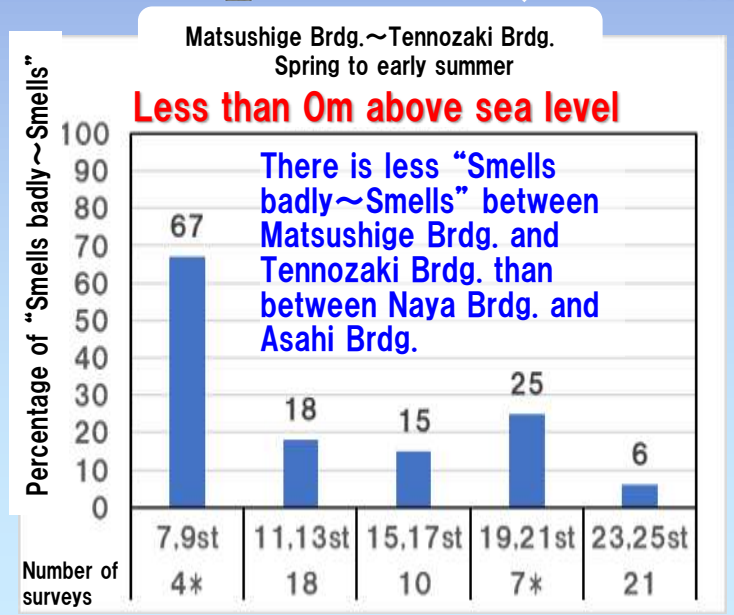
Few Many

B D

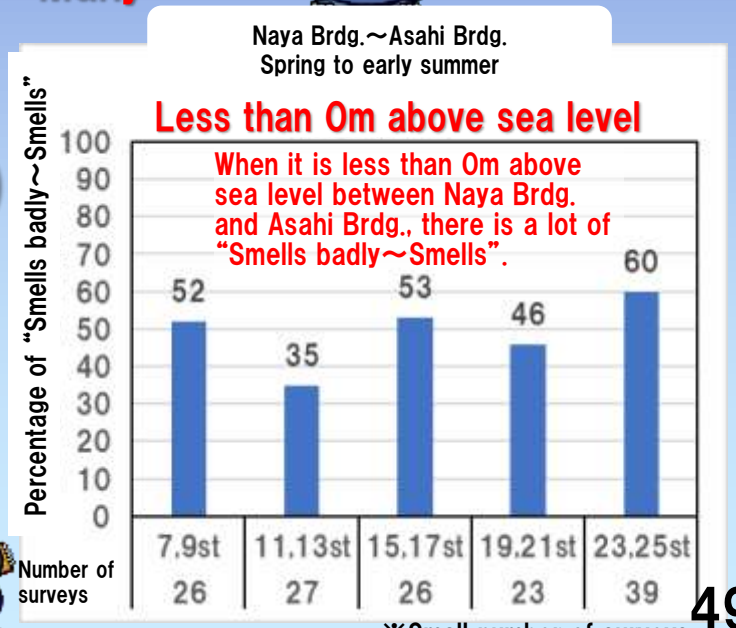



There is less "Smells badly～Smells" between Matsushige Brdg. and Tennozaki Brdg. than between Naya Brdg. and Asahi Brdg.



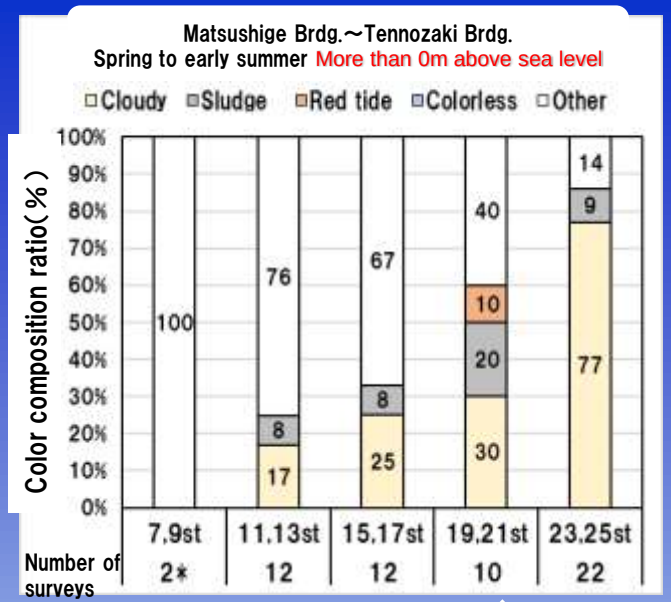

When it is less than Om above sea level between Naya Brdg. and Asahi Brdg., there is a lot of "Smells badly～Smells".

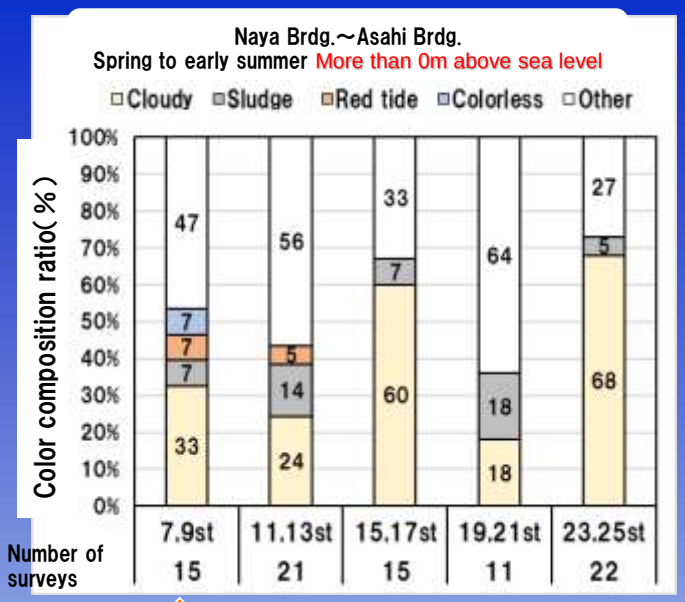



※Small number of surveys

Downstream Upstream

No noticeable trend




A

C

High

Low

Little color of river like sludge

Many color of river like sludge

0m above sea level

Many color of river like cloudy

Little color of river like cloudy

Color

B

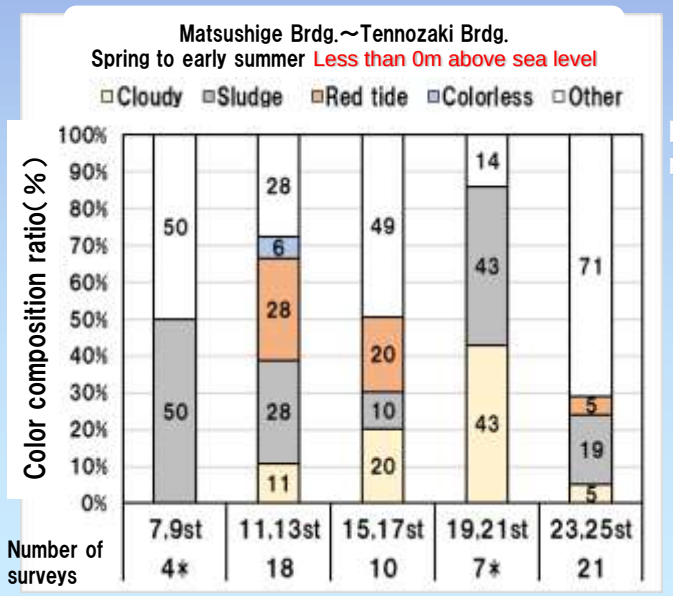
D

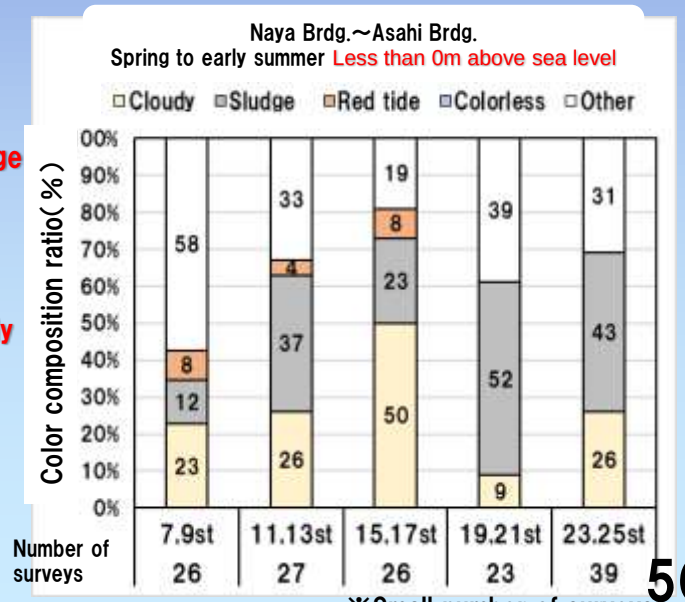
Little color of river like sludge

Little color of river like cloudy

Many color of river like sludge

Many color of river like cloudy



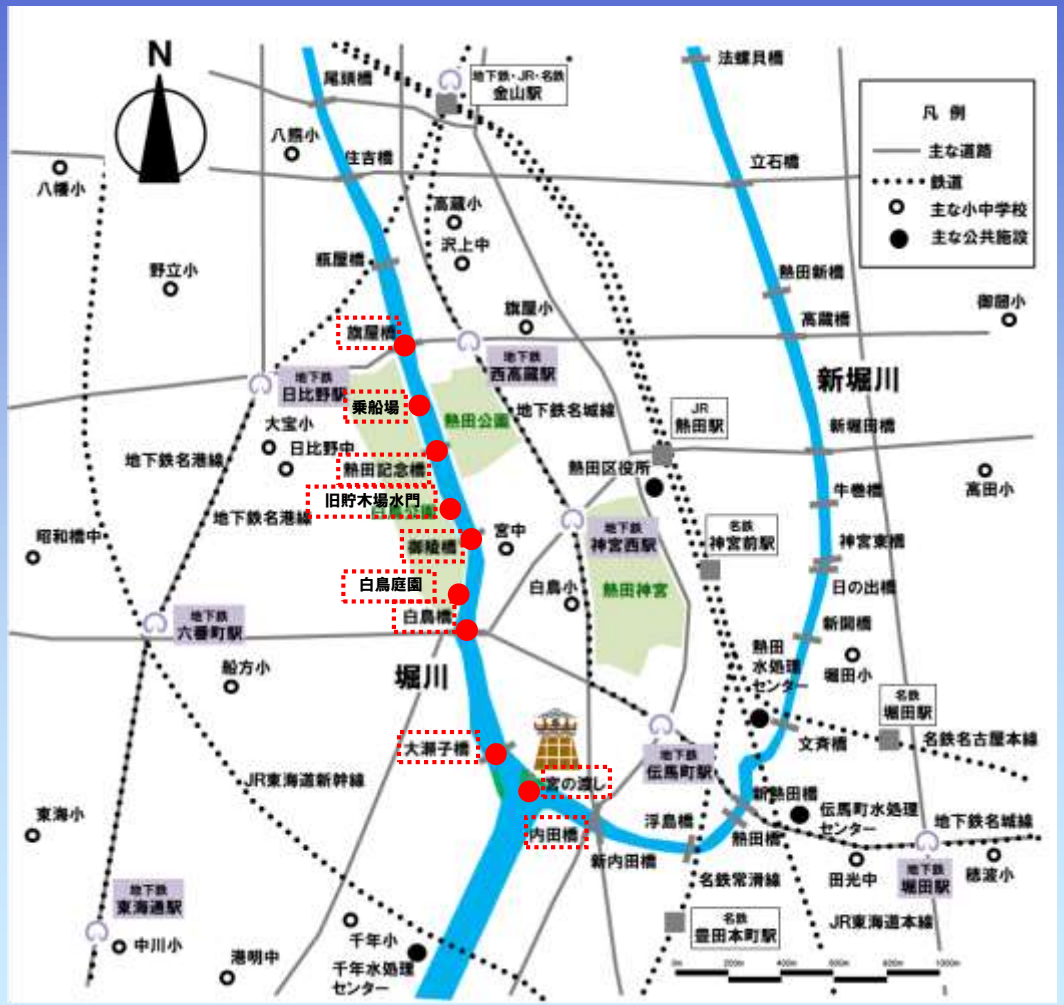

※Small number of surveys

# 5.3. Movement and accumulation mechanism of suspended substance around Shiratori and Miyano-Watashi

July 31 to August 2, 2019 (research organization) Earth Club Survey Group・・・Under investigation

The state of suspended substance around Shiratori and Miyano-Watashi where the actual state of movement and accumulation of suspended substance has not been investigated has been gradually revealed by public surveys.

## Around Shiratori and Miyano-Watashi




Please take a picture of suspended substance moving and accumulating with mobile phone, and send the date and place of photography to the secretariat.

(Hypothesis) When the tide level difference is small

••• There is little movement and accumulation of suspended substance

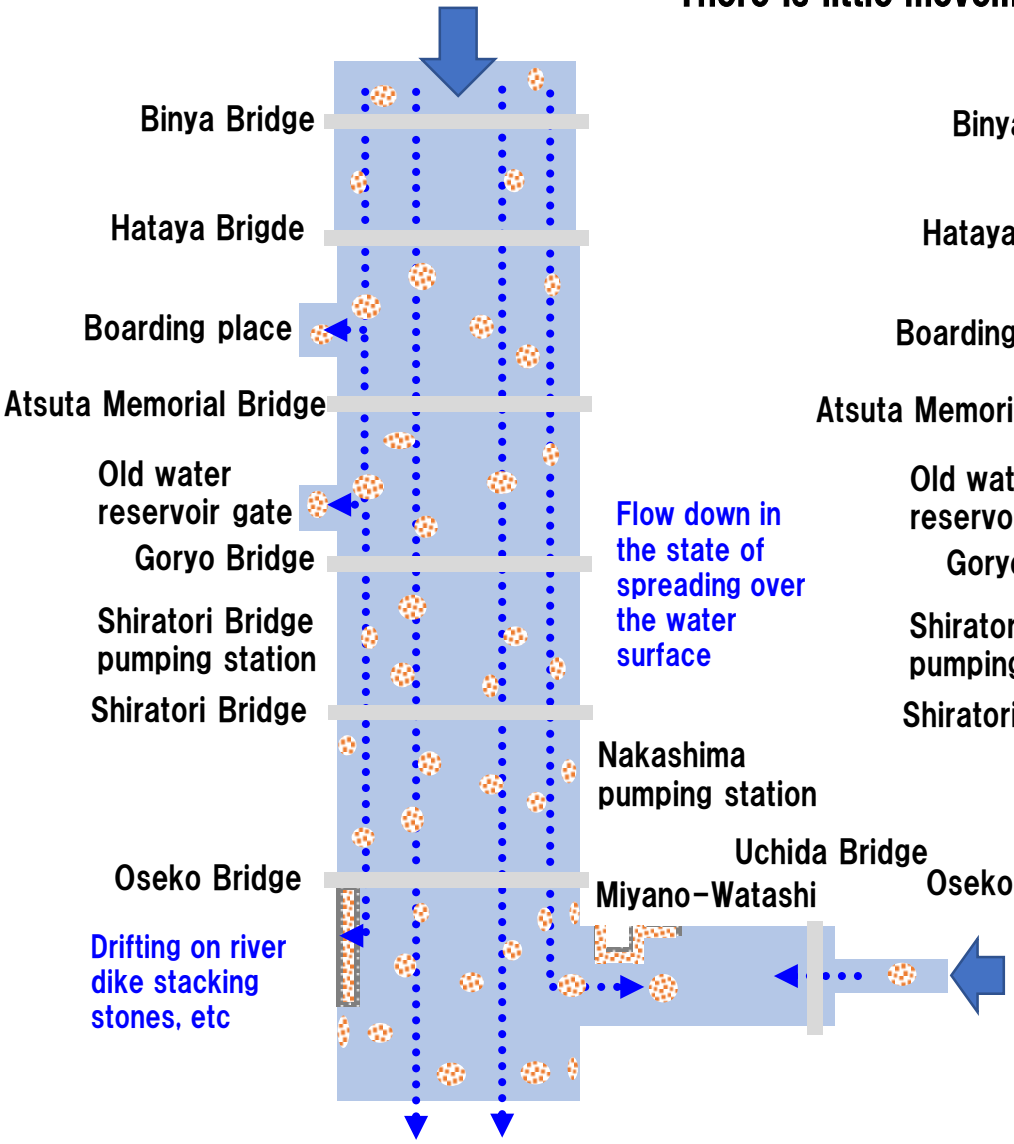
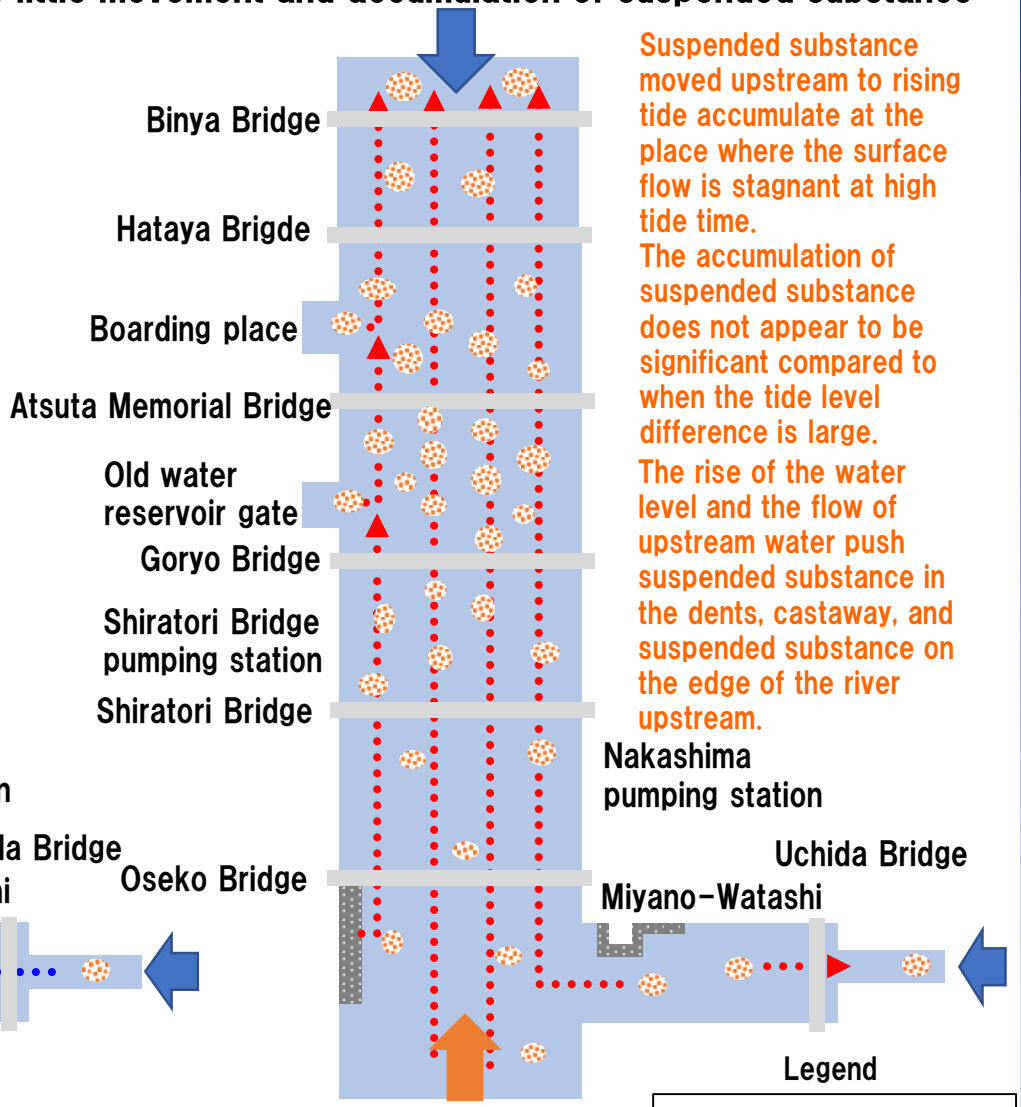



Fig.1 Ebb tide～low tide time




Suspended substance moved upstream to rising tide accumulate at the place where the surface flow is stagnant at high tide time.
The accumulation of suspended substance does not appear to be significant compared to when the tide level difference is large.
The rise of the water level and the flow of upstream water push suspended substance in the dents, castaway, and suspended substance on the edge of the river upstream.

Legend

- suspended substance
- suspended substance moving direction
- river dike stacking stones

Fig.2 Rising tide～high tide time

(Hypothesis) When the tide level difference is large ••• Suspended substance easily move and accumulate

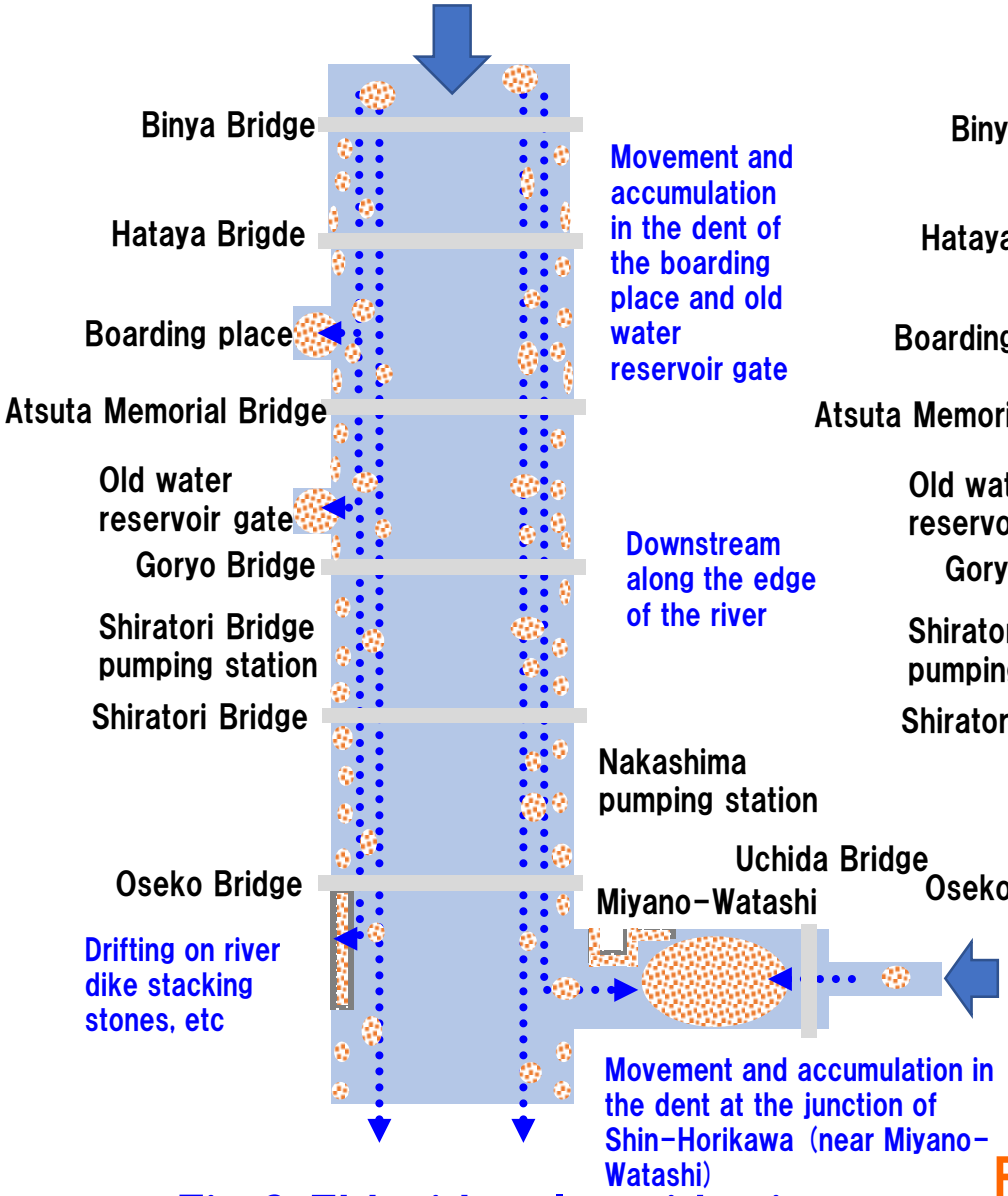



Fig.3 Ebb tide～low tide time

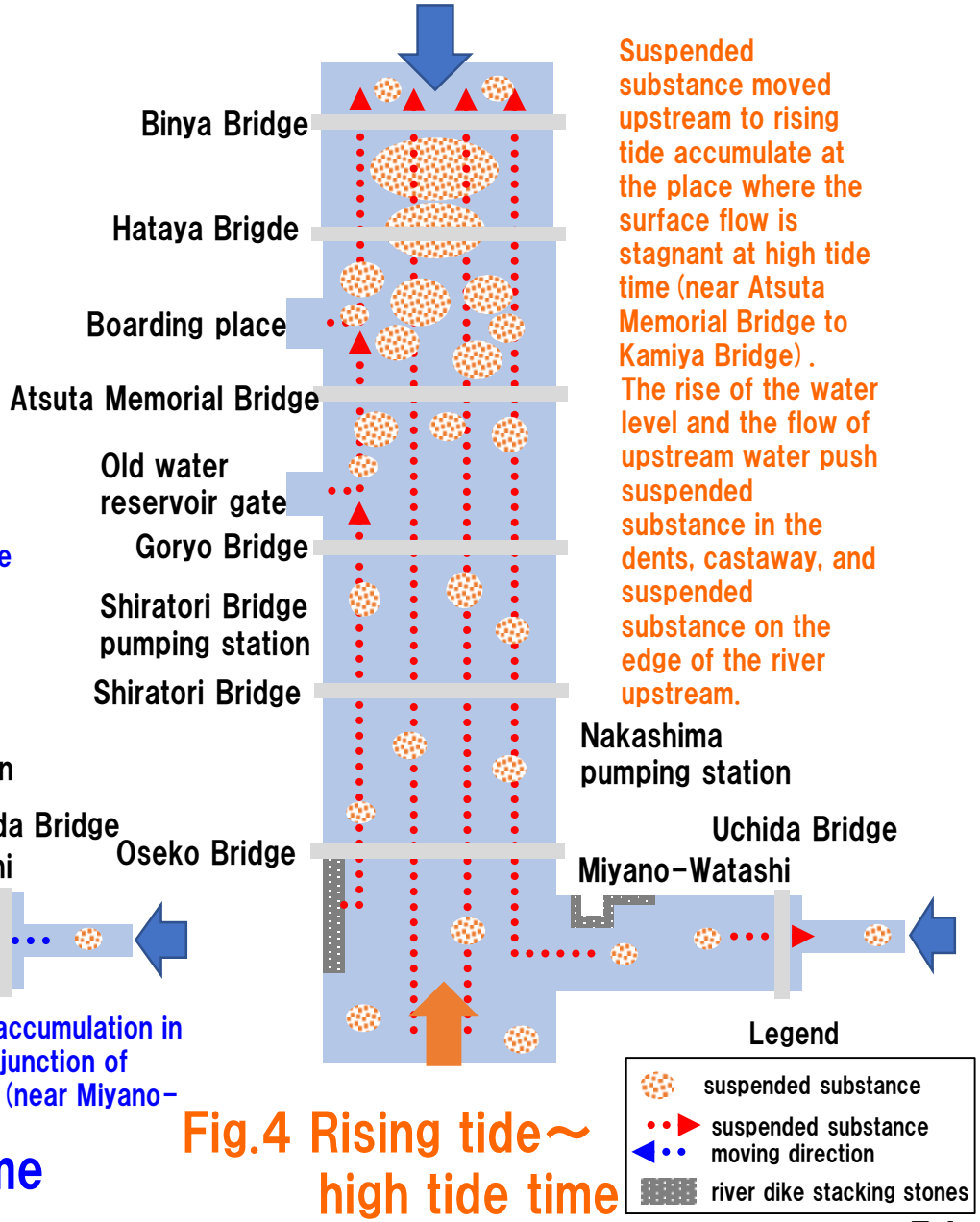


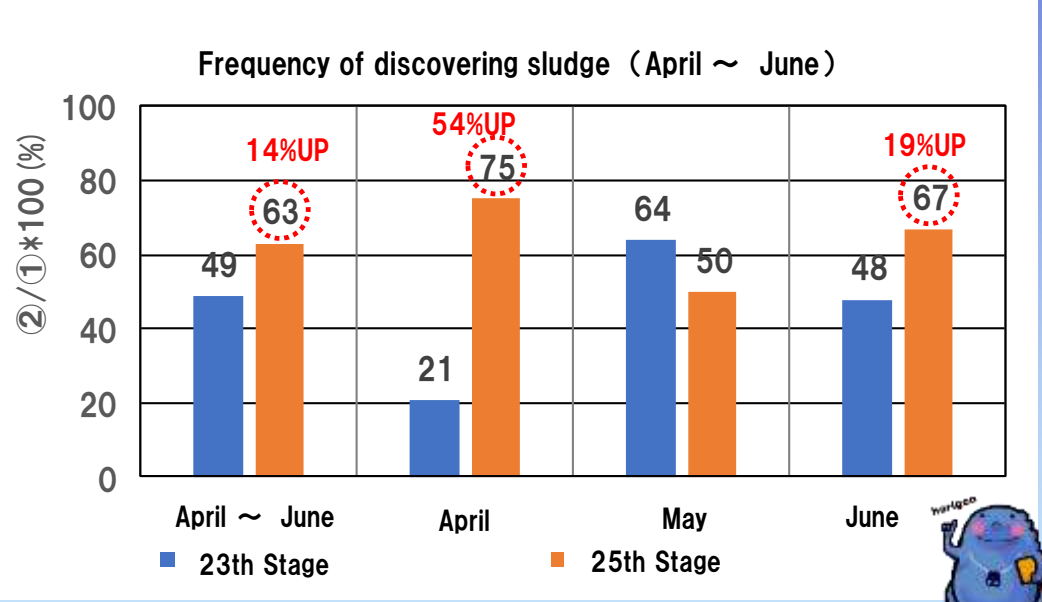

Fig.4 Rising tide～high tide time

# 5.4. Shin-Horikawa after dredging of sludge

■Area
Shin-Horikawa between Maiduru bridge and Mukoda bridge
■Data
Before dredging：23th Stage (April～June,2018) 65 Data
After dredging：25th Stage( April～June,2019) 63 Data

## Frequency of discovering sludge

①Number of survey ②Number of survey which sludge was discovered




It become clear due to civil survey that at upstream of river which water resourse is limited and substitution of water is few, organic substance and contaminant ** flow out during rainfall and sludge based on these things have great effect on impact of water stain.
Further investigation is necessary because survey at 25th stage is the survey immediately after dredging.

(hypothesis)
The reason of increase of frequency of discovering sludge

■The reason of increase on April
Dredging soften mud in the bottom of river.
Therefore, the mud became easy to rise up.

■ The reason of increase on June
The mud rolled up due to dreadging piled up and the algae breeded on the mud. Then, it is discovered that the algae was separated and floating.
Also, the floating sludge from the bottom of river was discovered. A lot of these sludge was staying in the water long time. This phenomenon is considered due to tide and weather condition.
It is considered that these factors caused increase of frequency of discovering sludge

**Contaminant :Small trush in sewage

# Why is the impression of clearness not Good all year round?

（hypothesis）

Mechanism of contamination in the upstream area of Shin-Horirawa River

Impression of clearness in Shin-Horikawa River is not good all year round. Because river bottom of Shin-Horikawa River is low to upstream from downstream, it is thought that the bottom water in the lower layer is always stagnant, and it is difficult for the water to be replaced. For this reason, the upstream area where effluent water from water treatment center and suspended substance associated from rain water by combined sewer system is an environment that tends to settle and accumulate on bottom river. And it is thought that poor oxygenation of water and mud of bottom is advanced. In the area, it is considered that a large amount of sulfide is generated, causing milky and bad smell, and it is a factor that deteriorates impression of clearness.

Bad smell occurrence
（smell of the rotten egg）

Hydrogen sulfide
($H_2S$)

**Milky**
**＝Blue white**

Sulfied（mostly $H_2S$,$HS^-$）reacts with $O_2$ &$CO_2$ to colloid formation sulfide

$2H_2S+O_2 \rightarrow 2S+2H_2O$
$2H_2S+CO_2+Sun \rightarrow CH_2O+2S+2H_2O$

Diffusion

Dissolved substance
(including organic substance)

Suspended substance
(including organic substance)

Sinking

Fresh water
(Warm all year round)

- Effluent water from water treatment center
- Rain water by combined sewer system

A flow occurs that lifts the bottom layer sea water to the face
→Sea water and fresh water mix
- Flocculation…suspending
- Oxidation of sulfide…milky

Sea water

Floating mud with many organic substances
→Sludge generation

Sea water

Deposited in the mud and water
Sulfied（$H_2S$, $HS^-$etc）

Consumption of oxygen accompanying decomposition of organic substance, etc. and colloid formation of sulfide.

Poor oxygenation of water and mud of bottom

Sea water

$SO_4^{2-}$
(Including Sulfate ion)

Sulfate reducing bacteria
（mostly in mud）
＊bacteria that like environment without oxygen

Sulfate reducing bacterium produce hydrogen sulfide（$H_2S$）etc. ,with organic substance decomposed and sulfate ion（$SO_4^{2-}$ ）reduced.

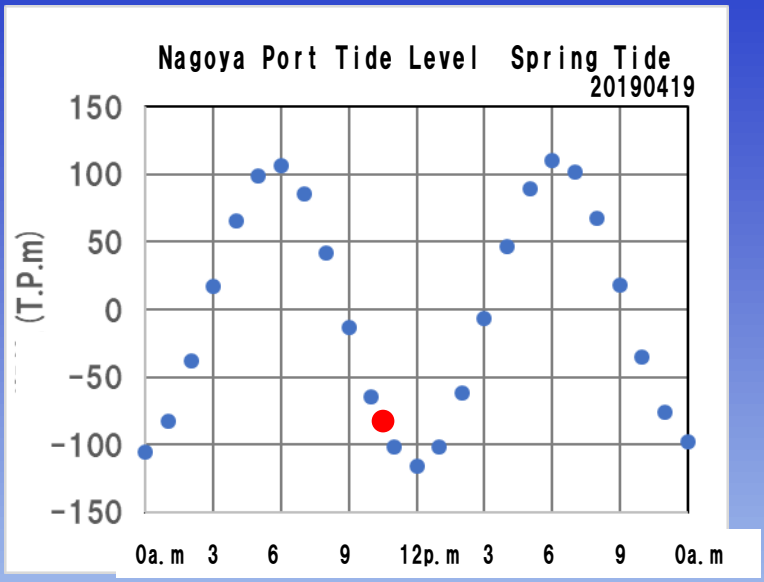
$SO_4^{2-}$＋Organic Substance→$S^{2-}$＋$H_2O$＋$CO_2$
$S^{2-}$＋$H^+$→$HS^-$　　$HS^-$＋$H^+$→$H_2S$

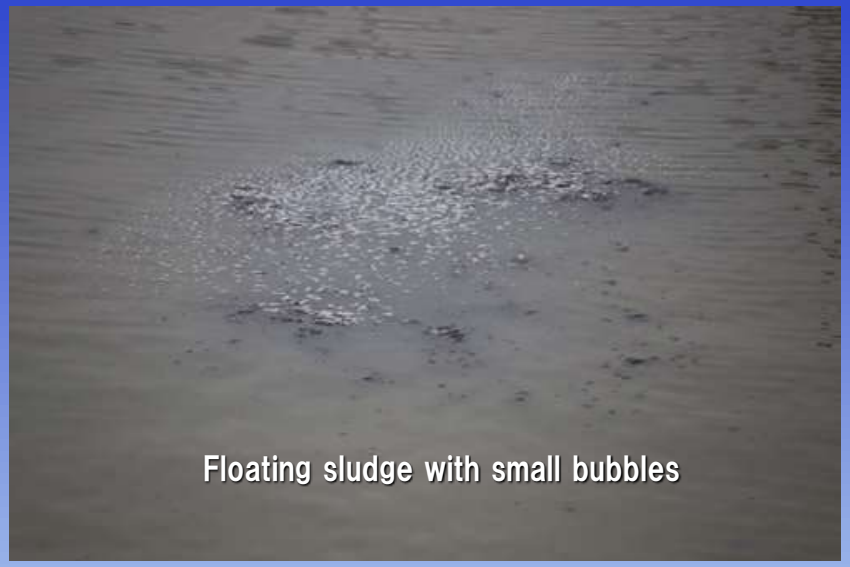
(Properties of hydrogen sulfide)
- Heaviar than air
- Specific gravity 1.1905
- Colorless, water soluble
- mild acidity

# Shin-Horikawa River Upstream area After taking away Sludge Citizens Survey (some part)

## April 19th ,2019

Survey Group：Water Research Institute survey group、eco doko cheer group
Taiyu Kensetsu survey group、Kokawasemi srvey group



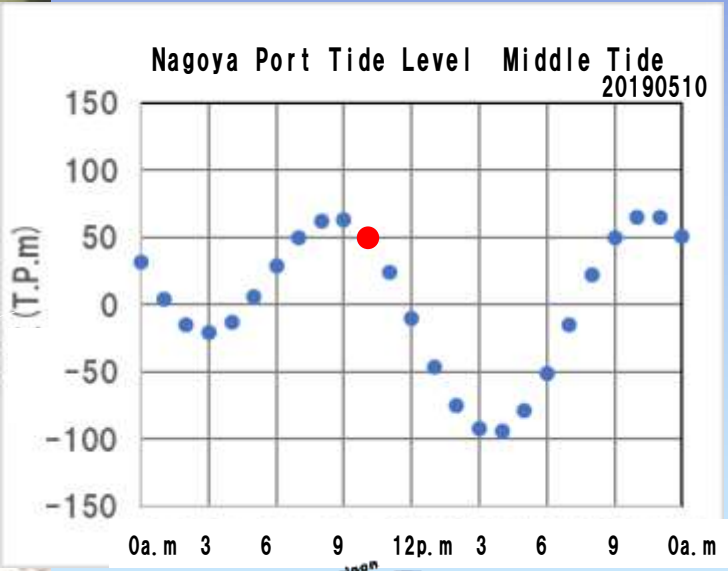


# May 10th ,2019

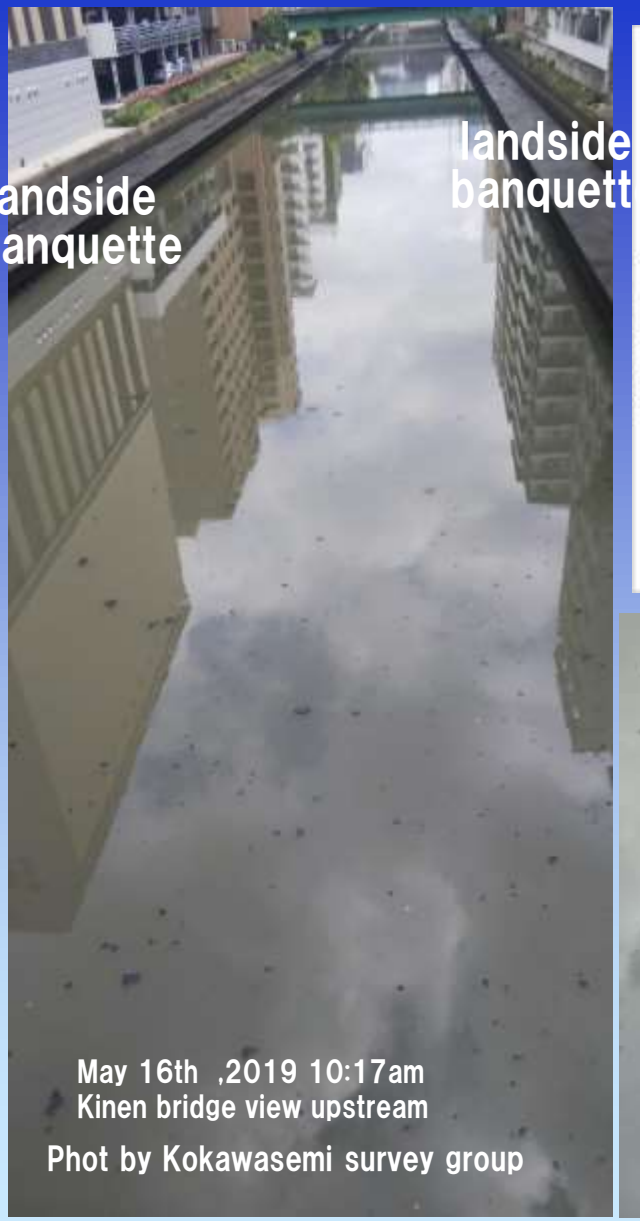


River flow speed was getting fast. Near the bridge, 1/3 of the left bank was milk white without flowing. Also 1/3 of the right bank had no flow too. Only middle part could flow. It looked like shape V. 2/3 of the right bank had a darker color than left and smell is not good.

Report by Kokawasemi survey group

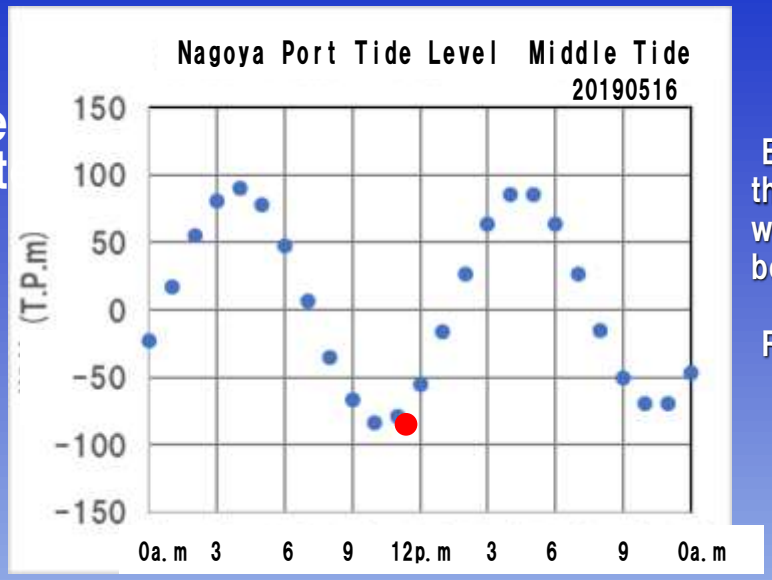



# May 16th ,2019



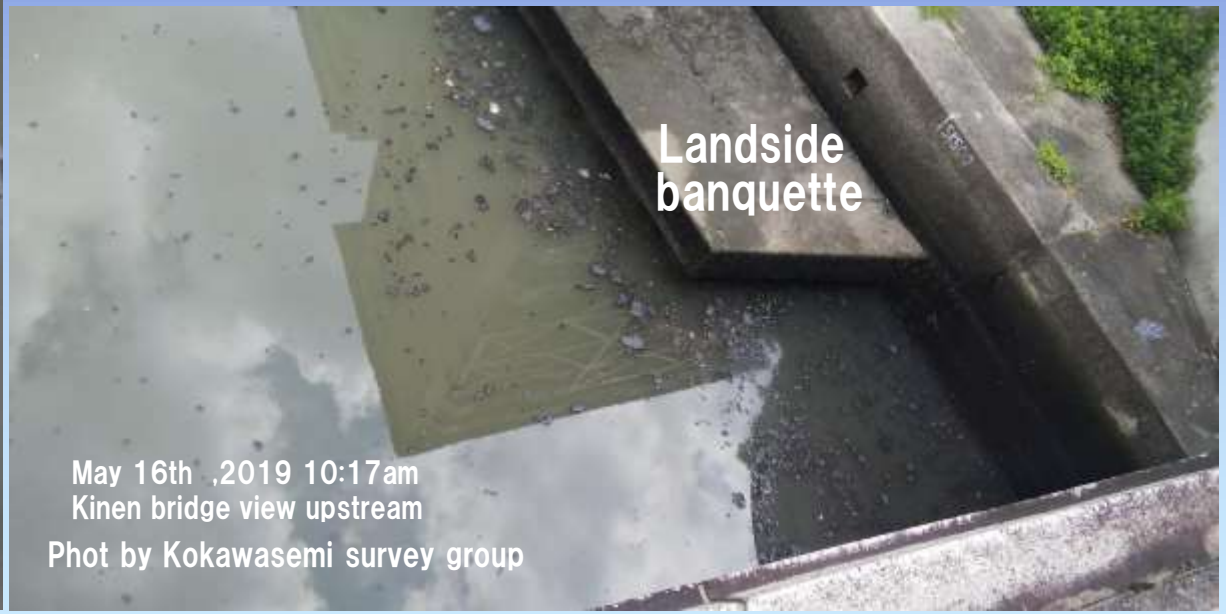

May 16th ,2019 10:17am
Kinen bridge view upstream

Phot by Kokawasemi survey group




Big and small bubbles were more than usual so we could see them whole of the river. We felt not good because sludgs wrer big and whole.

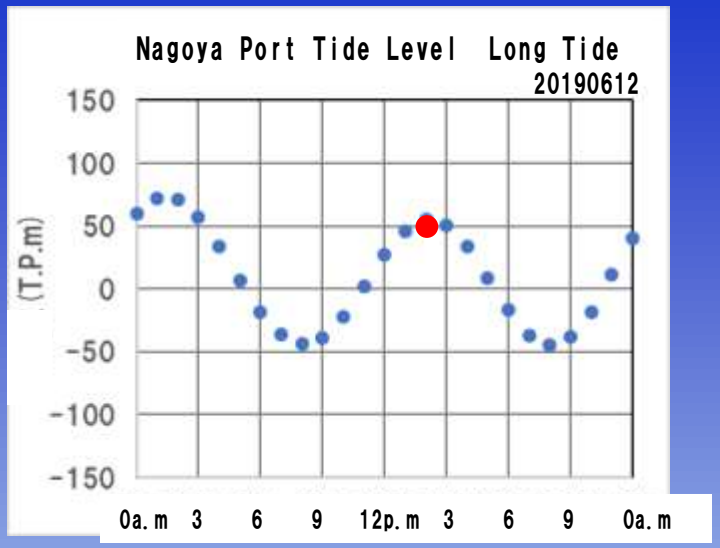
Report by Kokawasemi survey group

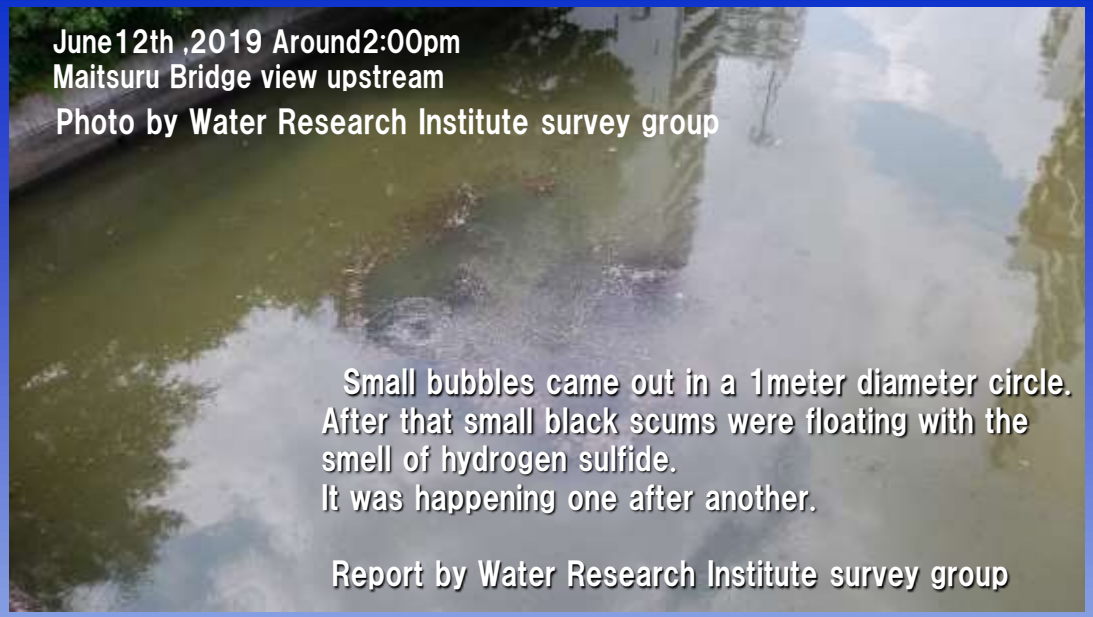




May 16th ,2019 10:17am
Kinen bridge view upstream

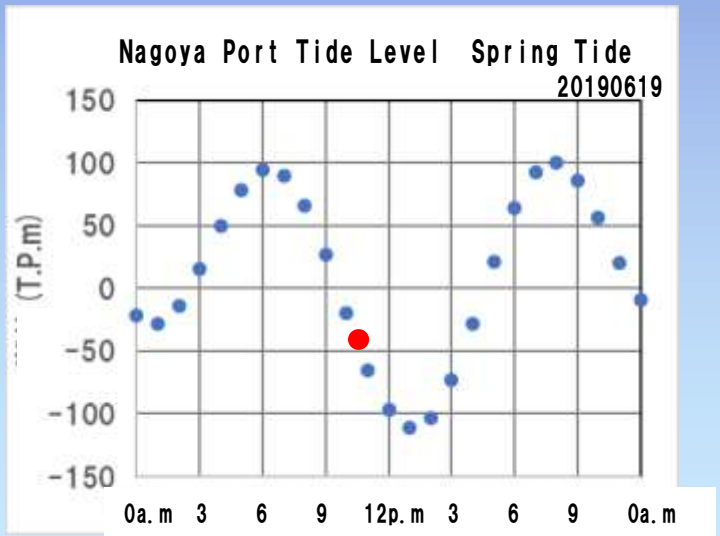
Phot by Kokawasemi survey group

## June 12th,2019




## June 19th,2019

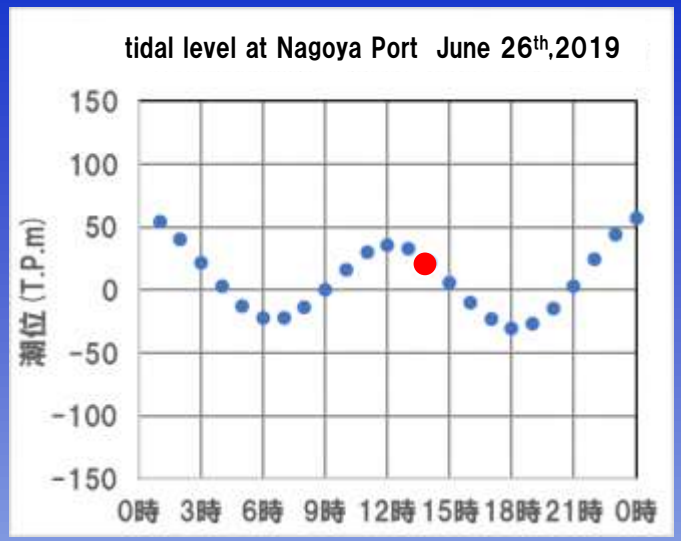






**Green algaes in a mat shape were floating. We thought they grew at the landside banquette and peeled off.**

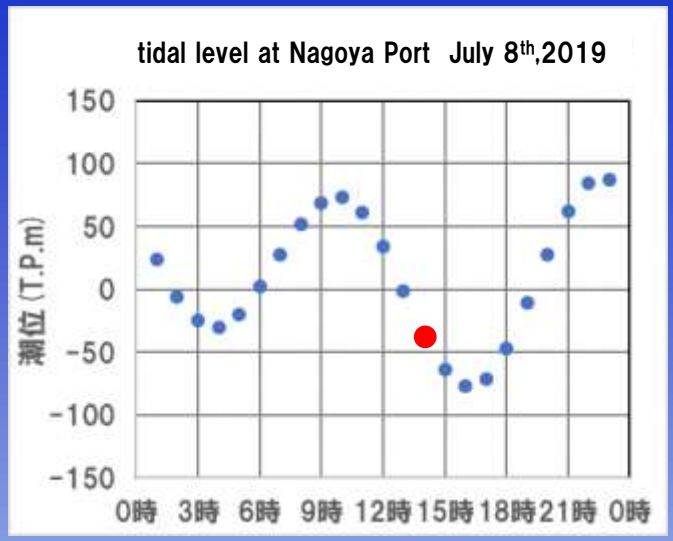
## June 26th, 2019




There were scum both which came to the surface from the bottom and which came off from berg of revetment.
Water depth was 4.9m and **Do was measured from the surface to 2m deep**.
report : Water issue research institute survey group


photo :
Water issue research institute survey group

## July 8th, 2019

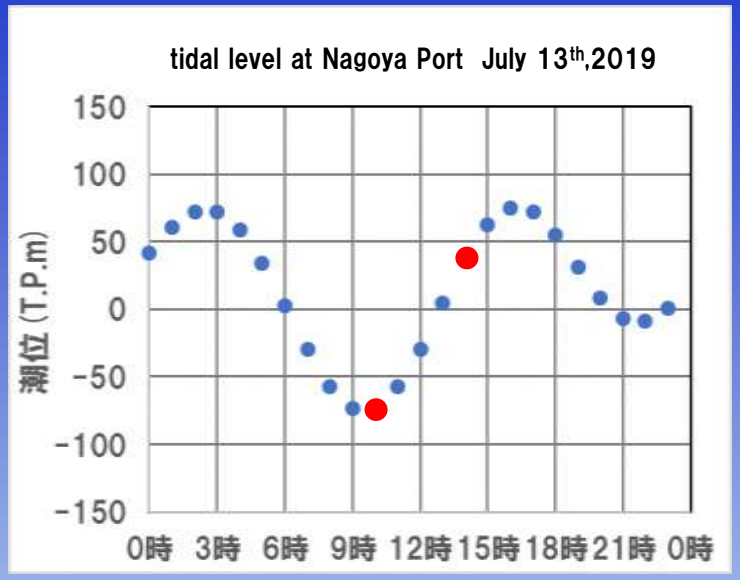



Scum was on the left side of the bank on July 5th, then moved to the center of the river on July 8th. It might be affected by the flow and wind.
report : Water issue research institute survey group


photo : Water issue research institute survey group

photo : Water issue research institute survey group

# July 13th , 2019



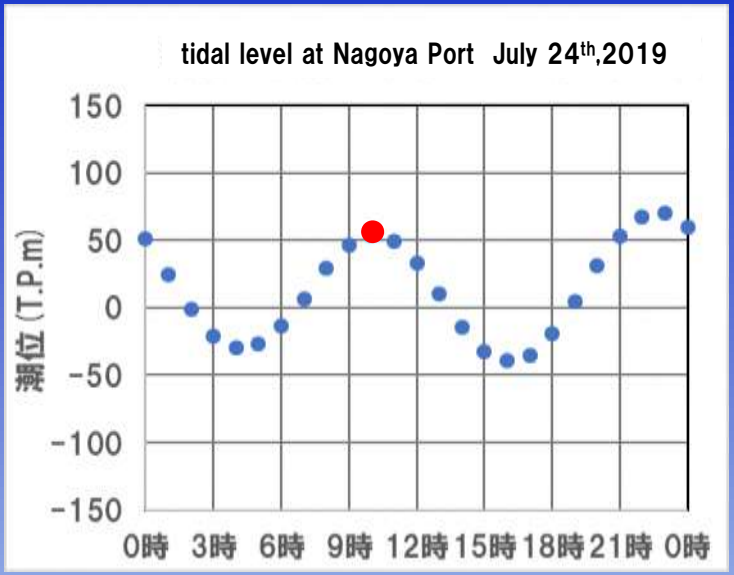




A lot of scum make us depressed. We want to find out a difference between place scum occurs and place scum never occur. We also want to know relation between occurrence of scum and water color.

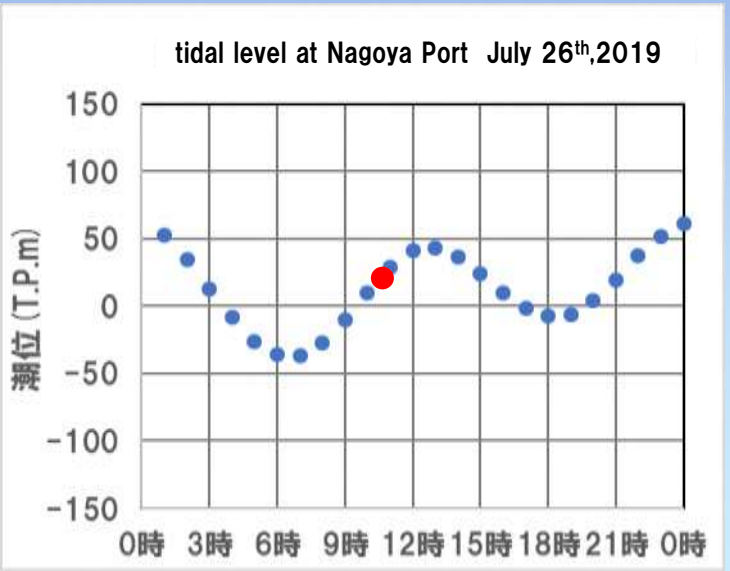
report : eco doco cheering group


## July 24th, 2019





## July 26th, 2019




# Bubbles are produced by sailing ship

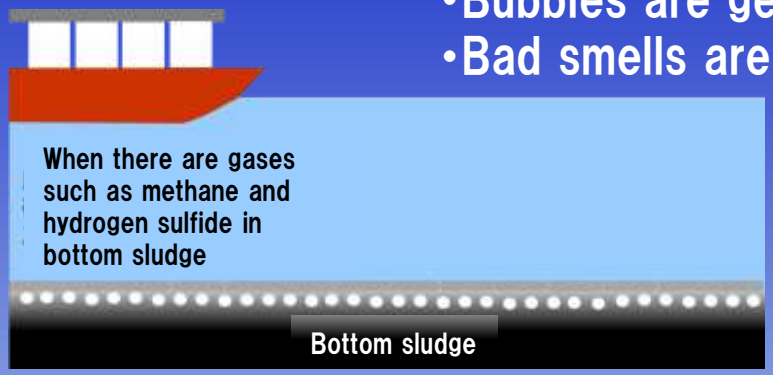
## After a ship passed, the produced bubbles are easy to be left on the surface of the water

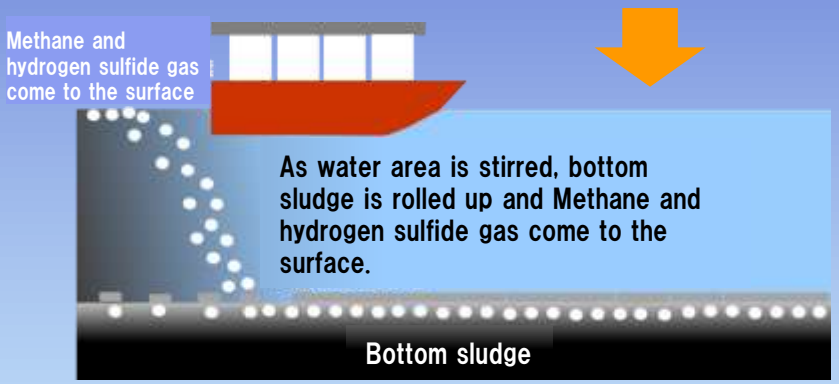


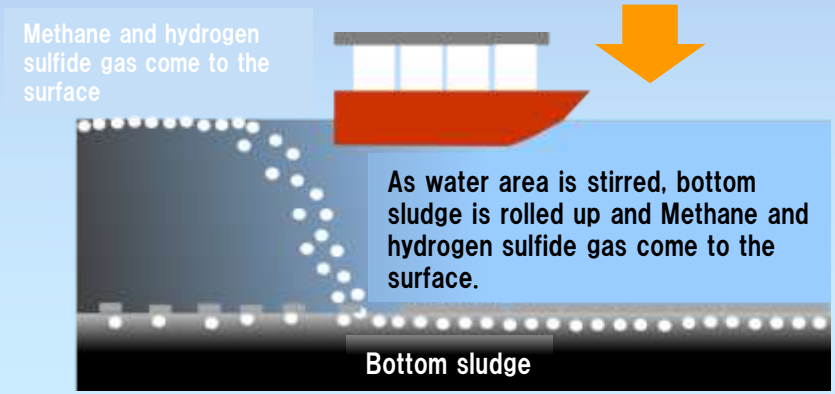
「第24ステージ と同様」を訳しましたが
何について同様なのか(同じデータを再
起きている現象が同じなのかデータの再

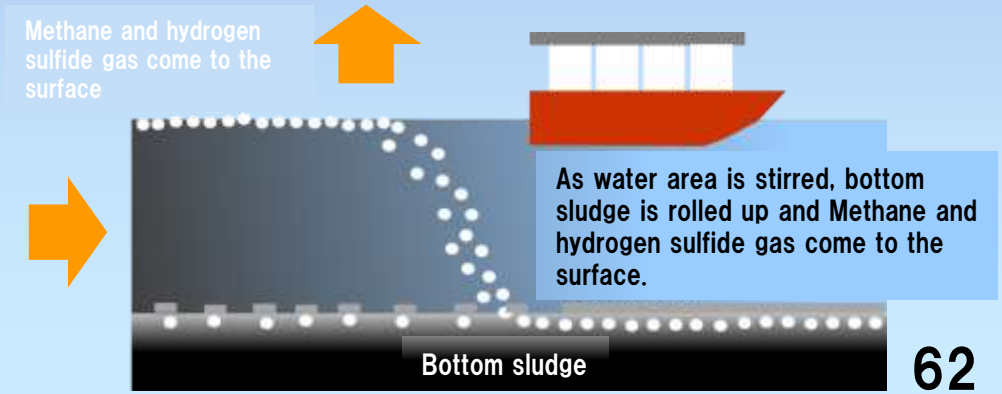
same condition などと補記が必要かと思

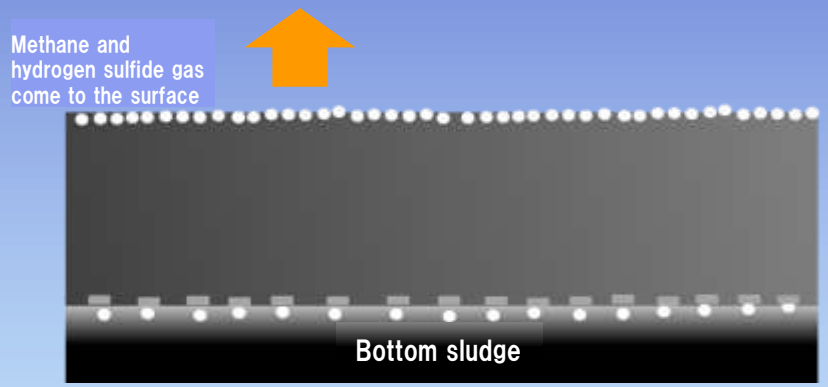
*9th investigation
(same as 24th stage)

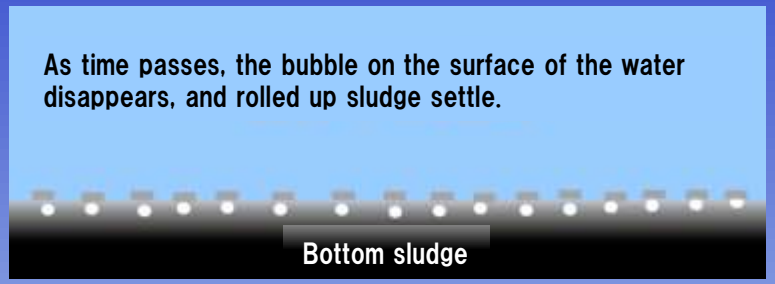












# When a ship is sailed temporary・・・

- ・Sludge is rolled up
- ・Bubbles are generated
- ・Bad smells are generated（the rotten egg smell, mud smell)

When there are gases such as methane and hydrogen sulfide in bottom sludge

Methane and hydrogen sulfide gas come to the surface

As water area is stirred, bottom sludge is rolled up and Methane and hydrogen sulfide gas come to the surface.

Methane and hydrogen sulfide gas come to the surface

As water area is stirred, bottom sludge is rolled up and Methane and hydrogen sulfide gas come to the surface.

Methane and hydrogen sulfide gas come to the surface

As water area is stirred, bottom sludge is rolled up and Methane and hydrogen sulfide gas come to the surface.

Methane and hydrogen sulfide gas come to the surface

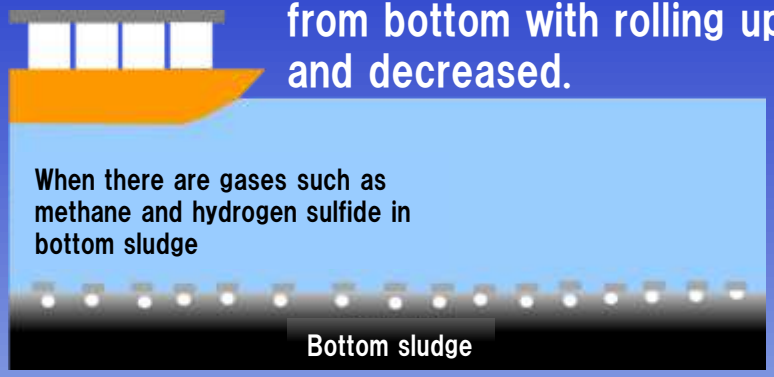
As time passes, the bubble on the surface of the water disappears, and rolled up sludge settle.

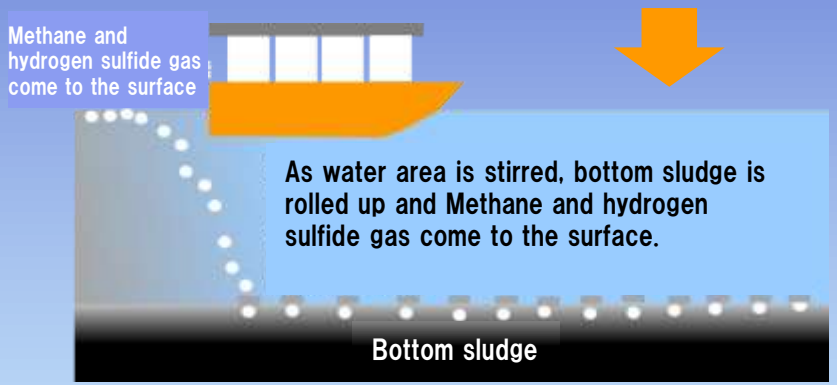
# When a ship is sailed regularly

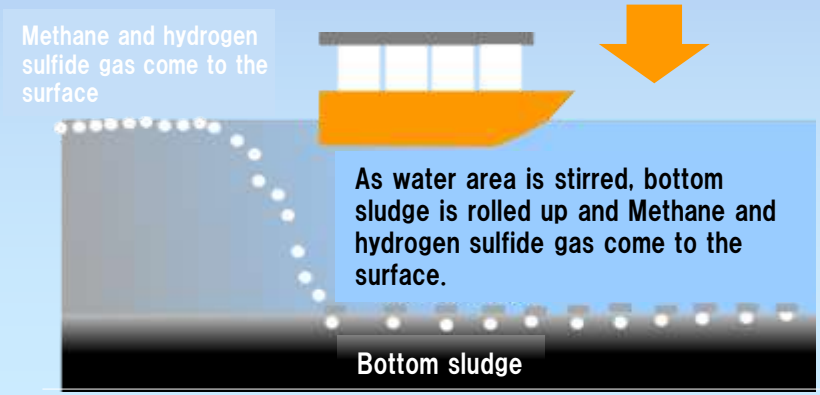
Gases such as methane gas and hydrogen sulfide gas are released from bottom with rolling up of sludge, and decreased.

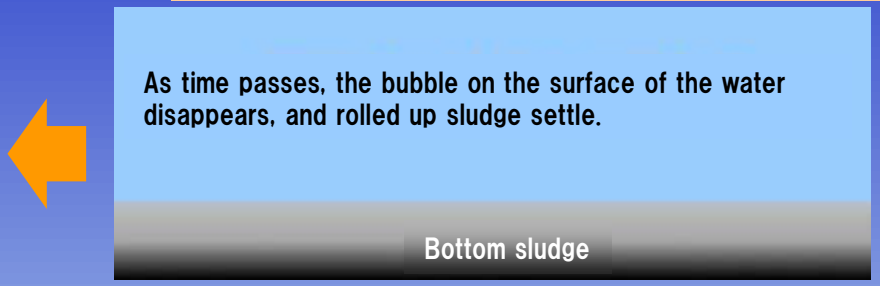
**When long-term regular ship's sailing is realized ••••**

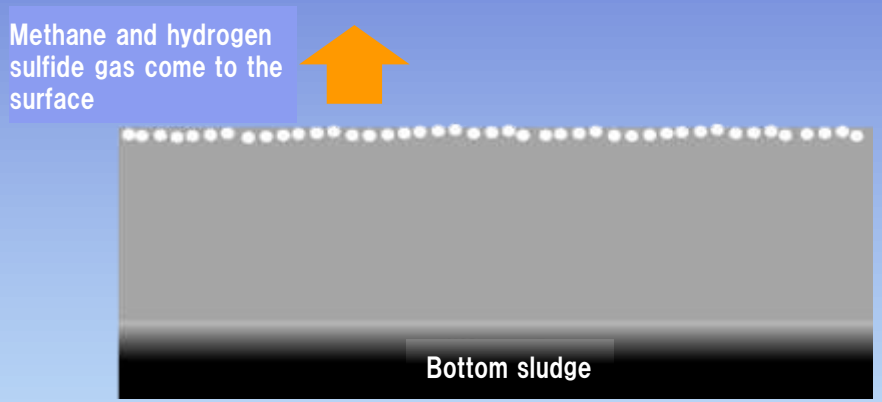
As water area is stirred regularly. oxygen continues being supplied to the bottom of the river. In this way, the state of the bottom of the river is improved little by little (control accumulation of sludge), and we think that water quality will be improved more.

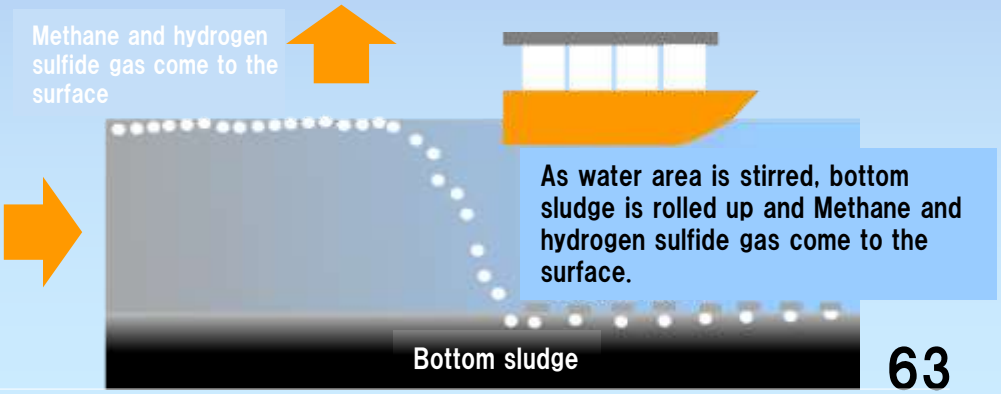


# from secretariat

■ Every data you offer to us is valuable

Information about subtle change you find when you survey Horikawa river can be valuable data to understand the present situation of the river. We're looking forward to your data from now on.

■ Let us introduce your activity

Your activity, such as survey, think and cheer up Horikawa, is the motivation to increase the number of those who love Horikawa, Nagoya City and the Earth.

■ Let's hand down the past appearance of Horikawa as record

To know about the past Horikawa is very important to design the future Horikawa.

We refer Horikawa's pictyures taken in Taisho and Showa era to know forgotten past Horikawa. Do you keep photos which Horikawa was photographed in in your album? For example, photo of your family with Horikawa in the background of the picture is Okay.

(contact) secretariat

e-mail:2010@horikawa1000nin.jp

Please send comments and pictures (with date and place) from mobile phone or PC.

＊We think image quality of picture taken by mobile phone camera is enough.