

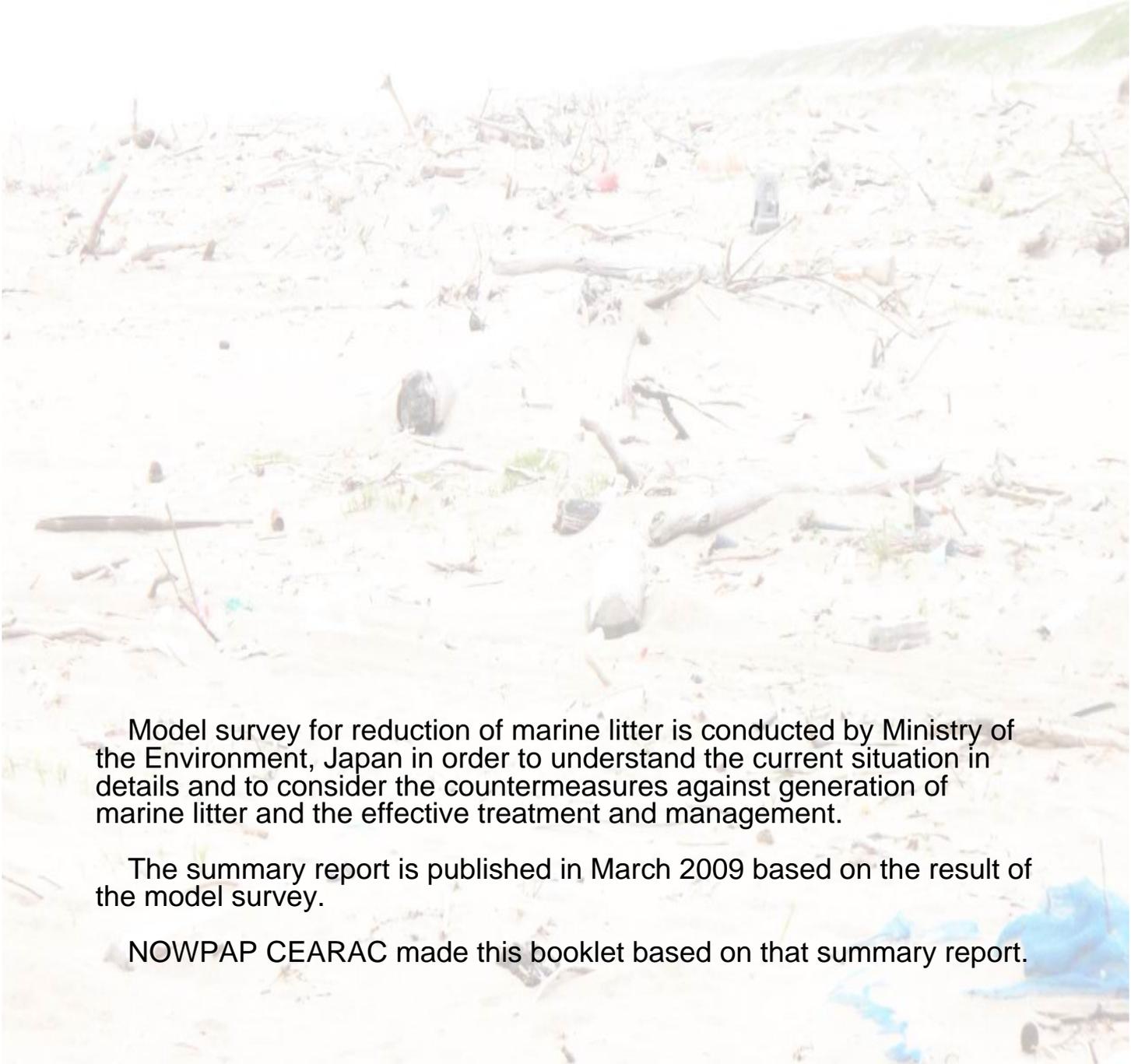
Model Survey for Reduction of Marine Litter Summary

Current State of Marine Litter
in the Model Areas and
Appropriate Countermeasures



March 2009

Global Environment Bureau,
Ministry of the Environment,
The Government of Japan



Model survey for reduction of marine litter is conducted by Ministry of the Environment, Japan in order to understand the current situation in details and to consider the countermeasures against generation of marine litter and the effective treatment and management.

The summary report is published in March 2009 based on the result of the model survey.

NOWPAP CEARAC made this booklet based on that summary report.

Table of Contents

1. Model Survey Background

- 1.1 Problems with marine litter
- 1.2 Existing legal system concerning the disposal of marine litter
- 1.3 Role of people involved in the disposal of marine litter
- 1.4 Outline of model survey of measures to reduce marine litter in Japan
- 1.5 Model areas (11 seacoasts in seven prefectures)

2. Actual Situation of Marine Litter

- 2.1 Percentage of marine litter by country (by model area)
- 2.2 Percentage of marine litter by material (by model area)
- 2.3 Ranking of marine litter by type (in all the model areas)
- 2.4 Seasonal fluctuations in quantities of marine litter
- 2.5 Effective collection period considering seasonal fluctuations in the amount of marine litter
- 2.6 Annual amount of marine litter (by model area)
- 2.7 Estimation of the annual collection and disposal costs of marine litter
- 2.8 Collection and disposal methods of marine litter
- 2.9 Findings concerning the source of marine litter (Example of Ise Bay)
- 2.10 Systematic classification of preventive measures against marine litter according to type

3. Appropriate Countermeasures against Marine Litter

- 3.1 Actual situation of cleaning activities and problems
- 3.2 Course of action to be taken for cleaning activities
- 3.3 System where people can work together
- 3.4 Course of action to be taken for establishing a system in each model area
- 3.5 Current situation of countermeasures against marine litter and challenges
- 3.6 Course of action for preventing the generation of marine litter
- 3.7 Efforts to prevent marine litter from abroad
- 3.8 Recommendations for preventive measures against marine litter

1. Model Survey Background

1.1 Problems with marine litter

- Because **a large number of people litters**, it is difficult to claim their responsibility.
- **Sources spread across a wide area** such as upper river basin and abroad.
- In many cases, **the areas marine litter generated and drifted are different**.
- Many different types of litter are discharged in large quantities. It is difficult to **subsidize the expense of litter disposal**. So, litter cannot be sufficiently collected or disposed of.
- Since litter drifts even to inaccessible rocky beaches, it is often **difficult to collect**.
- **Marine litter is hardly recognized as an environmental problem** because it neither causes serious, direct damage to the health nor catches the public eye.



1. Model Survey Background

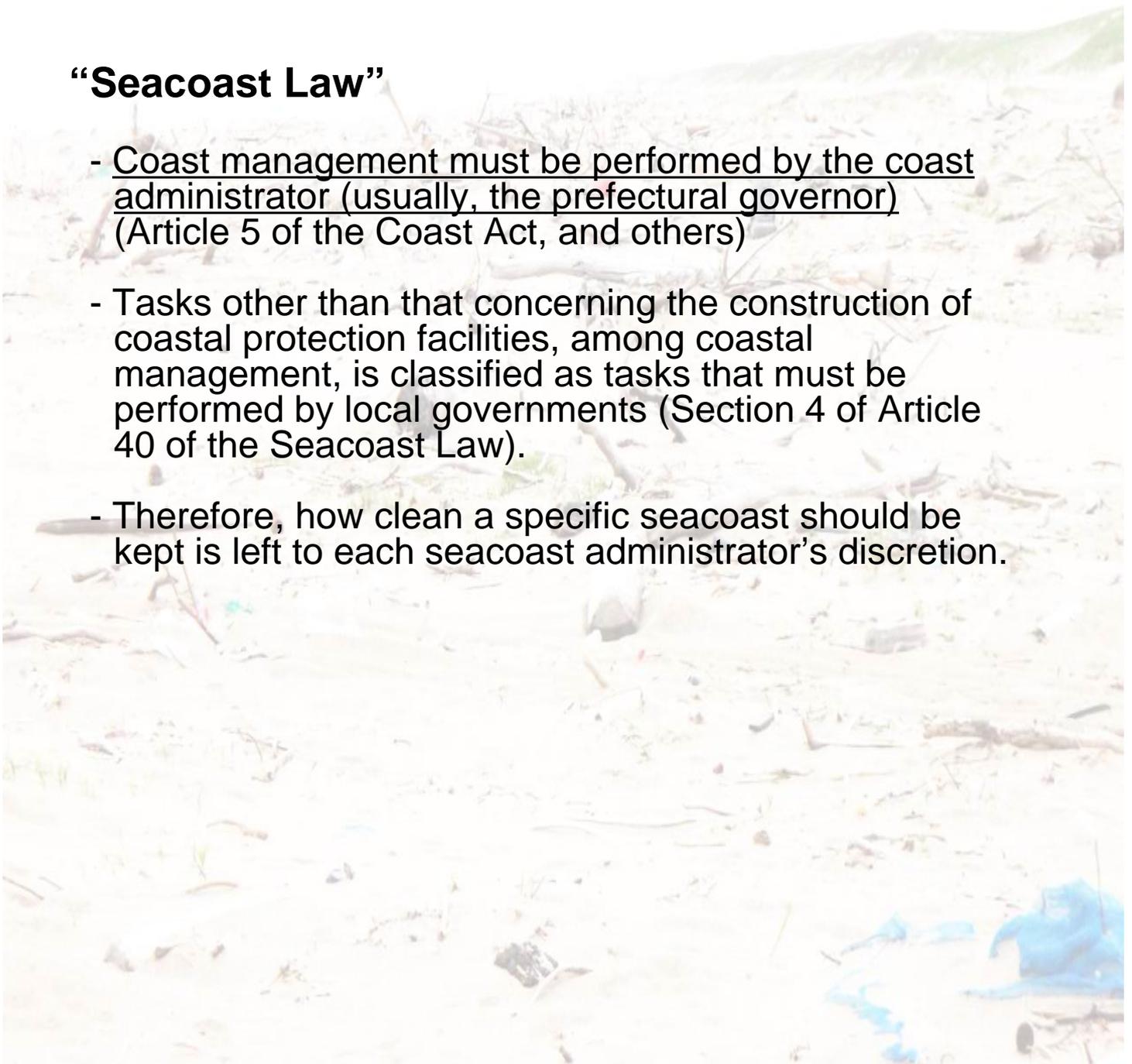
1.2 Existing legal system concerning the disposal of marine litter

“Waste Disposal and Public Cleansing Law”

- The occupant of land or a building (the administrator in the absence of the occupant) must try to keep the land or building clean. (Section 1 of Article 5 of the Waste Disposal and Public Cleaning Law)

“Seacoast Law”

- Coast management must be performed by the coast administrator (usually, the prefectural governor) (Article 5 of the Coast Act, and others)
- Tasks other than that concerning the construction of coastal protection facilities, among coastal management, is classified as tasks that must be performed by local governments (Section 4 of Article 40 of the Seacoast Law).
- Therefore, how clean a specific seacoast should be kept is left to each seacoast administrator’s discretion.



1. Model Survey Background

1.3 Role of people involved in the disposal of marine litter

<Summary of High-level Inter ministry Meeting on Marine Litter (March 2007)>

1. Countermeasures against marine litter

- For marine litter, although the administrator of public property such as beaches is not the person who litters, the administrator must try to keep public property clean, and is responsible for the handling of marine litter.
- However, when marine litter that cannot be handled only by the administrator of public property in terms of quality and quantity drifts onto beaches, the municipal government may be compelled to collect and dispose of marine litter.
- Some prefectures subsidize municipal governments, but they may not have taken sufficient measures against marine litter.

2. Toward the solution which field truly requires

- It is most effective, as a tentative measure, to promote establishment of a system where local stakeholders can work together.

1. Model Survey Background

1.4 Outline of model survey of measures to reduce marine litter in Japan

Outline of model survey

The following activities are mainly performed in the model areas on 11 seacoasts of seven prefectures:

- (1) Conducting detailed analyses of the types and quantity of marine litter
- (2) Cleaning the seacoast by local residents
- (3) Considering the countermeasures against marine litter with local people and organizations concerned (including prefectures, seacoast administrators, local governments, local NPOs, residents' associations, fishermen's cooperatives, and academic experts)



Cleaning and analysis by human labor



Cleaning by heavy machinery

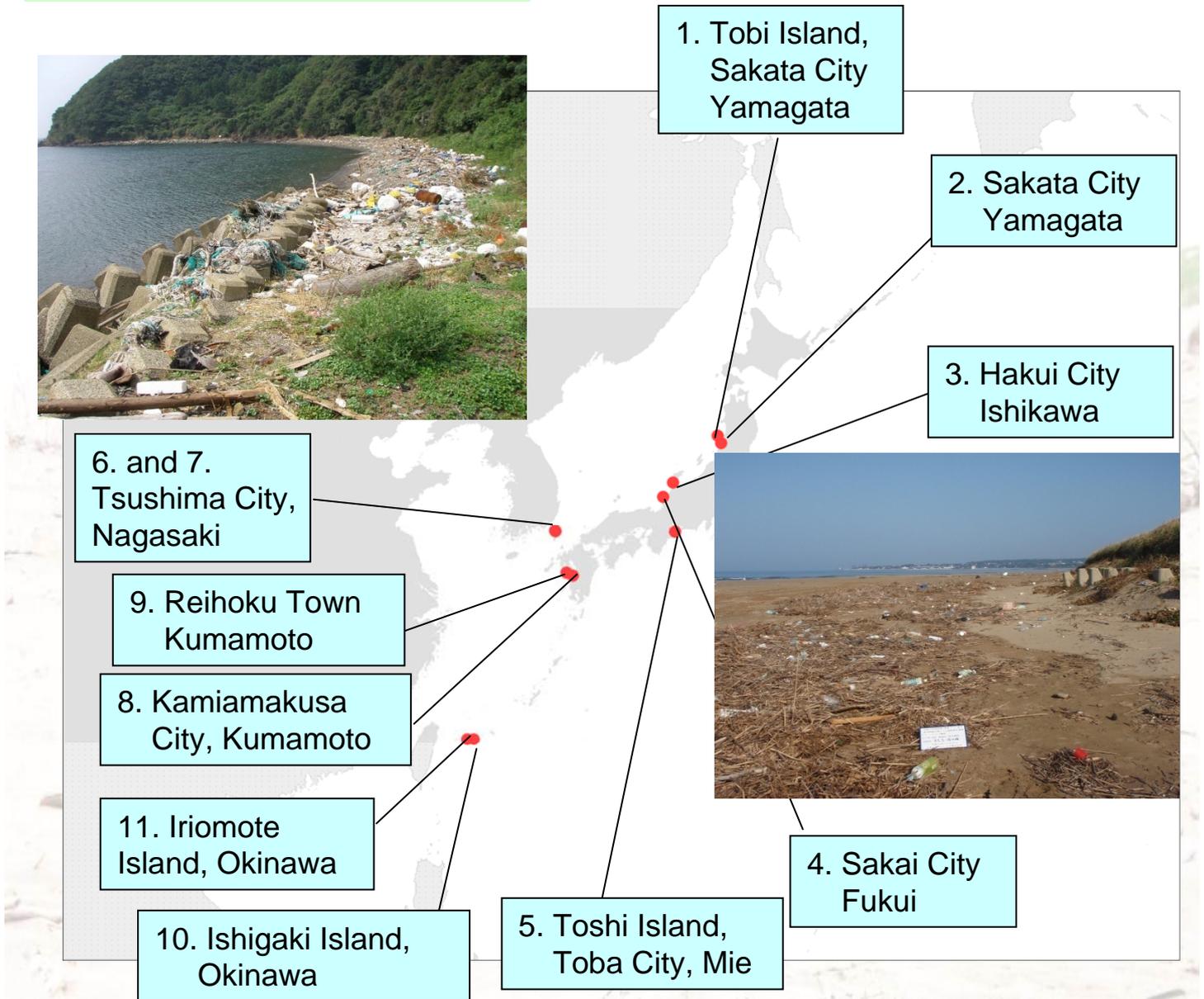
Expected results

- (1) Determination of the actual situation of marine litter (Estimation of the quantity and source).
- (2) Establishment of an efficient and effective marine litter collection and disposal method according to the actual local situation.
- (3) Examination of what the appropriate measures against marine litter should be, according to the actual local situation, and establishment of a system where local stakeholders can work together.

1. Model Survey Background

1.5 Model areas (11 seacoasts in seven prefectures)

Model survey areas



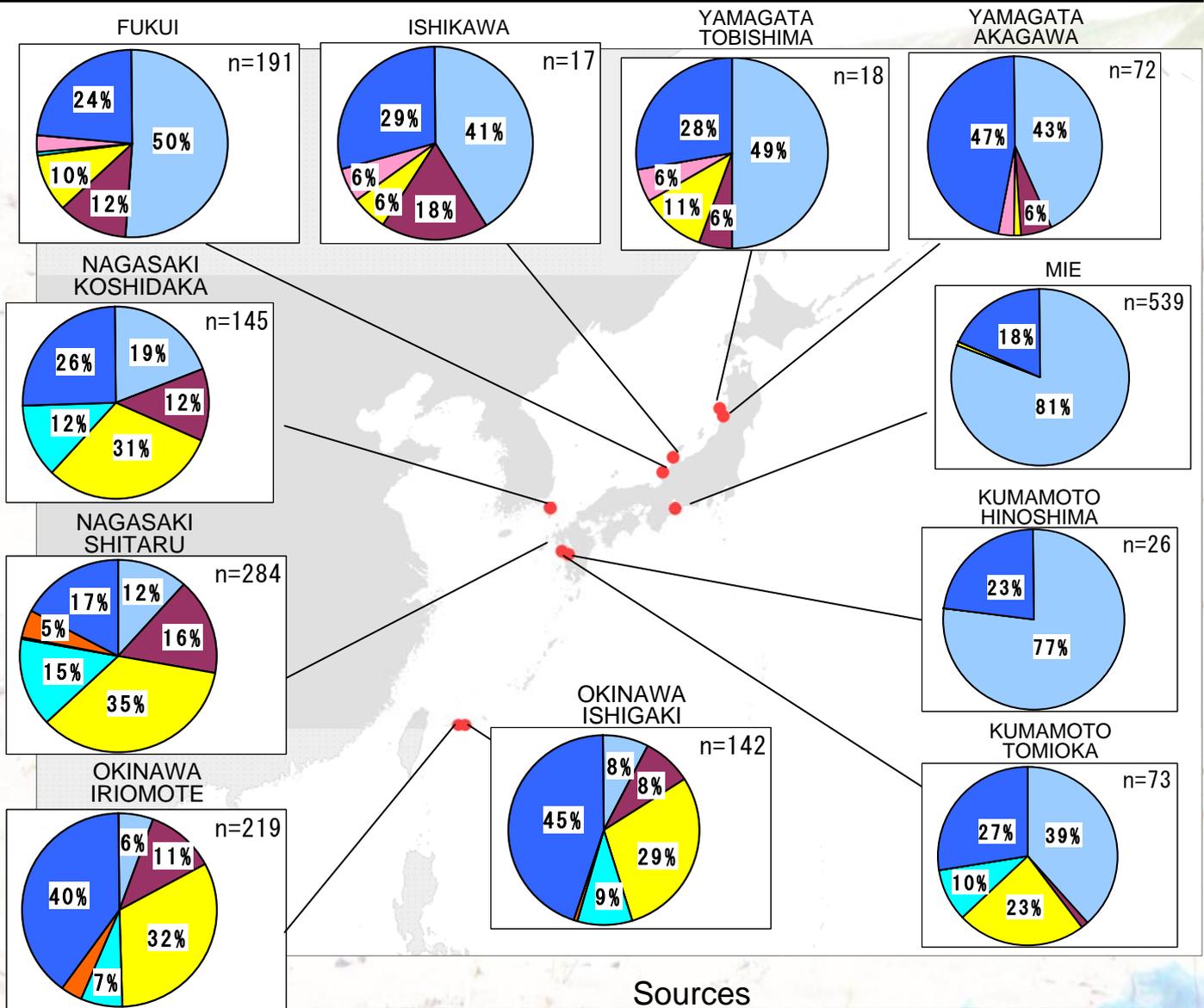
*Survey period: For one year from October 2007 to September 2008

2. Actual Situation of Marine Litter

2.1 Percentage of marine litter by country (by model area)

◆ Percentage of PET bottles by country

- Most of the PET bottles found in Yamagata, Ishikawa, Fukui, and Kumamoto (Tomioka Beach) Prefectures were from Japan, which account for approximately half of the total number.
- Almost 100% of the PET bottles found on Toshi Island of Mie Prefecture (located at the mouth of Ise Bay) and in Hinoshima of Kumamoto Prefecture were from Japan.
- Most of the PET bottles found in Tsushima, on Ishigaki Island, and on Iriomote Island were from abroad.

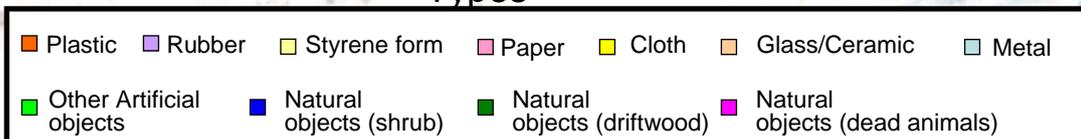
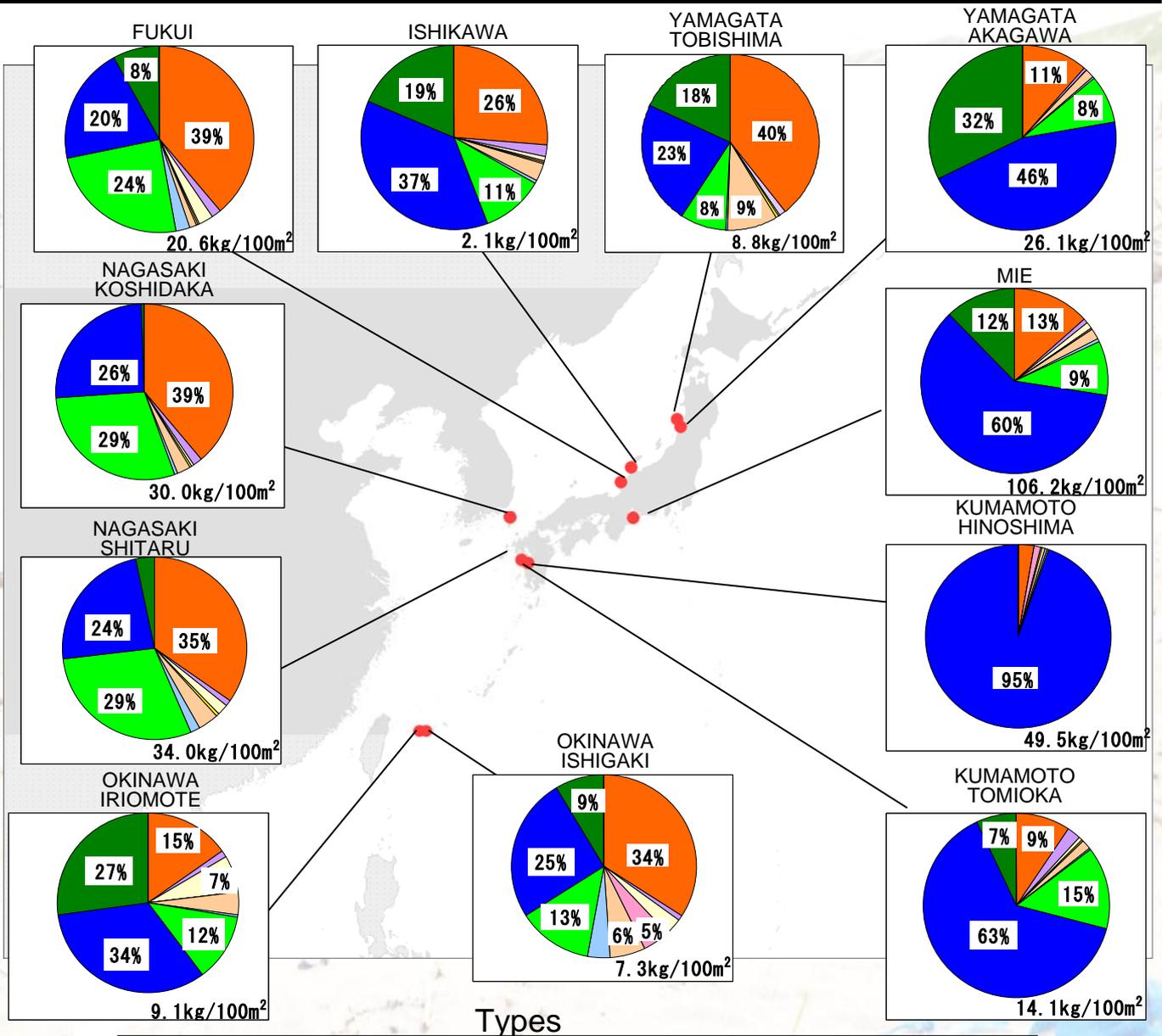


2. Actual Situation of Marine Litter

2.2 Percentage of marine litter by material (by model area)

◆ Weight percentage of marine litter by material

- Plastics account for 30 to 40% of the total marine litter on northeast part of NOWPAP sea area side.
- Many natural objects such as driftwood and shrubs are found in Yamagata (at the mouth of the Aka River), Mie, and Kumamoto Prefectures, accounting for 70 to 90%.
- Many different types of waste such as plastics, foamed polystyrene, glass, driftwood are found in Okinawa Prefecture.



2. Actual Situation of Marine Litter

2.3 Ranking of marine litter by type (in all the model areas)

- Household solid waste (lids, caps, food containers, straws, cigarettes, etc.) accounts for most of litter.
- Much fishery-related waste including rope, string, bobbers, and floats can be seen.
- Waste considered to be generated by business activities, such as timber, also constitutes the greater part of marine litter.

Legend			
	Household solid waste		Industrial and trade waste
	Fishery-related waste		Others

<Ranking by quantity>

Order (Quantity)	Name
1	Fragments of rigid plastics
2	Fragments of foamed polystyrene
3	Fragments of plastic sheets and bags
4	Pipes for oyster farming
5	Pieces of broken glass or ceramics
6	Rope and string
7	Lids and caps
8	Food wrappers and containers
9	Groceries
10	Bags (except for agricultural use)
11	Packing strap bands
12	Straws and cocktail stirrers
13	Wood and others
14	Plastic beverage bottles
15	Bobbers, floats, and buoys
16	Creels
17	Cigarette butts and filters
18	Disposable lighters
19	Metal fragments
20	Glass beverage bottles

<Ranking by weight>

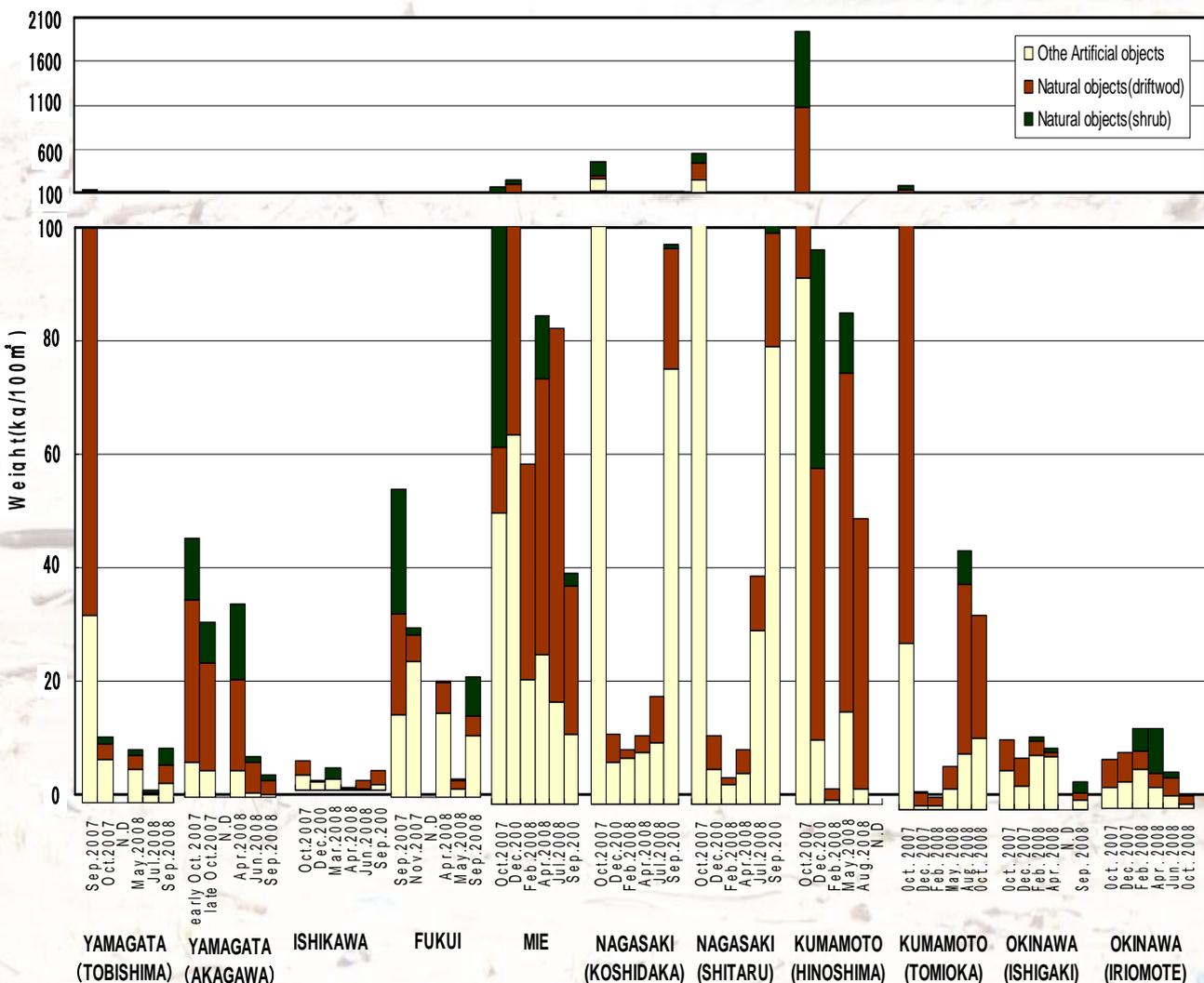
Order (Weight)	Name
1	Shrub
2	Driftwood
3	Wood and others
4	Fragments of rigid plastics
5	Rope and string
6	Groceries
7	Bobbers, floats, and buoys
8	Glass beverage bottles
9	Fishing net
10	Pieces of broken glass or ceramics
11	Plastic beverage bottles
12	Shoes and sandals
13	Fragments of plastic sheets and bags
14	Lids and caps
15	Fragments of foamed polystyrene
16	Creels
17	Floats of foamed polystyrene
18	Tires
19	Food wrappers and containers
20	Oil drums

2. Actual Situation of Marine Litter

2.4 Seasonal fluctuations in quantities of marine litter

Cumulative amount of marine litter and seasonal fluctuations

- Up to now, an extremely large amount of marine litter has accumulated in some areas such as Nagasaki and Kumamoto Prefectures, but marine litter does not necessarily accumulate in large quantities immediately after cleaning.
- Much marine litter is found in winter on the beaches facing north and west (Yamagata, Ishikawa, Fukui, and Okinawa Prefectures).
- There is much marine litter in spring and summer on the beaches facing south (Nagasaki and Kumamoto Prefectures).

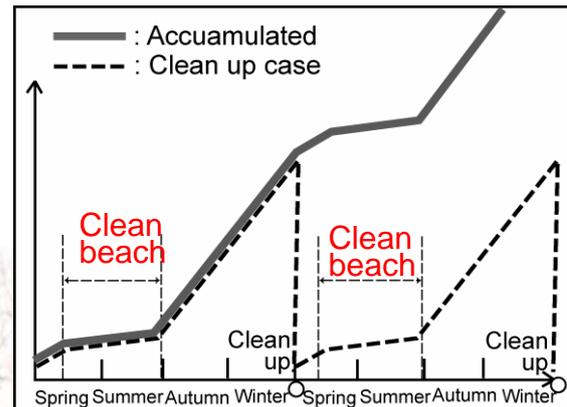
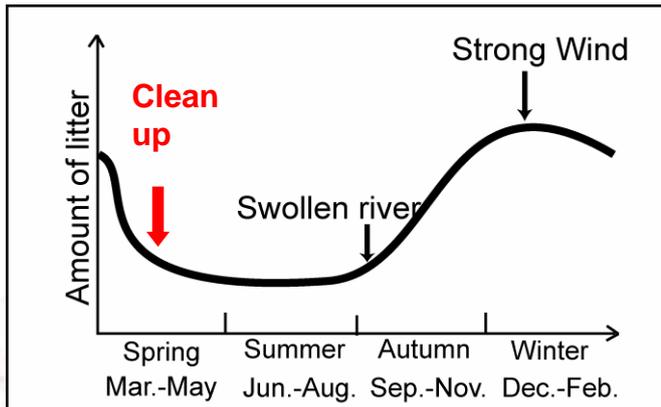


* This graph shows the density of marine litter (weight per hundred cubic meters). The total amount of marine litter on each seacoast depends on the coastline length.

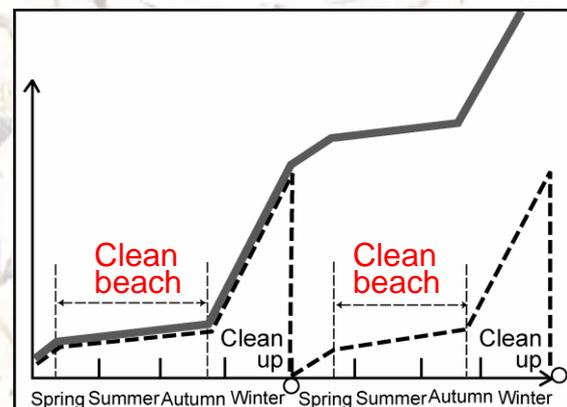
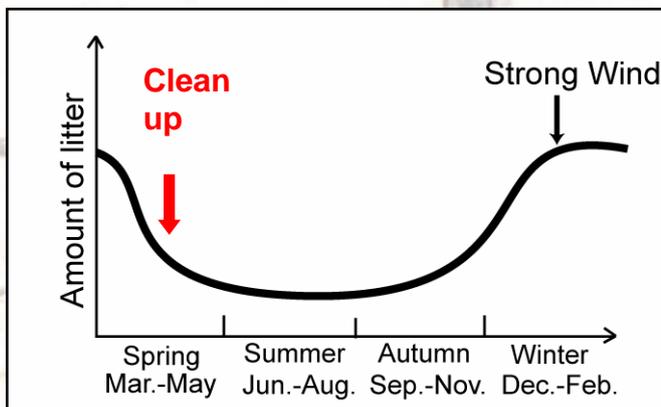
2. Actual Situation of Marine Litter

2.5 Effective collection period considering seasonal fluctuations in the amount of marine litter (1)

- ◆ (1) In the case of the seacoast of Sea of Japan (Coast facing north): Yamagata, Ishikawa, and Fukui Prefectures



- ◆ (2) In the case of the East China Sea (Coast facing north): Okinawa Prefecture

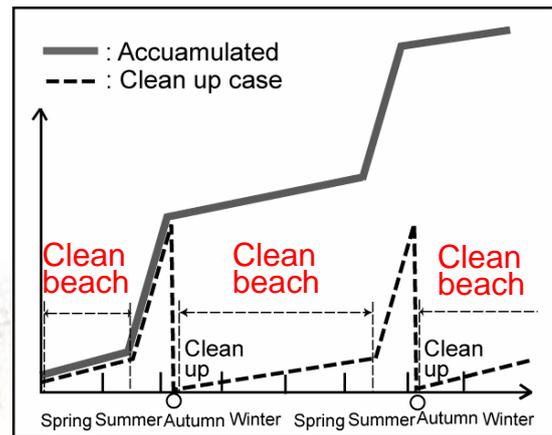
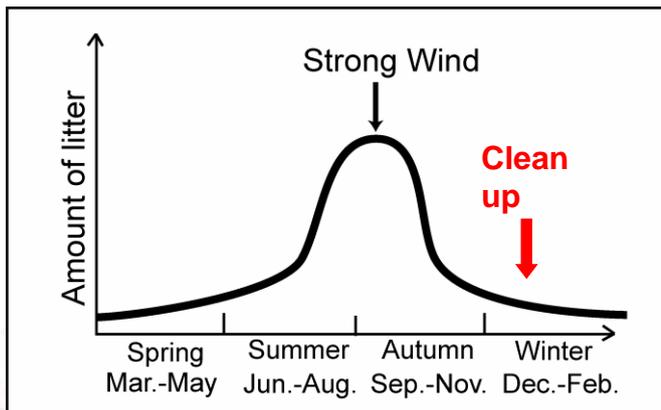


- **To keep the seacoasts clean for a long time, collection after marine litter peaks is effective.**
- **Frequent collection is effective for preventing marine litter from drifting to other places.**

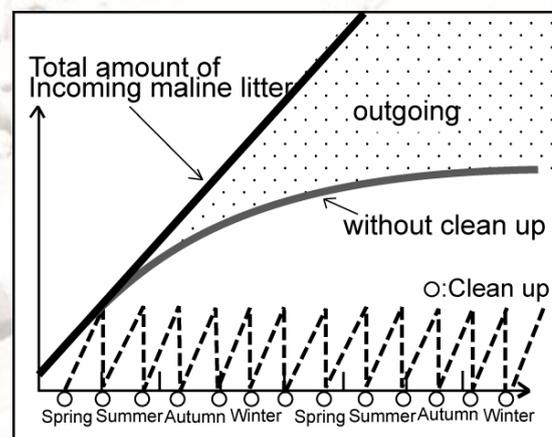
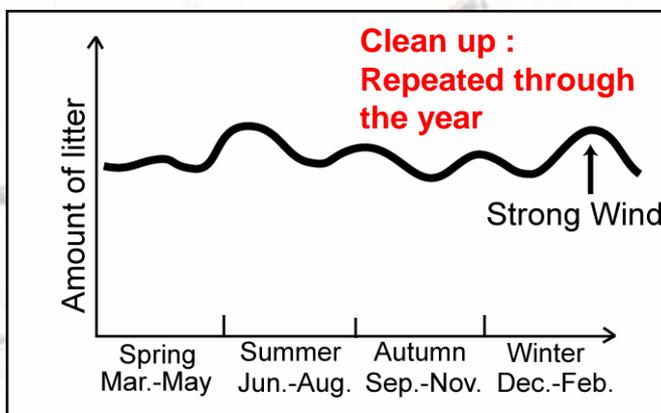
2. Actual Situation of Marine Litter

2.5 Effective collection period considering seasonal fluctuations in the amount of marine litter (2)

- ◆ (3) In the case of the seacoast of the Sea of Japan and the East China Sea (Coast facing south): Nagasaki and Kumamoto Prefectures (Tomioka Beach)



- ◆ (4) In the case of inner bays: Mie and Kumamoto Prefectures (Hinoshima Beach)

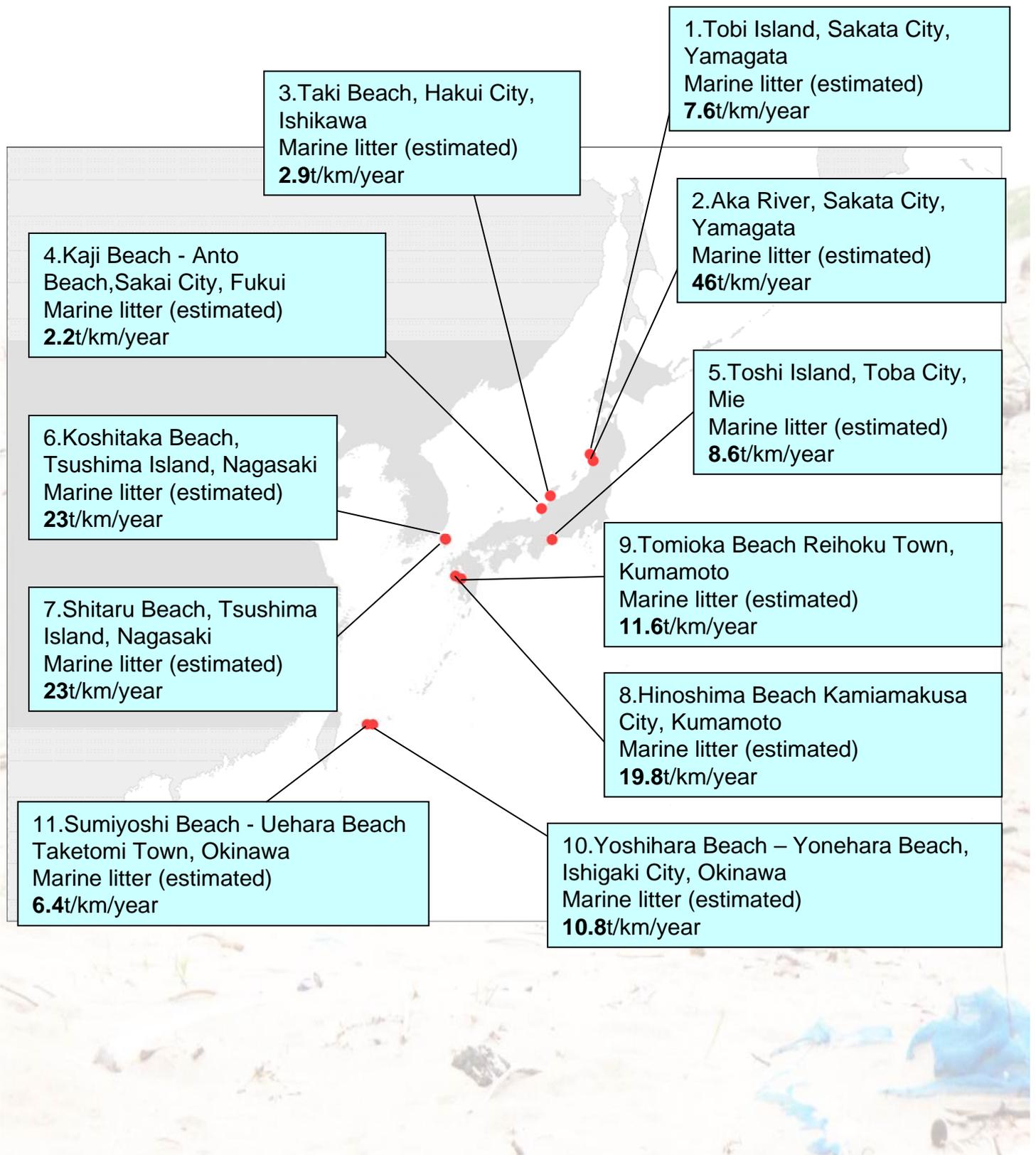


- **To keep the seacoasts clean for a long time, collection after marine litter peaks is effective.**
- **Frequent collection is effective for preventing marine litter from drifting to other places.**

2. Actual Situation of Marine Litter

2.6 Annual amount of marine litter (by model area)

◆ Estimated annual amount of marine litter



2. Actual Situation of Marine Litter

2.7 Estimation of the annual collection and disposal costs of marine litter

	Estimate annual amount of marine litter (Weight: t)	Estimate annual amount of marine litter (Volume: m ³)	Requirements for estimating costs	Collection cost (Thousand yen)	Pick-up and hauling costs (Thousand yen)	Disposal cost (Thousand yen)	Total costs (Thousand yen)	Cost per kilometer (Thousand yen)	Cost per ton (Thousand yen)
Yamagata Prefecture (Tobi Island)	13	45	Three small boats	2,740	930	680	4,350	2,560	330
Yamagata Prefecture (mouth of the Aka River)	207	863	Collect and haul objects difficult to dispose of with heavy machinery	11,630	720	5,380	17,730	3,940	90
Ishikawa Prefecture	16	76		1,440	690	370	2,500	290	160
Fukui Prefecture	21	124		430	30	170	640	220	30
Mie Prefecture	64	492		250	260	40	550	550	10
Nagasaki Prefecture (Koshitaka & Shitaru)	11	60	Dispose of waste within the island	120	100	50	270	530	20
Kumamoto Prefecture (Hinoshima)	99	619	Total collection	2,230	1,410	1,440	5,080	6,770	50
Kumamoto Prefecture (Tomioka)	35	269	Total collection	890	770	560	2,210	740	60
Okinawa Prefecture (Ishigaki Island)	54	315	Ordinary hauling disposal	470	640	1,410	2,520	710	50
Okinawa Prefecture (Iriomote Island)	32	229	Ordinary hauling disposal	290	1,130	990	2,410	890	80

- (1) Since the estimated collection cost assumes that beach cleaning is performed by volunteers, assistance from local residents is essential.
- (2) The estimated disposal cost assumes that municipalities bear the disposal expenses of marine litter which they will dispose in general waste disposal facilities.
- (3) The expense for the coordinator who recruits beach cleaning workers, coordinates with administrative agencies, and goes through the necessary formalities is required, even though expense is not included in the collection and disposal costs.
- (4) The costs are estimated considering the actual situation of local beach cleaning.
- (5) The transportation cost for volunteers is not included except for the ferry charge to the west seacoast of Tobi Island.

2. Actual Situation of Marine Litter

2.8 Collection and disposal methods of marine litter (1)

Collection and transport

➤ The collection and transport methods are decided based on the characteristics of seacoast and existence of roads to access.

Method	Item	Type	Sand beach	Pebble beach		Rocky beach	Remarks
				With a road	Without a road		
Collection method	Human labor	Human labor	○	○	○	○	The basic method. Collect small pieces of litter. Certain amount of people are required for effective collection.
		Vacuum cleaner	×	○	○	○	Effective to collect small pieces of foamed polystyrene from the gaps between rocks, but cannot be used for a long time.
		Chain saw	○	○	○	○	Fit to cut driftwood. Inconvenient for carrying around.
		Engine cutter	○	○	○	○	Suitable to cut ropes and buoys. Inconvenient for carrying around.
	Heavy machinery	Back hoe	○	○	×	×	Can collect heavy objects. Human labor is also required.
		Rake dozer	○	×	×	×	Fit to collect litter on a sand beach. Human labor is required to sort litter out.
		Beach cleaner	○	×	×	×	
Carry-out method	Human labor	Human labor	○	○	○	○	Suitable to carry out litter other than heavy objects and bulky refuse.
		Two-wheeled cart	○	×	×	×	Can be used on a flat, compacted sand beach.
		Wheelbarrow	○	×	×	×	
		Platform truck	○	×	×	×	
	Heavy machinery	Rough terrain dumper	○	○	×	×	Can be used on a flat seacoast.
		Car	○	○	×	×	Can be used on a flat, compacted sand or pebble beach.
		Small boat	○	○	○	○	Sailing or landing depends on the weather, the sea, or the lay of the land.
		Crane	○	○	○	○	A temporary storage site is required within the operation range of the crane.
		Monorail	○	○	○	○	Installation, maintenance, and removal costs are needed. Partial alteration of the surrounding environment is required.
		Winch	○	○	○	○	

Note: ○ and × denote practicable and not practicable.



Collection by human labor



Collection with a vacuum cleaner



Collection with a back hoe



Collection with a beach cleaner



Transport by human labor



Transport with a rough terrain dumper



Transport with a small boat

2. Actual Situation of Marine Litter

2.8 Collection and disposal methods of marine litter (2)

◆ Pick-up, hauling, and disposal

- Pick-up and hauling are performed with vehicles. Deck barges are used for isolated islands.
- It is advisable to select disposal methods with effective use (recycling) in view, based on the disposal facilities and other factors.

Method	Item	Type	Sand beach	Pebble beach		Rocky beach	Remarks
				With a road	Without a road		
Pick-up / hauling methods	Have haulers come to the site (beach) to collect litter.				○		Garbage trucks and other vehicles
	Haulers store litter at a temporary storage site and transfer it later.				○		Trucks, deck barges, and others
	Directly carry litter into disposal facilities.				○		Hauling in person
Disposal	Combust litter in municipal incinerators.				○		General solid waste
	Subcontract disposal to waste disposal companies.				○		Objects difficult to dispose
	Effective use (recycling).				○		Biomass fuel, reduction in the volume of foamed polystyrene, and others

Note: ○ and × denote practicable and not practicable.



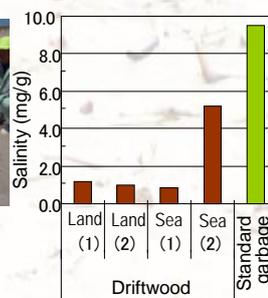
Effective use of driftwood
(Left: Comminution, Right: Sold as biomass fuel)



Effective use of driftwood
(Left: Chopping wood, Right: Carbonizing wood in a kiln)



Effective use of foamed polystyrene
(Left: Foamed polystyrene, Right: Volume reduction by using SD solvent)



Salinity included in driftwood is lower than general garbage
(Left: Driftwood at the sea (1), Right: Analysis results)



Pick-up/hauling with a garbage truck



Pick-up/hauling with a truck

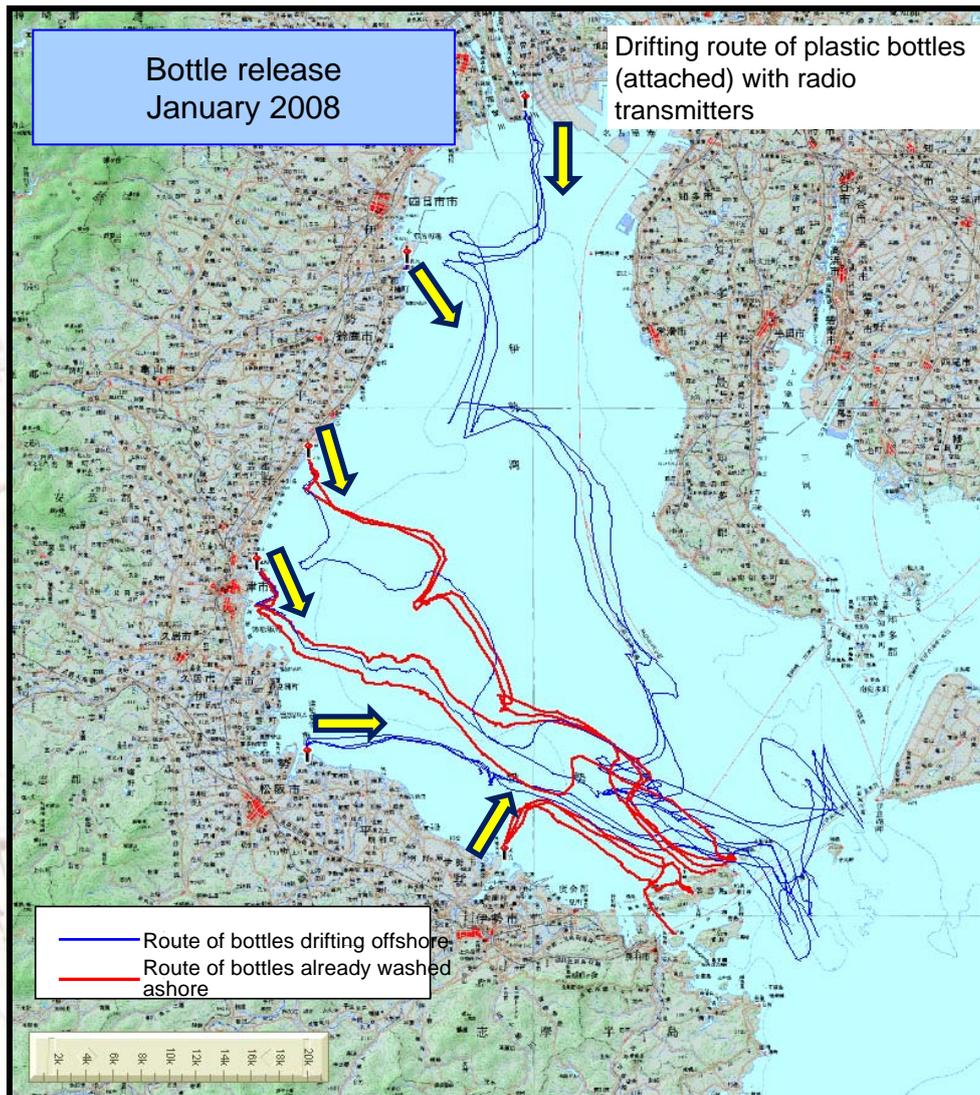


Pick-up/hauling with a deck barge

2. Actual Situation of Marine litter

2.9 Findings concerning the source of marine litter (Example of Ise Bay)

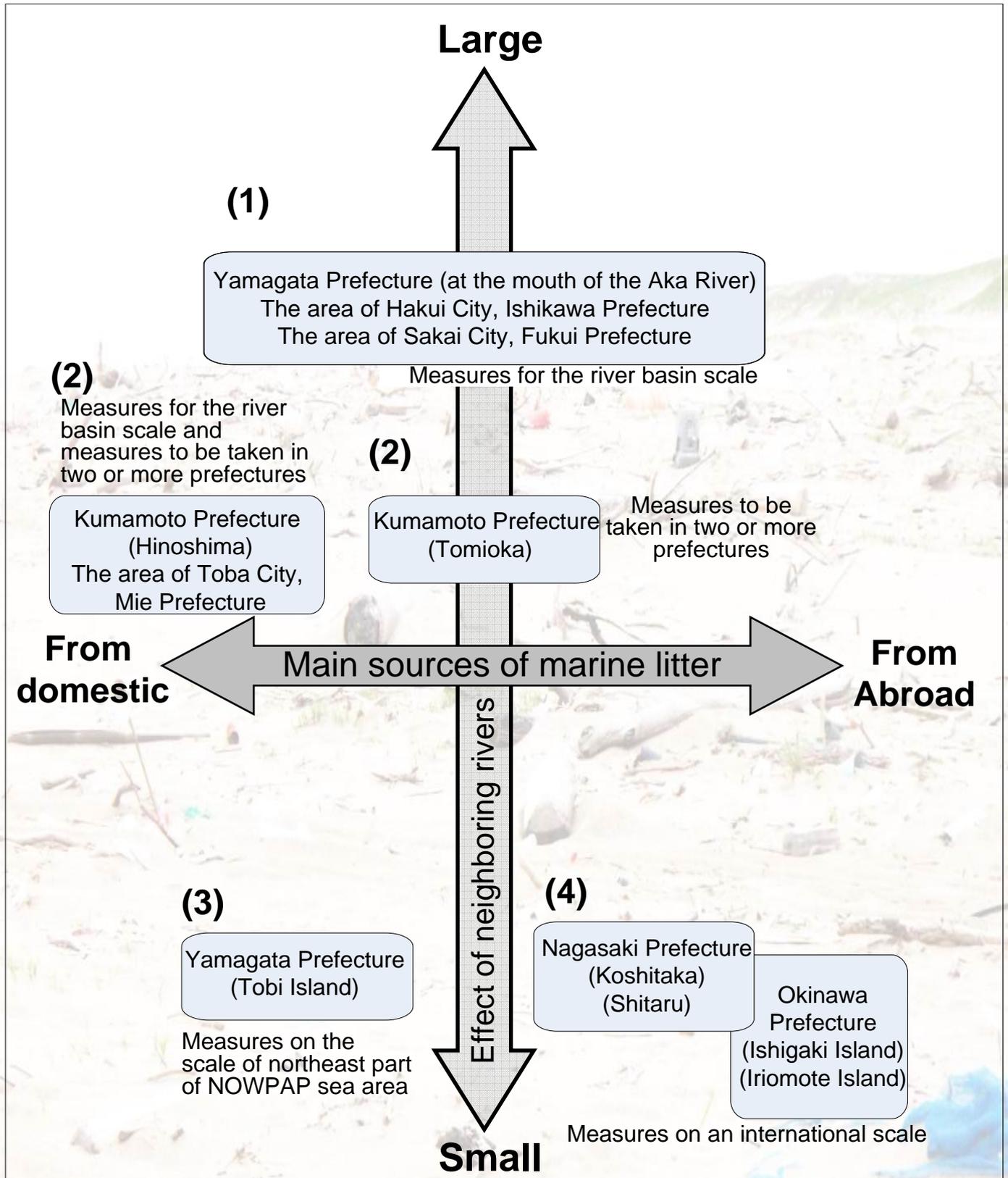
- Analyze the drifting route by using a drift bottle equipped with a homing device.
- Litter flowing into the Ise Bay through rivers tends to drift to the Toshi Island, Toba City, (a model area).



Rivers where bottles were released	The number of released bottles	The number of bottles that drifted to Toshi Island	The number of bottles that drifted to Ise Bay
Kiso River	3	0	0
Suzuka River	3	0	3
Nakano River	3	2	2
Anou River	3	2	2
Kushida River	3	0	0
Miya River	3	2	3
Total	18	6	10

2. Actual Situation of Marine Litter

2.10 Systematic classification of preventive measures against marine litter according to type



3. Appropriate Countermeasures against Marine Litter

3.1 Actual situation of cleaning activities and problems

◆ Actual situation of cleaning activities

- NPOs, residents' associations, and other organizations regularly carry out beach cleaning.
- Local NPOs and residents' associations handle recruitment of workers and management of the cleaning. There are many unstable factors in financing.
- Marine litter collected by volunteers is disposed of in municipal waste disposal facilities.
- Marine litter may not be able to be incinerated on isolated islands because of the limited capacity of incineration plants.

◆ Problems with cleaning

- It is difficult to maintain the number of volunteer participants for the cleaning activity.
- **Stable funds** are required for participants' insurance, as well as consumables such as gloves and garbage bags for collection.
- **The general waste disposal cost is borne by municipalities.**
- **Objects difficult to dispose of** are often left uncollected on the beach. **How to raise funds** for the disposal cost is also a problem.
- **Proactive efforts by seacoast administrators is limited.**

3. Appropriate Countermeasures against Marine Litter

3.2 Course of action to be taken for cleaning activities

◆ Examples of progressive regional actions

- Beautiful Yamagata Sea Platform (Yamagata Prefecture)
- Clean Beach Ishikawa (Ishikawa Prefecture)
- Kanagawa Coastal Environmental Foundation (Kanagawa Prefecture)
- "Sanukiseto" Partnership Project (Kagawa Prefecture)

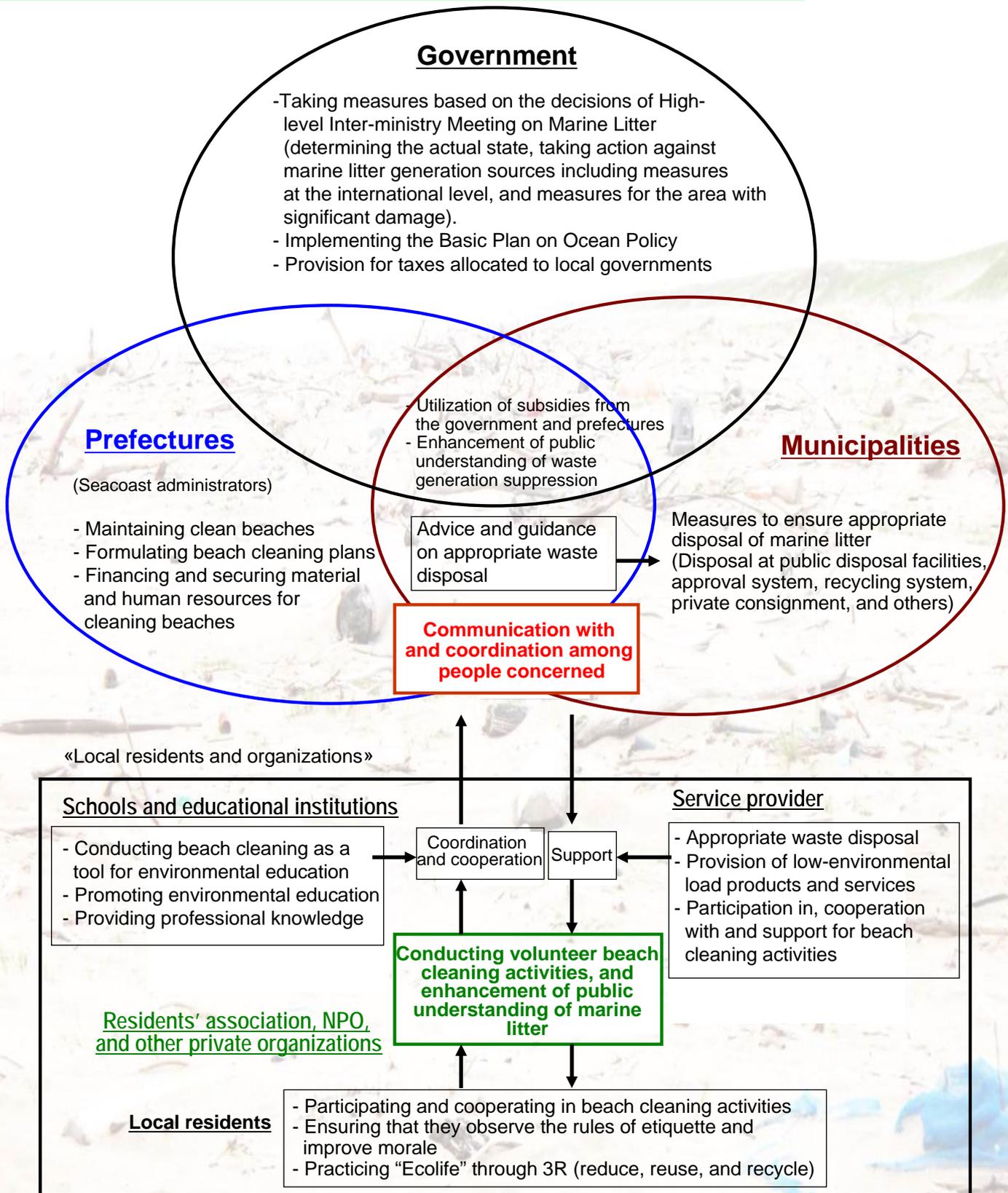
◆ Points in working with local stakeholders

- **Participation and cooperation of local residents and volunteers is essential** to collect marine litter.
- **It is important for local government to support beach cleaning conducted by local residents and volunteers based on the proper division of roles** (for example, providing materials and equipment and disposal of collected waste).
- It is also important for local government to build close ties with local residents and volunteer organizations through cooperation and information sharing.
- It is necessary to **construct communication and coordination networks and establish a system to integrate these networks** in order to promote a system where local stakeholders can work together.

3. Appropriate Countermeasures against Marine Litter

3.3 System where people can work together

◆ Division of roles of agencies and organizations concerned



3. Appropriate Countermeasures against Marine Litter

3.4 Course of action to be taken for establishing a system in each model area

Model area	Government	Prefecture	Municipalities	Local residents and others	
Yamagata Prefecture	Granting subsidies	Utilizing, continuing, and strengthening Beautiful Yamagata Sea Platform			
Ishikawa Prefecture		Utilizing, continuing, and strengthening Clean Beach Ishikawa			
Fukui Prefecture		Setting up a working group on marine litter	Preparing for establishing the platform	Continuing regular beach cleaning	
Mie Prefecture		Providing information on the results of this model survey to the Ise Bay Regeneration Meeting	Appealing for marine litter suppression activities on the website and distributing garbage bags	Coordinating with NPOs through prefectural appeals	
Nagasaki Prefecture		Providing technical support	Promoting action plans to solve the marine litter problem	Establishing a coordination and cooperation system with NPOs, local residents, and others.	Continuing regular beach cleaning
Kumamoto Prefecture		Promoting the Amakusa area marine litter partnership system (Establishing and promoting a coordination and cooperation system with the national government, prefectures, municipalities, NPOs and other private organizations, and local residents)			
Okinawa Prefecture		<ul style="list-style-type: none"> - Holding a separate consultation by people concerned on "information sharing", "making cleaning plans", "establishing collection systems", and "cost reduction measures". - Establishing a council on countermeasures against marine litter - Making preparations for setting up the platform 			

3. Appropriate Countermeasures against Marine Litter

3.5 Current situation of countermeasures against marine litter and challenges

◆ Current situation of countermeasures against marine litter

➤ Efforts as a measure against general waste generation

- (1) Preventing illegal dumping
- (2) Preventing the generation of waste through environmental education
- (3) Taking prefecture-wide measures against waste generation
 - Nagasaki Prefecture waste disposal plan
 - Okinawa Prefecture "Chura-Shima (Island) Environmental Beautification Ordinance"

➤ Efforts intended for marine litter

- (4) Making the marine litter problem known to every local resident through events, beach cleaning and education
 - Sakai City, Fukui Prefecture (Waterfront ecological forum "SOS from the Mikuni-no-Umi ")
 - Tsushima City, Nagasaki Prefecture (Joint beach cleaning activities between Pusan University of Foreign Studies in South Korea and universities and areas around Kyushu)

◆ Challenges for preventing the generation of marine litter

- Promoting enhancement of public understanding of marine litter to prevent its generation.
- Strengthening efforts for coordination, aimed at the preventing the generation of marine litter in river basins.
- Estimating investigation of the marine litter generation sources to take well-thought-out measures based on the generation sources.
- Strengthening the coordination and cooperation with countries concerned to prevent the generation of marine litter originated from abroad.

3. Appropriate Countermeasures against Marine Litter

3.6 Course of action for preventing the generation of marine litter

◆ Preventing the generation of household solid waste

- Preparing pamphlets on preventing marine litter and informing the public based on the results of the model survey
- Enhancement of public understanding of marine litter in coordination with local public organizations

◆ Preventing the generation of fishery-related waste

- Ensuring that fishermen and people involved in the fishing industry properly use and manage fishing equipment.

◆ Preventing the generation by natural cause

- Taking measures that lead to the management of forests such as appropriate disposal of wood abandoned in forestlands
- Taking measures to prevent drifting of plants such as reed grass that seem to flow out of river basins

◆ Preventing the wide-ranging generation (*e.g. basin*) of marine litter

- Making the issue of marine litter known to residents in the upper river basin and appealing for them to work at prevention
- Taking measures to reduce outflow of waste from inland such as promoting the collection of waste from agricultural water channels

◆ Pinpoint prevention of the marine litter based on the generation source

- Conducting a well-thought-out investigation to find the marine litter generation source
- Holding a conference and making cooperative efforts with people concerned to take measures for the specific waste including fishery-related, industrial and trade waste

3. Appropriate Countermeasures against Marine Litter

3.7 Efforts to prevent marine litter from abroad

- Increasing awareness between the Japanese government and neighboring countries and establishing a cooperation framework
- Making efforts and sharing experiences by utilizing the framework of the Northwest Pacific Action Plan (NOWPAP) (share the results of the model survey)
- Launching enhancement campaign of public understanding of marine litter in cooperation with neighboring countries
- Communicating and holding working-level talks with neighboring countries to prevent inflow of waste such as medical waste and discharged plastic containers to Japan
- Working at the local government level with the local governments of neighboring countries



3. Appropriate Countermeasures against Marine Litter

3.8 Recommendations for preventive measures against marine litter

◆ **Monitoring on the state of marine litter**

- (1) Monitoring on the state of marine litter and annual variation of it
- (2) Estimating the generation source by using marine litter drift simulation
- (3) Estimating the amount of waste flowing out of rivers
- (4) Survey on wastes originating from beaches
- (5) Estimating the amount of waste flowing from Japan to abroad

◆ **Effective collection and disposal in accordance with different beaches**

- (1) Ensuring the division of roles among people concerned
- (2) Providing support to volunteers for cleaning beaches
- (3) Studying collection methods on beaches which are difficult to access or beaches where human labor is difficult to recruit
- (4) Establishing a disposal system for isolated islands
- (5) Considering the waste volume reduction, recycling, and effective utilization
- (6) Preparing a manual on how to effectively clean beaches

◆ **Prevention of marine litter (measures against the generation source)**

- (1) Making the issue known to the public and appealing for preventing marine litter
- (2) Promoting the prevention of marine litter with attention to river basins
- (3) Improving environmental education
- (4) Calling service providers' attention to preventing marine litter
- (5) Communicating with countries concerned about waste drifting to Japan in large quantities such as medical waste and waste plastic containers
- (6) Promoting international cooperation on marine litter problems

◆ **Others**

- (1) Establishing a system where local stakeholders can work together
- (2) Experts' and private companies' participation in discussions
- (3) Sharing the results of the model survey to other areas