Ministry of the Environment
Erimo Area Kuril Harbor Seal Management Project Implementation Plan, FY 2022

March 2022

Hokkaido Regional Environment Office

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Background

The Ministry of the Environment establishes an “Erimo Area Kuril Harbor Seal Management Project Implementation Plan” (hereafter the “Implementation Plan”) every fiscal year in order to appropriately implement the project in accordance with the “Erimo Area Kuril Harbor Seal Specified Rare Wildlife Management Plan (hereafter the “Management Plan”) (Phase II)”, which was established in March 2021.

The goal of the Management Plan is to establish procedures for population management, damage prevention and the like in order to work toward present and future coexistence in the Erimo area between Kuril harbor seals and the local community, including the coastal fishing industry. The Ministry of the Environment will establish these procedures through partnership with various organizations, including the Hokkaido Government, Erimo Town, fishing industry associations, members of the fishing industry, local residents, related organizations, and universities and research institutions. Working toward the accomplishment of these goals, the FY 2022 Implementation Plan shall be defined as given below, taking into account the results of the projects implemented from 2016 to 2021.

FY 2021 Project Implementation Results and Assessment

1. Damage Prevention Measures

The following initiatives were implemented in order to mitigate damage to the fishing industry.

(1) Improvement of fishing nets

Reduce damage to salmon trap nets caused by Kuril harbor seals, and in order to block entrance by Kuril harbor seals into salmon trap nets, the Ministry of the Environment installed the damage preventing net (hereafter the “rope grids”) at the tunnel entrance to the bag net in trap nets that were particularly susceptible to severe damage in the Cape Erimo area during the trap net fishing seasons in spring and autumn, and verified their effectiveness.

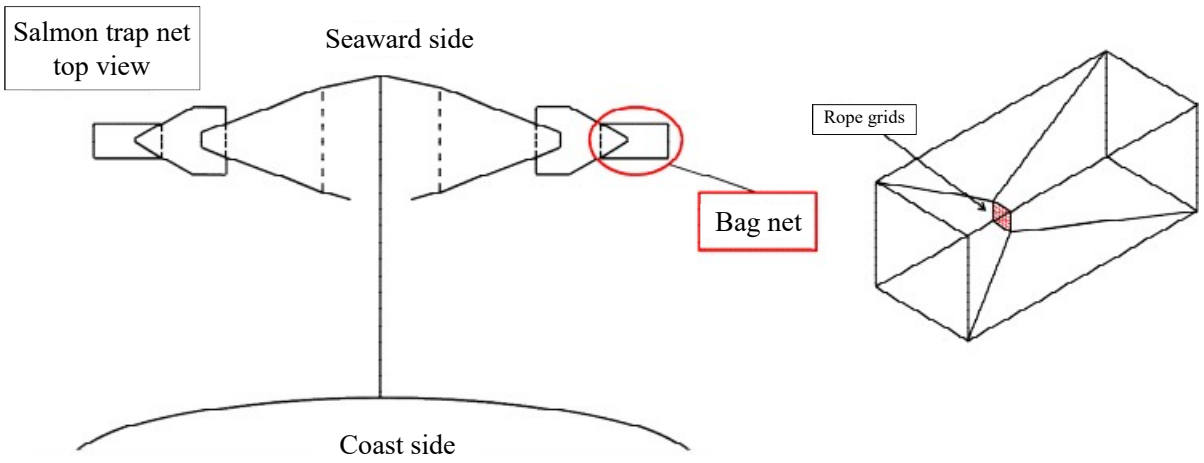
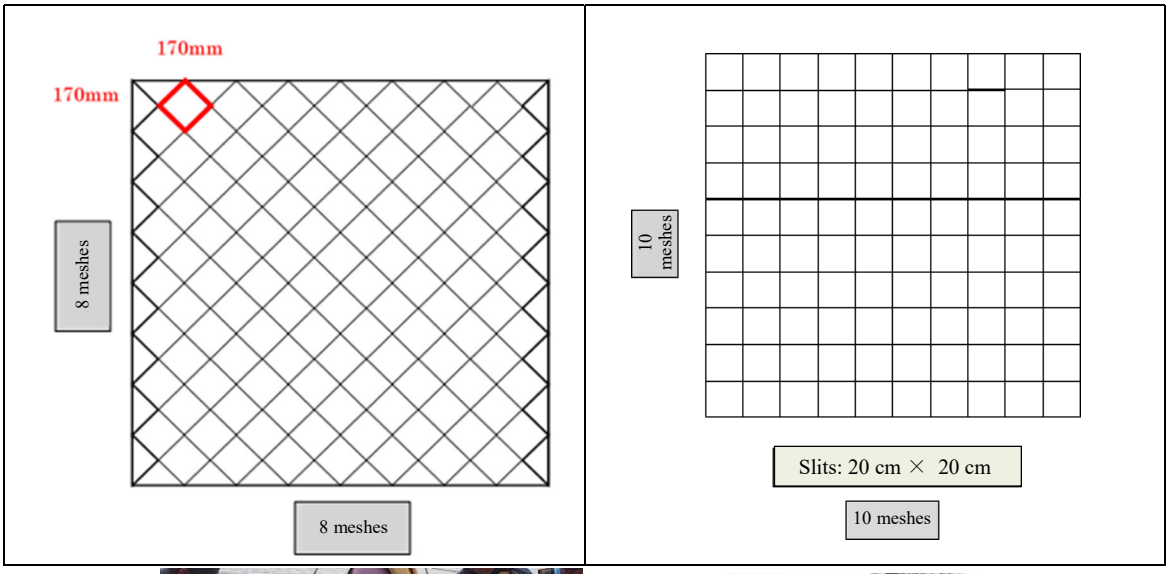


Fig. 1. Installation status of Rope grids



『Angled type』 『Horizontal type』

Fig. 2. Angled and Horizontal type of the rope grids

Table 1. Fixed trap net with the rope grids

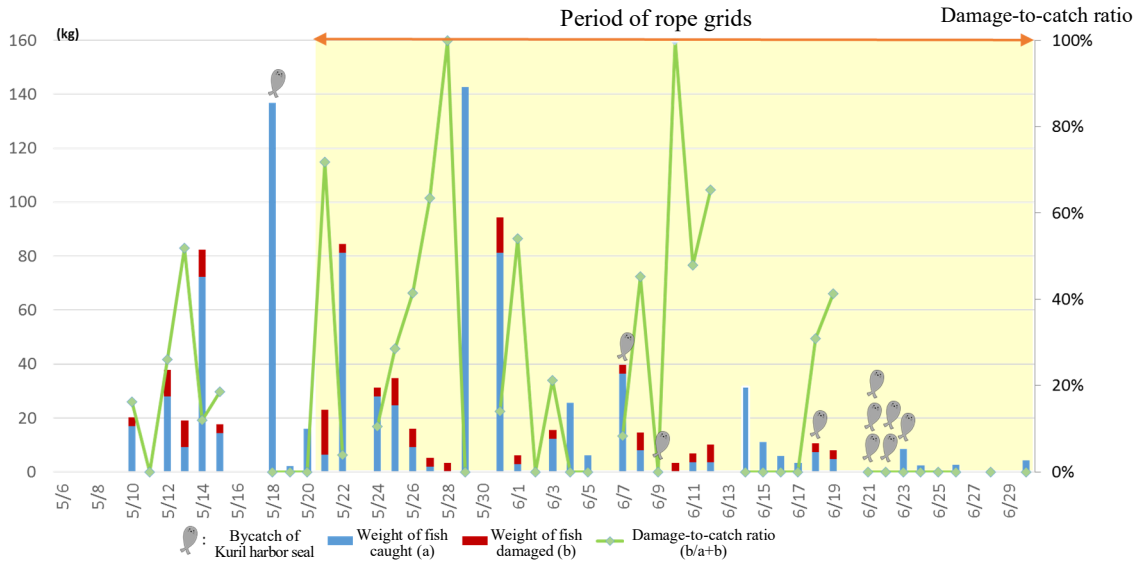
Salmon trap net fishing season	Sector name	Number of nets with rope grids installed	Type of the rope grids	Installation period
Spring	Toyo	1	20 cm × 20 cm (horizontal)	5/22-6/30
Autumn	Toyo	1	20 cm × 20 cm (horizontal)	
	Cape Erimo	3	18 cm × 18 cm, 17 cm × 17 cm (mainly angled)	1 trap net : 9/2-11/20
	Shoya	4	18 cm × 18 cm (angled)	

*Trap net fishing is not practiced in the waters east of Cape Erimo during the spring fishing season.

<Effect verification of the rope grids>

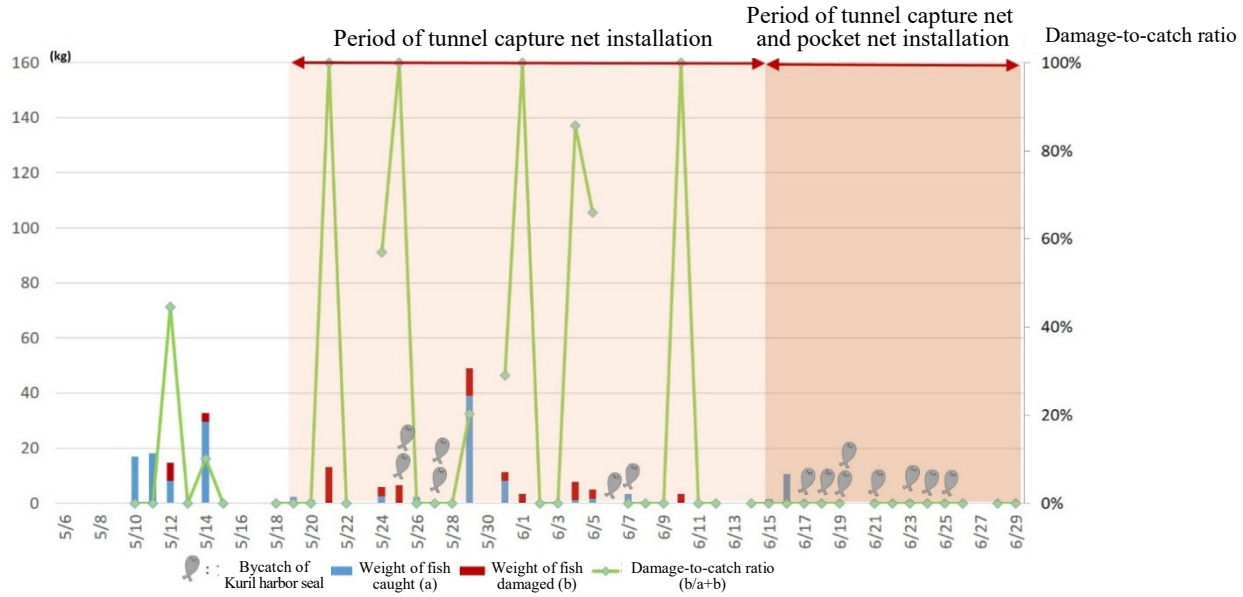
① Spring fishing season (Toyo sector)

The installation of the rope grids was carried out in one salmon trap net (seaward side) in the Toyo sector (Cape Erimo west side), which was the same sector as in the spring fishing seasons from 2016 to 2019. The configuration of the rope grids was 20 cm × 20 cm horizontal type（Dyneema® ・white). The damage rate during installation period of the rope grid was 12.6%. After the rope grid was installed, Kuril harbor seals that had invaded the bag net could not be confirmed from the images of the underwater camera except for the collection date of the bycatch individuals. The confirmed damage probably was because the fish that had been damaged by the stagnation, etc., were flowing into the bag net due to the tidal current. It is possible that the Kuril harbor seal invaded the bag net at night when the underwater camera was not visible, but it is unlikely that the Kuril harbor seal was displaced when it forcibly passed through the rope grids.



【The rope grids】5/22-6/30：20cm × 20cm Horizontal type

Fig. 3. Total catch size and damage-to-catch ratio of Salmon and Trout (Toyo sector seaward side)



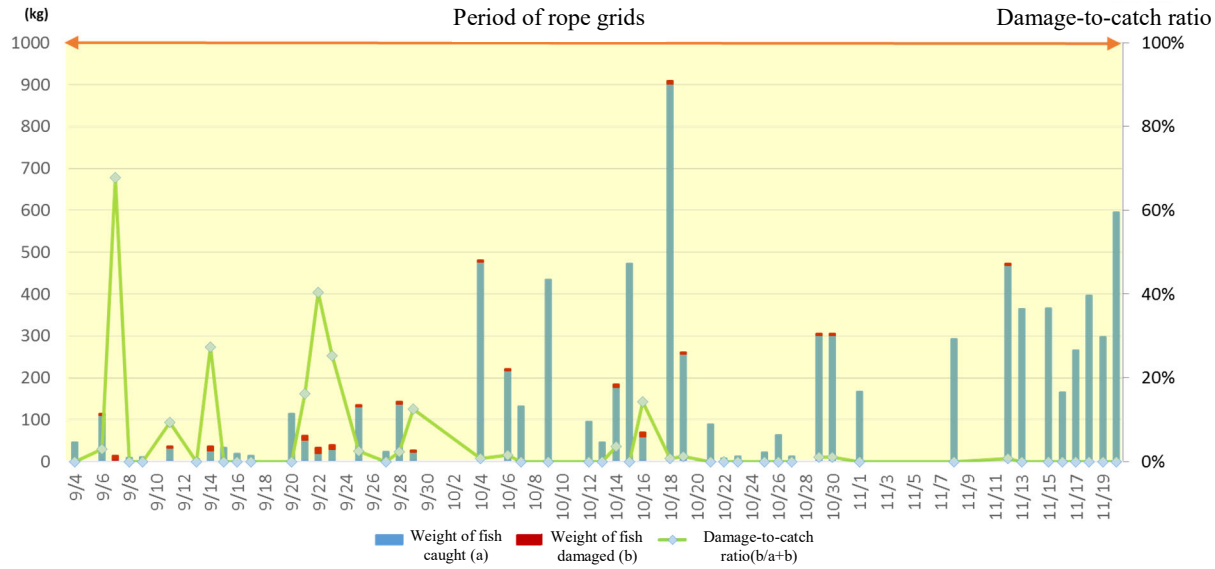
【Capture net】5/19-6/14：20cm × 20cm Horizontal type
【Capture net and pocket net】6/15-6/29：20cm × 20cm Horizontal type

Fig. 4. Total catch size and damage-to-catch ratio of Salmon and Trout (Toyo sector land side)

② Autumn fishing season (Cape Erimo sector)

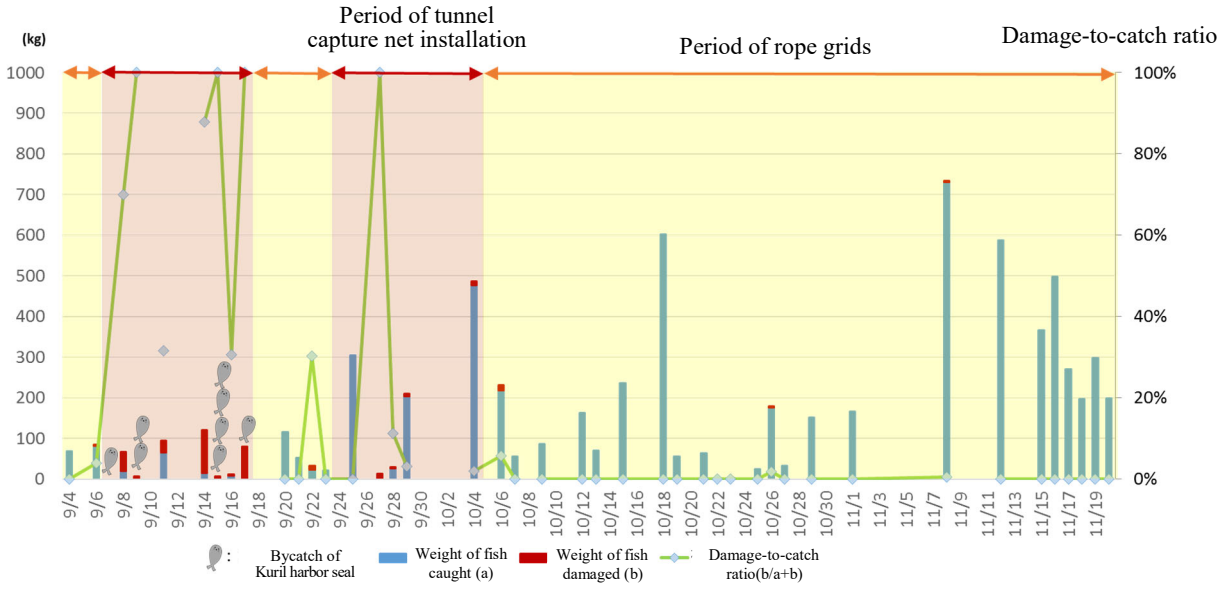
In the fall, eight trap nets are installed, but the effect was verified for one that has been continuously implemented from 2016 to the fall of 2020. Since 2018, we have been using a grid net with a mesh size of 17cm × 17cm, but from mid-October we tried a mesh pattern with a mesh size of 18cm × 18 cm. However, from around October, the arrival of Kuril harbor seals could hardly be confirmed in the images taken by the underwater camera, and the effect due to the difference in the rope grids. The damage rate of the northern seaward side was 1.3%, and the damage rate of the northern land side was 2.4%. It is possible that the Kuril harbor seals were not very close to the fixed nets because the damage rate was lower than usual and the Kuril harbor seals were not witnessed around the fixed nets during the embarkation investigation. The reason for the decrease in the number of harbor seal visits is that the Kuril harbor seals may have learned that it is difficult for the Kuril harbor seals to invade the vault net by changing part of the vault nets on the northern land side and northern seaward side equipped with capture nets to nets made of thicker threads. In addition to this, it is probable that the red tide that occurred in the surrounding sea area from the end of September and the large number of Bluefin tuna visiting this term made it difficult for the Kuril harbor seals to approach the set net.

Although it did not occur in the trap nets for which the effect was verified this year, damage to the bag nets thought to be caused by Kuril harbor seals occurred in the surrounding trap nets. In addition, this season there has been damage to the bag nets, which is believed to be caused by Bluefin tuna.



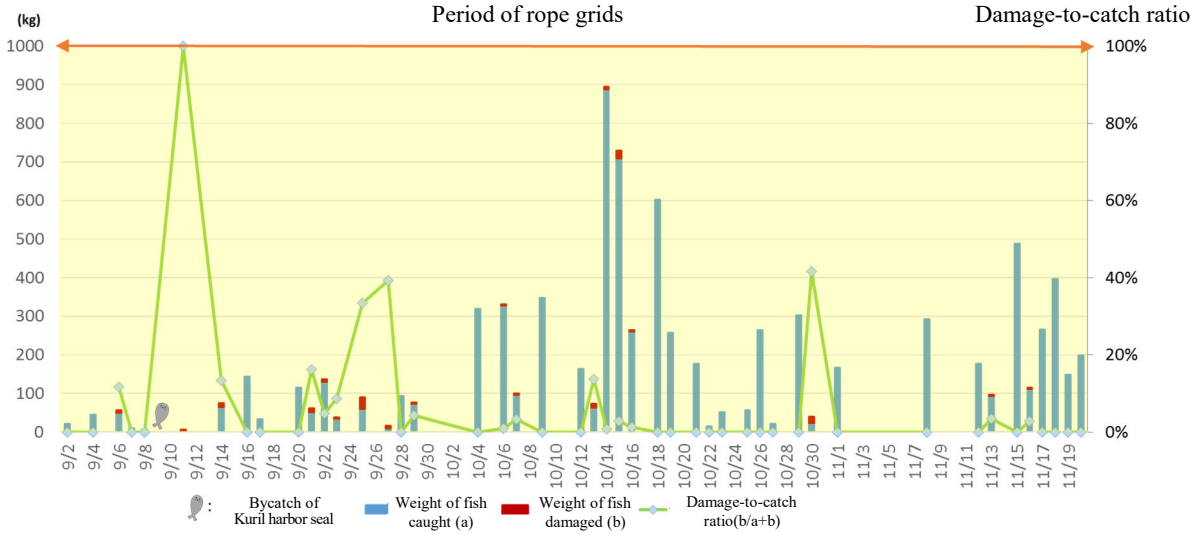
【The rope grids】9/4-10/18：17cm × 17cm Angled type, 10/19-11/20：18cm × 18cm Angled type

Fig. 5. Total catch size and damage-to-catch ratio of Salmon and Trout
(Cape Erimo sector, net: southern seaward side)



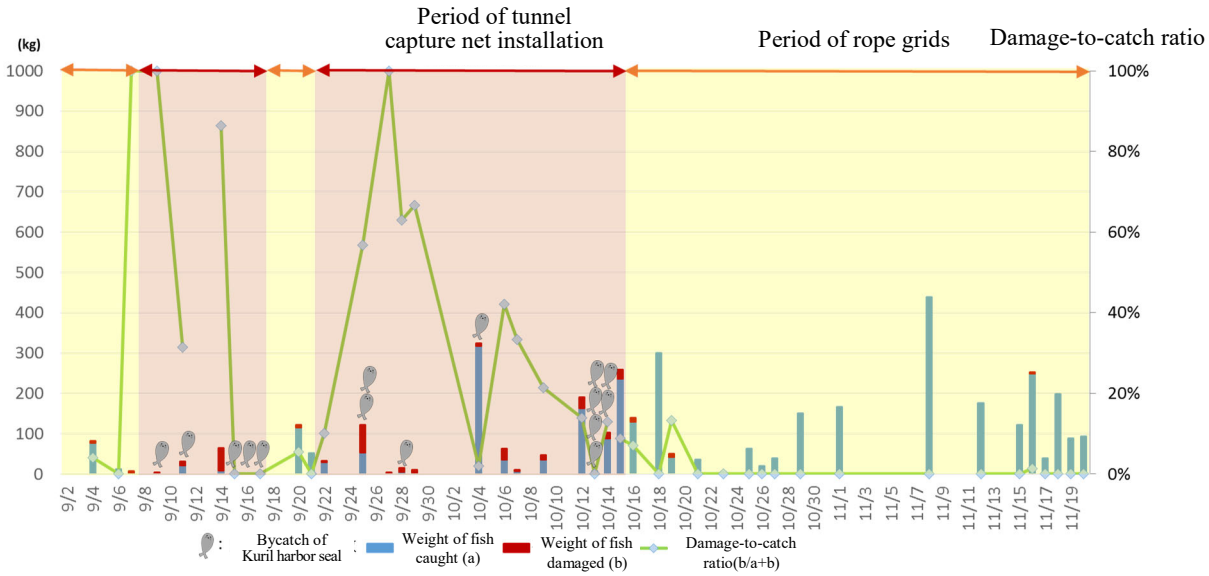
【The rope grids】9/4-9/6, 9/18-9/23, 10/5-10/21：17cm × 17cm Angled type
10/22-11/20：18cm × 18cm Angled type
【Capture net】 9/7-9/17, 9/24-10/4：17cm × 17cm Angled type

Fig. 6. Total catch size and damage-to-catch ratio of Salmon and Trout
(Cape Erimo sector, net: northern seaward side)



【The rope grids】9/2-11/20 : 17cm × 17cm Angled type

Fig. 7. Total catch size and damage-to-catch ratio of Salmon and Trout
(Cape Erimo sector, net: southern land side)



【The rope grids】9/2-9/7, 9/18-9/21 : 17cm × 17cm Angled type
10/16-10/21 : 18cm × 18cm Horizontal type
10/22-11/20 : 18cm × 18cm Horizontal type
【Capture net】 9/8-9/17, 9/22-10/9 : 17cm × 17cm Angled type
10/10-10/14 : 16cm × 16cm Angled type

Fig. 8. Total catch size and damage-to-catch ratio of Salmon and Trout
(Cape Erimo sector, net: northern land side)

(2) Assessment of damage control measures

- The number of trap nets equipped with a rope grid in the autumn fixed net increased by 2 from last year to 8 in 3 districts. It is considered that this is a result that the fishermen who are already using it are expecting the damage reduction effect of the rope grid. In addition, measures are being taken with each trap net, such as a trap net that is always equipped with a rope grid during the trap net fishing operation period, and a rope grid that is attached only when damage to Kuril harbor seals begins to occur.
- In recent years, there have been cases where the effect cannot be fully exerted due to damage to the bag net, which is thought to be caused by Kuril harbor seals, and damage to the grid net by large creatures such as Bluefin tuna, and blockage by Sunfish. Therefore, it is necessary to devise a usage method such as attaching a fishery fastener so that the grid net can be removed depending on the situation.

2. Population Management

The Ministry of the Environment captured seals using salmon trap nets, gillnets, in order to perform population management aimed at both mitigating damage to the fishing industry and maintaining a sustainable Kuril harbor seal population level. Further, attempts were made to capture seals alive to the greatest extent possible, and research data necessary for developing future measures was gathered, after which 2 of the captured individuals were fitted with EM transmitter tags and released and some others were euthanized by a veterinarian.

(1) Capture using salmon trap nets

① Spring fishing season (Toyo sector)

In order to catch Kurel harbor seals, a funnel-type capture net (hereafter the “capture net”) with a funnel attached to a rope grid was installed during the period from May 19 to June 29. A total of 14 Kuril harbor seals were captured in a total of 43 days. In addition, in order to reduce feeding damage and damage to the net caused by Kuril harbor seals that have invaded the bag net, a pocket net (Fig.9) was tried from June 15. Of the eight Kuril harbor seals captured after wearing the pocket net, five were captured in the pocket net. It is probable that the Kuril harbor seals staying in the pocket nets reduced the damage to the fishing industry caused by the harbor seals and reduced the possibility of escaping from the vault.

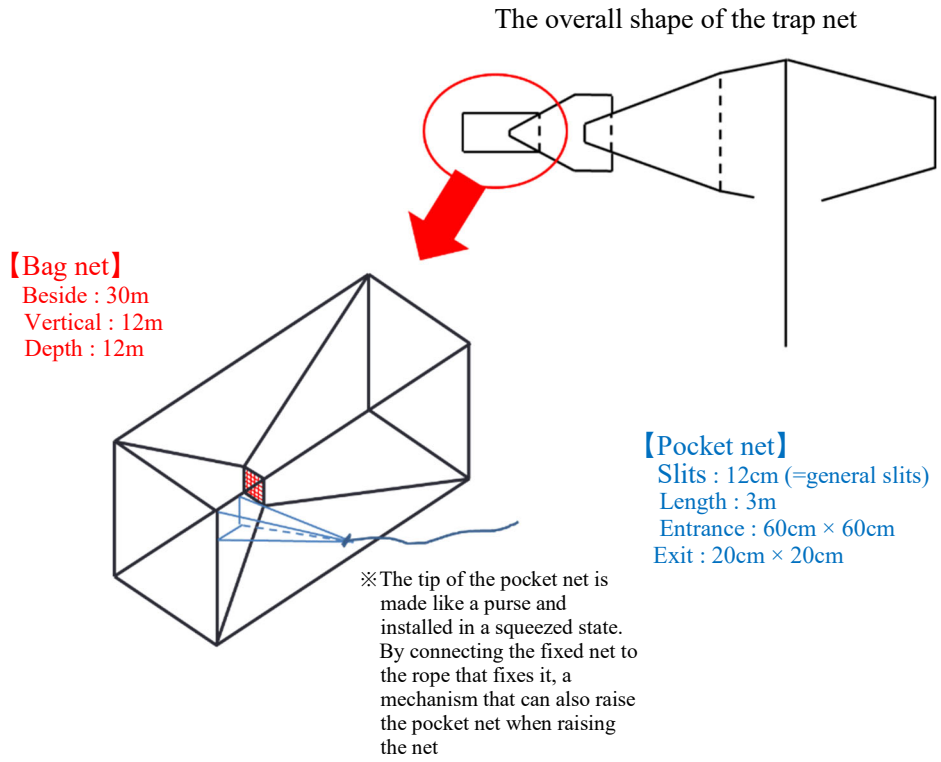
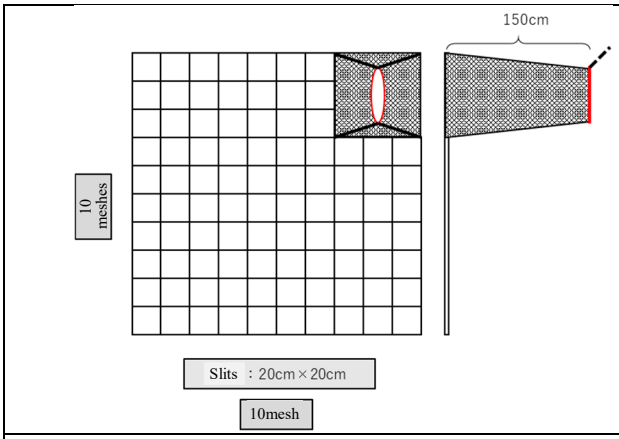
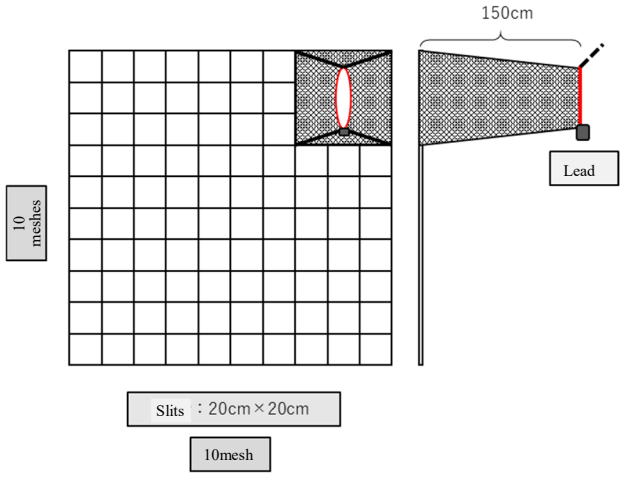


Fig. 9. Pocket net structure

<table>
<tr>
<td> 
</td>
<td>【Period to install】
（5/19-5/20）</td>
</tr>
<tr>
<td> 
</td>
<td>【Period to install】
（5/21-6/5）

【Remarks】
5/24 A hole opens in the ceiling of the bag net
5/25 Capture 2 seals
5/27 Capture 2 seals</td>
</tr>
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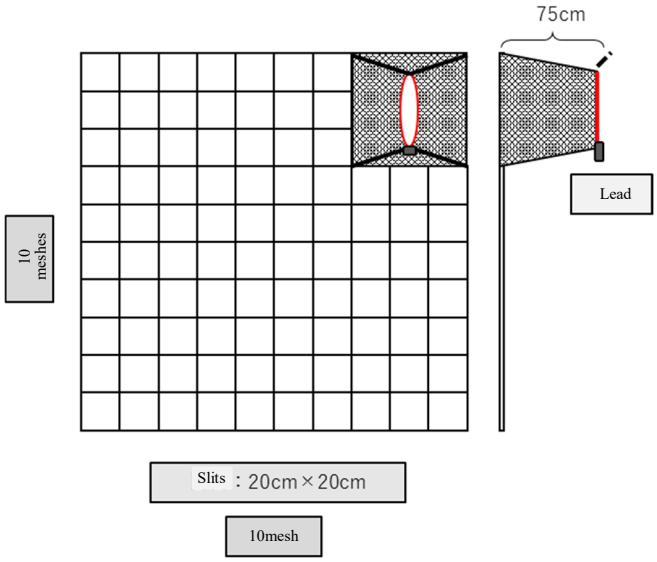
<td> 
</td>
<td>【Period to install】
（6/6-6/29）
【Remarks】
6/6 Capture 1 seal
6/7 Capture 1 seal
6/14 A hole opens in the side of the bag net
6/15 Installation of pocket net
（captured on the pocket net are as ”●”）
6/17 Capture 1 seal（●）
6/18 Capture 1 seal（●）
6/19 Capture 2 seals (1 seal ●)
6/21 Capture 1 seal（●）
6/22 A hole opens in the ceiling and side of the bag net
6/23 Capture 1 seal（●）
6/24 Capture 1 seal
6/25 Capture 1 seal</td>
</tr>
</table>

Fig.10. Spring fishing season capture nets

② Autumn fishing season (Erimo sector)

Kuril harbor seals were captured from early September to mid-Octobor. The capture net is installed on the northern seaward side every year, but this year it was installed in two places, the northern seaward side and the northern land side net. The northern seaward side captured 23 seals for a total of 22 days and the northern land side for a total of 34 days for a total of 56 days. Although the structure of the capture net has been improved by adding lead, it was not possible to sufficiently verify the effect as with the above-mentioned grid net because the arrival of seals could hardly be confirmed from the beginning of October.

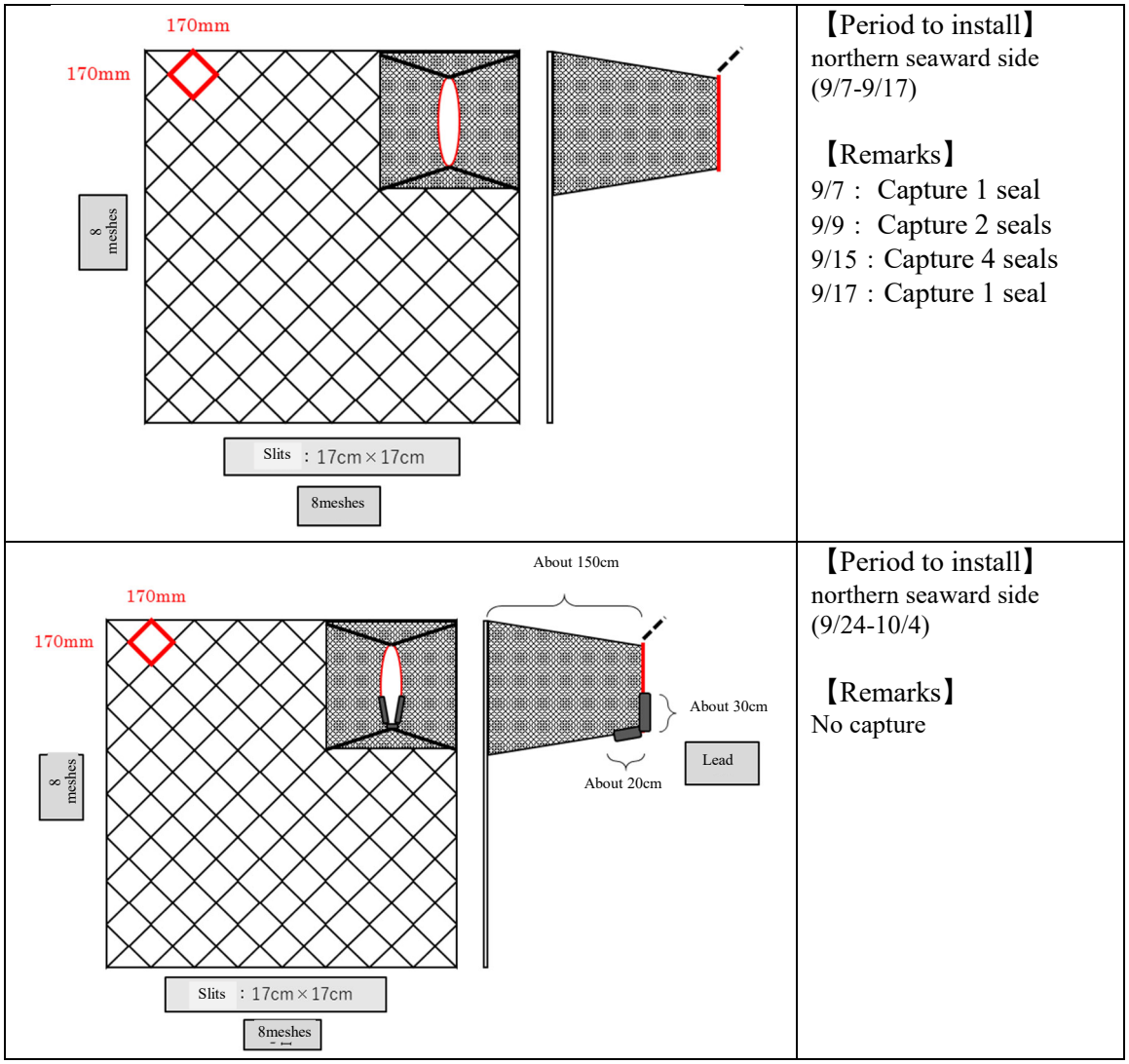


Fig. 11(1). Autumn fishing season capture nets

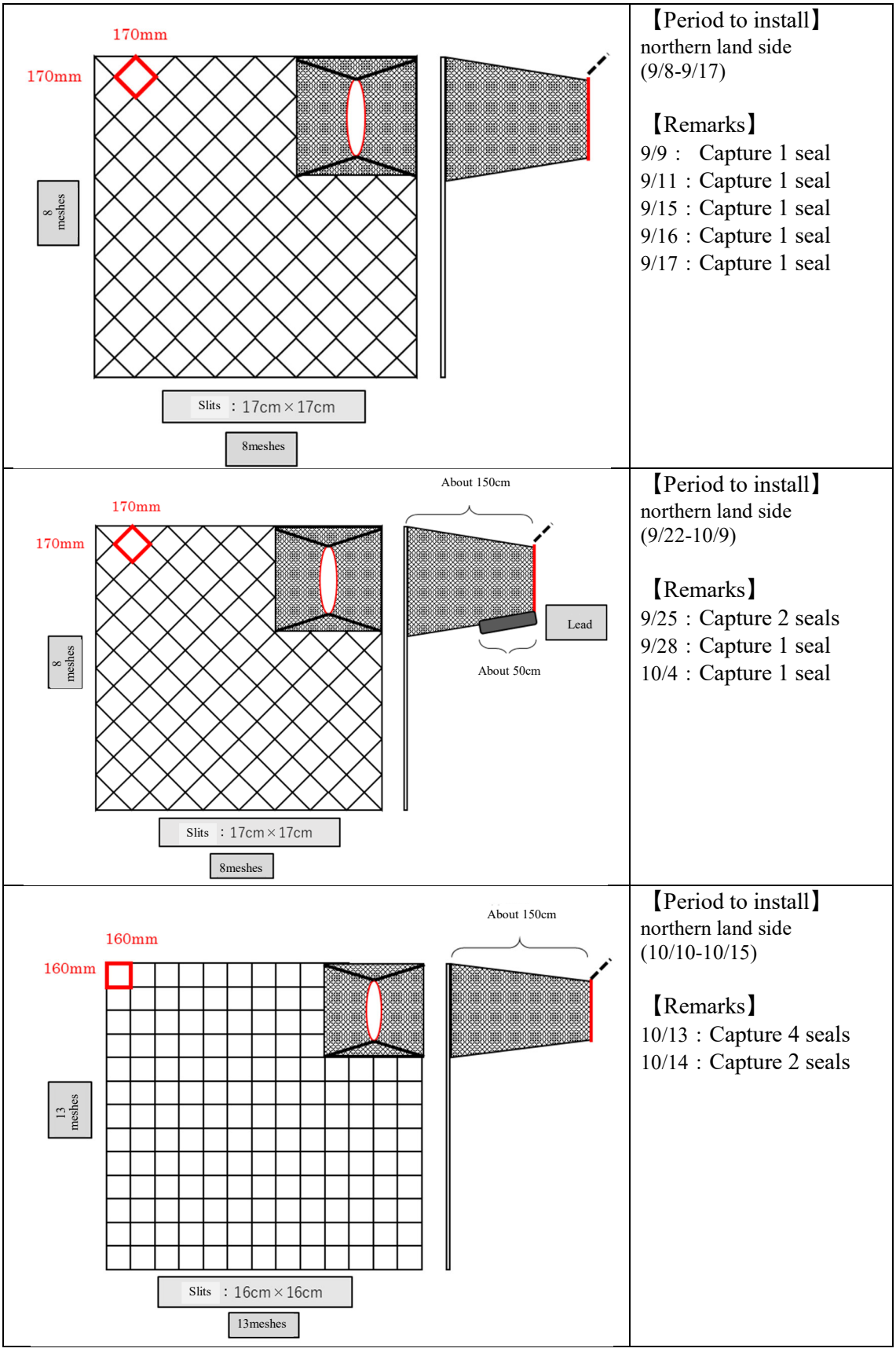


Fig. 11(2). Autumn fishing season capture nets

(2) Capture using gillnets

Gillnet captured 14 seals near the rocky shore reefs of Cape Erimo on June 2, 2021.

(3) Capture as part of an academic investigation (test firing of firearms)

In order to investigate the possibility of capture by a gun, and the effects on the Kuril harbor seals, a test shot was conducted with an air gun on February 13, 2021 near Cape Erimo Reef, accompanied by a veterinarian. It was shot, but after the individual was recovered, it was found to be a harbor seal, and the Kuril harbor seal could not be captured.

[Academic investigation implemented in FY 2020]

In the winter season when gun test shooting is carried out, the possible days are limited due to the influence of storms, and since catching with fixed nets and gill nets can be expected, shooting with guns will not be carried out in 2022.

(4) Capture results

A total of 49 seals were captured using salmon trap nets, gillnets, etc. (This number does not include 2 individuals which were fitted with EM transmitter tags/patches and released.) During the emergency capture efforts conducted using three additional salmon trap nets in the autumn fishing season, eight of them were bycaught.

Until now, the age composition has been tabulated into four categories: juveniles (< 1 year old), juveniles (1 year old), sub-adults (2-4 years old), and adult animals (5 years old-). 1 year old and over, totaled in 3 categories of adults. However, the data was calculated in three categories: Pup / current year, 1 year old and over, and adults.

Table 2. Kuril harbor seal capture results by capture method

	Pup / < 1 year		1 year old and over		Adults		Total
	Male	Female	Male	Female	Male	Female	
Spring salmon trap nets	1	2	0	2	1	8	14
Autumn salmon trap nets	2	1	3	6	6	3	21
Subtotal	6		11		18		35
Gillnets	4	7	1	2	0	0	14
Air guns	0	0	0	0	0	0	0
Total	17		14		18		49

* Individuals whose sexual maturity is confirmed by tissue sections of the genital organs are considered to be adults. When releasing or transferring the Kuril harbor seals, adults weighing 80 kg or more are targeted.

(5) Bycatch results

With the cooperation of fishermen, a total of 55 seals were recovered from the trap net.

Table 3. Kuril harbor seal bycatch results by capture method

	Pup / < 1 year		1 year old and over		Adults		Total
	Male	Female	Male	Female	Male	Female	
Spring salmon trap nets	4	5	0	0	0	1	10
Autumn salmon trap nets	14	17	3	6	4	1	45
Total	40		9		6		55

(6) Assessment of population management

The result of this year's catch was 49, which is close to the guideline for the number of catches, 52, and 18 adults could be caught with a trap net. We were able to capture the largest number of adults among the trap net capture records that we have been conducting since 2016. It is thought that the number of seals attached to the set net could be reduced, which led to the reduction of fishery damage.

3. Monitoring

(1) Population size and structure

○ Largest number monitoring

Due to the influence of COVID-19, continuing from last year, it was not possible to conduct a long-term land-based census (Tokyo University of Agriculture). Added the UAV survey record that has been implemented since 2017.

【Visual data】

<1983 – 2010> Survey report of one week during molting season (Kobayashi et al. 2014)

<2011 – 2019> Results of Tokyo University of Agriculture Long-Term Census – July through November (Kobayashi, unpublished data)

<2020－2021> Due to the influence of COVID-19, it was not possible to conduct census performed by Tokyo University of Agriculture.

【UAV data】

<2017 – 2021> Census results from April to November centered on low tide time (Ministry of the Environment)

※Compared with visual inspection, UAV monitoring may not be possible depending on the weather conditions, but it is possible to count individuals hidden behind rocky reefs that are difficult to find visually. Therefore, when a visual survey and a UAV survey are conducted at the same time, the UAV is more likely to count the number of landed individuals.

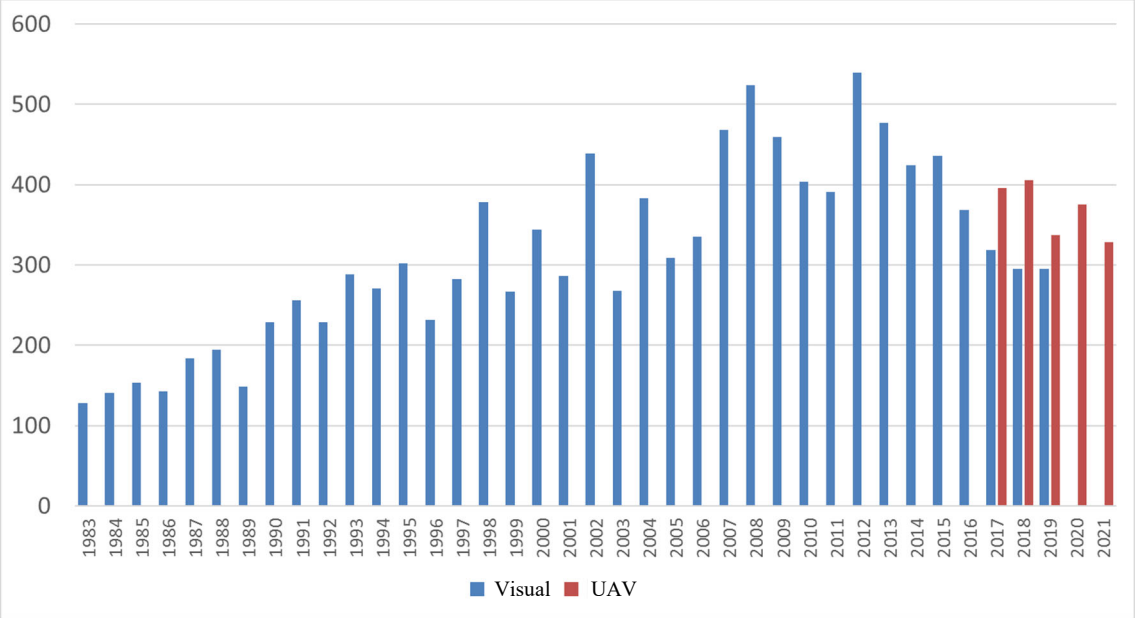


Fig. 12. Largest number of Kuril harbor seals hauling out at Cape Erimo

※Largest number of Kuril harbor seals hauled out, it seems that it has been on a downward trend since 2012. However, the results of wildlife census vary greatly from year to year, and it is necessary to consider changes in survey frequency and accuracy (Survery subject is not constant), landing frequency and detection rate due to capture (Implemented from 2016) . Therefore, it is considered that the increase and decrease in the maximum landing population and the increase and decrease in the number of individuals in this graph do not always match.

＜Census method using UAV＞

In conducting censuses by UAV, the Ministry of the Environment used video recording (ii. below), which enables the effective and efficient measurement of the population size in a short time, in addition to the still image recording (i. below) to generate orthographic images.

i. Still image recording settings to generate orthographic images (Measurement of individual population and size):
Still images were recorded with the altitude set at approx 60 m, the front overlap ratio at 90% and the side overlap ratio at 40%.
Time required: approx. 1 hour

ii. Simple settings only for population size measurement (Counting the number of individuals) :
Videos were recorded with the altitude set at approx. 110 m and the speed at10.5 m/sec.

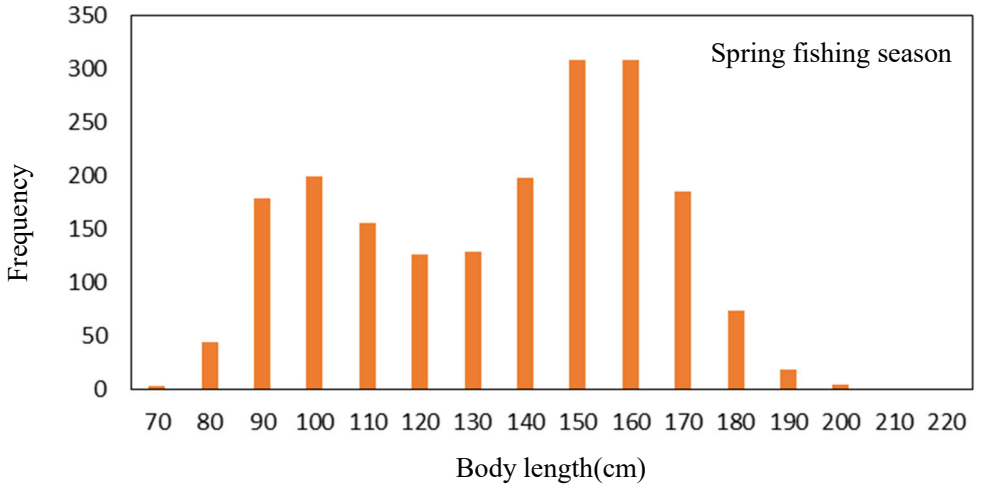
○ Population composition

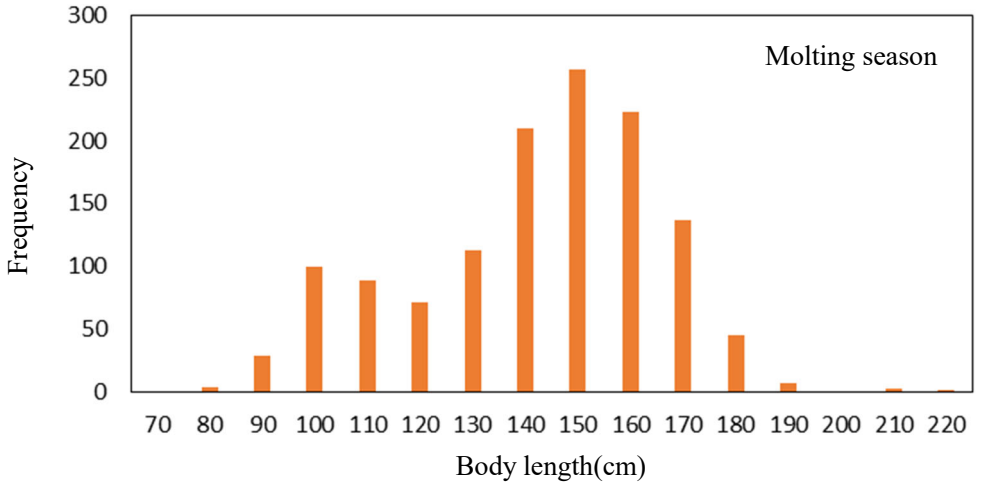
The Ministry of the Environment captured drone images of rocky shore reef haul-out sites at Cape Erimo and to its west between April and November 2021, and based on measured data on the head-and-body lengths (from the tip of the snout to the base of the tail) of all individuals confirmed in those images, clarified the body lengths of Kuril harbor seals on the rocky shore reefs of Cape Erimo by season (Fig. 13).

In the spring fishing season, drone images captured numerous small individuals less than 100 cm in length, and many individuals born during the breeding season from late April to June were hauling out. Further, a large number of individuals considered adults and measuring 140 cm or longer were also hauling out, with the highest proportion of individuals measuring between 150 cm and 160 cm.

In the summer fishing season, the proportion of individuals less than 100 cm declined; the proportion of those 140 cm or longer remained high and showed a trend similar to that in the spring fishing season. During the autumn fishing season, the proportion of those less than 100 cm further dropped, and that of those about 140 cm became the highest. The proportion of large individuals 150 cm or longer diminished, suggesting that many individuals of about 140cm use the haul-out sites in the autumn fishing season.

Niizuma reported in 1986 that adult females appeared at haul-out sites after the pupping season began and their appearance rate plummeted after the molting season ended, suggesting that the haul-out frequency of adult females varies with season. The Ministry of the Environment surmised that the drop in the proportion of large individuals in the autumn fishing season was due partly to a decline in the haul-out frequency of adult females.





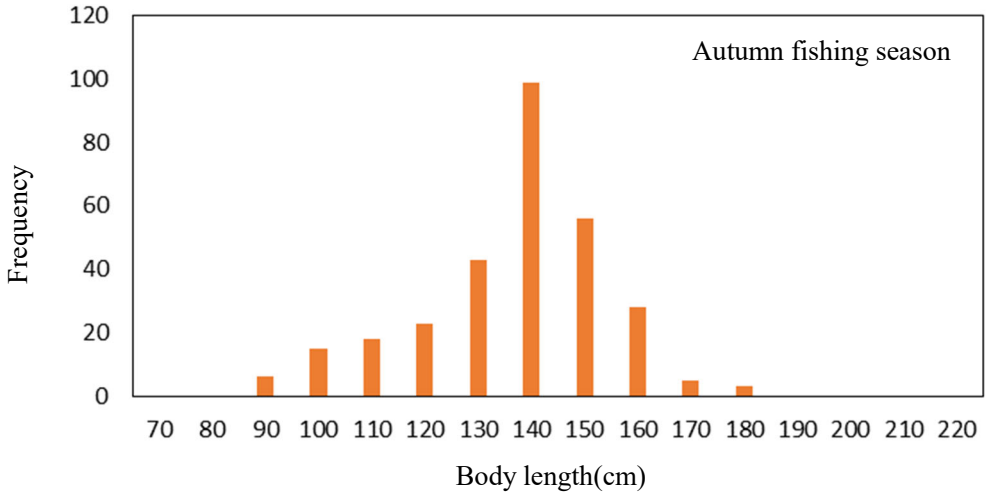


Fig. 14. Comparison of body lengths by season

(2) Population trends

Ecological data necessary to ascertain population trends (body length, body weight, age, sex, breeding conditions, etc.) was obtained from captured and bycaught individuals. Most of the captured individuals were juveniles (< 1years old) and adults (5 years old and over), and the bycatch individuals were biased towards juveniles (<1years old) (Fig. 14).

Fig. 14. Estimated age and sex of captured and bycaught individuals

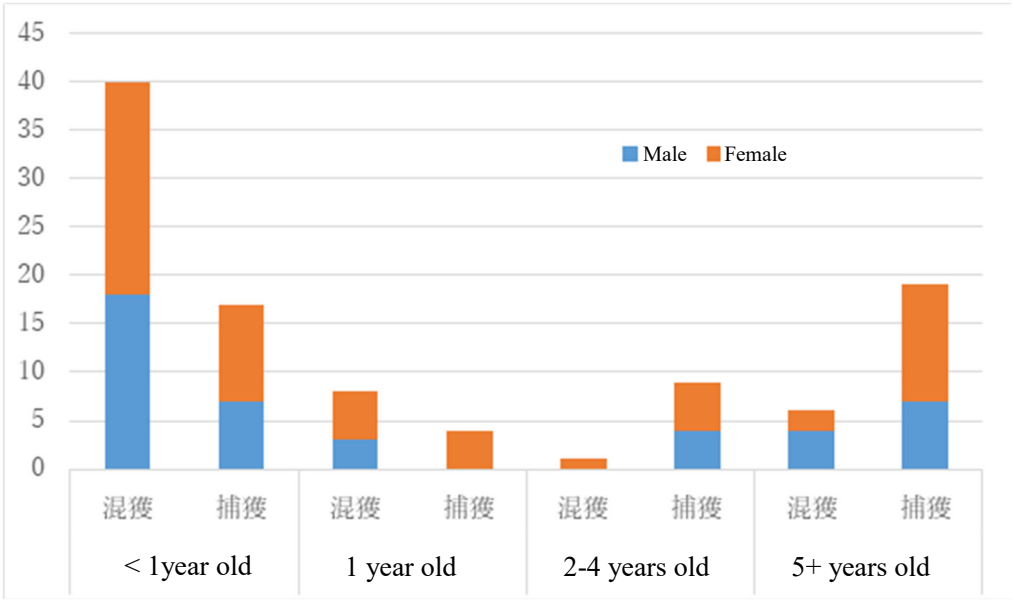


Table 4. Breeding status of males

No.	No. Data version	Data	Full lengrh (cm)	Body lengrh (cm)	Body weight (kg)	Primary sperm cell	Sperm
EZ2143		2021/9/6	147.7	132.5	54.0	×	×
EZ2141	EZ210906-1	2021/9/6	158.4	142.1	57.0	×	×
EZ21100	EZ211013-3	2021/10/13	163.5	141.5	69	×	×
EZ2169	EZ210915-1	2021/9/15	160.5	144.2	71	×	×
EZ2198	EZ211013-1	2021/10/13	160.5	142.2	72	×	×
EZ2170	EZ210915-2	2021/9/15	157.1	138.9	91	○	×
EZ2151	EZ210908-2	2021/9/8	195.7	173.9	113.0	○	×
EZ2175	EZ210917-1	2021/9/17	204.3	181.5	126	○	×
EZ2187		2021/10/4	203	184.2	139	○	×
EZ2102	EZ210525-1	2021/5/25	198.2	175.7	145.0	○	○
EZ2154	EZ210909-1	2021/9/9	210.5	193.6	145.0	○	×
EZ2184	EZ210925-1	2021/9/25	208	184.6	145	○	×
EZ2172	EZ210915-4	2021/9/15	201.7	179.6	151	○	×
EZ2171	EZ210915-3	2021/9/15	205	182.8	156	○	×
EZ2195		2021/10/9	206.2	181.7	158	○	×
EZ2191		2021/10/6	205.8	186.4	169	○	×

Table 5. Breeding status of females

No.	No. (Data version)	Data	Full lengrh (cm)	Body lengrh (cm)	Body weight (kg)	Presence or absence of a fetus.	Corpus luteum	Corpus albicans
EZ2155	EZ210909-2	2021/9/9	145.4	128.9	50.0		×	×
EZ2186	EZ211004-1	2021/10/4	136.1	124	52		×	×
EZ2164	EZ210913-2	2021/9/13	150.4	134.0	53.0		×	×
EZ2174	EZ210916-1	2021/9/16	145.9	124.8	54		×	×
EZ2173	EZ210915-5	2021/9/15	140.5	122.1	55		×	×
EZ2156	EZ210909-3	2021/9/9	151.5	138.7	62.0		×	×
EZ2163	EZ210913-1	2021/9/13	155.0	137.5	62.0		×	×
EZ2185	EZ210925-2	2021/9/25	158.9	140.3	63		×	×
EZ2137	EZ210624-1	2021/6/24	168.0	147.9	78.0		×	×
EZ2103	EZ210525-2	2021/5/25	165.0	144.9	80.0		×	×
EZ2127	EZ210619-1	2021/6/19	165.2	151.1	87.0		△	○
EZ2138		2021/6/25	179.0	157.9	90.0		△	○
EZ2104	EZ210527-1	2021/5/27	192.1	169.0	104.0		△	○
EZ2158		2021/9/9	187.3	172.4	109.0		△	○
EZ2120	EZ210606-1	2021/6/6	188.5	162.4	110.0		△	○
EZ2105	EZ210527-2	2021/5/27	187.7	170.4	111.0		△	○
EZ2121	EZ210607-1	2021/6/7	175.0	155.6	117.0		△	○
EZ21102	EZ211014-2	2021/10/14	179.1	160.5	118	○	○	○
EZ2133		2021/6/22	186.1	165.8	119.0		△	○
EZ2135		2021/6/23	183.5	159.0	119.0		△	○
EZ21101	EZ211014-1	2021/10/14	190.6	169.7	129	○	○	○
EZ2128	EZ210619-2	2021/6/19	196.9	174.3	130.0		△	○
EZ2160	EZ210911-1	2021/9/11	210.1	187.3	136.0		△	○

○ To investigate the range of activity of harbor seals, two Kuril harbor seals captured by a trap net were attached with EM transmitters and released. Individual 1 (male 71 kg) began investigation on September 28 but was euthanized because it was recaptured on October 13 (Fig.15). Individual 2 (female 120 kg) has been under investigation since October 13(Fig.16). Individual 2 travelled about 100 km north along the coast and stayed around Cape Erimo and northward for about 15 days each.

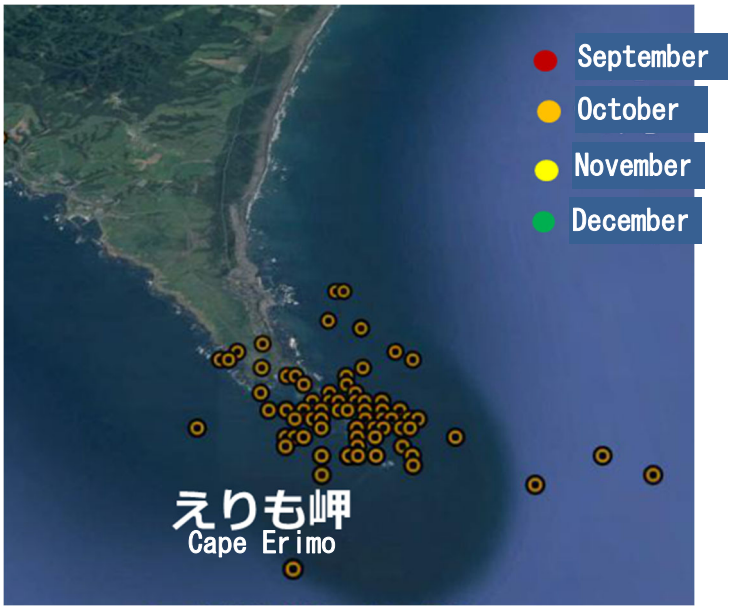


Fig. 15.Behavior history of individual 1

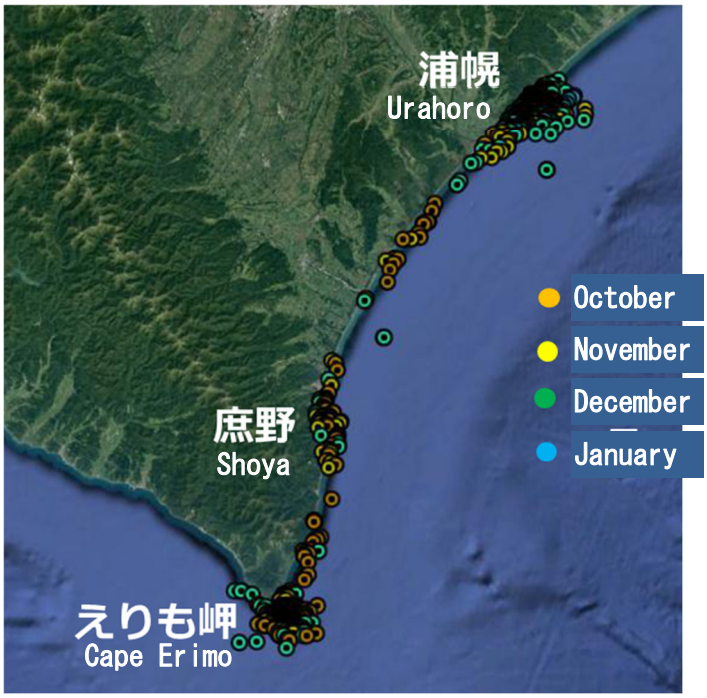


Fig. 16.Behavior history of individual 2

(3) Survey of the stomach contents of captured and bycaught individuals

○ Survey of stomach contents of captured individuals

The top three prey organisms in terms of the Proportion of Index of Relative Importance (IRI %) were Octopodidae spp. (50.5%), *Sardinops melanostictus* (37.3%) and *Verasper moseri* (7.8%) (Fig. 17).

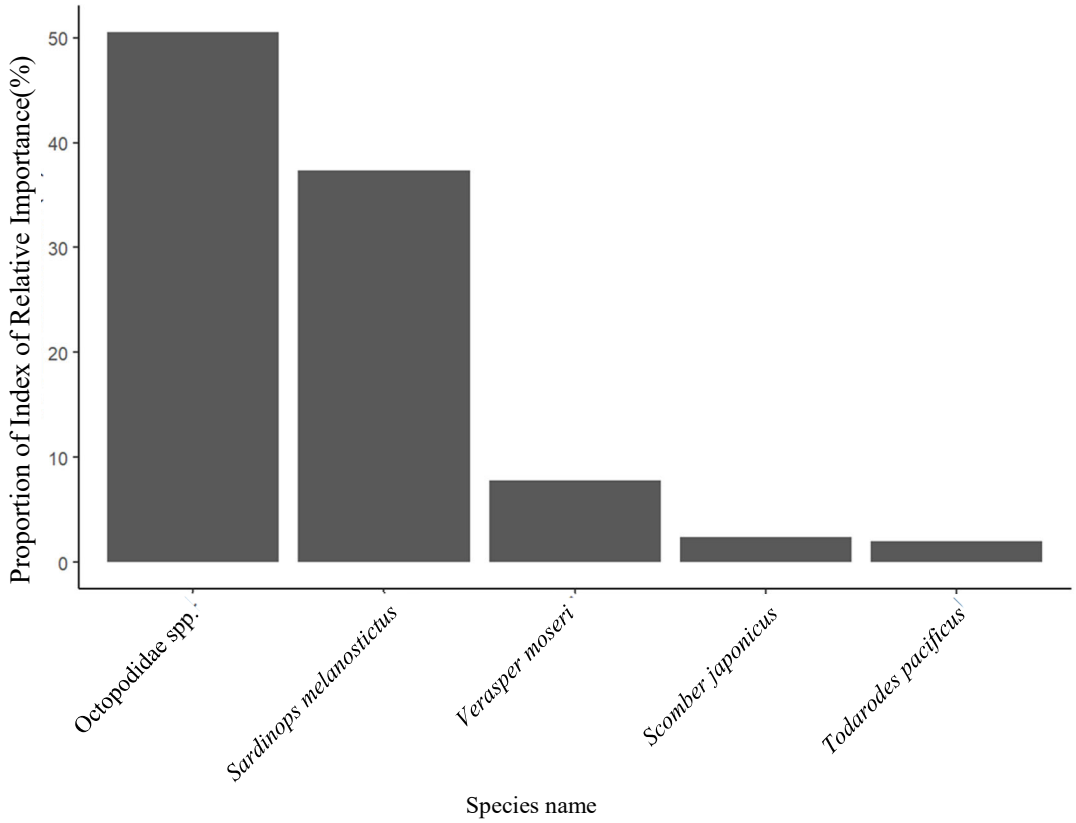


Fig. 17. Proportion of Index of Relative Importance (IRI %) of prey organisms among of captured individuals

*IRI:

$$IRI_i(\%) = \frac{\{I_i(\%) + W_i(\%)\} \times Fo_i(\%)}{\sum[\{I_i(\%) + W_i(\%)\} \times Fo_i(\%)]} \times 100$$

Frequency of occurrence (Fo%): an index showing prey organisms being consumed at a high frequency = (number of stomachs in which organism was found / number of individuals checked, excluding individuals with no stomach contents) × 100

Proportion of all prey represented by a particular species of prey organism (I%): an index showing prey organisms being consumed in large numbers = (number of particular organisms found / total number of organisms found) × 100

Weight ratio (W%): an index showing prey organisms being consumed in large amounts = (weight of particular organisms found / total weight of organisms found) × 100

○ Survey of stomach contents of bycaught individuals

The top three prey organisms in terms of the Proportion of Index of Relative Importance (IRI %) were Octopodidae spp. (30.5%), *Physiculus maximowiczi* (30.3%) and *Eleginus gracilis* (13.6%) (Fig. 18).

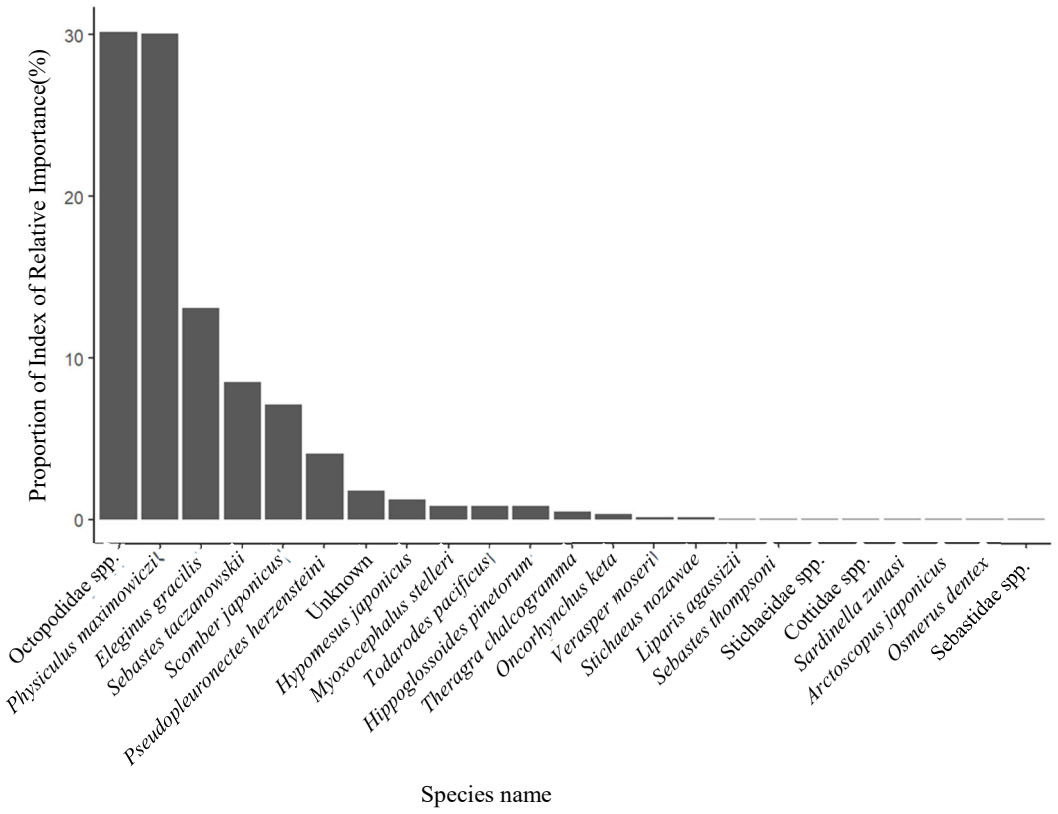


Fig. 18. Proportion of Index of Relative Importance (IRI %) of prey organisms among of bycaught individuals

(4) Asessment of monitoring

○ Since 2012, a declining trend has been seen in the number of individuals hauling out. However, because the results of population surveys of wild animals vary greatly from year to year, the frequency and accuracy of the surveys, variation in haul-out frequency due to capture (capture using gillnets and capture test with a gun), etc. must be taken into consideration. In addition to future long-term population monitoring, the frequency and accuracy of surveys need to be improved.

○ It is necessary to accumulate continuous data about population structure, genetic diversity, infectious disease, etc. Further, regarding home ranges, in addition to working toward the accumulation of information about subadult and adult individuals, both of which are currently insufficient, it is necessary to continue monitoring and fully understand sea conditions and any variation in seal activity accompanying population management.

4. Survey of the Damage Done to the Fishing Industry

(1) Survey of damage done to the fishing industry of trap net in autumn

An understanding of the damage done to the fishing industry was gained through the analysis of questionnaires completed by autumn salmon trap net fishermen in the Erimo area (representing a total of 21 nets) which recorded the number of fish damaged on each fishing day. The percentage of damaged fish in the entire Erimo area is 1.92%, which has been kept low since two years ago (Fig.19). The damage rate decreased slightly on the east side of Cape Erimo from last year, but increased on the west side of Cape Erimo from last year (Fig.20). The reason for the increase in the damage rate was that the catch in the eastern part of Cape Erimo was almost the same as last year, but it decreased to about 1/4 in the western part of Cape Erimo, and the migration of seals has changed due to the influence of red tide.

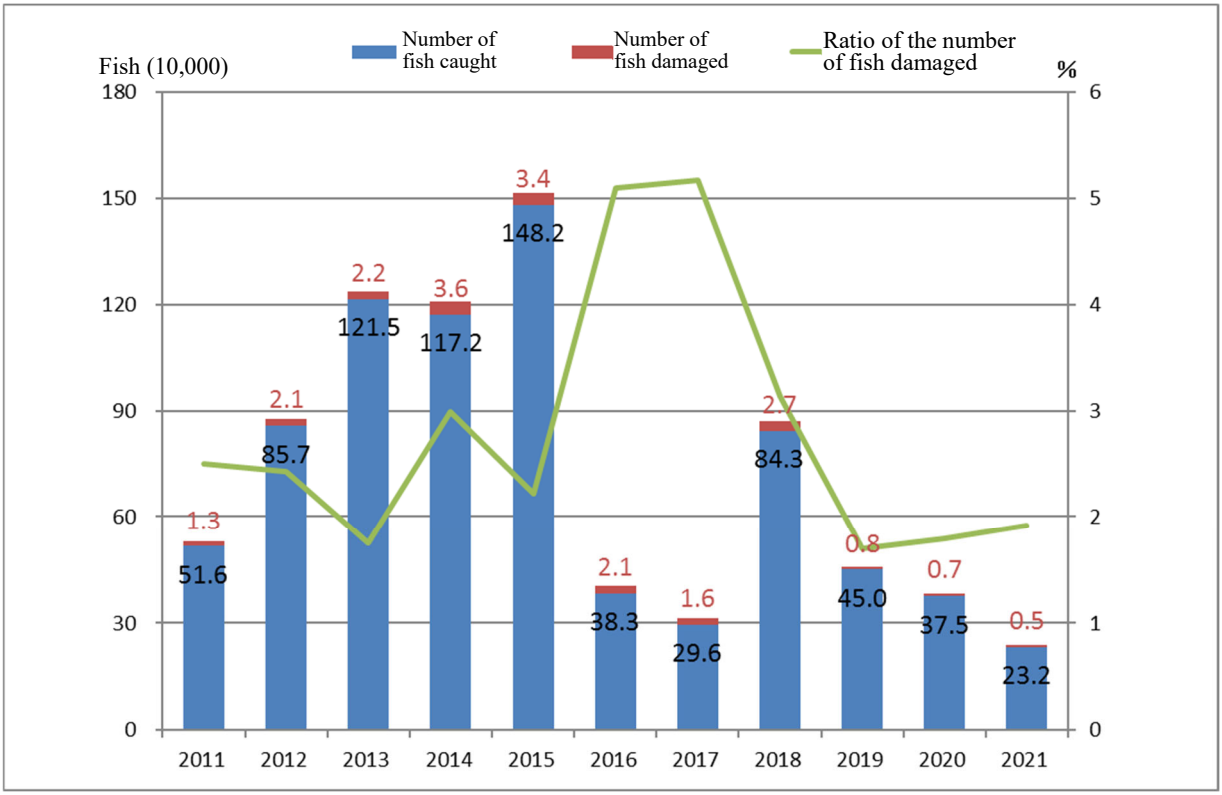


Fig. 19. Changes in damage-to-catch ratio across the Erimo area

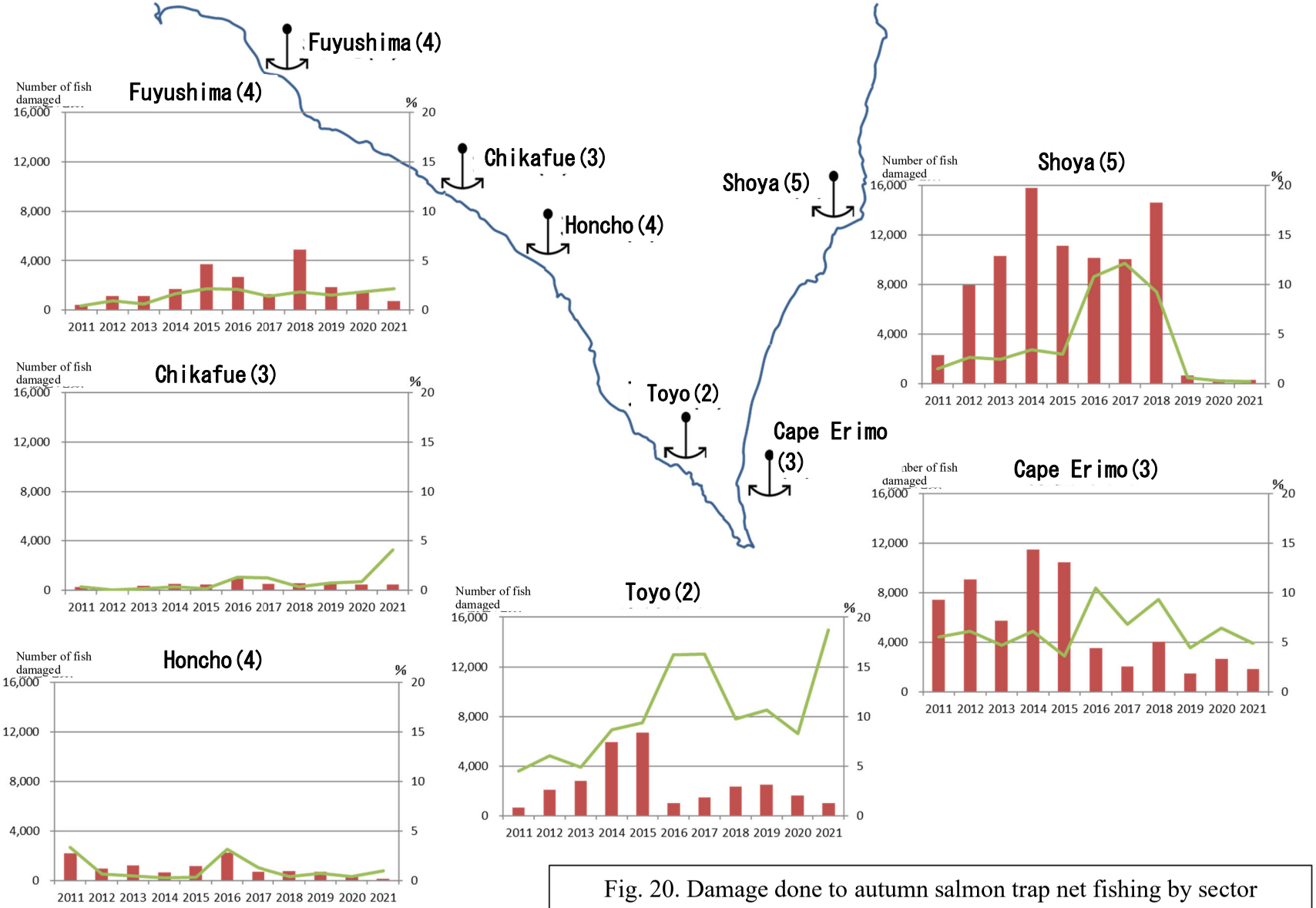


Fig. 20. Damage done to autumn salmon trap net fishing by sector
*Numbers given in parentheses represent numbers of trap nets.

(2) Survey of damage done to the fishing industry of the longline octopus

Every year, around October to November, there is feeding damage that is thought to be caused by harbor seals, but this year there was almost no catch and no damage was reported.

(3) Assessment of the damage done to the fishing industry

Regarding the catch, the record poor catch that has continued since 2016. Furthermore, the arrival of Kuril harbour seals may have changed due to the occurrence of red tide this year. Therefore, it is difficult to make a definitive evaluation, but the decrease in the damage ratio in the Cape Erimo and the Shoya sectors may show the effects of population management and damage prevention measures. However, the damage rate has doubled in Toyo sector, it is necessary to continue to perform monitoring while adopting damage prevention measures to make a long-term assessment.

5. Public Awareness

(1) Communicating information both inside and outside the Erimo area, and public awareness

- As part of the class at Erimo Elementary School, we explained the ecology of the Kuril harbor seal by correspondence.
- Photographs of Kuril harbor seals were posted at the photo exhibition of the Erimo Town Cultural Festival hosted by Erimo Town.
- In addition to participating in the Hokkaido Seal Management Study Group hosted by the Hokkaido Government, a representative of the Ministry of the Environment made a presentation on Kuril harbor seal management in the Erimo area at the Hokkaido Seal Workshop held on February, 2022.
- In order to disseminate accurate information abroad, the FY 2021 Implementation Plan was translated into English and made available on our website: http://hokkaido.env.go.jp/post_34.html.

(2) Transferring seals to aquariums and zoos

In order to make effective use of individuals captured in living organisms and to disseminate information on this project, we will respond as much as possible to requests for transfer to zoos and aquariums, but no seals were transferred, due to a lack of requests in 2021.

Table 6. Kuril harbor seals transferred to date

	Institution	Number of individuals transferred
2016	Noboribetsu Marine Park Nixe (Noboribetsu City, Hokkaido)	1 (1 female juvenile)
	New Yashima Aquarium (Takamatsu City, Kagawa)	4 (3 female juveniles and 1 male juvenile)
	Ueno Zoological Gardens (Taito City, Tokyo)	1 (1 female juvenile)
	Kamogawa Seaworld (Kamogawa City, Chiba)	1 (1 male juvenile)
	Yokohama Hakkeijima Sea Paradise (Yokohama City, Kanagawa)	3 (3 female juveniles)
2017	Yokohama Hakkeijima Sea Paradise (Yokohama City, Kanagawa)	2 (1 female juvenile and 1 male juvenile)
Total transferred to date		12 (9 female and 3 male juveniles)

*Additionally, a weakened individual (1 male juvenile) that washed ashore in Erimo Town in 2016 was transferred to Ouchiyama Zoo (Taiki Town, Mie Prefecture) in November 2017.

(3) Assessment of public awareness

- The effort to gain the understanding of local residents and foreign countries were furthered through communicating information inside and outside the Erimo area. Further, communicating information outside of the area created opportunities for information exchange with experts and others. It is necessary to continue to find good opportunities for communicating information in the future.
- It is considered difficult to transfer a large number of individuals due to institutional issues including the conditions of individuals to be transferred and limits to the number of individuals that can be accepted by host institutions. However, it is necessary to continue working to raise public awareness in partnership with related organizations.

FY 2022 Project Implementation Plan

1. Damage Prevention Measures

Based on results of the various damage prevention measures that have been implemented to date, the following initiatives will be implemented to establish new and improved methods for mitigating damage to the fishing industry.

Furthermore, these methods will be implemented in collaboration with researchers and other related parties, and with adequate consideration of opinions from local fishermen; in addition to presenting the results of experimentation to the community at reporting and conference meetings, etc., advice and suggestions will be gathered for more effective damage prevention efforts, etc., and these will be reflected in the Implementation Plan for the following fiscal year.

(1) Improvement of fishing nets

- Methods proven in previous tests to mitigate damage by blocking entrance into salmon trap nets (such as the installation of rope grids) will be used to further improve nets that prevent damage. Regarding improvements to nets, During the salmon trap net fishing seasons in spring and autumn, effect verification will be conducted on damage preventing trap nets through the installation of rope grids in trap nets, where damage is particularly severe in the Cape Erimo area.
- In light of previous studies conducted abroad which have suggested that only rope grids with opening widths of less than 18 cm are able to prevent entrance into nets by young individuals, and that color may have an effect on fishing efficiency (Suuronen et al. 2006), tests will be performed on rope grids with opening widths of less than 20 cm, as well as rope grids angled at 45 degrees from the horizontal in order to reduce salmon avoidance behavior, with the goal of improving their damage prevention effects.

(2) Gathering information on damage management

- We will collect other examples of measures to prevent fishery damage using marine mammals, such as chasing away, learning animals, and repellent devices for the purpose of preventing fishery damage.

2. Population Management

The following initiatives will be implemented in order to perform population management aimed at both mitigating damage to the fishing industry and maintaining a sustainable Kuril harbor seal population level.

(1) Because damage prevention alone is not enough to prevent increases in the scope of damage, Kuril harbor seals will be captured in cooperation with members of the fishing industry, with the aim of mitigating damage to the fishing industry (preventing increases in the scope of the damage, reducing the severe damage to salmon trap nets, etc.), while also preserving the sustainability of the seal population. Furthermore, research has clarified that juvenile seals, which are susceptible to bycatch, but particular sub-adults and adults cause damage to salmon trap nets, the following methods will be employed toward establishing techniques to capture subadult and adult individuals preferentially.

- In salmon trap nets where damage is particularly severe, seals will be captured over a period of approximately one month during both the spring and autumn fishing seasons, using trap nets which may be capable of preferentially capturing individuals that come into or near to the trap nets (installing trap nets with tunnel shaped rope grids at some of the bag net entrances, etc.).
- Depending on the population management situation, individuals hauling out on rocky shore reefs in the Cape Erimo area will be captured, as a supplementary measure, using gillnets (nets will be raised immediately after any Kuril harbor seal is caught) primarily during salmon trap net fishing seasons.
- In order to be able to preferentially capture damage-causing individuals, methods for distinguishing individuals that persistently attack salmon trap nets will be considered.
- Implementation of capture experiments using small trap nets, etc, by fisheries organizations in the Cape Erimo fishing port will be considered.
- More effective yet still feasible capture methods will be considered through exchanging ideas with members of the fishing industry, other experts, and so on.
- In recent years, when installing fishing nets with capture nets and damage preventing nets, direct damage to the fishing nets by Kril harbor seals has begun to be seen, and in response to this, fishing nets aimed at reducing damage when installing capture nets.

(2) The number of individuals to be captured will be determined based on the following considerations.

<Current habitat situation>

In recent years, the largest number of Kuril harbor seals hauling out at a single time in the Erimo area has been on a growing trend, rising from 400 individuals to around 600 individuals. The estimated population size, taken from the largest number of individuals hauling out at a single time corrected using the haul-out ratio and discovery rate, is approximately 1,000 individuals. Further, the average population growth rate over the past 30 years has been 5% (Matsuda et al. 2015).

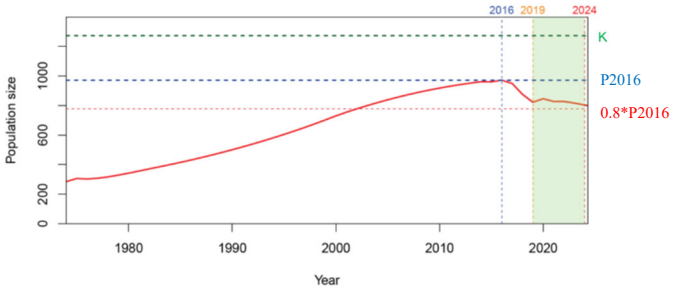
<Considerations essential for determining the number of individuals to be captured>

- Examination will be conducted based on the number of individuals captured over the course of six years from 2016 to 2021 and the number of individuals to be captured will be determined based on the findings.
- The following will be considered when determining the number of individuals to be captured: mitigating damage to the fishing industry, while also guaranteeing population sustainability so that the Kuril harbor seal does not once again become threatened, and keeping the probability of extinction within 100 years to under 10%, all with continuing management beyond 2022 as a necessary condition.
- In light of the reality that the Kuril harbor seal was only recently reassessed from the status of Threatened to Near Threatened, that the Erimo population is highly occlusive, and that there are a number of uncertain elements in the estimates of population size, population structure and ecology, it is necessary to sufficiently account for the safe sustainability of the population.
- The number of individuals to be captured must be adjusted flexibly in consideration of the number of bycaught individuals and imbalances in sex and age among captured individuals (for example, in

cases when a high number of adult females, who strongly influence population trends, have been captured, or in cases when the number of juvenile bycatch deaths has decreased).

<Determining the number of individuals to be captured>

- In the current resource management simulation, which takes the number of bycaught individuals, infectious disease outbreaks and the like into account, the probability of extinction within the next 100 years is nearly 0% if the population in 2024—when Phase II of the Management Plan ends—is managed at a level that is 80% of the population at the time the Management Plan was established (March 2016), and if this level is maintained from 2024 onward (Kitakado 2019). Therefore, the Ministry of the Environment has determined, through an estimation of population dynamics taking the population growth rate and other factors into account, that 50 seals are to be captured annually during Phase II of the Management Plan (Fig. 21). In the event that the number of individuals captured in a single year is too low or too high, we will listen to the opinions of the Scientific Committee and adjustments will be made in the number of individuals to be captured in the following year.
- Approximately 53 seals (excluding released and bycaught individuals) are to be captured in 2022. This number was calculated by adding to the annual 50 seals a shortfall of 3 from the 52 which had been estimated for 2020.
- The number of individuals to be caught by capture method, it is expected that large individuals attached to the salmon trap net will be caught, which is considered to be effective in reducing damage to the fishery. For this reason, we will minimize the capture by the salmon trap net.
- On the other hand, it is assumed that it will be difficult to catch up to 53 heads with the salmon trap net alone. Therefore, based on the above, it is a guideline to catch about 41 individuals with the salmon trap net in 2020 and 2021, and the remaining 12 individuals with the gillnet.
- In addition, when the number of catches reaches 53 individuals, which is a guideline, individuals attached to the salmon trap net are confirmed, and if there is concern about fishery damage, the salmon trap net will continue to be caught from the viewpoint of reducing fishery damage. However, the maximum number of individuals is 20% of total number of catches.



Year	Number of seals caught	Number > 1 year old	Comparison with Initial 2016 number
2016	45	971	1.00
2017	137	950	0.98
2018	143	876	0.90
2019	44	822	0.85
2020	84	846	0.87
2021	49	827	0.85
2022	50	828	0.85
2023	50	816	0.84
2024		804	0.83

Fig. 21. Results of the reassessment of the number of individuals caught

*Population dynamics were predicted when 50 individuals were captured over the two years, taking into account the 2021 cature record.

- Because there have been few successful captures made to date, and there is not sufficient data to show the effectiveness of damage reduction through seal capture, the Ministry of the Environment aims to gather the information necessary to establish monitoring procedures in order to gain a grasp of the effects of seal capture on the Kuril harbor seal population and on the reduction of damage to the fishing industry while also working toward improving seal capture techniques.

<Adjustments and changes to the number of individuals to be captured, etc., and procedures for determining the number in future years>

- The number of individuals to be captured in 2023and beyond will be approximately 50 per year, in principle, and adjusted according to the excess or deficiency in the number of individuals captured up to the previous year.
- The maximum number of individuals to be captured each year will be reexamined after hearing the opinion of the Science Committee.
- From a viewpoint of adaptive management, the information necessary for reexamining the plan will be gathered, a sustainability assessment will be performed, and a new Implementation Plan with the number of individuals to be captured will be established every year.
- In 2022, which is the middle year of the 5-year management plan period, the Ministry of the Environment will make an interim assessment of project implementation based on scientific knowledge and perform population management that fits the population's situation.

(3) The following other considerations will be made regarding population management.

- In the event that sudden changes in population conditions due to an unforeseen circumstance, such as an epidemic outbreak, are discovered in the population, the number of individuals to be captured may be flexibly reassessed even during a year in which capture is being conducted.
- To the fullest extent possible, the Ministry of the Environment will effectively put captured individuals to practical use, including use for research in order to gather data which will facilitate appropriate population management, and strategically raising individuals and transferring them to zoos and aquariums for educational and other purposes. Moreover, in cases when captured individuals are to be euthanized, a method will be employed which limits their suffering to the greatest extent possible.

3. Monitoring

Surveys covering the following items will be conducted in order to appropriately manage the Kuril harbor seals by verifying project implementation effectiveness and reflecting feedback about the population's situation into the Management Plan. Moreover, as a part of adaptive management, survey items may be added as necessity dictates.

Further, in order to examine project assessment and future management plans, the Ministry of the Environment will examine necessary surveys and assessment methods, through a monitoring working group, etc.

(1) Population size and structure

- Accurate haul-out numbers will be surveyed by performing counts of the number of individuals hauling out using visual observation from on land and images captured by drone or other unmanned aerial vehicles (UAVs). The omission rate will be calculated from the counts obtained by UAV and visual observation, and attempts will be made to improve the accuracy of these measurements.
- Regarding the timing of the UAV survey, if the survey conditions are met, it will be conducted regardless of the season. In addition, parameters such as the past discovery rate and the landing rate at the time of the UAV survey, which are necessary for continuing to shift the landing number survey mainly to UAV, will be organized and continued the analysis.
- Images captured by UAV will be analyzed (measurements of body length, girth, etc.) and all efforts will be made to ascertain the structure of the population.

(2) Survey of the damage done to the fishing industry and of the effectiveness of damage prevention measures

- In addition to requesting members of the fishing industry to record the damage situation (number of fish damaged, number of individuals bycaught) on each fishing day, information from shipboard surveys, etc. will be gathered, and the degree and extent of the damage will be ascertained. Multiple indices will be used in the assessment of the damage situation, including the damage-to-catch ratio, total catch size, total catch value, and others.
- Surveys will be conducted on the stomach contents of bycaught and captured individuals to clarify the general situation of salmon predation by seals.
- The effectiveness of damage preventing nets will be verified through surveys of seal behavior and the situation of salmon entering the nets, using underwater cameras installed at salmon trap nets, through gathering information about the installation times and duration of installation of rope grids in trap nets, and through the verification of persistent attacks on trap nets by individual identification and of changes in seal appearance rate due to capture.
- Surveys will be conducted on the damage situation in the local fishing industry other than damage done to fisheries other than salmon trap nets such as octopus longlines, using means such as interviews.
- A fishery damage awareness survey will be planned for the purpose of comprehensivery understanding the scale of fishery damage and the fishermen's awareness of damage.

(3) Population trends

- ○ Ecological data which is necessary to ascertain population trends (body length, body weight, age, sex, blubber thickness, breeding conditions, etc.) will be obtained from bycaught and captured individuals.
- ○ Surveys will be conducted on Kuril harbor seal range, etc., using EM transmitters.
- ○ Specimens necessary for the analysis of infectious diseases, the population's genetic diversity and the like will be collected.

(4) Habitat

The Ministry of the Environment will gain the cooperation of members of the fishing industry, and consider how to build a system for collecting and analyzing information which is necessary to gain a complete understanding of coastal ecosystems, including fish fauna as the seal's food sources.

(5) Assessment of sustainability

Population conditions will be assessed based on quantitative analysis of monitoring results.

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