Ministry of the Environment
Erimo Area Kuril Harbor Seal Management Project Implementation Plan, FY 2021

March 2021

Hokkaido Regional Environment Office

Contents

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 2021 Implementation Plan shall be defined as given below, taking into account the results of the projects implemented from 2016 to 2020.

FY 2020 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

With the goal of establishing procedures to mitigate particularly severe damage to salmon trap nets, and in order to block entrance by Kuril harbor seals into salmon trap nets, the Ministry of the Environment installed rope grids (spring fishing season: 20 cm × 20 cm [made of Dyneema®], autumn fishing season: 17 cm × 17 cm [made of Dyneema®], etc.) 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. In addition to the conventionally used horizontal rope grids, rope grids angled at 45 degrees from the horizontal were also used, as these are thought to more easily allow *Salmoniformes* to enter.

In addition, a fishery fastener was installed around the rope grid to facilitate replacement work this year.

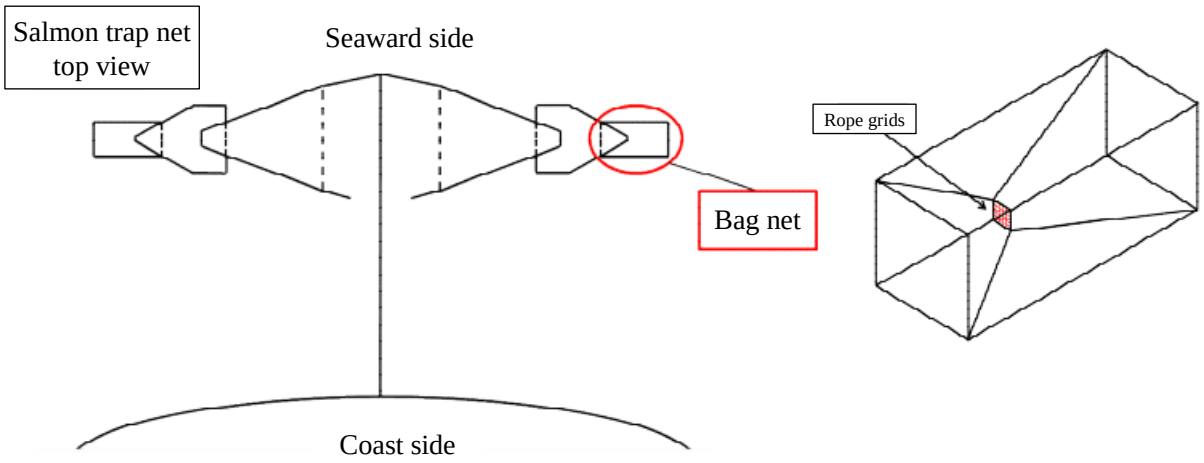
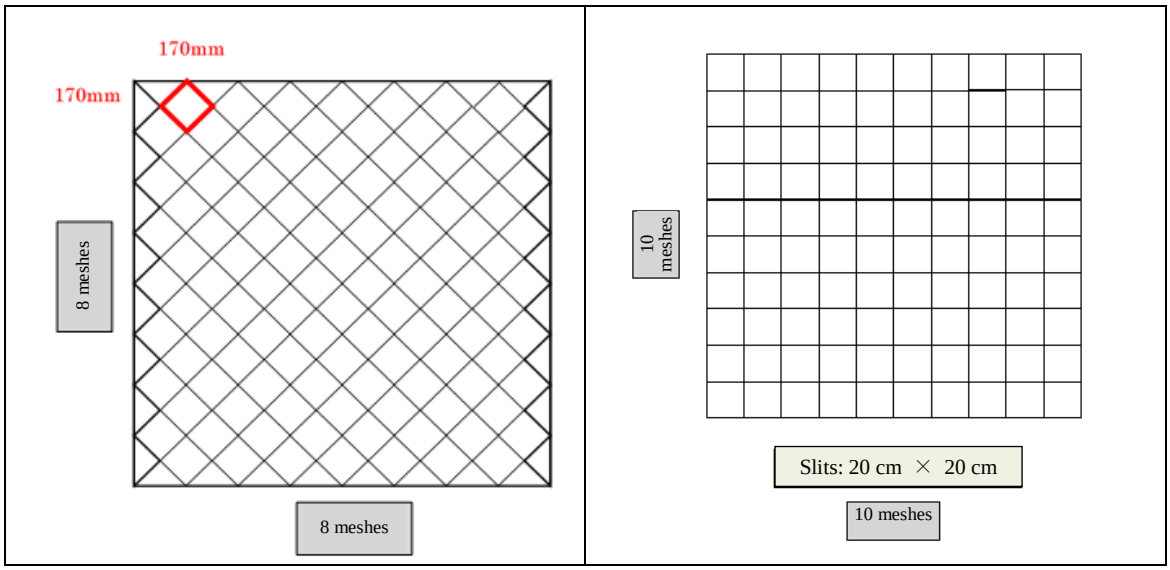


Fig. 1. Rope grid installation



Angled rope grids
(slits: 16 – 20 cm × 16 – 20 cm)

Conventional horizontal rope grids
(slits: 16 – 20 cm × 16 – 20 cm)

Fig. 2. Angled rope grids (left) and conventional horizontal rope grids (right)

Table 1. Rope grid types and installation periods

Salmon trap net fishing season	Sector name	Number of nets with rope grids installed	Type of rope grids	Installation period
Spring	Toyo	1	20 cm × 20 cm (horizontal)	5/19 – 7/1
Autumn	Toyo	1	20 cm × 20 cm (horizontal)	9/3 – 11/7 (50 days during the period)
	Cape Erimo	3	18 cm × 18 cm, 17 cm × 17 cm (mainly angled)	9/7 – 11/20 (65 days during the period) 9/7 – 11/20 (75 days during the period) 9/7 – 11/20 (18 days during the period)
	Shoya	2	18 cm × 18 cm (angled)	9/5 – 11/19 9/5 – 11/19

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

<Results of the monitoring of the improvement of fishing nets>

① Spring fishing season (Toyo sector)

Damage prevention through the installation of damage preventing nets in the spring of 2020 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 damage preventing nets was 20 cm × 20 cm, which had previously been confirmed to reduce damage. Regarding the material used, Dyneema® (white) was selected in 2019. In addition, a fishery fastener was installed around the rope grid to facilitate replacement work.

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

This season, the catch was very small even though the fishing has been below average in recent years, and the amount of damage was small for both the seaward side net with the damage preventing nets and the coast side net with the catch net. In spring, there are many large individuals seals come to visit (few newborn individuals seals come to visit), so even a net with a relatively large mesh 20cm × 20cm is considered to have a control effect.

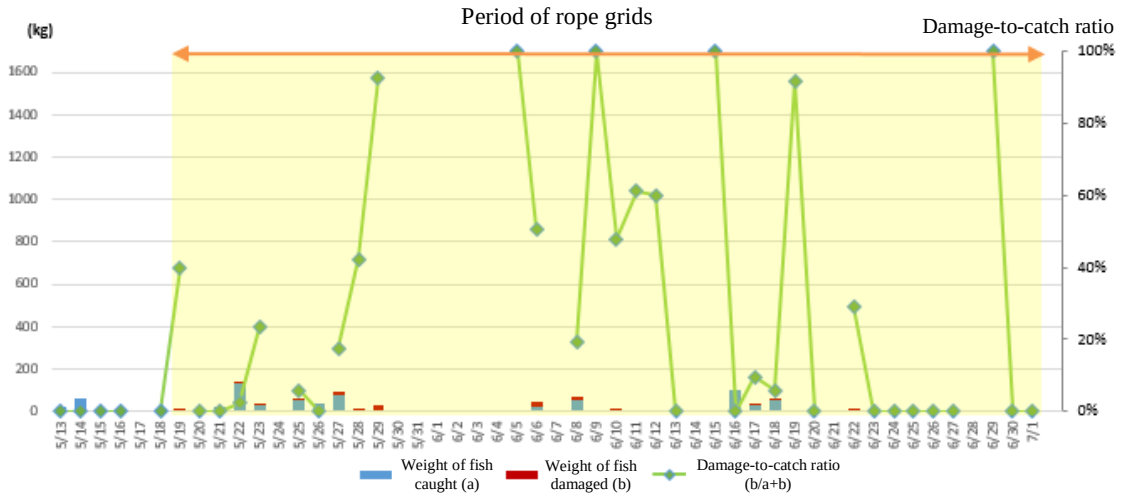


Fig. 3. Damage preventing net installation and damage conditions by day (Toyo sector seaward side)
(Throughout the whole period: 20 cm × 20 cm, horizontal)

② Autumn fishing season (Cape Erimo sector)

Damage prevention through the installation of damage preventing nets in the autumn fishing season, this year as well, we continued to use the angled, which were able to control the fish well and efficiently in the fall from 2018. As for the mesh size, we used 17cm × 17cm, which we have never used before, as with the tunnel capture net. In addition, a fishery fastener was installed around the rope grid to facilitate replacement work. Last year, if there was a lot of damage, we replaced it with a control grid with a smaller mesh. However, this year, only 17cm × 17cm grids with angled slits was used, and when the catch was small, adjustments were made such as removing the control grid once in anticipation of more catch. No damage to the control grid due to catching of sunfish and sharks was not observed

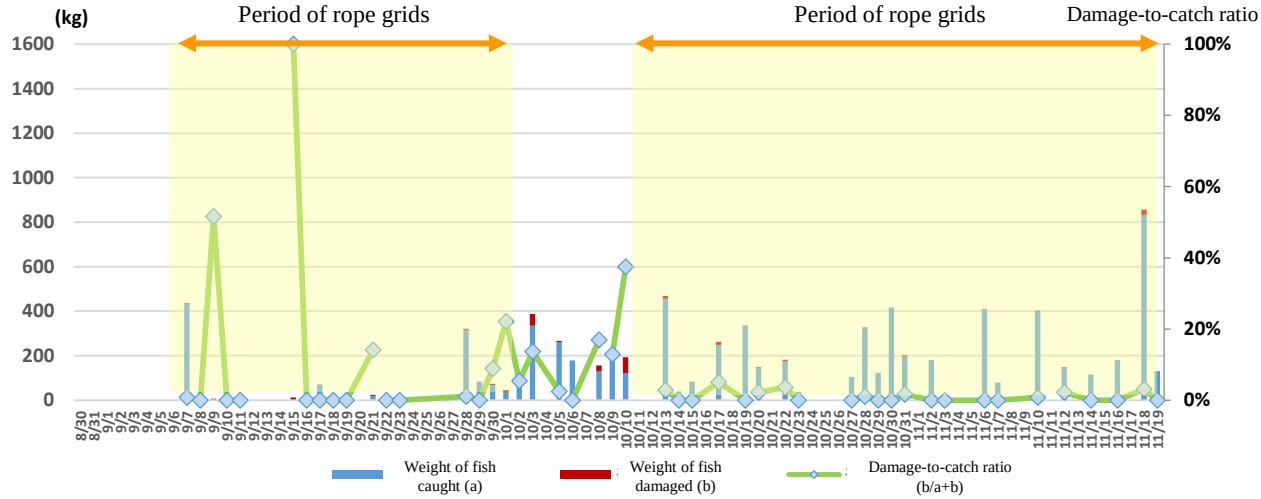


Fig. 4. Damage preventing net installation, total catch size and damage-to-catch ratio (Cape Erimo sector, net: southern seaward side)

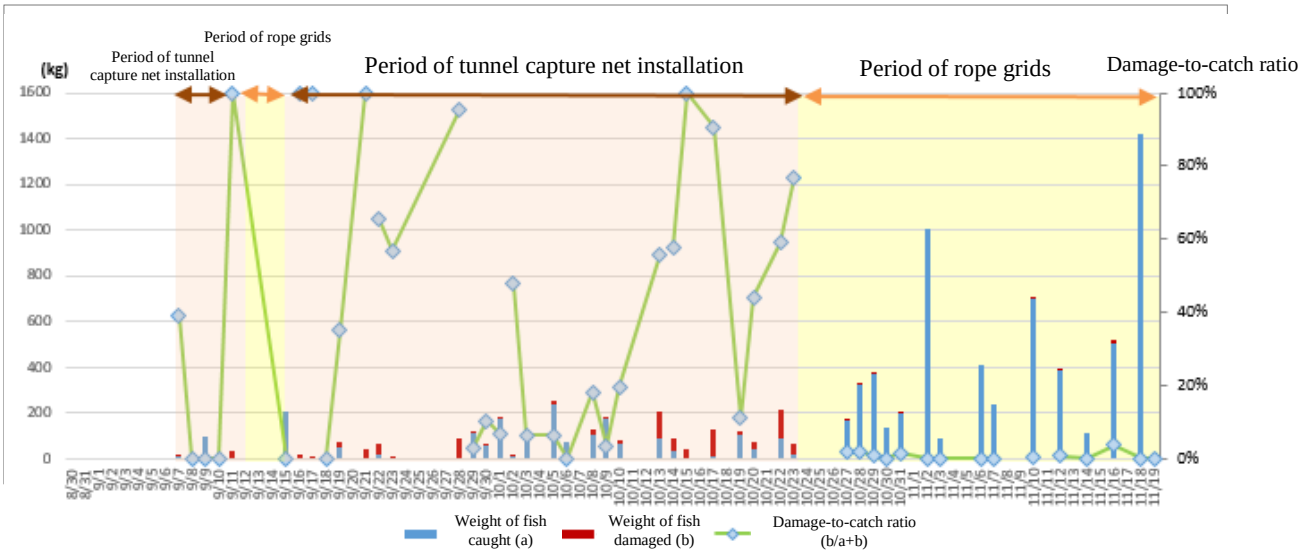


Fig. 5. Damage preventing net and tunnel capture net installation, total catch size and damage-to-catch ratio (Cape Erimo sector, net: northern seaward side)

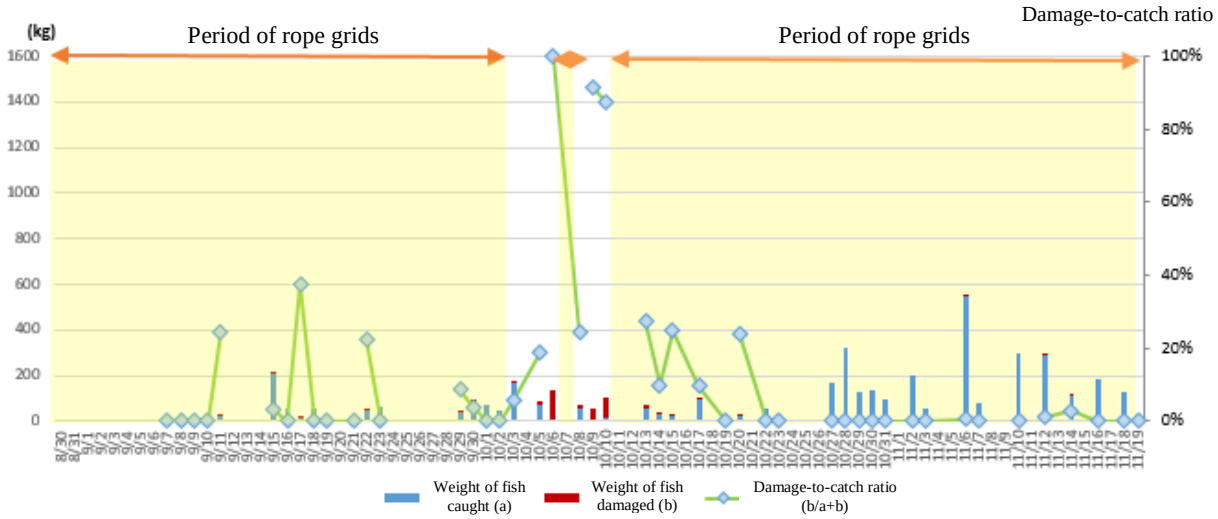


Fig. 6. Damage preventing net installation, total catch size and damage-to-catch ratio

(Cape Erimo sector, net: southern land side)

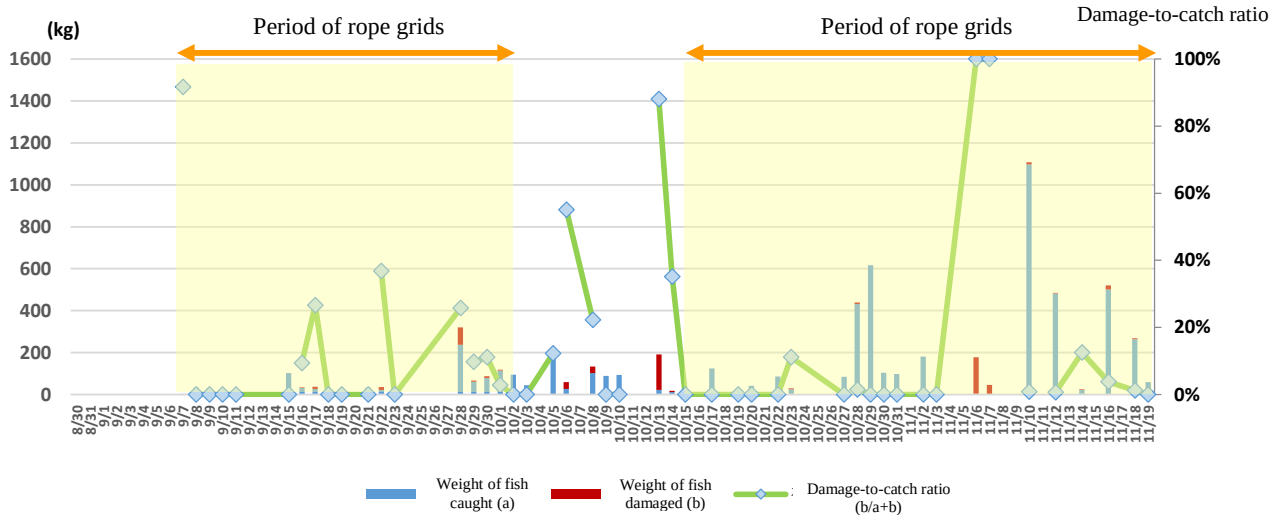


Fig. 7. Damage preventing net installation, total catch size and damage-to-catch ratio

(Cape Erimo sector, net: northern land side)

<Assessment of the improvement of fishing nets>

- As in previous results, the damage mitigation effects of installing rope grids in individual salmon trap nets were confirmed, and their effectiveness as a means of damage prevention for trap nets that were susceptible to severe damage was shown. Further, since it has been confirmed that the frequency of Kuril harbor seal visits to the net areas is decreased, it is reasonable to expect mitigation effects for undetected damage, such as salmon being taken from nets.
- In2020, the total number of nets on which salmon trap nets with rope grids were installed increased: with one net installed in one sector during the spring fishing season and seven nets in three sectors during the autumn fishing season. This is considered to reflect growing expectations for the damage reduction effects of rope grids by fishermen who are already using them. It is essential to further improve damage preventing nets to make them highly effective at preventing Kuril harbor seals from entering the nets while also having minimal effects on salmon. The use of such nets according to the amounts of fish caught and damaged should also be examined.

(2) Improvement of ultrasonic wave repellent equipment

For the development of equipment (hereafter “repellent equipment”) which effectively emits ultrasonic waves that have been shown to be effective in repelling Kuril harbor seals in previous experiments (Murata et al. 2016), tests of this equipment installed on salmon trap nets were conducted in spring. The repellent equipment used was the same as that used in 2018, which was based on improvements (i.e., emission in two directions on each side and more powerful batteries).

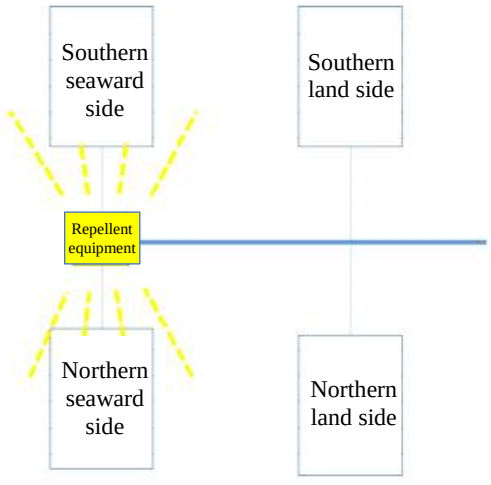


Illustration of repellent equipment installation

Improved repellent equipment

○ **Spring fishing season (Toyo sector, using repellent equipment alone)**

In the spring fishing season, ultrasonic wave repellent equipment alone was installed and activated from June 4 to June 17 in one salmon trap net on the seaward side in the Toyo sector.

No clear difference was shown by the presence or absence of the repellent equipment. A certain amount of damage was found when the repellent equipment was installed (Figs. 8 and 9).

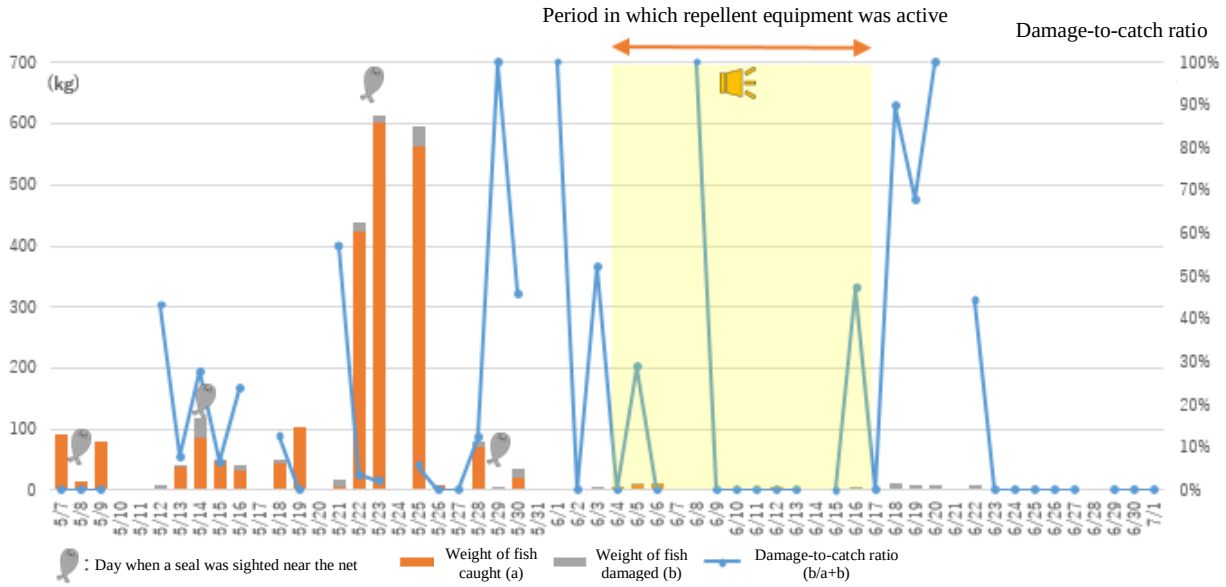


Fig. 8. Repellent equipment installation and damage conditions by day (<u>with</u> repellent equipment, on the seaward side)

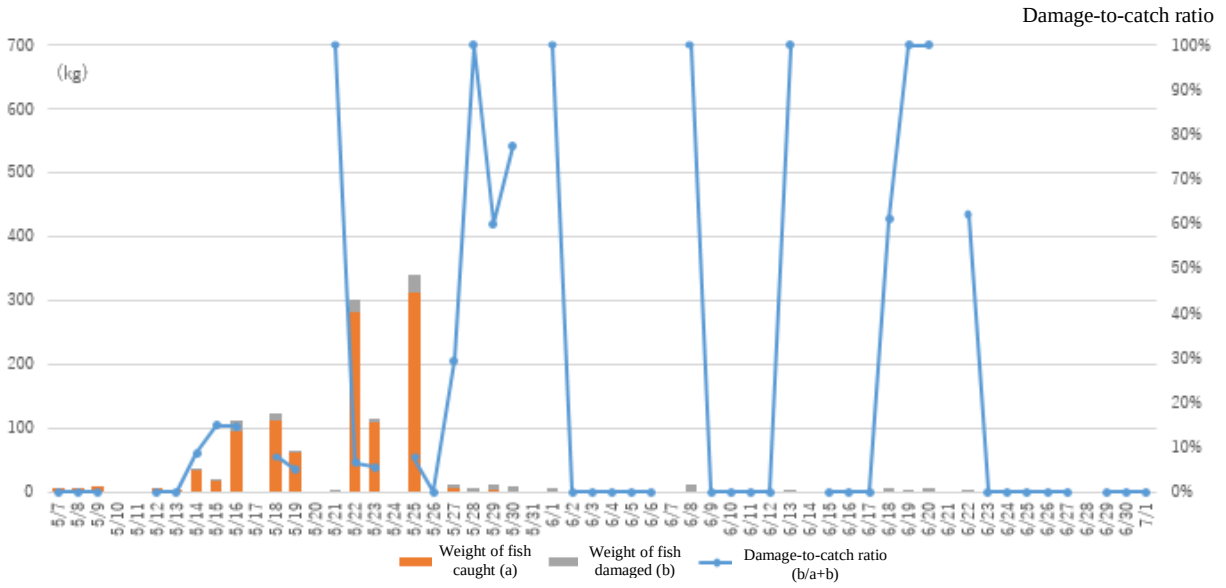


Fig. 9. Repellent equipment installation and damage conditions by day (<u>without</u> repellent equipment, on the land side)

<Assessment of ultrasonic wave repellent equipment tests >

○ Regarding the effect of ultrasonic wave repellent equipment, the amount of damage was small regardless of whether the repellent equipment was in oparation or not, as in last year, but damage was confirmed even when the repellent equipment was in operation. Also, the situation is the same for the land network where the repellent equipment is not operating, and it can be said that it is very difficult to judge the effect of the repellent equipment.

In fact, previous experiments that were conducted using floating cages and those using trap nets did not show any noticeable effects on repelling Kuril harbor seals. For this reason, with the advice of the Kuril Harbor Seals Scienticic Committee, prepare a summary material such as the history and verification contents so far, and the test will be susupended after 2021 in consideration of its practicality in the fishing industry.

Table 2. Comparison table of Prototype specifications and Improved basic design specifications

Item	Prototype specifications	Improved basic design specifications
Installation time	from spring 2017	from spring 2018
Structure (main unit and power supply)	Separated	Separated
Housing configuration	2 circular units	1 circular unit, 1 square unit
Rough housing dimensions	950 × 530 × 550 mm	1,070 × 670 × 790 mm
Housing material	Stainless steel	Stainless steel
Weight-in-air	46.5 kg or less	71.7 kg or less (main unit)
Ultrasonic wave oscillator	600 W × 1	600 W × 2
Freguency	50 kHz, 200 kHz	
Sound pressure	206 dB re 1μPa (output 600W, distance 1m)	
Number of shots	40 － 375 time / minute	
Launch pulse width	500 μs － 3.0 ms	
Ultrasonic wave intensity	Adjustable (max intensity 600W, 9 levels from 20 to 100)	
Ultrasonic wave emission angle	Linear 0° – 90° (from vertical to horizontal)	
Frequency ofultrasonic wave emission	Selectable (default: continuous)	
Cycle operation	free	
Ultrasonic wave emission output switching	Impossible	Possible (one or two direction)
Battery capacity*	3 days (default settings) ※Lead-acid battery	4 days (default settings) ※Lithium ion battery

Battery specifications		
Type	Lead-acid battery	Lithium ion battery pack
Weight	4.5 kg × 2	6.5 kg
BT Unit weight	14.5 kg	10 kg
Capacity	12 AH	20 AH
Charging time	15 hours	5 hours

2. Population Management

The Ministry of the Environment captured seals using salmon trap nets, gillnets, etc. 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

With the cooperation of salmon trap net fishermen in the Cape Erimo area, tunnel capture nets from which Kuril harbor seals cannot easily escape (Fig. 12) were deployed in the spring fishing season for a total of 45 days between May 19 and July 2 (which was raised 39 times), and a total of 44 days in the autumn fishing season between September 6 and September 11 and on between September 16 and October 23 (raised 31 times).

Additionally, tunnel capture nests were installed on a total of three trap nets in the autumn fishing season: one trap net in the Toyo sector and two in the Cape Erimo sector. Attempts to capture seals were made as follows: for the seven days between September 15 and 21 on the Toyo trap net (which was raised seven times), for the seven days between September 18 and 21 and between October 27 and 29 on the Cape Erimo trap net 1 (raised six times), and for the 26 days between September 7 and 15 and 16 and between October 17 and 28 and between November 10 and 20 on the Cape Erimo trap net 2 (raised 16 times).

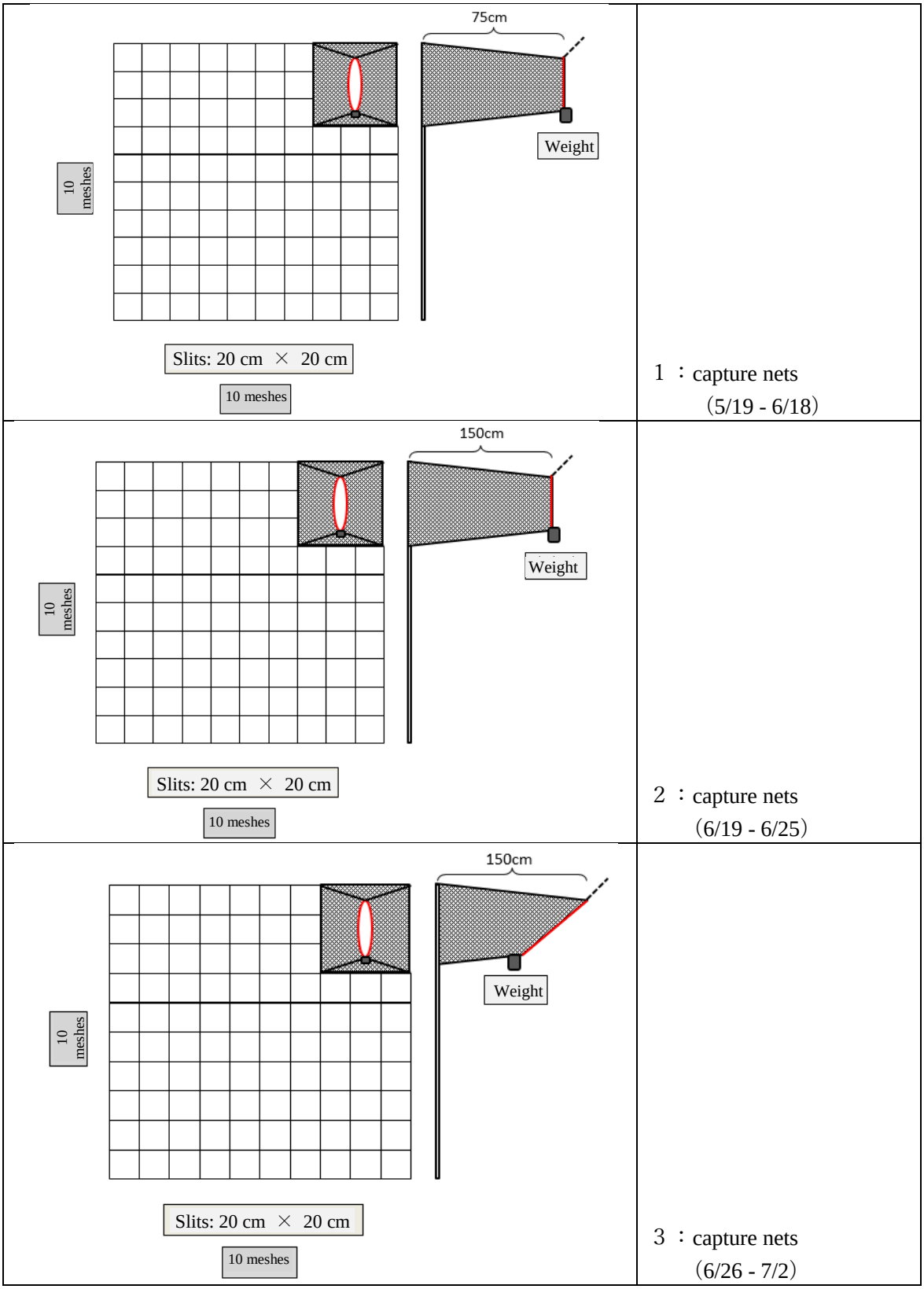


Fig. 10. Spring fishing season capture nets

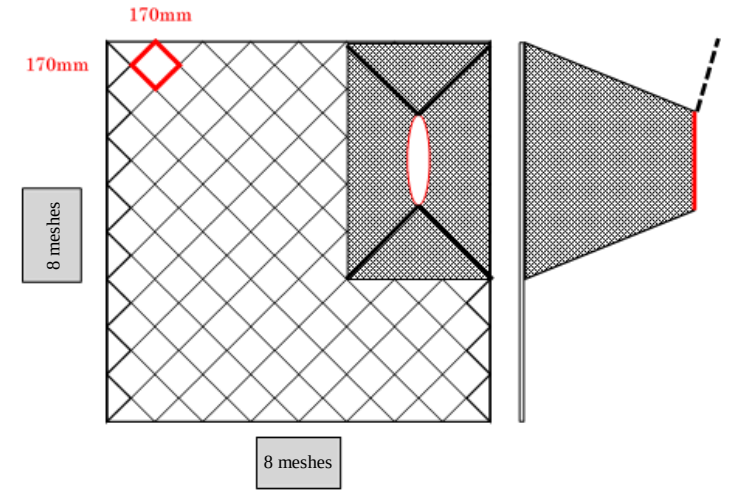
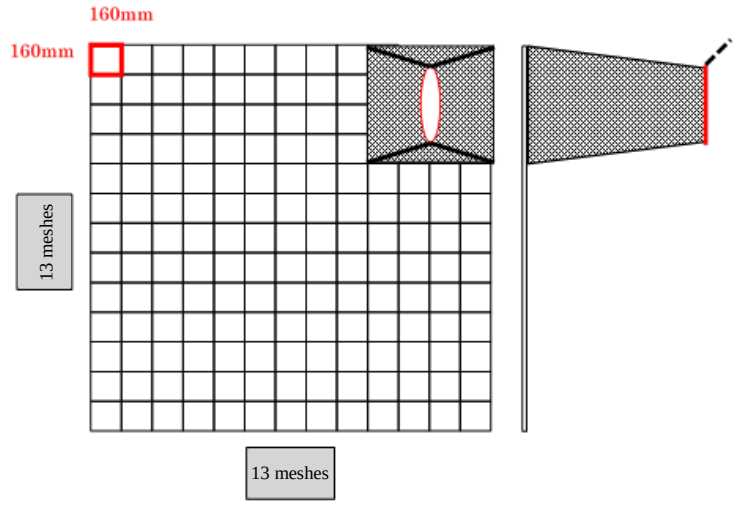
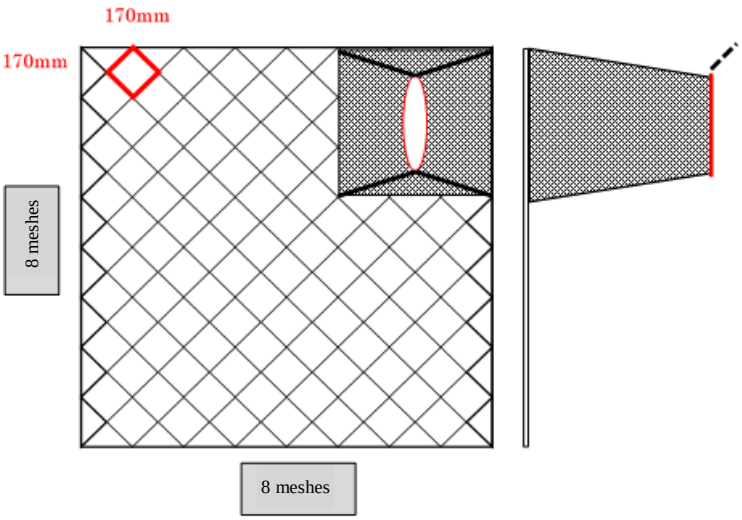
	1．17cm×17cm angled capture nets （Entrance of tunnel ： Vertical 5 meshes×side 3 meshes）
	2．16 ㎝×16 ㎝ horizontal capture nets （Entrance of tunnel： Vertical 4 meshes× side 4 meshes）
	3．17cm×17cm angled capture nets （Entrance of tunnel： Vertical 3 meshes×side 3 meshes）

Fig. 11. Autumn fishing season capture nets

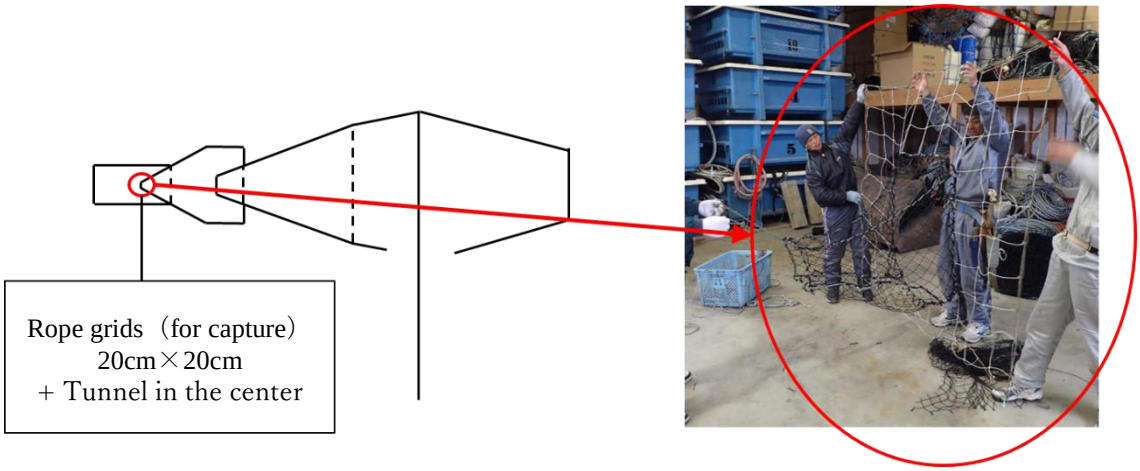


Fig. 12. Structure of tunnel capture nets installed on salmon trap nets

(2) Capture using gillnets

Capture of seals using gillnets was performed with the cooperation of members of the fishing industry near the rocky shore reefs of Cape Erimo on June 19, 2020.

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

In order to investigate the possibility of using firearms for capture, as well as the effects on the Kuril harbor seals, etc., test firing by two marksmen using air guns was carried out in the presence of a veterinarian, near the rocky shore reefs of Cape Erimo on February 11, 2020. As a result, three seals（two juveniles and one unknown ） was captured.

[Academic investigation implemented in FY 2019]

(4) Capture results

A total of 84 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 to investigate the percentage of those hauling out.) During the emergency capture efforts conducted using three additional salmon trap nets in the autumn fishing season, eight of them were bycaught.

Further, seals were categorized using age estimates made based on growth curves, with individuals aged 5 years and older designated as adults (sexually mature individuals), with immature individuals aged 2 to 4 years designated as subadults. (The age composition is provisional.) While individuals aged 1 year old and in their first year of life were designated as juveniles, this data was tabulated separately.

Table 3. Kuril harbor seal capture results by capture method

Capture method	Juveniles (< 1 year)		Juveniles (1 year)		Subadults (2 to 4 years)		Adults (5+ years)		Unknown	Total
	Male	Female	Male	Female	Male	Female	Male	Female		
Spring salmon trap nets (35 times)	1	1	0	0	0	0	2	3	0	7
Autumn salmon trap nets (26 times)	6	8	0	0	7	5	1	2	0	29
Emergency capture (26 times)	1	1	0	0	4	1	1	0	0	8
Subtotal	18		0		17		9		0	44
Gillnets (once)	21	13	0	0	2	1	0	0	0	37
Air guns (once)	0	2	0	0	0	0	0	0	1	3
Subtotal	36		0		3		0		1	40
Total	55		0		20		8		1	84

*The age composition is provisional.

*The table does not include 2 individuals which were fitted with EM transmitter tags/patches.

<Results of the monitoring of population management>

① Population size and structure

○ Due to the influence of COVID-19, it was not possible to conduct a long-term land-based census (performed by Tokyo University of Agriculture) .

<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>

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

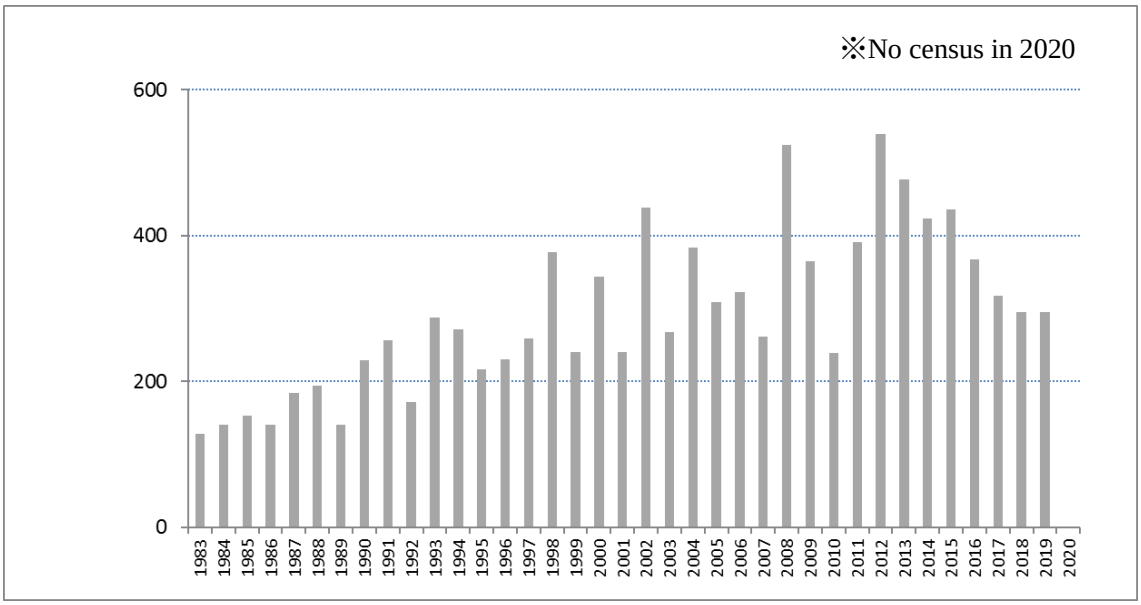
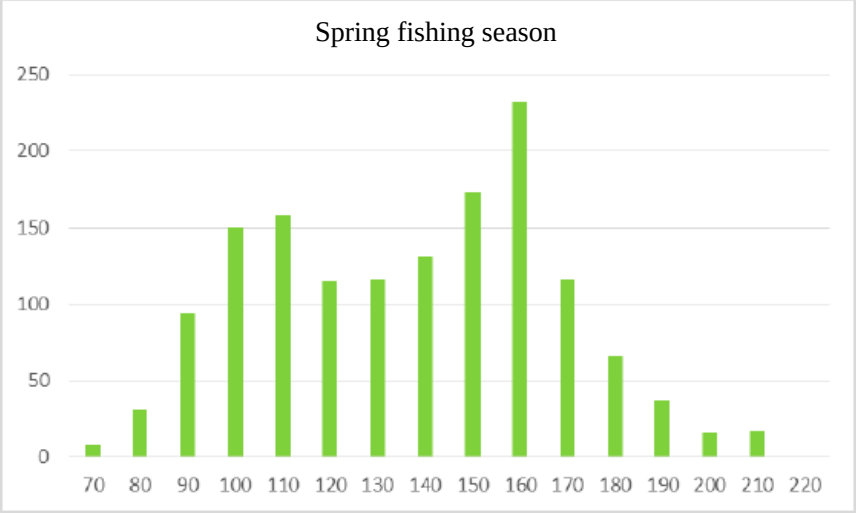


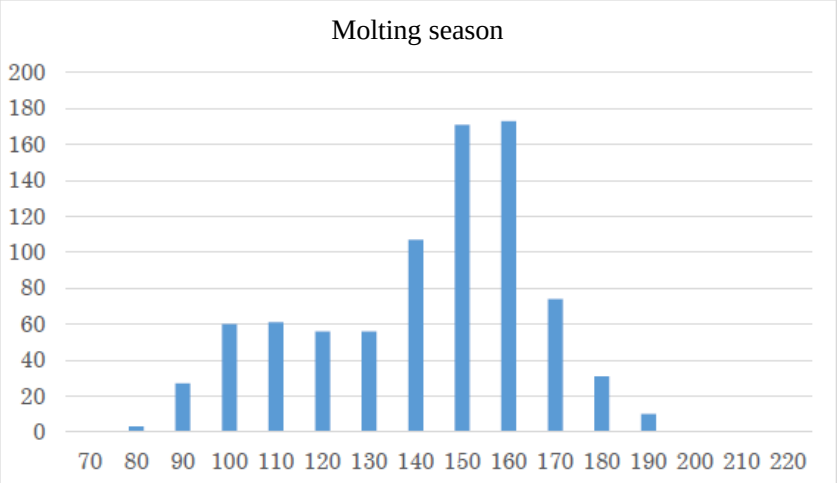
Fig. 13. Largest number of Kuril harbor seals hauling out at Cape Erimo

※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.

○ Images captured by UAV were used to generate orthographic images and ascertain differences in the size of individuals at each rocky shore reef haul-out site.

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 October 2020, 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. 14). For analysis purposes, the Ministry constructed numerical expressions to estimate a body length (from the tip of the snout to the tip of the tail) based on a head-and-body length by using measured data (n = 126) on the body lengths and head-and-body lengths of Kuril harbor seals that were collected in 2020 by the Marine Wildlife Center of Japan. The Ministry then estimated the body lengths of those individuals captured in the drone images based on the measured data on their head-and-body lengths.





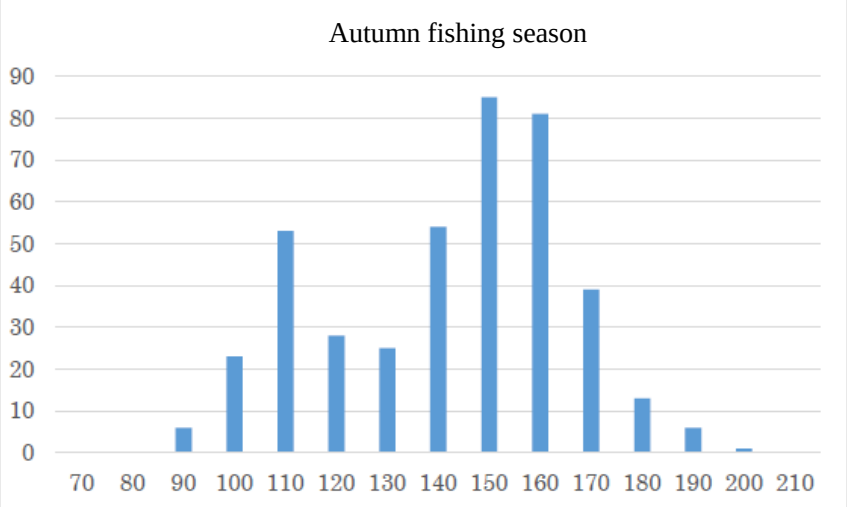


Fig. 14. Comparison of body lengths by season

In the spring fishing season, drone images captured numerous small individuals less than 100 cm in length, which suggests that many individuals born during the breeding season in May and 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. During the molting 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 medium-sized individuals 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. The drone images capturing numerous individuals considered newborns, measuring less than 100 cm, during the spring fishing season has led the Ministry to think that drone images of rocky shore reef haul-out sites will likely allow an accurate estimation of the number of Kuril harbor seal births in the Erimo area.

<Census method using an unmanned aerial vehicle>

In conducting censuses by unmanned aerial vehicle (drone) in the Cape Erimo area, 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 conventional still image recording (i. below) to generate orthographic images.

Equipment used: DJI Phantom 4 Pro; software used: DJI GS Pro

i. Conventional still image recording settings to generate orthographic images (Measurement of individual sizes is under consideration.):
   In the 3D Map Area mode, 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:
   In the Waypoint Flight mode, videos were recorded with the altitude set at approx. 110 m and the speed at 10.5 m/sec.
   Time required: approx. 8 min.

② Population trends

○ Ecological data necessary to ascertain population trends (body length, body weight, age, sex, blubber thickness, breeding conditions, etc.) was obtained from captured and bycaught individuals. Age estimation showed a larger number of juveniles (<1 year old) among both captured and bycaught individuals (Fig. 15).

*The age composition is provisional.

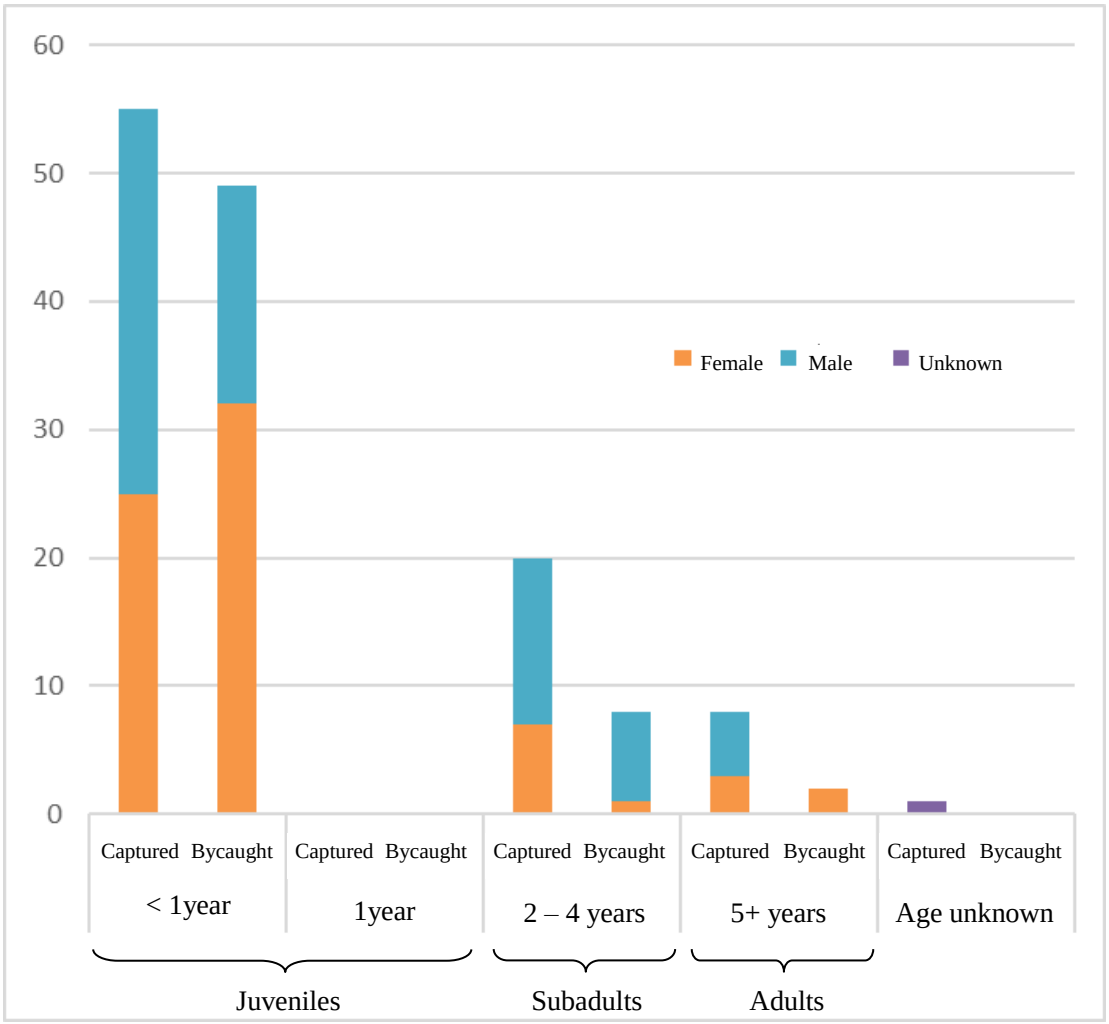


Fig. 15. Estimated age and sex of captured and bycaught individuals in 2020

○ Individuals were fitted with EM transmitters, and a survey of their areas of activity, etc. was conducted.
The Kuril harbor seals were captured by a stationary capture net, and EM transmitters were attached to the two captured adult individuals. Individual 1 was fitted with EM transmitters for a total of 36 days from October 20 to November 15, and Individual 2 was fitted with EM transmitters from October 24 to the present (March 10).
As a result, it was confirmed that Individual 1 had moved to the vicinity of Bansei Onsen in Taiki Town, which is 90km awaya from Cape Erimo in a straight line.

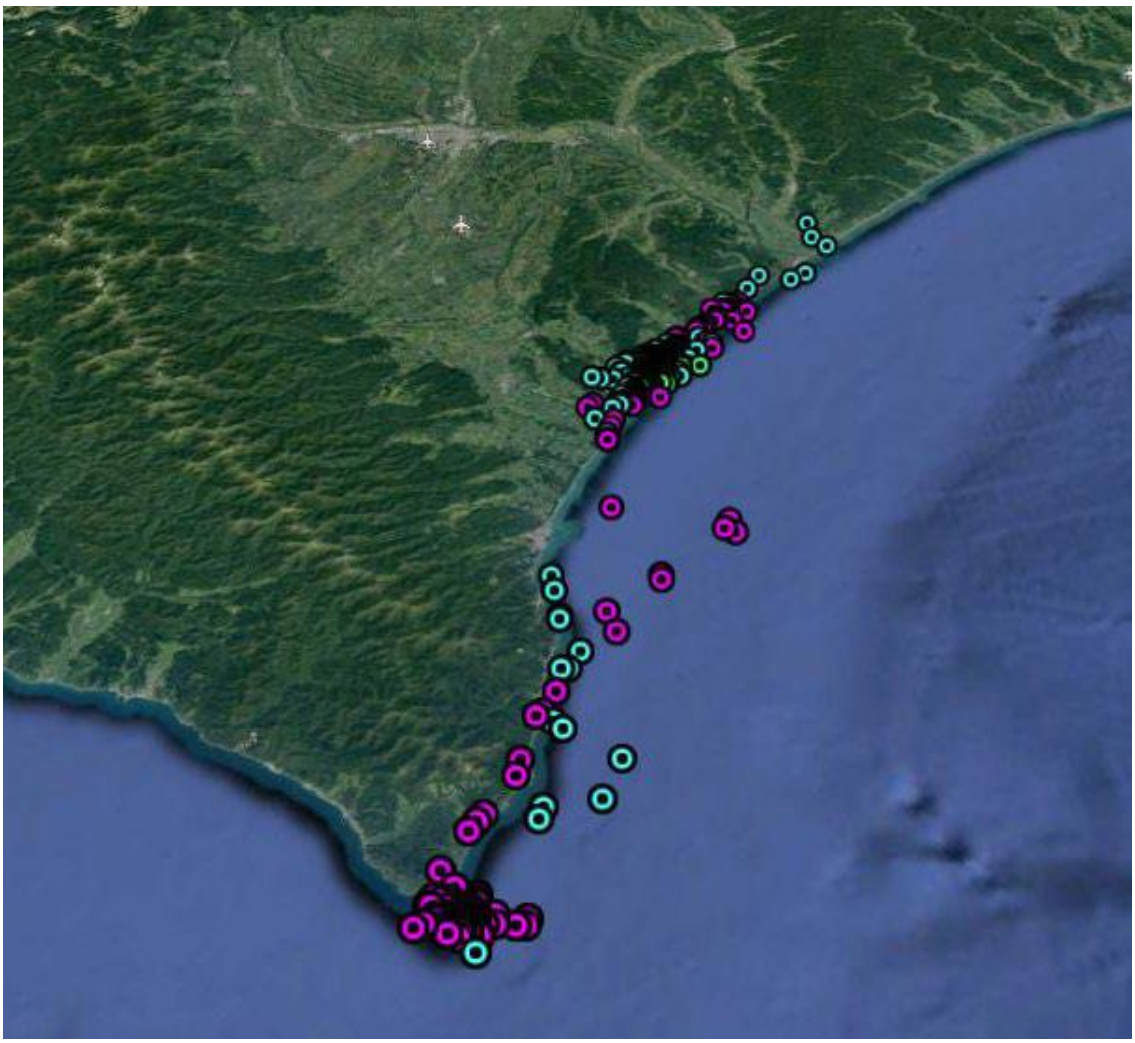


Fig. 16.Behavior of individual 1
(Pink：The trajector of October , Blue：The trajector of November)

③ Survey of the stomach contents of captured and bycaught individuals

○ Overall results

The top three prey organisms in terms of the Proportion of Index of Relative Importance (IRI %) were Octopodidae spp. (80.0%), Osmeridae spp. (4.5%) and small size *Seriola quinqueradiata* (4.1%) (Fig. 17).

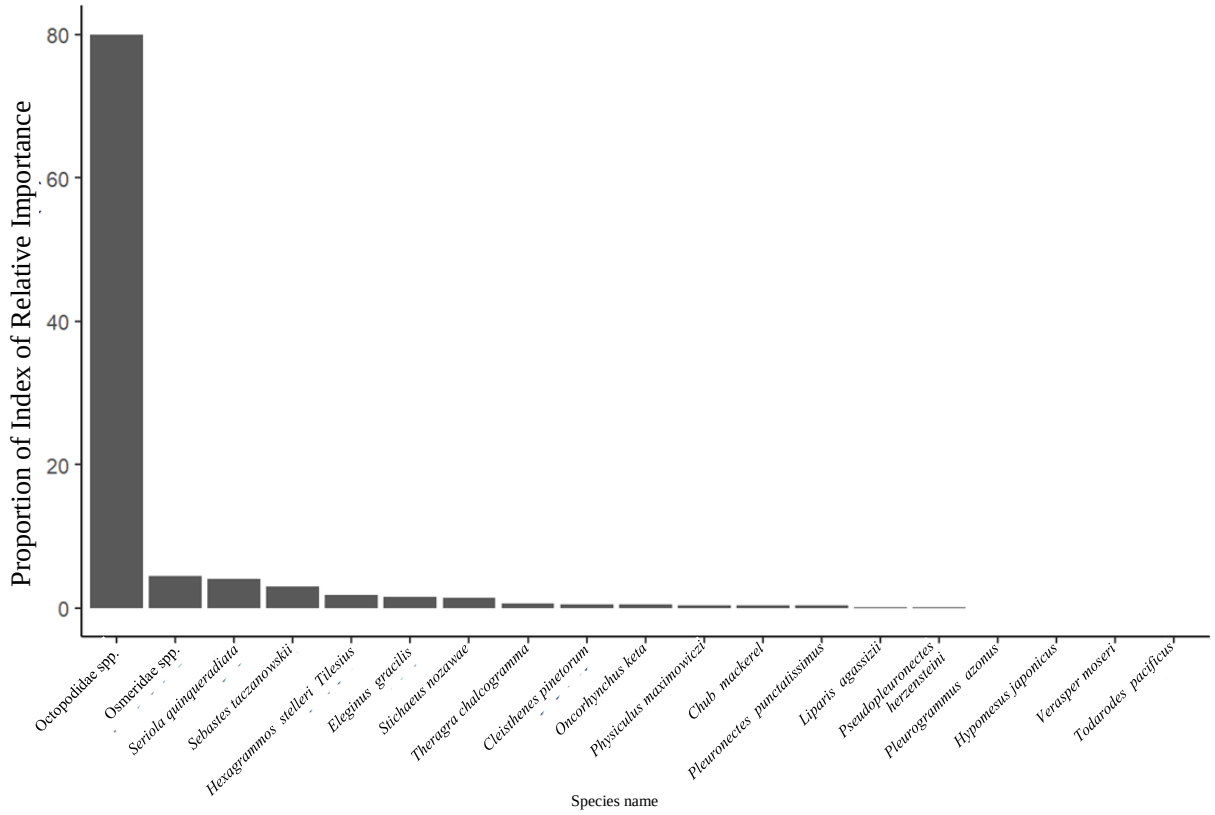


Fig. 17. Proportion of Index of Relative Importance (IRI %) of prey organisms among all the captured and bycaught

*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

○ Capture results by capture method

- Capture using gillnets

Mother's milk was found among the stomach contents of one individual in their first year of life. The prey organisms found among the stomach contents of the individuals, the top three species in order of their frequency of occurrence (FO%) , were: *Stichaeus nozawae* (27.3%), *Theragra chalcogramma* (18.1%) *Hexagrammos stelleri Tilesius* (9.1%).

The Proportion of Index of Relative Importance (IRI %) of those prey organisms was as follows: *Stichaeus nozawae* (31.4%), *Theragra chalcogramma* (22.1%) and *Hexagrammos stelleri Tilesius* (17.7%) (Fig. 18).

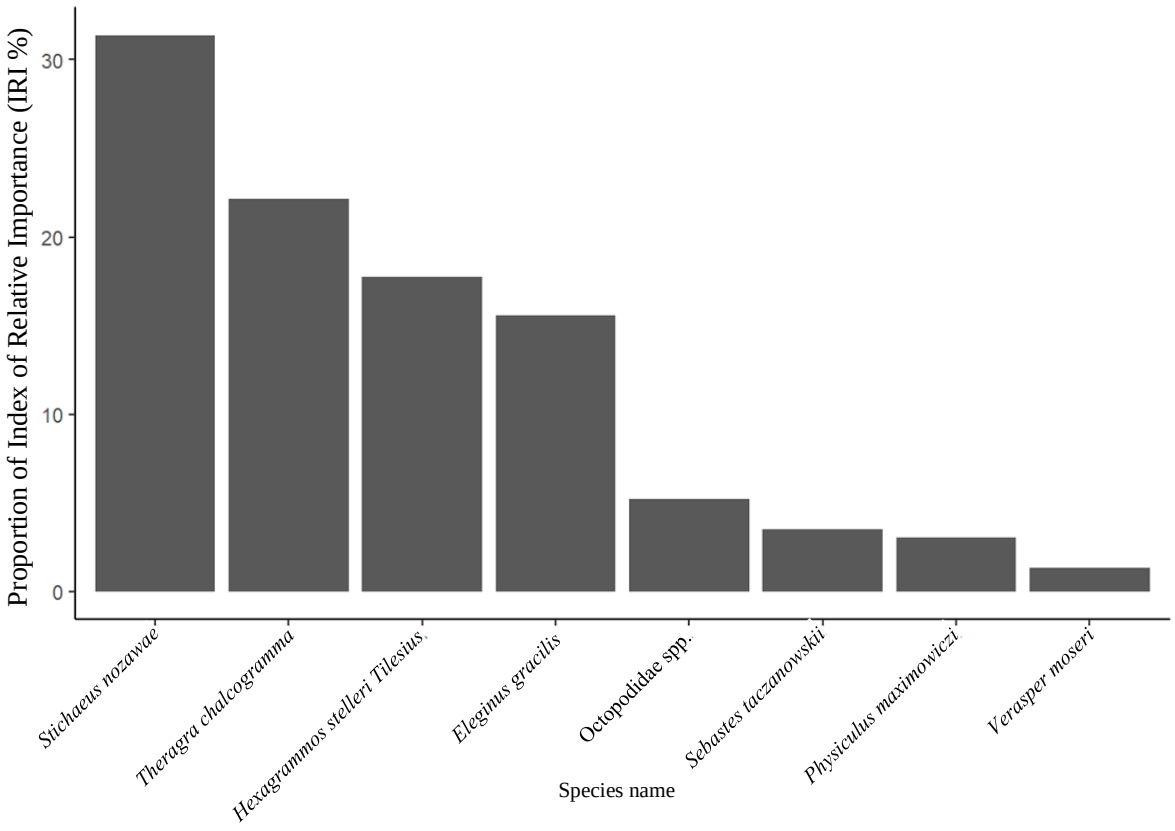


Fig. 18. Proportion of Index of Relative Importance (IRI %) of prey organisms among captured individuals by gilnets

- Capture using salmon trap nets

The prey organisms found among the stomach contents of the individuals, the top three species in order of their frequency of occurrence (FO%) , were: Octopodidae spp. (55.5%), *Scomber japonicas*, *Sebastes taczanowskii*, *Oncorhynchus keta and* small size *Seriola quinqueradiata* (11.1%).

The Proportion of Index of Relative Importance (IRI %) of those prey organisms was as follows: Octopodidae spp. (89.4%), *Scomber japonicas* (3.8%) and *Sebastes taczanowskii* (3.1%) (Fig. 19).

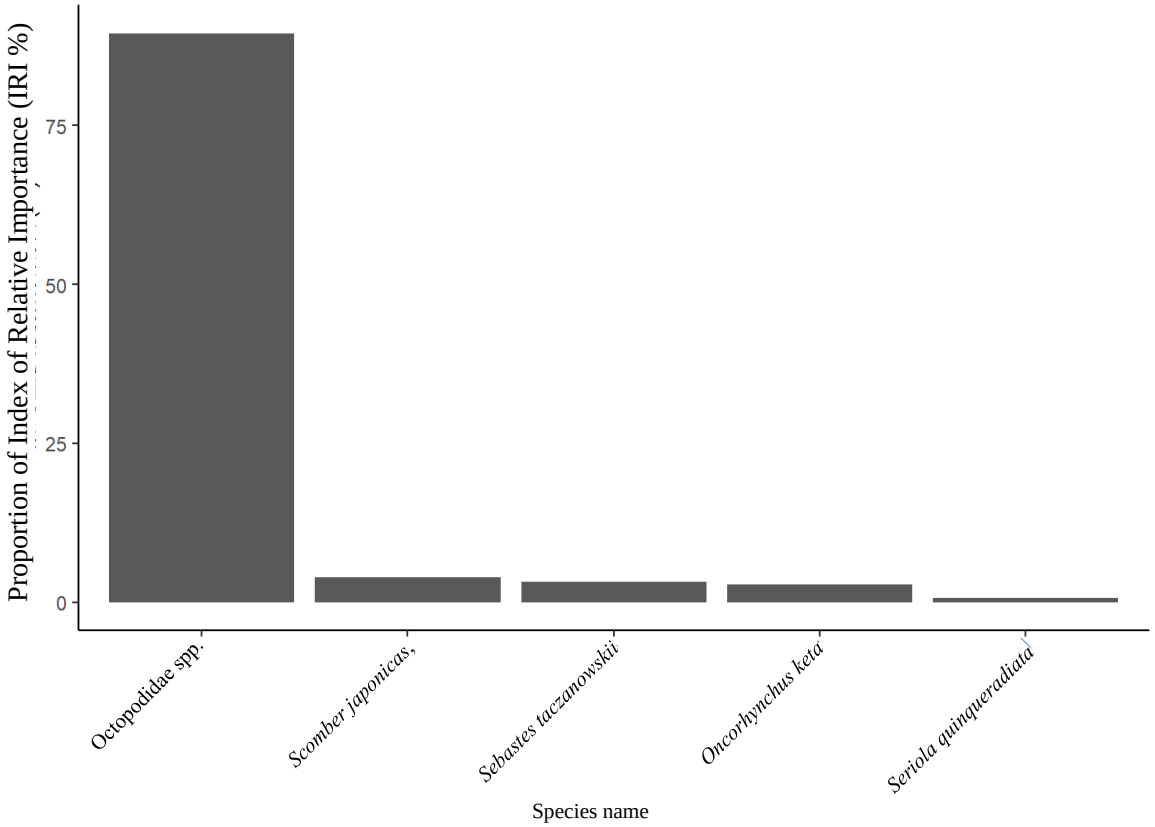


Fig. 19. Proportion of Index of Relative Importance (IRI %) of prey organisms among captured individuals by salmon trap nets

- Results of bycaught individuals

  Mother's milk was found among the stomach contents of two individuals in their first year of life.

  The prey organisms found among the stomach contents of the individuals, the top three species in order of their frequency of occurrence (FO%) , were: Octopodidae spp. (28.9%), *Sebastes taczanowskii* (9.6%) *and* small size *Seriola quinqueradiata* (8.4%).

  The Proportion of Index of Relative Importance (IRI %) of those prey organisms was as follows: Octopodidae spp. (80.0%), Osmeridae spp. (4.5%) and small size *Seriola quinqueradiata* (4.1%) (Fig. 20).

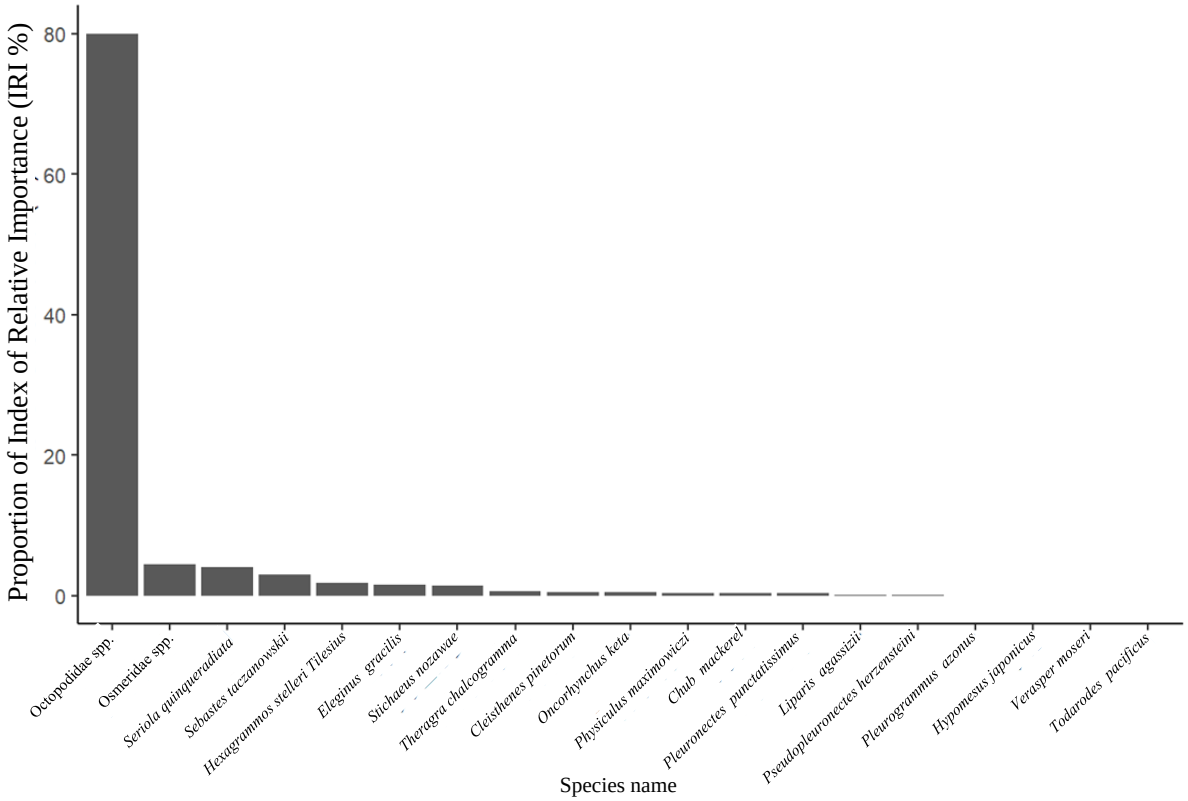


Fig. 20. Proportion of Index of Relative Importance (IRI %) of prey organisms among bycaught individuals

<Assessment of population management>

① Capture results

- Similar to 2020, the number of individuals captured in salmon trap nets was relatively low, and the majority of these were larger individuals. Conversely, in gillnets, the number of individuals captured per day was high, but many smaller individuals were captured. Monitoring results to date show that many large individuals attack salmon trap nets, with a tendency for the same individuals to persistently attack trap nets. For this reason, it is necessary to continue to conduct population management centering around capture using salmon trap nets. Further, caution is needed in order to avoid reductions in capture efficiency due to seal learning.The number of individuals captured in 2020 was 84, which was close to the target of 86, the predetermined goal at the time of the Implementation Plan. In particular, the number of individuals captured in salmon trap nets, there were 44 captures, which was more than in previous years.In addition, in order to examine the capture method, additional capture was carried out using three additional trap nets in the autumn, and as a result, eight individuals were captured. Also, it is necessary to continue researching the capture method while paying attension to the decrease in capture efficiency so that it can be captured mainly by salmon trap nets.

② Population size, trends, etc.

- 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, it is difficult to assess increases or decreases in population from the results of surveys conducted over only a few years. Further, 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 from long-term continuous surveys and information about subadult and adult individuals, both of which are currently insufficient, it is necessary to continue monitoring and fully understand any variation in seal activity accompanying population management.

3. Survey of the Damage Done to the Fishing Industry

< Results of the monitoring of damage done to the fishing industry>

○ 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. While record poor catches have continued since 2016, the damage-to-catch ratio in 2020 stood at 1.79%, which was kept low like 2019 (Fig. 21).

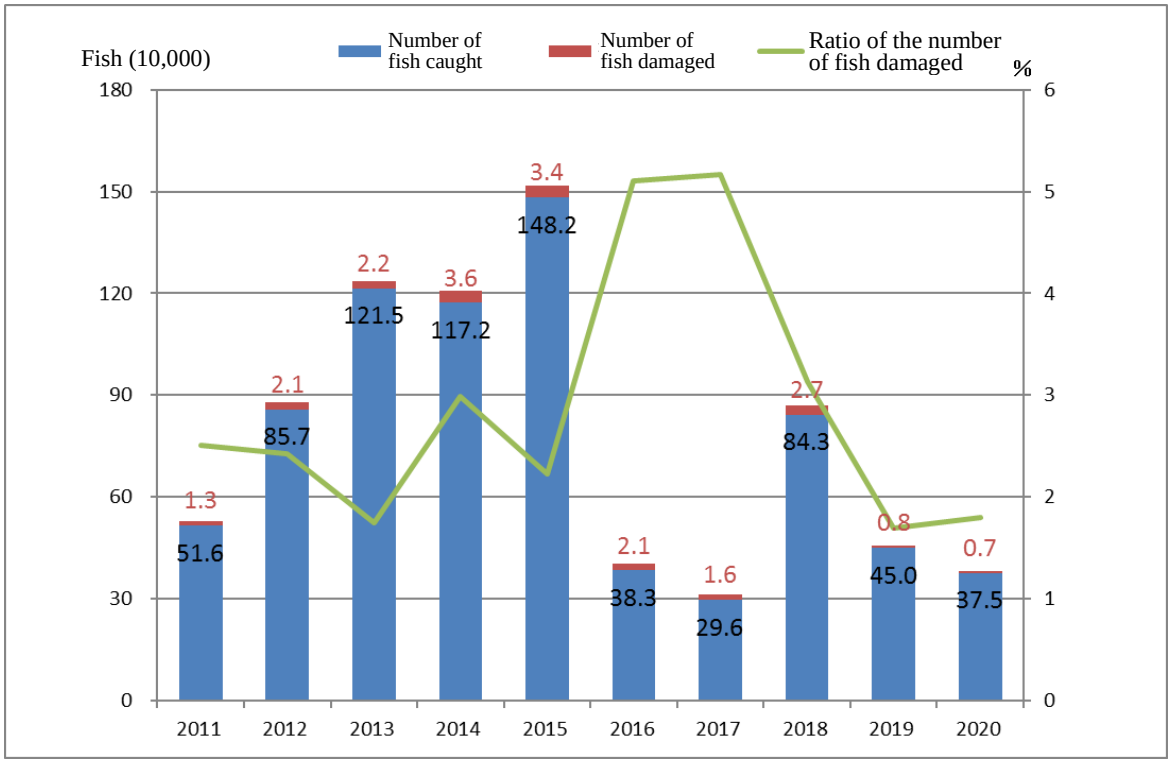


Fig. 21. Changes in damage-to-catch ratio across the Erimo area

○ Comparison of the damage in each sector showed that among the Toyo, Cape Erimo and Shoya sectors, which have had high damage-to-catch ratios to date, the Toyo and Shoya sector had witnessed lower ratios than 2019, whereas the Toyo and Cape Erimo sectors still tends to be high (P30 Fig. 22).

○ The Ministry of the Environment conducted field studies of the damage done to the longline octopus fishing industry using boats.

<Assessment of the damage done to the fishing industry>

- Record poor autumn salmon catches that have continued since 2016 make it difficult to compare the catch size in 2020 with those in other years when the catch was good and to make a definitive assessment. However, the decline in damage-to-catch ratio in 2020 in areas that had been subjected to heavy damage, namely, the Toyo and Shoya sectors, may be an indication of the effectiveness of the population management and damage prevention measures that have been implemented thus far. However, Damege ratios in Toyo and Cape Erimo sectors still tends to be high, for this reason, it is necessary to continue to perform monitoring while adopting damage prevention measures to make a long-term assessment.

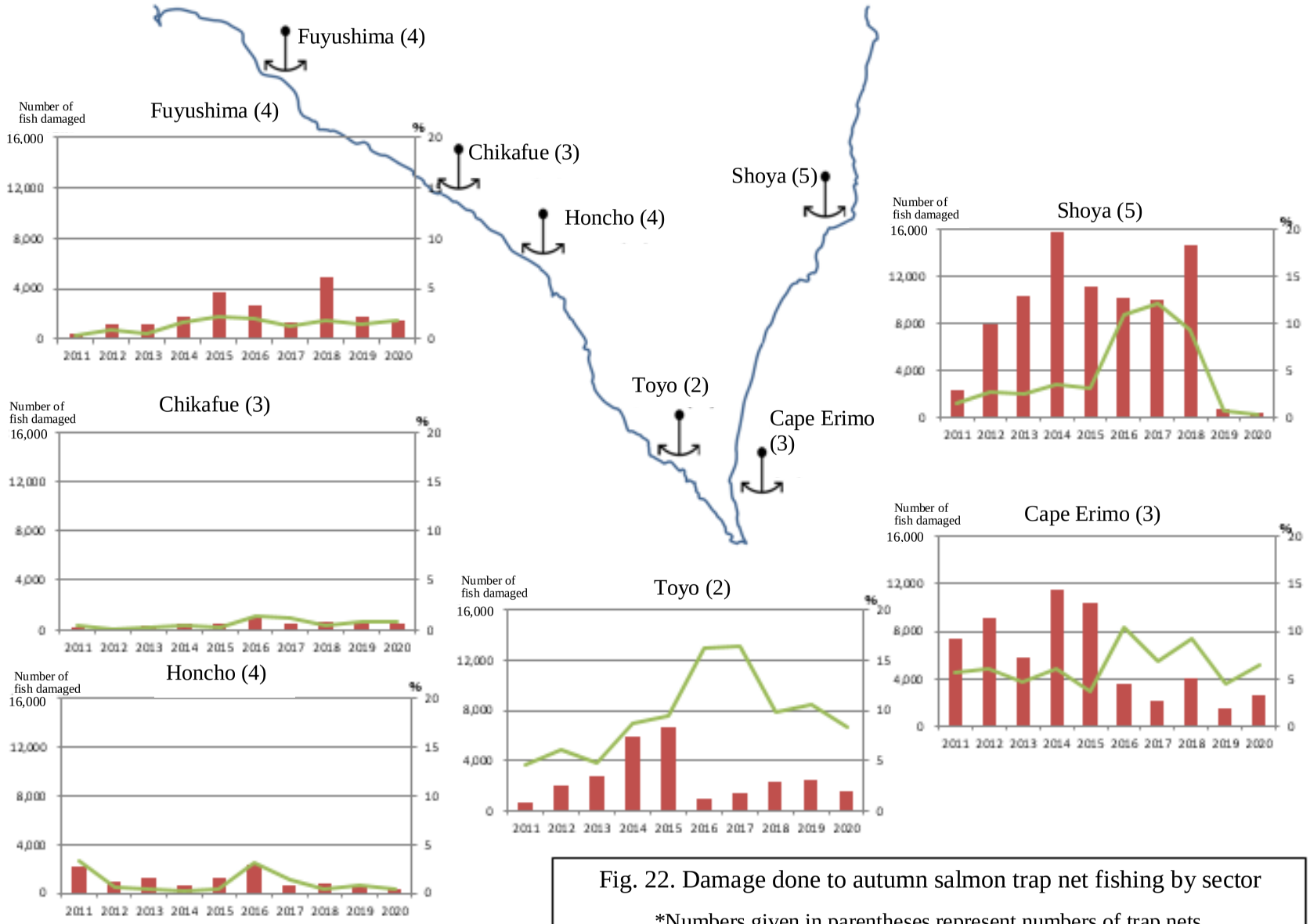


Fig. 22. Damage done to autumn salmon trap net fishing by sector

*Numbers given in parentheses represent numbers of trap nets.

4. Public Awareness

(1) Transferring seals to aquariums and zoos

- In 2020, no seals were transferred, due to a lack of requests.

Table 4. 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)
2018	None	0
2019	None	0
2020	None	0
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.

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

- In partnership with the Erimo Town Board of Education and as part of the regional study curriculum, the Ministry of the Environment offered classroom and extracurricular lessons at Hokkaido Erimo High School on topics including measures to prevent damage to the fishing industry caused by Kuril harbor seals (twice in total in October 2020).
- 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 in Haboro Town on October 5, 2020.

- In order to disseminate accurate information abroad, the FY 2020 Implementation Plan was translated into English and made available on our website: http://hokkaido.env.go.jp/post_34.html.

<Assessment of public awareness>

- With regard to the transfer of Kuril harbor seals to aquariums and zoos, 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.
- The effort to gain the understanding of local residents was furthered through communicating information within 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.

FY 2021 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, the following experiments will be conducted with their goal being the establishment of procedures to mitigate the particularly severe damage done to trap nets.

- During the salmon trap net fishing seasons in spring and autumn, experiments 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, because research performed to date has clarified that not juvenile seals, which are susceptible to bycatch, but particular subadults and adults cause damage to salmon trap nets, the following methods will be employed toward establishing techniques to preferentially capture subadult and adult individuals

that persistently attack trap nets and to reduce juvenile bycatch.

- ○ 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 the event that an extreme imbalance appears in the sex, age, etc. of captured individuals, or in the event that it becomes clear that the below mentioned maximum number of individuals to be captured will not be reached, other capture methods (including the use of firearms) will be considered as necessity dictates in light of the seal capture situation.
- ○ 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).

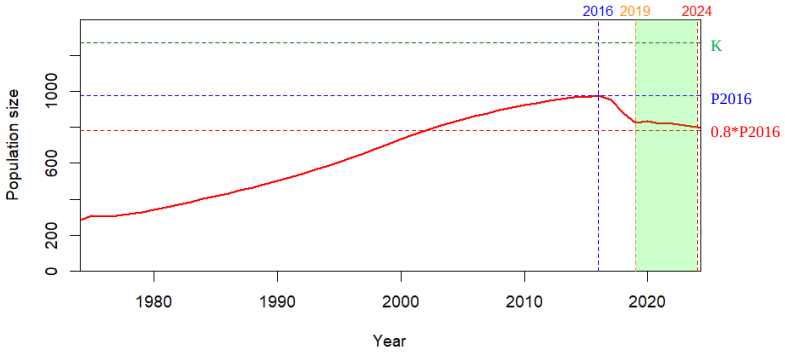
<Considerations essential for determining the number of individuals to be captured>

- Examination will be conducted based on the number of individuals captured over the course of five years from 2016 to 2020 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 the next 100 years to under 10%, all with continuing management beyond 2021 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. 17. Results of the reassessment of the number of individuals caught). 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 52 seals (excluding bycaught individuals) are to be captured in 2021. This number was calculated by adding to the annual 50 seals a shortfall of 2 from the 86 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, the number of cattle caught by the salmon trap net increased significantly in 2020 due to the improvement of the net, and although it became the highest number ever, from the number of catches up to 2019, it is assumed that it will be difficult to catch up to 52 heads with the salmon trap net alone. Therefore, based on the capture of salmon trap nets, we plan to capture them with gillnets.

- Based on the above, as for the number of catches by method, it is a guideline to catch about 44 individuals with the salmon trap net in 2020 and the remaining 8 individuals with the gillnet.
- In addition, when the number of catches reaches 52 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.
- If the planned number is not reached, it will be added to the number of gillnet catches for the following year.



Year	Number of seals caught	Number > 1 year old	Comparison with initial 2016 number
2016	45	975	1.00
2017	137	953	0.98
2018	143	879	0.90
2019	69	826	0.85
2020	84	833	0.85
2021	50	820	0.84
2022	50	821	0.84
2023	50	812	0.83
2024		800	0.82

Fig. 23. Results of the reassessment of the number of individuals caught

*Population dynamics were predicted when 50 individuals were captured over the three years, taking into account the 2020 cature record.

*Until 2020, it is assumed that the capture is 80% biased toward the current age, and from 2021 onward, the current age will be 1/3 as before, and the rest will depend on the age composition for individuals over 1 year old. Was assumed to be catured.

- 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 2022 and 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.

- During the five-year Management Plan period (at the end of roughly three years), 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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