Ministry of the Environment Erimo Area Kuril Harbor Seal Management Project Implementation Plan, FY 2018

March 2018
Hokkaido Regional Environment Office

Contents

Background

The Ministry of the Environment will establish an “Erimo Area Kuril Harbor Seal Management Project Implementation Plan,” (hereafter, “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”) which was established in March, 2016.

The goal of the Management Plan is to establish procedures for population management, damage prevention measures, monitoring, etc., 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 2018 Project Implementation Plan shall be defined as given below, taking into account the results of the projects implemented during 2016 and 2017.

FY 2017 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 the particularly severe damage done 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 season: 20 cm × 20 cm (made of Vectran™), autumn season: 18 cm × 18 cm (made of Dyneema®), etc.) at the tunnel entrance to the bag net in trap nets with particularly severe damage in the Cape Erimo area during the trap net fishing seasons in spring and autumn, and verified their effectiveness.

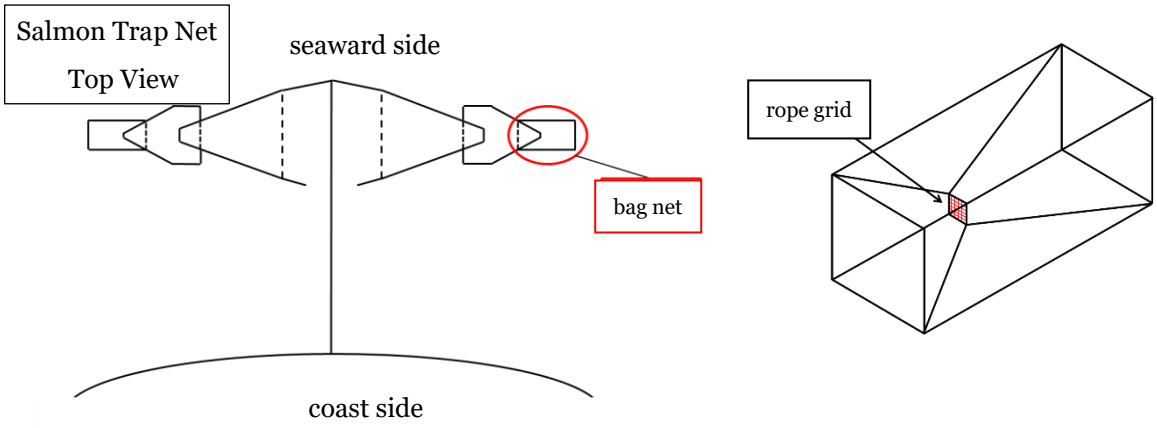


Figure 1. Rope Grid Installation

Rope Grid Installation

Table 1. Rope Grid Types and Installation Periods

Salmon Trap net season	Sector Name	Number of nets with rope grids installed	Type of rope grid	Installation period
Spring	Toyo	1	20 cm × 20 cm (Vectran™)	5/27 – 7/1
Autumn	Toyo	1	20 cm × 20 cm	9/3 – 11/20
	Cape Erimo	3	20 cm × 20 cm, 18 cm × 18 cm, 16 cm × 16 cm, and custom-made grids (various sizes)	2 nets: 8/31 – 11/17 1 net: 10/28 – 11/17
	Shoya	1	20 cm × 20 cm, 18 cm × 18 cm	9/2 – 10/5

<Results of monitoring of the improvement of fishing nets>

① Spring Season (Testing Conducted in Toyo Sector)

Damage prevention through the installation of damage preventing nets in the spring 2017 season was carried out in Toyo sector (Cape Erimo west side), which was the same sector as in the spring 2016 season, in one salmon trap net (sea side). The configuration of the damage preventing nets was 20 cm × 20 cm, as had been confirmed to reduce damage in 2016, however, in order to reduce salmon avoidance influenced by coloration, the material used was not Dyneema® (white) as had been used previously, but Vectran™ (golden brown).

While the total salmon catch size was lower than in a typical year, the damage-to-catch ratio was kept low on days when the total catch size was relatively high. (Fig. 2).

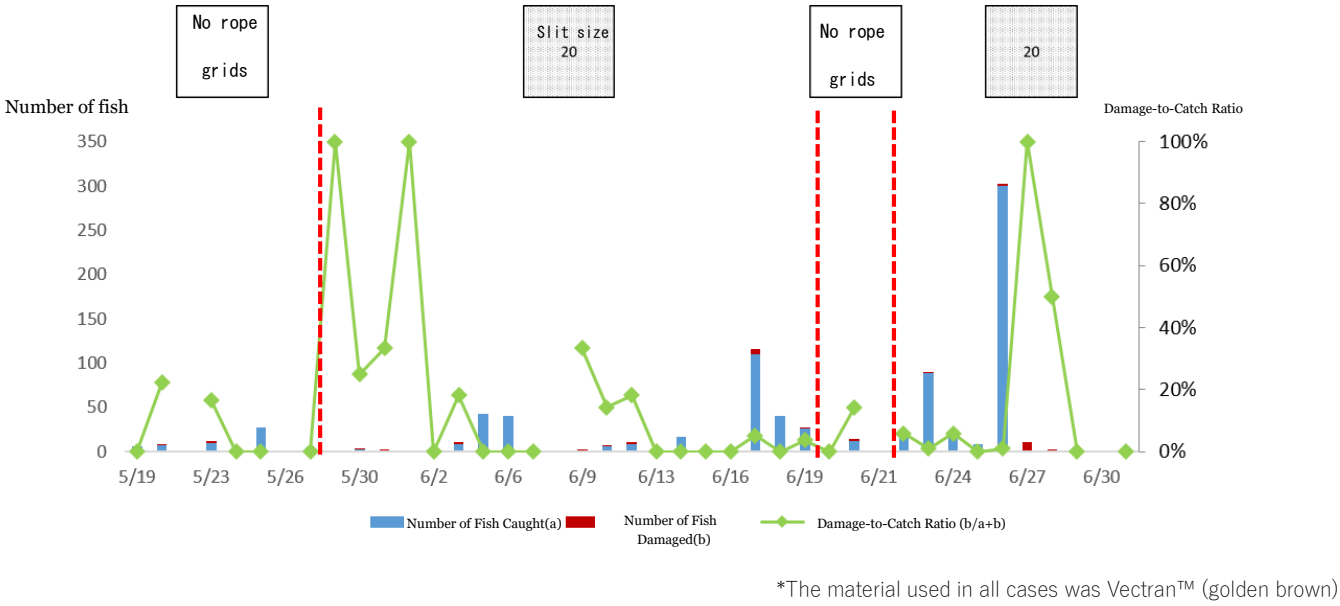


Figure 2. Damage Preventing Net Installation and Damage Conditions by Day (Toyo Sector Sea Side)

②Autumn Season (Cape Erimo Sector)

Damage prevention through the installation of damage preventing nets in the autumn season was carried out in Cape Erimo sector, which was the same sector as in the autumn 2016 season, in one salmon trap net.

Regarding the sizes of the slits (rope grids) at bag net entrances, while a certain degree of damage prevention effects were found in the slits sized 20 cm × 20 cm in 2016, slits of 20 cm × 20 cm, 18 cm × 18 cm, and 16 cm × 16 cm (Dyneema®) were installed and the total catch size and damage-to-catch ratio were investigated in 2017.

The results of this investigation showed some damage with the 20 cm × 20 cm grids, but reductions of damage in the 18 cm × 18 cm and 16 cm × 16 cm grids (Figures 3 – 5).

In the latter half of the season, mainly 18 cm × 18 cm grids were used in three nets in the Cape Erimo sector. Based on the results of previous experiments, it is considered that while they do not completely prevent damage, 18 cm × 18 cm grids are relatively effective at preventing damage, while still guaranteeing a favorable total salmon catch size. However, because the total salmon catch size was small as had been the case in the

previous year, their effectiveness in times with large total catch sizes will be investigated further.

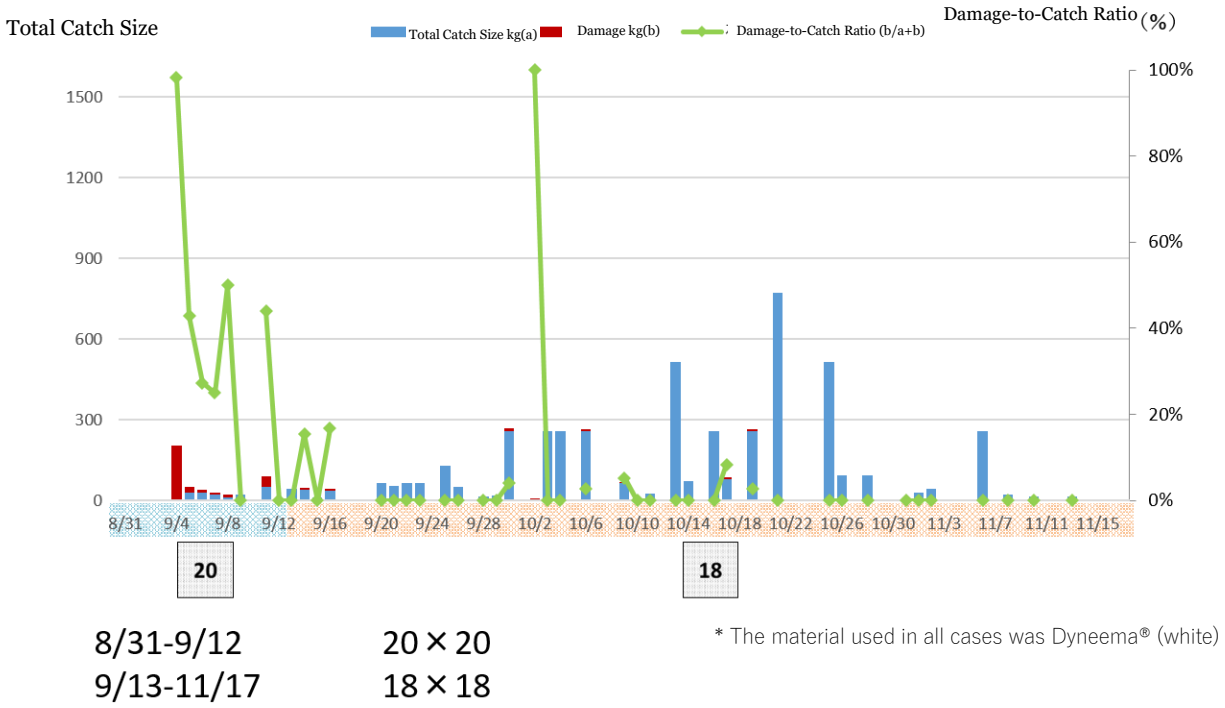


Figure 3. Damage Preventing Net Installation (20×20⇒18×18) and Total Catch Size, Damage-to-Catch Ratio (Cape Erimo Sector, Net: Land Side)

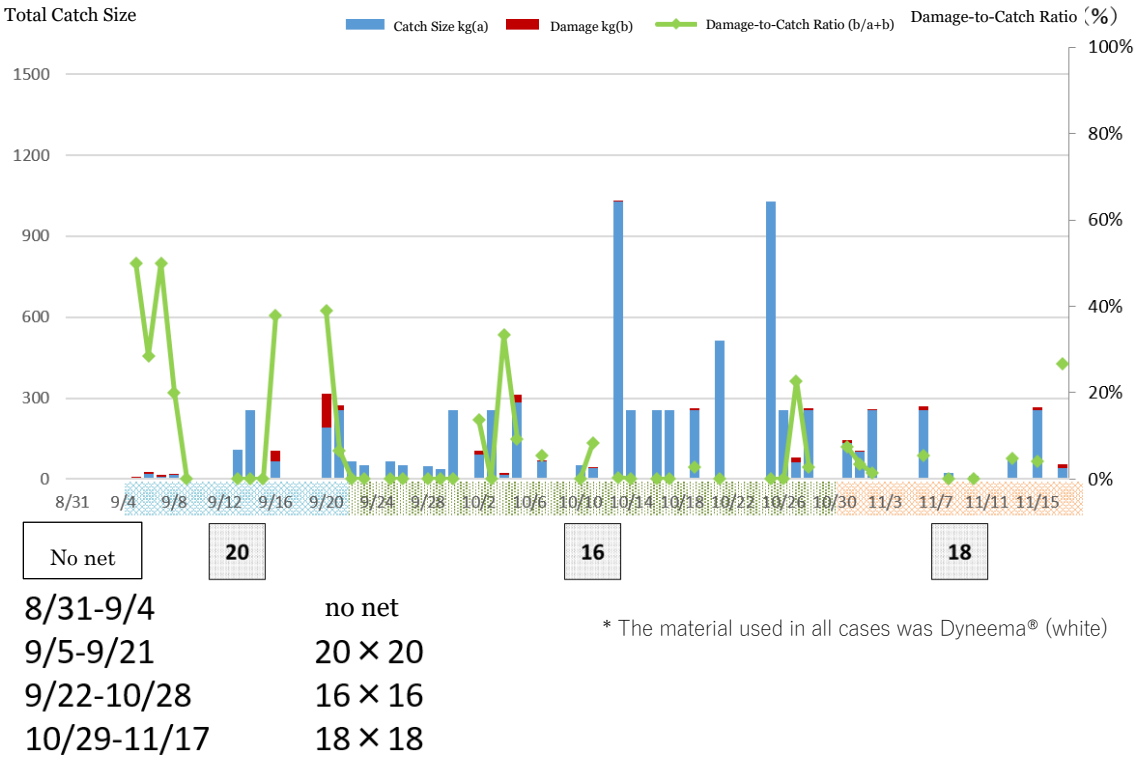


Figure 4. Damage Preventing Net Installation (20×20⇒16×16) and Total Catch Size, Damage-to-Catch Ratio (Cape Erimo Sector, Net: Sea Side)

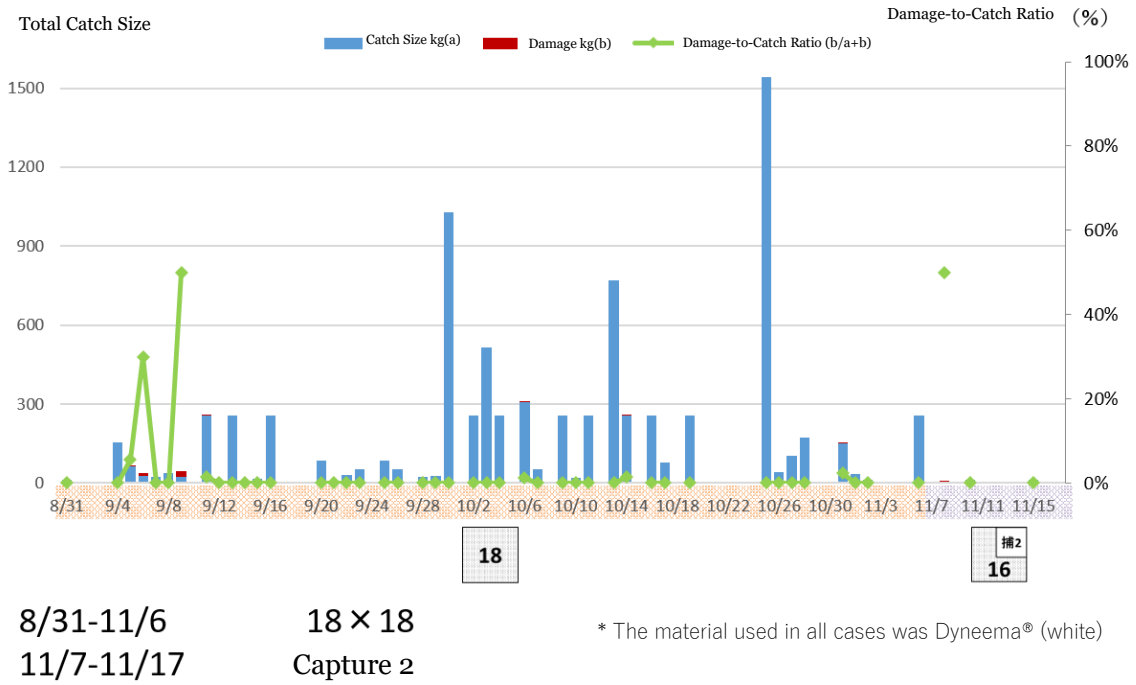


Figure 5. Damage Preventing Net Installation (18×18) and Total Catch Size, Damage-to-Catch Ratio (Cape Erimo Sector, Net: Land Side)

<Assessment of the improvement of fishing nets>

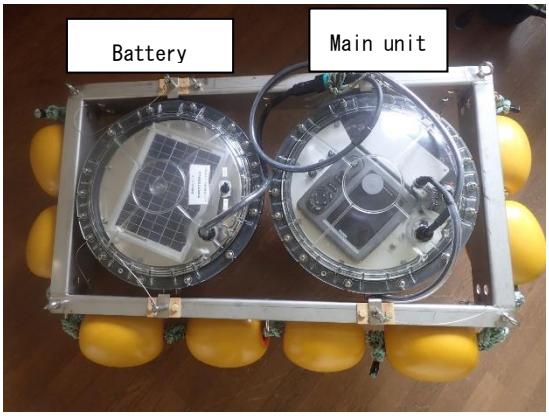
○ In a manner consistent with previous results, the damage mitigation effects of installing rope grids in individual salmon trap nets were confirmed, and their effectiveness as a prevention method in trap nets with particularly severe damage was shown. Further, it has been confirmed that the frequency of Kuril harbor seal visits to the net areas is decreased, and it is reasonable to expect mitigation effects for undetected damage, such as salmon being carried out of nets.

○ In 2017, rope grids were installed in one salmon trap net in one sector during the spring season, and in five trap nets in three sectors during the autumn season; though this was a decrease of one sector and one trap net compared to 2016, there was an increase in the total number of days on which trap nets were installed. It is considered that this is the result of increasing expectations of damage reduction effects from rope grids by fishermen who are already using them. However, because there are some fishermen who are concerned about the effects on salmon, it is essential to plan further improvements aimed at creating damage preventing nets

that are highly effective at preventing Kuril harbor seals from entering, while also having minimal effects on salmon, in order to further the adoption of damage prevention measures.

（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, as well as examinations of Kuril harbor seal behavior were conducted using floating cages. Further, based on opinions of fishermen who had used trap nets, improvements were made in the configuration, etc. of the equipment, mainly related to durability.



Repellent Equipment (① Spring)

Improved Repellent Equipment (② Autumn)

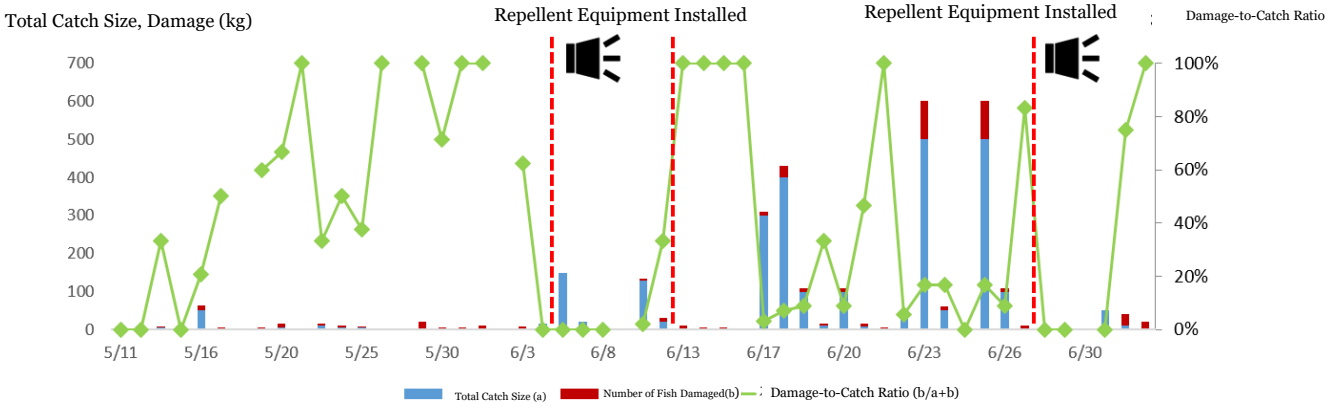


Figure 6. Installation of Repellent Equipment and Damage Conditions by Day (Spring Salmon Trap Nets)

In the spring salmon trap nets, the damage-to-catch ratio was nearly zero during the period in which repellent equipment was installed, and there was a remarkable reduction in damage compared with the period in which the equipment was not installed (Fig. 6). Testing with autumn trap nets was conducted in conjunction with damage preventing nets, and while the difference found was not as remarkable as that with the spring trap nets, the damage-to-catch ratio was low during the period in which the equipment was installed.

Further, in tests conducted with floating cages, the repellent equipment was activated one hour per day for a period of nine days, and seal behavior was recorded while the equipment was active and while it was inactive. As a result, while it is possible that avoidance behavior is continuing, further verification is considered necessary.

<Assessment of improvement of ultrasonic wave repellent equipment>

○Reductions in damage were found in tests of installation on salmon trap nets. However, there were problems with durability during installation with the spring trap nets, and the work toward the development of effective equipment is proceeding, including additional improvements to be made to the configuration, etc. of the equipment after long-term installation on trap nets. Moving forward, in addition to making further improvements based on the opinions of fishermen, it is necessary to continue to verify the effectiveness of the equipment through methods including tests of long-term installation with trap nets, which could not be conducted in 2017 due to unfavorable circumstances.

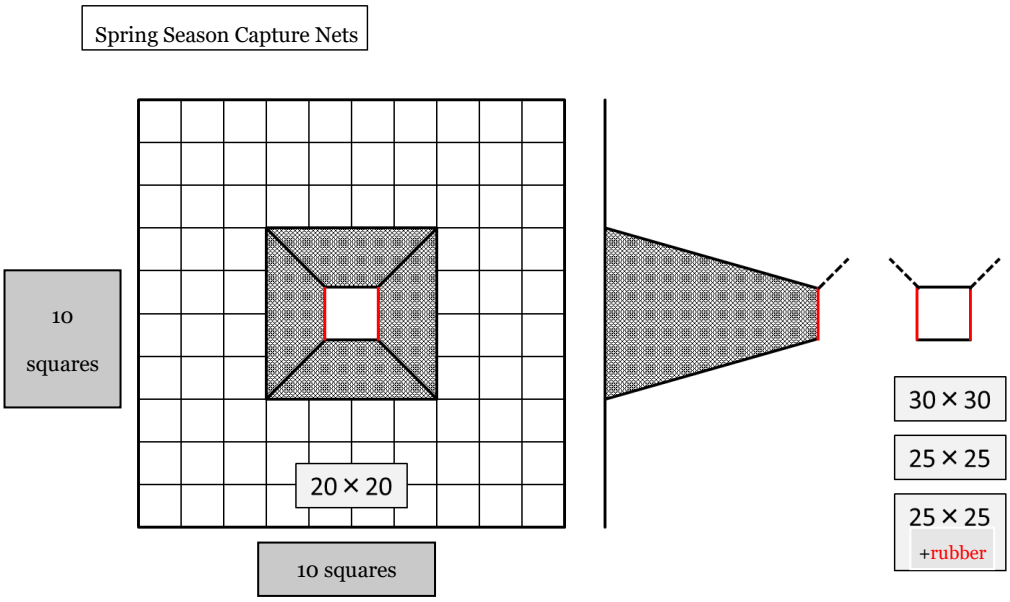
2 Population Management

The Ministry of the Environment attempted to capture seals using salmon trap nets, gillnets, etc. in order to perform population management aimed at both mitigating the damage done 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 captured individuals were transferred to aquariums, etc., fitted with EM transmitter tags and released, or 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. 7) were deployed in the spring season for a total of 36 days between 22. May and 26. June, and a total of 46 days in the autumn season, between 6. September and 10. October, and then between 7. November and 17. November. During the deployment periods, nets were raised 33 times and 24 times, respectively.



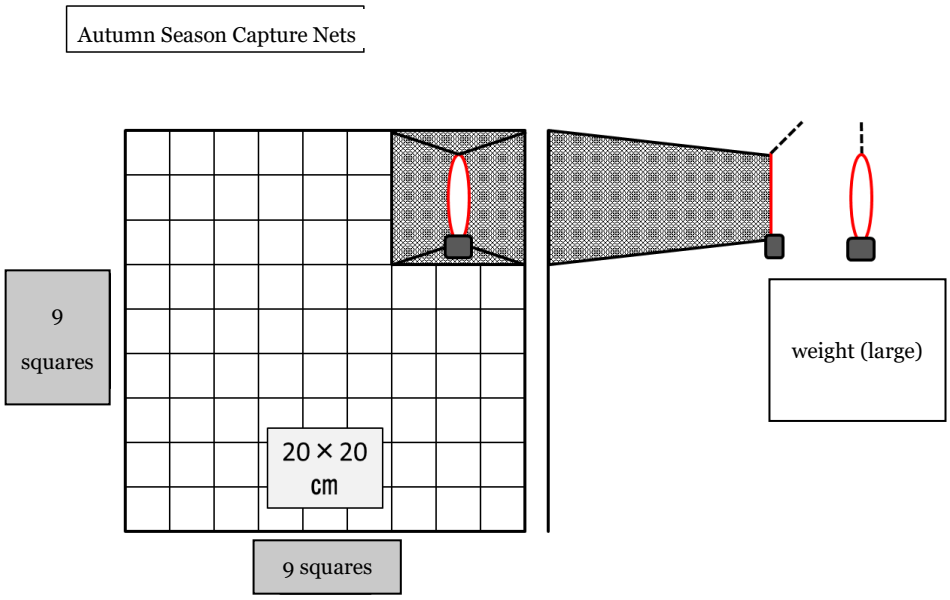


Figure 7. Structure of Tunnel Capture Nets Installed on Salmon Trap Nets (above: Spring; below: Autumn)

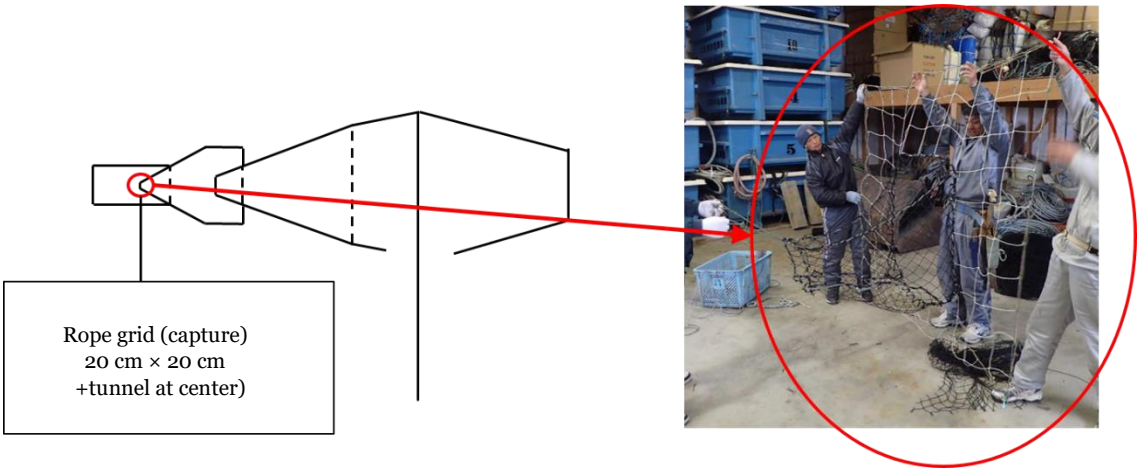


Figure 8. Structure of Tunnel Capture Nets Installed on Salmon Trap Nets

（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 11 days between 31. May and 13. November, 2017. (Approximately 3 hours were spent working at sea on each day of seal capture.)

（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 one marksman using a rifle was carried out in the presence of a veterinarian, near the rocky shore reefs of Cape Erimo on 13. February 2017.

Further, test firing by two marksmen using air guns was carried out in the presence of a veterinarian on 22. February, 2018.

Capture results

Between February and November 2017, a total of 137 seals (not including 3 individuals which were fitted with EM transmitter tags and released, 3 individuals which were re-captured and re-released, and 3 individuals which escaped) were captured using salmon trap nets, gillnets, etc.

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. Additionally, while individuals aged 1 year old or in their first year of life were designated as juveniles, this data was tabulated separately.

Table 2. Kuril Harbor Seal Capture Results by Capture Method

Capture method	Juveniles (<1 year)		Juveniles (1 year)		Subadults (2 to 4 years)		Adults (5+ years)		Total
	Male	Female	Male	Female	Male	Female	Male	Female	
Spring salmon trap nets (33 times)	1	1	3	1	2	0	5	11	24
Autumn salmon trap nets (24 times)	0	1	0	1	2	3	1	2	10
subtotal	3		5		7		19		34
Gillnets (11 times)	24	33	13	18	4	6	0	4	102

subtotal	57	31	10	4		102
Academic investigation (2 times)*	0	0	0	1	0	1
合計	60	36	17	24		137

*Does not include 3 individuals which were fitted with EM transmitter tags and released, 3 individuals which were re-captured and re-released, and 3 individuals which escaped.

<Results of monitoring of population management>

① Population size and structure

○ The largest number of individuals hauling out found in a long-term land-based census (performed by Tokyo University of Agriculture) was 413 individuals on 5. June.

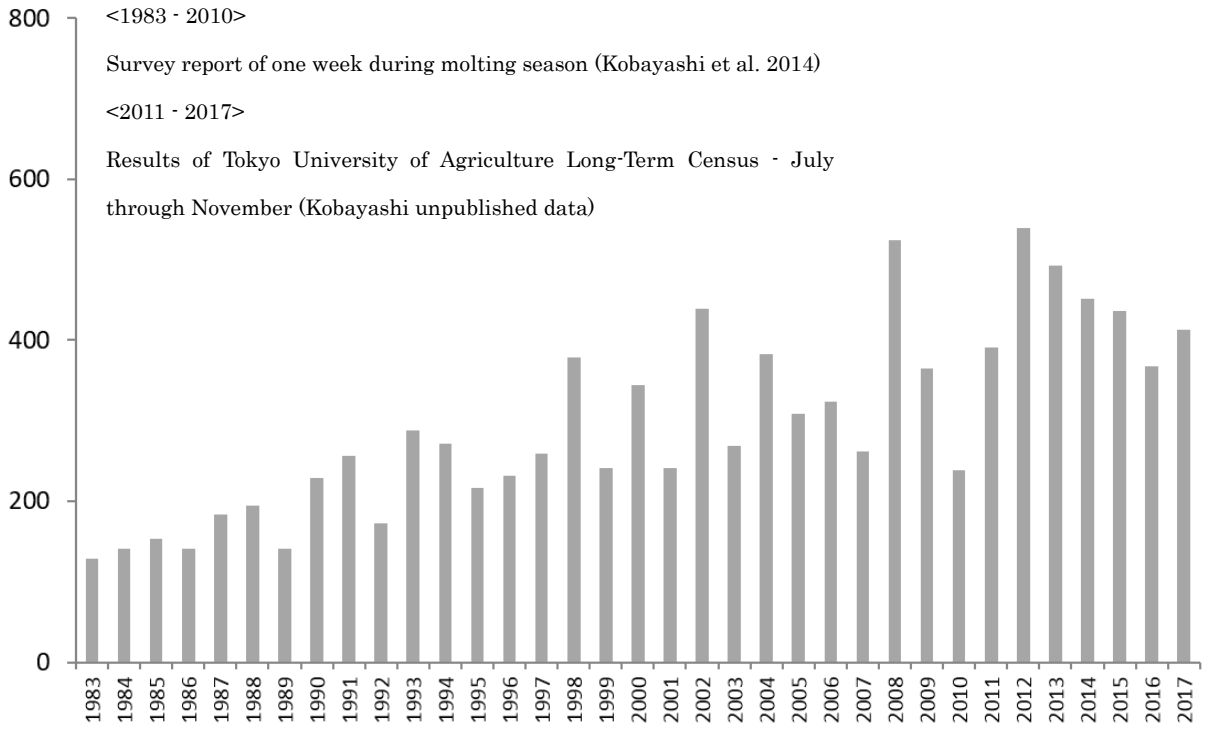


Figure 9. Largest Number of Kuril Harbor Seals Hauling Out at Cape Erimo

○ Images captured by UAV were used to generate orthographic images and ascertain differences in size of individuals at each rocky shore reef haul out site. 2016 survey results showed that the composition of the sizes of individual hauling out was different at each rocky shore reef in surveys conducted on the same day; 2017 survey results showed that the sizes of individuals using each rocky shore reef was different, even in surveys conducted on different days or in different seasons.

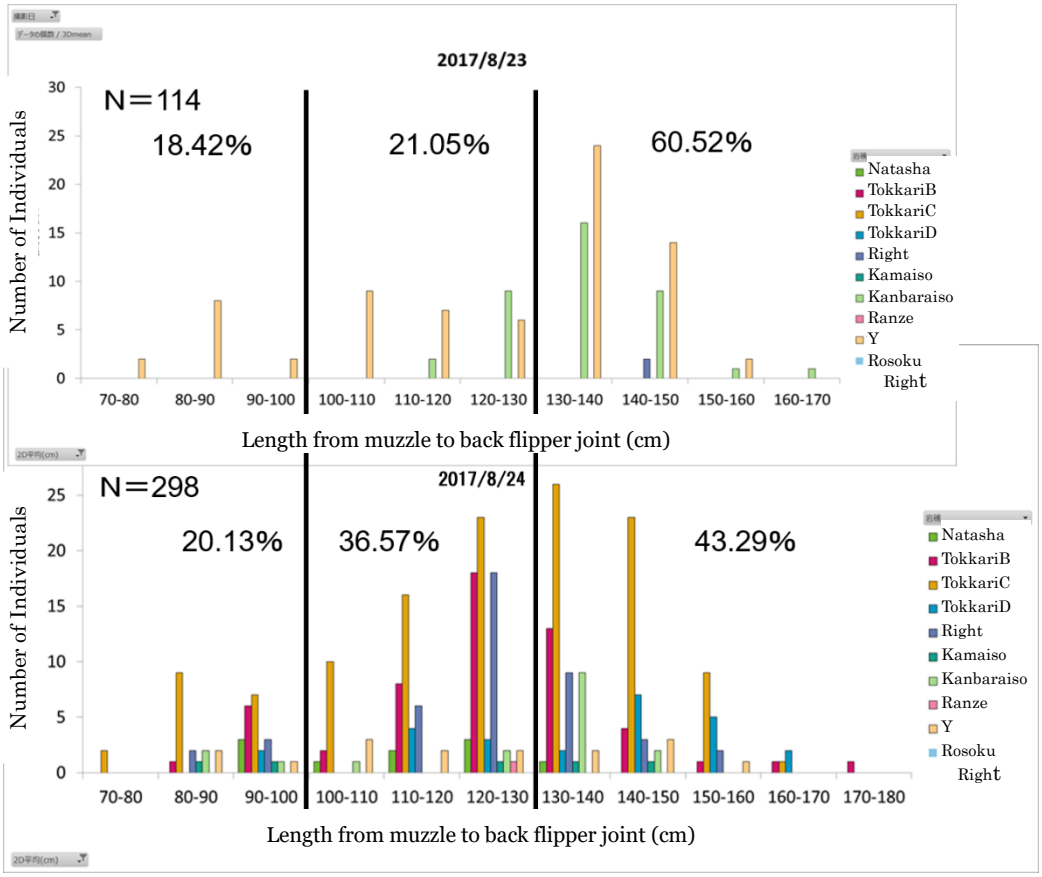


Figure 10. Seal Size Distribution by Rocky Shore Reef

②Population 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 using body length data and growth curves showed a larger number of juveniles among both captured and bycaught individuals. Further, there was a higher number of females in both groups (Fig. 11).

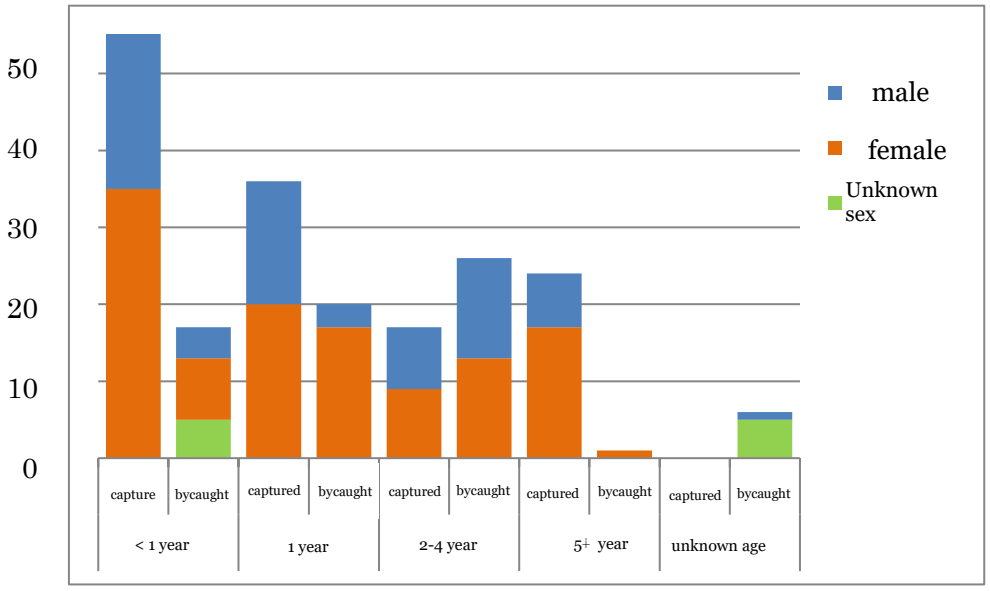
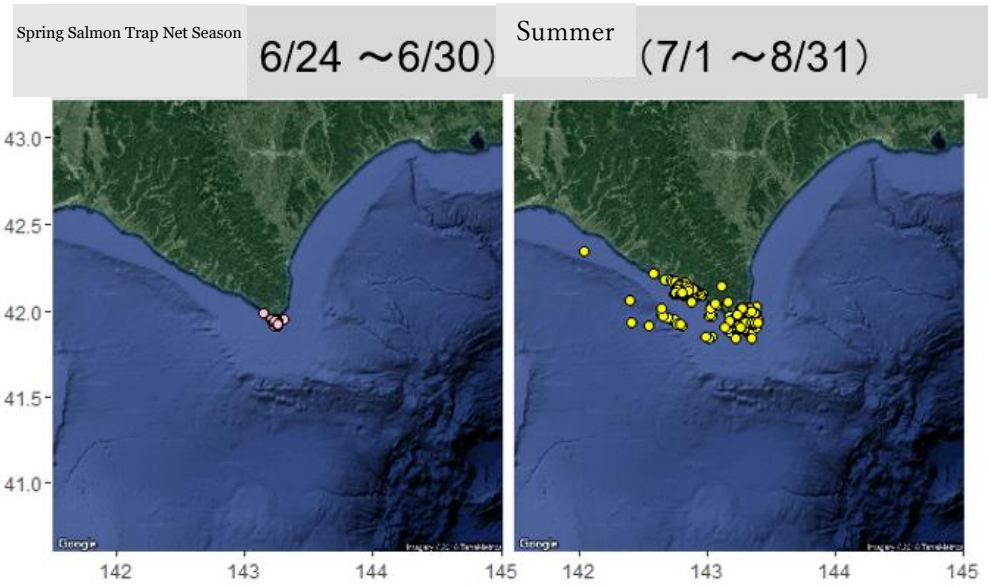


Figure 11. Estimated Age and Sex of Captured and Bycaught Individuals in 2017

○On 24. June, one juvenile and one adult were fitted with EM transmitters, and a survey of area of activity, etc. was conducted. The transmitter fitted to the adult was lost on 7. July due to molting, but the adult's home range up to that point had been smaller than that of the juvenile. The home range of the single individual from whom long-term data was received (juvenile (first year of life) male) is shown in Figure 12. The home ranges of the juveniles fitted with transmitter tags in and after August of the past year did not show large variations, but this individual which was fitted in late June was primarily active west of Cape Erimo from the spring salmon trap net season to the beginning of the autumn salmon trap net season in July and August, and was primarily active east of Cape Erimo after the beginning of the autumn season. Further, its home range was found to become smaller in the winter season.



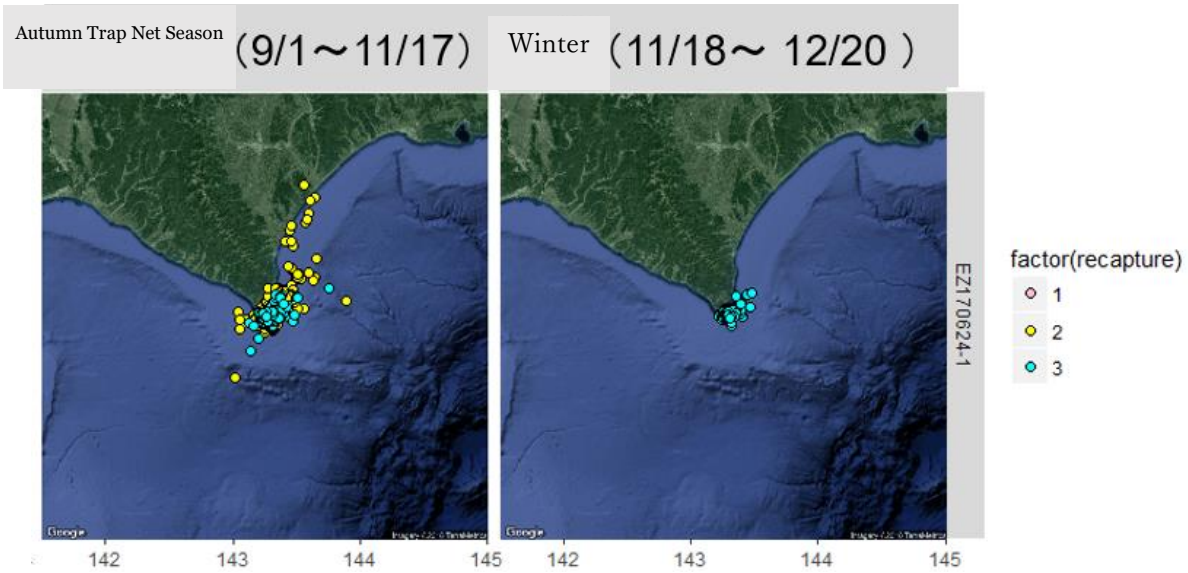


Figure 12. Home Range of an Individual (Juvenile, Male) Fitted with an EM Transmitter Tag (24. June – 20. December, 2017)

③Survey of stomach contents of captured and bycaught individuals

○In a survey of the stomach contents of 193 captured and bycaught individuals, stomach contents were found in 63 individuals. Salmon was found infrequently, with cephalopods, gadidae, etc. taking up the majority, which was consistent with the results of previous surveys (Fig. 13). Further, salmonids were ranked second in IRI only among adults based on analysis of the results by growth stage, and salmonids were not highly ranked in IRI among subadults and juveniles (Fig. 14).

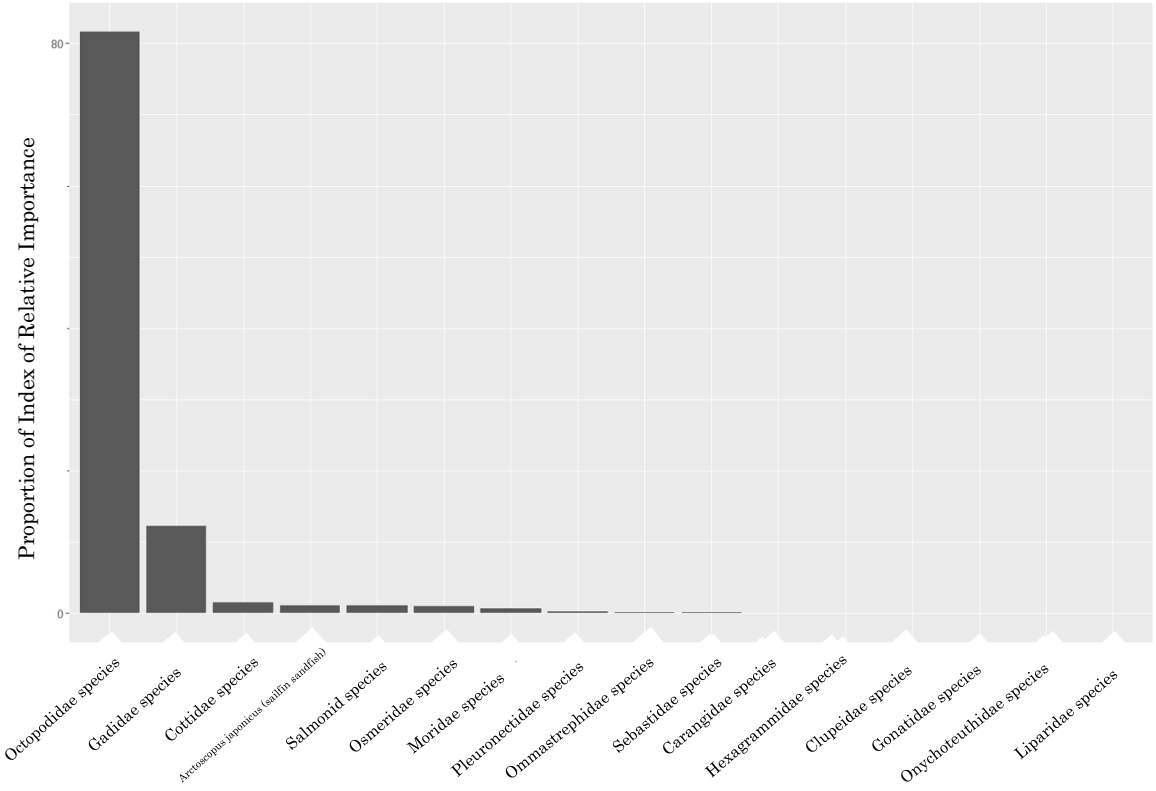


Figure 13. Results of Analysis of Stomach Contents of Captured and Bycaught Individuals (Total)

: Proportion of "Index of Relative Importance" (IRI*) of Prey Organisms

*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

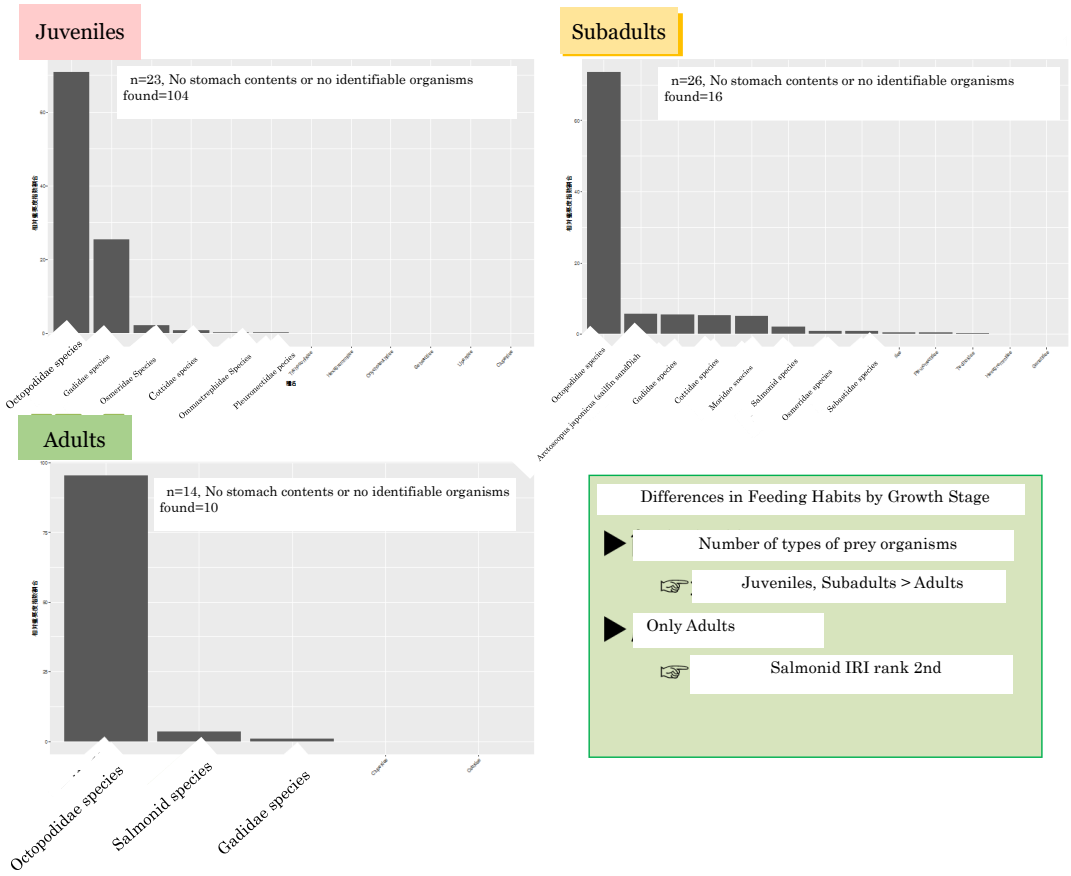


Figure 14. Results of Analysis of Stomach Contents of Captured and Bycaught Individuals (by Growth Stage)
: Proportion of "Index of relative importance" (IRI*) of prey organisms

<Assessment of population management>

①Capture results

○ The number of individuals captured was 137, which was close to the predetermined goal of 140 for 2017. Although the number of individuals captured in salmon trap nets was relatively low, many larger individuals were captured. Conversely, while the number of individuals captured in gillnets was high, many smaller individuals were captured. In the future, it will be necessary to make improvements in capture methods using trap nets, as well as to capture seals without an imbalance in growth stage, taking advantage of both trap nets and gillnets. Further, caution is needed in order to avoid reductions in capture efficiency due to seal learning.

②Population 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 in only a few years. Further, the frequency of the surveys, variation in haul-out frequency due to capture, etc. must be taken into consideration. In addition to future long-term population monitoring, the frequency and accuracy of surveys need to be improved. Further, many of the captures in 2017 occurred after 5. June, which had the largest number of individuals hauling out in 2017, and careful observation of future trends will be necessary to ascertain the effects of capture.

○ 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, which are currently insufficient, it is necessary to conduct monitoring and fully understand any variation in seal activity accompanying population management.

○ Surveys of stomach contents suggest that, in comparison with juveniles and subadults, adult individuals have a higher level of dependence on salmonids; however, further surveys are necessary due to the small sample size. In the future, it will be necessary to collect data throughout the year by capturing individuals in winter and performing analysis of stomach contents, etc., as well as to monitor year-to-year variations.

③Impact evaluation

○Actual capture outcomes were imbalanced in favor of juveniles to a greater degree than had been estimated in simulations, though evaluation of the impact on the population suggested that there would not be a large impact based on current simulations. (Fig. 15. Note that the age compositions of the captured individuals are estimated values.)

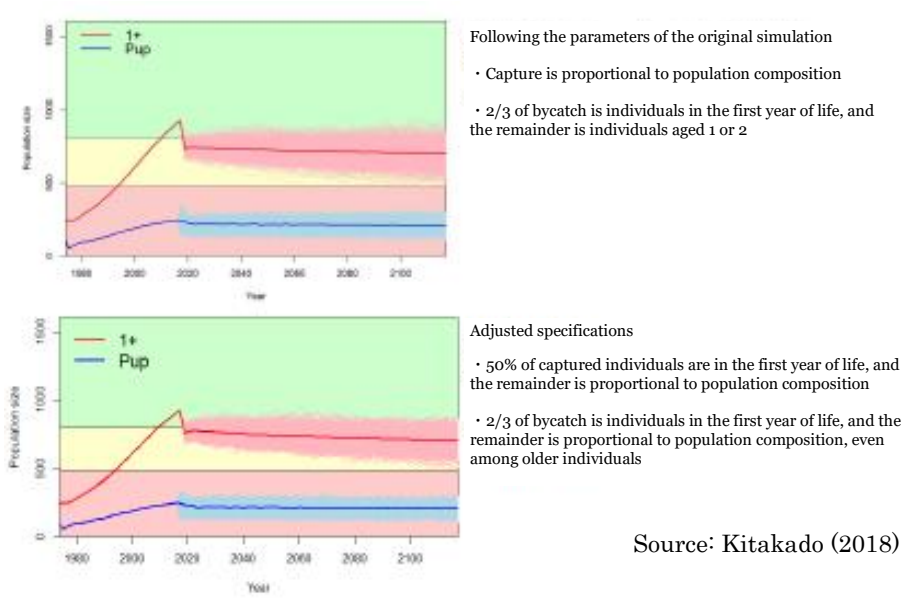


Figure 15. Evaluation of Estimations Based on Simulations and Actual Capture and Bycatch Results

3　Survey of Damage Done to the Fishing Industry

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

○ An understanding of the damage done to the fishing industry was gained through 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; it was found that while the number of fish damaged in 2017 was low, the total number of fish caught in the autumn trap nets tended to be lower than in an average year, making the damage-to-catch ratio higher. This was the same tendency that was found in 2016.

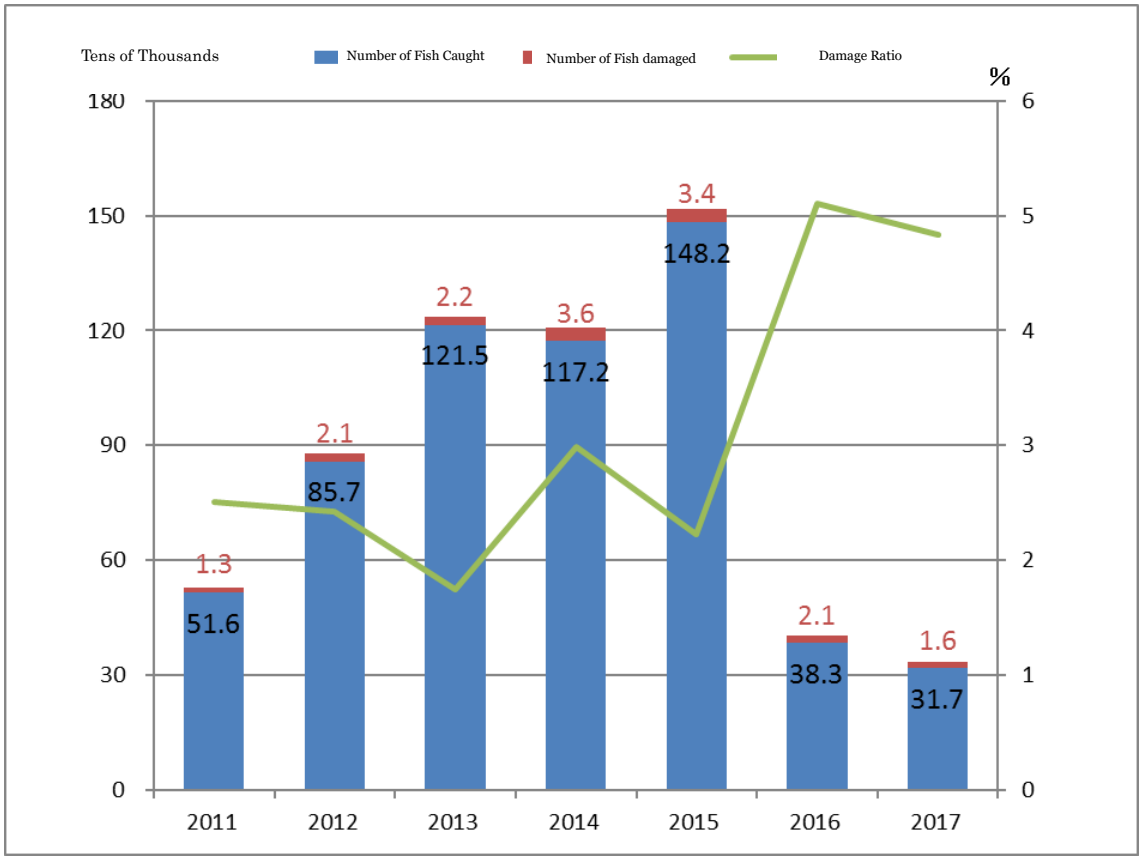


Figure 16. Autumn Salmon Trap Net Damage Situation in the Erimo Area

○Comparison of the damage situation in each sector showed that the damage-to-catch ratio was higher in every sector; however, it was found

that the number of fish damaged was vastly lower than in 2015 and before in the Toyo and Cape Erimo sectors, in which damage preventing nets have been installed long-term in salmon trap nets. Further, comparison with 2011 (in which the whole region saw the lowest total number of fish caught in the past 5 years) showed that the number of fish damaged was greatly reduced in only the Cape Erimo sector. (See Fig. 17 on page 20.)

○The Ministry of the Environment conducted surveys of the damage done to the longline octopus fishing industry using questionnaires.

<Assessment of the damage done to the fishing industry>

○ Because the overall catch was extremely poor in 2017, as had been the case in 2016, conditions did not allow sufficient assessment of damage done to the fishing industry from the perspective of the effects of damage prevention measures and population management. For this reason, it is necessary to continue to perform monitoring in the future.

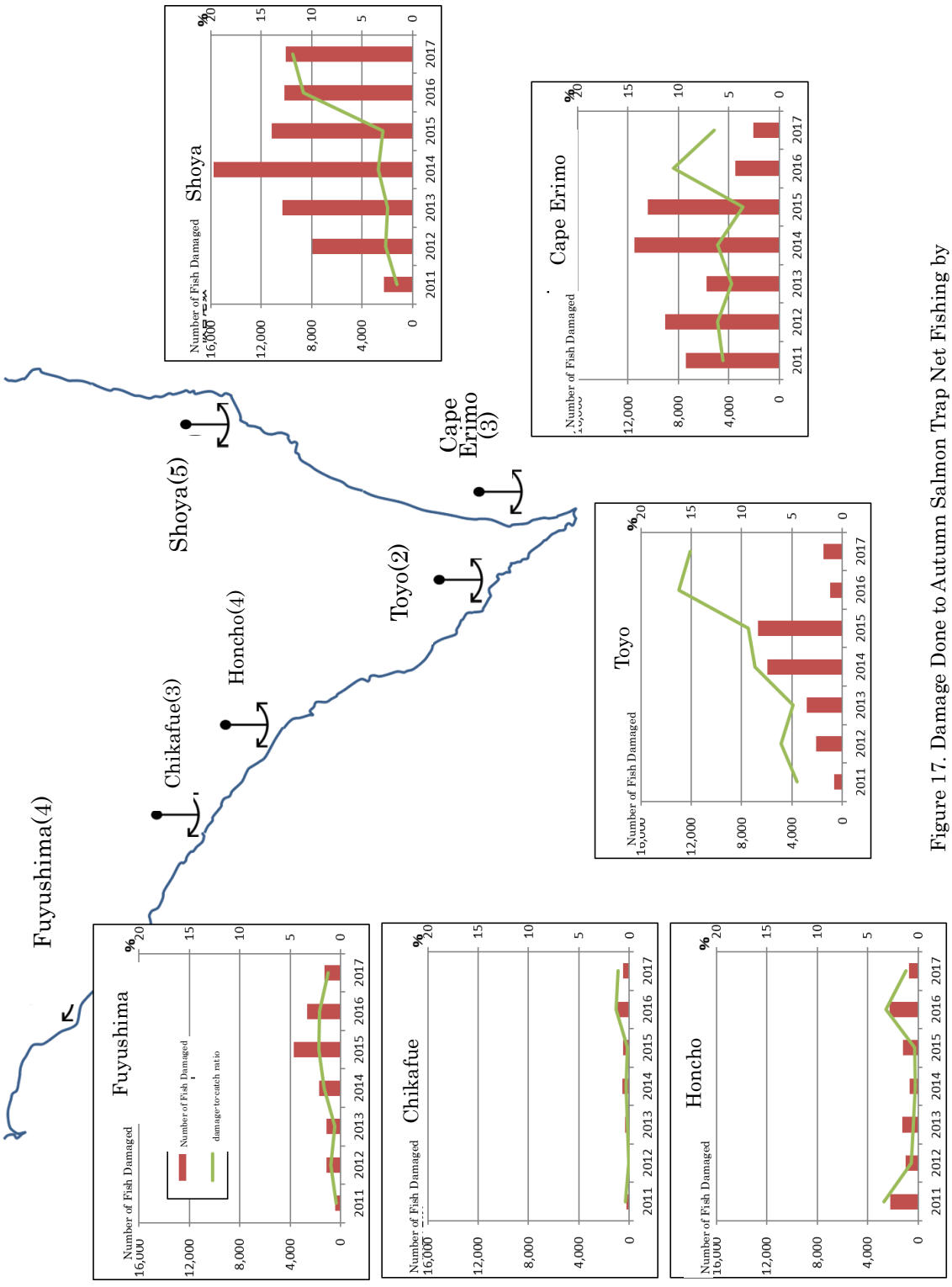


Figure 17. Damage Done to Autumn Salmon Trap Net Fishing by Sector

*Numbers given in parentheses represent numbers of trap nets.

4 Public Awareness

（1）Transferring seals to aquariums and zoos

○ From among the individuals that were captured alive in 2017, 2 juveniles are scheduled to be transferred to Yokohama Hakkeijima Sea Paradise, with assistance from the Japanese Association of Zoos and Aquariums and Otaru Aquarium.

Table 3. Kuril Harbor Seals Transferred to Date (Including Planned Transfers)

	Institution Name	Number of individuals transferred
2016	Noboribetsu Marine Park Nixe (Hokkaido, Noboribetsu City)	1 (1 female juvenile)
	New Yashima Aquarium (Kagawa, Takamatsu City)	4 (3 female juveniles and 1 male juvenile)
	Ueno Zoological Gardens (Tokyo, Taito City)	1 (1 female juvenile)
	Kamogawa Seaworld (Chiba, Kamogawa City)	1 (1 male juvenile)
	Yokohama Hakkeijima Seaparadise (Kanagawa, Yokohama City)	3 (3 female juveniles)
2017 (planned)	Yokohama Hakkeijima Seaparadise (Kanagawa, Yokohama City)	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.

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

○ At the Youth League of the Hokkaido Society of Commerce and Industry Hidaka Block Workshop (held in October of 2017) and the Japan Fisheries Cooperative Salmon & Trout Trap Net Operators Conference, etc., initiatives working to foster coexistence between the local communities and the Kuril harbor seals were explained to attendees, and there was time for discussion and exchanging of opinions.

○ In collaboration with the Mansfield Foundation, the Ministry of the Environment accepted a trainee belonging to the U.S. National Oceanic and Atmospheric Administration in June of 2017; various groups operating in the Erimo area described their initiatives, and the trainee shared information including descriptions of initiatives related to marine animals in Hawaii, and there was time for discussion and exchanging of opinions. Presentations were made explaining initiatives working to foster coexistence between the local communities and the Kuril harbor seals at events including a workshop titled “Issues Facing Marine Spatial Planning in Japan,” which was held in February of 2018.

○In order to disseminate accurate information abroad, the FY 2017 Implementation Plan was translated into English and used on our homepage, etc. http://hokkaido.env.go.jp/post_34.html

<Assessment of public awareness>

○The transfer of seals to aquariums and zoos was reported in various outlets, which furthered public awareness outside of the Erimo area. In the future, it will be necessary to foster public awareness in collaboration with related organizations, including presentations held at facilities where seals are kept.

○ 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, including overseas, created opportunities information exchange with experts and others. It is necessary to continue to find good opportunities for communicating information in the future.

FY 2018 Project Implementation Plan

1 Damage Prevention Measures

The following initiatives, based on results from various inspections and prevention measures which have been implemented in the past, 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, as well as 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 (horizontal grids have been used up to now) in order to reduce salmon avoidance behavior, with the goal of improving their damage prevention effects.

（２）Verification the effects of ultrasonic wave repellent equipment

Improved repellent equipment designed in 2017 will be installed in the vicinity of salmon trap nets, and the continuance etc., of its repellent effects on Kuril harbor seals will be verified.

２　Population Management

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

（１）Because damage prevention alone is not enough to avoid increases in the scope of the damage, capture of Kuril harbor seals will be carried out in cooperation with members of the fishing industry, with the aim of mitigating the damage done to the fishing industry (preventing increases in the scope of the damage, reducing the severe damage done to salmon trap nets, etc.), while also preserving the sustainability of the seal population. Furthermore, because it has been made clear in the research performed to date that it is not only the easily bycaught juvenile seals, but particular subadults and adults that cause damage in salmon trap nets, the following methods will be employed, aimed at establishing techniques to selectively capture subadult and adult individuals that persistently attack trap nets, and to avoid 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 selectively 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.).

○Individuals hauling out on rocky shore reefs in the Cape Erimo area will be captured 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 selectively capture individuals that are causing damage, methods for distinguishing individuals that persistently attack salmon trap nets (such as checking iron rust buildup) 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.

（2）Regarding capture, the maximum number of individuals to be captured will be determined based on the following considerations.

<Current habitat situation>

In recent years, the largest number of individual Kuril harbor seals hauling out 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 corrected using the haul-out ratio and discovery rate, is approximately 1000 individuals. Further, the average population growth rate over the past 30 years has been 5% (Matsuda et al. 2015).

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

○ Examinations will be conducted over the course of three years from 2016 to 2018, and the maximum number of individuals to be captured will be determined.

○ The following will be considered when determining the maximum number of individuals to be captured: mitigating damage to the fishing industry, while also guaranteeing population sustainability such 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 2019 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 maximum number of individuals to be captured must be adjusted freely to fit 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 maximum number of individuals to be captured>

○In the current resource management simulation, which takes the number of bycaught individuals, outbreaks of infectious disease, etc., into account, the probability of extinction within the next 100 years is nearly 0% if the population in 2018 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 2019 onward (Kitakado 2006).

○Therefore, the Ministry of the Environment will determine the maximum number of individuals to be caught such that the population in 2018 will come down to about 80% of the population at the time the Management Plan was established; through estimation of population dynamics taking into account the number of individuals captured and bycaught in 2016 and 2017, as well as the population growth rate, etc., it has been determined that approximately 140 seals (excluding the number of bycaught individuals) are to be captured in 2018.

○ Because there have been few successful captures made to date, and there is very little data showing the effectiveness of damage reduction through seal capture, The Ministry of the Environment aims to use this as an opportunity to work toward establishing seal capture techniques, as well as to gather the information necessary to establish monitoring procedures in order to gain a grasp of the effects of capture on the Kuril

harbor seal population and of the effectiveness of damage reduction through seal capture.

Table 4. Results of Reassessment of Numbers of Individuals Captured

Source: Kitakado (2017)

Captured in 2016	Captured in 2017-18	Captured in 2019 and beyond	P2019/P2016	Min(P/K)
45	100	25	0.871 (0.822)	0.408 (0.355)
45	120	25	0.836 (0.786)	0.401 (0.334)
45	130	25	0.817 (0.766)	0.396 (0.325)
45	140	25	0.801 (0.749)	0.392 (0.323)
45	150	25	0.782 (0.728)	0.385 (0.304)

・Numbers in parentheses are values for the lowest 5%
・Individuals to be culled will be selected in accordance with the population age ratio, including individuals in their first year of life.
・Individuals in their first year of life make up approximately ⅔, and individuals aged 1 & 2 make up approximately ⅓ of bycaught individuals.

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

○The number of individuals to be captured in 2019 and beyond will be adjusted based on evaluation of project implementation results to date.

○ The maximum number of individuals to be captured each year will be reexamined after hearing the opinion of the Science Committee.

○ In the event that the number of individuals captured in a single year is too low or too high, adjustments will be made in the number of individuals to be captured in the following year.

○ From the point of view of adaptive management, the information necessary for reexamining the plan will be gathered, a sustainability assessment performed, and each year from next year onward, a new Implementation Plan will be established and the maximum number of individuals to be captured will be determined.

○ During the three-year Management Plan period, a formula for doing management that fits the population's situation will be developed, including a system for incorporating feedback from new data.

（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 maximum number of individuals to be captured may be freely 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, verify project implementation effectiveness, and provide feedback about the population's situation to 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 unmanned aerial vehicle (UAV). 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.

○ 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 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, and of 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, and through gathering information about the installation times and duration of installation of rope grids in trap nets.

○ Surveys will be conducted on the damage situation in the local fishing industry other than damage done to salmon trap nets, using means such as interviews.

（３） Population trends

○ Ecological data which is necessary in order 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 performed on Kuril harbor seal range, etc., using EM transmitter tags.

○ The Ministry of the Environment will continue to collect specimens necessary for analysis of items such as infectious disease and the population's genetic diversity.

（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 in order to gain a complete understanding of the coastal ecosystem.

（5） Assessment of sustainability

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

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