

Health Evaluation of Ringed Seals Documented in the Southern Bering Region, Winter 2017-Spring 2018

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EXECUTIVE SUMMARY

Between December 20, 2017 and May 16, 2018, the National Marine Fisheries Service Alaska Region's Marine Mammal Stranding Program confirmed reports of 28 ringed seals observed in four communities in the southern Bering Sea. The presence of ringed seals in these locations was highly unusual. Recognizing the ongoing changes in the Bering Sea/Arctic climate, including a shifting ice extent, an effort was made to determine whether the seals were healthy animals extending their range, or instead, compromised seals coming ashore in atypical locales. Consequently, an evaluation of the health of these ringed seals was completed which involved 1) a photographic assessment in cases where a physical examination was not possible, 2) an assessment of examination findings in two seals successfully relocated to a rehabilitation facility, and 3) an assessment of necropsy findings in three seals that died on site, during transport, or after admission to the rehabilitation facility. Results of these evaluations are most consistent with a conclusion that the seals' health was compromised, possibly as a result of challenging conditions associated with Bering Sea and Arctic climate change.

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I. Background

Ringed seals (*Phoca hispida*) are sufficiently rare in the southern Bering Sea so as to be identified as an extralimital species with sightings deserving of a report to the National Marine Fisheries Service (NMFS) Alaska Region's (AKR) Marine Mammal Stranding Program. In December of 2017, NMFS received the first of such reports from Unalaska in the Aleutian Islands. Between January and May of 2018, an additional 43 reports of ringed seals, all probable yearlings, were received from communities located along the southern Bering Sea. Of those reports, NMFS has been able to confirm 28 individual ringed seals from Nelson Lagoon, Akutan, the Pribilof Islands, and Unalaska.

On March 27, 2018, NMFS sent a flyer to several southern Bering Sea communities through the Marine Mammal Stranding Network and the Aleutian Pribilof Islands Association requesting information on ringed seal sightings in order to determine the magnitude and scope of the species' presence. With only single unconfirmed reports coming in from Atka and Adak, it became apparent that Unalaska was the focal location. As of May 7, 2018, 18 of the 28 confirmed individuals were reported from Unalaska. No further reports of ringed seals in the southern Bering Sea were received after May 16, 2018.

Presentation of the animals' behavior was variable, ranging from alert and skittish to lethargic and moribund (i.e. in terminal decline). Of the five animals that were considered moribund, two died as arrangements were being made for transport to the Alaska SeaLife Center (ASLC) for rehabilitation, and one died soon after arrival at the ASLC. These three animals were subsequently necropsied. The remaining two moribund ringed seals were successfully transported to the ASLC and are currently in good health at the facility.

While some of the symptoms (e.g., alopecia) noted in these young ringed seals were the same as those seen in the recently closed 2011 Arctic Pinniped Unusual Mortality Event (UME), the latter included multiple species and age classes. The primary cause for the 2011 UME was not determined.

The reason for the increased presence of extralimital ringed seals in winter 2017/2018 was undetermined. Pinniped experts at the NMFS Marine Mammal Lab speculated that the increased presence of these young ringed seals in southern Bering Sea locations may be a reflection of the extremely low volume and extent of sea ice. The amount of sea ice during winter 2017/2018 was less than any year since the onset of written records in 1850. Given notable changes in the environment and the increased reports of ringed seal sightings in the southern Bering region during the winter 2017-spring 2018, NMFS's Marine Mammal Stranding Program was interested in evaluating the health of the animals to 1) establish a baseline in health assessment and 2) determine whether these seals were most likely fit yearlings extending their range or compromised individuals relocating as a result of suboptimal conditions. The outcome of this health determination could help to inform management decisions should similar events arise in a rapidly transforming Bering Sea.

II. Health Evaluations

A. Photographic Health Evaluation

1. Protocol

NMFS AKR developed a quantitative scoring system of the ringed seal images since there were no hands-on health assessments conducted on the seals on site and/or in most cases the only data available were from photo-documentation. Of the 28 individual ringed seals reported in the southern Bering region during winter 2017-spring 2018, photographs from 20 were included in the photographic health evaluation. There were several reported ringed seals whose photographs did not include discernable features, or who were clearly moribund and were transported to the ASLC for attempted rehabilitation, or who died and were necropsied. Photographs of these individuals were not sent to reviewers, thus the animal numbers provided to reviewers, and presented in the results below, are not sequential.

From one to seven photographs of each of these 20 seals were sent to six reviewers with expertise in ringed seals or animal health, but with diverse backgrounds and experience levels. Using the classifications provided in Table 1 below, these experts were asked to review the photographs and provide assessments for four factors: 1) body condition; 2) presence of alopecia; 3) hydration status (as evidenced by the presence of an eye ring); and 4) the presence of other pathology. Information on behavior, which was sometimes submitted by members of the public who observed the seals in the wild rather than by experienced stranding network members, was provided to the reviewers but not included in the assessment. Each reviewer was provided with all the photographs and an Excel sheet template to record their assessments independent of each other. The Excel template had rows for each individual ringed seal and columns for each factor. For each factor, a pre-defined response with a corresponding score (see Table 1) was provided via a drop-down list. For this assessment, a higher score equates to presumed poorer health, and a lower score presumes better health.

Table 1: Categorization and Score Equivalent for each of the Four Factors

SCORE	BODY CONDITION	ALOPECIA	EYE RING	OTHER PATHOLOGY
1	robust	none	present	absent
2	average	scant	absent	-
3	thin	patchy	-	present
4	emaciated	extensive	-	-
no score	unknown or NA	unknown or NA	unknown or NA	unknown or NA

One reviewer deviated from the protocol when categorizing two of the factors and created new responses that did not correspond to any pre-defined score: for presence of eye ring this reviewer added the response “scant”, and for the presence of other pathology created a new

response of “minor”. For consistency and comparisons of responses and scores, “scant” was interpreted as meaning there was at least some indication an eye ring was “present”, and “minor” was interpreted as meaning there was some indication that other pathology was “present”. For purposes of data analyses and reporting, and to maintain anonymity, the reviewers were assigned a number (1-6) in place of their name.

2. Results

For each of the 20 individual ringed seals included in the photographic health assessment, a summary table is presented indicating the number of reviewers who provided a score other than “unknown or NA” for each factor (indicated by the number in parentheses after the factor), the range of scores provided, and the average of the individual scores for each factor. Reviewers were not asked to provide a score for behavior, rather NMFS AKR provided a description of behavior based upon information provided by the original observer. Also included in the individual seal summaries are the unedited comments that the reviewers provided for that individual seal.

RINGED SEAL 1

There was one photo of this animal available for review; photo 1.1 is displayed. There was no information from the original observer regarding behavior.

Table 2: Summary of scores for ringed seal 1

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	1-2	1.80
Alopecia (5)	1-3	1.60
Eye Ring (4)	1	1.00
Other pathology (3)	1-3	1.67
Total		6.07



Reviewers’ comments for ringed seal 1:

- Okay body condition but not the best angle to evaluate. No alopecia on visible body, some coat disruption suggests under lying scars or skin differences. Eye rings different, R (~1/2 eye width>L next to zero), left doesn't look present, possibly 'crusty' and suggestive of eye problems. Buffed out dry, out of water for a long period of time. Makes me wonder how long ringed normally stay out of water, something that Dr. Reichmuth's research is looking into. Fecal staining suggests diarrhea. Discoloration of 'chin' suggests oral cavity lesions.
- Eye ring is wet from tearing most likely; animal appears alert responsive and aware of observer; old coat
- Coat is old and ready for molting, body condition healthy

RINGED SEAL 3

There was one photo of this animal available for review; photo 3.1 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as approachable.

Table 3: Summary of scores for ringed seal 3

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	1-3	2.40
Alopecia (5)	1	1.00
Eye Ring (4)	1-2	1.50
Other pathology (5)	1-3	1.80
Total		6.70



Reviewers' comments for ringed seal 3:

- Slightly thin based on slight 'waist.' Based on there being a slight 'neck visible, and how telescoped the neck is, when extended it would probably have a more distinct 'neck' than average. Dry. There is a hint of old, thin eye rings but the eyes appear 'squinty' to me and not in a relaxed closed position which could mean eye pain or a moribund state. The approachability in and of itself is significant.
- New coat; closed eyes
- Coat good, body condition is not concern

RINGED SEAL 4

There were three photos of this animal available for review; photo 4.1 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 4: Summary of scores for ringed seal 4

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2-3	2.80
Alopecia (5)	1-2	1.40
Eye Ring (5)	1	1.00
Other pathology (4)	1-3	1.50
Total		6.70



Reviewers' comments for ringed seal 4:

- I think that the small patch of skin near the left eye is hairless, but it might just be wet....

- Thin based on slight waist. R eye is squinty when compared to L and seems to have a goopy discharge. Eye rings are present but scant. There appears to be green staining on the fur around the front left flipper. The 3rd photo seems to show flipper sucking behavior, additionally the flipper itself is moist on the side closer to its mouth. 'Non-nutritive' suckling is considered abnormal behavior.
- Stained green coat fore flipper; focal hair loss or wet l medial canthus?
- Young seal, body condition is not plump but common to young pups/yearlings in spring, not of concern. Green staining of left flipper and arm of interest

RINGED SEAL 6

There were two photos of this animal available for review; photo 6.1 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as approachable.

Table 5: Summary of scores for ringed seal 6

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2-3	2.80
Alopecia (5)	1-2	1.40
Eye Ring (4)	2	2.00
Other pathology (5)	3	3.00
Total		9.20



Reviewers' comments for ringed seal 6:

- Nose appears raw and bleeding, dark spots may be scratches with wet hair dried over it on the muzzle and above the eye brows, maybe another injury on the dorsum near the shoulder blades or its just normal coloration Average
- Thin- slight waist. Multiple coat disruptions suggestive of scavenger wounds. Nasal and lip lesions, atypical of scavenger damage. Possible nasal discharge dripping on rock.
- focal bleeding right FF; extensive injury to snout with loss of pigmented skin of nose
- lesions and bleeding from nostrils and mouth; possible lesion on R fore-flipper
- Injury to face, would like more photos of dorsum to understand "dark patches" by shoulders.

RINGED SEAL 7

There were three photos of this animal available for review; photo 7.1 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 6: Summary of scores for ringed seal 7

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2-3	2.80
Alopecia (5)	1-2	1.20
Eye Ring (5)	1	1.00
Other pathology (4)	1-3	2.00
Total		7.00



Reviewers' comments for ringed seal 7:

- The animal in 7.1 does not look to be the same animal as 7.3 unless this was over several weeks. 7.1 & 7.2 is thin while 7.3 appears average, but the angle of the shot and the exposure limit the ability to clearly see the silhouette at the neck, shoulder blades, and spine, and pelvis (all the landmarks used to note condition)
- Thin, hips evident. There is some discoloration of the coat in 7.1 that doesn't look like a typical wet patch, not sure but does look greasy, probably not significant. Also, in 7.1 eyes are not open evenly, the left is squinty, looks a little crusty, and doesn't appear to have an eye ring though a partial is present in other photos, never the less appears infected.
- possible erosion on eyelids; squinting; body folds; are we sure 7.1-7.3 is the same animal
- Thin in hips but not in a condition warranting removal from environment. This seal is not the same seal or location as 7.1 or 7.2?

RINGED SEAL 8

There were four photos of this animal available for review; photo 8.3 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as moribund.

Table 7: Summary of scores for ringed seal 8

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2-4	3.00
Alopecia (5)	3-4	3.60
Eye Ring (5)	1	1.00
Other pathology (5)	1-3	2.60
Total		10.20



Reviewers' comments for ringed seal 8:

- Erosive lesion on the ventral aspect of the philtrum of the nose

- Thin- waist. Rust colored fur staining. Unevenly opened eyes. Eye rings scant. Eyelids irregular with pale areas, third eyelid swollen and injected. Wound on nasal planum. Unevenly flared nostrils.
- Iron-red stain (common on adult bearded seal); hair loss (HF; tail; RFF; LFF; abdomen; chest); left HF claw partial missing; eyelid erosions periorbital hair loss; 3rd eyelid inflamed; planum erosion
- Conjunctivitis?; lesion on nasal septum; iron-stained coat
- Injury to face, would like more photos of dorsum to understand "dark patches" by shoulders.

RINGED SEAL 9

There were two photos of this animal available for review; photo 9.2 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 8: Summary of scores for ringed seal 9

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2	2.00
Alopecia (5)	1	1.00
Eye Ring (5)	1	1.00
Other pathology (5)	1-3	1.40
Total		5.40



Reviewers' comments for ringed seal 9:

- Body twisted in both photos which may obscure a waist but probably only slight below average at worst. There may be an area of thinning fur on the left side of his tail but it may just be shadow. Left eye not as opened as compared to right eye.
- Periorbital hair loss; ?? possible corneal lesions (white spots)
- Body condition normal, seal not of concern

RINGED SEAL 10

There were three photos of this animal available for review; photo 10.2 is displayed. There was no information from the original observer regarding behavior.

Table 9: Summary of scores for ringed seal 10

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (4)	2-3	2.50
Alopecia (5)	3	3.00
Eye Ring (4)	1	1.00
Other pathology (3)	3	3.00
Total		9.50



Reviewers' comments for ringed seal 10:

- Images are pretty fuzzy, so it is difficult to assess the mucus membranes, etc. Not really the right angle for body condition but would think thin
- Eye rings scant and uneven, also uneven in terms of how open they are with the left not as open as the right. Fecal staining. A curly cue of something seems to be coming out between the hind flippers.
- Hair loss (HF; FF) there is suggestion of raised skin lesions (bumps) on the abdomen; skinfolds; image very light but looks like an old coat
- Poor photo, possible raised lesions under fur on ventrum, hair loss on flippers

RINGED SEAL 11

There were seven photos of this animal available for review; photo 11.3 is displayed. There was no information from the original observer regarding behavior.

Table 10: Summary of scores for ringed seal 11

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	3-4	3.40
Alopecia (5)	2-3	2.40
Eye Ring (5)	1-2	1.40
Other pathology (5)	3	3.00
Total		10.20



Reviewers' comments for ringed seal 11:

- Nictitating membrane or other ocular tissue is covering the right cornea, blepharospasm (squinting) and epiphora (tearing) is running down his face. In the later photos, there is mucoid discharge typical of a secondary bacterial infection
- Emaciated- very angular. Area of alopecia on chest actually appears more like a healing wound than a 'primary' alopecia, has a couple other smaller wounds. Right eye has swollen, injected third eyelid and not as open as left, mucopurulent discharge.

- R (eye) 3rd eyelid prolapsed inflamed; moderate to severe ocular discharge; lateral canthus skin lesion; subtle periorbital hair loss; appears alert; skinfolds; hair loss skin wound topical erosion chest; jagged pattern suggest injury
- Injury to right eye. Potential hair loss on right flipper? Potential injury(ies) to chest area. Not plump but not of concern

RINGED SEAL 12

There were three photos of this animal available for review; photo 12.1 is displayed. There was no information from the original observer regarding behavior.

Table 11: Summary of scores for ringed seal 12

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	3-4	3.60
Alopecia (5)	3-4	3.20
Eye Ring (1)	2	2.00
Other pathology (4)	1-3	2.50
Total		11.30



Reviewers' comments for ringed seal 12:

- Wet face from sticking it in the water- eye rings are N/A. Some raised gelatinous material on dorsal surface of right rear flipper (discharge from a lesion, fish guts from the deck, other)
- Emaciated- prominent hips, notable spine, loose/foldy skin. Some areas of alopecia appear to be associated with wounds. Cannot assess eye rings since has a wet face, wondering if this animal was drinking water off the dock. The left eye is not as open as the right. Uneven flare to nostrils. Several punctate, draining wounds with mucopurulent discharge.
- Skinfolds, hair loss (FF; HF; abdomen; tail; rump;) 2 skin wounds (?) RHF with exudate or something
- Open lesions and/or growth on R hind-flipper
- Thin, spine defined, not able to molt properly, lesion on right flipper

RINGED SEAL 13

There were six photos of this animal available for review; photo 13.3 is displayed. There was no information from the original observer regarding behavior.

Table 12: Summary of scores for ringed seal 13

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2	2.00
Alopecia (5)	1-3	1.40
Eye Ring (4)	1	1.00
Other pathology (5)	1-3	2.60
Total		7.00



Reviewers' comments for ringed seal 13:

- Looks like some sort of patchy dermatitis on the left side (DDX) dirty hair from something dark red he was laying upon.
- On the high side of average but not quite robust. Only one photo had evidence of an eye ring in one photo. Eye are not open wide and mostly closed in some photos. There is some patchy pink discoloration of fur as well as some uneven texture to wet fur suggestive of skin bumps but possibly due to the substrate.
- Discoloration pink of coat suggests possible underlying focal skin lesions; focal bumps belly (beginning parapox lesions?)
- Old coat, good body condition, possible skin lesions on left side/lateral and a bit caudal

RINGED SEAL 14

There were three photos of this animal available for review; photo 14.3 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 13: Summary of scores for ringed seal 14

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2-3	2.40
Alopecia (5)	1-2	1.20
Eye Ring (5)	1	1.00
Other pathology (5)	1-3	1.80
Total		6.40



Reviewers' comments for ringed seal 14:

- Note: no view of the ventrum to check for alopecia
- Eye rings present but scant with the exception of one area, possibly some crustiness to the left of the left eye. Eyes are not open far. Very small nick on the ventral point of the nasal planum.

- Green algae staining whiskers; subtle periorbital; hair loss medial canthus; nose single erosion;
- Old coat, good body condition, possible skin lesions on left side/lateral and a bit caudal

RINGED SEAL 16

There were two photos of this animal available for review; photo 16.2 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 14: Summary of scores for ringed seal 16

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (4)	2	2.00
Alopecia (5)	1	1.00
Eye Ring (5)	1-2	1.40
Other pathology (4)	1-3	2.00
Total		6.40



Reviewers' comments for ringed seal 16:

- Does not show enough of the back of the neck, shoulder blades, spine, or pelvis to determine if the animal is average or thin. Impression is average.
- Eyes open unevenly, right eye more closed than left with a slight crustiness to the eyelids. Uneven flare to nostrils. Some patchy pink discoloration to fur, some uneven texture as well.
- Periorbital hair loss subtle; ocular discharge; possible upper eyelid lesion (L); possible corneal lesion/discharge (L) skin folds
- Possible small lesions or vesicles on L hind-flipper
- Old coat, not of concern

RINGED SEAL 17

There were three photos of this animal available for review; photo 17.2 is displayed (evaluated seal is in foreground). Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 15: Summary of scores for ringed seal 17

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	1-2	1.80
Alopecia (5)	1	1.00
Eye Ring (5)	1-2	1.60
Other pathology (5)	1-3	1.40
Total		5.8



Reviewers' comments for ringed seal 17:

- Small wound on nasal planum (Same as #14?). Possible corneal lesion in right eye, cloudy spot.
- Same as #14? I could not match ring patterns.
- Coat is of interest, body condition not of concern

RINGED SEAL 18

There were two photos of this animal available for review; photo 18.1 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 16: Summary of scores for ringed seal 18

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2-3	2.80
Alopecia (5)	3	3.00
Eye Ring (5)	1	1.00
Other pathology (5)	1-3	2.60
		9.40



Reviewers' comments for ringed seal 18:

- Right rear flipper wound on dorsal surface
- Thin- neck obvious. Punctate lesions with serosanguinous drainage. Eyes not fully open. Unsymmetrical flare to nostrils.
- Hair loss; FF; HF; mixed coat (old/new); periorbital hair loss subtle; r HF red lesion; > 2 focal old healing skin erosions
- Severe conjunctivitis or injury in R eye
- Old coat, body condition not of concern, but hair loss on flipper areas as well as possible skin lesions on right side of body (above arm) and face of concern

RINGED SEAL 19

There were two photos of this animal available for review; photo 19.1 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 17: Summary of scores for ringed seal 19

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (4)	2-3	2.25
Alopecia (5)	1-2	1.60
Eye Ring (5)	1-2	1.20
Other pathology (5)	3	3.00
		8.05



Reviewers' comments for ringed seal 19:

- Trauma/ tear along the dorsal medial eyelid with exposure of the conjunctiva, and epiphora running down the face. Does not show enough of the back of the neck, shoulder blades, spine, or pelvis to determine if the animal is average or thin. Impression is average.
- Slight neck and waist noticeable. Fur has punctate dark spot that are suggestive of alopecia or punctate wounds. Irregular eyelid of right eye with injected third eyelid. Nostrils are not evenly flared.
- Upper eyelid contraction mal shaped eyelid opening; periorbital hair loss; dried discharge;
- severe conjunctivitis or injury in R eye

RINGED SEAL 21

There were four photos of this animal available for review; photo 21.2 is displayed. There was no information from the original observer regarding behavior.

Table 18: Summary of scores for ringed seal 21

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (4)	2-3	2.75
Alopecia (5)	3-4	3.20
Eye Ring (5)	1-2	1.40
Other pathology (5)	3	3.00
Total		10.35



Reviewers' comments for ringed seal 21:

- Debatable if the animal in 21.1 is the same as the other images- lack of rust staining (which in our experience does not wash off), missing little ring of alopecia in the 2 o'clock position of the left whisker/ muzzle area, and subtle differences in the nose. Not enough of the body is visible in this hunched position to score 21.1 but would think that it is average based on impression. 21.2-21.4- hemorrhagic head injury affecting the right eye with blepharospasms (squinting) and mucoid discharge of the left eye suggestive of a bacterial infection. Not enough image of the back of the neck, shoulder blades, area over the spine and pelvis to make a real assessment. Impression is thin KS
- Hard to assess body conditioning because of orientation, most photos have head telescoped in, one has head slightly up and neck is notable. Bloody discharge from right eye, left eyelid appears lined with crust.
- Hair loss (belly; neck; FF) bleeding injury between eyes; right eye injury unclear etiology; not sure if right eye is still intact; crusty discharge left eye; periorbital; coat stain red; hair loss; dermatitis skin erosion belly RST
- Yuck, at first, I thought that was red algae stuck to its face, but in photo 21.4 it appears to be blood; serious injury or infection of R eye? Also, I'm not convinced from the photos alone that the seal in 21.1 is the same as the one in 21.2-21.4
- "Rust" staining to fur, unknown scenario re. Hauling out; cannot see hips/but from this photo would say body not plump but not of concern. Eye lesions, hair loss, old coat, eye /head injury, thinner body condition noticeable i.e. neck region. I do not understand numbering system provided re. Individual seals. Photo 21.1 is a different seal than 21.2, 21.3, 21.4

RINGED SEAL 22

There was one photo of this animal available for review; photo 22.1 is displayed. There was no information from the original observer regarding behavior.

Table 19: Summary of scores for ringed seal 22

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (3)	2-3	2.67
Alopecia (2)	1	1.00
Eye Ring (4)	1-2	1.50
Other pathology (1)	1	1.00
Total		6.17



Reviewers' comments for ringed seal 22:

- Photo of head and shoulders only. Not enough view of the back of the neck, shoulder blades, tissues over the spine and pelvis for accurate assessment. Impression is normal. Also, cannot assess the typical areas of the lesions. Scant tiny eye rings
- Limited view. Eyelids appear to be lined with dried crust.
- squinting eyes; old coat; hair loss; skinfolds
- Limited view
- Body condition noticeable but not of enough concern to remove this seal from the environment.

RINGED SEAL 23

There were three photos of this animal available for review; photo 23.1 is displayed. Based upon input from individuals who observed the animal in the wild, behavior was described as alert.

Table 20: Summary of scores for ringed seal 23

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	3-4	3.40
Alopecia (5)	4	4.00
Eye Ring (2)	2	2.00
Other pathology (5)	3	3.00
Total		12.40



Reviewers' comments for ringed seal 23:

- Resolution and exposure on only photo with the eyes prohibited assessment for eye rings. Severe dermatitis with either an algae or fungus
- Thin- neck obvious with skin folds, slight waist, notable hips. Patchy green staining of fur. Exposed skin has a raw appearance. Eyes maybe cloudy.
- Algae stained coat; sever chronic dermatitis; lumpy skin; skinfolds
- Relocated this seal to ASLC for study re. Hair loss, algae growth, skin lesions. Body condition not of concern.

RINGED SEAL 29

There were three photos of this animal available for review; photo 29.3 is displayed. There was no information from the original observer regarding behavior.

Table 21: Summary of scores for ringed seal 29

FACTOR	SCORE RANGE	SCORE AVERAGE
Body condition (5)	2-3	2.80
Alopecia (5)	2-3	2.60
Eye Ring (5)	1-2	1.60
Other pathology (5)	1-3	2.20
Total		9.20



Reviewers' comments for ringed seal 29:

- Appears to have a small excoriation (scratch) or ulceration on the ventral aspect of the philtrum of the nose. Looks like the entire tail has alopecia and maybe the dorsal aspects of the front flippers. Photos did not include a view of the coverage of the shoulder blades, spine, and pelvis from the top down. Impression is thin.
- Minor other pathology. Small scars on eyelids. Possible cloudy spots on right eye. Third photo eyes not open wide.
- R (eye) lesion; corneal lesions; periorbital hair loss subtle; rHF focal hair loss
- Old coat, hair loss on tail and flippers/flipper area, possible eye lesions

3. Conclusions

A rough estimate of health through photographic assessment is based on the following assumptions:

- a. Given the inability to examine the animals in the field, photo-documentation provides a relatively accurate and adequate platform to assess external features associated with health, including body condition, hydration status, and presence of alopecia and other pathology.
- b. Any uncertainty inherent with photograph assessment applies to all photos equally.
- c. Pathology may be bilateral or unilateral on the body and evidence of pathology may be missed due to body positioning.

None of the ringed seals had a “perfect” score which would indicate a well hydrated, robust animal with no hair loss or other apparent pathology (Figure 1). Fifteen of the twenty (75%) appeared thinner than average (Figure 2). Some level of alopecia (i.e., hair loss) was evident in 15 of 20 (75%) seals, ranging from evidence of little hair loss in eight seals, to patchy or extensive hair loss in six (Figure 3). Only one animal was considered free of other external pathology by all reviewers. Many of the animals had festering lesions or wounds, mostly on the flippers or around the face (Figure 5).

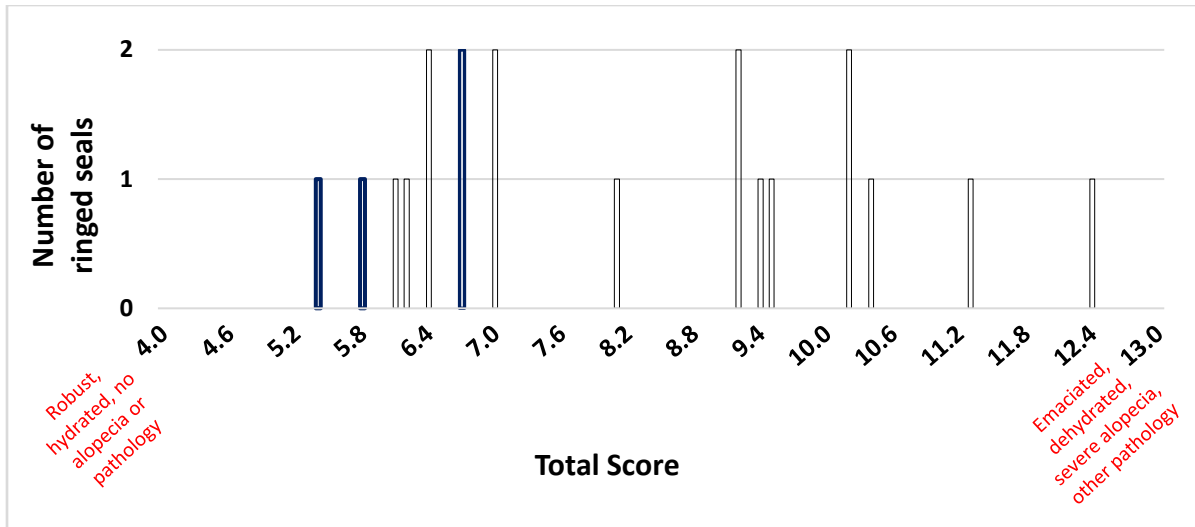


Figure 1. Total Scores

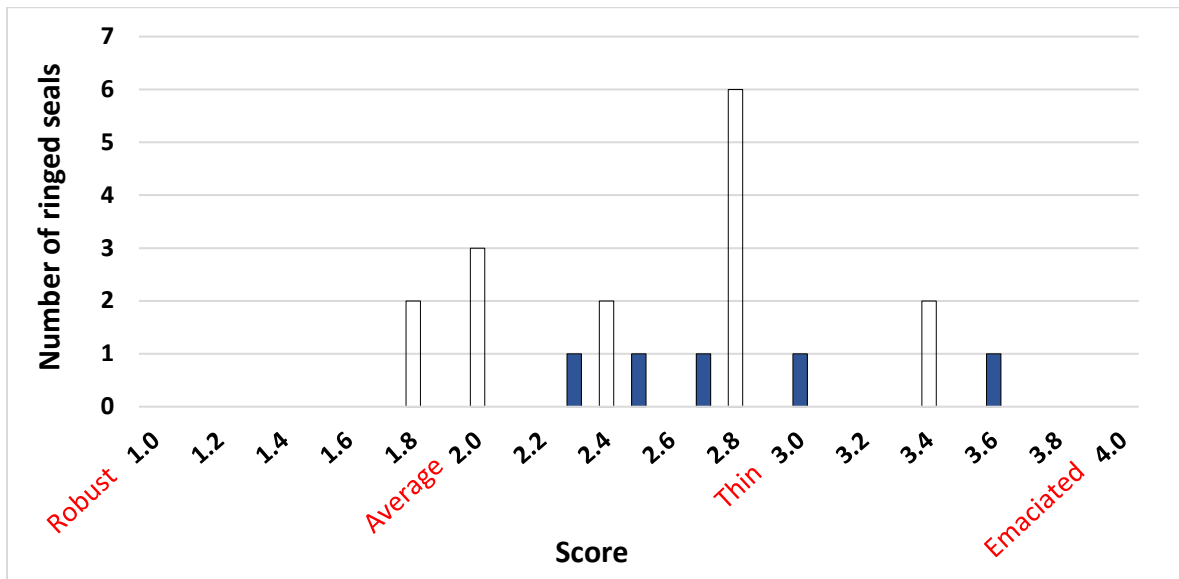


Figure 2. Body Condition Scores

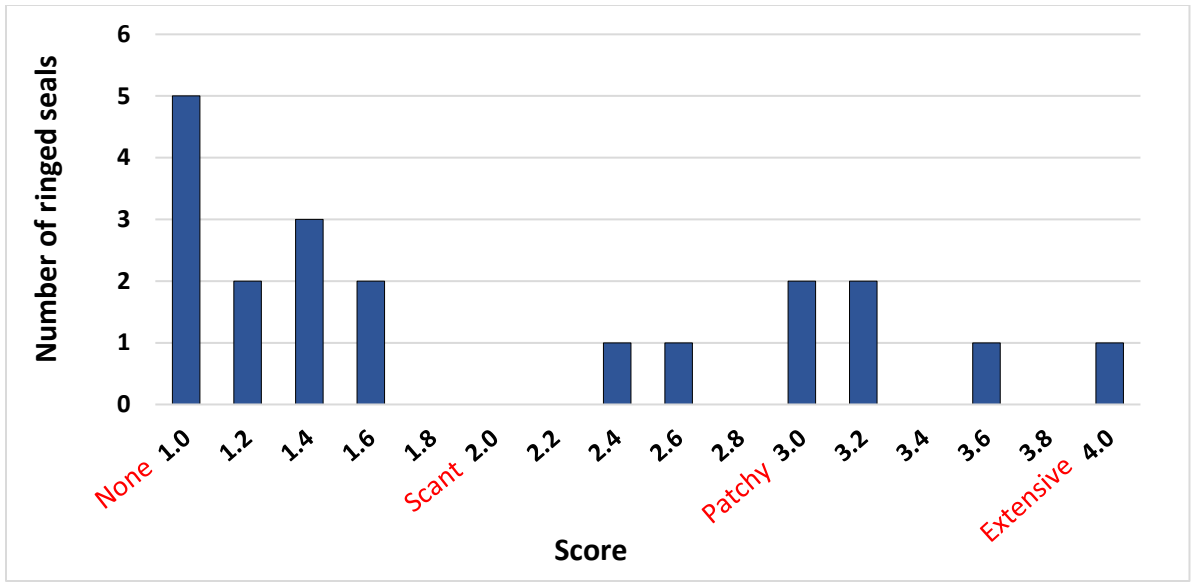


Figure 3. Alopecia Scores

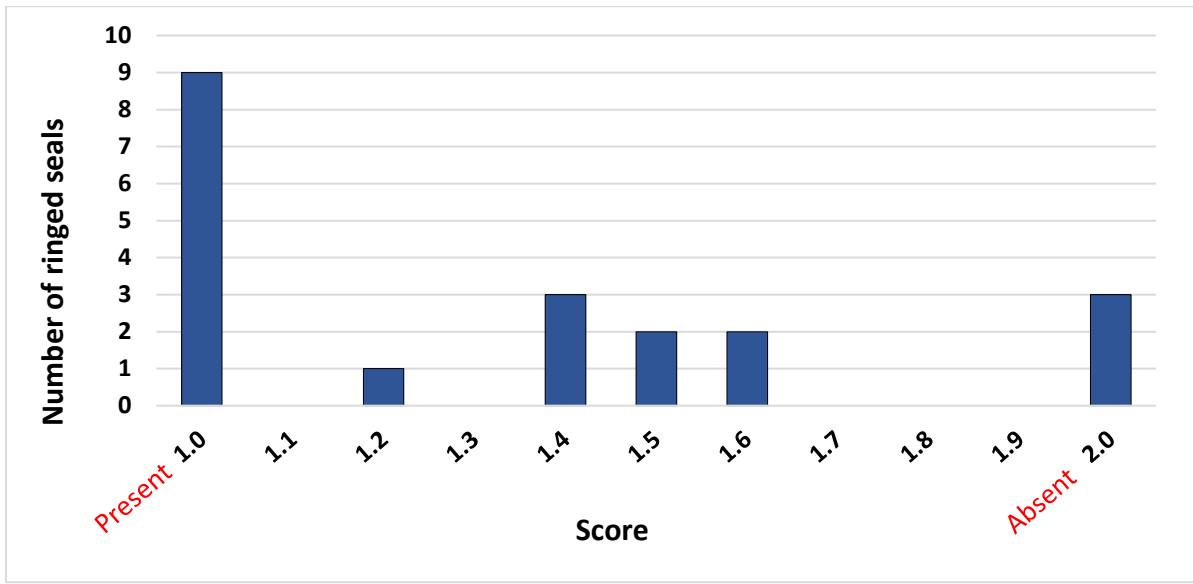


Figure 4. Eye Ring Scores

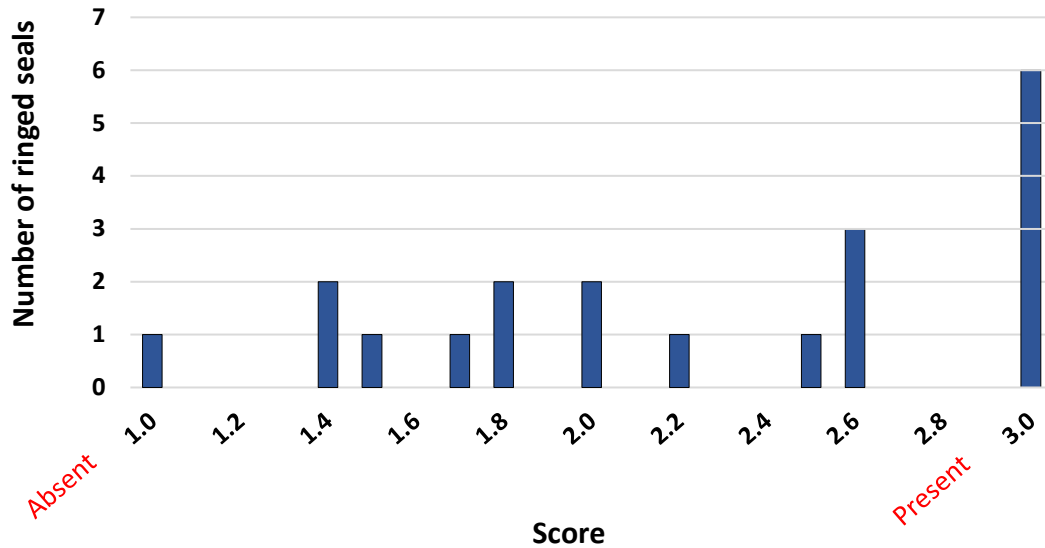


Figure 5. Other Pathology Scores

B. Necropsy Results

Necropsy results of the three moribund animals that subsequently died are included below.

1. 2018008

Ringed seal 2018008 was a female yearling first observed February 7, 2018. The decision was made to transport the seal to the ASLC for rehabilitation, but the animal was found dead on February 10, 2018 prior to transport.



GROSS DIAGNOSES:

- a. Chronic active, severe active pustular dermatitis HFs
- b. Chronic active, suppurative lymphadenitis, bilateral inguinal
- c. Chronic active, severe, necrosuppurative arthritis, myositis and fasciitis with abscessation, bilater hind flippers
- d. Probable septicemia with encephalitis
- e. Moderate, acute pulmonary edema

SUMMARY: This ringed seal had dermatitis of the hind flippers which appears to have ascended up the legs with necrotizing fasciitis, arthritis and lymphadenitis and most likely terminally resulted in septicemia and encephalitis. This animal was in poor condition with an empty gastrointestinal tract. She also had a dermatitis of the hind flippers, the infection of which

seems to have spread through the tissues, to the draining lymph nodes and likely septic with final encephalitis. With primarily gram-positive cocci, this is suggestive of a streptococcal infection, some organisms of which do cause necrotizing fasciitis “flesh eating bacteria”. Cultures have been submitted to Phoenix Labs and any Streptococci will be characterized at UC-Davis. It is a little odd that a dermatitis appears to have been the cause of this very extensive lesion. There was no evidence of bite wounds or fractures suggesting other causes of this extensive infection.

2. 2018018

Ringed seal 2018018 was a female yearling first observed April 3, 2018 at 1430. The decision was made to transport the seal to the ASLC for rehabilitation, but by 1900 the same day the animal had already died.



GROSS DIAGNOSES:

- a. Severe, acute, fibrinosuppurative peritonitis
- b. Probable necrotizing hepatitis / hepatic necrosis
- c. Mild Icterus
- d. Dehydration
- e. Mild, chronic, pustular dermatitis, HF's
- f. Chronic moderate, lymphadenitis, axillary, mesenteric
- g. Marked thymic atrophy
- h. Probable meningoencephalitis

SUMMARY: This animal had a peritonitis of unknown cause. This likely is related to hepatic necrosis or hepatitis and the terminal event was likely bacterial encephalitis. The stomach through the colon was empty.

3. 2018019

Ringed seal 2018019 was a female yearling first observed on April 5, 2018, looking alert, but lethargic and thin. The animal was transferred to the ASLC April 6, 2018. She failed to respond to treatment and supportive measures and died April 11, 2018. Exam revealed an emaciated animal with alopecia, pale mucous membranes and a firm, distended abdomen.



GROSS DIAGNOSES:

- a. Perforated stomach with severe peritonitis with effusion/ free fluid in the abdomen
- b. Large number of nematodes present in the intestines, through the perforation, and free in the abdominal cavity
- c. Discolored, dilated areas of intestines consistent with enteritis with associated enlarge lymph nodes
- d. Pneumonia
- e. Liver and gallbladder abnormalities including abscesses and dilation of the biliary tree
- f. Multiple indications of sepsis

SUMMARY: The necropsy of this ringed seal identified severe parasitism with perforation of the stomach by nematodes resulting in chronic, active, and granulomatous peritonitis.

C. Live Animal Findings

1. 2018014 (ASLC#PH1802, Taku), Ringed Seal #8 above

A malnourished lethargic male yearling was rescued from Unalaska on March 10, 2018 and admitted to ASLC on March 11, 2018. On admission he presented with dehydration, malnutrition, lungworm and bacterial pneumonia, gastrointestinal complications, and patchy alopecia. He was treated with antimicrobials, anti-parasite medications, gastroprotectants, respiratory therapy, fluids, and nutritional support. Initially he was tube-fed and has since transitioned to eating dead fish. All medications and treatments have been discontinued and the seal has grown in axillary girth and body mass.

2. 2018034 (ASLC#PH1804, Spencer)

A malnourished lethargic male yearling was rescued from Little South America on May 5, 2018 and admitted to ASLC on May 6, 2018. On admission he presented with lethargy, dehydration, malnutrition, severe lungworm and bacterial pneumonia, gastrointestinal complications, puncture wounds on the head and right shoulder, and patchy alopecia. He was treated with antimicrobials, anti-parasite medications, gastroprotectants, respiratory therapy, fluids, and nutritional support. Initially he was tube-fed and has transitioned to eating dead fish. All medications and treatments have been discontinued and the seal has grown in axillary girth and body mass.



III. Summary

The association of the Arctic subspecies of ringed seals and sea ice varies throughout the year on a seasonal basis. The closest association is the period starting from early winter and gradually increasing through mid-May to early June. Seals rest on the ice in subnivean lairs during this period and it is in these lairs that females typically give birth in late winter/early spring. Pups nurse for between 5-9 weeks, shedding their lanugo at about 4-6 weeks. During May and June, molting ringed seals may spend an average of 55% of their time on ice. Between the time lairs are abandoned and the ice breaks up, seals may remain uncovered on the ice with solar radiation aiding in the molting process. Once ice breakup occurs, the seals move to the water and forage more intensely (Kelly *et al.* 2010a, Kelly *et al.* 2010b). While Bering Sea ringed seals are included in the Arctic subspecies, some variability in life history may occur between discreet populations within the group (Kelly *et al.* 2010).

The timing of the ringed seal yearlings' appearance in the southern Bering Sea fits with the timing of closest ice association. Crawford *et al.* (2012) found habitat use differed substantially between adult and subadult ringed seals with range overlap between the two only during the open-water period. Adult ringed seals remained in the Chukchi and northern Bering Sea, whereas subadult ringed seals traveled south into the Bering Sea as sea ice coverage increased during November and December and stayed with the receding sea ice edge in the spring. Adult and subadult ringed seals were also found to utilize different prey species, especially during winter and spring.

It is possible that the young seals observed in the southern Bering Sea were foraging too far from the ice edge to return and moved onshore in the southern terrestrial locations to rest. On April 4, 2018 there was also a pod of killer whales observed in Unalaska Bay, so refuge from predation may be another reason that ringed seals moved on shore.

None of the seals appeared to be in optimum condition and it is unlikely that they represent a cohort of robust, healthy seals extending their range. More probably, the disruption of ice led to some level of compromise, as evidenced by various assessed parameters including body condition, hair coat and external pathology.

The most common thread among all the seals was a thin or emaciated body condition. Among the seals evaluated through photographs, 15 of the 20 were considered less than average with respect to body condition, three were considered average and only two were considered between average and robust. Starvation or malnutrition may not manifest as emaciation in phocids such as ringed seals as it does with otariids or terrestrial mammals. Phocids have thicker blubber and higher lipid content than fur seals or sea lions, with the lipid content of ringed seals considered high among phocids. The fatty acid content between inner and outer layers of blubber also differs significantly in phocids and this difference supports the hypothesis that stratification of blubber may be associated with two different uses; the outer layer serving to insulate and the inner layer used as energy storage (Liwinag *et al.* 2012). In the photographic assessment, seals were generally described as thin if they appeared to be lacking fullness

around the neck or around the hips/flanks. Of the three animals that died, all were considered in poor body condition. Blubber depth, which has been used as an index of body condition, was measured in all of the carcasses. Typically, average blubber thickness in subadult ringed seals is maximum in January and February and then declines until July (Quakenbush *et al.* 2011). The sternal/xiphoid blubber thickness measurements of the seals that died, 2018008, 2018018 and 2018019, were 0.8, 0.4 and 0.3 cm respectively, substantially less than average blubber depths of 3.5 and 2.7 cm measured in adults and subadults in the respective lean months of May and July. Both of the live ringed seals currently at the ASLC were considered malnourished upon admission.

Alopecia was also a common finding. Fifteen of the 20 seals assessed through photographs had evidence of hair loss, ranging from scant to extensive. Alopecia was found on only one of the three animals that died and both of the live ringed seals at ASLC presented with patchy hair loss. Alopecia was also a significant finding in the 2011 Arctic pinniped UME. Alopecia has been observed in numerous pinniped species, including both otariids and phocids, and the prevalence has been noted to be increasing in some (Lynch *et al.* 2011; Pugliares-Bonner *et al.* 2018). The signalment is not the same in all species. In gray seals, for example, weanlings are most commonly affected with no sex bias (Pugliares-Bonner *et al.* 2018), whereas in Australian fur seals, the condition favors juvenile females (Lynch *et al.* 2011). Loss of fur can have cumulative negative impacts, including increased metabolic rate to compensate for increased heat loss and a change in energy requirements. If diet can't augment the energy requirements, a decline in nutritional condition may result (Rosen *et al.* 2007). Consequently, alopecia may indicate reduced body condition (Lynch *et al.* 2011). However, it is uncertain whether the poor condition is due to the alopecia through increased heat loss leading to increased metabolic demands and possibly the inability to compensate through diet, or to some underlying pathology, such as contaminants or disease, that may also cause the alopecia (Bowen *et al.* 2015). While multiple etiologies have been suggested, including disease, parasitism or dietary shifts, no specific cause has been found. In some pinniped species, abnormally warm water temperatures are thought to trigger the onset of alopecia and fungal dermatitis (Higgins 2000) and the increased prevalence of seals with alopecia over time may suggest an association with warming water and concurrent shifts in water chemistry or prey availability (Pugliares-Bonner *et al.* 2018).

Only one of the 20 photographically-assessed animals was considered by all reviewers to be free of external pathology. Fourteen of the 20 were considered to have evidence of eye or eyelid abnormalities. Eye conditions are not common among harvested and stranded dead ringed seals. While the majority of cases seen during the 2011 UME had eye involvement, the ocular lesions with the 2018 ringed seals do not fit the UME early characteristics (R. Stimmelmayer pers com, July 9, 2018). Other external pathologies noted included festering skin lesions or wounds, mostly on the flippers or around the face, bleeding from the nose, fecal staining and dermatitis. The significance of these findings is uncertain, but they may also indicate some level of compromise.

In conclusion, the question remains whether these animals were outliers or, with continued changes in the Bering Sea, indicators that regional ringed seals as a group may be adversely affected by changing climatic conditions. In February of 2019, in an effort to determine if the event was being replicated, NMFS sent a flyer to numerous communities throughout the southern Bering Sea requesting community members report any sightings of ringed seals in their area. As of May 20, 2019, only one ringed seal was reported: a healthy looking and behaving animal was briefly observed in the St. Paul harbor. However, historic conditions in the region do not appear to be returning. The lack of sea ice in late January – March of 2019 was also unprecedented (Theriault Boots 2019) and there are indications of other widespread ecosystem changes (Gramling 2019). With marine mammals as ocean sentinels (Simeone et al. 2015), it is likely that the transformation of Bering Sea ecosystems will result in novel challenges for ice-associated seal species in that region.

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