

**Implementation Strategy for Emergency Vaccination
of Hawaiian Monk Seals
(DRAFT)**

NOAA National Marine Fisheries Service
Pacific Islands Fisheries Science Center
Hawaiian Monk Seal Research Program

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List of acronyms

DOCARE	Division of Conservation and Resource Enforcement (Hawaii)
DAR	Department of Aquatic Resources (Hawaii)
DLNR	Department of Land and Natural Resources (Hawaii)
MSF	Monk Seal Foundation
NPS	National Park Service
OLE	Office of Law Enforcement (NOAA)
SLP	Sea Life Park
USGS	US Geological Survey
USCG	US Coast Guard
WAQ	Waikiki Aquarium

Background

Triggers for vaccination of free-ranging Hawaiian monk seals (HMS) against morbillivirus or West Nile virus include suspected or confirmed cases as well as antibody detection through routine health surveillance. While the safety and efficacy of vaccines are evaluated in captive monk seals and a routine vaccination program is developed for the wild population, an interim response plan for emergency vaccination of wild monk seals is needed.

Core information on vaccines, their use in phocids, and the triggers for vaccination of wild Hawaiian monk seals are outlined in the *Hawaiian Monk Seal Vaccination Research and Response Plan (VRRP)*. The most current body of knowledge on morbillivirus infections in seals is well described in Duignan *et al.* 2014.

The following outlines specific protocols and logistical considerations should any of these triggers be reached, with a focus on morbillivirus. This document focuses heavily on the main Hawaiian Islands (MHI) where outbreak detection and emergency response are most feasible, and may be refined for the Northwestern Hawaiian Islands (NWHI) where applicable in the future. Additionally, this document identifies current gaps in response capability and outlines a budget for increasing vaccination preparedness.

A project was undertaken beginning in 2013 using long-term datasets from the NWHI to model the potential spatial and temporal progress of a morbillivirus outbreak in HMS. The objective is to obtain reliable estimates of how quickly an outbreak may spread in the MHI and in a subpopulation in the NWHI. Results of this study will allow us to estimate tactical approaches and time constraints on vaccination and other emergency responses (such as quarantine) in order to contain an outbreak and limit its impact. This information is especially important when considering the logistical difficulties of vaccinating seals at remote locations such as Kahoolawe, Niihau and Lanai.

While guidance from the effort described above is pending, it remains prudent to design the response plan to enable vaccination of as many seals as possible as soon as a trigger is identified. *Thus, this document was created under the conservative assumption that, if a trigger is met, vaccination efforts in the MHI may need to be instituted on many islands simultaneously.* This assumption therefore places a greater demand on personnel, travel and equipment resources, which may be revised after informed by the outcomes of the modeling project.

Implementation Plan Timeline

Now:

- Continue prophylactic vaccination trials in captive HMS and continue to purchase items on supply list as funds become available
- Share planning process with agencies, stakeholders (webinars and briefings completed Fall-Winter 2014-2015)

Short-term:

- Incorporate feedback from stakeholders and finalize operational plan, circulate among volunteers (NOAA/MSF, TMMC) and staff (NOAA, TMMC) that may be involved in response
- Determine appropriate interim vaccine (if any) while waiting on Purevax availability
- Incorporate model findings into vaccination approach and revise triggers/responses as appropriate
- Test dart gun and marking materials
- Develop training protocols for vaccination response activities and begin training of staff and volunteers (work w/ PIRO, MSF, TMMC)
- Conduct outreach to public, agency partners, legislature as appropriate
- Generate additional discussion on routine vaccination of HMS
- Implement prophylactic vaccination trial for wild HMS (as soon as appropriate vaccine is available)

Long-term:

- Develop refresher training modules and provide refresher training to staff and volunteers.
- Expand planning to include other emerging disease threats as appropriate

Overview of a Vaccination Response Scenario

First 24 hours after trigger identified:

- Appropriate parties will be notified (See Figure 1, Table 1, Appendix A).
- Mobilize on-hand vaccine stores and immediately order additional vaccine.

24-48 hours after trigger identified:

- Trained volunteer surveillance on each island will be activated in order to:
 - Report ID and location of all observed seals
 - Identify and report potentially sick seals
- Field Teams will be deployed to administer vaccines to seals as specified by the trigger (see VRRP) and according to protocols below.
- Scientific and animal health professionals will be consulted for additional non-binding input as needed.

Biomedical Sampling:

- Concurrent with vaccination efforts and to the extent that veterinary staff availability permits, blood and nasal swabs will be collected opportunistically from select wild, healthy animals
- Follow up collection of blood and nasal swabs on vaccinated seals will be conducted opportunistically 6-12 months post vaccination. At least 25% of vaccinated animals will be sampled within 6 months of treatment and at least 50% of all vaccinated animals will be sampled within 12 months of treatment.

Incident Command Structure (ICS)

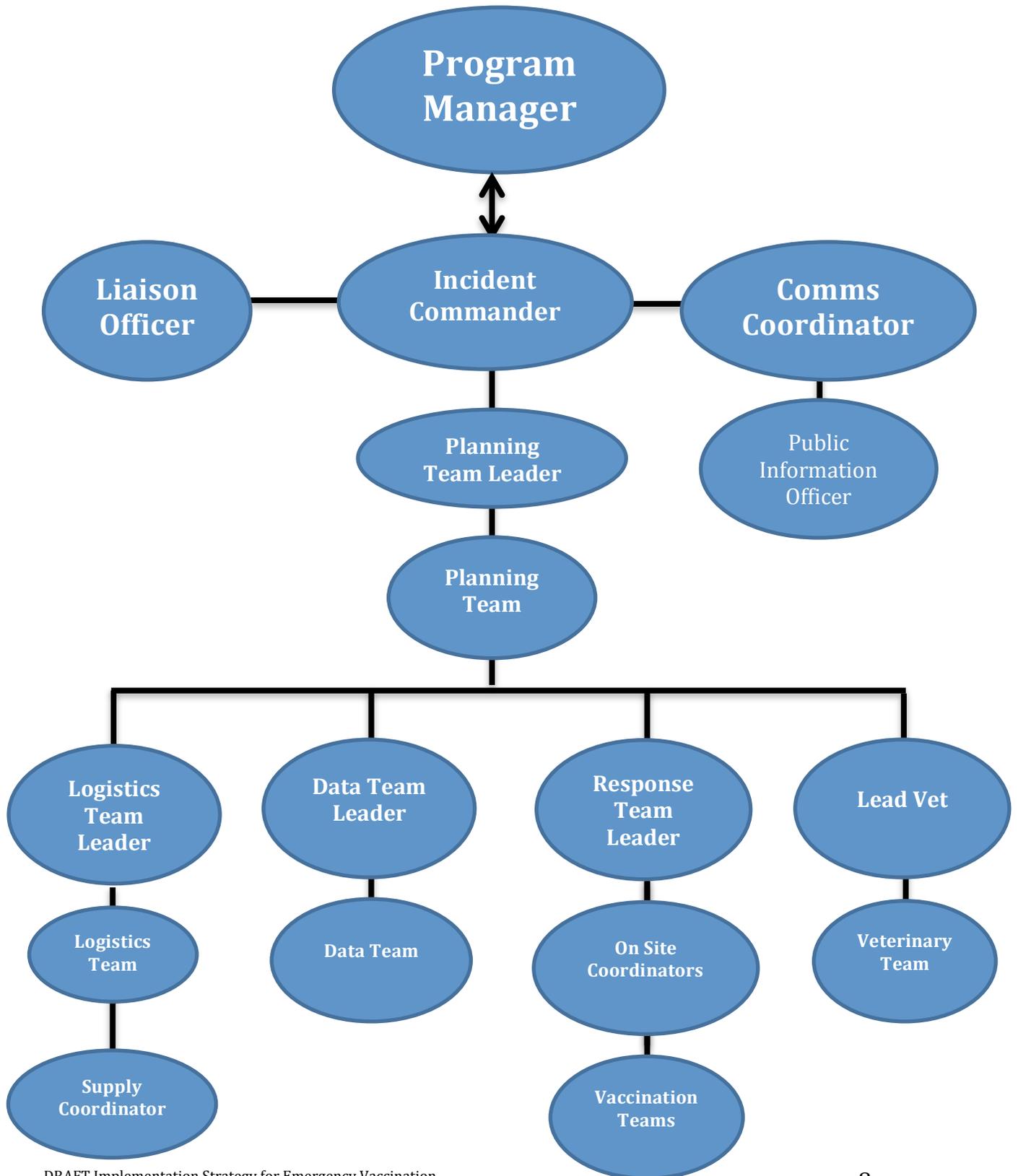
ICS will be used for mobilization, organization and implementation of the vaccination effort (Figure 1, Table 1). The ICS and roles contained herein are consistent with the guidelines being developed for National NOAA ICS as well as those in use for Monk Seal Emergency Responses. See Appendix A for contacts. Some individuals may fill multiple roles or serve on multiple teams.

Table 1. ICS Roles and Responsibilities for HMS Vaccination Event

Title*	Roles and Responsibilities
HMSRP Manager	<ul style="list-style-type: none"> • Authority to make program decisions
Incident Commander	<ul style="list-style-type: none"> • Assembles Planning Team (logistics team lead, data team lead, response team lead, and lead veterinarian) • Focal point for information flow up and down command chain • Informs and briefs program manager/senior management
Communications Coordinator	<ul style="list-style-type: none"> • Receives, collates and disseminates regular (at least daily) updates to/from on-site coordinators and team leaders
Public Information Officer	<ul style="list-style-type: none"> • Issues press releases • Serves as primary media point of contact • Coordinates with Program Manager for all public releases of information
Liaison Officer	<ul style="list-style-type: none"> • Liaises with external agencies (See Appendix A) • Coordinates staff/volunteer support for facilities preparations • Keeps IC updated on status of support assets • Coordinates with Logistics lead on seal hospitalization needs
Planning Team Leader	<ul style="list-style-type: none"> • Develop response plan with IC • <i>Planning team:</i> logistics team leader, data team leader, response team leader, lead veterinarian
Lead Veterinarian	<ul style="list-style-type: none"> • Updates IC on response effort and requests for additional assets • Makes decisions on courses of action for response in consultation w/ IC • Is available to vaccination teams for immediate consultation during vaccination response • Receives and facilitates information sharing among veterinarians/veterinary teams deployed in field/hospitals
Veterinary Team	<ul style="list-style-type: none"> • Responsible for health and welfare of seals • May conduct sampling <i>and</i> vaccination at some sites • Provide necropsy oversight as needed • Provide animal care & husbandry assistance in hospital(s)

	<ul style="list-style-type: none"> • Provide veterinary guidance for decisions regarding movement of seals among facilities • <i>Personnel will be divided to maintain appropriate quarantine</i>
Response Team Leader	<ul style="list-style-type: none"> • Leads on-site coordinators and response teams • Support Veterinarian Lead • Responsible for safety of personnel and volunteers • If no Veterinarian Lead, updates IC on response effort and requests for additional assets
On-site Coordinators (OSC) (1/island)	<ul style="list-style-type: none"> • Coordinates and communicates with all vaccination teams on one island and reports back to the Response Team Leader on Oahu • May serve on vaccination response team
Vaccination Response teams	<ul style="list-style-type: none"> • 2-3 trained persons per team • Carry out vaccination and marking of seals • May conduct sampling of seals with members of veterinary team • Communicate progress to OSC daily
Logistics Team Leader	<ul style="list-style-type: none"> • Coordinate logistics for transport of animals, supplies, and personnel travel.
Supply coordinator	<ul style="list-style-type: none"> • Responsible for inventory of vaccines, response kits, quarantine items, necropsy gear, sampling supplies • Orders new supplies when response occurs • Facilitates proper sample handling and storage • Responsible for submission of samples for testing
Data Team Leader	<ul style="list-style-type: none"> • Stays at central headquarters to be available for assistance with ID of seals and other data needs during response • Compiles data at the end of each day/response to summarize seals vaccinated, sampled, etc. and communicates w/ IC
Logistics Team <i>May also be part of Field Operations Team</i>	<ul style="list-style-type: none"> • Coordinate with OSCs to ensure all supplies and assets are available (trucks, boats, cages, etc.) • Coordinates travel arrangements with assistance from administrative staff • De-mobilize response, ensures all assets are cleaned and stored at end of response
Field Operations Team	<ul style="list-style-type: none"> • Provide on-scene support for response efforts, including animal handling, transportation, boat operations, etc. • Assist Logistics Team de-mobilize response • Assist Veterinary Technician process samples

Figure 1. Incident Command Structure for HMS Vaccination Event



Design of Field Teams

Response vaccination administration will be accomplished by Field Teams. Field Teams will consist of staff (PIRO, PIFSC, Island Coordinators, State of Hawaii), agency partners (when applicable) and volunteers.

- **NOAA staff** with appropriate authorization will lead vaccination efforts, transport vaccination kits, maintain contact through the ICS and conduct training/refresher training.
- **Federal and state agency partners** may be asked to assist as needs arise, particularly in remote locations.
- **Volunteers** will conduct beach surveillance and provide real-time information on seal haulouts and identification. Trained volunteers may be asked to assist HMSRP staff in vaccination administration as needed.

Field Teams will not restrain seals and hence do not require a veterinarian or head handler (experienced and physically capable of leading capture and restraining head of large seals). Specific field team considerations relative to each MHI location are provided below (See “Island Specific Considerations”).

Biomedical sampling (*i.e.*, blood and swabs) of healthy live seals may be elected in certain locations and a more robust Field Team with a head handler and trained biomedical sampling team will be necessary.

Volunteer Roles

Trained volunteers will:

- conduct surveillance for hauled out seals and sick seals,
- conduct post-vaccination monitoring of vaccinated seals.

Introductory training will be arranged through NOAA for key volunteers. Refresher and advanced training will be provided by NOAA staff on the ground. Volunteers trained by The Marine Mammal Center (TMMC) will be asked to assist with animal care and husbandry needs.

Upon administration of vaccines, volunteers may be asked to document the take of the seal with written notes and photographs. Volunteers may also be needed to assist with crowd control and outreach depending on the amount of people on the beach and the extent of animal handling.

Volunteers may be asked to assist in more advanced roles involving the use of crowding boards, playpens, restraint, and transport depending on needs of the vaccination team and level of training.

Marking Seals

Identifying individual seals that have been vaccinated is crucial to the implementation and assessment of the vaccination process. Most seals in both the MHI and NWHI can be identified by flipper tags, applied bleach marks, scars, and “natural bleach marks” (areas of lighter pelage). In the interest of safety, efficiency, minimizing seal disturbance, and improved public perception, HMSRP may decide to only apply a specific vaccination mark to seals that lack distinguishing markings (or markings are hidden by posture). An applied bleach mark is the most efficient method for identifying seals with minimal disturbance. The HMSRP has trained Island Coordinators on bleaching and tagging seals for routine population assessment and this additional utility underscores the importance of regular bleaching and flipper tagging efforts.

For seals that are *not* easily identifiable, vaccination marking will be necessary. The use of hair bleach used on sleeping seals may not be the most effective technique for marking vaccinated seals, as it requires a minimum of 4 minutes to take effect and requires the seal to be still and remain dry. HMSRP will test the use of colored epoxy as a potential marking technique.

Vaccination Protocols

The ideal vaccination schedule is as follows:

- Day 0 – Initial vaccine
- Day 28 (+/- 7 days)* – Booster vaccine
- Day 365 – Booster vaccine

* Seals that do not receive a booster vaccine within 35 days of the initial vaccine may not develop sufficient immunity. Therefore, the vaccination sequence should be re-started for these individuals (*i.e.*, seals should receive a new “initial” vaccine at the next available opportunity and a booster 28 days (+/- 7 days) afterwards).

Table 2: Vaccination decision tree. The following table assumes that the trigger identified requires vaccination of both sexes. This may differ, according to the trigger. Refer to VRRP for specifics.

Scenario	Vaccinate?
Pregnant female (or suspect pregnancy)	Depends on type of threat and stage of pregnancy
Lactating female	Yes
Dependent (nursing) pup	No
Weaned pup	Yes
Adult male	Yes
Subadult or juvenile male	Yes
Sick/suspect sick seal	No
Molting seal	Yes
Seal vaccinated <21 days ago	No
Seal vaccinated +/- 28 days since initial vaccination	Yes
Seal not boosted in 35 days after initial vaccination	Yes; re-start vaccination schedule

Pre-vaccination Seal Assessment Checklist

1. Determine seal ID, age class and sex.
2. Has the seal been vaccinated previously? If so, how long since vaccination?
 - a. If it has been < 28 days since initial vaccination, STOP – do not vaccinate.
 - b. If \geq 28 days since initial vaccination, CONTINUE with assessment.
 - c. If unknown, and of appropriate sex, CONTINUE with assessment.
3. Is the seal in a safe location to be vaccinated?
 - a. If flushed, is there a safe escape pathway for the seal? Note rocky substrate or other hazardous structures, cliffs/edges or roadways on which the seal could endanger itself. If only escape route is through unsafe structures, STOP – do not vaccinate. Call lead veterinarian for guidance.
4. Complete the following visual health status assessment:
 - a. Evaluate **nutritional condition**. If nutritional condition is emaciated, STOP – do not vaccinate. Complete remainder of visual health status assessment and then contact lead veterinarian.
 - b. **Responsiveness**: Note any lethargy or lack of response to normal environmental stimuli. Do not approach seal to elicit response.
 - c. **Respiratory rate (RR)** should be approx. 2-10 breaths per minute, depending on activity.
 - d. **Respiratory effort/character**: Do you notice any straining to breathe? Any abnormal noise when breathing? (Occasional sneezing is normal)
 - e. **Nasal discharge**: “Normal” nasal discharge is white/foamy and should not be pouring from the nares or exuded upon every exhalation. Abnormal discharge is yellow, green, red and/or in great quantity.
 - f. **Ocular discharge and hydration**: Normal seals will have moist, clear eyes, sometimes with a small amount of wetness around them. Abnormal discharge around the eyes would be thick/viscous, yellow or green; the hair around the eyes may be matted. Dehydrated seals will have eyes that appear sunken back into the skull and dry, sometimes crusty ocular discharge around the eyes.
 - g. **External abnormalities**: is there any evidence of skin abnormalities or unhealed trauma, other wounds or abscesses?
 - h. **If any abnormalities are noted in steps a-g, STOP – do not vaccinate. Complete health status assessment and then contact lead veterinarian.** Continue to maintain visual on seal.
5. Has the vaccine been properly stored (fridge/ice packs)? If no, STOP.
6. If there are no contraindications as listed above, proceed with vaccination.

Important notes:

- Never vaccinate a seal that appears sick or otherwise debilitated.
- Vaccines must remain cold (refrigerated or on ice packs in a cooler) at all times.
- Do not draw up vaccine into syringe until it is ready to be used.
- Maintain sterility – never re-use needles. When in doubt about sterility, use a new needle.

Protocol for vaccination of single seal:

To eliminate the need for restraint, a pole syringe will be used. The vaccinator should try to approach without being detected, administer the vaccine, and quickly back away. Ideally the seal would not be flushed into the water allowing it to be observed from a distance. Vaccines may be administered without the use of crowding boards but personnel (“crowders”) should be close by and ready to block seal from escape into water before vaccination or from dangers in the area.

1. Confirm seal ID, take photos and standard data; obtain ancillary video if it helps with identification or documentation.
2. Complete veterinary pre-vaccination checklist
3. Assign roles and brief on plan
4. Draw up vaccine and vaccinate using pole syringe
5. Record results and post-vaccination observations
6. Disinfect or dispose of gear that was in contact with seal

Protocol for vaccination of single seal & application of mark:

If the seal is unidentifiable, the team should take multiple photos and apply a vaccination mark immediately after successful vaccination. Crowding boards will be used to ensure that seals do not flush into the water after vaccination. If bleach marking must be used, it will be important for personnel have the crowding boards at the ready.

1. Confirm seal ID, take photos and standard data; obtain video if necessary.
2. Complete veterinary pre-vaccination checklist
3. Assign roles and brief on plan
4. Prepare marking materials
5. Draw up vaccine
6. Vaccinate using pole syringe and mark seal
7. Record results and post-vaccination observations
8. Disinfect or dispose of gear that was in contact with seal

Protocol for vaccination when multiple seals are in the same location:

Ensure correct identification of seals, consider marking needs and develop strategy for vaccinating as many seals as safely possible. Consider: a) working as two teams on separate seals, or b) using extra crowdors to “hold” a seal while another is vaccinated (crowdors monitor waiting seal for signs of stress). Call communications coordinator/incident commander at home base if guidance on prioritizing one seal over another is needed.

If only one seal needs a vaccination mark, it should be vaccinated and marked first. If both seals need vaccination marks, vaccinate seal with highest priority first. When crowding multiple seals, separate them to avoid injury and minimize stress.

1. ID seals, take pictures, and standard data; obtain video if necessary.
2. Decide on priority seals (female>male)
3. Veterinary pre-vaccination checklist
4. Assign roles and brief on plan
5. Prepare marking materials if necessary
6. Crowdors gain control of seals if necessary
7. Draw up vaccine and vaccinate using pole syringe; apply mark if necessary
8. Record results and post-vaccination observations
9. Disinfect or dispose of gear that was in contact with seal

The above protocols are designed with the intent that vaccinations will be administered without handling of the seal and by using the pole syringe. If seals are handled for other reasons (epidemiology sampling, pole syringe malfunction), a standard syringe and 18 g x 1.5” needle may be used to administer the vaccine by hand.

Post-vaccination Seal Assessment

1. **Responsiveness:** Note any lethargy or lack of response to normal environmental stimuli. Do not approach seal to elicit response.
2. **Respiratory rate (RR)** should be approx. 2-10 breaths per minute, depending on activity.
3. **Respiratory effort/character:** Do you notice any straining to breathe? Any abnormal noise when breathing? (Occasional sneezing is normal)
4. **Nasal discharge:** “Normal” nasal discharge is white/foamy and should not be pouring from the nares or exuded upon every exhalation. Abnormal discharge is yellow, green, red and/or in great quantity.
5. **Ocular discharge and hydration:** Normal seals will have moist, clear eyes, sometimes with a small amount of wetness around them. Abnormal

discharge around the eyes would be thick/viscous, yellow or green; the hair around the eyes may be matted. Dehydrated seals will have eyes that appear sunken back into the skull and dry, sometimes crusty ocular discharge around the eyes.

6. **Injection site:** is there any swelling or discharge at the injection site? Do you see any external skin abnormalities, other wounds or abscesses?

Live Animal Sampling Protocol

Not all vaccinated seals will be sampled prior to vaccination. As time and logistical considerations allow, some seals may be sampled during the vaccination effort in order to assess possible exposure or to measure post-vaccination titers. All samples should be put in a cooler with blue ice in the field immediately. The following *minimum* samples should be collected during live animal sampling:

- Two red top tubes
- One EDTA/lavender top tube
- 4 nasal swabs
- Remainder of Epi Sampling Protocol as time permits

Table 3. Live Animal Sampling Requirements

Sample type	Minimum # of samples	Test	Laboratory	Storage
Serum (RTT)	2 mL	Serology (serum neutralization, PCV, CDV)	U of Georgia or Cornell	-80°C
Serum (RTT)	1 mL	CBC	Idexx/Antech	Blue ice/fridge; send out
Whole blood (LTT)	1 mL	Chemistry	Idexx/Antech	Blue ice/fridge; send out
Nasal swab	1 swab in VTM	Archive	Archive	-80°C
Nasal swab	1 swab in VTM	PCR, sequencing	UC Davis	Send out (-80°C)
Nasal swab	2 swabs in dry cryovial	Archive	Archive	-80°C

Dead Animal Sampling Protocol

Dead seals reported during an outbreak situation require immediate sampling and necropsy. The MHI Necropsy Protocol should be followed.

Top priority samples include: blood (serum, buffy coat), nasal swabs (in RNA later, VTM and dry cryovials), fecal swabs (dry cryovials) and paired samples of tissue (lung, pulmonary lymph node, liver, brain, CSF), one of which should be fixed in formalin and the other frozen at -80°C. An individual involved in a necropsy should not subsequently be in contact with live seals until the person has undergone full disinfection (shower, complete change of all clothing and footwear).

Proper Disinfection and PPE

Over the course of vaccinating seals, it is possible that Field Teams will come across an infected seal shedding morbillivirus but not showing any clinical signs. Fortunately, morbillivirus survives poorly outside of a host. For disinfection purposes, conservatively assume that all seals and their body fluids are infective to other seals.

Fomites are objects that can carry infectious pathogens (germs) from one place to another. Likely fomites in a vaccination situation include clothing, dirty hands, footwear, and medical supplies. To avoid being a fomite (think “Typhoid Mary”), only take essential gear in the vicinity of seals. Always wear clean gloves and dispose of gloves between animals. Disinfect all gear that comes in contact with a seal or seal bodily fluid (urine, feces, blood) and do not allow “dirty” gear to come in contact with clean gear. Change into fresh coveralls if there is any chance that they may have contacted the animal or bodily fluids. Always dispose of sharp instruments properly in a designated container and do not reuse needles.

The preferred disinfectant is Accel (accelerated hydrogen peroxide). It can be used as a detergent and disinfectant for all types of gear, is environmentally friendly, nontoxic and is not affected by sunlight. Accel must remain on surfaces for a minimum of 5 minutes in order to properly disinfect. Organic material such as dirt can harbor germs, so always be sure to wash objects of debris *before* disinfecting.

An alternative disinfectant is dilute bleach, which must remain on surfaces for a minimum of 10 minutes to properly disinfect and can be inactivated by heat/light after 24 hours. Surfaces must be cleaned of all organic material before bleach is used as a disinfectant.

Do not allow any gear used in the field during vaccinations to come in contact with pets or livestock.