



VACCINATION MANUAL LUMPFISH

The purpose of this manual is to provide general recommendations applicable before, during and after the vaccination of lumpfish. The manual is based on experience in the field in recent years, but is also a working document in the process of development. New versions will be released continuously as new knowledge and experience becomes available.

Feel free to contact PHARMAQ if you have any questions regarding vaccination.

Table of contents

	Page
1. Prior to vaccination	
a. Taking delivery of vaccine.....	3
b. Preparation for vaccination: Vaccine and fish.....	5
c. Preparation for vaccination: Environment and equipment.....	6
d. Preparation for vaccination: Personnel and health.....	7
e. Hygiene.....	8
2. Vaccination	
a. Anaesthetisation.....	9
b. Needle lengths and diameters.....	9
c. Injection area and injection technique.....	11
d. Changing needles and vaccine bags.....	14
e. Fish welfare.....	15
f. Hygiene.....	15
g. Continuous quality control.....	16
3. After vaccination	
a. Hygiene and disinfection.....	17
b. Mortality, behaviour, appetite, environment.....	17
c. Feeding after vaccination.....	19
d. Re-examination.....	19
4. Differences between vaccination of lumpfish and salmon.....	20
Attachment A - Form - Delivery inspection of vaccine.....	21
Attachment B - Poster - Unintentional self-injection of fish vaccine.....	22
Attachment C - Poster - Recommended injection site.....	23

1. PRIOR TO VACCINATION

a. Taking delivery of vaccine

Important considerations	Requirement/ Recommendation	Explanation
Temperature	2-8°C	Vaccines must be kept at the required temperature for storage and transport to avoid vaccine emulsion separation.
Vaccine type and number of doses.	Correct vaccine and number of units received.	On delivery of vaccine, always check that it corresponds to the one ordered.
Appearance of vaccine on receipt and in use.	Appears as a white, creamy liquid when homogenized with no separation. (see Photo 1)	Aqueous phase at the bottom of the bag (see Photo 2) or if separated into three distinct layers MUST NOT BE USED May be used if there is a clear oil layer on the top: (see Photos 3-4)
Shelf life.	Check expiry date.	Ensures that vaccine shelf life has not expired and quality of emulsion.
Batch number.	Check batch number printed on bag.	Ensures traceability in the manufacturer's system.
Inspection form for delivery.	Use a standard inspection form for delivery (see Attachment A)	If in doubt, ask the vaccine manufacturer on how to use form.



Photo 1 - Homogeneous and ready for use



Photo 2 - Separated vaccine with brown aqueous phase at bottom **MUST NOT BE USED**

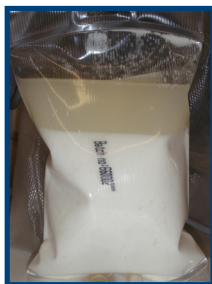


Photo 3 - Normal appearance when stored upright. Must be shaken before it is ready for use (oil on top)



Photo 4 - Lying in refrigerator. Must be shaken before it is ready for use (oil on top)

b. Preparation for vaccination: Vaccine and fish

Important considerations	Requirement/ Recommendation	Explanation
Vaccine separation before use.	Check that the vaccine is homogeneous and was kept at room temperature overnight.	Shake the vaccine the day before use and keep it at room temperature (See Attachment A)
Bringing vaccine to room temperature.	Ideally 15-20°C for manual vaccination. Not above normal room temperature or below 2°C.	The vaccine is easier to work with at a temperature of 15-20°C. Easier to homogenise vaccine at 20°C than at 10°C.
Homogeneous vaccine at start-up and in during use.	Shake well before use.	Non-homogeneous vaccine can vary in effect and side effects. Vaccines need to be shaken for longer at cooler ambient temperatures.
Calibrating dose.	Correct dose in each fish is essential. Correct number of doses per vaccine bag.	Calibrated with, for example, 1 ml syringe/pipette (see Photos 5 and 6). Note the number of vaccinated fish per bag.
Grading and number of fish.	Fish well graded close to vaccination.	Good grading improves the speed and precision of injection. The fish may be graded and vaccinated continuously, and will experience this as a single stress episode.
Fish weight/size.	Minimum 8 grams.	It has been observed that fish resume feeding more quickly with fewer side effects if larger than 8 gr.
Fish health.	Best possible state of health with no disease.	Inspection and assessment by the fish health personnel. Vaccination process (stress) could trigger outbreaks of latent diseases.
Withholding/starve feed.	PHARMAQ recommends withholding feed from the fish for 24 hours before vaccination. The fish should be kept in the dark and covered by a tarpaulin to minimise aggressiveness.	The need to withhold feed will vary between installations and water temperatures. The fish should not have feed which will distend stomachs and/ or intestines, but should not be starved so long that they become aggressive.



Photo 5 - Calibration using syringe and long 1 ml pipette



Photo 6 - Calibration using 1 ml syringe

c. Preparation for vaccination: Environment and equipment

Important considerations	Requirement/ Recommendation	Explanation
Water temperature.	Avoid large temperature variations before, during and after vaccination.	High water temperature increases the risk of serious side effects. Temperature variations can have a stressful effect on fish.
Vaccinators.	Well-trained personnel. See information about continuous quality control in Section 2g.	Ensure that sufficient personnel are available. Confirm shortly before planned vaccination. Get Information on fish weight/ size and vaccine to allow assembly of correct equipment (injectors, needle size etc.)
Other equipment.	Pumps, pipes, tanks etc. shall be well maintained clean, disinfected, and also free of rough and sharp edges that can harm the fish.	Careful handling reduces the risk of damage to the fishmucus and surface during the vaccination process.

d. Preparation for vaccination – Personnel and health

Important considerations	Requirement/ Recommendation	Explanation
Personnel should be familiarized and have knowledge of the safety procedures.	Personnel should know where to find the safety data sheets, and be aware of the standard operating procedures in case of self-injection.	See Attachment B: Advice in the event of unintentional self-injection. Following self-injection: Quick assessment and rapid response is of the utmost importance.
Vaccination team safety procedures.	Any vaccination team should be trained in the vaccination procedures.	Not all teams are equipped with adrenalin EpiPen (see Photo 7) If not and in any case, access to a surgery and or doctor is essential.
Notifying the local medical centre/ surgery.	A clearly displayed poster stating the telephone number and location of the doctor's surgery should be always available.	The local surgery staff should be aware beforehand on how to deal with self-injection cases.

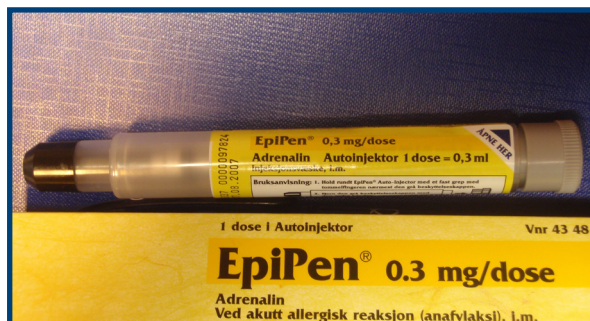


Photo 7 - An example of an adrenalin auto-injector used in cases of anaphylactic shock

e. Hygiene

Important considerations	Requirement/ Recommendation	Explanation
Clean equipment.	Equipment which may come into direct or indirect contact with fish shall be clean and disinfected.	Vaccination equipment moved between sites represents a risk of transferring disease.
Clean tanks.	The receiving tank should be washed,steamed and disinfected before vaccinated fish are put in it.	Minimises the risk of transmission of disease that may be in the biofilm Ensures good water quality.

2. VACCINATION

a. Anaesthetisation

No clear guidelines currently exist regarding whether to, and how to, anaesthetise lumpfish prior to vaccination.

In contrast with salmon, lumpfish remain immobile without anaesthetization during vaccination. They also display normal behaviour after vaccination without the use of anaesthetic. When anaesthetics are used the fish may become more agitated and adhere to surfaces, making it necessary to remove each fish before vaccination. Many therefore choose not to use anaesthetics and find that this improves fish welfare.

Sedation before vaccination may possibly reduce stress in connection with handling.

Ask PHARMAQ field personnel or the fish health service for advice regarding anaesthetisation.

b. Needle lengths and diameters

Important considerations	Requirement/ Recommendation	Explanation
Needle length.	The entire bevel of the needle must penetrate the abdominal wall.	Ensure deposition in the abdominal cavity. See Photo 8
Low condition factor.	Consider using shorter needle.	Reduces risk of injecting into the internal organs e.g. intestine.
Low vaccine temperature.	Bring vaccine to room temperature.	For easier injection. Cold vaccine is more viscous and may cause uneven dosing because of incomplete filling of vaccine in the injector's chamber.
Fish size and condition factor.	Important to check the needle length on fish of different sizes before commencing. The condition factor of lumpfish normally displays a wide variation.	The thickness of the abdominal wall may vary with the size of the fish.

b. Needle lengths and diameters - Continued

Important considerations	Requirement/ Recommendation	Explanation
Needle quality.	Check the needles before use.	Even new needles may be damaged and blunted (see Photo 9)

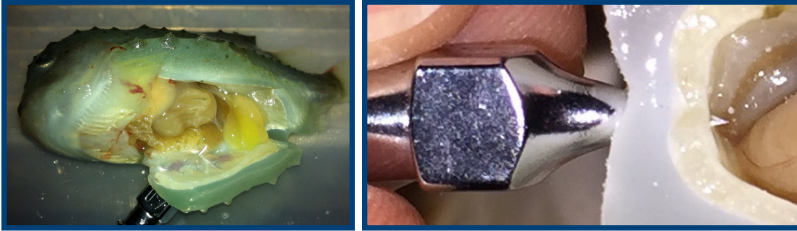


Photo 8 - Correct, with entire bevel inside the peritoneum before deposition



Photo 9 - New needle from box, not good enough

The following table provides general guidelines for the selection of needle length for use on lumpfish. We recommend smaller diameter needles for lumpfish than for salmon: 0.5 or 0.6 mm needles.

Manual vaccination

Approx. fish length (to base of caudal fin), cm	Fish weight, gr	Inject 90 degrees to abdominal wall. Needle length, mm
Less than 5.5-6	8-12	4
6-7	9-18	4-5
7-10	15-35	6
10+	30-40+	7+

c. Injection area and injection technique (Photos 10 to 14)

Important considerations	Requirement/ Recommendation	Explanation
Speed of vaccination.	Shall not compromise quality.	It is important to have a good rhythm and adequate speed during vaccination to ensure best quality.
Injection angle.	As close to 90 degrees as possible in manual vaccination. (see Photos 11 and 12) Angle of the needle must not deviate from 90 degrees.	Minimises damage to tissue. If there is size variation the needle length as well as the angle of injection should be considered when injecting to avoid injecting vaccine into any of the internal organs.
Injection area.	The recommended injection area is midway between the caudal edge of the sucker and the anal pore .(see Photo 12)	This minimises the risk of tissue damage
Pressure on the fish.	The needle shall glide in easily	A blunt needle may cause laceration and tissue damage. The small abdominal cavity and large volume of vaccine dose may cause leakage from the injection area. This occurs occasionally and may be visible as a drop of vaccine externally on the fish. Occurrence may be reduced by a smaller needle diameter. Lumpfish should not be squeezed after vaccination.
Depositing vaccine dose.	The entire dose should be deposited in the abdominal cavity before the needle is withdrawn.	

c. Injection area and injection technique (Photos 10 to 14) - Continued

Important considerations	Requirement/ Recommendation	Explanation
Needle guard.	A needle guard is not often used when injecting lumpfish. At some locations a modified needle guard is used but does not provide such good protection. The needle is somewhat exposed.	Important to be calm while vaccinating to avoid self-injection.
Vaccine injection area and dose deposition.	In the abdominal cavity within a specific area. (see Photo 13)	Depositing vaccine in the intestine or too far forward (sucker) indicates incorrect injection or a needle too long (see Photo 14)

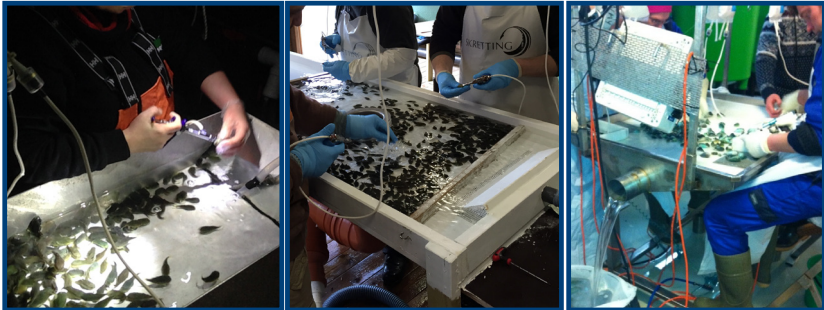


Photo 10 - There are many ways to organise vaccination

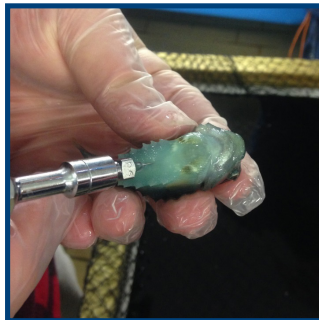


Photo 11 - Correct vaccination: Good grip, little pressure on abdomen. (Easy needle penetration)



Ideal injection point for lumpfish vaccination

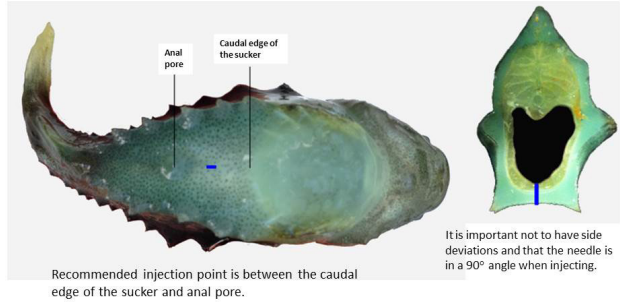


Photo 12 - Correct injection area. Cavity behind the pyloric caeca and transition to intestine. Intestine must not have feed.



Photo 13 - Deposition of vaccine in abdominal cavity

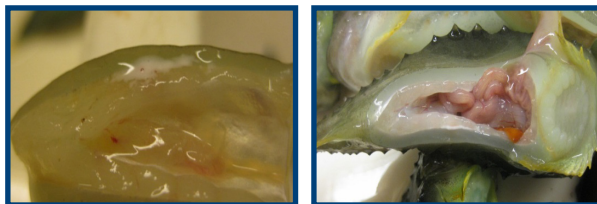


Photo 14 - **Incorrect:** Deposition in muscle caused by incorrect angle of injection or needle too short.

d. Changing needles and vaccine bags

Important considerations	Requirement/ Recommendation	Explanation
Homogenization of vaccine.	2 minutes shaking and squeezing the bag.	Homogeneous vaccine is important to ensure uniform efficacy.
Tube and tubing attachment.	Use sterile tubing. No leaks. The same tubes should never be used for more than one day.	
Storage and re-use of opened bags.	Opened bags should be used within 12 hours.	If the vaccine separates inside the tube during storage, the tube should be replaced. (see Photo 15)
Air bubbles in vaccination equipment.	Shall not occur and must be removed.	Air bubbles may cause incorrect dosage and malfunction of the vaccine injector.
Replacing needles.	When a needle becomes blunt or damaged, normally after 2000-3000 fish or if lacerations occur.	Take special care when vaccinating fish with a large size variation.

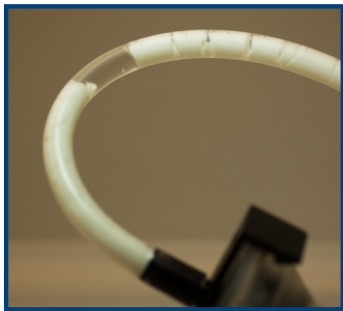


Photo 15 - Tubing stored overnight may look like this. **MUST NOT BE USED**



Photo 16 - Duo adapter allows a single bag to be used simultaneously by more than one vaccinator.

e. Fish welfare

Important considerations	Requirement/ Recommendation	Explanation
Euthanasia of ungraded fish.	Euthanize fish while under the anaesthetic.	Euthanasia with minimum suffering is important in animal welfare and is required by law.
Handling fish.	Fish shall be handled with care. Minimizing stress to the fish.	Fish are subject to considerable stress during vaccination.

f. Hygiene

Important considerations	Requirement/ Recommendation	Explanation
Clean needle.	Replace needles frequently.	Reduces the risk of contamination and transmission of disease. (see Photo 17)
Washing and disinfecting gloves.	At breaks and after handling diseased fish.	Avoid increasing the risk of contamination and transmission of disease.
Washing and disinfection of surfaces.	After handling fish with lesions and at breaks.	Avoid increasing the risk of contamination and transmission of disease.



Photo 17 - Sterilisation of needle using sponge and 70% alcohol

g. Continuous quality control (Photos 18 and 19)

Important considerations	Requirement/ Recommendation	Explanation
Internal inspection of fish	Should be carried out in addition to any external inspection. Entire range of size should be checked, especially at the start.	The same persons should always carry out this task. Most frequent monitoring at the start will improve the result. Both external injection area and internal deposition of vaccine should be inspected.



Photos 18 and 19 - Elements of quality control: Evaluation of vaccine at surface after vaccination: large amount (Photo 18) and moderate (Photo 19)

3. AFTER VACCINATION

a. Hygiene and disinfection

Important considerations	Requirement/ Recommendation	Explanation
Disinfecting and washing equipment.	Regular washing and disinfection of vaccine injectors. Regular washing and disinfection of the vaccination table and anaesthetic machine/tubs.	Soapy water followed by disinfection. Water, degreaser and scrubbing brush followed by disinfectant.
Opened vaccine bag.	Should be used within 12 hours.	Storage increases contamination risk. Use duo adaptor or Y-connector to empty the bags (see Photo 16). Get one delivered if necessary.

b. Mortality, behaviour, appetite, environment

Important considerations	Requirement/ Recommendation	Explanation
Mortality	Normally low: less than 1%	
Behaviour	Little deviation from normal behaviour after vaccination.	
Appetite	Lumpfish generally resume feeding quickly. Normal appetite can be expected no later than 7-9 days after vaccination.	It is recommended to withhold feeding until the day after vaccination. The fish should be kept in the dark and not fed to minimise aggressiveness. A sample of the population should be inspected after a week to obtain a general view on feeding status.

b. Mortality, behaviour, appetite, environment - Continued

Important considerations	Requirement/ Recommendation	Explanation
Yellow/white casts/ strings in the water. (see Photo 20)	May vary and should be minimal.	Direct injection into the intestine or fish which have not eaten for a period of time.
Vaccine on water surface.	May vary and should be minimal. (see Photos 18 and 19)	Often more noticeable in connection with vaccination of smaller fish and inadequate injection technique. Leakage from injection area, anal pore or originating from the vaccinating table during calibration. Running water over the surface quickly breaks vaccine down.
Avoid stress.	Fish should not be stressed in the first week after vaccination.	This applies to temperature, salinity, light and handling.



Photo 20 - Mucosal membrane excretion from intestines (yellowish and grey), with vaccine (white). Vaccine was injected into the intestine and excreted with the faeces.

c. Feeding after vaccination

Important considerations	Requirement/ Recommendation	Explanation
When to start feeding.	Do not feed the fish until the day after all individuals in the tank have been vaccinated.	Feed is rapidly transported through the intestines of fish. Large amounts of mucus and/ or liquid can be produced in the intestines if fish are not fed or have limited access to feed for a long period.
Feeding resumed.	Practically all fish have resumed feeding.	A few individuals can be expected to become emaciated and die after vaccination.

d. Re-examination

Important considerations	Requirement/ Recommendation	Explanation
Evaluation of the injection area	Can be carried out by necropsy a few weeks after vaccination. (see Photo 21)	External injection area becomes invisible shortly after vaccination. Internally, the vaccine reaction is visible for a longer period.
Vaccination inspection before transfer.	At least 20 fish should be inspected internally for vaccine absorption and residues, as well as side effects.	Small amounts of vaccine residue indicate good absorption of vaccine.

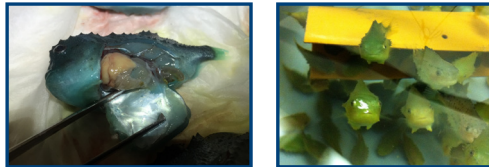


Photo 21 - Evaluation of the injection area can take place a few weeks after vaccination. On the left: fish 4 weeks (270 degree days) after vaccination. Monitor the behaviour of the fish.

4. Differences between vaccination of salmon and lumpfish

Important considerations	Lumpfish	Salmon
Withholding feed before vaccination.	24 hours – fish should be kept in the dark under a tarpaulin to prevent aggressiveness.	12-15 degree days.
Vaccine dose.	0,05 ml	0,1 or 0,05 ml
Vaccination technique.	Manual.	Manual or mechanical.
Anaesthetizing before vaccination.	Practice varies.	Standard.
Needle diameter.	0,5 or 0,6 mm	0,7 mm
Needle length.	8 g fish – 4 mm -> 40 g fish – 7 mm	20 g fish – 3 mm -> 100 g fish – 8 mm
Injection area.	Midway between caudal edge of the sucker and anal pore.	3/4 of length of pelvic fin cranial to the pelvic cartilage, maximum 10 mm forward, along the mid line.
Needle guard on injector.	Modified type used to some extent	Always used.
Removal of scales from needle.	N/A	Must be removed frequently.
Feeding after vaccination.	Wait at least one day.	Wait at least two days.

Attachment A

Control of vaccine received

Date received		Type of vaccine	
Time in transit		Batch no.	
Method of delivery		Use by date	
Freeze indicators / temperature logger		Amount (liters)	
	Number of loggers:	OK? <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Comment		

Possible vaccine separation

The vaccine bags may be visually inspected while lying flat (e. g. in a refrigerator). Avoid shaking the bags before they are checked for possible watery layer in the bottom of the bag.

A brown layer in the bottom of the bag (fig. 4), indicates that the vaccine emulsion has separated. This vaccine **SHALL NOT BE USED**. It is normal to find an upper layer of oil in the vaccine bag before it is shaken and does not indicate a problem (fig. 2 and 3). If you have doubts, please contact PHARMAQ or your veterinarian immediately.

Check vaccine as follows. If the vaccine is received immediately prior to vaccination perform only one check.

1. Check on arrival:

Check 10 % of the bags, but not more than 10 bags. Visually inspect for separation or change of color in the bottom of the bag.

2. Main check 2 - 3 days before start:

As in point 1. Note: The vaccine must be shaken thoroughly right before use until oil is mixed into the emulsion (fig. 1).



Figure 1
Homogenous vaccine



Figure 2
Upper oily layer is normal during storage



Figure 3



Figure 4
Separated vaccine

Number of bags checked:		OK? <input type="checkbox"/> Yes <input type="checkbox"/> No	Date/Sign.
Number of bags checked before use:		OK? <input type="checkbox"/> Yes <input type="checkbox"/> No	Date/Sign.

Comment

If vaccine received is not as ordered, if indicators or loggers show that the vaccine may have frozen, or if the method above indicates vaccine separation do NOT use the vaccine. Contact your prescription veterinarian and site manager immediately. Set the vaccine in quarantine in a refrigerator until the vaccine has been inspected. If the vaccine is declared OK, store refrigerated (2 - 8°C) until it is to be used. Ensure that there is sufficient room for air circulation, and that vaccine bags are not in direct contact with refrigeration panels.

Attachment B

Advice in the event of accidental self-injection with fish vaccine

Preventive safety measures

It is important that personnel carrying out the vaccination of farmed fish follow the recommended safety measures which have been designed in order to prevent or at least minimise the risk of accidental self-injection. These measures include the following:

- Provide personnel with effective training in vaccination technique and first aid as well as an introduction to the procedure which must be followed in the event of accidental self-injection.
- Use a well-fitting needle-guard on the syringe in order to protect the fingers and hand from the needle point.
- Use appropriate gloves to ensure a good grip on the fish.
- Take regular breaks and ensure a comfortable working position and good lighting. Make sure the rate at which vaccination is carried out does not affect quality and safety.
- It is extremely important to ensure that the fish are properly anaesthetised. Most accidental self-injections occur when fish wriggle.
- Notify the local doctor prior to the commencement of vaccination.
- Woman in pregnancy should not administer products containing fish vaccine.
- Make sure that first aid equipment is at hand.
- During machine vaccination operations it is important to comply with the manufacturer's warnings regarding the risks of self-injection. You must never attempt to approach or interfere with the needle path while the machine is in operation.

PHARMAQ's advice in the event of accidental self-injection

To the vaccinator

If you have been accidentally injected with fish vaccine, seek the assistance of a doctor immediately, even if the injected amount is small. Take the printed information from the vaccine package with you to the doctor. If pain persists for more than 12 hours after medical examination, you must consult the doctor again.

Accidental injection of fish vaccine into the human body can lead to severe pain and swelling, especially if the preparation is injected into a joint or a finger. In rare cases, the loss of an affected finger may result if treatment is not commenced immediately.

Self-injection may result in sensitisation to fish vaccine such that any subsequent self injection may produce an allergic reaction leading to anaphylactic shock. This could be life-threatening without rapid and proper treatment.

To the doctor

The introduction of even a small amount of a fish vaccine product into a person can result in pronounced swelling which may result in ischaemic necrosis at the injection site or even the loss of an affected finger.

The site of injection must IMMEDIATELY be examined by a surgically competent person, and if necessary, incision and irrigation of the affected area must be performed, especially when ligaments or soft finger tissue are involved. However this type of intervention should only be undertaken if the risks associated with it outweigh those of inaction.

Repeated self-injection may reinforce the reaction thereby elevating the risk of anaphylactic shock.



Contact information

General practitioner:
Local casualty clinic:
Emergency telephone:

For further information about PHARMAQ's pharmaceutical products, contact:

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E-mail: customer.service@pharma.no

PHARMAQ shall be notified in the event of the unintended self-injection of PHARMAQ's products. Håken Lasse Leira, who is Chief Physician at the Department of Occupational Health at St.Olavs Hospital in Trondheim, Norway, also wishes to be informed.

PHARMAQ

zoetis

Procedure for the vaccinator and doctor in the event of self-vaccination of fish vaccine.

General remarks

Modern fish vaccines contain formalin-inactivated bacterial and/or viral antigens, as well as of adjuvants. The standard dose is 0.05-0.1 ml, or in some cases, 0.2 ml. The injection is made into the abdominal cavity of the fish, either manually or by machine. Almost 450 million vaccinations of fish were carried out in Norway in 2011, approximately half manually and half by machine.

In the event that the entire dose is injected accidentally into the vaccinator's finger, the injury may become serious if the finger is not treated properly. **The injured operator must be taken urgently to hospital for surgical treatment within the space of a few hours.**

In the past it was recommended that vaccinators should have access to adrenalin as a contingency in the event of anaphylactic shock. However, the risk of shock must be extremely small since in over 20 years no incidence has been reported. Today, this contingency is best provided for by the regular health services. **It is recommended that the municipal health services are notified when vaccination operations commence and of the health risks associated with this procedure. A copy of this advisory leaflet can be provided to the local health care centre.**

Personnel assigned to carry out vaccinations must have thorough training prior to starting work. They must be familiar with safety procedures and the measures to be taken in the event of self-vaccination.

It is the responsibility of the Operations Manager, to prepare a contingency plan which includes notification of the local health services prior to the commencement of vaccination operations.

Information for the vaccinator

There is a theoretical risk of anaphylactic shock following self-injection. In such cases the symptoms will become apparent a few minutes after injection. In addition to these local symptoms, the person will feel unwell, and may experience redness of the skin or around the eyes or mouth. At the same time he or she may feel warm, and a bright red rash may develop. This is often followed by heart palpitations, anxiety and pronounced listlessness. Irritation of the stomach and intestinal canal may give rise to stomach pain, nausea and vomiting. In especially serious cases, a person may experience difficulties in breathing, become confused and lose consciousness. Involuntary urinary or fecal incontinence may occur.

If shock is suspected, he or she must be taken to a casualty clinic or hospital as soon as possible. Call the local emergency services immediately and notify them that you have a patient who may be at risk of undergoing anaphylaxis following unintended vaccination. Every minute counts!

Machine vaccination

In the event of self-injection, most if not all of the dose will be injected into a finger. The injury should be examined by a surgeon within a few hours! As well as the reaction associated with the finger (pain, swelling, discoloration), swelling may also develop further up the arm, accompanied by listlessness, nausea and a high temperature. If the finger receives the proper treatment, these symptoms will normally pass in due course.

Antibiotics (penicillin or similar), anti-inflammatory drugs or painkillers are not sufficient! If the finger is not treated by a surgeon in time, the reaction may be so severe as to require amputation.

NB! Never use your fingers to remove fish from the vaccination machine. Use sausage tongs or something similar!

Manual vaccination

If the syringe tip only scrapes the skin, this will result only in local inflammation, and will require no treatment other than painkillers, if required. However, if the vaccinator becomes listless, or experiences nausea or a high temperature, it is likely that a larger proportion of the dose has been injected. In such cases he or she should seek medical advice if the symptoms continue for more than six hours.

If the entire dose has been injected into the finger, the injury must be examined by a surgeon, as described for machine vaccination.

Information for doctors

Modern injected fish vaccines contain formalin-inactivated bacterial and/or viral antigens, as well as a variety of oils used as adjuvants, such as mineral oils. The standard dose is 0.05-0.1 ml. The injection is made into the abdominal cavity of the fish, either manually or by machine. In the event of self-injection, most if not all of the dose will be injected into the vaccinator's finger.

In the event of self-injection with fish vaccine, there is a theoretical risk of anaphylactic shock which, if it occurs, will require immediate treatment according to standard guidelines.

Any suspected cases of anaphylaxis must be fully investigated and reported afterwards.

In cases of self-injection in which some or the entire dose has been injected, it is the concentration of mineral oil which is the critical factor. Oils used as adjuvants in fish vaccines contain powerful tissue toxins and without surgical intervention (incision and irrigation, etc.) may result in necrosis and subsequent amputation. **For this reason it is important that all cases of vaccine self-injection are urgently examined by an experienced surgeon.**

In addition to the local reaction at the site of injection, the vaccinator may also experience local pain and oedema, lymphangitis and lymphadenitis of the arm, accompanied by nausea, vomiting and a high temperature. Antibiotics and anti-inflammatory drugs are insufficient as exclusive treatments in such cases. The finger must be examined by a surgeon! An anti-tetanus injection is not required.

Trondheim, 14 May 2012

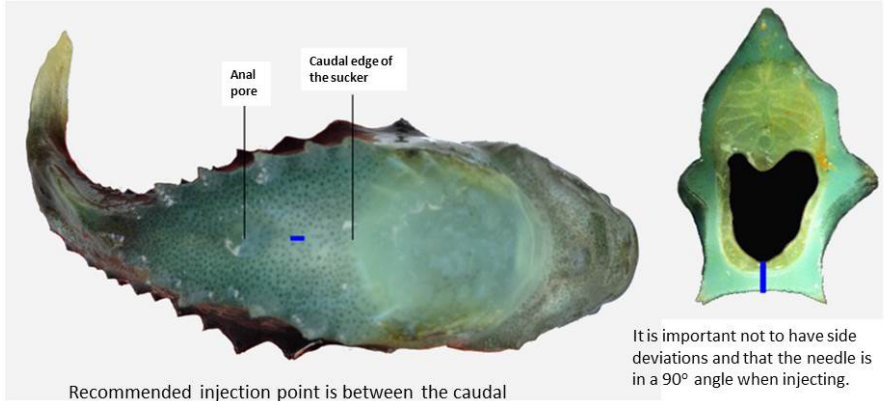
Håken Lasse Leira,
Chief Physician, Department of Occupational Health
St Olavs Hospital
Trondheim, Norway

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Attachment C

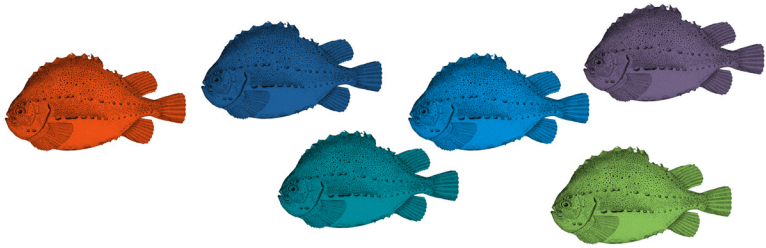
Ideal injection point for lumpfish vaccination



PHARMAQ
we make aquaculture progress

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The vaccination manual and Attachments A, B and C may be downloaded from our website: www.pharmaq.com



**WE MAKE
AQUACULTURE
PROGRESS**