

Palintest

Water Analysis Technologies

Water Quality Testing Guide for Aquaculture Systems



Who is this guide useful for:

Egg Producers

Smolt Producers

Fish Producers

Fish Processor/Harvester

Introduction

The farming of aquatic organisms is a rapidly growing industry. The continued increase in demand for fish and fish products is **driving innovation within aquaculture systems**. The growth in the farming of aquatic organisms has particularly led to an increase in the number of closed aquaculture systems.

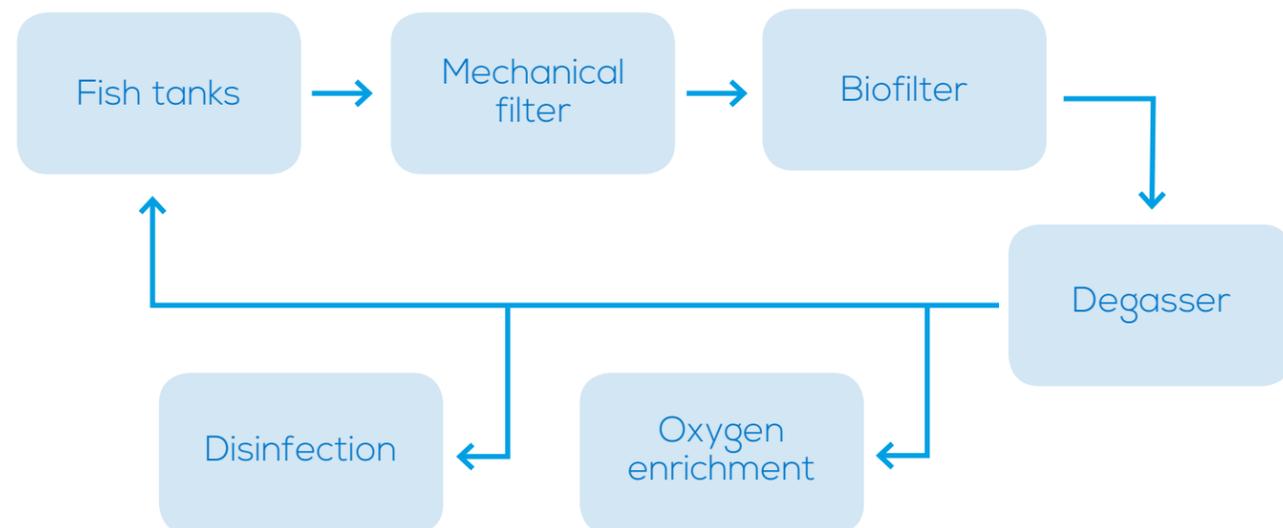
The **yield, quality, size and uniformity of stock are all significantly impacted by water quality parameters**, which must be closely monitored and controlled for the best results. With a constant drive to improve yield, quality, size and uniformity it is imperative to understand **how to get the best out of your closed aquaculture system**.

At Palintest, **we understand the requirements of closed aquaculture systems** and the impact of water quality on **stock health** and **crop yield**. There are a number of key parameters that must be monitored, understood and controlled within the system.

Fish farming puts pressure on water quality parameters, particularly:

- Gasses: dissolved oxygen, carbon dioxide and total gas pressure
- Alkalinity and pH
- Nitrogen cycle
- Turbidity and suspended solids
- Other water quality indicators

RAS - Recirculating Aquaculture System



Dissolved Oxygen (DO)

Arguably the most important water quality parameter for aquaculture is dissolved oxygen (DO). DO is critical to the survival of fish crop and can take affect quickly if levels are not properly controlled.

Usually the concentration of dissolved oxygen in water is related to the amount of oxygen in the air above. Due to the density of fish and their waste products in aquaculture systems, dissolved oxygen is consumed faster than it can be naturally replenished. To account for this, oxygen is pumped into the water to help maintain the optimum level.

Micro 600 Dissolved Oxygen

- ✓ Galvanic DO and temperature measurement
- ✓ Enhanced accuracy with automatic temperature compensation
- ✓ Splash-proof



Micro 800 Dissolved Oxygen

- ✓ Most sophisticated DO meter measuring DO, temperature, salinity and conductivity
- ✓ Advanced optical DO probe, making it ideal for static water measurements
- ✓ Integrated data storage with GPS functionality
- ✓ Simple maintenance with long term calibration stability
- ✓ IP67 waterproof



Alkalinity, Hardness and pH

Even young fish can temporarily survive at extremes of pH 5 and pH 9. However, even small changes in pH can affect other elements of water quality that can rapidly affect fish health.

The pH, in combination with carbonate hardness, effects the amount of CO₂ that is dissolved into the water from the air above. Acidic water absorbs CO₂ from the atmosphere, whereas basic water can convert relatively harmless ammonium into toxic ammonia. Therefore tight pH control is critical. This in turn means the buffering capacity of the water, or alkalinity, is also critical.

In addition to being a measure of carbonate hardness, alkalinity is an important measure of the buffering capacity or acid capacity of the water. This reflects how well the water can withstand changes to pH with the addition of acidic or basic compounds.

Micro 600 pH meter

- ✓ pH, temperature and optional ORP measurement
- ✓ Enhanced accuracy with automatic temperature compensation
- ✓ Multi-point calibration (up to 3 points) with automatic buffer recognition
- ✓ Splash-proof



Micro 800 pH meter

- ✓ Most advanced pH meter, featuring a double junction electrode which increases the life of the electrode by resisting contamination
- ✓ Facilitates good laboratory practice with calibration reminder and pH slope indicators
- ✓ Store 500 data sets and export via USB
- ✓ Automatic buffer recognition for rapid calibration
- ✓ IP67 waterproof



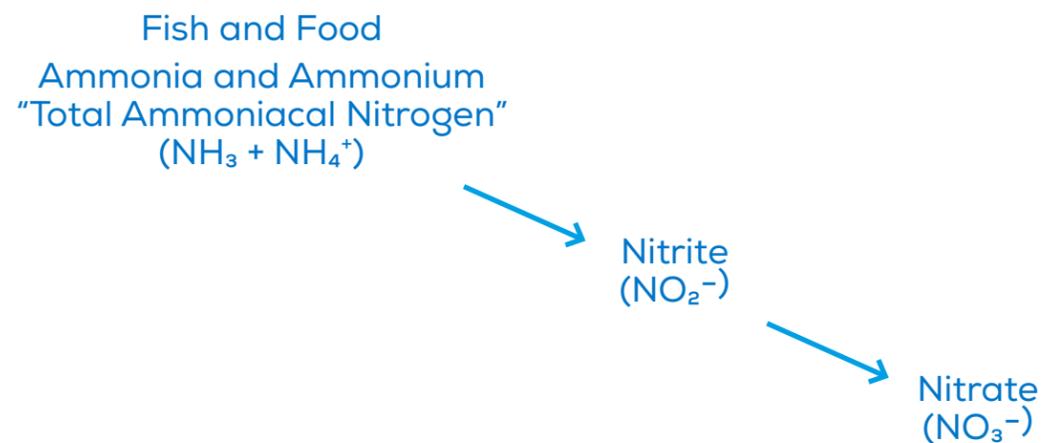
7500 Photometer

- ✓ Includes more than 100 test methods including Alkalinity and Hardness
- ✓ Bluetooth and USB data transfer for seamless data management
- ✓ Compatible with the Palintest Aqua Pal App, making analysis of results simple and easy whilst in the field.
- ✓ IP67 waterproof



Nitrogen Cycle

In aquaculture, the majority of nitrogen comes from ammonia, excreted as a waste product by fish and from the break down of uneaten feed or morts. Ammonia is toxic to fish and even at low levels can cause long term damage if it is not treated. Colourless and odourless; ammonia can only be detected by testing the water. The nitrogen cycle plays an important role in aquaculture systems through the conversion of ammonia to nitrate which is much less harmful. Nitrite, an intermediate in the cycle, is poisonous to fish at all pH levels. Ammonia, Ammonium, Nitrate and Nitrite all need to be closely monitored.



The ratio of ammonia (NH₃) to ammonium (NH₄⁺) depends upon pH and temperature.

Even if the pH is kept low, a build up of ammonium can still become toxic. High ammonium levels also mean that if there is a pH swing, the risk of fish death is high.

Unlike ammonia and nitrite, fish are able to tolerate much higher concentrations of nitrate (up to 50 mg/L NO₃⁻).

pH	Ratio NH ₃ :NH ₄ ⁺
11.25	100:1
10.25	10:1
9.25	1:1
8.25	1:10
7.25	1:100

7500 Photometer

- ✓ Includes more than 100 test methods including total ammoniacal nitrogen, nitrate and nitrite.
- ✓ Bluetooth and USB data transfer for seamless data management
- ✓ Compatible with the Palintest Aqua Pal App, making analysis of results simple and easy whilst in the field.
- ✓ IP67 waterproof



Turbidity

Turbidity is a measure of the cloudiness of the water, caused by suspended solids that scatter light. Solids are usually removed by mechanical filtration, often in conjunction with flocculants to help 'polish' the water. Whilst this is often sufficient, increasing turbidity can be an indicator of many water quality issues.

If filtration isn't efficient, a build up of waste solids can:

- Create algae blooms
- Provide surface area for pollutants and oxygen consuming bacteria
- Provide surface area for disease causing organisms
- Reduce efficiency of UV disinfection on returning water
- Stress or reduce flow through biofilters

Early detection of increasing turbidity can help to stop a minor issue evolving, ultimately preventing fish mortality.

Turbimeter Plus

- ✓ Quick and simple method for measuring turbidity
- ✓ Utilises Quadoptix technology with four measurement points for increased accuracy
- ✓ Easy transfer of data to PC via USB
- ✓ Detects increases in turbidity at a very low level, which is not visible to the human eye
- ✓ IP67 waterproof



Sulphate, Phosphate and Metals

Sulphates, phosphates and metals can each disrupt the aquaculture process and need to be monitored on a regular basis.

Sulphates are present in some borehole waters and can be converted into deadly hydrogen sulphide if filters become blocked and turn anoxic.

Phosphates can be present in incoming water and act as a food source for algae.

Metals such as copper, iron, manganese or aluminium can either directly attack fish health, attack the bacteria in the biofilters or cause staining.

7500 Photometer

- ✓ Includes more than 100 test methods including sulphate, phosphate and metals
- ✓ Bluetooth and USB data transfer for seamless data management
- ✓ Compatible with the Palintest Aqua Pal App, making analysis of results simple and easy whilst in the field.
- ✓ IP67 waterproof



Aquaculture Testing Solutions

With such a high value stock, and intensive farming methods reducing margins for error, there is a clear need for easy testing and a solution based approach in aquaculture systems. That is why Palintest products are particularly suited to the Aquaculture industry.

Parameter	Product	Reagent	Frequency and Control Point
Dissolved Oxygen	Micro 600 DO PT1240	No reagent needed	Daily, upon start up Source water and in-tank
	Micro 800 DO PT1303		
pH	Micro 600 pH PT1200	No reagent needed	Daily, upon start up Source water and in-tank
	Micro 800 pH PT1330		
Turbidity	Turbimeter Plus PTH092		
Alkalinity	Photometer 7500 Benchtop kit PTBR7500	Alkaphot AP250 (250 tests)	Daily, upon start up In-tank
Ammonia		Ammonia API52 (250 tests)	
Nitrite		Nitricol API09 (250 tests)	Daily or Weekly In-tank
Nitrate	Nitratetest API63 (200 tests)		
Phosphate	Standard kit PTBH7500	Phosphate LR API77 (200 tests)	Weekly or Monthly Source water
Sulphate		Sulphate API54 (250 tests)	
Metals	Engineers kit PTBW7500	Copper API86 (250 tests)	During and after cleaning In tank and effluent
Chlorine		Chlorine HR API62 (250 tests)	
		Chlorine DPD AP011 (250 tests)	
Chlorine Disinfection	Kemio Disinfection Benchtop Kit KEMR10DIS	Chlorine Sensors KEM25CLO (500 tests)	
		Chlorine Dioxide Sensors KEM25CDX (500 tests)	
Chlorine Dioxide	Soft Case Kit KEMS10DIS	Chlorine Dioxide Sensors KEM25CDX (500 tests)	

Disinfection and cleaning

Fish tanks and pipework are often cleaned with chemical disinfectants including chlorine and chlorine dioxide. To effectively validate these systems, there is a need to measure levels of disinfection at both high and ultra low levels. Monitoring these levels verifies the method and can ultimately lead to cost savings.

Kemio Disinfection

Expert testing for critical disinfection parameters

✓ **No training required**

Suitable for all users, with clear visual instructions for performing a test

✓ **Reduce uncertainty**

Act on clear pass/fail results based on your specification

✓ **Suitable for all sample types**

Not affected by coloured or turbid samples

✓ **Fully traceable results**

Go paperless and manage up to 10,000 data sets

✓ **Personalised to your testing needs**

Add your own test limits and information to drive corrective action and give meaning to your results



Testing for

	Range	Temperature
Chlorine	Standard range 0.02 - 10 mg/L free chlorine 0.02 - 75 mg/L total chlorine	2°C - 35°C 2°C - 35°C
	High range 0.1 - 25 mg/L free chlorine 1 - 500 mg/L total chlorine	5°C - 25°C 5°C - 30°C
Chlorine Dioxide	0.02 - 50 mg/L	5°C - 40°C
Peracetic Acid (PAA)	5 - 2000 mg/L	5°C - 30°C

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