

Dissolved oxygen consumption report
Petuna Aquaculture
Date: 11 March 2024 (version 1.1)

Dissolved Oxygen Consumption Report

Petuna Aquaculture

Date: 11th March 2024

CONFIDENTIAL



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Date	Purpose of Issue/Nature of Revision	Revision No.	Authorised by
31/1/2024	Final report	1.0	Depha Miedecke
11/3/2024	Revised report	1.1	

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Background

The following conditions (DO1) were placed as an amendment and addition to the environmental licenses: 9888/3, 9890/3, 9891/3 and 9892/3.

1. By 31 January 2024, or a date otherwise advised by the Director in writing, the licence holder must submit a Dissolved Oxygen Consumption Report for the Director's approval which has been prepared using the methodology provided by the Director.
2. The Dissolved Oxygen Consumption Report must contain the following information:
 - 2.1 The estimated total dissolved oxygen demand resulting from the activity, including a specific estimate of the respiratory oxygen demand of farmed finfish.
 - 2.2 Calculations must be provided for the following periods:
 - 2.2.1 the 12-month period from 1 December 2022 to 30 November 2023 and separately for each season within this period, based on actual feed input and dissolved nitrogen outputs;
 - 2.2.2 the 12-month period from 1 December 2023 to 30 November 2024 and separately for each season within this period, based on predicted feed and dissolved nitrogen
3. The Dissolved Oxygen Consumption Report must include a description of the scientific methods and assumptions underlying the calculations, and the degree of confidence in their accuracy.
4. By 1 January 2025, or a date otherwise advised by the Director in writing, the licence holder must submit a report containing revised dissolved oxygen consumption calculations for the 12-month period from 1 December 2023 to 30 November 2024, based on actual feed and dissolved nitrogen outputs.

This report details the requirements for Petuna Aquaculture.

Method

The methods used conform with the letter issued on the 12 January 2024 as detailed below.

Principles of calculation

The total dissolved oxygen demand is to be determined for a 12-month period, and seasonal periods within it as specified in the licence condition, on the basis of feed input / biomass grown during the corresponding periods.

Calculations are to be based on a mass balance approach regarding the fate of carbon (C) and nitrogen (N). According to research by Wang et al. (2012), up to 70% of the total C and 62 % of the total N contained in feed are released to the receiving environment.

Calculations must consist of, and clearly identify, the following elements:

1. The carbon components contributing to DO demand: a. Respiratory demand based on the Respiratory Quotient (RC);
b. Demand associated with the release of dissolved organic carbon (DOC) to the environment;

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c. Demand associated with the release of particulate organic carbon (POC) to the environment.

2. The nitrogen components contributing to DO demand:

a. Demand associated with the release of Dissolved Inorganic Nitrogen (DIN), (such as Total Ammonia Nitrogen and urea), from finfish pens to the environment;

b. Demand associated with the release of dissolved organic nitrogen (DON) to the environment;

c. Demand associated with the release of particulate organic nitrogen (PON) to the environment.

3. The overall dissolved oxygen consumption: Amounts of N and C released to the receiving environment over a time period of approximately 12 months, and the resulting carbon and nitrogen components, are to be considered.

The following assumptions were used for calculations:

Carbon calculation:

Respired (%)	0.48
DOC (%)	0.03
POC (%)	0.19
Fish Gain	0.3
Respiratory Quotient (RC)	1

Nitrogen calculation:

DIN (%)	0.45
DON (%)	0.02
POC (%)	0.15
Fish Gain	0.38

Results and discussion

The following results were calculated using Wang et al 2012. However, Petuna would like to suggest to EPA, that Wang et al 2013 would be newer information/calculations that should be incorporated in the reporting framework and methodology.

Resources

There are several differences between the 2012 and 2013 papers that have been referenced in the methods. Petuna's suggestion is to use the 2013 assumptions as they are more up to

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date. The following details the differences:

Nitrogen	Wang Et al 2012	Wang Et al 2013
DIN (%)		
Dissolved inorganic nitrogen	0.45	0.39
DON (%)		
Dissolved organic nitrogen	0.0225	0.03
PON (%)		
Particulate organic nitrogen	0.153	0.15
Fish Gain	0.38	0.43

Carbon	Wang Et al 2012	Wang Et al 2013
Respired (%)	0.48	0.4
DOC (%)		
Dissolved organic carbon	0.03	0.03
POC (%)		
Particulate organic carbon	0.19	0.19
Fish Gain	0.3	0.38

Carbon: 8% of Feed Carbon moved into Biomass from Respiration.

Nitrogen: 6% moved from DIN (5% into Biomass, 1% split between DON/POC).

This changes totals by 5.92% reduction in Oxygen environmental demand.

We would like Wang et al 2013 to be considered also based on the fact that:

- Feed formulations are primarily designed in Norway
- Any novel ingredients are tested in Norway
- Generally, high energy feeds were developed in Norway prior to companies using them in Australia

1 December 2022 o 30 November 2023

The following graphs are generated using actual feed data from Petuna Aquaculture.

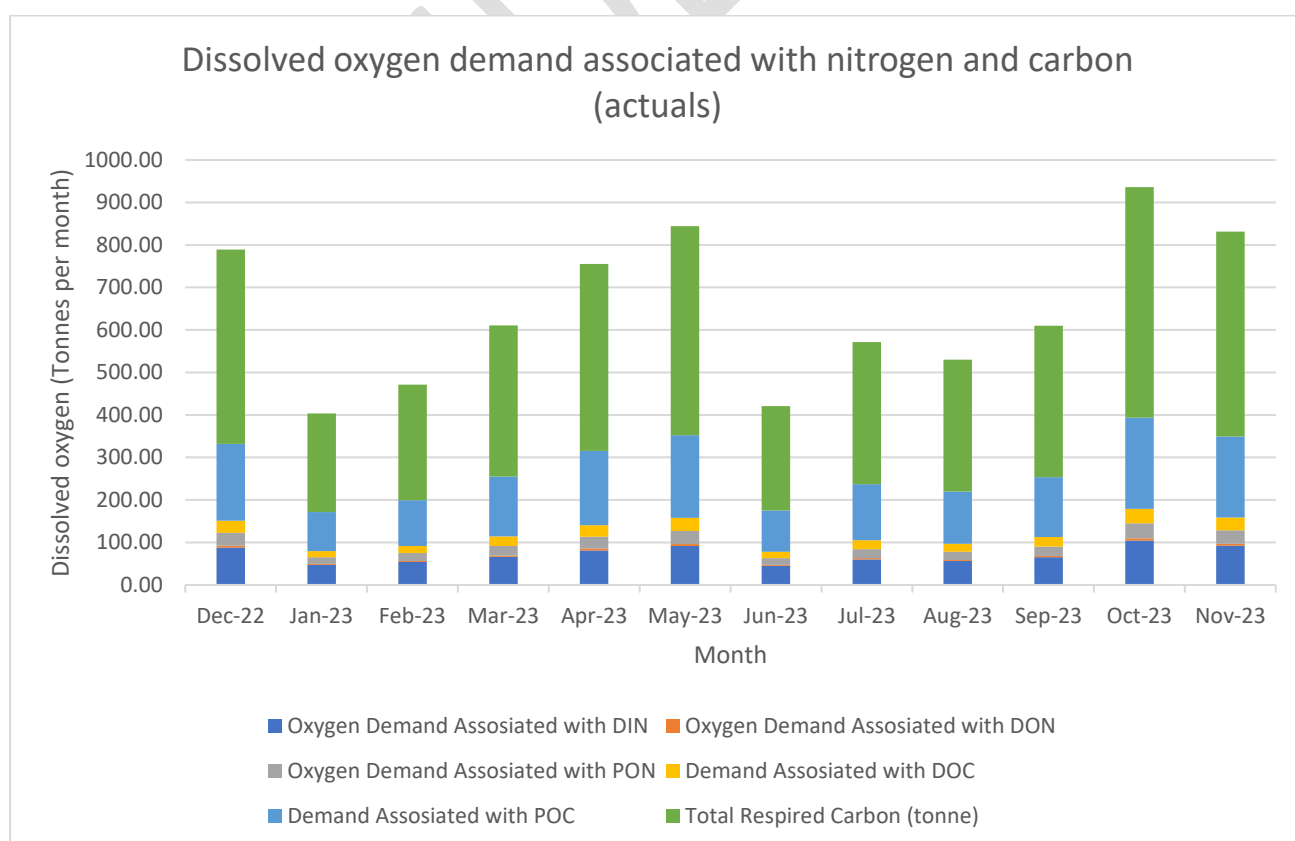
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Table 1: Nitrogen and carbon dissolved oxygen demand calculated results using actual feed data (1 December 2022 to 30 November 2023) in tonnes per month

	Oxygen Demand from DIN	Oxygen Demand from DON	Oxygen Demand from PON	Oxygen demand from DOC	Oxygen demand from POC	Total Respired from Carbon
Dec-22	88.06	4.40	29.94	28.57	180.97	457.18
Jan-23	46.88	2.34	15.94	14.52	91.93	232.25
Feb-23	53.86	2.69	18.31	17.00	107.69	272.06
Mar-23	66.05	3.30	22.46	22.25	140.90	355.95
Apr-23	81.45	4.07	27.69	27.52	174.31	440.37
May-23	91.59	4.58	31.14	30.72	194.57	491.55
Jun-23	45.20	2.26	15.37	15.33	97.10	245.32
Jul-23	60.39	3.02	20.53	20.91	132.42	334.53
Aug-23	55.95	2.80	19.02	19.38	122.76	310.12
Sep-23	65.12	3.26	22.14	22.28	141.09	356.44
Oct-23	104.46	5.22	35.52	33.88	214.59	542.11
Nov-23	92.55	4.63	31.47	30.13	190.80	482.01





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Conclusion

Petuna Aquaculture have calculated the oxygen demand using the scientific evidence available. It is recommended that Wang 2013 is used for any subsequent reporting as this is newer information/evidence.