

Name	Minimum O2 on bottom waters
DPSIR class	Impact
ECASA sub-group	Water quality
ECASA code	MINO2BOT
Proposed by participant	16 – University of Goteburg, Sweden
Definition, computation,	<p>The minimum oxygen concentration that could occur in the bottom water might change due to changes in the vertical flux of organic matter from the surface water and/or fish farms. The new minimum level (at the end of a stagnation period) is computed by FJORDENV when the program is given the changes in the supply of organic matter. FJORDENV uses the following formulae:</p> $O_{2\min} = O_{2in} \left(1 - \frac{T_e}{T_0} \right)$ <p>Where O_{2in} is the oxygen concentration of new basin water, T_e is the length of a stagnation period (dependent on the physics and bathymetry of the area) and T_0 is the timescale for complete oxygen depletion in the deepwater:</p> $T_0 = \frac{O_{2in}}{\frac{\mu F_c}{H_b}}$ <p>Here F_c is the flux of particular organic carbon into a fjord basin (gC/month/m²), which depends on the water exchange, bathymetry and possible contributions from fish farming over deep bottom areas, H_b is the mean depth of the sill basin and μ is the amount of oxygen needed to oxidise organic matter measured as carbon (~3.5 gO₂/gC).</p>
Data required	<p>O_{2in} – the oxygen concentration of new basin water</p> <p>The change of the supply of organic matter and nutrients to the surface layer</p> <p>Hypsography of basin</p> <p>Water exchange of basin (~ stratification, sea level, wind speed, river run off and tidal components inside/outside the basin).</p>
Summary, scientific meaning, implementation	<p>Eutrophication effects in an inshore area could result in increased oxygen consumption in the basin water. This could be caused by increase of organic matter from farms. Low oxygen levels often results in basins with long residence times, and the lowest concentration of oxygen will occur at the end of a stagnation period. The level at that time will therefore also strongly rely on the rate of water exchange and hypsography of the area (e.g. Aure and Stigebrandt, 1989, Aure and Stigebrandt, 1990, Stigebrandt, 2001). Climatic variations of the water exchange may be important (Erlandsson et al., 2005).</p>

ECASA indicator

Range of validity

Standards by Swedish Environmental Protection agency:

Class	Status	Minimum O ₂	Description
I	High levels	> 6.0	No effects
II	Moderately high levels	4.0 - 6.0	No likely effects
III	Low levels	2.0 - 4.0	Animals are effected: many species tries to leave the area
IV	Very low levels	0 - 2.0	Longer periods of Class IV levels results in death for most species that are unable to escape the area.
V	Hydrogen sulphide	< 0	Class V levels results in extinction of animals and plants in the area

Species concerned (fishes/molluscs)

All

Related type of aquaculture

Minimum oxygen level is a valid indicator in the basin water of any type of inshore aquaculture

Relevant environments for this indicator

Minimum oxygen level as an indicator of aquaculture impact on environments can be applied to any type of semi-enclosed sea, like a fjord, bay or lagoon.

Geographic scale

Local to regional

Direct relevance to objectives

A

Clarity in design.

A

Realistic collection or development costs

A

High quality and reliability

A

Appropriate spatial and temporal scale

A

Obvious significance

A

advantages

disadvantages

references
State of validation
Recommendations
Why using this
indicator
How to use it
(sampling...)