

<b>Name</b>	<b>Secchi depth</b>
<b>DPSIR class</b>	Impact
<b>ECASA sub-group</b>	Water quality
<b>ECASA code</b>	SECCHI
<b>Proposed by participant</b>	16 – University of Gothenburg, Sweden
<b>Definition, computation,</b>	<p>The change in Secchi Depth could be measured or be obtained as an output from FJORDENV by giving the program information about changes in supplies of nutrients. FJORDENV uses the following computation:</p> <p>Changes in Secchi Depth, relative the known state (subscript <math>I_n</math> denotes the initial state), due to changes in concentration of particular organic phosphorus is given by</p> $\text{Secchi Depth Change} = \frac{D_s}{D_{I_n}} = \frac{C_s / D_{I_n}}{C_s / D_{I_n} + 0.4 \cdot c_{Pf}}$ <p><math>C_s</math> is an empirical coefficient depending on properties of the pelagic ecosystem (Hoejerslev, 1986, Aure and Stigebrandt, 1989). The attenuation coefficient due to absorption due to phytoplankton is proportional to the available amount of nutrients in the water and the constant of proportionality is set to a typical value of <math>0.4 \text{ m}^2 \text{ mmol}^{-1}</math>. The parameter <math>c_{Pf}</math> denotes the change in concentration of phosphorus to the surface layer (The formulation above assumes phosphorus to be the nutrient limiting phytoplankton growth).</p> <p><math>D_{I_n}</math>: the initial (standard) Secchi Depth Value  <math>D_s</math>, the current Secchi Depth  or</p> $c_{Pf} = \frac{P_f}{Q_s}, \text{ the change in concentration of phosphorus (mmol P/m}^3\text{),}$ <p>where <math>P_f</math> is the rate of change of phosphorus supply from local sources (mmol P/s) and <math>Q_s</math> is the water exchange in the surface layer (computed from FJORDENV). The proportionality constant of <math>0.4 \text{ m}^2/\text{mmol}</math> could need to be evaluated should the plankton population differ substantially from the one found in Nordic waters.</p> <p>Hypsography of basin  Water exchange of basin (~ stratification, sea level, wind speed, river run off and tidal components inside/outside the basin).</p>
<b>Data required</b>	
<b>Summary, scientific meaning, implementation</b>	<p>Strong relation to the depth of the euphotic zone where the photosynthesis takes place. In coastal, Nordic waters the production layer is about 3 times greater than the Secchi Depth (Stigebrandt, 2001). There is a direct relation between eutrophication and Secchi Depth as an increase in organic matter in the area gives a decrease of water clarity. Nutrient supply from a fish farm is dependent on number and weight of fish, temperature and food composition (Stigebrandt 1999)</p>

<p><b>Range of validity</b></p>	<p>The sensitivity of the local environment to changes in nutrient supply depends in turn on the flushing rate of the surface layer (Stigebrandt, 2001).          Measurements of the Secchi depth are cheap, easy and the method is very robust. The empirical constants of the computational formula are few and stable (Sandén and Håkansson, 1996, Aarup, 2002, Erlandsson and Stigebrandt, 2005).          Secchi depth measurements are available for a large number of fjords in Norway. Data is probably also available for many other European sites (like Ria de Formosa, Portugal). Remote sensing data can be used to asses Secchi depth at a location.          Standards by the National Environmental Protection Agency:</p> <table border="1" data-bbox="604 655 1427 947"> <thead> <tr> <th>Class</th> <th>Impact</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>No/Insignificant change</td> <td>&gt;1.0</td> </tr> <tr> <td>II</td> <td>Small change</td> <td>0.77-1.0</td> </tr> <tr> <td>III</td> <td>Apparent change</td> <td>0.53-0.77</td> </tr> <tr> <td>IV</td> <td>Significant change</td> <td>0.30-0.53</td> </tr> <tr> <td>V</td> <td>High change</td> <td>&lt;0.30</td> </tr> </tbody> </table>	Class	Impact	Value	I	No/Insignificant change	>1.0	II	Small change	0.77-1.0	III	Apparent change	0.53-0.77	IV	Significant change	0.30-0.53	V	High change	<0.30
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<p><b>Species concerned (fishes/molluscs)</b></p>	<p>All</p>																		
<p><b>Related type of aquaculture</b></p>	<p>Secchi depth is a valid indicator in the surroundings of any type of aquaculture.</p>																		
<p><b>Relevant environments for this indicator</b></p>	<p>Secchi depth as an indicator of aquaculture impact on environments can be applied farms in any type of semi-enclosed sea, like a fjord, bay or lagoon.</p>																		
<p><b>Geographic scale</b></p>	<p>Local and regional</p>																		
<p><b>Direct relevance to objectives</b></p>	<p>A</p>																		
<p><b>Clarity in design.</b></p>	<p>A</p>																		
<p><b>Realistic collection or development costs</b></p>	<p>A</p>																		
<p><b>High quality and reliability</b></p>	<p>B</p>																		
<p><b>Appropriate spatial and temporal scale</b></p>	<p>A</p>																		
<p><b>Obvious significance advantages</b></p>	<p>A</p>																		
<p><b>disadvantages</b></p>	<p>Secchi depth measurements are available for a large number of fjords in Norway. Data is probably also available for many other European sites (like Ria de Formosa, Portugal). Remote sensing data can be used to asses Secchi depth at a location.</p>																		
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<p><b>State of validation</b></p>																			
<p><b>Recommendations</b></p>																			