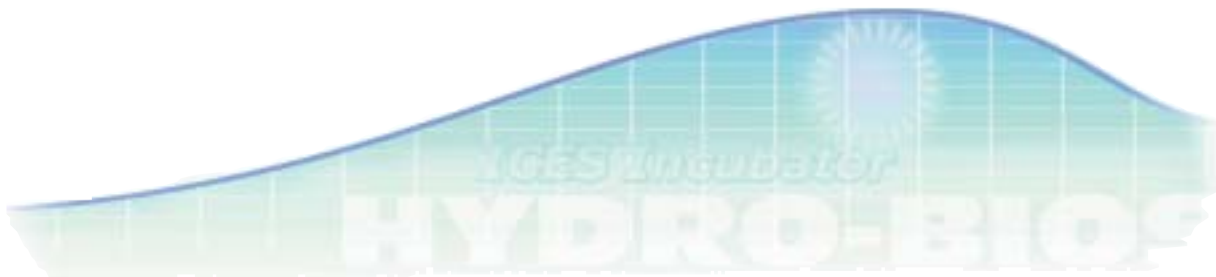
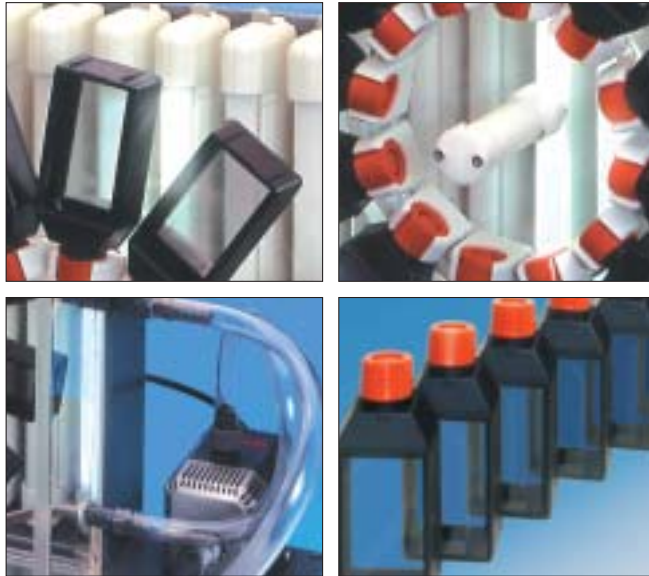


# ICES Incubator

ICES Standard for Phytoplankton  
Primary Production Measurements



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## The Device

The **ICES Incubator** consists of an illuminated transparent plexiglass tank incorporating a turning wheel on which 12 experimental bottles can be clamped.

The tank is filled with water which is set in motion by an adjustable circulating pump. Thus the turning wheel is set in rotation at speeds up to 10 rpm with the experimental bottles acting as paddles. Tank connections for a second water circulation allow for temperature adjustments of the water by using external tempering equipment.

The 12 experimental bottles of 50 ml capacity each have different optical coatings, so that each bottle has individual transmission rates and thus generating a number of 12 different irradiance (or light intensity) levels.

The illumination unit is equipped with 10 fluorescent tubes with a wave spectrum according to ICES specifications, each one of which can be switched individually.

For higher irradiance levels a second illumination unit can be mounted onto the ground plate of the ICES Incubator.



## The Method

One of the most important marine processes is the formation of organic material resulting from the interaction of carbon dioxide, water and sunlight, a process known as photosynthesis. The ability to measure this process is of great importance when accessing marine pelagic systems. In practice the most sensitive method for measurements of photosynthesis is to measure the absorption of carbon dioxide. The high sensitivity of carbon dioxide absorption measurements allows the use of this method under all circumstances, at low and very high algal concentrations and under low light and temperature conditions.

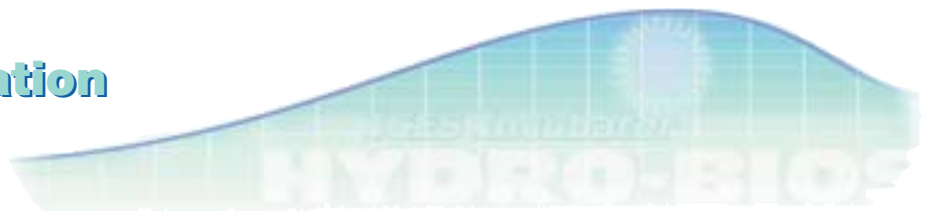
The method itself is called the  $^{14}\text{C}$  method because it is based on the absorption of the radio-active  $^{14}\text{C}$  isotope of carbon (Steemann-Nielsen, 1952). The method's principle is to add a known amount of radio-active tracer to a water sample and to stop the absorption process after a fixed period (called the incubation time) by filtering the water sample over an appropriate filter. The  $^{14}\text{C}$  isotope incorporated into the algal biomass is subsequently counted in a liquid scintillation counter and the total activity measured. When the  $^{12}\text{C}$  amount of carbon is known (or measured) the carbon absorption can be calculated on the basis of added  $^{14}\text{C}$  and the original  $^{12}\text{C}$  amount in the sample, on the basis of proportionality in the absorption process.

The objective of the ICES Incubator method is to measure the carbon absorption under conditions of different irradiances (or light intensities) during an incubation period of 2 to 4 hours. The relation between the photosynthetic rate and the irradiance is called a P-I curve. Based on this relationship, data on underwater irradiance conditions and daily solar irradiance the primary production per square meter can be calculated. Regular measurement extrapolations extending to annual primary production can be made, giving information about the trophic status of the water body being studied.

The incubator shown here has been mainly developed for monitoring purposes. It should be used preferentially for water samples taken from a mixed water layer which has a fixed temperature. For calculations of productivity per square meter additional data on vertical water attenuation are needed as well as daily irradiance values. Additional measurements of the amount of phytoplankton (based on chlorophyll-a concentration measurements) should be carried out for interpretation purposes.



# Ordering Information



<b>450 000</b>	<b>ICES INCUBATOR consisting of:</b>	
1	Ground plate with fixing screws for plexiglass tank and illumination unit	Dimensions: 510 x 325 x 20 mm
1	Centrifugal pump (power supply 220 - 240 V AC, 50 / 60 Hz required)	Hauling capacity: 10 l/min.
2	PVC tubings	415 mm long
1	Illumination Unit with 10 individually switchable fluorescent tubes (power supply 220 - 240 V AC, 50 / 60 Hz required)	Dimensions: 350 x 335 x 150 mm
1	Plexiglass tank with diaphragm valve and hose nozzles	Dimensions: 350 x 400 x 100 mm
1	Turning wheel for 12 experimental bottles	Dimensions: 180 mm dia.
<b>450 010</b>	<b>Set of 12 Experimental Bottles, 50 ml capacity</b>	
	with optical coating, transmission rates: 0 - 100 %	
<b>450 020</b>	<b>Set of 10 Spare Fluorescent Tubes</b>	
<b>450 030</b>	<b>Additional Illumination Unit with 10 individually switchable fluorescent tubes</b>	
	(power supply 220 - 240 V AC, 50 / 60 Hz required)	Dimensions: 350 x 335 x 150 mm