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Mussel production in relation to ecohydraulic conditions in the culture area of NW Thessaloniki Gulf (NW Aegean, Greece)

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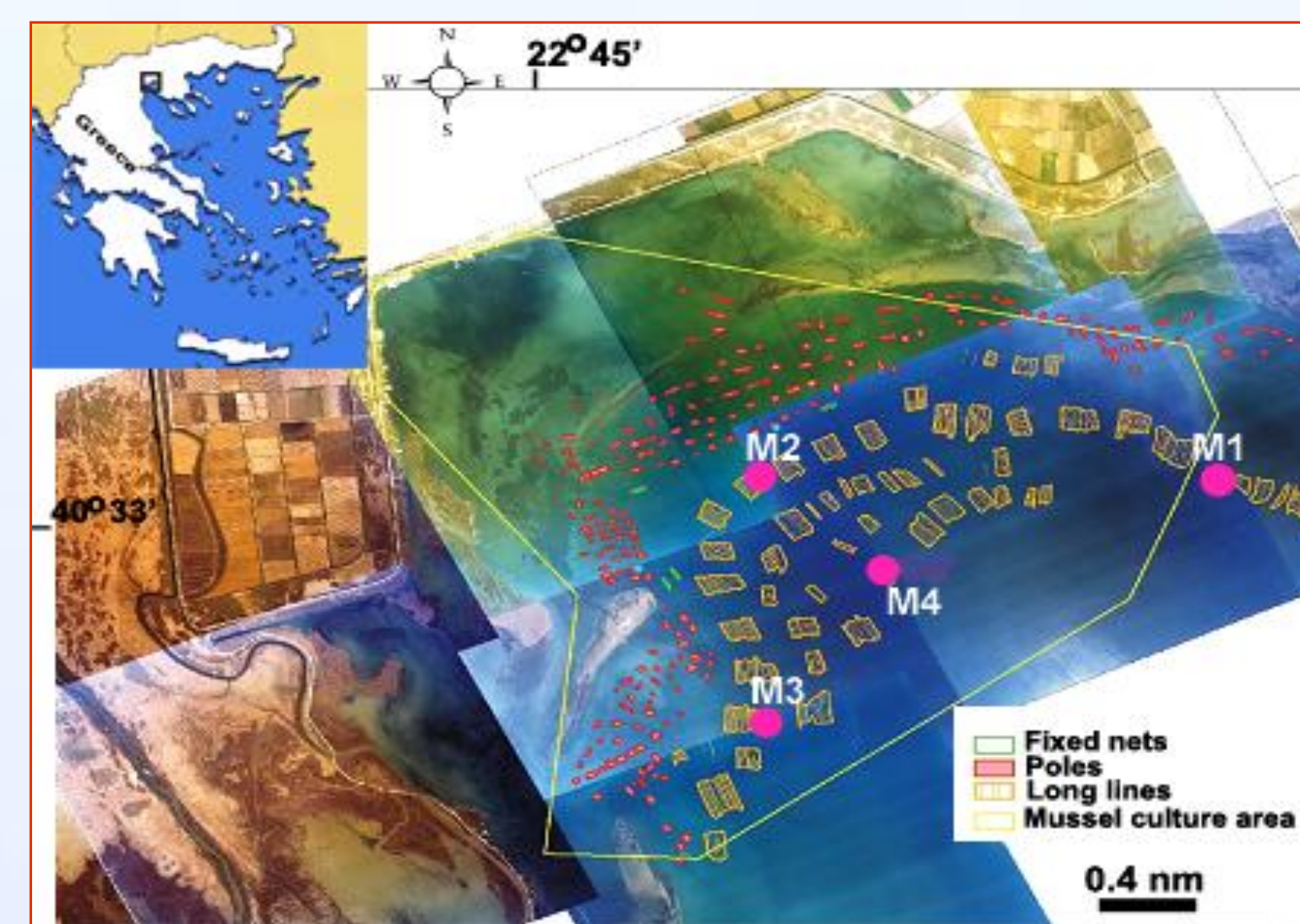
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Introduction

Mussel culture with longlines system takes place since 1990 with an average production of 10.000 t/year, in NW Thessaloniki Gulf (NW Aegean Sea). This harvest represents the 30 % of the greek annual production. The quality of the mussels is strongly affected by environmental parameters, food availability and culture practices. This study focuses on the mussel production in the NW Thessaloniki Gulf using hydrodynamic data, in relation to food availability, in terms of Chlorophyll-a (Chl-a) records, during the period of January 2006-March 2007.

Fig. 1. Study area. The modified aerophotograph is from NCMR (2001).



Materials and Methods

For the purpose of this study, three stations (M1, M2, M3) with longline mussel units and one reference station (M4) with no mussels were frequently monitored (Fig.1). The quality of the mussels was expressed as condition index, wet weight (Davenport & Chen, 1987) (commercial weights) while the distance between socks were measured. Hydrodynamic results were based on field measurements in combination with a mathematical model as described by Savvidis *et al.* (2007). Food availability in terms of chl-a was measured using standard methods. As culture operation, the distance between the socks was measured in the three stations M1, M2, M3. The qualitative evaluation of mussel cultures handling, their environment and the mussel production was based on socks distance, area hydrodynamics, Chl-a, mussel wet weights and condition index %.

Results and Discussion

The model results were in good agreement with the field data showing, under the influence of northwestern winds (prevailing wind over the study area), sufficient current velocities (10 cm/sec) with parallel direction to the coastal line, significantly reduced velocities among the mussel units (<5 cm/sec) and similar velocities cyclonic/anticyclonic offshore, where the reference station is cited (Fig. 1 & 2). The reduction of the current velocities between the positions outside and inside the units was more than 30% (Fig. 2).

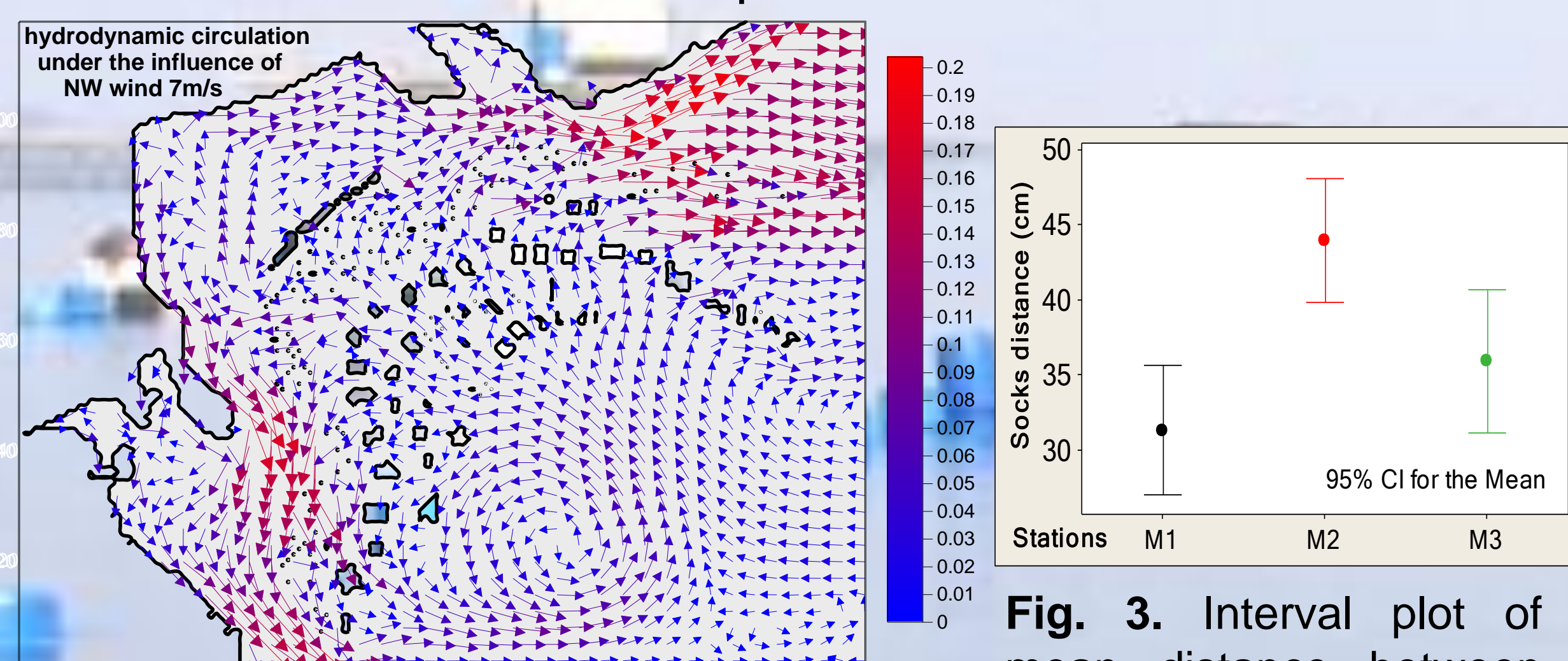


Fig. 2. Hydrodynamic conditions in the study area with prevailing NW winds (Savvidis *et al.* 2007).

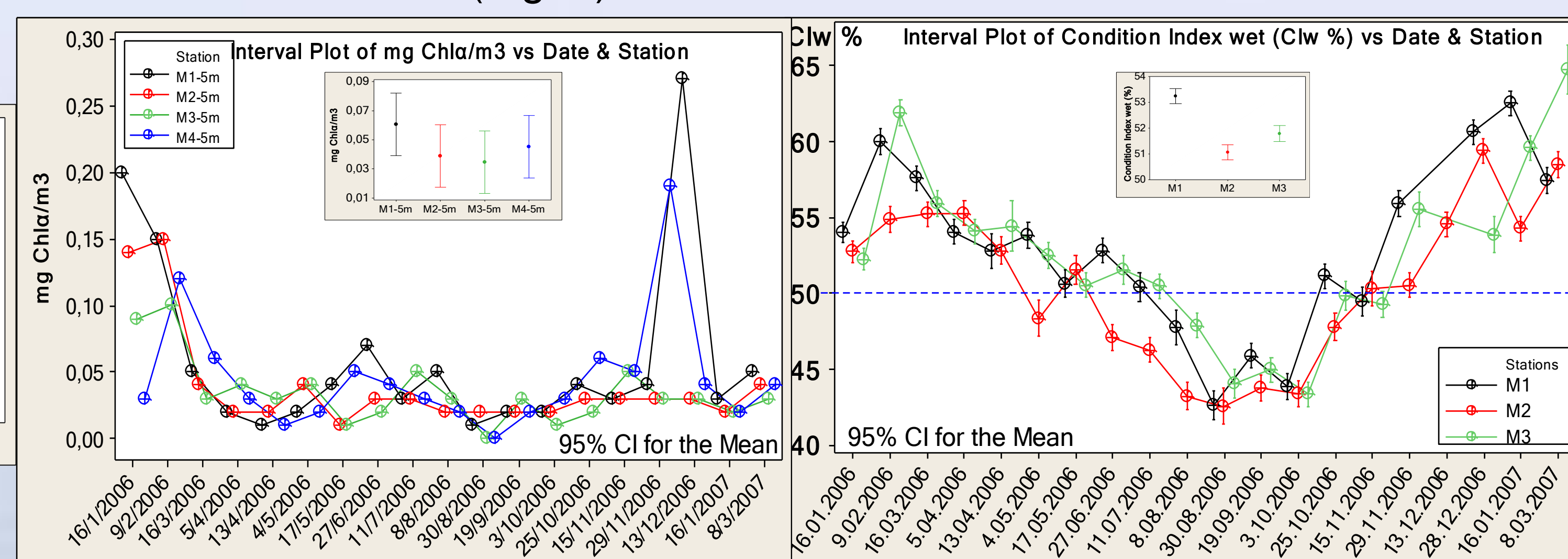


Fig. 4. Spatio-temporal fluctuation of Chl-a (left) and mussels condition index (CI%) for wet weights (right). Mean values and 95% confidence intervals. In enthetic figures, the mean values of Chl-a and CI% per station.

All longlines of mussel units are moored at the same direction: in parallel to the prevailing NW winds. The higher current velocities were recorded in M1 station with a mean value of 8 cm/sec (inside the unit) (Fig. 2). This station is located far from dense units and is exposed to an unhindered eastern current. Consequently its hydrodynamic conditions (current velocities > 5 cm/sec) are considered rather sufficient according to Ingles *et al.*, (2000) even though this unit was the denser than the other stations concerning the distance of socks (Table 1).

Table 1. Qualitative evaluation of the mussel units environmental conditions and their production.

Parameter	Station			Quality evaluation		
	M1	M2	M3	M1	M2	M3
Distance between socks (cm)	31.23	42.89	35.54	+	+++	++
Hydrodynamics (mean currents velocities inside the units, cm/sec, Savvidis <i>et al.</i> 2007)	8	3.6	4.5	+++	+	++
Chla (mg/m ³)	0.06	0.04	0.03	+++	++	++
Handling & environment total				7	6	6
Mussel wet body weight (g)	4.00	3.63	3.49	+++	+	+
Shell (valves) wet weight (g)	3.15	3.12	2.89	+++	+++	+
Total wet mussel weight (g)	7.97	7.58	7.12	+++	++	+
CI % (wet weight) of mussels	53.24	51.06	51.79	+++	+	+
Production total				12	7	4

Better hydrodynamic conditions improve the ambient mussel environment and the food availability expressed as chl-a seems to support higher values of the mussel condition index (CI %) at M1 station (Table 1 & Fig. 4). The available amount of chl-a within the mussel units (0.03 – 0.06 mg/m³) was among the lower ones in comparison with any other areas in the Mediterranean or elsewhere (Gangnery *et al.*, 2004), however these food amounts are considered from good to ideal for desirable condition of the harvest (Ingles *et al.*, 2000). The mean CI% value > 50% (Fig. 4), verify the fact of a good mussel growth. However, if the culturists adopt less dynamic practises following the authorities instructions (i.e. the longer distance between the shocks of 50 cm), it is expected that ecohydraulic conditions will ameliorate the harvest quality as it seems to be partially done in M2 station (Table 1).

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