

## Supplementary S2.1

Concentrations of dissolved nutrients, including total ammonia nitrogen TAN ( $\text{NH}_4$  and  $\text{NH}_3$ ), nitrate ( $\text{NO}_3$ ) and phosphate ( $\text{PO}_4$ ), monitored at the integrated seaweed tanks following the fish culture, throughout the experimental period (average values) for each seaweed species. Seawater, refers to the ambient seawater concentrations. Inlet, refers to the water coming into the seaweed cultivation tanks following the fish culture (rich with nutrients), and outlet, refers to the water flowing out of the seaweed cultivation tanks (after being biofiltered). Further values and methods used were described in our earlier work [23].

	<i>Hypnea musciformis</i>			<i>Ulva rigida</i>			<i>Gracilaria conferta</i>		
	Seawater	Inlet	Outlet	Seawater	Inlet	Outlet	Seawater	Inlet	Outlet
TAN ( $\text{mg L}^{-1}$ )	0.003±0.003	0.53±0.03	0.23±0.06	0.006±0.001	0.36±0.1	0.1±0.08	0.009±0.006	0.47±0.07	0.25±0.07
$\text{NO}_3$ ( $\text{mg L}^{-1}$ )	0.05±0.01	0.06±0.0003	0.03±0.01	0.05±0.01	0.05±0.2	0.03±0.01	0.05±0.002	0.07±0.01	0.05±0.01
$\text{PO}_4$ ( $\text{mg L}^{-1}$ )	0.001±0.001	0.09±0.004	0.06±0.01	0.002±0.001	0.05±0.04	0.03±0.02	0.003±0.002	0.11±0.01	0.07±0.02
	Inlet			Inlet			Inlet		
TAN ( $\text{g m}^{-2} \text{d}^{-1}$ )	0.03±0.03	5.07±0.33		0.07±0.01	3.72±1.09		0.1±0.06	4.89±0.75	
$\text{PO}_4$ ( $\text{g m}^{-2} \text{d}^{-1}$ )	0.01±0.01	0.86±0.04		0.03±0.01	0.53±0.39		0.03±0.02	1.14±0.15	

## Supplementary S2.2

The MAA contents ( $\text{mg g}^{-1}$ ) for *Gracilaria conferta* and *Hypnea musciformis*, cultivated under the different environmental conditions. Evaluation was preformed using dry weight (DW).

<i>Gracilaria conferta</i>						
	Culture condition	Palythine ( $\text{mg g}^{-1}$ )	Asterina-330 ( $\text{mg g}^{-1}$ )	Palythinol ( $\text{mg g}^{-1}$ )	Shinorine ( $\text{mg g}^{-1}$ )	Porphyra-334 ( $\text{mg g}^{-1}$ )
Initial two weeks	Control	0.01	0.00	0.56	0.08	0.10
	Fish + Shade	0.02	0.00	0.70	0.08	0.09
Third Week	Fish + Shade	0.01	0.00	0.85	0.12	0.09
	Fish + Sun	0.05	0.00	0.93	0.20	0.04
	Seawater + Sun	0.05	0.01	1.45	0.30	0.01
	Salt	0.21	0.02	0.74	0.13	0.00
<i>Hypnea musciformis</i>						
	Culture condition	Palythine ( $\text{mg g}^{-1}$ )	Asterina-330 ( $\text{mg g}^{-1}$ )	Palythinol ( $\text{mg g}^{-1}$ )	Shinorine ( $\text{mg g}^{-1}$ )	Porphyra-334 ( $\text{mg g}^{-1}$ )
Initial two weeks	Control	0.28	0.02	0.63	0.47	0.00
	Fish + Shade	0.23	0.01	2.05	0.82	0.03
Third Week	Fish + Shade	0.29	0.02	1.40	0.98	0.02
	Fish + Sun	0.49	0.04	1.69	1.00	0.03
	Seawater + Sun	0.44	0.02	0.71	0.38	0.00
	Salt	0.81	0.06	1.67	0.76	0.05

### Supplementary S2.3

Pearson coefficient (r) between the antioxidant activity and the different compounds/attributes evaluated in the present study for the three species: *Ulva rigida*, *Gracilaria conferta*, *Hypnea musciformis*. Green: Positive correlation. (-) no available data. \*\* p<0.01, \*p<0.05.

species	Compound										
	Palythine	Asterina 330	Palythinol	Shinorine	Porphyra 334	Total MAAs	Phycoerythrin	Phycocyanin	Total chlorophylls	polyphenols	SPF
<i>Ulva rigida</i>	-	-	-	-	-	-	-	-	-0.3223	0.7224 **	0.066
<i>Gracilaria conferta</i>	0.4316	0.3146	-0.2547	-0.3616	-0.07	-0.2232	0.527 *	0.5 *	0.435	-	0.2894
<i>Hypnea musciformis</i>	0.4136	0.5224 *	0.6284 **	0.6724 **	0.5924 **	0.7332 **	0.3435	0.4147	0.416	-	0.8794 **