## *Ulva Rigida* (Chlorophyta) in the North-Eastern Adriatic fouling communities with regard to different environments and substrata

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In the northern Adriatic seaweeds are not an important element in fouling communities. The most frequently noted species is *Ulva rigida* C. Agardh, 1822. It is a typical species for the fouling on floating objects throughout the world. Being a nitrophile species it inhabits before all slightly polluted environments (PERES, 1967) but also rather polluted harbors, where it is accompanied by some other algae (*Enteromorpha, Cladophora, Chaetomorpha*) representing the main nitrophile facies (RIGGIO, 1979). Therefore *Ulva* is considered the main eutrophication indicator in the sea and estuarine environments influenced by urban sewage effluents (HO, 1981). *Ulva* is as well common in cleaner environments richer in riverborne nutrients.

The data were collected from supralittoral to upper infralittoral, over a period of 20 years. All data are expressed as average values and are presented in a form consistent with standard ecological methods, so that frequency is according to ODUM (1971) and cover is after PERES & PICARD (1964).

Along the north-eastern Adriatic coast Ulva is the most frequent and the most abundant in slightly polluted harbors and in shellfish parks rich in nutrients, while in clean localities and shellfish parks poor in nutrients *Ulva* is of secondary importance in fouling communities (Table I). But in the Rijeka petrol-harbor, rich in nutrients. the settlement of *Ulva* was not intensive, probably due to a considerable oil pollution.

With regard to the substratum *Ulva* reacts differently. Its distribution over different parts of a ship is in correlation with light intensity, coating toxicity, relative water speed during sailing and similar. Because of this *Ulva* never settles on the keel of ships, axis of propellers, and on very toxic coating layers. However, the texture of the substratum could be of influence to the settlement of the *Ulva* species. For example, the rough surface of an oyster shell is more favorable for settling than the smooth shell of a mussel or glass plates (Table I).

The ecological importance of *Ulva* as a fouling species is unsubstantial, except on floating objects, because of its low abundance, growth, biomass, and low covering rate. Being a fouler *Ulva* very rarely reaches the adult stage, its thalli were in average only 3-8 mm high, extremely 71 mm on oyster shells. Only on the hulls of ships domiciled in harbors slightly polluted by urban sewage, in the upper part of the water line, *Ulva* thalli reached the length up to 20 cm but towards the ship-keel their dimensions decreased successively to only about 1-2 cm.

The seasonal distribution of *Ulva* is not strictly determined. At most it was found in the fouling from May to October with a peak in June.

The dynamics of *Ulva* in fouling communities is very accelerated alreadv after 15 days of exposure of the test substratum the thalli start to die out, and the mortality begins after 1-2 months, rarely after 4 months. The reason of such an accelerated development of *Ulva*, which thalli almost never reach the adult stage, is the fouling competition and kind of substratum.

Table I. Frequency of occurrence (F %) and average cover (C %) in relation to various substrata and environments (*rich in nutrients).

| | Non-pollut. sites | | Shell-fish parks | | Petrol harbor | | City harbor | |
|---|---|---|---|---|---|---|---|---|
| | F | C | F | C | F | C | F | C |
| Glass plates | 4 | 8 | | | *6 | 5 | | |
| *Ostrea edulis* | | | *50 | 12 | | | | |
| | | | 1 | 5 | | | | |
| *Mytilus gallo-provincialis* | | | *4 | 7 | | | | |
| | | | 2 | 7 | | | | |
| Fishing ships: | | | | | | | | |
| Bow | | | | | | | 25 | 7 |
| Hull | | | | | | | 25 | 3 |
| Stern post | | | | | | | 13 | 40 |
| Stern | | | | | | | 25 | 6 |
| Rudder | | | | | | | 25 | 60 |
| Propeller - sides wing: external | | | | | | | 50 | 66 |
| internal | | | | | | | 25 | 60 |

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X