EPIFAUNA on benthic macroalgae

Figure 1: Giant kelp *Macrocystis pyrifera* in coastal waters of New Zealand

Their host & vehicle

Benthic macroalgal belts are hotspots of primary production in coastal waters all around the world. The high productivity and morphological diversity of macroalgae, ranging from small filaments to the huge thalli of giant kelp (Figure 1), create a structurally complex habitat for a diverse assemblage of organisms that live on the surface of algal thalli – the epifaunal community. Fascinated by this diverse community in the 'great aquatic forests' of South America, Charles Darwin noted on his journey with the *Beagle*: 'The number of living creatures of all orders, whose existence intimately depends on the kelp, is wonderful. A great volume might be written, describing the inhabitants of one of these beds of sea-weed.'

The 'living creatures' mentioned by Darwin use benthic macroalgae in different ways. Sessile filter feeders usually use their algal host simply as biogenic substratum to grow on. Herbivores, such as peracarid crustaceans (Figure 2), consume large amounts of algal biomass. They are often highly mobile browsing the algal surface but also excavating extensive burrows into particular parts of the algal thallus. Epifaunal organisms are often specific with respect to choice of their macroalgal host. Host choice is mainly controlled by food requirements of epifaunal organisms, the nutritional quality of the host, the presence of algal defence mechanisms against herbivory, and the efficiency of the host as shelter from predators. The latter is often more decisive for host choice than food quality so that epifaunal herbivores commonly live under nutritionally sub-optimal conditions.

Figure 2: *Peramphithoe femorata* – a common herbivore amphipod species on *Macrocystis integrifolia* in Chilean kelp forest

The efficiency of an algal host as shelter from predators increases with the structural complexity of the phytal habitat. In dense benthic macrophyte assemblages epifaunal organisms can hide efficiently from predators. Here they grow and reproduce, often forming extensive populations. Occasionally, however, algae are detached from benthic habitats, e.g. due to storm surge and herbivore feeding activity. Many kelp species possess air-filled swim bladders that allow them to float at the sea surface after detachment. In Volume 89 of JMBA we showed that the structure and composition of the epifaunal community change significantly immediately after detachment of the algal host. While some of the mobile species are simply unable to hold onto floating algae, other inhabitants, which are well able to cling efficiently to their algal host, seem to leave detached floating algae actively (Miranda & Thiel 2008). By doing so, they avoid being carried out of the kelp forest into open waters where predators from the water below or from the air (Figure 3) forage intensively on the epifauna of floating macroalgae (Vandendriessche et al. 2007a, b). The ones that remain on the detached alga, however, might travel on their floating host over extensive distances driven by ocean currents. Since buoyant macroalgae persist at the sea surface for weeks or months after detachment, rafting might lead to efficient dispersal of epifaunal organisms. The estimated amount of kelp rafts in some areas is enormous, occasionally exceeding 1000 individual algal rafts per km^2. The exchange of floating algal thalli and their rafting associates between distant coastal kelp forests can connect apparently isolated epifaunal populations, thereby facilitating the persistence of phytal species on a large geographic scale. Thus, these algal rafts can be important dispersal agents in many oceans. Especially along coasts with extensive kelp forests and alongshore currents these algal rafts accumulate on true rafting highways with a year-round extensive traffic volume. Whether and how often these algal rafts might occasionally achieve intercontinental trips is one of the most interesting research questions for the future.

References

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Figure 3: Seabirds (*Sterna* sp.) foraging on rafting epifauna on floating *Macrocystis pyrifera* off the Chilean coast.