

An underwater structure unfortunately provides an ideal site for marine growth colonisation. This increases the size and weight of the structure, causing it to suffer greater waveloading and current forces. To maintain its safety, it is necessary to

assess the extent and nature of the marine growth. Local variations in the type and density will occur according to environmental conditions; for example, the warmth derived from the hot products in the risers can encourage local growth.

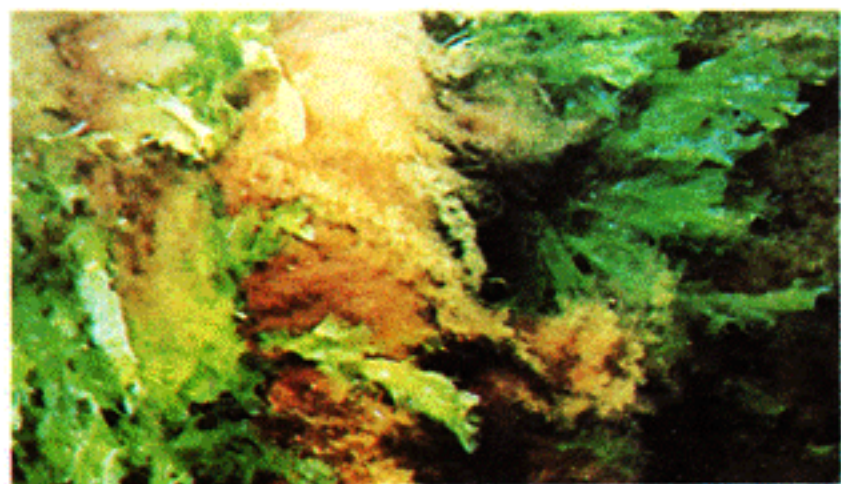


Fig. 1 Seaweeds: *Ulva lactuca* (green); *Polysiphonia* (dull red)

Seaweeds are present on most structures on sunlit surfaces less than 15 m deep. Annual species such as the green ribbon-like and dull red feathery seaweeds in Fig. 1, may grow to 15 cm

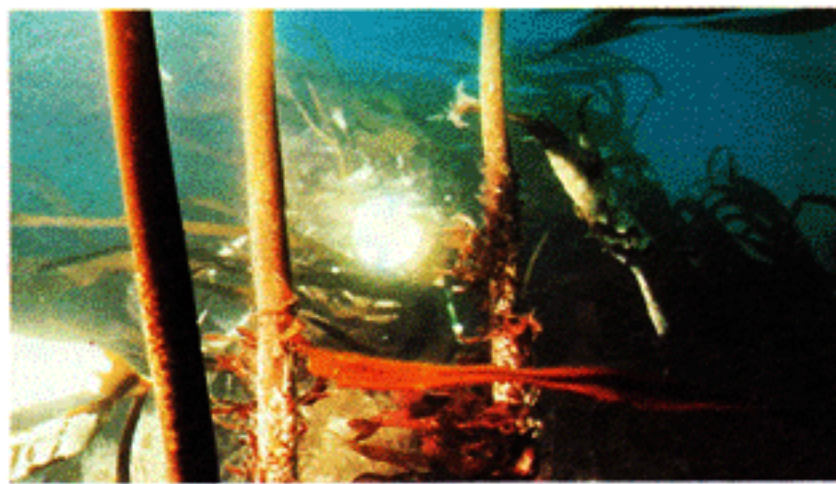


Fig. 2. Kelp: *Laminaria hyperborea*

long in summer. Perennial kelps (roots living for more than 2 years) as in Figs. 2 and 3, are slower to colonise but may grow to 50–150 cm.



Fig. 3. Mussels: *Mytilus edulis*. Kelp: *Laminaria digitata*

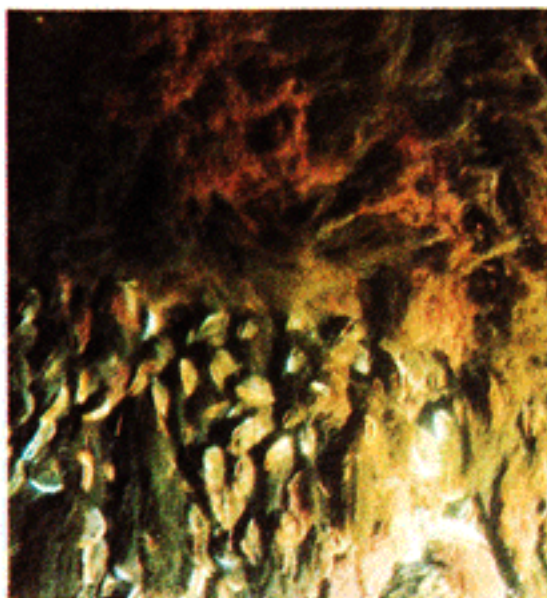


Fig. 4. Mussels: *Mytilus edulis*. Seaweeds: *Polysiphonia*; *Ectocarpus*



Fig. 5. Mussels: *Mytilus edulis*

Mussels are characteristic fouling organisms which grow most densely on the upper surfaces of horizontal members in the 0–20 m depth range. Fig. 3 shows a typical mussel bed about 4 cm thick composed of animals up to 5 cm long. In sunlit areas,

mussels themselves bear an overgrowth of filamentous red and green seaweeds up to 15 cm long, like those in Fig. 4. Mussel shells on offshore structures are smooth, glossy brown or black in contrast to the abraded blue-black shells of inshore mussels.



Fig. 6. Tubeworm: *Pomatoceros triqueter*

A dense cover of solitary tubeworms, so crowded that their hard calcareous ('chalk') tubes are growing away from the steel surface, forming a brittle layer 0.5 to 1.5 cm thick.

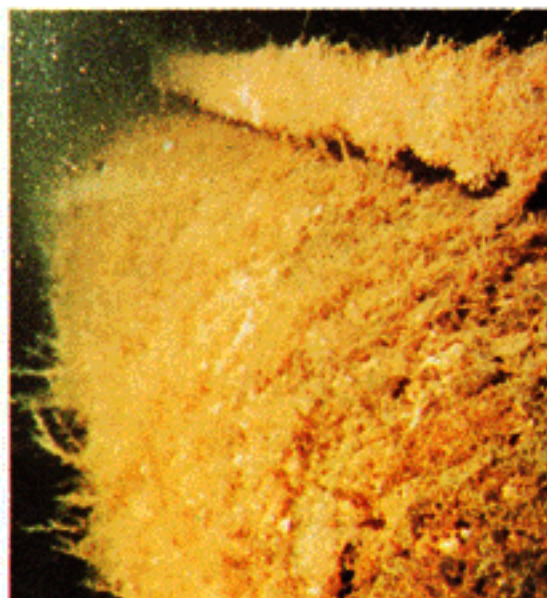


Fig. 7. Hydroids: *Bougainvillia ramosa*

Plant-like colonial animals called hydroids are the principal members of the layer of soft growth found on most structures offshore. Many, like those in Fig. 7 (4–6 cm long), may be confused with seaweeds, but individuals of up to 6 cm long (Fig. 8) are easily recognised by their large pink 'heads'.



Fig. 8. Hydroids: *Tubularia larynx*



Marine growth can be described as either hard or soft. Hard growths include mussels, barnacles, hard corals and calcareous tube worms etc. Soft growths include anemones, sponges, soft corals, kelps, sea squirts etc. It is important to be able to differentiate between these two groups since they will affect the engineering stress calculations and also the choice of

cleaning method used to remove them. Marine fouling makes it difficult for divers to apply NDT and inspection techniques. Divers often spend far longer removing the marine growth than doing the actual inspection. Here are some common varieties likely to be encountered in the North Sea for example.

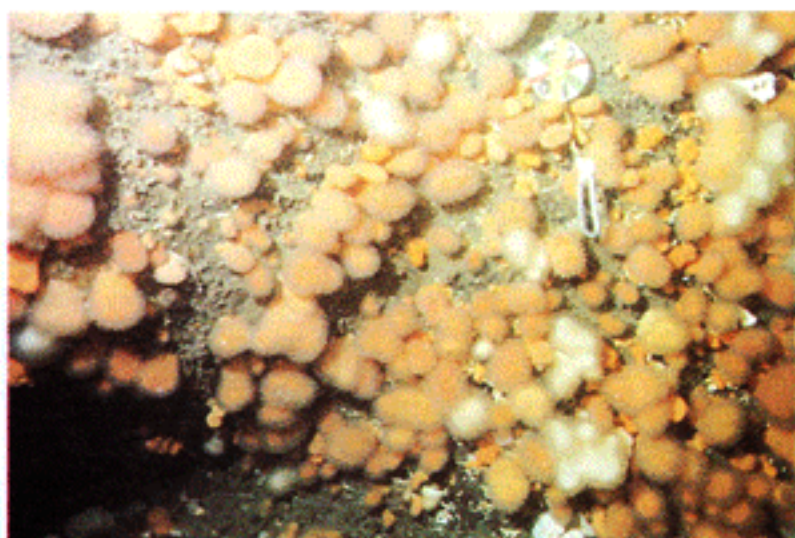


Fig. 9. Dead men's fingers : *Alcyonium digitatum*

This colonial soft coral is one of the soft organisms that usually overgrows the initial hard fouling layer of tubeworms or barnacles. Individuals here are 3 to 12 cm high and range from white or pale yellow to deep orange.

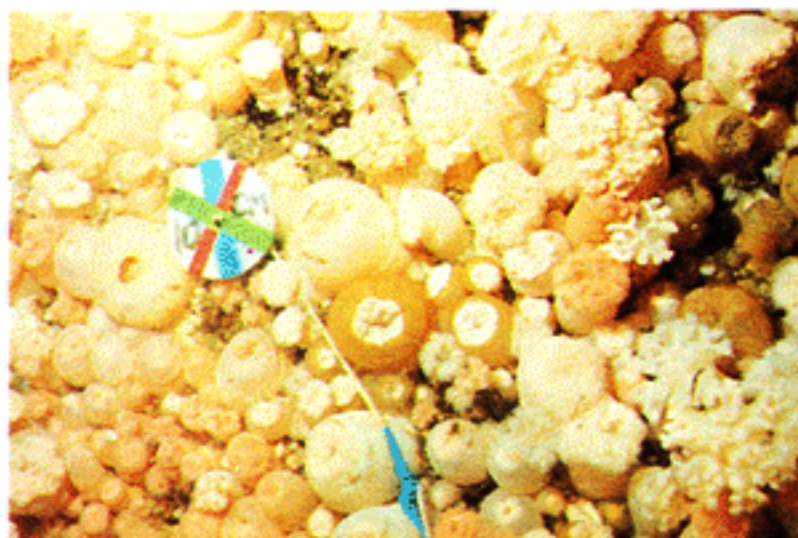


Fig. 10. Plumose anemones : *Medridium senile*

Present on most structures, particularly those deeper than 30 m. Fig. 10 shows a typical dense cluster of individuals 8 to 15 cm long. Colour ranges from palest yellow through orange to reddy-brown.



Fig. 11. Colonial tubeworm : *Filograna implexa*

This colonial tubeworm is often present at depths greater than 50 m. Individual tubes of the worm are only 0.5 mm wide and 4 to 7 mm long, but may form large dome-shaped growths up to 50 cm in dia. and 20 cm high (Fig. 11). Another form is a thin, spreading, disc-shaped area of tubes. In Fig. 12 discs 10 to 40 cm in dia. have almost run together forming a layer 1 cm thick.

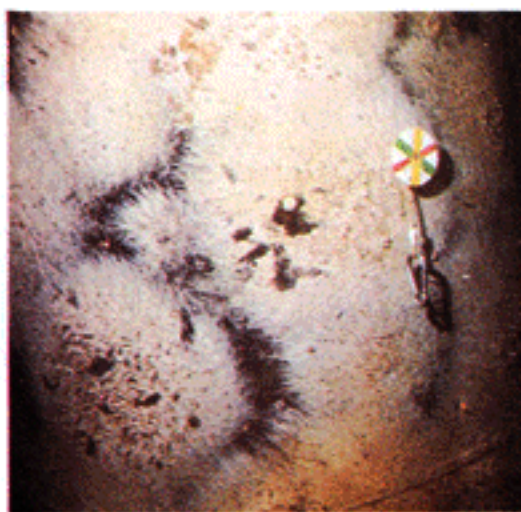


Fig. 12. *Filograna implexa*

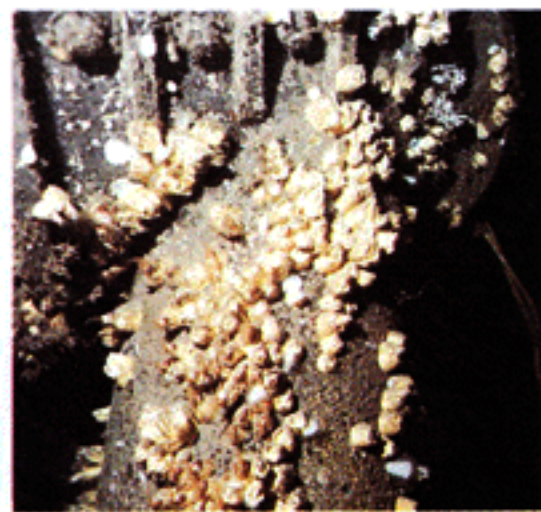


Fig. 13. Deep water barnacle : *Balanus hameri*

Various species of barnacles are found at varying depths. Individuals in Fig. 13 are 2 to 3 cm in dia. and 3 to 4 cm high and this photograph illustrates a characteristic cluster of these barnacles in a silt-free area.

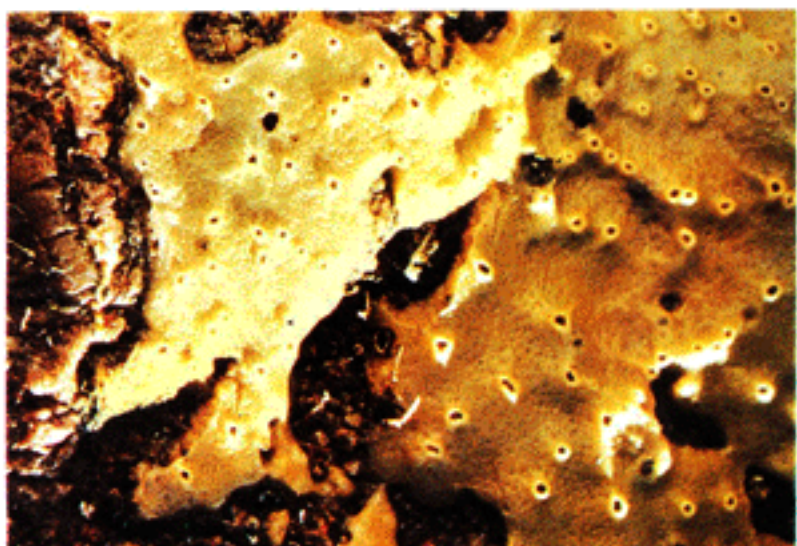


Fig. 14. Breadcrumb sponge : *Halichondria panices*

Encrusting sponges may be recognised on some structures. Size and shape are very variable but the surface pattern and holes of the breadcrumb sponge may be noted by the diver.

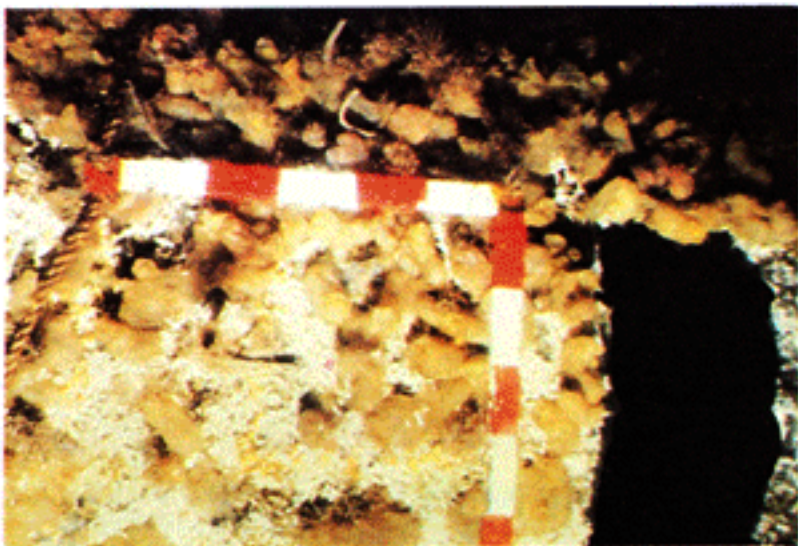


Fig. 15. Sea squirts : *Ciona intestinalis*

Sea squirts, such as those in Fig. 15, may be abundant in regions free from silt. The individuals in this photograph are 4 to 6 cm long growing over a background cover of solitary tubeworms.