Introduction to Antifoulings.

If corrosion protection is the first priority for users of marine paints, fouling protection will follow shortly after. Fouling is the growth of marine organisms on the underwater area of vessels outside hull. Any organism capable of attaching itself to a vessel can cause fouling. Fortunately, only relatively few species are found on ships hulls. These species can be divided in three categories.

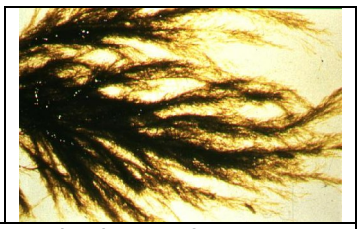
Slime fouling

As soon as any object is immersed in the sea, a film of organic molecules will settle on the object within minutes. This so-called conditioning film is believed to enhance settlement of bacteria, diatoms (such as *Achnantes*) and filamentous algae. *Achnantes* is a diatom type that can be found in all world seas and on most ships too. A slime layer on a ship is always present but not always visible.

Microscopic picture of Achnantes.

Algae fouling

Initially algae settle in the form of individual cells but in time they multiply to form a chain of cells and finally, may develop to strings of several meters in length. Examples are the well-known *Enteromorpha* (‘green algae’) and *Ectocarpus* (‘brown algae’). Strong adhered algae fouling is a sign that the Antifouling has reached the end of its service life.

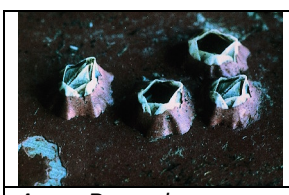


Microscopic picture of Ectocarpus.

Animal fouling

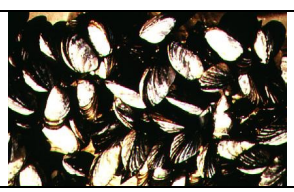
Barnacles, tubeworms and mussels are three more notorious examples although tubeworms and mussels tend to be more proliferated in subtropical waters. Barnacles is a generic name for a class of organism which have in common that after settlement of the larvae (cyprids) on a surface a hard, calcareous shell is build. Once a barnacle has adhered to a substrate it is not easy to remove. From a tiny shell of 5 millimeters in diameter a barnacle shell might grow to a diameter of 5 centimeters. During the shell growing process enormous powers are developed to such an extent that it can undercut hard epoxy coatings. Examples are the common Acorn barnacle and the typical Gooseneck barnacles.

Microscopic picture of cyprid larvae.



Acorn Barnacle

Tubeworms



Mussels

Gooseneck Barnacle

Effects of fouling

The most quoted effect of fouling on a ship hull is the increase in drag and hull roughness resulting in speed reduction. Other effects are blockage of cooling water inlets and the already mentioned corrosion initiated by bacteria and coating damage by barnacles.
However, shipowners will be more concerned about loss of speed as it influences sailing schedules and increases fuel bills. Using antifoulings is therefore an effective solution and worthwhile investment too.

Antifoulings until recently were based the principle that biocides are released from the coating and create a hostile environment at the coating-water interface. A certain minimum concentration is required to deliver effective protection but then again, too high concentrations lead to overkill and may be harmful for non-target organisms (marine life that will not adhere to ships, for instance fish). Also, it will increase the cost of the antifouling.
The mechanism how biocides are released can vary from antifouling to antifouling and depends on lifetime, coating system and budget. Transocean delivers four ranges of Antifouling paints and their working mechanism is explained in a separate brochure “Transocean Antifoulings protect the world around”.

Because of the environmental pressure on the use of biocides, other strategies to protect a ship against fouling are gaining interest amongst both paint suppliers and customers. The prevention of fouling or to minimize the adhesion of organism by using silicone-based coatings is a direction that has already led to commercial products such as the Transocean Ultima system.