Marine Biosecurity: Control Measures

Antifouling Coatings – Applying the correct antifouling coating and maintaining it correctly is still the number one line of defence against INNS. Using your vessel regularly will maintain ablative (eroding) antifouling coatings.

Exposure to air – Drying out is one of the more successful and inexpensive methods of INNS removal. Most will respond to air exposure during the tidal cycle, for example oyster bags with INNS can be moved up the beach to increase air exposure, however full desiccation is required to ensure mortality.

Enclosure and/or chemical treatment – For large or fixed structures that cannot be removed from the water, such as docks or certain vessels, enclosure has been shown to be effective in some parts of the world. This involves wrapping a structure, including entire ships, pontoons, mooring lines, etc with sheets of plastic. The trapped water is then either left to go stagnant or a chemical accelerant is added- either method kill both target and non-target species. This method was used by Natural Resources Wales at Holyhead.

Chemical Sprays and Washes – Different species react differently to what we might think of as toxic substances so they don't always work effectively. They are also non-specific and can end up killing non-target species. Chemical treatment is only undertaken under licence and in exceptional circumstances. Some trials have been undertaken in Ireland using a range of substances on *Didemnum vexillum*.

When a vessel with obvious biofouling/INNS needs to be treated, and there are no suitable facilities to crane it ashore, chemical treatment of a beached vessel's hull at low water might be the only option available. The vessel, at a suitable location, for example in a cradle on a slipway or propped against a harbour wall, can be sprayed with the appropriate treatment at low water springs to allow maximum time for the treatment to work. The dead biota can then be scraped off and disposed of appropriately. As this action will involve the discharge of a biocide onto the shore or into the sea a license will be required. Expert advice should be taken as to what treatment to use as not all biocides will work on all INNS.

Mechanical and manual removal – scraping, power washing, hull cleaning and other manual removal methods should be done after consultation with specialists and

undertaken carefully. Many INNS will easily fragment and under stress can possibly begin to release larvae or gammets, therefore manual removal can sometimes actually make the problem worse unless full capture systems are used. The Green Blue has collated a useful guide to wash down facilities.

Removal of Suitable Growing Surfaces - Where it is cost effective to do so. removal of all unnecessary equipment or material from the water is a very useful control measure, including but not limited to disused infrastructure e.g. pontoons, shellfish trestles or other structures. Also including structures not needed seasonally e.g. pontoons, moorings, vessels ropes or fenders not in use in winter.

Chemical or heat shock treatment of aquaculture stocks - INNS overgrowing shellfish in culture reduce optimal growth rates, devalue contaminated seed stocks and increase the weight burden of ropes and equipment. Various chemical treatments, such as dipping for in dilute bleach, spraying with acetic acid solution or use of calcium hydroxide or dipping in strong saline solutions can be effective in removing INNS in culture. Oysters can withstand short duration immersion in hot (80-85oC) water which can be effective in removing algal spores.

Manipulation of environmental conditions - By manipulating the salinity of a marina or harbour by controlling fresh water inputs from rivers and streams it can be made unsuitable for a range of species, particularly those that require fully saline conditions throughout their life cycle. Improved biosecurity might inadvertently be a feature of marinas and harbours that have riverine inputs and either tidal sills or lock gates. The salinity in such developments can vary from near fully marine to fresh depending on riverine flow rates and exchange of seawater.

Naturally occurring freshwater could be controlled and incorporated into the design of new marinas and harbours in order to enable the manipulation of the salinity. Careful consideration would need to be given with regard to target species so as not to inadvertently select for a brackish-tolerant non-native species that would outcompete native species.

NB: Anti-corrosion (sacrificial anode) systems on boats work best when the salinity is kept at a constant level but are less effective when the salinity fluctuates.

Antifouling Coatings

Antifouling paints or coatings work by leaching heavy metals, such as copper and zinc, into the immediate surrounding water, which many species cannot tolerate. Antifouling paints are generally applied after the hull of a vessel has been thoroughly cleaned and dried and have been found to effectively reduce the recruitment of fouling species, although several non-native species such as *Tricellaria inopinata*, *Schizoporella japonica* and *Watersipora subatra* are known to be tolerant and occur on or immediately adjacent to treated surfaces. These paints can also be applied to aquaculture structures and equipment.

Although an effective method for preventing fouling, antifouling paints do lose their effectiveness over time and, if even small areas are missed during the painting process (typically the lower surface of the keel or areas under cradle supports) or damaged (e.g. scratched or worn if the boat settles on the bottom), organisms can still attach and colonise thus reducing its overall effectiveness. Selection pressure for tolerance to the constituents of antifouling paint is particularly likely in species that have 'hitch-hiked' attached to treated or partially treated vessel hulls with near-depleted antifouling paint.

Copper contamination, in particular, has now been implicated in the establishment of INNS rather than their removal or prevention. Apart from being a major contaminant in stormwater runoff, copper is also the primary component of many antifouling paints, and wooden pilings are often treated with copper chromated arsenate to prevent fouling. Limiting the use of copper in antifouling paints could potentially reduce the chemical tolerance advantages that INNS exploit for establishment and dispersal, and help to re-populate areas with native species.

For information about more engineering led solutions, see Marine Engineering Biosecurity Solutions on the RAPID LIFE website.