As a Jersey based marine business, Jersey Sea Farms has been taking active steps to minimise the loss of aquaculture derived plastics and other plastics, into the marine environment and associated negative outcomes for a number of years. The Department of the Environment is unaware of these because no structure or will exists to discuss or describe anything other than aquaculture licencing, licence compliance factors and pay licence fees.

This submission relates specifically to the Panels' ToR3 , ***To consider the role that businesses can play in the reduction of plastics and the benefit to the environment this could bring***.

Jersey Sea Farms has been instrumental in this for a number of years at European level and with co-operative projects with national and multinational players.

The brief summaries here involve some highly technical descriptions. These are deliberately included to reveal that the nature and potential solutions to the problem are far more complex than the current zeal to 'Ban Marine Plastics' etc., that prompted this review.

Between 2006 -10 JSF was a full partner in the European Project Fp7 SUDEVAB (c€1M) ,that investigated all aspects of sustainable abalone (Ormer) aquaculture . The JSF area of responsibility was that of the effects of marine pollution on ormers as food. One of these aspects was that of nano particle size plastics. (This was 2006 when plastic pollution had yet to receive any serious academic let alone public focus).The reason for the investigation was to identify a possible route for the ingestion of highly toxic anthropogenic carcinogens including dioxins ,PCBs and dibenzofurans. The risk was based on the ability of nano plastics to both adsorb and absorb through the whole particle , concentrating loadings of these pollutants .It should be noted that this specific risk has yet to be properly exposed in the mainstream media. The results for Ormers were well within safety parameters and orders of magnitude lower than filter feeders such as mussels and oysters.

In 2012 the company was approached by Acheson and Acheson https://www.achesonandacheson.co.uk/ a UK company specialising in commercial supply of cosmetics as own brand labels to high street stores such as M+S. Their requirement was to test Native Oyster Shell fragments as an alternative to plastic exfoliants . Over a period of time a number of grades of shell were provided to them and testing followed. The result was the replacement of plastic bead exfoliant with sustainably derived shell extract from 2014 onwards. This has now become the industry norm.

In 2015 the business developed Microreef , an innovative system for the restoration aquaculture of the European Native Oyster, this is a keystone environmental indicator species with UK and EU Action Plans and OSPAR protection. This system allows full commercial aquaculture of the species for the first time with the bonus of generating a substantial 'fall out ' of juvenile native oysters into the wild to rejuvenate extirpated beds. The quantity of plastic used by this system is less than 50% of the plastic per oyster produced than that used in Pacific Oyster culture.

The main JSF product is the IPR protected Ortac3 and Ortac4 systems for growing juvenile native oysters to prepare for Microreef. The original Ortac3 was designed in 1998 and commercial

experience has identified how failures can arise in service and contribute to marine plastics. These have been thoroughly addressed in the 2018 Ortac4 with some major plastic innovations currently under commercial test.

JSF has lined up with the multinational company Dow Dupont (see

https://www.mddionline.com/dow-corning-siloxane-research-program-overview-and-update)

to utilise their advanced siloxane products and experimental materials to reduce biofouling. These are used mostly in medical devices and the use to prevent settlement of weeds and animals on aquaculture products is novel. JSF has taken these novel systems and added a further suite of deterrents , all of which can simply introduced into the moulding process producing ready to use equipment that is extending the commercial life (and reducing plastic usage), as well as reducing labour costs massively. This will be transferable technology for all marine plastic usage globally.

The main plastic innovations are;

The use of ultra long length siloxane molecules that self-stratify on to the moulding surface .These create super-hydrophobic conditions that accelerate water run off and debris dispersal (such as biofilm a biofouling precursor), as well as facilitating detachment of hard fouling such as barnacles. Dow have provided different molecules with different functionalities in Tonnes of product for trialling , this represents an investment of £10's of thousands on their behalf.

JSF has taken cutting edge research to move the systems much further on:-

The use of SLIPS technology see https://www.nature.com/articles/nature10447 . A specific molecular weight silicone oil is added to the moulding process to create a slippery medium between the siloxane molecules .This makes a near zero loss slippery and repellent surface.

A novel application unreported anywhere in the literature is the use of nanoparticle titanium dioxide. (this is the substance that makes white paint white) . Firstly to deter the settlement of barnacle larvae that use red light florescence to trigger settlement and TiO2 does not glow in that part of the spectrum.

It also creates a dynamic ampiphilic surface on exposure to sunlight UV .This is a complex interaction that shifts surface tensions and creates an unstable surface for biofilm bacteria to establish on.

Furthermore on exposure to sunlight UV in the intertidal regime used by aquaculture it creates a electrolytic toxic surface for bacteria .

All of these systems are non-toxic to marine animals and plants that are not in direct contact with the surface, there is no sloughing off of material or chemicals.

A completely converse system where settlement is required onto plastics is also being trialled by JSF and although the current use is exclusively aquaculture it has the potential to radically change how plastics are viewed in the marine environment. **This aspect is entirely novel, not published anywhere and could be seen to come from Jersey as a global initiative if there was interest.**

In order to produce enough native oyster seed JSF has been working with Jasconius Hatchery near Galway in Ireland to produce and improve the use of 'spatting pond 'technology for hatching oysters. The conventional route is to settle larvae onto old mussel shell , but JSF has been experimenting with various plastics using the experiences gained from the opposite requirements of the Otac4 namely no settlement wanted.

It turns out that plastics (PP,LDPE,HDPE,and UPVC) with higher than usual lime filler are particularly effective.

Lime filler (just finely crushed limestone) *is a normal filler for plastics* that reduces cost and can improve characteristics. Usually it is a few percent but can easily go to 50%.

Plastic with more than 20% lime filler *SINKS.*

Notwithstanding that plastic loss to the marine environment should be minimised , the use of plastics still remains essential for many products used in leisure and commercial marine activities .If that material sank naturally it would sit on the sea bottom creating a site for biological settlement, and biological settlement surfaces are frequently a limiting factor for generating biodiversity. Many subtidal areas around the world consist of muds and silts and are virtual deserts due to the lack of settlement surfaces.

Having generated settlement the plastic would be biologically coated and form part of the geology rather than float in the abioseston.

To put it simply , once the use or loss of plastic into the marine environment has been minimised , then any that is lost may high volumes of lime filler, can generate a positive outcome and minimise environmental risk.

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