Jersey’s Sea Lettuce Problem

Why we are here, and what we can do about it

A short report from SOS Jersey, October 2017
Introduction

Sea lettuce blooms are a problem world-wide, including in St Aubin’s Bay in Jersey, Channel Islands.

We do not believe we should just hold our hands up and say, ‘there is nothing we can do about it’; indeed, we strongly believe the scientific community will find a way to sort out the problem. This will not happen tomorrow in Jersey – it may well take some years – but we can work towards diminishing the problem, starting now.

So much more data collection needs to be undertaken so we can find out more about what’s happening in and around our waters, but there are ways to start helping now, and here we look briefly at two of those ways based on lengthy conversations with aquaculture specialist Tony Legg and soil ecologist Glyn Mitchell.

This is a short report designed to be read by all. If you would like to read more detailed, science-based versions, you are most welcome. Details of how to get them are on the last page.

With very best wishes for a local and international solution,

Jacqui Carrel

Jacqui Carrel
Environmental Scientist for SOS Jersey

All photos in this report are taken in Jersey.
Contents
Introduction ........................................................................................................................................ 1
Sea Lettuce....................................................................................................................................... 3
  What is it? ........................................................................................................................................ 3
  What’s the problem in Jersey? ........................................................................................................... 3
  Why sea lettuce thrives in St Aubin’s Bay ......................................................................................... 5
Opportunities missed............................................................................................................................. 5
An opportunity for 2018 ...................................................................................................................... 6
  Furrowing .......................................................................................................................................... 6
  Oysters ............................................................................................................................................. 7
  Costs ................................................................................................................................................... 7
Chemical Soil....................................................................................................................................... 8
  What is it? .......................................................................................................................................... 8
  What’s the problem in Jersey? ........................................................................................................... 8
  What are the effects? ......................................................................................................................... 8
An opportunity missed................................................................................................................................ 9
An opportunity for 2018....................................................................................................................... 9
Conclusion......................................................................................................................................... 10
Contact Details & Links ..................................................................................................................... 10
Sea Lettuce

What is it?

Sea lettuce (Ulva lactuca) is a flat, thin, green seaweed that resembles slimy lettuce leaves. The fronds, which attach to rocks, other seaweeds, surfaces and materials, can grow up to 45cm long and 30cm across. The sea lettuce can be easily torn from where it is attached and can accumulate in large, drifting masses called blooms.

To get a bloom of Ulva, three main conditions must be present: warm water, enough sunshine and plenty of available nitrogen; other conditions, such as areas of shallow, standing water, a poor current, excess phosphates and an oft-disturbed benthic layer which contains trapped nutrients, can speed up the effect.

We cannot do anything about our warm waters and plentiful sunshine, so must look at two parameters we can affect: excess nitrogen and poor drainage/currents. Two of the main sources of nitrogen in St Aubin’s Bay are ammonia (NH₃) and nitrates (NO₃), most of which enter our water system via the Bellozanne sewage outflow. Nitrates also enter via runoff. The levels entering the Bay are too high but, until the new sewage treatment works (STW) is built, we must find other ways to mitigate the damage the nitrogen load causes. We cannot unbuild La Collette (the reclaimed land has detrimentally altered the water flow), but we can help St Aubin’s Bay drain better so that sea lettuce spores enter the outgoing gyre rather than taking hold in the Bay area.

What’s the problem in Jersey?

Sea lettuce blooms are particularly prolific in areas where nutrients are abundant. The blooms have been particularly bad in the last several years: they are unsightly, too slippery to walk on, and produce gases which not only smell bad enough to affect locals and businesses in the vicinity, but which can also be hazardous to health.

In fact, we can assuredly say the seasonal Ulva blooms in St Aubin’s Bay have a negative impact environmentally, socially and economically; we can also say that much of the problem is due to the illegally high discharges of nitrates (often 4-6 times legal limits) into St Aubin’s Bay from the Bellozanne Sewage Treatment Works.

---

1 The benthic boundary – the lowest level of water plus the sediment surface and some subsurface layers – in St Aubin’s bay warms substantially above ambient temperatures, is heavily illuminated by day and contains a mix of blades and spores. It is hard to design a better environment for all stages of Ulva growth.

2 SOS Jersey, an entirely voluntary and unfunded body, has been campaigning on the issue of the sea lettuce blooms in St Aubin’s bay for many years now. The relevant (paid) States departments have been dragging their feet on the issue, with current Ministers, until October 2016, being happy to publicly blame the problem squarely on the water coming from France. At this point, SOS Jersey released relevant data to the media and the “It’s all the fault of the French” opinion was updated to an admission that maybe some of the problem was “home grown”.
St Aubin’s Bay is home to an area of the seagrass *Zostrea noltii*, also known as eelgrass, which provides a habitat and feeding area for marine flora and fauna and birds such as Brent geese. Despite the States’ protestations to the contrary, sea lettuce blooms do adversely affect seagrass growth\(^3\). While sea lettuce benefits some species, the seagrass has a much more important role locally; the seagrass is also important in stabilising sediments and reducing wave energy.

The half tide and below platform is mostly covered by random patches of slightly raised seagrass and water-filled ponding. The seagrass found here is of the small-leaved form, which is the type generally found in stressed environments; while this form has much faster recovery and photosynthetic rates than the larger-leaved variety, its presence is a damning indictment of the state of St Aubin’s Bay waters.

While sea lettuce provides a habitat to some small invertebrates such as amphipods, large amounts prevent sunlight reaching plant life below; when the plants cannot photosynthesise, they die. Bacteria feeding on decomposing dead sea lettuce use up a lot of oxygen in the water, depriving other species of oxygen, which also die or move elsewhere; in effect, sea lettuce smothers seagrass.

When the tide is low, piles of sea lettuce are pushed and scraped to the low water mark using JCBs and lorries. The machinery damages the sand structure and disrupts seagrass beds and other sand-living organisms. It is also very expensive, with little return on the investment.

The States also considered using a costly and (in our opinion) ineffective sea lettuce harvesting machine, but that fell through when the machine caught fire. This year, the States trialled loading sea lettuce onto a landing craft and dumped it at sea; the craft can manage up to 60 tonnes a day. Sea lettuce blooms have been ‘better’ (ie, less bad) than last year, but without substantially better measuring, we cannot say this is due to the landing craft trial; it could equally be due to the poor summer experienced this year or some other factor(s).

In fact, this approach to managing the blooms may be politically obvious but is not a control mechanism. For example, at temperatures of 20°C, *Ulva lactuca* grows at a rate of up to 20% per day; the biomass increase alone would be up to 60 landing craft loads per day with St Aubin’s Bay in full bloom.

The effect of variations in wind strength and insolation, relative to the tidal cycle, further help outperform any meaningful mechanical extraction process.

---

\(^3\) See [https://www.waikatoregion.govt.nz/assets/PageFiles/41458-coastal-factsheets/4797_CFS2016_Sea%20lettuce_MR.pdf](https://www.waikatoregion.govt.nz/assets/PageFiles/41458-coastal-factsheets/4797_CFS2016_Sea%20lettuce_MR.pdf), for example.
Jersey’s sea lettuce problem & what we can do about it ~ SOS Jersey

Why sea lettuce thrives in St Aubin’s Bay

St Aubin’s Bay offers fantastic conditions for *Ulva* blooms because:

- The Bay’s intertidal platform below half tide is shallow pitched, holds a lot of standing water in shallow ‘ponds’, and comprises a lot of fine sand; in addition, in recent years, winter sea temperatures have shown less extreme cold and been more consistently level.

- These stable ponding create an ideal environment for the adhesion of sea lettuce zoospores and the initial development of disc-shaped thalli\(^4\). Nitrogen (mostly in the form of nitrates and ammonia) from the freshwater and sewage effluent outflows into the Bay is held there through a combination of factors such as not fully mixing with seawater, particulate settlement, elevated temperatures, and bacteria in the sand that turn the nitrogen into forms available for uptake by other organisms, including sea lettuce.

- Land reclamation at La Collette has reduced advection currents; taken with the aforementioned physical factors and coupled with increasing (and illegal) discharges from the sewage treatment works and increased particulate settlement, the Bay becomes an efficient photo-bioreactor area.

> *The initial development of a sea lettuce bloom can therefore be located, in the case of St Aubin’s at least\(^5\), as the first few millimetres of water-saturated sand in a clearly defined platform below the half tide mark.*

Opportunities missed

While the reduction to a point where *Ulva* blooms are never triggered may be elusive, and mending our environment will take many years, we need to work towards taking away the tipping point needed for the regular blooms that blight St Aubin’s Bay in the summer and early autumn months.

What were the opportunities missed? There were two main ones, using native oyster and furrowing, both of which could have been trialled properly. We still hope the furrowing idea, outlined below, will be trialled by the relevant States of Jersey departments.

This year’s ‘trial’, undertaken by the Department of the Environment in late May 2017, was a travesty and of course failed. It had no meaningful relationship with the proposal put forward by Tony Legg and was undertaken without reference to the him.\(^6\) We also hope the States will revisit the oyster idea, this time looking at it as a valuable adjunct to the furrowing.

---

\(^4\) A thallus (pl, thalli) is a plant body that is not differentiated into stem and leaves, and that lacks true roots and a vascular system.

\(^5\) Other authors have identified areas such as St Brieuc where initial settlement is rock-derived.

\(^6\) SOS Jersey were not informed of the trial either, which is rude.
An opportunity for 2018

Tony Legg’s current proposal, fully supported by SOS Jersey, is a much cheaper alternative to current clearance methods and would be effected by a) employing some of anti-biofouling strategies used in marine industries and b) increasing the size of the marine nitrogen sink by a set of novel ecosystem approaches using furrowing and, potentially, oysters.

Present in this area are variable densities of the seagrass Zostrea noltii; currently, this has general protection but if the densities exceed a certain minimum, it would have specific protection under the OSPAR convention. Any trial or expanded operation would need to show that any impact on this species was neutral or positive.

We’ll look briefly at furrowing and the role of native oysters.

Furrowing

The beach itself shows natural drainage patterns which develop naturally below the half tide platform when water from the upper part of the beach is draining as the tide goes out.

The drainage runnels are not deep, so runoff ponds across most of the area creating ideal conditions for sea lettuce zoospore settlement. By the same token, there are few of the raised, drained areas that seagrass prefers.

The proposed trial, to artificially create furrows, would cause minimal changes to the beach itself and be very low cost. This trial would encapsulate the modern biofouling reduction principals of disperse, deter and deny:

**Disperse:** By creating narrow furrows parallel to the natural flow of the water down to the low tide mark, self-sustaining drainage channels can be established that duct the substantial volume of water normally retained in the area, down to the low tide mark and the gyre beyond.

**Deter:** The effect of drainage in this way dries the ponding elements, meaning sea lettuce zoospores cannot settle.

At the same time, the draining creates a beneficial environment for the Seagrass proliferation both by creating drained, slightly raised areas and increasing the depth of viable sand used for rhizome growth before the sand becomes anoxic.

**Deny:** Any zoospores that have settled now become exposed to the air and dry out and die.

As the amount of sea lettuce decreases, so the seagrass will be allowed a significant increase in leaf cover. In turn, the increased amount of sea grass will decrease the amount of nitrogen available to the sea lettuce.

---

7 Biofouling (or biological fouling) is the accumulation of algae (or plants and animals) on wetted surfaces.
In summary, this means the furrows would i) create a cascade of pressures on the early development of *Ulva*, followed by ii) a wave and tidal energy furrowing of any developed macroalgae into the low water gyre, forming iii) a competitive nitrogen sink as the *Zostrea noltii* begins to increase in area and potentially also through a nearby Native European Oyster *Ostrea edulis* aquaculture system. If you would like to know more about the specifics, please contact us; details are at the end of this report.

Much work has been done to discover the correct drainage angles and furrow cross sections to minimise seagrass damage to less than 2% initially – and probably much less than that, given the potential for recovery with limited internodal damage.

The furrowing should not be confused with the failed trial run by DoE which used heavy machinery, overwide furrows, double-sided spoil heaps, an area with little surface water drainage, no sea grass, at the wrong part of the tidal cycle, the wrong time of year and, most importantly, was above the half tide mark, which means a quite different sand profile and anoxic layer position.

Oysters

Initially, and before the furrowing concept was developed, Tony Legg approached the Ministers of the Department of the Environment (DoE) and Department for Infrastructure (DfI) with a proposal to develop an expanded Native Oyster (*Ostrea edulis*) industry which would, at the same time, not only benefit the marine ecosystem directly, but also help decrease the amount of nitrogen in the sea.

It should be added at this point that Tony Legg is a prime mover in creating the true aquaculture of this species in Europe through innovative equipment and increased seed supply and one would have expected the States to respond with active interest. Instead, Mr Legg was asked if he couldn’t try it out somewhere else first?

SOS Jersey became involved, but to no avail and, sadly for Jersey, Mr Legg did go elsewhere. Significant projects have since been successfully run in Scotland, Ireland and in the Solent – and these could be translated to a Jersey context at no or minimal cost to the States of Jersey.

Costs

**Furrowing:** The cost of a full year’s operation would hinge on the number of restoration runs needed on the furrows. If this is the maximum expected (three), and the furrowing was done properly, the cost would be a maximum of £2,000.

**Oysters:** As there is a commercial element to this venture, the States would not have to pay for this part of the sea lettuce reduction scheme.

*Compare these costs to the huge annual amounts (£30,000+ pa) spent pushing St Aubin’s Bay sea lettuce to the low water mark over the last several years. Compare too, the environmental and social costs and benefits.*

---

8 If you would like a more detailed explanation, please email us – details on last page.

9 Plans to reintroduce substantial numbers of *Ostrea edulis* to the area mean not only would more nitrates be potentially taken from the water, but the oysters themselves contribute to a balanced ecosystem, part of which is the development of associated colonies of nitrifying bacteria.
Chemical Soil

The soils in Jersey are not, in the main, in a good shape. The resultant health problems caused by lack of minerals and the applications of pesticides such as glyphosates are outside the remit of this short report, but one benefit of ‘sorting our soils’ will be to stop needing to poison the soil, plants and us and to help all return to health. Here we will concentrate on the use of NPK\(^{10}\) fertilisers and as they pertain to Jersey’s sea lettuce problem and briefly outline why we need to be turning to soil regeneration strategies.

What is it?

Chemical soils are those that have been subject for a long time to the use of artificial fertilisers (usually NPK-based) and pesticides\(^{11}\). Plants deprived of their needed range of minerals need fertilisers to help them grow. We have seen huge amounts of NPK fertilisers shipped into the Island to help feed our ailing plants.

Chemical soils also lack life and structure, so do not hold onto carbon and water as they might. Instead, soils become compacted and easily allow water to wash over and through our agricultural fields.

What’s the problem in Jersey?

In terms of NPK fertilisers, the nitrogen and phosphorus components are those that help feed sea lettuce blooms. Nitrates and phosphates not used by plants stays in the soil until it rains, whereupon the chemicals are flushed out into the sea via natural water courses or via Bellozanne sewage treatment works. While a new plant is planned, the current one at Bellozanne is old and not fit for purpose and won’t extract the excess nitrates\(^{12}\), so they flow into St Aubin’s Bay.

Of course, nitrates and phosphates enter the sea all around the Island, but other bays do not have the ‘perfect storm’ of circumstances to facilitate regular, uncontrollable sea lettuce blooms.

Some of the nitrates permeate the bedrock and trickle out in solution gradually; this could turn out to be a very long-term problem for us, but we need to do tests to ascertain the degree of the problem.

What are the effects?

Excess nitrates, added to the phosphate load, shallow and warm standing water, poor currents and more (see Why sea lettuce thrives in St Aubin’s Bay, above) mean sea lettuce has the perfect environment to bloom for long periods.

---

\(^{10}\) N = nitrogen; P = phosphorus; K = potassium. (‘K’ comes from the Latin ‘kalium’ for potash.) Although the other minerals are needed for good health, plants need more N, P and K than any of the others.

\(^{11}\) Insecticides, fungicides, larvicides, bactericides and herbicides.

\(^{12}\) The new one could, but won’t – as yet, anyway – because of the cost.
An opportunity missed

Soil ecologist Glyn Mitchell has been overseeing field trials in Jersey\textsuperscript{13}, which are aimed at regeneration of soils: essentially, the soil microbial regeneration places back essential microbes into the soil (to suit the crops the farmer wishes to grow). As the soil regains natural health and fertility, the use of chemical fertilisers reduces; results in Jersey and elsewhere indicate a period of one to four years (depending on initial conditions).

In the trial areas, essential and beneficial bacteria and fungi have been returned to the soil and the increased plant health and general biodiversity is very obvious. In addition, we have seen some very surprising and interesting results being thrown up.

The results are not just based on eye-view alone, but also on chemical testing carried out by an independent laboratory. However, in a sad reflection of Tony Legg’s tale (see Opportunities Missed, above), the States of Jersey also showed discourtesy and disinterest in Mr Mitchell’s work. The States of Guernsey, on the other hand, are keen to work on the project, and trials, under Mr Mitchell’s direction, are underway over there.

Plant health (and thus ours) aside, other benefits are thus: proper, microbe-rich humus develops, sequestering carbon and holding onto water – like we (or at least people of my age) learned about at school and saw for ourselves on field trips. The latter means there is less runoff when we have heavy rain, and fewer remaining NPK nitrates are flushed into our water courses at once, meaning the nitrate and phosphate load in St Aubin’s Bay is not so large.

An opportunity for 2018

The States of Jersey could:

- Back actual trials, making sure they are properly done
- Start rewarding farmers for regenerative practices instead of for farming with chemicals
- Underwrite\textsuperscript{14} the crops in the trials (about £8,000 per hectare) for the first few years

Jersey is a small island, with relatively little red tape. We have a fairly enclosed ecosystem and could become world leaders in regeneration of soils.

There is more, much more, but we are sticking to sea lettuce-related issues here. Mr Mitchell is happy to talk about the projects, the results, and to show interested parties the fields in question; his details are at the end of this report.

\textsuperscript{13} Mr Mitchell, who runs the Credible Food Project is overseeing farmer-led field trials that are also being studied by undergraduate Lucy Jouault of Oxford Brooks University, under the direction of Professor Martin Hodgkin, Dr. Elaine Ingham of SFW and Professor David Johnson from New Mexico State University. Qualitative soil assessments are processed in Jersey (by the farmer); they are available for inspection against conventional soil assessments done by a UK laboratory.

\textsuperscript{14} Underwriting means just that – the chances are the funds would not be needed.
Conclusion

We wish to work with the States and wider scientific communities on the sea lettuce problem and we sincerely hope our suggestions will be properly looked at. We also look forward to hearing others’ experiences and results at the conference and to maintaining contact after the event.

Contact Details & Links

Copies of this report, Tony Legg’s full report and Glyn Mitchell’s study are available from sosjersey.co.uk/jersey-sea-lettuce-conference-2017, along with other helpful links.

Alternatively, you can contact Jacqui Carrel, Tony Legg and Glyn Mitchell directly:

**Jacqui Carrel**  
BSc (hons) Environmental Science, PGCE Rural & Environmental Sciences  
jc@sosjersey.co.uk | +44 (0) 7797 733 613

**Tony Legg**  
BSc (Hons) Applied Zoology (UCNW) CiBiol, MIBiol, MIFM  
tony@legg.co.je

**Glyn Mitchell**  
Soil Ecologist, Credible Food Project  
crediblefood.com/new-blog/  
glynmitchell@gmx.com | +44 (0) 7797 844 116