Sussex Kelp Recovery Project

Progress & Impact Report

2023

sussexkelp.org.uk

“This large-scale protection of over 300 kilometres of seabed is a vital win in the fight against the biodiversity and climate crises.”

Sir David Attenborough, in response to the Sussex Nearshore Trawling Byelaw

Dan Smale

Foreword by Henri Brocklebank

Chair of the SKRP Steering Group

In March 2021 the recovery of the Sussex nearshore seabed began. Three years seems like a long time ago in our human terms. At the time we were cautiously coming out of a Covid lockdown, which feels like an increasingly distant period of our lives. But from the perspective of nature recovery, three years is really just the beginning.

Over those three years, the Sussex Kelp Recovery Project has developed and evolved, and we have worked and connected with so many people and organisations along the way. The pace and momentum has been extraordinary, but as we have had our meetings, zoom calls, webinars and screenings of films, the Sussex marine area has been starting its journey.

We know from all the sharing of information and the beautiful and moving film footage of Sussex Underwater and Big Wave TV, many thousands of people are now inspired by the Sussex seabed and what is happening here. While we learn what recovery in Sussex looks like, we are also learning about our delicate and beautiful marine ecosystems and the lesser-known wildlife that we share Sussex with. If you are reading this report, then I hope you have watched 'Our Sea Forest' (Big Wave TV; BBC1) and seen the majestic Sussex Stingrays swimming through the kelp of Bognor Reef. That single shot (a masterpiece by the filmmakers) says more about marine recovery than my written words can ever convey.

As we reach the three-year mark, we are meeting the balance point between anecdotal evidence and empirical, scientific evidence. Our anecdotal evidence comes from divers, commercial fishers, sea anglers and others and our empirical evidence comes from an array of scientific researchers and a growing group of citizen scientists.

In SKRP we take this balanced approach to evidence seriously. We need both. We are excited when catches of a particular fish are reported to be increasing after decades of decline, or when species that have not been recorded in Sussex for many years are spotted. This all tells us our marine ecosystems are changing – but in order to demonstrate the impact of the Byelaw we necessarily continue to measure and record what we see, so that the change can be robustly documented, and the correct conclusions drawn.

In a project that covers 300km^2, both forms of evidence are critical. But even more important than the balance between these two types of evidence are the insights that we take from them and, consequently, the decisions that the evidence informs. There is clearly a loss of kelp in shallower waters taking place. The causes of this loss are as yet unknown and we don't know if the same causes might affect kelp recovery further offshore. We'll be working with experts to understand more about what is happening in both habitats.

We hope in this report we have put the work and experience of academic researchers and sea users into full sight and shown you the context into which all this energy and effort is going. As we work with today's marine scientists and marine naturalists, we hope that we are going some way to inspiring the next cohort of younger people into those fields.

Henri is the Director of Conservation at Sussex Wildlife Trust
Sussex Wildlife Trust

The term *rewilding* describes what is happening here in Sussex, as we step back and let nature repair the damage of decades. SKRP's work is just one of a growing collective of global marine rewilding schemes. These are increasingly connected to, and learning from, each other. Additionally, the Sussex Nearshore Trawling Byelaw is just 300km^2 in a broader Sussex and Solent Seascape, and marine recovery will ideally involve multiple areas of protection and ecosystem improvements.

Foreword by Henri Brocklebank continued...

Here in Sussex the ability to enable change has been made possible by the Sussex Inshore Fisheries and Conservation Authority's statutory fisheries management byelaw process. However it is clearly not just Sussex eyes watching what is happening here, but also decision makers from elsewhere, keen to see how the Sussex seabed recovers and what aspects of our Sussex 'case study' are transferable to the many other locations where depleted marine ecosystems are found.

I want to thank the whole partnership for their ongoing commitment to our shared ambitions, they are a passionate team to work with. We very much appreciate the contribution of the scientific institutions and researchers that are informing our science programme as well as the ongoing contribution from the sea-using community. It is truly a collective and collaborative effort that depends on good communication, robust discussions and an adherence to shared goals.

An assumption about SKRP's work is that it is 'government funded' – the reality is that the work of the partnership and our associated research is financed by a vast array of funders, spanning corporate, charitable and philanthropic sectors. We have named funders in this report where applicable, but the reality is that the proportion of funding coming from statutory bodies is extremely limited. Every organisation in the partnership takes responsibility for fundraising their own contributions to SKRP work.

2024 to 2025 promises to be another exciting year for SKRP and we look forward to our second Kelp Summit in the autumn to bring together our Sussex experience against a national backdrop of marine recovery. The global aim is to see 30% of our oceans protected for nature by 2030 and there will be lessons that can be learnt from Sussex that could help this vital imperative.

Paul Boniface

Contents

All activities undertaken by the SKRP are aligned to its principles and support its aims, which in turn contribute to the delivery of its mission and vision. The main body of this report is divided into different sections, each covering one of the five SKRP aims and detailing the activities that are collectively working to achieve it.

Cover image: Blue-rayed Limpet on kelp.
Sam Roberts

SKRP vision

Our vision

The recovery of kelp and other essential fish habitats at scale in Sussex supports a thriving and sustainable marine ecosystem that benefits nature, fisheries, coastal communities and our planet.

Our mission

To champion, study and facilitate the recovery of Sussex kelp and other essential fish habitats, through progressive, coherent and collaborative action.

Our principles

- Working in collaboration with organisations, groups and individuals.
- Using and promoting an adaptive, science-led approach.
- Putting nature and climate at the centre of decision-making.
- Only committing to a natural capital approach where this results in a positive result for nature.
- Sharing SKRP research, experience, learnings and progress.
- Acting as a point of contact for the recovery of Sussex kelp.

Our aims

Aim 1

To **support and monitor** the **natural recovery** of kelp and other essential fish habitats in Sussex, and the impact of the Sussex Nearshore Trawling Byelaw.

Aim 2

To **understand the ecological, social and economic value** of kelp and other essential fish habitats in Sussex.

Aim 3

To **identify and minimise damaging impacts** on existing and potential kelp habitat and other essential fish habitats.

Aim 4

To **assess the need for,** and the feasibility of, **active kelp restoration.**

Aim 5

To **increase understanding and community engagement** in Sussex kelp and other essential fish habitats, so their importance to the environment and society is known, and to enable marine ecosystem recovery elsewhere.

Sussex Kelp Recovery Project

2023 Highlights

Conservation

300km²
of seabed protected from trawling by the implementation of the Sussex Nearshore Trawling Byelaw in March 2021. (p15)

Coverage

1.3m views in its first month
Sussex kelp reached a national audience through the inspirational BBC1 documentary Our Sea Forest, which shared its story through the eyes of local diver Eric Smith. (p10)

Collaboration

41 cross sector stakeholders
Attended the Sediment Monitoring & Adaptive Response Workshop in May 2023, to identify the steps towards minimising sediment's impacts on kelp recovery and fisheries. (p49)

Citizen science

241 kelp recorders
The community of local people recording their sightings of kelp (whether on the seabed or washed up on the beach) grew in 2023. (p21)

Connection

1st global kelp rewilding project
SKRP became part of the global Kelp Forest Alliance – a network of kelp projects and champions – and the first natural rewilding project on their pledge map. (p70)

Sussex Kelp Recovery Project

2023 Research highlights

Innovation

Pioneering techniques

Despite extremely poor visibility underwater, three Autonomous Reef Monitoring Systems (ARMS) and their precious cargo of plants and animals were retrieved from the seabed off Worthing in November 2023. (p30)

Carbon storage

Uncovering historic carbon

41 carbon cores have been collected to date from nearshore sites in Sussex Bay. These will be dated using gamma spectroscopy and their sources of organic materials identified via eDNA stable isotope analysis. (p42)

Surveillance

84 hours of BRUV footage

A third year of BRUV (Baited Remote Underwater Video) surveys were conducted. Footage is analysed to assess species diversity and abundance, and the composition of fish and invertebrates attracted to the bait. (p26)

Fisher engagement

Engaging local fishermen

Collaboration with fishers across Sussex increased through activities undertaken by the University of Exeter, Blue Marine Foundation and Adur & Worthing Councils, including a visit to meet peers in Lyme Bay. (p60)

Fisheries

Lobster numbers on the rise

New potting survey data at Selsey shows a gradual increase in lobsters over time, aligning with anecdotal reports from fishers. (p36)

Signs of biodiversity rebounding in Sussex Bay

While kelp in Sussex is yet to bounce back, the emergence of other species and habitats are promising steps towards this as they point to an increasingly healthy and diverse seabed.

The Sussex Nearshore Trawling Byelaw aims to remove a significant pressure from the seafloor to give essential fish habitats, including kelp, the opportunity to recover. Three years on, and as expected, kelp coverage is still low. Anecdotal evidence from divers, commercial fishermen, anglers and others, however, paint a picture of the once barren seafloor coming back to life in places. Here we look at some of the signs.

Return of mussel beds

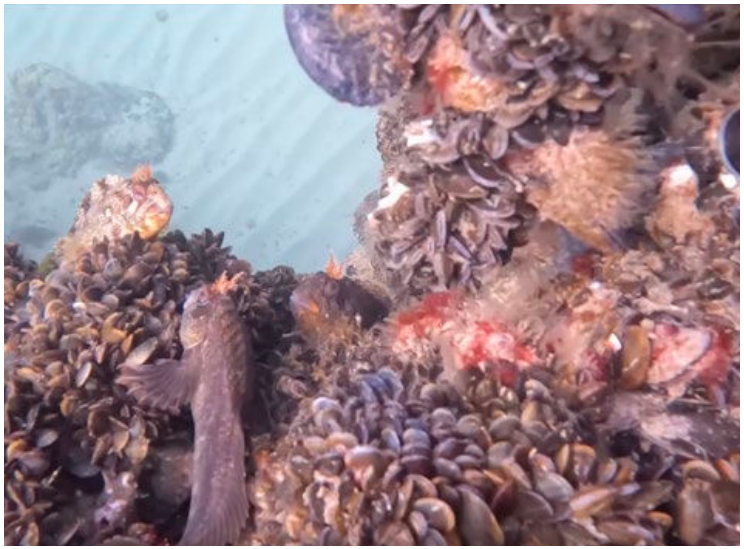
Laid down over millions of years, vast mussel beds used to cover the sea floor of Sussex Bay, several feet deep. It was on these beds that kelp used to grow, but they, like the kelp itself, disappeared following years of trawling. Since the Byelaw, sightings of mussels have increased, with anecdotal evidence in late 2023 of beds in some areas the size of football pitches! This is positive news for marine life as mussels, like kelp, play a vital role in the ecosystem; they filter water, are a food source for other animals and provide habitat for plants, invertebrates, and fish.

Nesting Black Sea Bream

Black Sea Bream *(Spondyliosoma cantharus)* are a benthic species which means they live close to the seafloor, and make their nests, called lunar pads, on the seabed. Because of this, their reproductive cycles are inherently linked to the condition of benthic habitats, and they are particularly vulnerable to bottom towed gear – indeed bream were a target species for trawlers in the Sussex Bay area. In the past year, increased sightings of Black Sea Bream and their nests, such as those featured in the Our Sea Forest film, and mentioned anecdotally by fishermen, is a positive sign that the breeding population is growing.

Sightings of rare species

A critically endangered Angel Shark *(Squatina squatina)* was caught near Brighton and returned to the sea in the summer of 2023, the first time this species had been seen in Sussex for decades!



Left: A Tompot Blenny rests on a mussel bed.
Sussex Underwater

Right: Black Sea Bream
Big Wave TV

"Over the last two-three years I, and other local fishermen, have noticed a steady increase in Bream stocks and these are now more widely distributed... Plus, more Bass shoals, both juvenile and larger. Generally, marine life appears to be on an up-turn."

Clive Mills, Bognor fisherman, February 2024

Our Sea Forest

Kelp in Sussex was at the heart of a captivating documentary by Big Wave TV, broadcast on BBC1, in September 2023.

Our Sea Forest, narrated by Chris Packham, tells the moving story of how our once thriving underwater forests, home to a multitude of different sea creatures, were lost and their slow road to recovery. Told through the eyes of Eric Smith, a Sussex free-diver of more than 60 years, the film poignantly captures the devastating impact that habitat loss can have on local people. But also, the profound sense of hope and joy a recovery can evoke.

Filmed over three years, **Our Sea Forest** was shown at 830PM on BBC1. It received rave reviews and struck a chord with viewers who inundated its stars, Eric and his daughter Catrine, with thousands of heartfelt messages through their community Facebook page, Sussex Underwater. A screening at the Ropetackle Arts Centre in Shoreham-by-Sea, also sold out.

The documentary is a milestone for local and national conservation and is the first time Sussex and its marine life have been the focus of a broadcast film.

"I wanted to make a really emotional story that made the viewer care about our lost forests, but also gave some hope."

Sarah Cunliffe , Director

The film can be seen on BBC iPlayer until September 2024. Read more about Eric, Catrine and Sussex Underwater on page 57.

Future outlook

From the introduction of the landmark Sussex Nearshore Trawling Byelaw in March 2021 and the subsequent formation of the Sussex Kelp Recovery Project partnership, to its ongoing collaborative research effort, and the communities and people that are passionate about restoring healthy seas, this report summarises the journey of marine recovery in Sussex so far and how a collective effort is literally putting kelp back on the map.

The return of Sussex kelp will take time. Annual surveys over the next 5-10 years are needed to record how and at what rate marine ecosystems recover from the impacts of trawling. Monitoring is also essential to allow the SKRP to assess the impacts of other factors such as storm events, sedimentation, pollution and climate change which could hinder recovery and undermine the benefits of the Byelaw.

Over the coming year, we will be heading out to sea to collect the next round of evidence to understand how the marine ecosystem is responding to protection. With the research programme well underway, and to build on the heightened interest following the Our Sea Forest film, community engagement, events and outreach with schools and local communities will be a key focus.

This is a collective journey, bringing together a wide network of people and organisations, with a common vision for nature recovery on a grand and pioneering scale. With early signs of marine life returning, the SKRP is hopeful to be able to say, in the words of Eric Smith, the godfather of Sussex kelp recovery, “We are winning!”

The coming years are an exciting time for the SKRP as the partnership deepens its understanding of how nature responds to the removal of a key pressure. It has been an inspiring journey so far and we hope you will join us in helping our marine ecosystem recover to benefit people, nature and climate.

An open Blue Mussel showing its mantle.
Big Wave TV

About Sussex kelp and the Sussex Kelp Recovery Project partnership

Diver holding kelp
Catrine Priestly

What is kelp?

Kelp are flat-bladed, large brown seaweeds commonly found around rocky shores. They often grow in dense 'forest' patches, creating some of the most biodiverse marine environments on the planet. Kelp can be thought of as 'marine trees' anchored to the seabed, creating a 'canopy' beneath which numerous species take shelter and find food.

The SKRP focuses on four historically common kelp species in Sussex (see infographic on page 14):

- Oarweed *(Laminaria digitata)*
- Tangle *(Laminaria hyperborea)*
- Sugar Kelp *(Saccharina latissima)*
- Furbellows* *(Saccorhiza polyschides)*.

While occasionally seen exposed at low tides, most kelp are permanently submerged (subtidal). All kelp have a claw-like 'holdfast' to attach to rocks, pebbles and artificial structures. They are vulnerable to detachment during storms and are often found washed up on beaches.

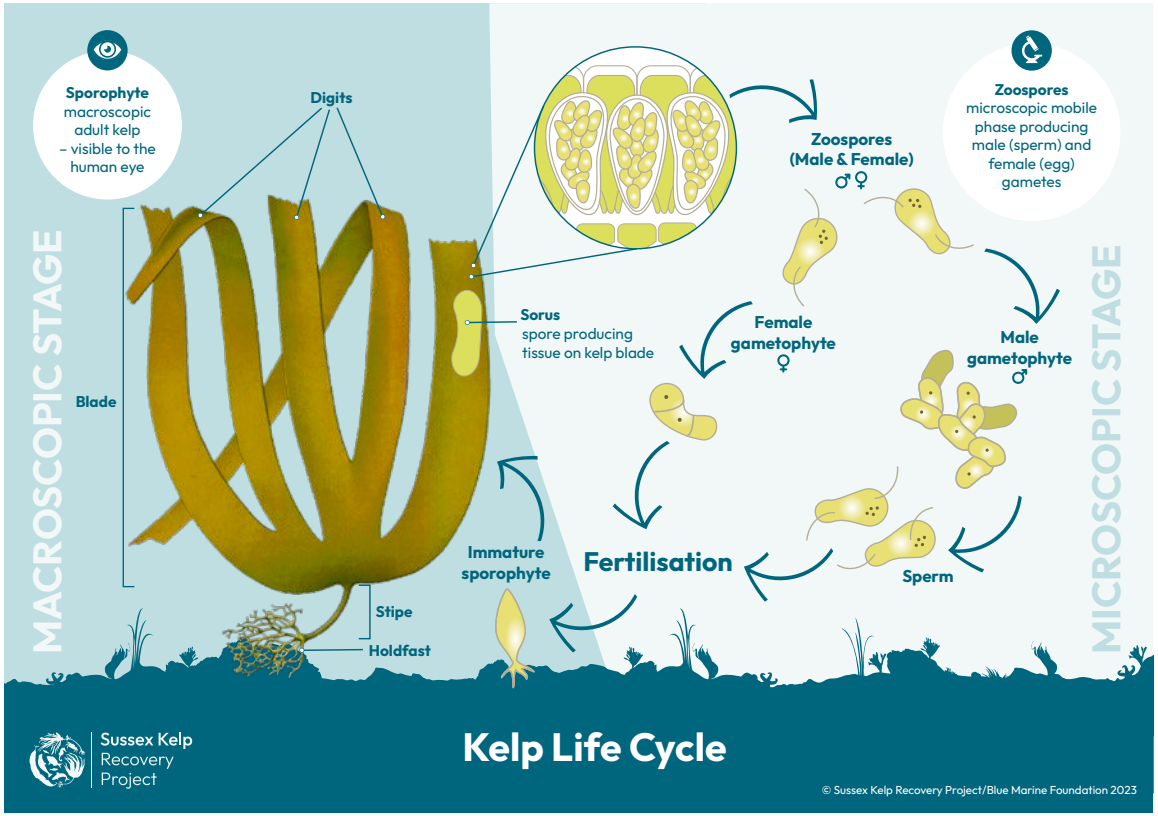
Lifespan

Some kelp are perennial and can live for over two decades (Oarweed and Tangle). In contrast, Furbellows is an annual species living for just one year, while Sugar Kelp can be annual but often lives for two or three years.

Kelp lifecycle

Kelp starts its life as a free-floating microscopic organism called the 'gametophyte'. The kelp we see growing on the seabed is a 'sporophyte', and this is the final phase in its multi-staged life cycle. All young sporophytes develop a simple blade (not a leaf) and it's difficult to tell young species apart. They either continue to grow into a single large blade (Sugar Kelp) or develop a longer stipe (stem) and a wider blade to create the familiar 'trident' form where the blade splits into multiple fronds or digits (Oarweed, Tangle and Furbellows).

*Furbellows is not a true kelp, but is often considered a pseudokelp due to similar appearance and ecology.



Sussex Kelp Species

Oarweed

Laminaria digitata

Perennial – 4–6 yrs
Blade split into 5–12 digits
Short, smooth, bendy stipe
1–1.5m average adult length
Depth range 0–15m


Tangle (aka Cuvie)

Laminaria hyperborea

Perennial – 5–18 yrs
Blade split into 5–20 digits
Long, rough, rigid stipe
1.5–2m average adult length
Depth range 0–30m


Sugar Kelp

Saccharina latissima

Annual/Perennial – 1–4 yrs
Single long frilly blade
Short stipe
1–1.5m average adult length
Depth range 0–30m


Furbellows

Saccorhiza polyschides

Annual – 1 yr
Blade split into 3–30 digits
Flattened stipe, bulbous holdfast
1–2m average adult length
Depth range 0–35m


Sussex Kelp Recovery Project

The origins of the Byelaw

In the late 1970s, abundant kelp beds between Selsey and Shoreham-by-Sea teemed with life, including important commercial species such as European Seabass *(Dicentrarchus labrax)*, Black Sea Bream, European Lobster *(Homarus gammarus)* and Common Cuttlefish *(Sepia officinalis)*.

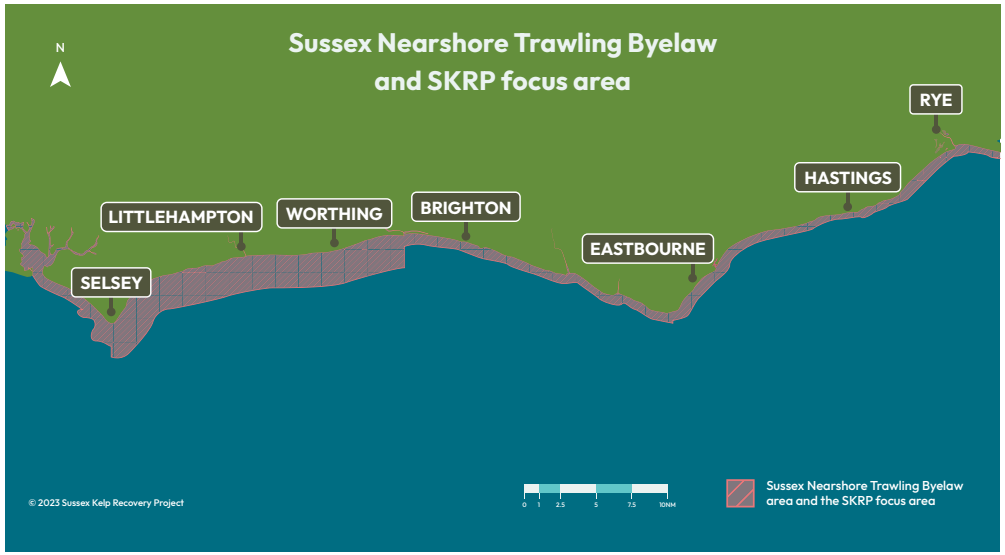
By the end of the century, 96% of the kelp had disappeared, along with the marine life it supported. Among the factors that caused the kelp to disappear were the great storm of 1987 and intensive fishing activity in the area using heavy trawl nets (trawling) which, when dragged along the seafloor, can destroy seabed habitats.

In 2010 an inshore habitat map – commissioned by Sussex Inshore Fisheries and Conservation Authority (IFCA) and created by the University of Brighton – showed how habitats in the area had changed and ignited discussions about kelp's role in the ecosystem. Over subsequent years, Sussex IFCA, who manage the area from the shoreline out to 6 nautical miles, created a compelling case to initiate a new piece of legislation which aimed to protect essential fish and marine habitats, and support sustainable inshore fisheries: the Sussex Nearshore Trawling Byelaw.

Inspired by an iconic film made by Big Wave TV, local and national organisations came together as the 'Help Our Kelp' group to promote the Byelaw and campaign for its implementation. Championed by Sir David Attenborough, Help Our Kelp generated huge public support and on 18 March 2021, trawling was prohibited from 304 km² of the Sussex coast.

Historic records show dense kelp beds in West Sussex at the start of the 1980s.

By 2019, only 4% of kelp beds remained.



In turn this launched the largest kelp recovery project in the UK, when in Spring 2021, Help Our Kelp's partners, along with Sussex IFCA and others, came together to form the Sussex Kelp Recovery Project partnership, and to collectively support the aims of the Byelaw.

Sussex Nearshore Trawling Byelaw and SKRP focus area

The Sussex Nearshore Trawling Byelaw area extends along the entire Sussex IFCA district, between 0.75km to 1km from Chichester Harbour in the west to Rye Bay in the east (as shown above).

A larger area of protection is in the west, which extends 4km seaward between Selsey Bill and Shoreham-by-Sea. Historic records show that this area was once covered by dense kelp beds and is therefore the initial focus for SKRP research and activities.

Byelaw timeline

Overleaf: The pathway to the Byelaw's implementation has been captured by the Marine Conservation Society to provide learnings for future ecosystem-based fisheries management.

Key milestones The Sussex IFCA Nearshore Trawling Byelaw 2019

MARINE CONSERVATION SOCIETY

1959

Background

Evidence of expansive kelp forests from historical diver surveys and anecdotal stories. Anglers become interested in netting and trawling restrictions. Highly productive static gear commercial fisheries associated with kelp. Anglers become interested in netting restrictions.

1987

Baseline shift

Council reports expansive kelp across West Sussex and a large storm washes kelp ashore making local people unhappy, the issue is discussed in parliament.

1990

Increased fishing inshore

Advances in fishing technology and changes in Sea Fisheries Committee (SFC) legislation lead to increased inshore trawling with larger trawlers allowed inside the 3 mile limit. Divers record decline in kelp across the Sussex district and static gear fishermen observe a decline in commercial species off west Sussex.

1995-98

Changes for trawling

Inshore pair trawlers allowed to target bass and bream west of Shoreham-by-Sea in the late spring and early summer. SFC District extended out to the 6 mile limit and a New Vessel Length Byelaw prohibits boats over 14m in the District*. In 1998 a trawling exclusion byelaw that prohibits trawling from 58 km^2 of the District between May and October is introduced recognising presence of juvenile flatfish species.

*Grandfather rights were given to vessels over 14m already operating in the area

2001 -03

Monitoring & Enforcement

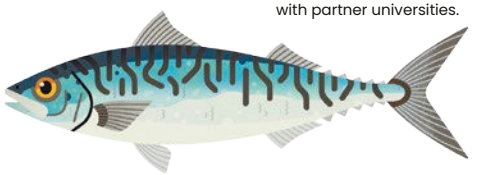
Significant changes in SFC management & leadership result in a strategic approach to the collection of marine habitat and fishing activity data to inform future management. Local fishermen and divers go to parliament to raise concerns about trawling.

In 2003 the new Patrol Vessel 'Watchful' becomes operational. Patrol & enforcement increased and there are prosecutions for vessels over 14m found fishing in the District.

2005

Policy shift

The Millennium Ecosystem Assessment values ecosystems and the services they provide to human well-being. As a result, ecosystem services were increasingly considered within environmental management.



2010

Sussex IFCA steps up Research

Sussex IFCA is formed and continues habitat & fishing effort research alongside development of long term juvenile fish survey. Habitat mapping projects undertaken with partner universities.

2012

Management review

Sussex IFCA carry out a public consultation to help identify management priorities alongside their statutory duties to introduce management on MPAs and review byelaws. Local anglers and some commercial fishers identified in this consultation that nearshore trawling was an issue in the west.

2012

Management approach

Using extensive inshore habitat data, Sussex IFCA systematically examine the type and extent of natural capital assets within the District, their sensitivity, diversity, associated ecosystem services and value. The angling community begin a three-year survey looking at juvenile fish along the Sussex coast.

2016

Byelaw review phase

Sussex IFCA reviews towed gear management and proposes new trawling restrictions with the aim to allow the natural capital of valuable sensitive sites inshore to reach its full potential and deliver improved ecosystem services. Particular emphasis is placed on recovering productive static gear fisheries that have declined. New netting management restrictions are considered in parallel.

January 2017

Collating Evidence

Evidence to support the need for management intervention on trawling is collated. This includes data about fishing activity, marine habitats and available evidence about potential future recovery. Information Sheets produced to support informal consultation.

December 2017

Informal consultation

Information about potential management interventions were shared online and stakeholders were consulted. Feedback was collected through online and paper surveys, seven public drop-in sessions and targeted communication. Stakeholders responded through email and letters and a report collated and analysed these responses.

July 2018

Management options

Analysis of the informal consultation is prepared and shared with Sussex IFCA members through the Committee structure and further evidence is provided alongside the draft management options.

October 2018

Final management options

Draft final management options are considered by the Authority. Towed camera surveys carried out to determine baseline seabed quality before restrictions. A natural capital approach was applied, and a condition assessment model was utilised.

March 2019

Draft byelaw

Management option and draft byelaw text options presented to the Authority members by officers. Members of commercial industry present at the meeting. Independent economic analysis of two pair trawler teams carried out. Only small remnants of kelp remains, and the owner Big Wave productions offers to make a film about it.

September 2019

Byelaw made

Quarterly authority meeting the byelaw was MADE with commercial industry present. Big Wave productions makes a film about the kelp in Sussex which is narrated by Sir David Attenborough. It is shared with the Sussex Wildlife Trust, Marine Conservation Society, Blue Marine Foundation and the IFCA.

September 2019

Formal consultation

Launched on the 12th September 2019 and closed on 10th October as outlined by Defra. Sussex IFCA provide information online, post (on request) and at seven drop-in sessions. 'Help Our Kelp' campaigns for the byelaw involving media and lobbying the government. Sussex Wildlife Trust sets up a web page linking to the consultation. There are 2,500 responses.

2020

Quality assurance & Confirmation

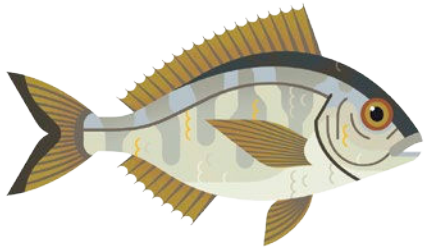
In January the Authority approve the final text of the Byelaw following examination and consideration of consultation responses. In February, the Byelaw and impact assessment sent to Defra and MMO for quality Assurance. Background research about seabed quality continues. The 'Help Our Kelp' campaign continues through school engagement, talking with local fishermen and helping anglers write letters of support. Local MPs receive letters of support and check on the progress of the byelaw within government.

March 2021

Implementation

The Secretary of State signs off the byelaw making it enforceable in law. The Authority immediately issues comprehensive guidance to fishers on the new Byelaw for enforcement purposes.

Compliance response is excellent with no infringements detected to date (Jan 2023).



Future

There are several future plans as a result of the byelaw including monitoring and enforcement by the IFCA. The formation of the Sussex Kelp Restoration Project who will fund additional social and environmental research. Big Wave productions will produce further films about kelp. A citizen's charity is aiming to use volunteers to replant kelp along the coast.

Local authorities are interested in a Sussex Bay Marine Park used to engage local people with the ocean and investigate carbon storage of kelp. It has also been a catalyst for looking into other marine management issues such as sedimentation and national authorities are keen to observe the recovery of the trawling ban area compared to MPAs.

The partnership behind the Sussex Kelp Recovery Project

The Sussex Kelp Recovery Project (SKRP) is a partnership of organisations working together to champion, study and facilitate the recovery of Sussex kelp and other essential fish habitats, through progressive, coherent and collaborative action.

Formed in 2021 after the Sussex Nearshore Trawling Byelaw was introduced, the partnership is a cross-sector collaboration where each partner brings their own unique skills, experience and focus.

In Spring 2024, the partnership comprised academic and research institutions, local authorities, NGOs, community groups and filmmakers. There is no lead organisation; partners work together to set the SKRP vision and strategy.

Marine recovery at the seascape scale requires the collaboration and support of a very wide community. The SKRP is grateful for the support of the SKRP Network, comprising members of the public through to regional, national and international organisations.

Organisations in the SKRP Steering Group

Sussex Wildlife Trust

Sussex Inshore Fisheries and Conservation Authority

Blue Marine Foundation

Zoological Society of London

University of Brighton

Adur & Worthing Councils

Queen Mary University of London

UCL

Affiliated members

Big Wave Productions

Research delivery partners

University of Sussex

University of Exeter

SKRP Network

Over fifty organisations and groups, plus a huge number of local citizen scientists, volunteers and other members of the community in Sussex, who support the recovery of Sussex kelp.

New Kelp Recovery Co-ordinator

In early 2023, George Short joined the Sussex Wildlife Trust as the project's new Kelp Recovery Co-ordinator.

Her role as the principal advocate for the rewilding of kelp and other essential fish habitats in Sussex sees her work with a vast range of people and organisations. A typical day may include meetings with government bodies and researchers, but also fishers, artists and members of the Sussex community. From translating scientific evidence to undertaking outreach and events, she has been pivotal in raising local awareness of the importance of kelp ecosystems and those of other essential fish habitats.

George holds a degree in Marine and Freshwater Biology from Aberystwyth University and a Masters degree in Marine Science from King Abdullah University of Science and Technology (KAUST). Her career has been spent in research and conservation studying the impacts humans are having on the marine environment.

It was while studying in Saudi Arabia that George first heard about the Help Our Kelp campaign which aimed to encourage support for the implementation of the Sussex Nearshore Trawling Byelaw. Cognizant of the Byelaw's potential to reverse decades of decline, she endorsed the campaign from afar. Five years on, she's chuffed to bits to be playing such an integral role in the solution - rewilding of the Sussex seas and its implications for marine recovery elsewhere.

"I'm incredibly proud to be part of such a pioneering effort to make real change for marine life and coastal communities in Sussex and beyond. In the coming year, I'm excited to get out into the water to see the next instalment of natural recovery hiding beneath the waves, to see which species and habitats are starting to make a comeback."

George Short

The SKRP's Research Programme

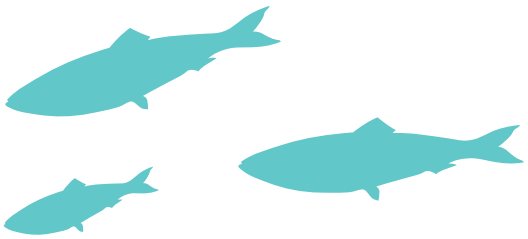
SKRP's Research Programme seeks to deliver on the project's aims by robustly measuring the changes to, and the impacts of, the Sussex Nearshore Trawling Byelaw on kelp and other essential fish habitats in Sussex.

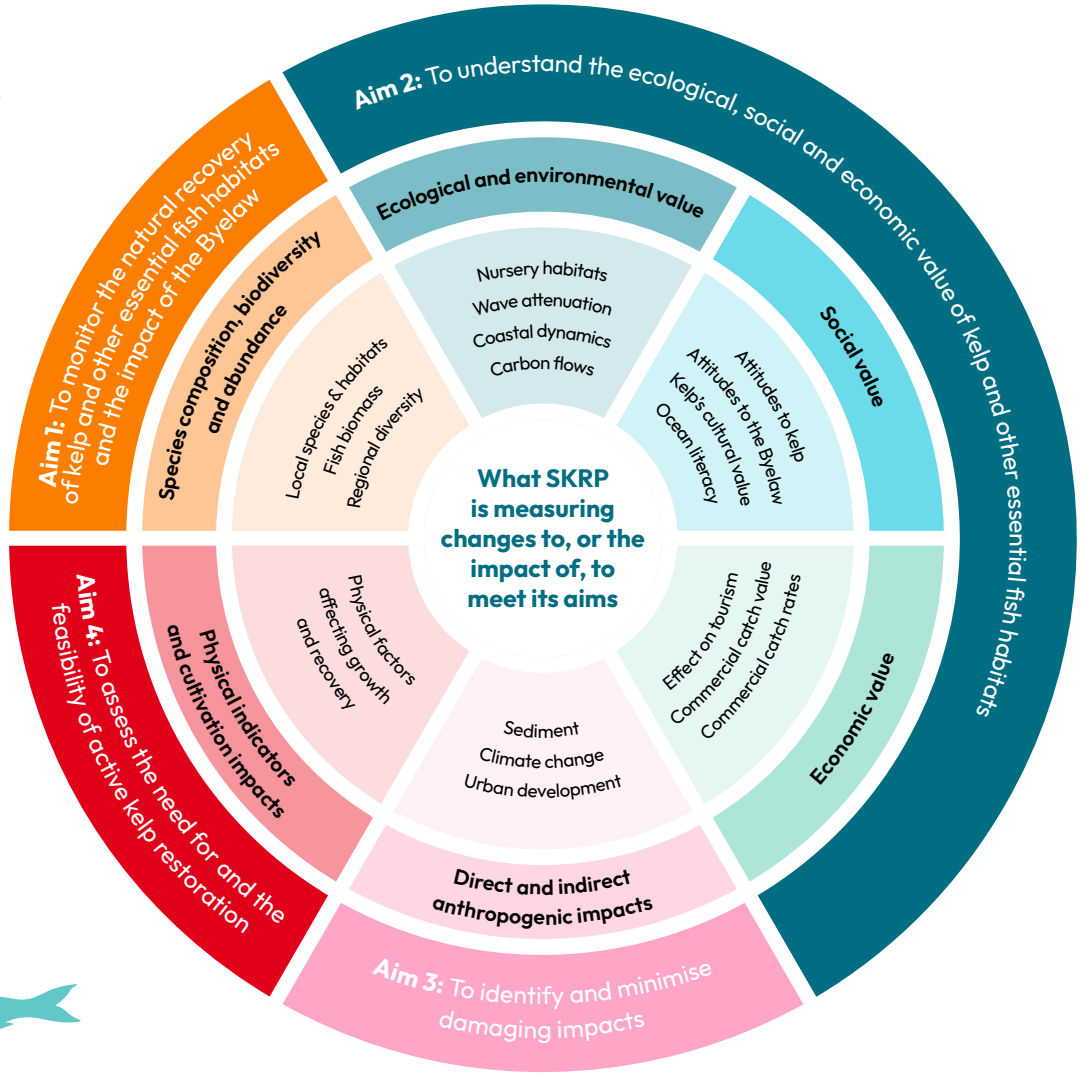
Why is a comprehensive and integrated seabed monitoring and research programme needed?

- Understanding and quantifying the value of kelp and other essential fish habitats using various measures can improve how they are perceived by society and encourage recovery efforts elsewhere.
- The impact of the Sussex Nearshore Trawling Byelaw (one of the largest trawling exclusion areas in the UK) on commercial fisheries needs to be comprehensively assessed, so that policy implications and intended outcomes can be evidenced.
- By monitoring a wide range of environmental and ecological factors, other potential impacts on the ecosystem can be identified, such as increases in herbivores or changes in water quality.

What do we expect the research to tell us?

- Even when key pressures have been removed from an area, the recovery of complex ecosystems can take years and even decades.
- Other species may recover and spread first. In marine habitats, the phases of change (called succession), are expected in a similar way to terrestrial rewilding. The abundance of species is anticipated to change over time until a dynamic mature community is formed.
- In recovering or newly available habitats, pioneer species – such as mussels – are often seen to establish quickly during the initial phases of succession. This is indeed what we are seeing in Sussex.



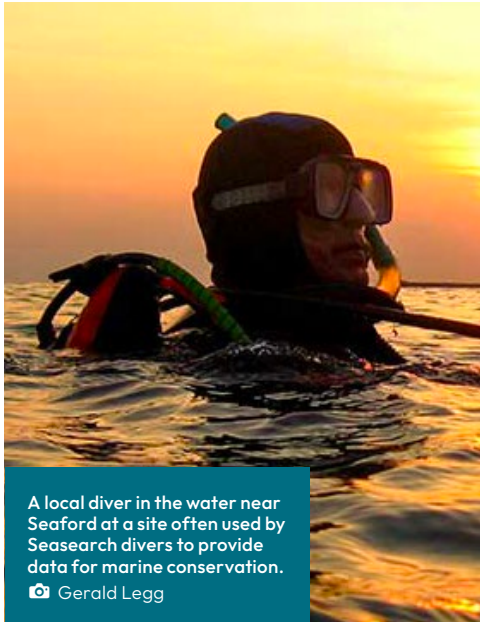


Right: How SKRP aims are delivered through individual research activities

Combining anecdotal and scientific evidence

While the SKRP seeks to collate a robust body of scientific evidence to assess the impacts of the Byelaw and monitor kelp recovery, this is not the only data that it values or collects. Anecdotal evidence from Sussex sea users is a vital and complementary source of information for the project.

Given the sheer size of the Byelaw area and the funding required to undertake such activities, quantitative monitoring and scientific evidence gathered in pursuit of SKRP's aims is necessarily limited to specific sites and/or times. This provides a crucial record of what's happening in certain areas, but not the complete picture.



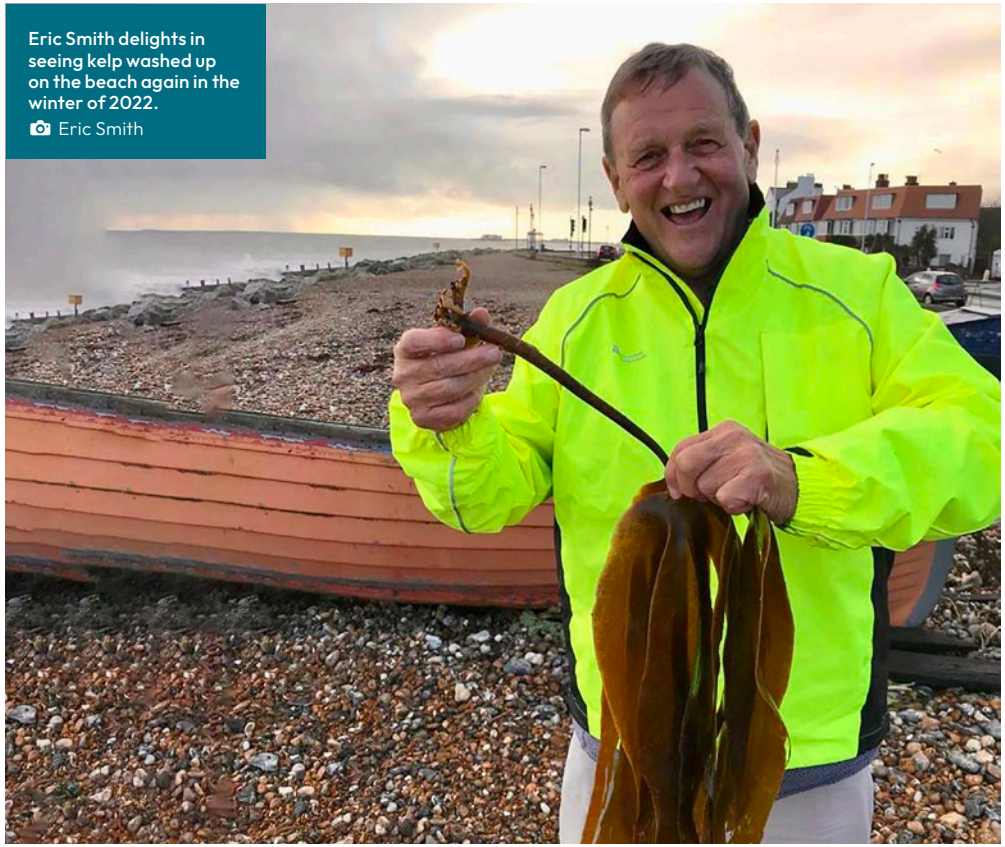
A local diver in the water near Seaford at a site often used by Seasearch divers to provide data for marine conservation.
Gerald Legg

Supplementing this is a growing body of anecdotal evidence, derived from the personal observations and data captured by local sea users such as divers, commercial and recreational fishers, beach walkers, sailors and many others.

To capture anecdotal evidence the SKRP undertakes qualitative interviews and surveys, and reviews photo and video documentation provided by Sussex Underwater and other members of the community.

Blending quantitative and qualitative evidence in this way is a powerful tool; it fills monitoring gaps while also making anecdotal evidence more robust. Additionally, future SKRP monitoring activities are informed by the partners' conversations with local people.

The SKRP is extremely grateful to the members of the community who provide anecdotal evidence.



Eric Smith delights in seeing kelp washed up on the beach again in the winter of 2022.
Eric Smith

"Sussex sea users are in the water every day and between them cover a far greater extent of the Byelaw area than our scientists can. Because of this, they really are the eyes and ears of the project!"

George Short, Kelp Recovery Co-ordinator

How can I help the kelp?

The most common question members of the SKRP are asked is 'What can I do to help the kelp?'. Help can (and has) come in a multitude of ways including filmmaking, funding, collecting evidence and information, and exchanging contacts, images and stories.

Sharing this exciting journey and ensuring that the recovery of the Sussex seabed is a collective endeavour, told by multiple voices for many years, is one of the most important things we can do.

The vast Sussex kelp beds were lost because they weren't visible enough. Now, due to the incredible efforts of local people, scientists, conservationists, documentary makers and others, awareness of the marine habitats and species of Sussex is growing, and in tandem, a local sense of pride in this fascinating and beautiful ecosystem. We hope this will only increase over the coming years.

To 'help the kelp' please share its story, donate to our work through our website, and explore opportunities to participate and collaborate in some extraordinary research.

A citizen scientist recording kelp observations in the app.
Big Wave Productions

Take part in the Sussex Kelp Recording Scheme

Avid beach walker, sea swimmer or scuba diver? Download the app to record when you do and don't see kelp on the beach or out at sea, to help us map where the kelp is recovering. This bespoke recording scheme for Sussex kelp was developed by the Sussex Wildlife Trust. To register, follow the links and fill in the form: sussexkelp.org.uk/volunteer

Volunteer with Sussex Seasearch

Seasearch recruits volunteer divers and snorkellers to help map the UK's near-shore seabed, and to record any species encountered there to build up a database of where different marine life is found. Sussex Seasearch is coordinated by the Sussex Wildlife Trust as part of the Marine Conservation Society's national Seasearch programme. www.seasearch.org.uk

Provide underwater footage

If you are an underwater photographer and are happy to share your existing shots or footage, along with the precise location of the filming, the SKRP can use it to map the distribution of kelp and other species.

To take part contact: livingseas@sussexwt.org.uk

Report sewage events

Report water pollution incidences directly to environmental regulators using their Incident Hotlines. For England, Scotland and Northern Ireland call: 0800 80 70 60

You can also share any evidence with Surfers Against Sewage by emailing saferseasservice@sas.org.uk

Aim 1

To support and monitor the natural recovery of kelp and other essential fish habitats in Sussex, and the impact of the Sussex Nearshore Trawling Byelaw

Grey Seal
Arthur Kingdon

Aim 1: Overview

The partnership's first aim is to support and monitor the natural recovery of kelp and other essential fish habitats. But what does this entail?

Fundamental to understanding the effect of the Nearshore Trawling Byelaw is a programme of research that monitors where, when, and how, the ecosystem recovers. However, assessing change in such a complex and dynamic ecosystem and over such a large scale (the total Sussex Nearshore Trawling Byelaw zone is 304 km^2) is a huge challenge.

Recovery will take time and only by repeating surveys annually for a period of at least 5 years or more will we be able to record how and at what rate ecosystems recover from the impacts of trawling and dredging. Annual monitoring is also essential to allow us to monitor the impacts of any other factors such as storm events, climate change, sediment and pollution events which may hinder recovery.

A comprehensive, collaborative, multi-disciplinary approach is necessary to monitor the recovery of the whole area and the SKRP's research programme involves multiple organisations using a variety of methods.

The following pages describe the cutting-edge scientific techniques, PhD studies, and citizen science projects that in combination create a holistic picture of Sussex seabed ecology, recording how habitats and species change over time in response to the Sussex Nearshore Trawling Byelaw.

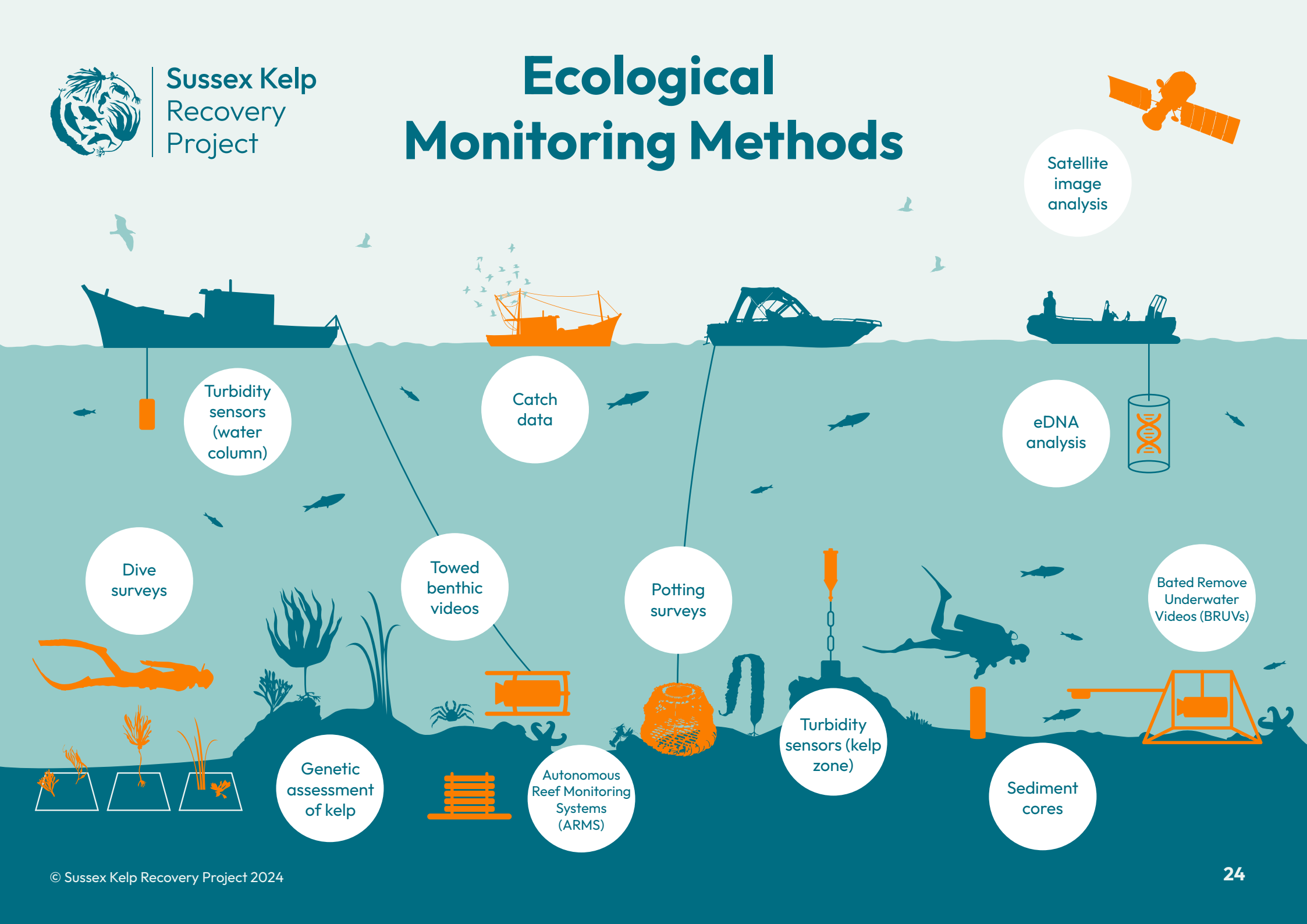
Activity & achievements since 2021

Aim 1: Summary

- 84 hours of BRUV footage analysed
- 75 surveys using towed underwater cameras
- 1 Research project completed
- 3 ARMS units retrieved from the seabed
- 81 species detected through environmental DNA analysis
- Around 400 kelp samples taken for genetic analysis
- Sussex Kelp Recording Scheme initiated
- 5 volunteer seabed monitoring site surveys undertaken
- 2 PhD (doctorate) projects underway
- 7 MSc (Masters) Degree projects completed or initiated
- 3 BSc (Bachelors) Degree projects completed

Sussex Kelp Recovery Project

Ecological Monitoring Methods



Environmental monitoring sites

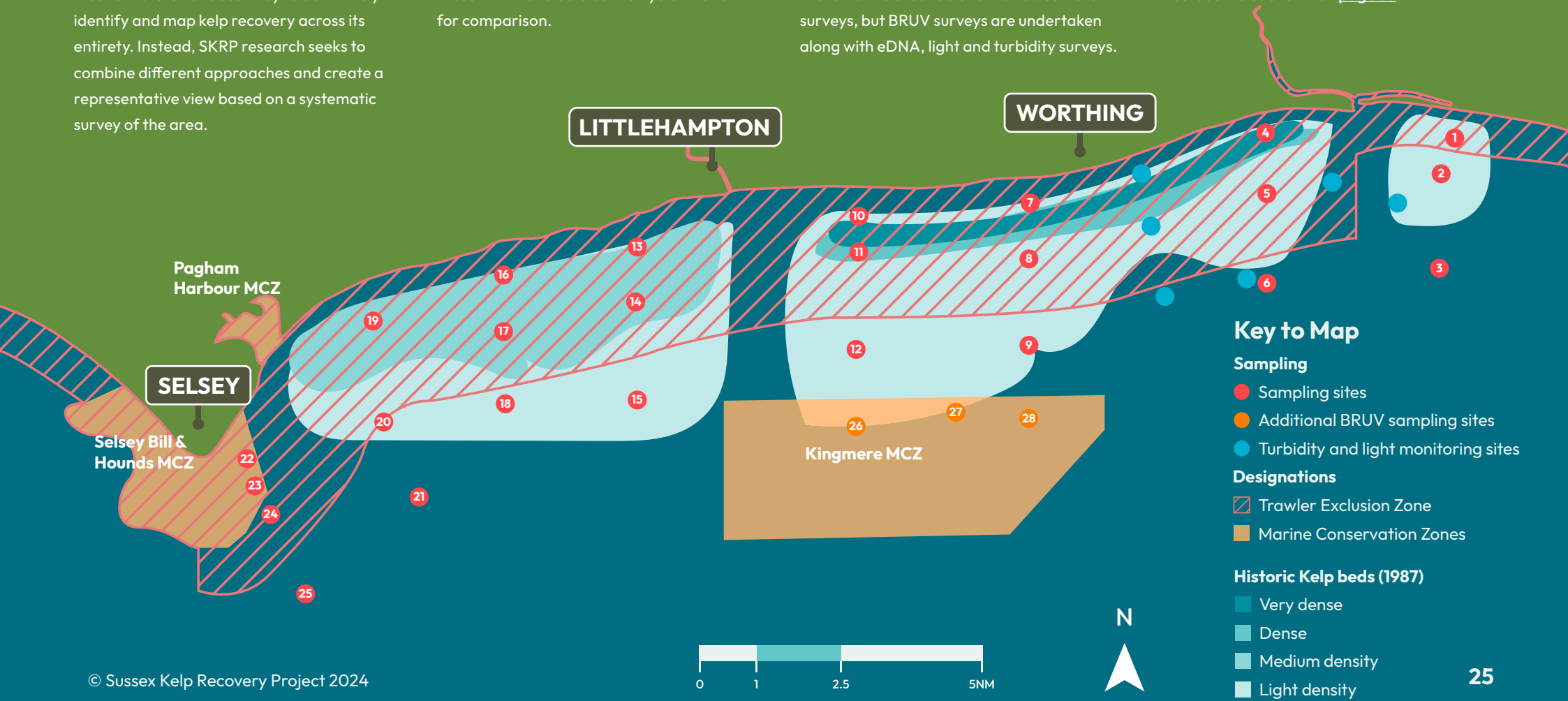
The western part of the Sussex Nearshore Trawling Byelaw zone between Selsey Bill and Shoreham by Sea, which is the focus for SKRP monitoring and research, is a vast area with a shoreline roughly 50 miles long. Its scale, coupled with the inherent challenges of undertaking underwater research, means there is no robust way to definitively identify and map kelp recovery across its entirety. Instead, SKRP research seeks to combine different approaches and create a representative view based on a systematic survey of the area.

The below map depicts the environmental monitoring sites that make up this survey. These span the historic kelp area, including off Worthing where kelp was once very dense (shown in dark blue). Sites extend outwards from the shore in triplicate so that a range of depths can be assessed and include those within and outside the Byelaw zone for comparison.

The 25 red dots denote a fixed GPS coordinate at which four research methods are deployed: BRUV units (3 used per site), eDNA sampling, towed benthic cameras, and turbidity and light surveys. Three further sites shown as orange dots are located inside the Kingmere Marine Conservation Zone (MCZ). Here the terrain is unsuitable for towed camera surveys, but BRUV surveys are undertaken along with eDNA, light and turbidity surveys.

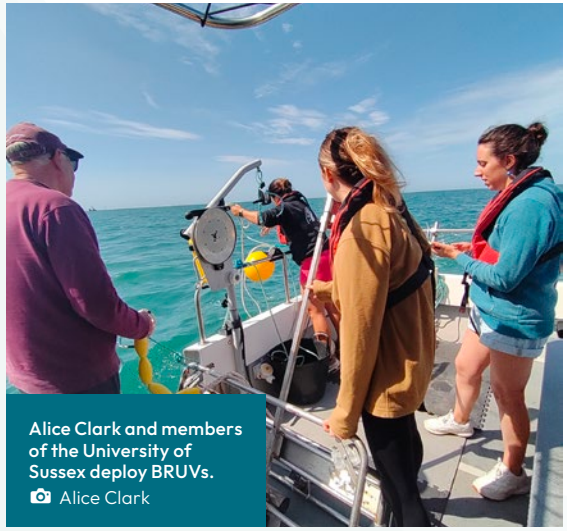
Further turbidity and light monitoring sites (shown as blue dots), are found between the Adur and Arun Rivers.

In addition to the ecological monitoring sites, crab and lobster potting surveys are carried out at sites off Selsey, Brighton and Eastbourne as shown on page 36.



Biodiversity after the Byelaw
– a focus on BRUV surveys

PhD project: Coastal rewilding and food security: understanding restoration pathways using BRUVS (Baited Remote Underwater Video Surveys) and environmental DNA (eDNA).
Alice Clark, University of Sussex



Alice Clark and members of the University of Sussex deploy BRUVs.
Alice Clark

How will the ecosystem in Sussex Bay change following the implementation of the Sussex Nearshore Trawling Byelaw?

To understand what species are using the area and how this changes over time, the University of Sussex, with support from Blue Marine Foundation, deployed BRUVs at 28 sites, including those where kelp was historically dense, in July 2021 and 2022 and in July, August and September 2023.

BRUV surveys use Baited Remote Underwater Video (BRUV) cameras. Data collected from the footage is analysed by PhD student Alice Clark, to assess species diversity and abundance, and the composition of fish and invertebrate communities attracted to the bait.

Over 180 minutes of footage were recorded at each site generating more than 84 hours of video for analysis undertaken by undergraduate and Masters students from the University of Sussex each year. BRUV surveys will be continued over the coming years to identify and track changes.

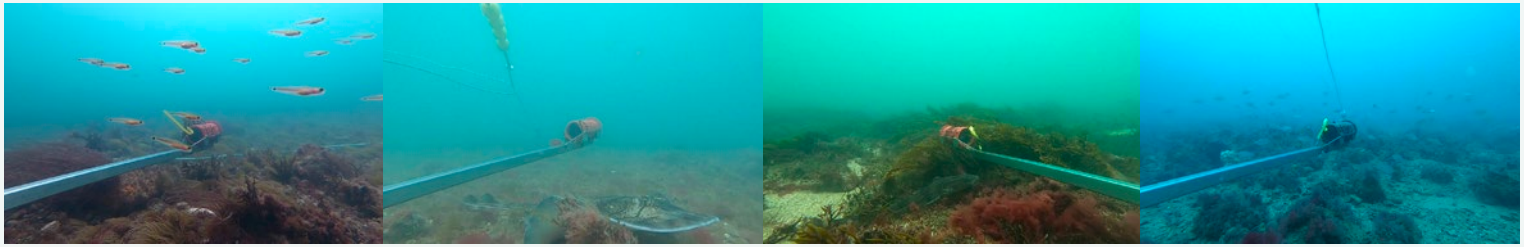
Learnings to date

- Overall, species diversity remained similar between the years of 2021, 2022 and 2023.
- A few species were identified in 2023 which had not been seen before, e.g. the Green Sea Urchin *(Psammechinus miliaris)*.
- No marked difference was seen inside vs outside the trawling exclusion zone, but Black Sea Bream and Conger Eels *(Conger conger)* were more frequently seen inside the trawling Byelaw zone and in Kingmere MCZ.
- A slight increase in pelagic species was detected in 2023, potentially driven by the extended sampling period into August and September.

What can we expect in the coming years?

As kelp and other essential fish habitats recover, the composition of mobile benthic species is likely to change and an increase in herbivores may be seen.

BRUV surveys are being supported by The Pebble Trust and Green the UK business sponsors: Stephens Rickard, Coolstays, OMG Tea, LRG, Wildscreen, Esure and Argentum Apothecary.



Left: Footage from BRUV surveys is used to identify mobile species.

Biodiversity after the Byelaw
– a focus on eDNA

In 2023, alongside BRUV surveys, Alice Clark and University of Sussex undergraduate and Masters students collected environmental DNA (eDNA) samples at each of the 28 sites within Sussex Bay. eDNA is genetic material shed by various organisms in the environment through scales, skin cells, faeces or any other excrements. This is likened to an organism leaving a 'fingerprint' that shows that they have been present in an area and can still be detected in aquatic environments 7-21 days after they've gone.

Two litre samples of water were collected from each of the sites. The water was then passed through a filter which traps eDNA suspended in the sample. Having been sent off for analysis, a list of the species that were present at each site was returned. Monitoring efforts were conducted in July 2021, July 2022, and extended from July to September 2023 due to adverse weather conditions. 2023 data is yet to be analysed.

As the Byelaw was introduced just 3 years ago, Alice does not expect to see significant changes in the biodiversity of the area.

Ecosystems which have endured decades of degradation (such as through trawling) will usually take 10-25 years to recover. In some cases, ecosystems may never return to their historical state, but instead end up in an alternate state. This could potentially happen to Sussex Bay, as many environmental factors have changed since the late 80s, when dense kelp beds were present in the area.

Nevertheless, the continuous, annual monitoring of these sites is essential to track biodiversity as it undergoes reestablishment within the ecosystem.

eDNA learnings to date:

- eDNA captures a higher species richness than BRUVs, however BRUVs complement eDNA surveys by providing environmental variables (e.g. habitat structure and seaweed cover) and species information (e.g. species abundance, biomass and behaviour).
- Species richness was not significantly different between 2021 and 2022.
- Community structure seems to be shifting already, likely due to the increase in seaweed cover in 2022.

South Coast Biosciences Doctoral Training Partnership (SoCoBio DTP). This is funded by the Biotechnology and Biological Sciences Research Council (BBSRC).

Alice Clark and University of Sussex undergraduate student collecting eDNA samples.
Matilda Neil

"I look forward to continuing uncovering the changes in marine biodiversity, since the introduction of the Byelaw, using eDNA metabarcoding. I am hoping that the results will convince policy makers that more trawling byelaws should be implemented across the country."

Alice Clark, University of Sussex

Towed benthic camera surveys

Each year towed seabed camera surveys are deployed at the same 25 locations. These record 300m of seabed terrain in a transect (straight-line) to monitor habitats and look for changes following the introduction of the Sussex Nearshore Trawling Byelaw.

A 5th year of towed camera surveys was conducted in 2023 by Sussex IFCA from aboard their fisheries patrol vessel 'Watchful'.

The videos are analysed by researchers at Zoological Society of London (ZSL) based on four criteria:

- **Seabed type:** What substrates do we see (sand, pebbles, shingle etc.) and which are suitable for kelp?
- **Kelp:** How much kelp do we see? Where is it? Which species are present?
- **Other habitats:** Which essential fish habitats are in the area?
- **Notable species:** What is the presence and abundance of habitat forming species?

The surveys create a permanent, standardised record of habitats covering a wide area that helps us understand the patterns of species diversity and recovery over space and time.

Learnings

- While kelp is yet to be seen in these videos, we have documented stable, valuable and distinctive habitats such as fields of Dead Man's Fingers *(Alcyonium digitatum)* which are small white corals, and Brittle Star *(Ophiothrix sp.)* beds. We have also documented cyclical changes in Bootlace Weed *(Chorda filum)*.
- Though these habitats might not all be suitable for kelp, some are essential fish habitats that are an important part of the mosaic of a healthy and diverse seabed, and protecting and recovering these was a primary goal of the Byelaw.

Next steps

With 5 years of surveys now completed, ZSL are analysing the data to identify which changes to habitats can be attributed to the effect of the Byelaw.

Towed camera surveys are funded by Sussex IFCA with financial support for ZSL's analysis from Platform Earth and PTES.

Towed video gear coming up on deck.
Angharad (Haz) Purcell – Sussex IFCA

Ensuring compliance with the Byelaw
– a day in the life of a Fisheries Officer

A Sussex Inshore Fisheries & Conservation Officer's job is one of two halves. The first is to enforce the regulations that both recreational and commercial fishers should be abiding by whilst fishing in the Sussex IFCA district. The second is to support the fishing community through engagement and education which is essential to ensure stakeholders understand the regulations in place and how to remain compliant. As 'boots on the ground', IFCA Officers are in the ideal position to address local concerns and interests, providing feedback to influence future decision making.

Seasonality and unpredictable weather

The seasons dictate the focus of our work throughout the year, whilst the notoriously changeable and unpredictable British weather alters our work on a weekly basis. Therefore, looking out the window and at weather charts is often where we start when it comes to planning enforcement activities. We also note current fishing trends, local information and intelligence reports, to ensure our attention is focused on areas of highest risk.

Whether on sea or on land, patrols and inspections are the largest role undertaken

When on a sea patrol, we conduct observations of fishing activities at sea, and board vessels to conduct inspections. As officers warranted under the Marine and Coastal Access Act, we are empowered to inspect vessels, vehicles or premises as part of our regulatory duties. At sea, we use three vessels: 'Watchful' an 18m twin engine bespoke design fisheries patrol vessel, with a daughter vessel 'Delta One' that can be launched at sea to conduct fishing vessel boardings, and 'Merlin' an 8m RIB that can operate independently out to sea but has a shallower draft allowing it to patrol shallower inshore locations such as estuaries.

Boarding fishing boats often provides the best snapshot of a vessel's fishing activity. It's fantastic to come alongside a vessel when they are actively hauling their nets and then jump on board to see what they're catching. A good chat with the skipper is the best way to get an idea of how their trip is going, where they've been and where they're going next. Inspecting the catch on a vessel is great for ensuring nothing is being retained that shouldn't be and gives officers an opportunity to assess the sorts of species present in certain areas. This is useful to feed back to the Authority, especially when research is being conducted or we are considering the impact of different regulations.

Checking for types of fishing gear

When on a sea patrol, officers are perfectly placed to observe for potential infringements of the Sussex Nearshore Trawling Byelaw. Observations at sea will allow the type of gear being used to be identified and navigation equipment will confirm the location of the vessel. Should a vessel be detected within the Nearshore Trawling Byelaw exclusion zone, officers will board those suspected of using prohibited fishing gear and conduct a thorough inspection, gathering evidence and talking to the skipper and crew as necessary. Non-compliant trawlers operating within the Byelaw boundary are penalised, but this is extremely rare.

Our aim is to ensure compliance with the Byelaw, ensuring fishers are well informed, know where they cannot use inappropriate fishing gear and are discouraged from breaching the regulations through an effective enforcement regime. By preventing damaging gear being used it will protect and enhance important nearshore habitats, which provide essential nursery grounds for fish, and important opportuities for the recovery of species such as kelp. Ultimately, this builds a healthier inshore environment and improves fish stocks within the district.

Sussex IFCA Fisheries Officer James checks a boat.
Felix Reitze de la Haye

Autonomous Reef Monitoring Systems

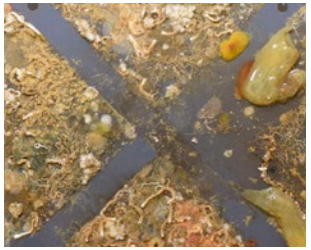
ARMS are standardized units designed to provide a small space for local animals and plants to settle for research sampling. They are widely used to examine tropical coral reef areas but are less common in temperate areas with fewer than a dozen deployed around the UK. This makes their use in Sussex a first, both for the area and for the habitat.

On 23rd November 2023, a team of kelp researchers boarded the New Dawn, skippered by Neville Blake, and headed to the Indiana, a wreck around 2.5km south of Worthing Pier. Their mission was to retrieve three Autonomous Reef Monitoring Systems (ARMS) that had been placed there 16 months previously.

Poor weather and storms during the year had hampered the ARMS collection and caused other mishaps: one unit went missing and was found upside-down tens of metres away, another was partially buried in sediment.

On the day, retrieving the ARMS was no less challenging due to extremely poor visibility underwater, down to 10cm! Thankfully, the expertise of diver Dr Ray Ward (Queen Mary University of London) meant all the units were recovered.

As ARMS need to be kept submerged until they are fully processed, they were brought to the labs inside containers of seawater which was filtered through a fine (40 micron) mesh, with the addition of bubblers to keep the benthic communities oxygenated during transit.



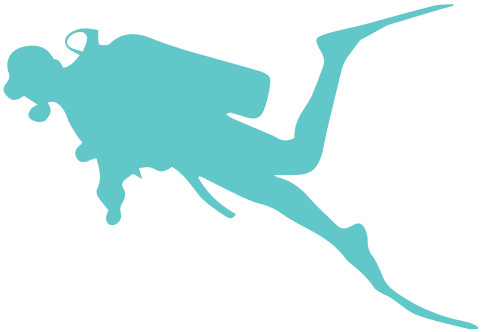
Left: Photographs of the disassembled ARMS plates. They are covered in life. You can see tubes from worms, Slipper Limpets, sea squirts and many other creatures.
Dr Chris Yesson

Below: Dr Margaux Steyaert and Dr Emma Ransome carefully disassembling an ARMS unit at ZSL.
Dr Chris Yesson

Processing involved disassembling the units, removing all motile (free-living) creatures (catching lots of crabs with tweezers!), sieving sediments into 3 size fractions, photographing the individual plates and finally scraping all sessile (stuck-on) plants and animals into a blender (the kind of thing you make milkshakes in) and homogenising it into a gruel-like substance ready for analysis.

What was found and next steps.

Over the course of the year, plants and animals had started to colonise the units and there were lots of signs of life. DNA from the samples will be analysed, using next generation sequencing to help identify the very small creatures present. This will give us a detailed picture of marine life and early colonisers in the area and help us think about patterns of succession in seabed habitats alongside the prospect of future kelp recovery.



Watch: Dr Ray Ward and Professor Mika Peck check the ARMS in Feb 2023.
youtu.be/1BasMyIRxzs

The history of Sussex kelp

PhD project: Investigating the history of Sussex kelp habitats and their impacts on local communities.
Madison Bowden-Parry, University of Exeter.

We asked Madi about her PhD.

What has been your focus in the last year?

Madi: In my PhD field season I have been busy deep diving into the archives. With the help of the Sussex community, I have been collating historical accounts and memories of kelp across Sussex and collecting data that comprise two chapters of my PhD.

As part of my data collection, I have been undertaking oral history interviews and participatory mapping exercises with fishermen in Sussex. During these semi-structured interviews, I aim to uncover and preserve the historical perspectives, memories, and experiences of kelp through the local ecological knowledge of fishermen, and visually map kelp through time and space based upon the mental maps created with them.

Credit **Left: Kelp Worthing early 1960s.**
David Nicholls

Right: Madi in Cornwall with Tangle that had been cast ashore.
Madison Bowden-Parry

What is participatory mapping?

Madi: Participatory mapping is the generation of mental maps to collect spatial information. During interviews, maps are constructed based upon the participants recalled memories and perceptions. When used alongside oral histories, participatory mapping can yield a comprehensive amount of fine-scale spatial information on fisheries behaviour and local ecological knowledge of an area.

Why is participatory mapping important for Sussex kelp?

Madi: In Sussex, current knowledge of the extent of historical kelp habitats is very limited as it is primarily based on just two historical surveys in reports from the mid-1950s and mid-1980s. Historical data on kelp habitats are urgently needed to establish accurate baselines for conservation and recovery.

Participatory mapping from oral histories can help extend the information on historical baselines of marine ecosystems and deepen our understanding of their past dynamics. Therefore, this method, in conjunction with interview data to provide context, can help fill the knowledge gaps we have about historical kelp in Sussex.

This PhD is funded and supported by the Centre for Doctoral Training in Sustainable Management of UK Marine Resources (CDT SuMMeR).

Monitoring the presence of invasive species

Research project: Are invasive species preventing kelp recovery?
Study period: August 2023 – January 2024
Francesco Marzano, Zoological Society of London.

Invasive species are more likely to thrive in degraded habitats due to their generalist attributes. This underscores the importance of understanding the ecological role of known invasive species in Sussex Bay and their potential impact on the recovering kelp habitat.

The three invasive species surveyed in this study by the project's lead researcher Francesco were Wireweed *(Sargassum muticum)*, Pacific Oysters *(Magallana gigas)*, and Slipper Limpets *(Crepidula fornicata)*. The towed video surveys conducted annually by Sussex IFCA provide the ideal methodology to assess the abundance of these immobile or slow-moving benthic species. The videos from the 2019 and 2023 surveys were analysed to assess invasive species population dynamics over the course of the time period.

Why these species were selected

- Wireweed forms large mats overshadowing other seaweeds, competing for light and space.
- Pacific Oysters can blanket the seabed, reducing habitat availability for kelp.
- Slipper Limpets indirectly impact kelp by outcompeting mussel beds, which play a role in seabed roughness, facilitating sediment deposition and stabilisation, potentially providing a surface for kelp attachment.

Findings

This project found that these three species are not yet abundant enough to prevent kelp recovery. However, population growth and spread have been observed, indicating that these species should be included in the annual monitoring of the towed video surveys conducted by Sussex IFCA to prevent potential issues they may cause if they become highly abundant.

Funding: People's Trust for Endangered Species.

"Understanding the full ecology of invasive species, especially those already established, is incredibly important as eradicating them may cause more harm than benefit"

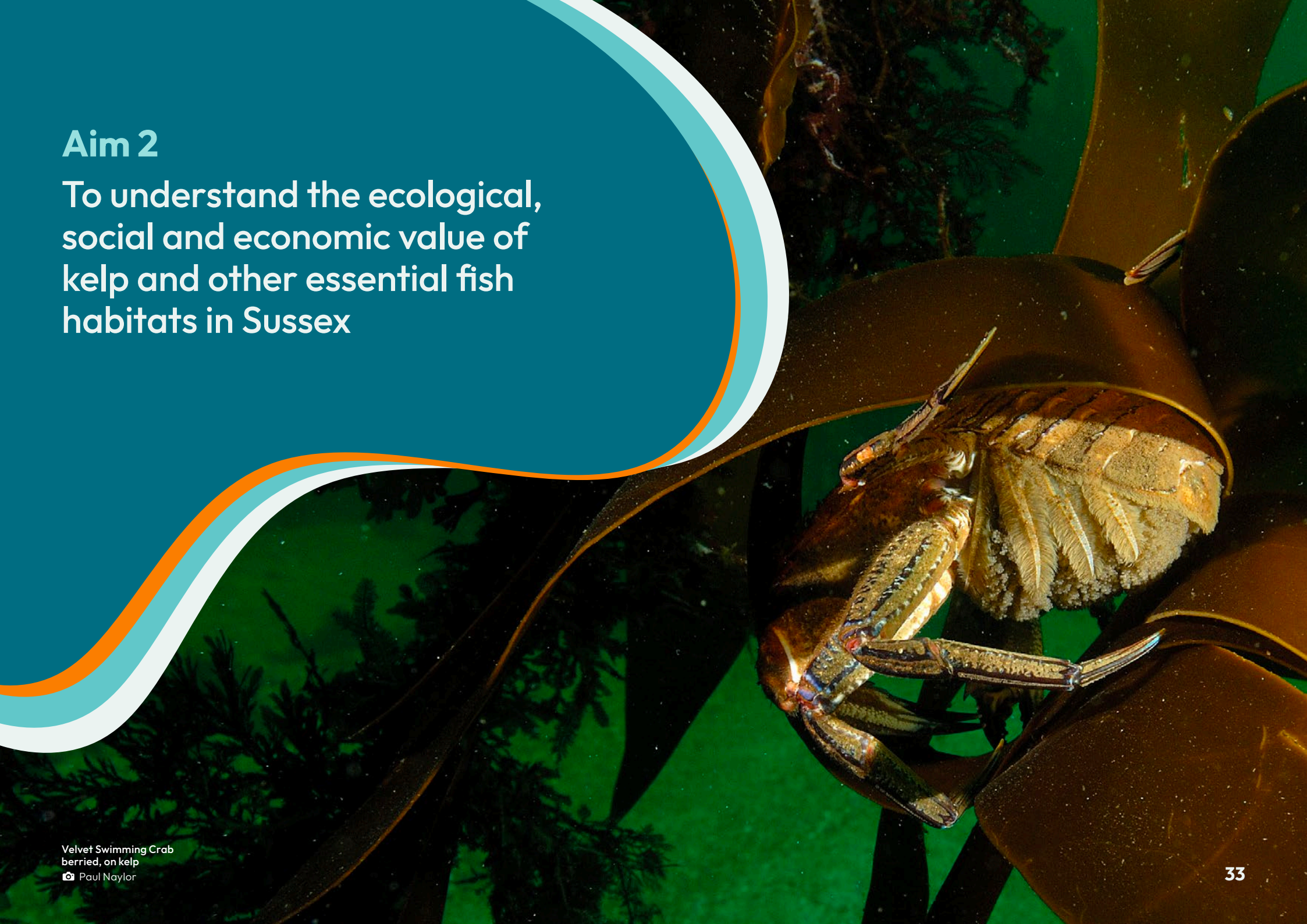
Francesco Marzano

Above:
Francesco Marzano.

Screenshots taken from the towed video cameras, an exemplar picture for each target invasive species.

Aim 2

To understand the ecological, social and economic value of kelp and other essential fish habitats in Sussex



Velvet Swimming Crab berried, on kelp
Paul Naylor

Aim 2: Overview

Kelp beds are some of the most productive and biodiverse habitats on the planet. They provide vital habitat in the form of shelter, feeding, spawning and nursery grounds for a huge diversity of fish and marine life, helping sustain healthy fish populations and therefore livelihoods and local economies.

Recovery of Sussex kelp beds and other essential fish habitats will increase the abundance and diversity of a myriad of species, many of which are of commercial importance such as European Seabass, Black Sea Bream, Brown Crab *(Cancer pagurus)*, European Lobster and Common Cuttlefish.

Assessing the benefits of kelp recovery and the ecosystem services it provides for people, nature and the economy, is a key part of SKRP's programme of research. This includes annual monitoring of crab and lobster populations, analysis of commercial fish and shellfish landings, and the use of innovative technology to understand the movement of fish throughout the English Channel.

Brown Crab.
Paul Naylor

Researching the value of kelp as a blue carbon store and conveyor is another area of increasing national and global interest. A four-year study will analyse the locations, depths and levels of kelp carbon stored in sediments when kelp decomposes.

Engaging and working with local fishing communities, sea users and residents throughout Sussex is of huge importance to the SKRP; to harness their knowledge, facilitate their participation in research and support the future of local fisheries as key beneficiaries of recovered kelp and other essential fish habitats.

Activity & achievements since 2021

Aim 2: Summary

- 36 crab and lobster surveys
- Shellfish landings data analysis
- Socio-economic survey of commercial fishers – 19 fishers interviewed
- Fishing communities engaged in Selsey, Bognor, Worthing
- Acoustic tags placed on 65 Black Sea Bream and 78 Europenan Seabass, and an acoustic array deployed
- 41 carbon cores extracted
- 2x MSc projects completed

Kelp Ecosystem Benefits

Kelp beds provide **spawning and nursery grounds** for many species including Black Sea Bream, Common Cuttlefish and European Seabass, supporting **significant commercial and recreational fisheries**

Kelp forms the base of **complex food webs, providing food** for herbivores, eaten in turn by predators such as seabirds, seals, and dolphins

Kelp acts as a **carbon conveyor**, drawing down carbon faster than many land plants, some of which is **fixed into marine sediments**

Kelp beds and the animals they support create superb wildlife experiences **supporting recreational business and tourism**

Kelp provides **shelter and feeding grounds** for seals and dolphins

Kelp beds provide a **natural coastal defence** by creating a physical buffer and absorbing energy from wave action and storm surges

Kelp provide a multi-dimensional habitat supporting many invertebrate species – **one kelp can support up to 80,000 individual animals**

Drift seaweed washed up on beaches can be **used as fertilizer**

Kelp **detritus provides vital food** and nutrients for filter feeders such as mussels

Sussex Kelp Recovery Project

Source ref: Williams et al. 2022

Crab and lobster surveys 2021-2023

How are Sussex's key commercial fisheries changing over time in response to the Sussex Nearshore Trawling Byelaw and anticipated recovery of historic kelp beds?

Between August and September in 2021, 2022 and 2023, surveys of Sussex's crustacean pot fishery were undertaken by Blue Marine Foundation, Sussex IFCA, local fishers and volunteers.

The survey began in Selsey, where 12 sites (5 inside the Byelaw area and 7 control sites outside) have been monitored over the three years, with support from Selsey fisher, Dan Langford. In 2022 and 2023, the survey was expanded further East to 15 additional sites with help from Brighton and Eastbourne fishers. Sites were selected based on habitat maps and by harnessing the fishers' local knowledge.

Strings of 20 pots were deployed at each site. The abundance, size, weight, sex and condition of Brown Crab *(Cancer pagurus)* and European Lobster *(Homarus gammarus)* caught in the pots were recorded before returning the catch to the sea. Understanding how the crustacean population is changing over time is vital to supporting this key fishery for the marine environment and local people.

Learnings

- In 2021, 2022 and 2023, there has been no significant differences inside and outside the Byelaw area or between years for Brown Crab and European Lobster abundance, size, weight, sex and condition.
- At Selsey, a gradual increase of lobster abundance is being seen since 2021 and a gradual decline of Brown Crab.
- A greater abundance of smaller European Lobster is being found inside the Byelaw area than outside across all years at Selsey.

Hypothesis: As the 2023 surveys were undertaken only two and a half years since the Byelaw was introduced, a lack of significant differences between sites is expected. Over time, greater changes between these areas are anticipated.

The data represents a baseline against which future data can be compared, and assuming other variables do not change significantly, any changes can be attributed with confidence to the effects of the Byelaw rather than other influencing factors.

Above: Selsey fisherman, Dan Langford, hauling the lobster pots.
Madison Bowden-Parry

Left: Crustacean pot fishery survey locations.

Commercial fisheries landings data

Fisheries landings data, captured by the Marine Management Organisation (MMO), provides insight into the status and economics of UK fisheries. Sussex IFCA can request this data at a local scale, and filter it for boats under 10m in length, to investigate the total value of Sussex fisheries as a measure of local economic status, and landings per unit effort (LPUE) as an indication of the health of fish populations.

SKRP chose ten indicator fisheries to monitor (see table below and overleaf), which either use kelp as a shelter or nursery, or are indicators of a healthy community, e.g. the presence of rays indicates the food web is healthy and capable of supporting larger predators.

However, a long-term dataset is needed to see the overall trend as fisheries are expected to recover slowly, while results vary annually and can be easily influenced by wider external changes such as license restrictions or variation in sea temperature. In addition, as the data is gathered at a scale larger than the Sussex Nearshore Trawling Byelaw area, more spatially restricted information will likely be needed to identify changes at this relatively localised scale.

Species	2019	2020*	2021*	2022	2023
Black Sea Bream	25.4	4.1	1.7	1.5	4.8
European Seabass	76.1	95.3	100.8	100.6	80.1
Pollock	3.8	0.8	1.4	0.7	0.6
Dover Sole	140.8	99.2	107.2	136.4	82.1
Plaice	430.1	198.3	124.9	152.7	58.4
Skates and rays	156.3	128.5	131.0	133.1	102.2

* Covid years are highlighted above as the pandemic affected fishing effort and activity. Live weight in Tonnes

Black Sea Bream.
Big Wave TV

Notes: The data presented are for vessels under 10 meters landing into Sussex ports, and which have been fishing in ICES squares 30E9 and 30F0; the ICES squares which encapsulate the Sussex IFCA district. As such, it approximates landings that can be attributed to the Sussex IFCA district. It is not a perfect representation, because vessels under 10 meters will fish outside the district and vessels under 14 meters are permitted to fish inside the district. Furthermore the Sussex IFCA district only occupies a portion of ICES squares 30E9 and 30F0. The MMO landings data will therefore likely be an overestimate of what is landed within the Sussex IFCA district.

Shellfish landings data

Landings data for shellfish within the Sussex IFCA district is collated via catch returns submitted by fishers as per the Sussex IFCA Shellfish Permit Byelaw 2015.

This Byelaw requires shellfish fishers to obtain a permit, and as part of the permit conditions they are required to submit monthly catch returns detailing what, when, where, and how they are fishing for shellfish species. Catch returns focus specifically on the following species:

- European Lobster *(Homarus gammarus)*
- Brown Crab *(Cancer pagurus)*
- Common Cuttlefish *(Sepia officinalis)*
- Whelk *(Buccinum undatum)*
- Spiny Spider Crab *(Maja brachydactyla)*
- Prawns *(Palaemon spp.)*
- Velvet Swimming Crab *(Necora puber)*

Fishers undertaking potting are required to detail their landings (by weight in kg) from potting/trapping activity throughout the district, the number of pots deployed per trip, and the number of trips undertaken to deploy these pots over the month. This provides an understanding of the total number of pots each fisher is deploying over each month (number of pots deployed per trip multiplied by number of trips). Landings Per Unit Effort (LPUE), i.e. the average amount of shellfish caught in each pot/trap, for each month is then calculated by dividing the total weight of a species landed by the total number of pots/traps.

Table: 2020, 2021, 2022 Shellfish Fisheries Landings returns. Source: Sussex IFCA

Fishery	Measure	2020	2021	2022
Common Cuttlefish	Catch weight (tonnes)	139.5	55.6	136.6
	% of SxIFCA Shellfish Catch Returns	11.1	4.6	12.5
	LPUE (kg/pot)	2.8	1.5	1.45
Brown Crab	Catch weight (tonnes)	73.9	54.7	32.2
	% of SxIFCA Shellfish Catch Returns	5.9	4.3	5.8
	LPUE (kg/pot)	0.37	0.29	0.29
European Lobster	Catch weight (tonnes)	11.6	8.6	12.6
	% of SxIFCA Shellfish Catch Returns	0.9	0.7	1.4
	LPUE (kg/pot)	0.06	0.05	0.07
Whelk	Catch weight (tonnes)	1034.3	1114.9	599.7
	% of SxIFCA Shellfish Catch Returns	82.1	90.3	79.2
	LPUE (kg/pot)	1.8	1.8	1.62

Fish tracking

Sussex IFCA, in partnership with University of Plymouth, Sussex Wildlife Trust and Natural England, are tracking fish using acoustic telemetry to gain an understanding of how nearshore habitats are used by different species. The data collected is used to inform an ecosystem-based approach to fisheries management.

65 Black Sea Bream *(Spondyliosoma cantharus)* and 78 European Seabass *(Dicentrarchus labrax)* have been tagged with acoustic transmitters and released in the Sussex IFCA District. The transmitters are picked up by receivers deployed in the nearshore and coastal area, including the major estuaries and within the Kingmere Marine Conservation Zone (MCZ), a known breeding site for Black Sea Bream.

Nick Rogers, Sussex IFCA Senior Research Officer and Pete Davies, University of Plymouth Postdoc retrieve a receiver for maintenance and data download.
Sussex IFCA

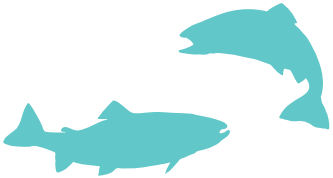
How fish move in and outside of the Sussex Nearshore Trawling Byelaw area and around Kingmere MCZ is of interest to the SKRP and may be utilised in the future to investigate whether this movement changes in relation to a change in fish habitats by, for example, an increase in kelp or other essential fish habitat.

The fish telemetry project in Sussex was initially conducted as part of the cross-Channel FISH INTEL project, which has allowed the use of innovative technology to understand the movement of fish at key sites along the coastlines of southern England, northern France, Belgium and the Channel Islands.

The FISH INTEL project has now come to an end, but Sussex IFCA, in collaboration with the University of Plymouth, have continued to maintain the acoustic receivers, downloading the crucial data on positions of individual fish in the process. Telemetry work at the University of Plymouth is now funded through Defra's Fisheries in Science Partnership (FISP) fund with the Angling for Sustainability project.

Findings and next steps

- 45% of Black Sea Bream tagged in 2022 were redetected in 2023, suggesting a level of inter-annual site fidelity.
- During the nesting season, Black Sea Bream were most likely to be redetected at the area in which they were tagged.
- Within Sussex, there appear to be two separate populations of European Seabass, one which is highly resident to inshore habitats. Another migratory population moves inshore during spring/autumn, likely because of moving to spawning areas. More data is needed to explore this theory.
- There were hardly any redetections of Black Sea Bream outside of the nesting season, suggesting overwintering sites do not fall within the nearshore Sussex environment.
- Scientific publications are being drafted and further results will be shared when available.



Kelp as a blue carbon store

Like all photosynthesising organisms, kelp removes carbon from the atmosphere by absorbing carbon dioxide and capturing it in its living tissue. This 'organic' carbon is temporarily captured but is released back into the atmosphere if the kelp tissue breaks down through natural decay. In this way kelp plays a vital role in cycling carbon through the ecosystem.

Due to climate change, there is great interest in finding ways to sequester (capture) and store atmospheric carbon over long periods of time (>100 years), otherwise known as carbon storage.

The key mechanism for carbon storage from terrestrial (land) plants, is the burial of plant tissue in soil – which in turn creates new soil. However, kelp are algae and do not have a buried root structure as their holdfast sits on top of, and attaches to, a firm substrate. When kelp die, they often wash back onshore and, when exposed to the elements, will decompose and return captured carbon to the atmosphere. Long-term storage of kelp carbon only occurs when kelp detritus is carried out into deeper waters and is absorbed into the sediment on the seafloor.

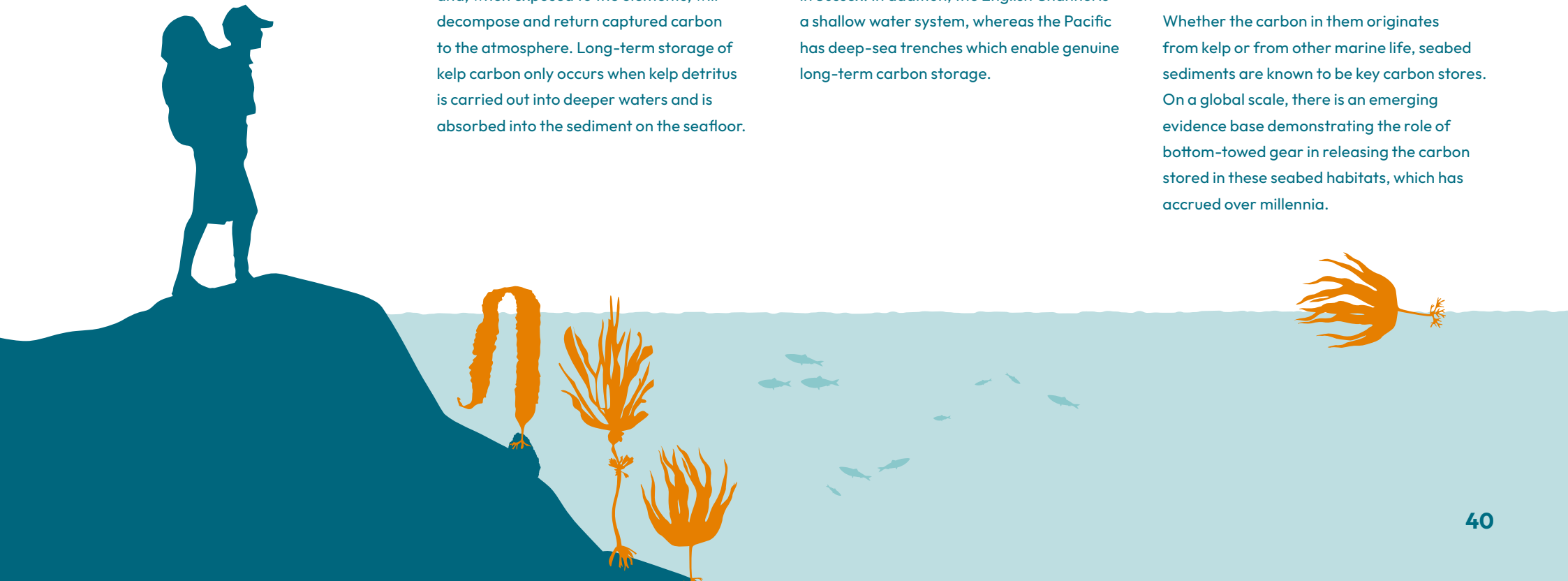
It is however, very difficult to measure the amount of kelp carbon being transferred in this way, and it is highly variable due to local factors such as currents and seabed topography. This has led to uncertainty over the value of kelp habitat as a long-term carbon store.

Most of the research to date on this topic has been based on the giant kelp species *(Macrocystis pyrifera)*, found off the Pacific coast of North America, which has very different characteristics to the species found in Sussex. In addition, the English Channel is a shallow water system, whereas the Pacific has deep-sea trenches which enable genuine long-term carbon storage.

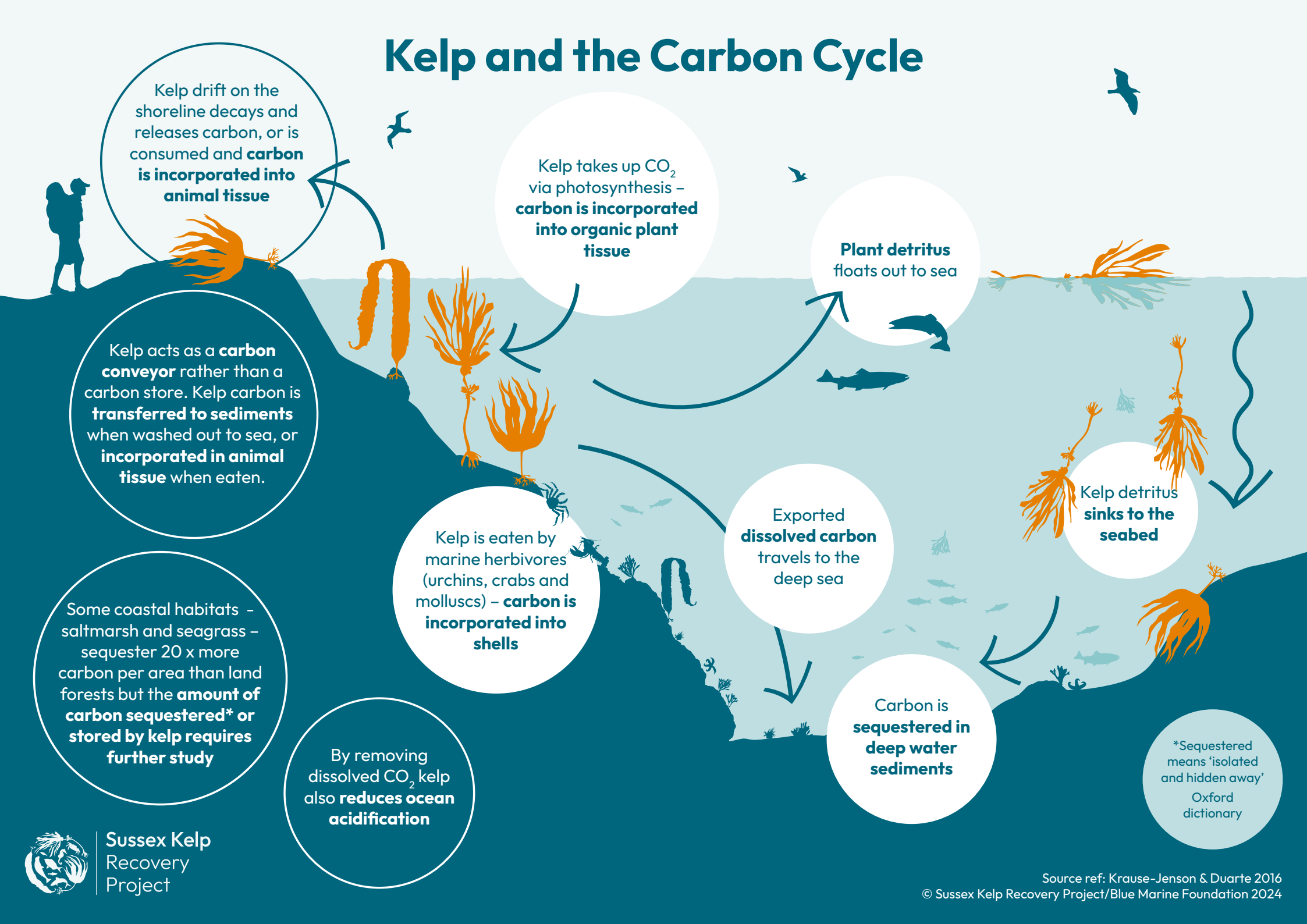
The Sussex Kelp Recovery Project aims to provide some answers to questions around kelp carbon cycles at a local level, which may inform the development of a quantifiable kelp carbon sequestration rate, though this process will take some years.

Ultimately, kelp's role as an ecosystem engineer and nursery habitat increases the abundance of other marine life – all of which are carbon based. Ultimately, healthy marine ecosystems are better at capturing and storing carbon than depleted ecosystems.

Whether the carbon in them originates from kelp or from other marine life, seabed sediments are known to be key carbon stores. On a global scale, there is an emerging evidence base demonstrating the role of bottom-towed gear in releasing the carbon stored in these seabed habitats, which has accrued over millennia.



Kelp and the Carbon Cycle



Kelp drift on the shoreline decays and releases carbon, or is consumed and **carbon is incorporated into animal tissue**

Kelp takes up CO_2 via photosynthesis – **carbon is incorporated into organic plant tissue**

Plant detritus floats out to sea

Kelp acts as a **carbon conveyor** rather than a carbon store. Kelp carbon is **transferred to sediments** when washed out to sea, or **incorporated in animal tissue** when eaten.

Kelp is eaten by marine herbivores (urchins, crabs and molluscs) – **carbon is incorporated into shells**

Exported **dissolved carbon** travels to the deep sea

Kelp detritus **sinks to the seabed**

Some coastal habitats - saltmarsh and seagrass – sequester 20 x more carbon per area than land forests but the **amount of carbon sequestered* or stored by kelp requires further study**

By removing dissolved CO_2 kelp also **reduces ocean acidification**

Carbon is **sequestered in deep water sediments**

*Sequestered means 'isolated and hidden away' Oxford dictionary

Sussex Kelp Recovery Project

Source ref: Krause-Jenson & Duarte 2016

Blue carbon student project

University of Brighton

Queen Mary University of London

PhD project: Evaluation of Sussex Bay kelp carbon storage and sequestration potential.
Claude Annels, University of Brighton

Claude's PhD investigates sites across Sussex Bay at a variety of depths and locations using sediment cores to evaluate carbon sequestration rates over time and to identify the sources of carbon e.g. whether it is from kelp or animal tissue.

Over the last year, the project's initial focus was 15 shallower nearshore sites with depths of between 15m and 45m. In total 41 cores were extracted across Sussex Bay by Claude and Lead Supervisor and corer Dr Ray Ward of Queen Mary University London, with the assistance of an excellent volunteer commercial dive team, and the help of commercial skipper Neville Blake on his boat New Dawn.

The type of sediment whether clay, sand, silt or gravel, influences the amount of carbon stored. 19 cores have been processed by Claude to date, providing information on how much organic matter (and carbon) is in the sediments. In recordings from other ecosystems, typically the finer the particles, the higher their capacity to retain carbon. However, this relationship is not always linear and specific regional disparity needs to be established to evaluate Sussex Bay's propensity to store 'Blue carbon'. While initial results conform to these expectations – the sandier the sediment, the lower the carbon associated – there is more work being done to quantify the amount of organic matter at deeper locations. Other factors influenced by sediment size will be investigated to explore which are most significant locally, such as porosity and water content.

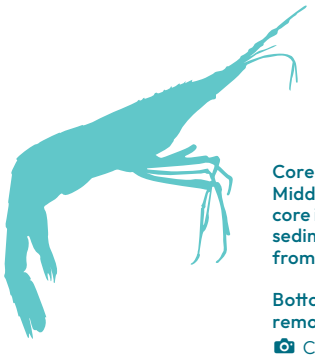
Why depth of the sites is of particular interest

When dating sediment samples, those from shallower sites are of a more dynamic nature as they are exposed to greater wave activity. This means sediment is mixed and lots of organic material is released into the water and transported elsewhere. At Queen Mary University of London, stable isotopic signatures of carbon and nitrogen have been evaluated to work out sources of organic material, and these have been produced for the key Sussex kelp species: Oarweed *(Laminaria digitata)*, Sugar Kelp *(Saccharina latissima)* and Furbellows *(Saccorhiza polyschides)*.

Initial results from eDNA analysis conducted in partnership with NatureMetrics revealed the presence of brown seaweed *(Phaeophyceae)* species, Thongweed *(Himanthalia elongata)*, Wireweed, Bootlace Weed and Wrack *(Fucus)* species, along with phytoplankton and microalgal species of marine origin, freshwater green algae and some terrestrial plant input.

The next phase of sampling will cover depths of 25m-60m across the Bay, from nearshore to beyond the Rampion Windfarm. eDNA and stable isotope work will also continue, and sediments will be dated using gamma spectroscopy to see changes in inputs of organic material over time.

This PhD is part-funded by The Pebble Trust and Platform Earth.



Core processing: Middle: Segmented core in preparation for sediment investigations from an open site at 18m.

Bottom: Pistol Shrimp removed from core.
Claude Annels

PhD Student Claude Annels with Tom Voice and Chris Hayes from Brighton Sub-Aqua Club.
Dr Ray Ward

Aim 3

To identify and minimise damaging impacts on existing and potential kelp habitat and other essential fish habitats

Sediment on a lobster pot.
Marianne Glascott

Aim 3: Overview

What may be hindering kelp's recovery?

Though kelp was once abundant in Sussex, a number of factors that have changed since the 1980s may prevent it coming back despite the implementation of the Sussex Nearshore Trawling Byelaw. These factors include poor water quality, increased sedimentation, changing water temperature and storm events.

To support kelp recovery, SKRP is assessing the potential sources and impacts of non-fishing pressures to understand which factors could pose the most significant barrier and which, if any, of these can be better managed to improve conditions for natural recovery.

Sediment has consistently been linked to the disappearance of kelp forests in many areas around the world and has been a focus of SKRP's work in Sussex since 2021, having been highlighted by many stakeholders as an issue of concern, not only for kelp recovery, but for local shellfish populations too.

Increased sediment levels can negatively impact both the growth and reproduction of kelp through physical scouring and smothering of the rocky substrate that kelp needs for settlement, and by increasing turbidity which reduces the levels of light in the water column needed for growth.

Increased sea temperature may also impede kelp recovery, as although temperatures are currently within the tolerance limit of kelp species known to the area, much higher temperatures – marine heat waves – especially in shallower waters, have been experienced on the south coast of the UK in recent years.

Collectively these, along with other factors such as increased levels of nutrients and pollution could hinder kelp recovery, or influence the structure and abundance of kelp assemblages, with species that were historically present potentially replaced by those more tolerant to the present conditions.

Activity & achievements since 2021

Aim 3: Summary

- Sussex Sediment and Adaptive Response workshop (May 2023) brought together 41 stakeholders from 27 organisations
- First meeting of a Sussex Sediment Working Group
- Sediment sources and impacts desk-based review
- Turbidity & light surveys undertaken at various sites in Sussex Bay
- Sediment Sources and Impacts workshop (September 2021) with 40 participants from 25 organisations
- Sediment sea user survey with 129 respondents
- 8 x sediment cores sampled
- 2 x PhD projects initiated

Sussex Sediment

Sources & Impacts

Sources

Rivers and estuaries carry silt and sediment from inland

Intense arable agriculture increases soil erosion

Storms and flooding stir up sediment and wash sediment into the sea

CHICHESTER

LITTLEHAMPTON

WORTHING

SHOREHAM

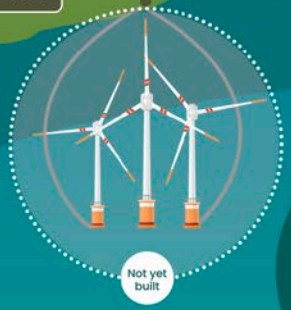
BOGNOR REGIS

CLIMPING

BRIGHTON

SELSEY

Trawler Exclusion Zone



Sediment flow from West to East

Trawling, windfarm construction and cabling stir up sediments

Dredge spoil is pumped from Brighton Marina directly into Beachy Head West Marine Conservation Zone

Sediment reduces light levels in the water and limits kelp growth

Dredging and spoil dumping add sediment to sensitive areas

Impacts

High levels of sediment impact kelp, marine life, fisheries and recreation

Sediment clogs crab and lobster gills and smothers fish nest sites

Sediment on the seabed prevents kelp and oyster spat settlement

Silt builds up in rockpools and on fishing pots

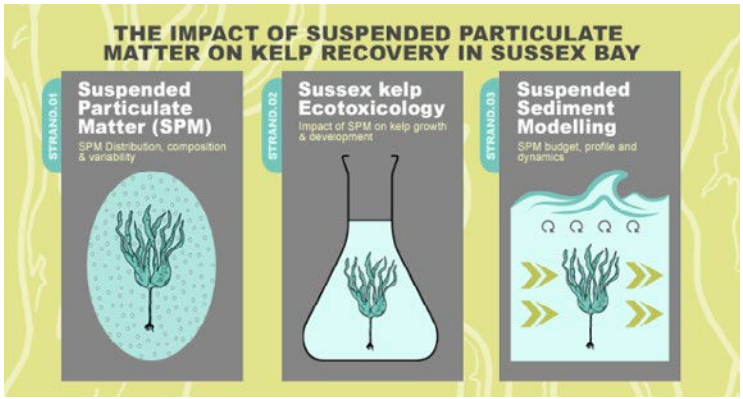
Impact of sediment on kelp

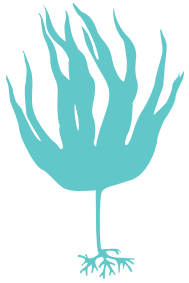
PhD project: The impact of Suspended Particulate Matter (SPM) on kelp recovery in Sussex Bay. Marianne Glascott, University of Sussex.

To understand the impact of Suspended Particulate Matter (SPM) on kelp habitats, Marianne is carrying out a PhD research study at the University of Sussex. The study is comprised of three strands:

1 **Understanding SPM composition and distribution in the Sussex Bay area.** SPM includes all particles in the water column such as clay, sand, contaminants, pollutants, algae, phytoplankton, zooplankton, organic matter, bacteria, and viruses, both living and dead. Turbidity, Suspended Sediment Concentration (SSC) and light in the 1-2m above the sea floor are most relevant to kelp growth and development. Research will investigate nearshore coastal environments where the University of Sussex monitors kelp habitat and biodiversity recovery. Regular sea users will be sought to aid measurement and sample collection.

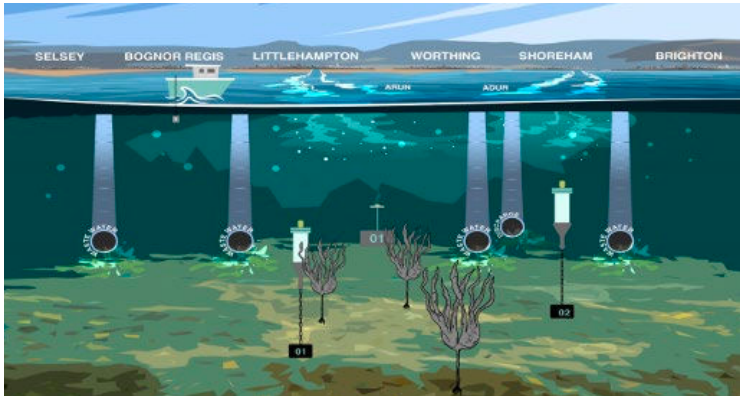
2 **Assessing the impact of local SPM on Sussex kelp growth using controlled experiments in aquaria.** Through the development and implementation of ecotoxicology testing, this lab-based assessment will enable an evaluation of the risks to the three most important species of kelp for reforestation in the area: *Laminaria hyperborea* (Tangle or Cuvie), *Laminaria digitata* (Oar Weed) and *Saccharina latissima* (Sugar Kelp).





The three strands of the SPM PhD project.
All images Marianne Glascott

Monitoring turbidity, light and temperature in the kelp zone in Sussex Bay.



3 **Providing a baseline understanding of the sediment budget, profile and dynamics within Sussex Bay through the lens of how this impacts kelp habitat.** It will map the pattern of SPM within the kelp restoration area to underpin our understanding of changes to water clarity and the photic zone, and its implications for kelp ecosystem recovery.

Providing meaningful data to help inform environmental decision-making

Kelp have evolved to develop within a forest environment where pH, dissolved oxygen, nutrient balance, light and shade is determined by the kelp forest: it is a clean, clear, sheltered, shady and protected habitat.

In Sussex Bay however, kelp is sparse and so its micro life stages are vulnerable to environmental stresses they have not evolved to tolerate. A number of sensors in Sussex Bay close to shore and further out are focused on areas where the kelp is and where we can understand the impact of river and wastewater pipe outflows. Research on turbidity and light will be linked to work being undertaken on biodiversity and distribution to provide a more rounded picture of what is happening. It will consider both established toxins (e.g. herbicides) and emerging contaminants known to be toxic to kelp, but which may or may not be present in sufficient concentration to do damage.

Impact of sediment on kelp
– an interview with Marianne Glascott

Could you elaborate on your methods for studying the composition and distribution of Suspended Particulate Matter (SPM) in Sussex Bay?

To understand SPM's role in kelp recovery, I've employed a field-based assessment by deploying sensors for spot and continuous data, primarily focused between the Adur and Arun rivers. These sensors, operational since early April 2023, gather data on turbidity, light, and temperature – key factors influencing kelp growth. Our data, enriched by seasonal variations and extreme weather events, lays the groundwork for assessing the impact of sea temperature, light availability and sediment distribution on kelp habitats. Water samples collected for SPM analysis are also integral to our ecotoxicology studies, examining SPM's effects on kelp growth stages. The invaluable support from local citizen scientists and partnerships with maritime organisations has been instrumental in our research.

How are you assessing SPM's impact on kelp growth and development?

At the Kelp Lab established at the University of Sussex, we're pioneering onsite ecotoxicology assays to investigate how SPM-related factors like light restriction and pollutant exposure influence kelp growth. Our laboratory is equipped with growing chambers and cold-water aquaria, allowing us to manipulate kelp lifecycles through photoperiod, temperature and light spectrum for targeted experiments. Initial pilot studies completed in late 2023 pave the way for more comprehensive ecotoxicology research, with plans to extend our findings through in-situ studies in Sussex Bay. The setup of this lab and ongoing experiments owe much to a broad network of collaborators who have contributed immensely to our progress.

How do you plan to establish a baseline for understanding sediment dynamics in Sussex Bay?

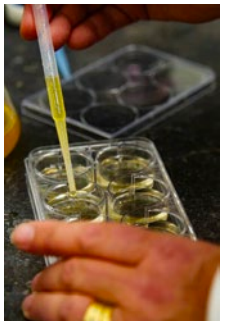
To delineate the sediment budget, profile, and dynamics within Sussex Bay accurately, I'm amalgamating data on river outflows, catchment areas, and weather and tidal patterns. This effort is complemented by a review of existing coastal dynamics models. Collaboration with the National Oceanography Centre in Southampton, which has generously provided a bursary, enriches our research framework. This multifaceted approach ensures a robust baseline understanding for the study's objectives.

Above: Marianne sampling kelp in Bognor.

Bottom right: *S. latissima* in Kelp Lab, Uni of Sussex.

Bottom left: Ecotoxicology cell cultures in Kelp Lab.

All photos Marianne Glascott



The research is funded by the University of Sussex, with additional support from Blue Marine Foundation and the National Oceanographic Centre, thanks to the West P&I bursary.

Understanding Sussex sediment:
the journey to date

While sedimentation is a natural process arising from land run off, erosion and wave scour, human activity, whether on land – such as farming and urban development – or at sea – such as trawling, dredging and dredged spoil disposal, have increased the levels of sediment and nutrient loading into coastal environments.

Worldwide, increased sedimentation and turbidity has consistently been linked to the decline of kelp forests and many sediment sources, both natural and anthropogenic are simultaneously occurring in, or adjacent to, Sussex coastal waters.

High levels of sediment can negatively impact both the growth and reproduction of marine life and kelp. Heavier sediments can cause physical scouring and smothering, while finer suspended silt increases turbidity, reducing light levels needed for photosynthesis and growth.

A programme of work was initiated in 2021 to assess the sources and impacts of sediment on kelp habitats. Over the past three years, this has encompassed desk-based reviews of the sources and impacts, a public survey of sea users to gather observations of the changes and sources of sediment, and workshops to share existing knowledge and bring cross-discipline stakeholders together. This led to the establishment in January 2024 of a Sussex Sediment Working Group.

Full reports from the workshops and reviews can be downloaded from **sussexkelp.org.uk**

Sediment Workshop Attendees
Rob Alcroft

2021

Sussex Nearshore Trawling Byelaw implemented
March 2021

Sussex Sediment Sources & Impacts workshop
September 2021

2022

Sussex Sea-users Sediment Survey Report
June 2022

Sediment Pathways and Transport Report
January 2023

2023

Sediment Monitoring & Adaptive Response Workshop
May 2023

Sediment Working Group meeting
January 2024

2024

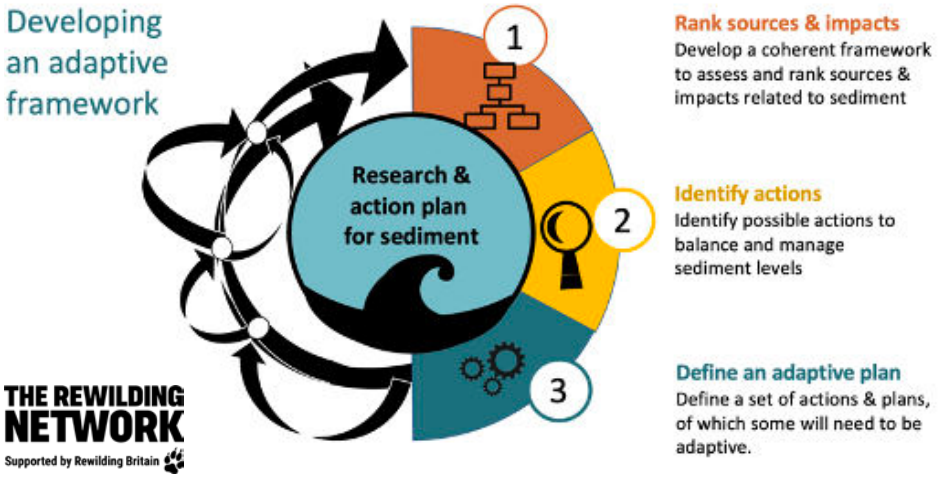
Developing a sediment management plan

Previous work fed into a Sussex Sediment Monitoring and Adaptive Response workshop in May 2023, attended by 41 stakeholders from 27 organisations including government and fisheries agencies, local authorities, researchers, NGOs and local sea users.

The event, which was funded by Rewilding Britain and hosted by Blue Marine Foundation and the Crab and Habitat Sediment Movement project (CHASM), sought to identify the steps that can be taken forward to help address potential negative impacts of sediment in Sussex. Ten presentations summarised current knowledge about sediment sources and impacts, and monitoring and research initiatives. Breakout groups then reviewed and prioritised a package of over 50 potential monitoring, research and management interventions.

Workshop outcomes:

- **Prioritisation** – Three key themes were identified: (1) Assessment of changes over time. (2) Impact of dredging and disposal. (3) Transport pathways and cycles.
- **Source and impact assessment** – There are fundamental knowledge gaps about the sources, pathways and impacts of sediment and interactions between habitats and species, which need to be better understood before an effective response plan can be created.
- **Adaptive response** – An adaptive framework is necessary to address changes in sediment to take into account and respond to changes in climate, land use, marine developments and fishing practices.
- **Awareness** – Policy makers, decision-makers and industry stakeholders need to be made more aware of the issues and level of concern regarding sediment to mobilise funding and develop integrated mitigation measures.
- **Connectivity** – Sediment is an issue that connects different areas, habitats and sectors, and to respond effectively and efficiently, a collective and cohesive approach is needed to draw together the various stakeholders and initiatives.
- **Funding** – Lack of funding is a challenge due to the scale and complexity of the sources and potential impacts.
- **Action** – While there are knowledge gaps to fill, there is a strong case for action to be taken now and to learn lessons from other parts of the UK.



Sussex Sediment Working Group

As a result of the interest and urgency evidenced by attendees of the workshop, a Sussex Sediment Working Group was proposed.

Support for the Group was positive and at the first meeting in January 2024, 22 people from 16 organisations attended and identified a number of initial next steps:

- **Formalise the Sediment Working Group** and secure funding for facilitation.
- **Collate existing information** including sediment data and map current sediment monitoring and research activities.
- **Review how sediment samples are processed** to ensure consistency of techniques and compatibility of data.
- **Review current policies** in place to manage and monitor sediment.

The ultimate aim of the Sediment Working Group is to establish a sediment monitoring and adaptive response plan to reduce and manage anthropogenic inputs of sediment, in order to optimize the conditions for healthy natural kelp recovery.

Other signs of pressures on kelp

The area of historic kelp in West Sussex that is the focus of SKRP's work was permanently underwater (subtidal) but elsewhere in Sussex, kelp in shallower waters is exposed at low tides (intertidal). Some of these intertidal kelp sites have shown signs of significant decline.

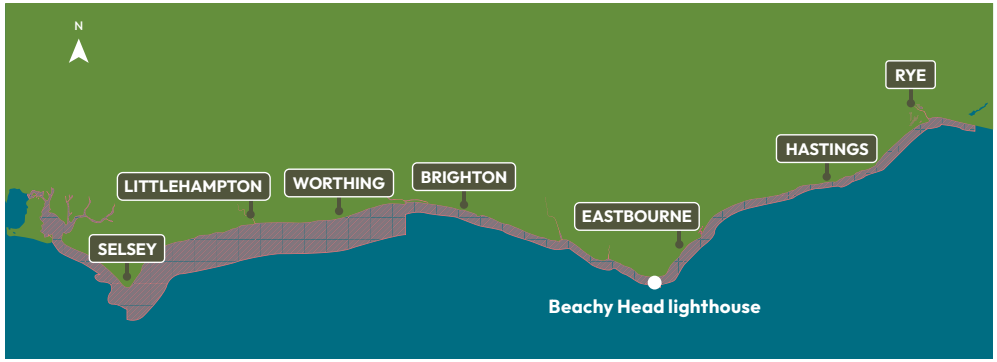
One example of intertidal kelp habitat is the presence of Oarweed *(Laminaria digitata)* in the area surrounding Beachy Head lighthouse near Eastbourne. Last year however, the formerly luscious kelp habitat on the seaward side of the lighthouse looked more like bare rock, as evidenced in the aerial images opposite.

In late 2023, a few isolated patches of healthy kelp have been sighted, but the greater extent has disappeared.

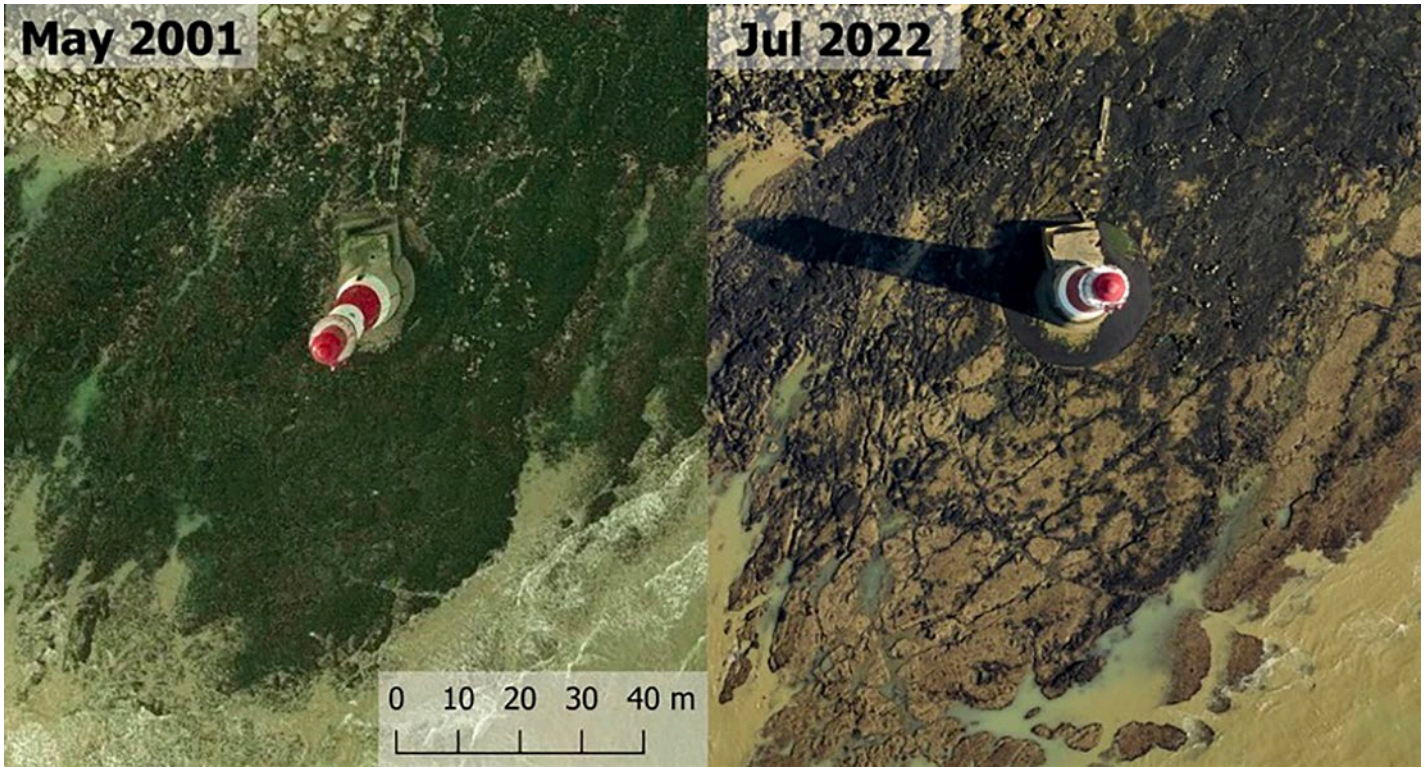
Shallower areas are subject to greater environmental stress from waves and temperature, and the influence of the recent record-breaking sea temperatures cannot be discounted.

Tracking these habitats through aerial imagery shows this decline has occurred in the last few years. The picture is repeated all along the coast of the South East, with similar declines seen at Seaford Head (Sussex) through to Ramsgate and Margate on the north Kent coast.

Efforts are underway to track and better understand the changes in our coastal kelp.



Below: Satellite images (references 46292 and 588632) courtesy of Channel Coastal Observatory (www.channelcoast.org).



Aim 4

To assess the need for and feasibility of active restoration

Nikki Hills

Aim 4: Overview

SKRP is a rewilding project, which follows the ethos of letting nature lead. This means giving natural processes and ecosystems time to recover with minimal human intervention following removal of a key pressure such as trawling.

Why does the partnership support natural recovery?

- Natural recovery is likely to result in more resilient ecosystems that are adapted to the prevailing conditions than actively managed habitats created by planting or seeding kelp.
- Current environmental conditions in Sussex Bay may be very different to those prevalent in the 1980s when kelp was last abundant. Factors that can affect recolonisation include water temperature, sediment levels, the presence of grazers, and levels of disturbance whether caused by natural events or human activities. (See Barriers and Optimum Conditions for Kelp Recovery on page 53.) This may mean other habitats and species may be more adapted to the current conditions than kelp.

Would the partnership ever consider planting or seeding kelp?

- Initiatives like planting or seeding kelp can be an expensive, resource intensive and uncertain process. SKRP partners are assessing the factors that may affect kelp settlement and growth, to better understand the optimal conditions required for any active restoration to be successful and to avoid wasting effort if those conditions cannot be met.
- As natural recovery takes time, it may be several years before the SKRP fully understands what is happening on the seabed or can observe significant change. It may then decide that, based on the evidence, it is necessary to give nature a helping hand by undertaking active restoration activities.

What if the kelp doesn't ever grow back?

Although the SKRP would love to see the species of kelp that was lost come back and the ambitions of the project are based around this, if it doesn't return, but other species or essential fish habitats do, that is a successful outcome if those habitats are diverse, healthy and support biodiversity.

Kelp on Worthing beach.
Wendy Fry

Barriers and optimum conditions for kelp recovery

Environmental conditions/tolerances

Water Temperature
Thermal tolerance varies between and within species. Key UK species show stress to prolonged exposure to water above 18°C

Light/Water Clarity
Kelp need light to photosynthesize and will grow at greater depths in clear waters

Water Motion
Tolerance to wave exposure varies between species. *A. esculenta* tolerates high wave action, *L. digitata* and *L. hyperborea* are found in moderately to fully exposed areas and *S. latissima* and *S. polyschides* in moderately exposed or sheltered areas

Acidity (pH)
Kelp species respond differently to changes in acidity. Increases in acidity (lower pH) can reduce *S. latissima* growth rate

Nutrients
Kelp require nutrients (inorganic carbon, nitrogen and phosphorous) for photosynthesis and growth, and can store nutrients for later use if levels are low

Salinity
Kelp only tolerate a narrow range of salinity of 30–35 PSU, outside of this range kelp performance decreases

Depth
UK kelp grows down to 48 m depth in clear waters but is limited to 2m depth in turbid (cloudy) waters

Grazers
UK kelp species are grazed primarily by marine snails, sea urchins and limpets, but at levels that do not currently have a negative impact

Substrate
Kelp tends to settle and grow on stable rocky habitat and are not found in sandy areas

Larval Sources
Where kelp beds have declined significantly, recovery may be limited by the lack of a local source of spores

Human direct and indirect pressures

Sedimentation
High sediment levels can directly scour kelp, smother bedrock and reduce light needed for kelp settlement and growth

Climate Change/Storms
Increased water temperature and storm intensity can lead to shifts in species distribution, favouring species that are more tolerant of higher temperatures and wave exposure

Pollution
Heavy metals in particular can delay development, reduce growth and potentially cause death

Eutrophication
High nutrient levels increase growth of smaller turf algae that outcompete larger slower growing species

Seaweed Farming
Poorly located kelp farms can shade natural kelp beds. Farmed kelp not sourced from local stocks could negatively impact native kelp genetic diversity

Fouling & Competition
Warming waters can lead to competition and displacement of native species by heat tolerant species and outbreaks of encrusting organisms e.g. *Membranipora membranacea* which can cause defoliation

Disease
Diseases are not currently commonplace in UK kelp species, but needs to be monitored as aquaculture increases

Direct Harvesting
Direct mechanical or hand gathering can remove mature reproductive stages, but is not widespread in the UK

Sussex Kelp Recovery Project

Aim 5

To increase understanding of, and community engagement in, Sussex kelp and other essential fish habitats, so that their importance to the environment and society is known, and to enable marine ecosystem recovery elsewhere

Eric Smith and daughter Catrine review Wakame kelp, an invasive species mostly found in Sussex on man-made structures.
Big Wave TV

Aim 5: Overview

Kelp beds and the marine life and fisheries they support provide commercial, recreational, aesthetic and health benefits to local communities, businesses and visitors alike. Public engagement is vital to raise awareness of the value of these coastal ecosystems and to involve a wide audience beyond the scientific community in their recovery.

In 2023, that awareness was given a huge boost by the broadcast of the Our Sea Forest film on BBC1, which received 1.3million views in its first month alone, along with significant press and TV coverage. A local screening of the film was a sold-out event that also included a stirring Q&A and the opportunity for those who support kelp, whether local volunteers or marine experts, to get together.

Each year, SKRP partners collectively give hundreds of presentations about the project with many aimed at national and international audiences. Engaging the local community in Sussex remains a key focus, with talks to school children, outreach with fishers along the Sussex coast, and briefings with stakeholders in the area such as local Councillors, regularly taking place.

Three dedicated new social media channels were launched in 2023 to help share updates and milestones with a growing kelp following and SKRP's journey to rewild Sussex seas was spotlighted in numerous local and national TV and newspaper articles.

Looking ahead, the SKRP team is planning a second Kelp Summit at the end of 2024 to bring key stakeholders and marine experts together with local people.

Activity & achievements since 2021

Aim 5: Summary

- Our Sea Forest broadcast on BBC1
- Public screening event in Shoreham-by-Sea
- 3 dedicated social media channels launched
- Two kelp-themed art exhibitions
- SKRP's work presented at hundreds of events
- SKRP's journey to rewild Sussex seas spotlighted in numerous TV and newspaper articles
- 4,300 views of SKRP Science film
- Engaging with the fishing community
- 16 University student projects
- Kelp Summit 2022 – cross-sector inspirational meeting

Our kelp forest film screening and Q&A

On a stormy night on the 18th October 2023, the inspirational BBC documentary 'Our Sea Forest' about Sussex kelp was screened locally at a sold-out event at the Ropetackle Arts Centre in Shoreham-by-Sea.

The event was introduced and closed by Henri Brocklebank, chair of the SKRP.

Following the screening, the stars of the film, Eric Smith and his daughter Catrine, joined its director, Sarah Cunliffe from Big Wave TV, and other members of the SKRP partnership representing conservationists, researchers, and fisheries management, to take part in a lively Q&A session.

Enthusiasm for the film and support for marine recovery efforts in Sussex, were in evidence in the room and from the non-stop questions from the floor. These canvassed Eric's experience, and his message of hope, as well as current pressures on our marine ecosystems and what local people can do to help.

Of the many memorable moments from the evening, a rousing response by Sam Fanshawe, UK Projects Manager at Blue Marine Foundation was a highlight. She spoke of the Sussex Kelp Recovery Project being one of the most inspiring and unique projects that she'd worked on in her 30-year marine conservation career, due to the passion that was shared by so many people with different interests and their dedication to working together to support nature's recovery.

The stars and director of the Our Sea Forest film joined representatives from SKRP to answer questions from the audience.
Sussex Wildlife Trust

Sussex Underwater
– community champions

Sussex Underwater is a community group founded by divers who in 2021, sought to share their extraordinary footage of the Sussex seabed on social media to document its recovery and show local people that what's out of sight, isn't out of mind.

It's been a whirlwind year for the Sussex Underwater team! Members, Eric and his daughter Catrine, as stars of the BBC 1 Our Lives documentary Our Sea Forest, were catapulted into the limelight when the film and their compelling story attracted the interest of national and local news sites, including TV interviews on BBC Breakfast and South East Today.

Reaction to the film from the public was immediate: Sussex Underwater received thousands of heartfelt messages from viewers who had been moved by Eric's personal account of witnessing catastrophic habitat loss, and his cautious joy of seeing its recovery.

In addition to their day jobs (all members are volunteers), the Sussex Underwater team dive, report marine life sightings, create spectacular and educational underwater videos, respond to their 16,000 strong community on their social media pages, and give an astonishing amount of talks and presentations to schools, community groups and other organisations.

To cope with the demand, the team has grown to nine people including two new youth champions who are helping to bring the story of seabed recovery to a new demographic. (Read more about Sussex Underwater champions on page 58)

Whether giving presentations to attendees of the UNA's Ocean Symposium, to the Women's Institute or to a local primary school, the members find that the audience's desire for a healthy marine ecosystem is palpable, even if the questions they get asked, differ. From school children they are most often quizzed about the size of the biggest fish seen, while adults ask what they can do to help.

Find Sussex Underwater on Facebook, Instagram and YouTube.

Left: Eric, Catrine and Sarah Cunliffe from Big Wave during filming.
Sussex Underwater

Below left: Eric and Catrine talk about the documentary on BBC Breakfast
BBC

Below: The Sussex Underwater Team
Sussex Underwater

"Just caught up on iPlayer. What a wonderful and inspiring story. Lets hope they roll out more no-trawling zones around the UK!"

"Congratulations on the film – loved it. Thank you for all your hard work and dedication. We all need a little more hope in our lives"

"What a wonderful, heartwarming film... and fabulous tribute to your lifetime of dedication. It should be compulsory viewing in our schools"

Some of the Facebook messages about the documentary.

Sussex Underwater youth champions

At the end of 2023, the Sussex Underwater volunteer team of Eric, Catrine, Paul, David and Dominic, were joined by four new members, Ruby, Ollie, Freya and Amy. The new recruits combine a passion for marine life as divers or sea swimmers, with the knowhow that comes from teaching, social media expertise or filmmaking.

Here we talk to the team's youth champions, Ruby and Ollie, about what it's like being part of Sussex Underwater.

What's your name?

Ollie Foster

Tell us a little about yourself?

I am a qualified scuba diver turned freediving fanatic, keen to stand up for our local wildlife.

What do you love about the sea/marine life in Sussex?

It's so alien! We have such crazy, amazing creatures crawling or finning round our rock pools and inshore areas that are so far from anything you'd ever see on land. You really are in their world. It feels like such a privilege.

What do you typically do for Sussex Underwater?

I am a diver/filmmaker. During the dive season I'm out locally collecting footage and recovery data for the team. Between this my time is spent editing and ultimately producing videos that we all see on the Sussex Underwater page.

What can we look forward to in the months ahead?

With the expansion of the team and a larger capacity boat, more videos! This year we'll be increasing the quantity of dives across the team, as well as visiting new areas in Sussex to document recovery since the trawler ban. It'll be a busy year.

What do you like best about volunteering?

Being able to show people what's out there, what it's doing and how we can help is really special.

Ollie Foster

What's your name?

Ruby Stothard

Tell us a little about yourself?

There's nothing I love more than exploring outdoors, which is why I work as a Beach School and Forest School leader – I can share my passion for learning about local wildlife.

What do you love about the sea/marine life in Sussex?

The Sussex coast is amazing because it's so varied, and has so many hidden gems. Rockpools in Bognor versus rockpools in Eastbourne are home to completely unique and diverse ecosystems.

What do you typically do for Sussex Underwater?

I am part of the Shore Team, making content about the marine life that lives or ends up on our beaches, as well as documenting any kelp that washes up. This information contributes to the SKRP's records of kelp bed recovery across Sussex. I also speak at our Sussex Underwater talks.

Ruby Stothard

What can we look forward to in the months ahead?

More interesting talks from our team across Sussex; and more fascinating underwater footage as talented divers and filmmakers have joined the team. Paul Boniface and I will be regular faces on our socials, connecting with our community through livestreams and posts showcasing local wildlife. And hopefully, more kelp!

What do you like best about volunteering?

Being in a lovely community of like-minded individuals who are passionate about protecting what's precious to us.

Wild Coast Sussex achievements

Ella Garrud, Wild Coast Sussex Project Manager

Over its three years, Wild Coast Sussex worked to engage and inspire Sussex communities to care for and protect their local coast and ocean. The project, which was delivered by partners Sussex Wildlife Trust (lead), Marine Conservation Society, Sussex Inshore Fisheries and Conservation Authority and Brighton SEA LIFE, came to an end in March 2024. Here we look at its key achievements.

Schools

Wild Beach is an outdoor education programme based on child-centred learning that gives children the chance to develop a strong connection with their local coastline. Children learn about Sussex coastal species such as kelp, the importance of looking after the beach environment and much more. It's been inspiring watching them grow in confidence while learning what they can do to help protect their local coastline. Children who aren't able to access the coast were also 'taken to the beach' by the programme. By handling natural beach materials, listening to beach sounds and experiencing its smells, the children were given a full-sensory experience of the coast in classrooms of Special Educational Needs schools.

Young people

Engaging 16-25 year olds was a key target for the project. Led by Marine Conservation Society, a series of events themed around the coast and ocean engaged young people and included silent disco beach cleans, Art by the Sea workshops, Ocean Hackathons, citizen science training (including kelp recording) and visits to SEA LIFE Brighton. These sought to enable learning, empower local communities, create change and advocate for mental health and wellbeing.

Net Recycling and Ghost Gear

Wild Coast Sussex consulted and worked with fishers and ports along the coast to tackle a key environmental issue; Ghost Gear. Read more about this important work run by Wild Coast Sussex on page 60.

Champions

A fantastic group of Champions volunteered their time on the project and were instrumental in enabling Wild Coast Sussex to be a success. Champions took part in opportunities including citizen science, communications, events and assisting Wild Beach sessions, and the project is immensely grateful for their hard work and creativity.

Wild Coast Sussex was funded by the National Lottery Heritage Fund thanks to money raised by the National Lottery Players.

Engaging local fishers

Engaging the local fishing community is of huge importance to the SKRP: to harness their knowledge, engage them in research and support the future of local fisheries as key beneficiaries of the recovery of kelp and other essential fish habitats.

Blue Marine Foundation, Sussex Wildlife Trust and Adur & Worthing Councils have worked with fishing communities in Selsey, Bognor and Worthing to help develop collaborative conservation, research and marketing initiatives.

Fisher-supported research

As well as working with individual skippers on crab and lobster surveys, Blue Marine Foundation has been working with fishers in Eastbourne, Brighton and Worthing, gathering anecdotal information of potential environmental and human impacts on crab and lobster populations, such as sediment and water quality.

Learning from peer projects: Lyme Bay Fisheries and Conservation reserve

In Worthing, Adur & Worthing Councils have worked with local day boat fishers to identify the support they need to market and sell their catch, including plans to renovate Worthing's Rotunda into an ice store and market area. Together with Blue Marine Foundation, Adur & Worthing Councils organised a visit to Dorset to meet local inshore Lyme Bay fishermen. The fishermen shared their experience of setting up facilities and initiatives to support the market of fresh sustainable seafood from within Lyme Bay following introduction of a trawling ban there in 2008.

"Surveys are a good thing for everyone to get knowledge of what's happening down there [on the seabed]. It's important to work with Blue Marine because we can't see with our own eyes what is down there. For them it's an understanding of what it's like, for us it's about the stocks – we can see what our future is."

Dan Langford, Skipper of the Rapid Return, on working with Blue Marine and the Sussex Potting Surveys 2023

Dan Langford, Skipper of the Rapid Return, is working with Blue Marine Foundation to monitor crab and lobster abundance in Selsey.
Madi Bowden-Parry

Net Recyling and 'Ghost Gear' – A Wild Coast Sussex initiative

Ghost gear is fishing gear that is either abandoned, lost, or discarded at sea. Most of this gear is made from non-biodegradable materials, so it remains intact in the ocean and continues to harm and kill the marine life that becomes entangled in it, hence its monikers of 'ghost gear' or 'ghost fishing'. Stopping ghost gear from entering our seas, or removing it if there, is consequently of huge importance.

Wild Coast Sussex have also been working with Ghost Fishing UK, providing them with regular reports of ghost gear sightings in Sussex. The award-winning charity has a team of volunteer scuba divers who are trained to remove entangled fishing gear along our coast, often a challenging and difficult task.

Through consultation with the fishing community and in collaboration with local ports, Wild Coast Sussex set up a scheme to recycle end-of-life fishing gear for Sussex fishers. They brought in Odyssey Innovation, a company who take fishing gear, recycle it into pellets and create new products such as kayaks. Though the Wild Coast Sussex project has now concluded, Worthing Coastal Office, Adur and Worthing Councils, and Shoreham Port hope to continue the recycling scheme.

Sharing the SKRP message locally, nationally and globally

In 2023, SKRP partners collectively made hundreds of presentations about the project. Here we review three of those.

Local: Presentation to Arun District Councillors

Councillors are a bridge between local communities and local government and can also play a key role in environmental efforts.

In October 2023, Kelp Recovery Co-ordinator George Short, gave an update on the project to Councillors in Arun, West Sussex.

A highlight of the talk for attendees was the focus on Bognor Regis, on the coast of the Arun District. George relayed Bognor's importance to the project as the site of the remaining 4% of the historic kelp beds that were once abundant from Selsey to Shoreham-by-Sea.

George Short and Sam Fanshawe from SKRP meet with Councillors in Bognor.
Sam Fanshawe

It is hoped that this stronghold of kelp, which was never trawled due to its rocky reef, will help reseed the Byelaw area when it releases its spores each year.

Councillors asked how they can best support the project locally. Resulting discussions highlighted the importance of supporting the sustainable small-boat fishing community that remains in Bognor.

National: Presentation to TAG

IFCAs Technical Advisory Group (TAG) promotes and facilitates communication, collaboration and coordination between the UK's 10 IFCA Districts and other government organisations in relation to fisheries research and marine science. It meets three times a year.

Dr George Balchin, Conservation and Research Manager at Sussex IFCA, shared the development of the Sussex Nearshore Trawling Byelaw at April's TAG conference.

The Byelaw was presented as a case study in ecosystem-based fisheries management. As a central objective of the Fisheries Act 2020, all IFCAs are moving in this direction and though each district and the fisheries they contain are different, there are many learnings from the approach in Sussex.

Dr George Balchin presenting at the TAG conference.
Jake Wilson

Of particular interest to attendees were:

- The body of evidence and data collected that informed the Byelaw
- Incorporation of an ecosystem-based approach to management
- The Byelaw's consultation process, which encompassed a huge range of stakeholders including the fishing community, and support for which fed into the development of the Byelaw and its approval by the Secretary of State.

Global: UNA Ocean Symposium

The Ocean Symposium 2023, hosted by United Nations Association Climate & Oceans, is a multi-stakeholder event taking place in Sussex, with a local and a global approach.

The theme for November's event was 'Empowering Communities for Ocean Action', and it sought to address critical issues including ocean pollution, ecosystem recovery, marine technology and climate change through thought-provoking discussions by expert speakers.

George Short was one of six speakers on the day, presenting an update on the SKRP to the packed-out audience as well as to international viewers via zoom.

As testament to the project's significance, it was also featured in nearly every other presentation on the day, a demonstration of its role as the cornerstone of seascape work in Sussex.

How kelp is inspiring local artists

The journey of SKRP to protect, recover and rewild the marine environment in Sussex has inspired art installations across the county.

The Untangling

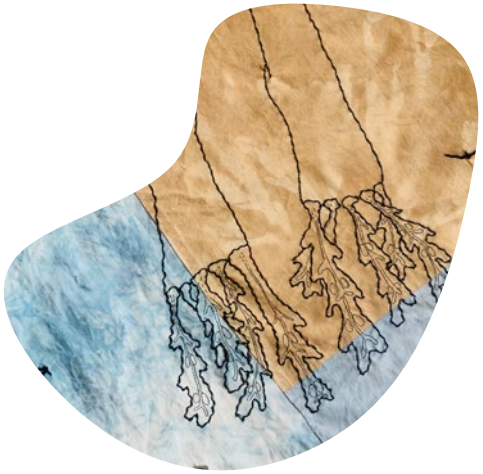
Artist: **Lila Wordsworth**
Curator: **Persephone Pearl**
Where and when: **ONCA environmental justice gallery, Brighton throughout September 2023**

'The Untangling' celebrated the profound impact the trawling ban is having on the Sussex seabed ecosystem. It featured a handmade quilt, hand dyed using seaweed responsibly foraged from (and returned to) Brighton beach and a poem celebrating the recovery efforts.

Through the symbolism of a quilt, the work explored the exploitation of our environment to communicate the importance of reducing human impacts and 'letting the seabed rest' so that it can begin to recover.

In drawing parallels between the harm inflicted to ecosystems and that experienced by marginalised people, 'The Untangling' extended its call for increased rest to the planet and people.

https://lilawordsworth.com/the-untangling



Lila Wordsworth

Interweaving Spaces

Artist: **Gil Mualem-Doron**
Where and when: **Worthing Theatres and Museums throughout autumn 2023**

Interweaving Spaces addressed biodiversity, cultural diversity and the disastrous effects of climate change.

It included a large-scale immersive installation that featured dozens of textile strips suspended from the ceiling simulating kelp forests. Sound and dance performances, such as that performed by Blkdiamondance also took place, in which members of the public joined in dancing and weaving through the kelp installation.

The exhibition invited people to "dive in" and imagine how they are connected to other kelp forests in different regions worldwide, and to other coastal communities across the globe, many of whom are threatened by global warming and rising seas.

www.gmdart.com/interweaving-spaces

Gil Mualem-Doron

Sussex Wildlife Trust

Wider marine recovery initiatives

Big Wave Productions

Sussex Bay

Sussex Bay is a movement initiated by Adur & Worthing Councils and powered by civic organisations, local businesses, communities and people. Formed by radical collaboration, it's on a mission to generate a £50 million fund by 2050 to accelerate local seascape recovery along 100 miles of Sussex coastline.

The global challenges of biodiversity loss and climate change are well known. In Sussex we are seeing its impacts at a local level, from the loss of our kelp beds (a hidden ecological crisis) and our polluted, ecologically-poor rivers, to coastal erosion and flood risks, and the decline of our small boat fishing industry.

Many pioneering projects and collaborations are underway in Sussex, including the Sussex Kelp Recovery Project, but more needs to be done. Informal conversations over several years had led to a deep local understanding of the need for more ambitious collaboration across public, charity and private sectors: particularly around research and funding.

Sussex Bay

Sussex Bay was formed in response to the explicit needs of the people working in nature recovery.

It seeks to fill critical research and funding gaps in the nature recovery system, by facilitating bold collaboration across sectors, enhancing and accelerating the impact of nature-based projects. By innovating in blue natural capital restoration methods and funding models, it will unlock the private investment required to finance nature's recovery. This is fundamental: for the UK to deliver its nature-related ambitions it must plug a finance gap of £56 billion (over the period of 2022-2032). Public and philanthropic grant funding will not be sufficient, private, nature-based investment must have a role in closing this finance gap.

Launching the UK's first Blue Natural Capital (BNC) Lab

Key barriers hinder seascape-scale recovery. Marine, coastal and estuarine recovery is generally small scale and there are very few

Adur & Worthing Councils

organisations working in the field. Projects spend time applying for funding, dealing with regulation and licensing which can be costly. Joined-up seascape level thinking is very new; around the UK there is little consensus about where habitat and species recovery is needed and how to do this.

To tackle and to ultimately unlock these barriers, Sussex Bay is setting up the UK's first Blue Natural Capital Lab. This is a place for collaboration, innovation, and testing. Where key agencies, local partners and communities will be brought together, including national policy teams, to explore better seascape planning, funding and project development. The BNC Lab also aims to help coordinate scientific research in Sussex Bay, and enable innovation in research and monitoring methods, including the use of new technology.

Sussex Bay will be presenting at various events in the Spring and Summer of 2024, including TEDxBrighton and Blue Earth's Future of Oceans event. Find out more at SussexBay.org.uk

Weald to Waves

LOCAL

Weald to Waves is a collaborative project to establish and monitor a 100-mile nature recovery corridor across Sussex.

The project is led by a growing network of farmers, land managers, councils, researchers, wildlife charities, schools, gardeners, and community groups. The corridor will run from the High Weald to Sussex Bay, blending terrestrial and marine environments. Across the 100-mile route, Weald to Waves works with regional partners to channel advice, funding and capacity to boost connectivity, soil and water health and the quantity and quality of habitats.

Building a network and a community

All 284,000 people living in the corridor have a potential part to play in nature recovery. In 2023, Alex Briggs joined the project to help build this network of local people, organisations and partners working collaboratively for nature recovery.

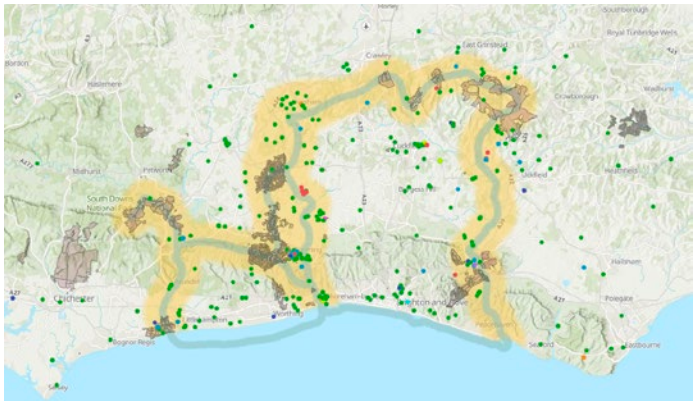
Over the past year Weald to Waves has grown rapidly; from seven founding land managers to over 500 pledges, covering 12,600 hectares. This equates to 15% of the corridor's 77,000 hectares. This community of pledges, committed to nature recovery in various forms, is becoming increasingly diverse as it's joined by farmers, land managers, gardeners, and community groups.

Over the coming months and years, the project will focus on developing action within these pledges, while continuing to build the network. In 2024 a landscape-scale monitoring framework will be trialled, utilising citizen scientists and experts to produce data that is meaningful for local land managers, while using indicator species to monitor habitat connectivity across the corridor.

Weald to Waves identifies and supports opportunities for nature recovery, from nature-friendly gardening to natural flood management solutions and regenerative agriculture. These land management changes can significantly improve the sustainability and resilience of our landscape, boosting biodiversity and reducing downstream sedimentation that ultimately can contribute to the recovery of Sussex kelp.

A-pan Sussex approach and collaboration with diverse conservation projects helps to ensure Weald to Waves takes a cohesive, landscape-scale approach that supports the recovery and sustainable use of our terrestrial and aquatic ecosystems.

Above: Weald to Waves vision of a nature corridor through Sussex.



Right: A vision turned into reality: an interactive map from the Weald to Wave website in March 2024 shows the 500+ pledges made by land managers, gardeners, community groups and farmers.

View the map and get involved at www.wealdtowaves.co.uk

James Baird
Times Photographer Richard Pohle

"We're asking farmers and land managers to put nature at the forefront of decision-making across their landholding. That is a radical shift and it will lead to the sea change in attitudes and farming practices that we so badly need."

James Baird, founder, Weald to Waves

Sussex Dolphin Project

The Sussex Dolphin Project aims to protect cetacean species off the coast of Sussex through research, awareness and education projects within the local community.

The project collaborates with organisations and individuals to create a sightings network that feeds a Sussex-wide citizen science programme. This data is combined with our land-watch volunteers' research to better understand the behaviour, movement, prey species and breeding sites of cetacean species in Sussex.

Through opportunistic sightings and citizen research, we have worked with other organisations as part of the South Coast Bottlenose Dolphin Consortium to understand more about England's only resident population of inshore Bottlenose Dolphins *(Tursiops truncatus)*.

Dolphins from this pod travel the coast between North Cornwall and East Sussex, with some individuals known to have travelled up to 760km between sightings. This population consists of an estimated 48 individuals but sadly reproduction levels are low and calf mortality is high, leading to concerns over their future. The Sussex Dolphin Project is working with other organisations to increase our understanding of the threats facing this population and working to reduce threats where possible.

As well as its research role, the Sussex Dolphin Project also focuses on educating the population of Sussex on the importance of a healthy marine environment and increasing opportunities for residents to get involved with marine conservation by providing training and volunteering opportunities. Our land-watch volunteering offers affordable training to get into marine conservation, and the research from this has already led to a significant increase in our understanding of Harbour Porpoise *(Phocoena phocoena)* off the coast of Sussex.

Three porpoises in Sussex Bay.
Thea Taylor

Sussex Dolphin Project volunteers spot a pod of harbour Porpoise while on a survey.
Sussex Dolphin Project

For more information visit SussexDolphinProject.org

You can also read the open access report by the South Coast Bottlenose Dolphin Consortium for which the Sussex Dolphin Project was a contributor: Using citizen science data to assess the vulnerability of bottlenose dolphins to human impacts along England's South Coast

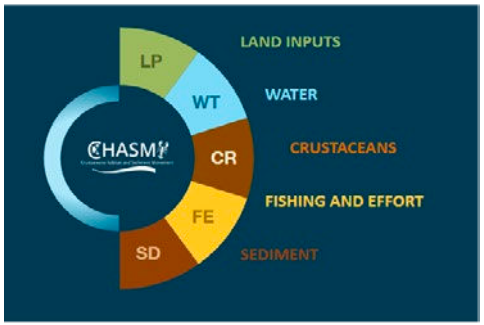
CHASM:
Crustaceans, Habitat and Sediment Movement

LOCAL

The Crustaceans, Habitat and Sediment Movement (CHASM) project, initiated in 2020, aims to understand the environmental, physical and climatological changes which may have impacted crab and lobster habitats around Selsey Bill. This will improve understanding of the marine environments, with a view to developing improved management practices to support sustainable crustacea habitats, while fostering collaboration with other local initiatives.

CHASM's focus on sediment followed observations by fishermen that crab and lobster catch on the Manhood Peninsula coast had been greatly reduced in recent years, particularly lobster, while the amount of sediment on the seabed and rocks locally had increased.

To research this issue, CHASM's programme includes seabed mapping, analysis of sediment compounds, review of sea surface temperature changes, and findings from a telemetry unit and sondes in the Chichester Harbour and Marina areas.



In its study of sediment within the marine environment, CHASM is a key contributor to the understanding of how this pressure may impact the recovery of Sussex kelp.

In 2023, CHASM co-hosted the Sussex Sediment Monitoring and Adaptive Response workshop with Blue Marine Foundation. CHASM scientists presented a work package framework for future funding and collaboration which had over 50 potential work streams under five themes: (1) Land inputs, (2) Water, (3) Crustaceans, (4) Fishing and effort, and (5) Sediment.

Workshop participants ranked the work streams based on two criteria: which could have the biggest impact, and which could fill the greatest evidence gap in our understanding. This prioritisation helped identify the areas on which CHASM will focus and target future funding opportunities.

CHASM Crustaceans Habitat and Sediment Movement

Final prioritisation of CHASM tasks

Theme	Work package tasks	Most impact	Fills a gap	Total per task
Sediment	SD2.2: Impact of dredging on levels of suspended particle matter and bed material	11	2	13
Water	WT3.1: Long term water quality monitoring	7	3	10
Sediment	SD2.1: Assessment of dredge activities	5	4	9
Sediment	SD1.2: Suspended sediment cycles, inputs and transport	8		8
Crustaceans	CR3.1: Crustacea response to contaminants	5	1	6
Crustaceans	CR1.1: Current and historic species composition	2	3	5
Fishing	FE1.2: Changes to gear, practices and legislation over time	5		5


Coastal JJ Photography

Seascape Restoration Research Network

NATIONAL

The coastal zone between the Solent and Sussex Bay is home to one of the largest concentrations of seascape restoration activities in the UK. Realising the collective vision of healthy and resilient coastal ecosystems will require careful coordination between the existing initiatives, as well as substantial funds.

Established in January 2023 by a collective of five south coast research institutions (Universities of Portsmouth, Brighton, Sussex, Surrey and the National Oceanography Centre in Southampton), the Seascape Restoration Research Network aims to facilitate collaboration between restoration projects in the Solent to Sussex Bay area, and ensure that efforts are synergistic, avoid duplication, and incorporate best practice. This multi-stakeholder network currently consists of 84 members from over 30 organisations across Hampshire, Sussex and the Isle of Wight.

Over the last year, the Network held a series of local workshops, which explored the role of nature-positive finance in the context of achieving seascape-scale restoration in the Solent and Sussex Bay. The output of these workshops is a report outlining a set of actions, which will help to better integrate the principles of marine natural capital into local restoration efforts.

More recently, the Network worked with Finance Earth and Pollination to deliver workshops in London, Cardiff, Belfast and Edinburgh, which brought together 300+ marine restoration stakeholders and resulted in the formulation of a roadmap to develop high-integrity marine natural capital markets in the UK.

Going forward, the Seascape Restoration Research Network will continue to engage with stakeholders across the Solent and Sussex Bay to strengthen the local capacity to restore the seascape. In addition, we will further develop our partnership with the research community to iterate a seascape restoration research agenda for the region.

All work undertaken by the Seascape Restoration Research Network is funded by the NERC Integrating Finance and Biodiversity programme.

If you would like to join the network, please message the project coordinator Dr Karolina Skalska (karolina.skalska@port.ac.uk) or PI Prof. Jo Preston (joanne.preston@port.ac.uk).

UK SEASCAPE RESTORATION RESEARCH NETWORK

Natural Environment Research Council

IFB Integrating Finance & Biodiversity

A local workshop at the Institute of Marine Science in Portsmouth in May 2023.
Sayyidah Salam

Environment Agency's kelp monitoring scheme

NATIONAL

Though kelp is a priority habitat, there is no national monitoring programme to improve our understanding of its extent and condition. The Environment Agency is working to address this critical evidence gap.

Over the course of three years (2022-2025), the Natural Capital and Ecosystem Assessment (NCEA) programme (a partnership of eight organisations managed by Defra) is monitoring the state of England's land and water environments and how they're changing over time, as well as exploring the vital ecosystem services that nature provides. Data collected will provide evidence and tools to better understand the true value of our natural assets and ensure this is considered in decision-making, management and policy application, so that better outcomes for nature and people can be achieved.

EA researchers on an echosounder.
Environment Agency

The Environment Agency is leading the estuarine and coastal components of this programme. The work includes developing a natural capital monitoring network to fill key gaps in estuarine and coastal natural capital asset inventories. In addition to monitoring seagrass, saltmarsh, plankton and fish, the Environment Agency is proposing a kelp programme.

In its 'Land-Sea Interface project', another Environment Agency led component of the NCEA programme, work to improve evidence on the ecosystem services our natural capital assets provide is planned, designed to complement the monitoring work proposed. Research proposals for kelp include increasing understanding around nutrient uptake, and its essential fish habitat and biodiversity enhancement benefits in the UK, as well as exploring the ecosystem service flows from kelp cultivation.

Dropdown video and camera survey of kelp habitat.
Environment Agency

How kelp is being monitored

Due to the extent of kelp habitat nationwide, a multi-method approach is planned, using a combination of new survey data, existing data and modelling. A core aspect of the Environment Agency's proposed ongoing kelp monitoring programme is the use of single beam echosounder and associated dropdown camera and video (echosounders can be used to map extent, density and canopy height of kelp beds to create an estimate of kelp biomass).

Other innovative monitoring techniques being explored include: Multibeam echosounder, optical remote sensing methods, uncrewed surface vessels, artificial intelligence, and working with citizen science projects and partner dive surveys.

A collaborative approach and the ethos of collect once use many times is at the proposed programmes core. The EA welcomes opportunities to coordinate on work with partners to create a robust baseline asset inventory for kelp, to inform future assessments on the state of this habitat and strategic restoration activity.

Environment Agency

NCEA Natural Capital and Ecosystem Assessment

Kelp Forest Alliance

GLOBAL

The Kelp Forest Alliance, founded in February 2022, is a growing movement of people and organisations brought together to enhance, protect, and restore kelp.

The Kelp Forest Challenge

To further their mission, the Kelp Forest Alliance launched the Kelp Forest Challenge. This rallying cry has 2 goals: to protect 3 million hectares and restore a further million hectares of kelp forests globally by 2040, and to reconnect people to these forgotten habitats.

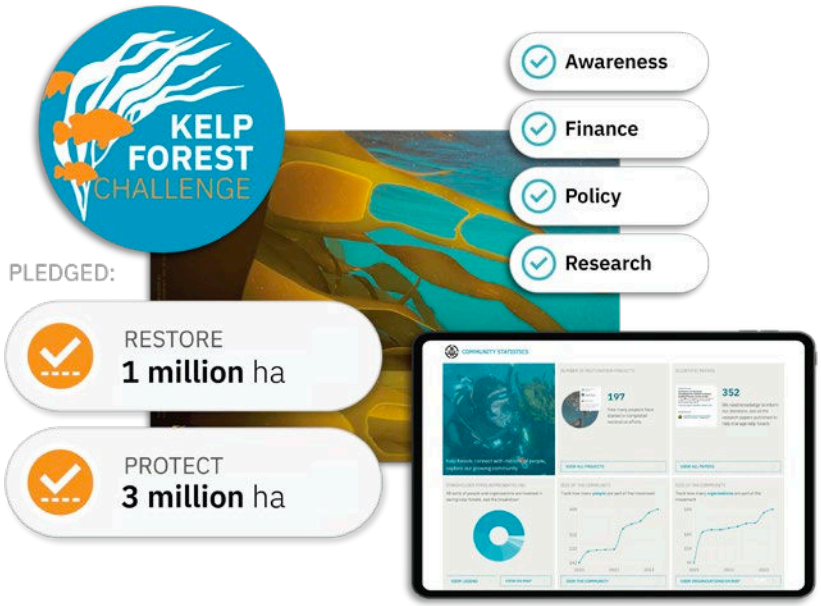
The Kelp Forest Challenge encourages individuals, groups and organisations to make a pledge, whether to protect or restore kelp forests, assist conservation projects, or to help increase awareness and inspire others. Everyone can take part.

To date they have received 28 pledges from eight countries that cover some 55,000 hectares. This includes 170km^2 that have been pledged by the Sussex Kelp Recovery Project.

Whilst travelling in Europe, Australia-based Program Director Dr Aaron Eger met the SKRP at the offices of Sussex IFCA to personally review the work that's happening in Sussex and its significance as the only kelp rewilding-focused project in the Kelp Forest Alliance.

Read more about the Kelp Forest Alliance at:
kelpforestalliance.com

KELP FOREST ALLIANCE



"Over 750 million people have a kelp forest in their blue backyard. People living in London, Los Angeles, Sydney, Tokyo, are connected to and inspired by these incredible underwater worlds. Still many of these forests and the work being done to save them, remain invisible beneath the waves. But if we're able to join these global projects and passions together, we can create a truly global movement to help our kelp and restore the fabrics of our cold water seas. What starts as a ripple in Sussex will be felt as a crashing wave in New Zealand. This is the essence of the Kelp Forest Challenge and I am so excited to see the great working happening here."

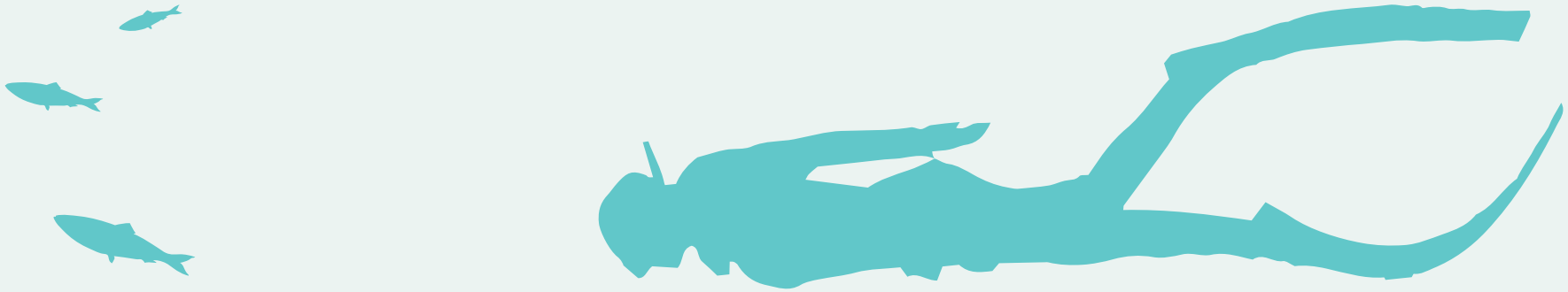
Doctor Aaron Eger, Program Director, Kelp Forest Alliance

Annex 1: Student projects

	Degree Level	Date	Title	University
2021	Bsc	2021	Exploring the Effectiveness of Marine Conservation Zones in West Sussex, using Baited Remote Underwater Videos (BRUVs)	Sussex
	Bsc	2021	Setting a baseline in marine fauna community composition using BRUV systems in West Sussex	Sussex
	Msc	2021	Kelps of the UK and Ireland: evidence of changes in abundance and distribution over the past half century	Sussex
	Msc	2021	Recoding Community Composition Across Different Areas of Protection Using BRUVS	Sussex
	Msc	2021	Using eDNA to assess inshore fish communities in kelp associated ecosystems	Sussex
	Msc	2021	Using historical remote sensing data to create kelp habitat maps for the West Sussex Coast	IMBRSea/ZSL
	PhD	2021-25	Coastal rewilding and food security: understanding restoration pathways using BRUVS (Baited Remote Underwater Video Surveys) and environmental DNA (eDNA)	Sussex
	PhD	2021-25	Evaluation of Sussex Bay kelp carbon storage and sequestration potential	Brighton
2022	Bsc	2022	A comparative study on marine research methods and monitoring ecosystem recovery of kelp forests	Plymouth
	Msc	2022	Assessing the effectiveness of eDNA to monitor the coastal inshore waters of Sussex	Sussex
	Msc	2022	Monitoring seaweed habitats in a kelp restoration zone	Imperial College London/ZSL
	Msc	2022	To help the Sussex kelp restoration project through the remote sensing of kelp forest in UK waters	Sussex
	Msc	2022	Evaluation of shoreline dynamics and assessment of historical coastal change in Sussex, England: The potential impact of kelp habitat loss	UCL
	Msc	2022	Assessing the effects of the Sussex Kelp Restoration Project on wave power and longshore sediment transport at the Sussex coastline	UCL
	PhD	2022-26	Investigating the history of Sussex kelp habitats and their impact on local communities	Exeter
	PhD	2022-26	Understanding the impact of suspended particulate matter on kelp recovery in Sussex Bay	Sussex

Annex 1: Student projects continued...

	Degree Level	Date	Title	University
2023	Bsc	2023	Assessing the impacts of an inshore trawling ban on vertebrate species size and biomass along the West Sussex Coast: with an emphasis on black seabream Spondyliosoma canthaurus	Sussex
	Bsc	2023	Sussex Nearshore Trawling Byelaw: changes in marine organisms abundance and body length two years post-establishment using stereo baited remote underwater videos	Sussex
	Bsc	2023	Investigating if fish diversity and community structure has changed two years after the Sussex Nearshore Trawling Byelaw, using baited remote underwater videos (BRUVs)	Sussex
	Bsc	2023	Impact of the Sussex Nearshore Trawling Byelaw on abundance and species richness of mesopredators and other feeding guilds	Sussex
	Msc	2023	Monitoring the West Sussex marine ecosystem following trawling ban implementation	Sussex
	Msc	2023	Monitoring community structure and identifying the presence feeding guilds of the Sussex IFCA District using eDNA samples	Sussex
	Msc	2023	Trophic assessment of marine vertebrate species abundance in the Sussex Kelp Recovery Project	Sussex



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SKRP Steering Group members

- Henri Brocklebank
- Sam Fanshawe
- George Short
- Dr Chris Yesson
- Robert Pearson
- Dr Ray Ward
- Dean Spears
- Professor Peter Jones

Contributing authors

- Alex Briggs
- Alice Clark
- Catrine Priestley
- Claude Annels
- Diana Alcroft
- Dr George Balchin
- Dr Jen Lewis
- Ella Garrud
- Emily Bulled
- Erin Lawes
- Francesco Marzano
- Jake Wilson
- Jane Cunningham
- Dr Karolina Skalska
- Madi Bowden-Parry
- Marianne Glascott
- Ollie Foster
- Ruby Stothard
- Sarah Cunliffe
- Thea Taylor
- Vanessa Simons

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- Alison Ross
- Beth Stacey
- Charlie Hubbard
- Claire Saxby
- Clive Mills
- Dan Langford
- Darren Keeble
- Dr Charlie Thompson
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- Dr Heidi Burgess
- Dr Margaux Steyaert
- Dr Valentina Scarponi
- Eric Smith
- Ian Titley
- James Tapley
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We have also been supported by contributions through our website, including through individual sponsored activities, fundraising, and corporate donations such as the generous support of local business Brighton Silver. Artists have generously donated their kelp related designs so that these products can help raise awareness of the project and contribute to the recovery.

Everyone working on the SKRP Steering Group extends a huge thank you to all of these individuals and organisations for making this work possible.

Ferry Farm community solar

Meadow Blue Community Energy

THE PEBBLE TRUST

Est 2009 BRIGHTON SILVER

Back cover image:
Catrine Priestley

Eric Smith


Sussex Kelp
Recovery
Project
sussexkelp.org.uk
Follow our rewilding journey at:
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