OCEANS OF VALUE




NATURAL CAPITAL ASSESSMENT OF THE ORKNEY MARINE REGION AREA FOR THE SCOTTISH WILDLIFE TRUST

Summary Report

January 2022

RSK ADAS

GENERAL NOTES

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BACKGROUND

Marine systems offer vital ecosystem services which, from an anthropocentric viewpoint, are of particular value to humans (e.g. food, fuel, health and well-being). From a more ecological perspective the flow of ecosystem services from natural capital assets also provide other values, including supporting the needs of multiple species at different scales in the marine and terrestrial biospheres. Despite this growing awareness of the value of these systems, to people, the economy and the natural environment, anthropogenic pressures continue to threaten the long-term sustainability and health of marine environments around the world.

The Scottish Wildlife Trust (hereinafter referred to as 'the Trust') recognise the importance of revealing this wide range of values (anthropocentric and ecological). It is this perspective that underpins their Oceans of Value (OoV) project. Focusing on the Orkney Islands Marine Region in Scotland (bounded by the 12 nautical mile zone shown in Figure 1), the OoV aims to compare results on 'value' between those gained from stakeholder engagement (using the Community Voice Method), to those obtained from a desk based natural capital assessment.

This report provides a summary of the second part of this comparison; a natural capital assessment of the 'hidden values' provided by habitats and species within the Orkney Islands Marine Region.

Please refer to the detailed technical report for additional information and assessment results.

PRIMARY OBJECTIVES OF STUDY

Identify and assess:

- The marine natural capital assets found within the Orkney Marine Region bounded by the 12 nautical mile zone;
- The location and condition of these assets and whether they are being used/managed sustainably;
- The assets that are most important for environmental health, society and businesses in Orkney;
- The assets that are most valuable in fighting against climate change;
- The assets that are most vulnerable to climate change;
- The assets that are most important for maintaining ecosystem services;
- The ecosystem services provided by Orkney's marine natural capital assets;
- The services that are most beneficial to the Orkney community; and
- Whether the benefits of these services are felt outside of the Orkney marine region;

The potential of the natural capital assessment to inform future marine spatial planning was also identified by the Trust as an important component of this study.

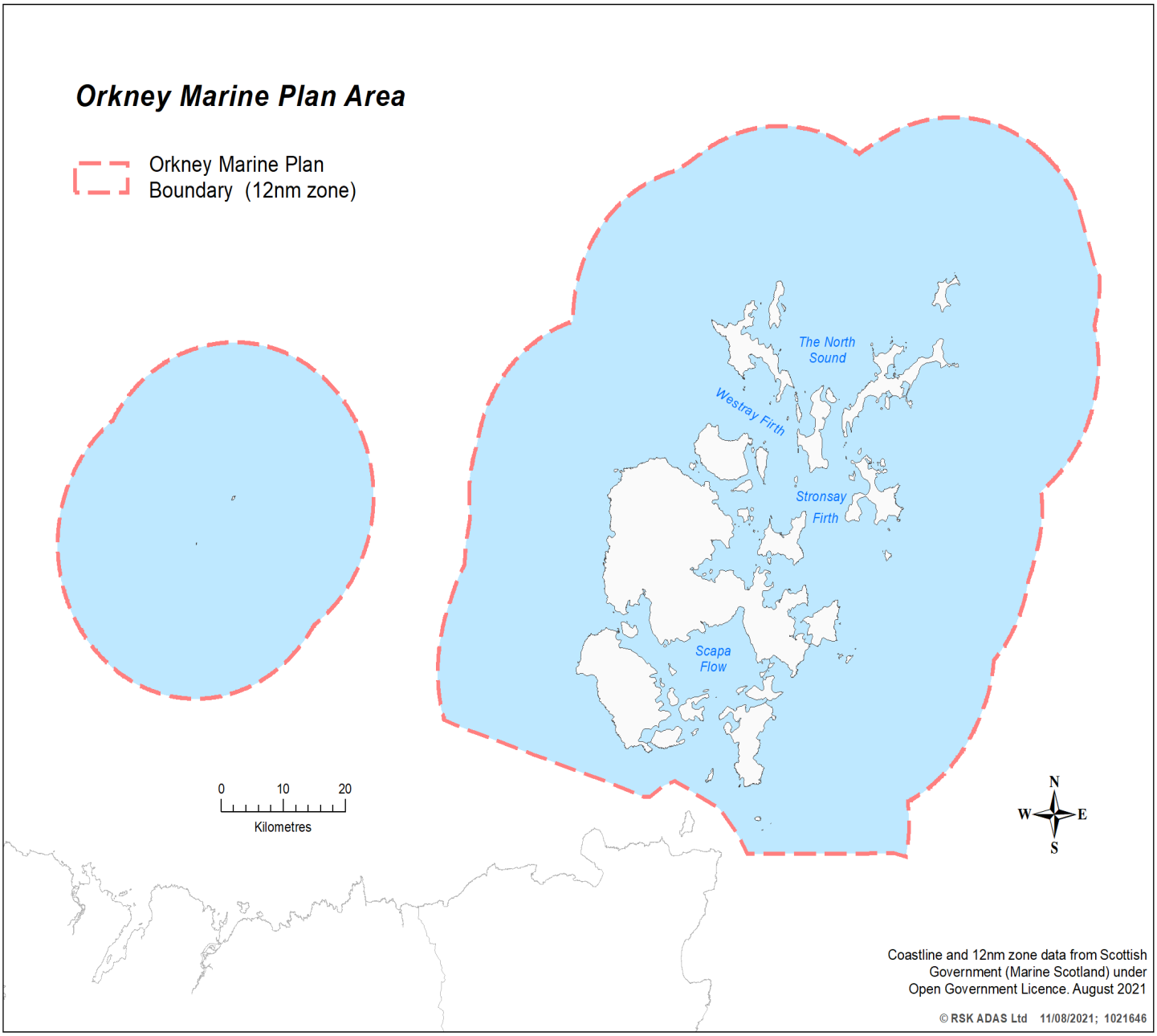

Figure 1: Orkney Islands Marine Region, Scotland .

MARINE NATURAL CAPITAL AND ECOSYSTEM SERVICES

What is Natural Capital?

The UK Natural Capital Committee (2017) define **Natural Capital** as:

"the elements of nature that directly or indirectly produce value to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions."

Broadscale Marine Habitats and Priority Marine Features

Marine habitats are those that occur below the spring high tide limit (or below mean water level in non-tidal waters) and include enclosed coastal saline or brackish waters. The predominant marine habitats in Orkney are sublittoral[1] coarse sediments and sands followed by large extents of infralittoral and circalittoral[2] rock.

Table 1: EUNIS[3] Broadscale habitats and total area (hectares) in the Orkney Islands Marine Region.

EUNIS	Mainland	Western Islands	Total Area
A3.1 High energy infralittoral rock	26,643	145	26,787
A3.2 Moderate energy infralittoral rock	27,062	0	27,062
A3.3 Low energy infralittoral rock	9,272	0	9,272
A4.1 High energy circalittoral rock	40,176	8,864	49,040
A4.2 Moderate energy circalittoral rock	53,831	11,002	64,833
A4.3 Low energy circalittoral rock	10,403	131	10,534
A5.1 Sublittoral coarse sediment	**375,389**	**101,716**	**477,105**
A5.2 Sublittoral sand	**151,630**	**67,830**	**219,459**
A5.3 Sublittoral mud	6,764	0	6,764
A5.4 Sublittoral mixed	13,161	0	13,161
A5.5 Sublittoral macrophyte dominated	431	0	431
A3.2/A4.2 Moderate energy infralittoral/circalittoral rock	0	7,632	7,632
Total	**714,762**	**197,320**	**912,080**

- The spatially extensive habitats, A5.1 (sublittoral coarse sediment) and A5.2 (sublittoral sand), have the greatest potential to contribute a high number of ecosystem services in the Orkney marine region.

[1] Sublittoral is the zone exposed to air at its upper limit by the lowest spring tides.

[2] Circalittoral is the subzone of the rocky sublittoral below that dominated by algae (the infralittoral) which is dominated by animals. See https://www.marlin.ac.uk/glossarydefinition/verticalbiologicalzones for additional biological zone definitions.

[3] European Nature Information System https://eunis.eea.europa.eu/

- For plant-based services, the infralittoral rock habitats A3.1 (high energy infralittoral rock), A3.2 (moderate energy infralittoral rock) and A3.3 (low energy infralittoral rock) have the greatest potential to provide ecosystem services due to their extent.
- Many of the habitats reviewed for Orkney were circalittoral and as such did not include a strong plant/algal component.
- Most seabed habitats were assessed as having the capacity to process and store waste, with habitats that support reefs of filter feeders (e.g. horse mussels and brittlestars) considered to provide a significant contribution. Marine algae and sediments with at least some mud content were considered to provide a moderate contribution. Circalittoral rock habitats and well-flushed sands and coarse sediments were assessed as having low capacity to process and store waste.
- There were a high number of records for Priority Marine Features assessed in the Orkney Islands Marine Region, including maerl, kelp and seaweed.

Table 2: Priority Marine Features by area (hectares)

PMF	Total area
Circalittoral mud	5,707
Flameshell beds	508
Kelp and seaweed communities on sublittoral sediment	468
Maerl beds	537
Saltmarsh	58

What are Ecosystem Services?

The UK Natural Capital Committee (2017) define **Ecosystem Services** as:

"functions and products from nature that can be turned into benefits with varying degrees of human input."

Benefits are the changes in human well-being or welfare that result from the consumption or use of goods and services or from simply knowing something exists.

Orkney Islands Marine Region Ecosystem Services

The marine habitats and species of the Orkney Islands currently deliver a range of ecosystem services classified as either:

- **Provisioning** -> benefits created through the provision of products from nature such as food, water and raw materials;
- **Regulating** -> benefits that arise through the moderation of natural phenomena, for example, sequestering carbon, removing pollutants from the air, regulating water flows;
- **Cultural** -> non-material, experiential benefits provided through interaction with nature, for example, recreation, tourism or aesthetic experiences; or
- **Supporting** -> cross cutting services which underpin the production of all other ecosystem services, for example, soil formation, nutrient cycling, provision of habitat, seed dispersal.

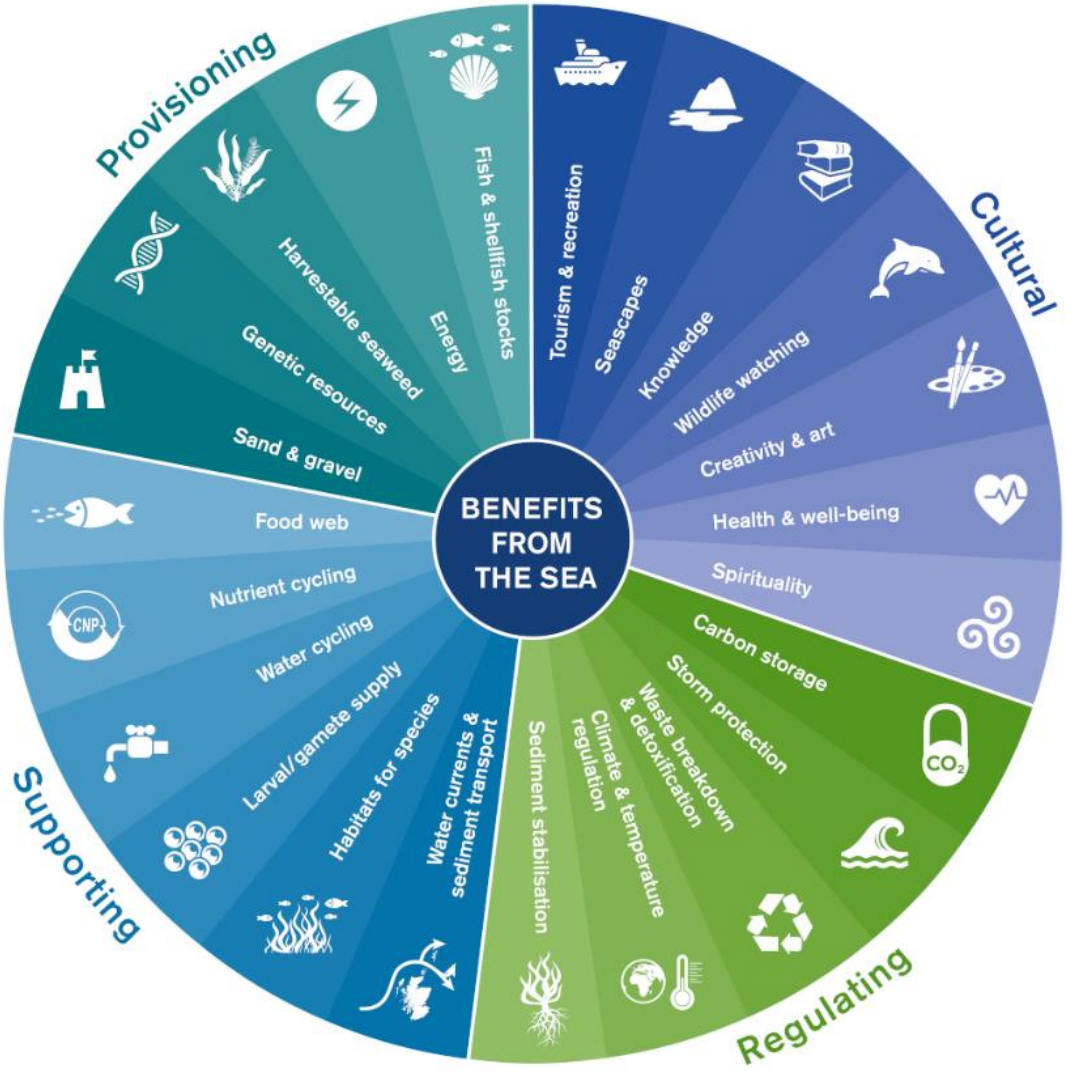

Figure 2: Ecosystem Services provided by Marine Environments. Reproduced with permission from NatureScot.

Ecosystem Services provided by Natural Capital Assets in the Orkney Marine Region

- Across the four types of ecosystem services, the evidence base (for a range of habitats and locations) is greatest for regulating services provided by seabed habitats.
- Regulation of the environment by marine habitats and associated species was supported by most habitats in the Orkney marine region.
- Sustaining fish populations is a key ecosystem service provided by a number of Orkney's marine habitats.
- Maintaining nursery populations and habitats is a key ecosystem service that many of these structured, biogenic or vegetated habitats provide.
- Horse mussel reefs, for example, provide a number of beneficial ecosystem services including the provision of nursery grounds for commercial fisheries species such as queen scallops and ecological niches for a wide variety of organisms.
- Of the provisioning services, the most well studied and evidenced is the role of seabed habitats in supporting wild capture fisheries.
- Relating cultural services to seabed habitats remains a significant challenge, especially for the more esoteric categories such as symbolic or religious meaning, and also existence or bequest value which, arguably, applies to all living things.

Pressures and Risks to Orkney Marine Region Natural Capital

Pressures on Orkney's marine environment are considered low relative to other Scottish Marine Regions: the two main activities affecting habitats are fishing and finfish aquaculture (Scottish Marine Atlas). Climate change pressures have also been evidenced as affecting habitats in the Orkney Marine Region.

Fishing Pressures

- Marine habitats that are relatively unimpacted by mobile gears in the Orkney mainland region are infralittoral rock and low energy circalittoral rock, sublittoral muds and macrophyte-dominated sediments (85% undisturbed or subject to low disturbance). High and moderate energy circalittoral rock was exposed to high levels of disturbance (>80% of habitat highly disturbed) with sublittoral coarse and sand sediments moderately disturbed (32% and 48% respectively) (Figure 3).

- Ecosystem services that are likely to be sensitive to fishing pressures include bioremediation and storage of waste.

- In areas of low disturbance, mobile gears may disturb the sediment disrupting carbon storage. Other regulating services that are supported by the abiotic habitat (sediment and rock), such as control of erosion rates, are not likely to be affected.

- In the western island region, a similar pattern was recorded with the infralittoral rock habitat A3.1 subject to low disturbance, while infralittoral rock (including a habitat that could not be assigned to infralittoral or circalittoral (A3.2/A4.2) was exposed to high levels of disturbance. Sublittoral coarse and sand sediments were highly disturbed (49% and 60% of extent respectively).

- The proportion of each broadscale habitat exposed to physical disturbance from mobile fishing gears in the Orkney marine region is variable.

- No priority marine features were assessed (through datapoint or polygon data) to be exposed to high levels of disturbance (i.e. category 5 or greater), however the spatial analysis suggested all priority marine features were subject to low levels of exposure.

- Habitats that are highly sensitive to surface abrasion, with slow recovery rates, may be degraded by even low levels of pressure. This is a concern for biogenic habitats where degradation may reduce habitat suitability for other species.

- Given the low recovery rates of horse-mussel, maerl, seagrass and flame shell beds, and their sensitivity to physical disturbance, these habitats were assessed as being in poor condition due to surface abrasion from mobile gears.

Finfish Pressures

- Organic enrichment caused by finfish aquaculture has been identified as a key pressure of concern within the Orkney Islands Marine Area (Orkney Islands Council, 2020).
- Organic enrichment results from the degraded remains of dead biota and microbiota, faecal matter from finfish stocks, flocculated colloidal organic matter and the degraded remains of feedstuffs.
- Organic enrichment may lead to eutrophication through nutrient enrichment. Adverse environmental effects include deoxygenation, and changes in community structure of benthos and macrophytes.
- While the scale of impact on habitats will be strongly influenced by hydrodynamics, we identified which features had a higher proportion of records within 1km of a finfish farm as a proxy for risk (based on previous work by Hall-Spencer et al., 2006) (Figure 4).
- The three features most at risk are:
    - Burrowed mud (25% of records),
    - Flame shell beds (20% of records),
    - Tide-swept algal communities (22% of records).
- The sensitivity of features to organic enrichment was found to be highly variable. The ecosystem services associated with burrowed mud and tide-swept algal communities have medium sensitivity to organic enrichment, but there was no data to assess the impact of organic enrichment on flame shell beds.
- The feature with the most sensitive ecosystem service provision is maerl. As 9% of maerl beds are within a 1km buffer of a finfish farm, the impact on their ecosystem services may be disproportionate.

Climate Pressures

- All habitats in Orkney (with the exception of seagrass meadows which are not considered to be sensitive to sea temperature increases according to Porter et al., 2020), are vulnerable to an extreme (5°C) increase in both sea surface and near bottom temperatures.
- The impact of this change is expected to be significant on burrowed mud, horse mussel beds, maerl, kelp and circalittoral mud habitats. For flame shell beds and brittlestar beds the impact is expected to be moderate, although confidence in the evidence base for these is low.
- The evidence base shows a high level of confidence that Maerl and brittlestar beds are also expected to be impacted significantly by decreases in pH. Likewise, flame shell beds are expected to be impacted significantly by decreases in pH levels, but confidence in the evidence base for this is low.

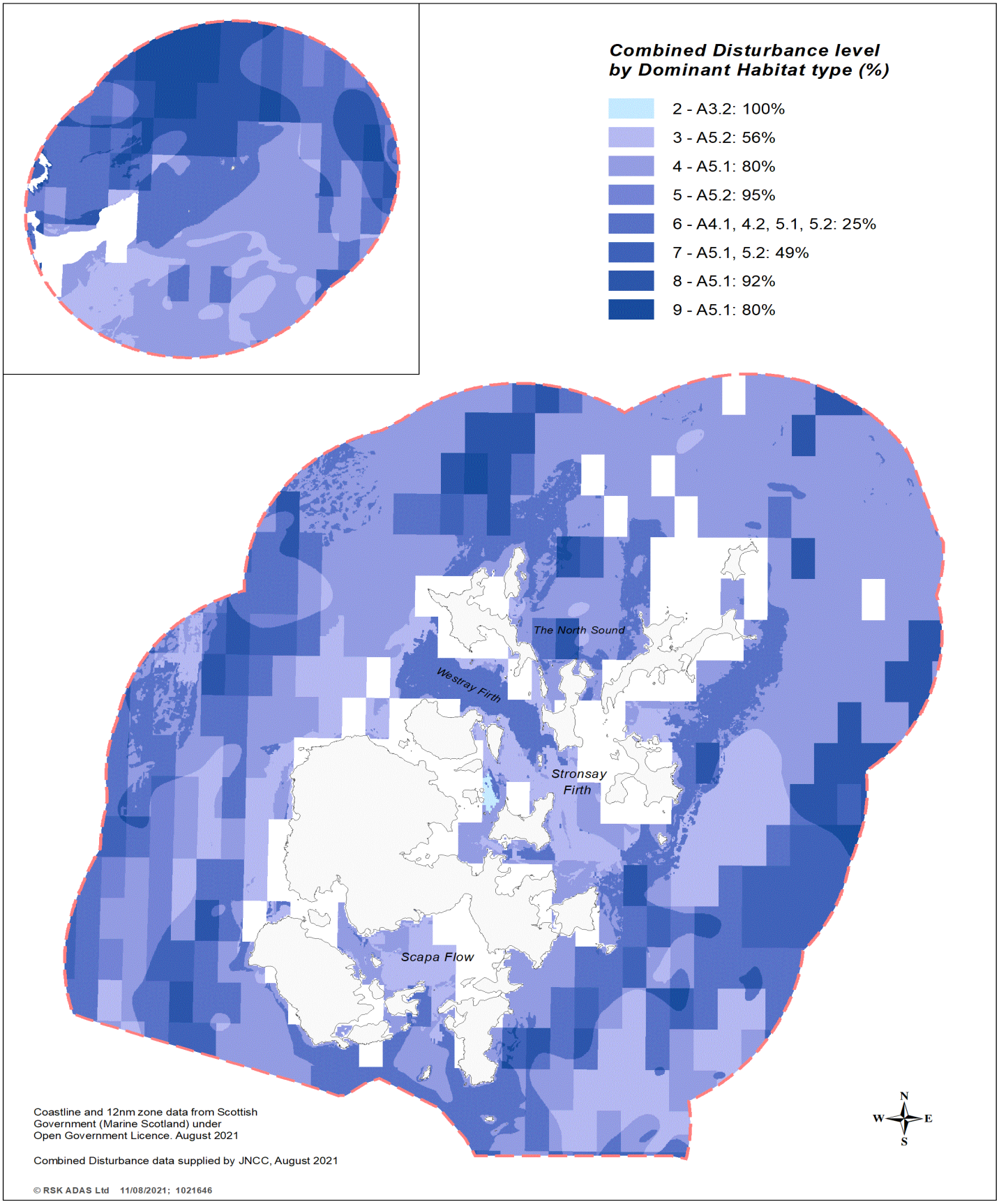

Figure 3: Combined disturbance from fishing pressure by habitat area.

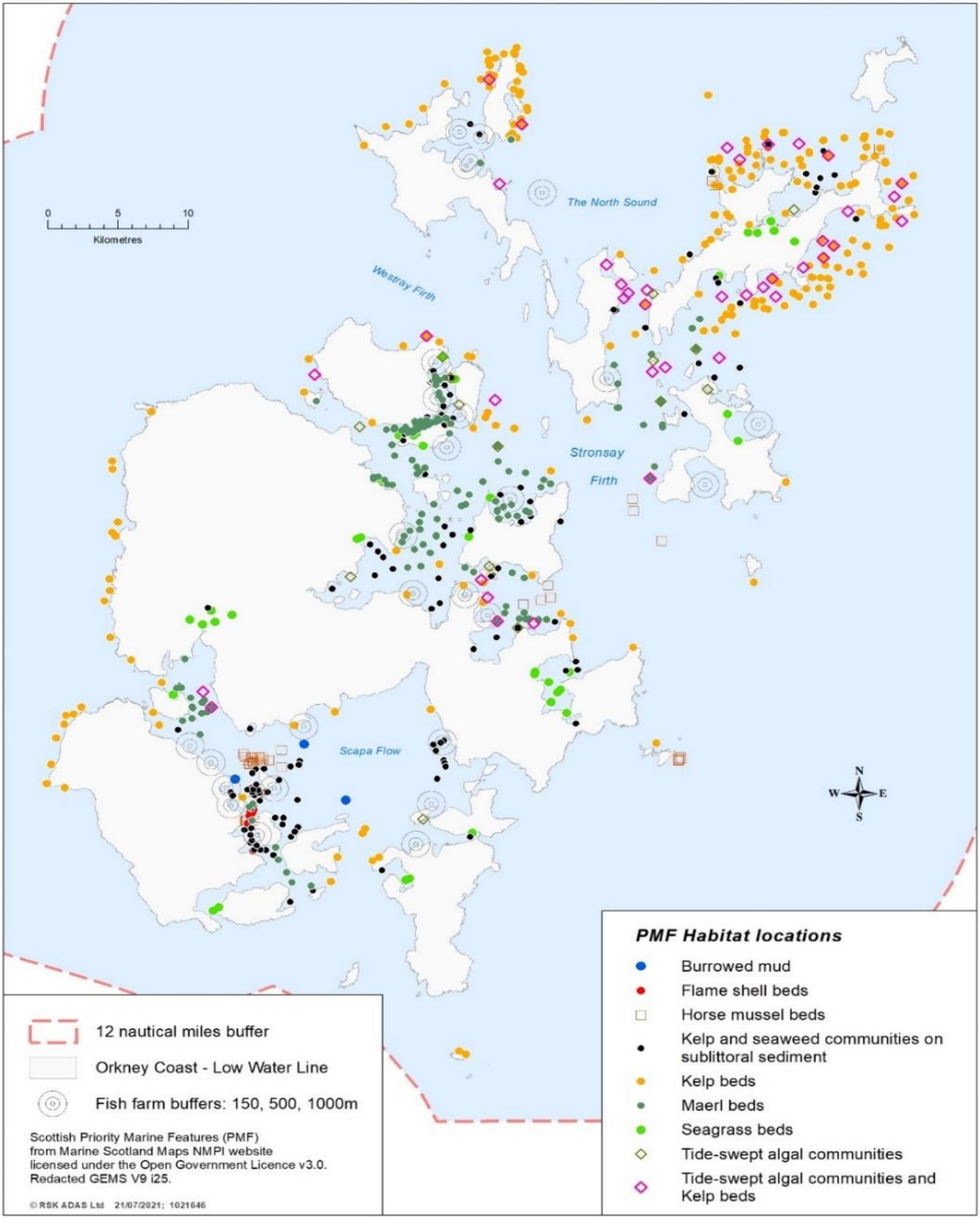

Figure 4: Priority Marine Feature records with 150, 500 and 1000m buffer zones around salmon farms.

RECOMMENDATIONS

Marine Natural Capital Assessments can provide the framework for delivering key objectives of marine spatial plans (in this case Regional Marine Plans), but further investment in data collection and monitoring is required to fulfil this potential.

The natural capital assessment undertaken as part of this study has identified a wide range of marine ecosystem services and habitats in the Orkney Islands Marine Region. Protecting and enhancing these habitats will be key to ensuring Orkney's marine environment continues to provide vital benefits and remains sustainable and viable into the future.

The following recommendations and considerations are suggested as potential ways to help achieve this:

- Fisheries provide significant economic benefits and represent a realised ecosystem service. Where potential adverse interactions have been identified between fishing activities and habitats, consideration should be given to implementing appropriate fisheries management measures to protect sensitive areas, such as biogenic reefs.
- Management measures should ensure that fishing activities are supported where they are compatible with habitat features.
- Fisheries management measures in Orkney have already been proposed to protect maerl beds from towed bottom-contacting gear (The Scottish Government, n.d.). Improved habitat mapping would support identification of the extent and boundaries of other sensitive features.
- As part of future marine planning, consideration should also be given to identifying appropriate fisheries management actions aimed at minimising the impacts that different fishing activities could have on key natural capital assets and ecosystem services.
- Where protected features are at risk from poor water quality, measures should be taken forward to improve water quality through collaboration with fish farms, terrestrial stakeholders, and regulating authorities. This measure could particularly benefit Scapa Flow's biogenic habitats.
- Pelagic habitats were not assessed in this study but they provide valuable ecosystem services and are key to connectivity and transport pathways (e.g. biogeochemical cycles, larval and gamete transport). Therefore, their inclusion in future natural capital assessments should be considered. Pelagic habitats have received little attention in the development of marine natural capital frameworks in the UK, which have focussed on benthic habitats. However, pelagic habitats could be defined and assessed according to factors such as stratification, depth and salinity.
- Participatory approaches that draw upon different value perspectives can be beneficial in promoting a holistic view of natural capital whilst helping to build the evidence base around the links between the generation of services and the associated beneficiaries. Any future natural capital plan or natural capital assessments of the Orkney marine region should look to engage key stakeholders (private, public and community representatives) to support a local place-based approach to marine planning and decision making.
- Investigate the establishment of a regular monitoring and evaluation process for Orkney's marine natural capital and evaluate where data already collected could be repurposed. Regular updates against a baseline account would provide ongoing understanding and evidence of the extent and condition of marine natural capital assets and ecosystem services.

Limitations and assumptions

Despite Orkney being a relatively well studied marine area, there remains a lack of suitable data to inform natural capital assessments and develop clear, location-specific conclusions and recommendations. Better understanding of key relationships and thresholds would greatly inform future assessments of ecosystem services and natural capital in marine environments.

The natural capital assessment undertaken as part of this study provides an indicator of likely condition however there are inherent assumptions and limitations.

- For some services there was little information and assigning a level of service provision and discriminating between habitats was difficult.
- As linkages between natural capital assets and ecosystem services are highly uncertain, or variable, depending on specific conditions, they are hard to elaborate across larger scales with high levels of confidence. Provision of ecosystem service is likely to be influenced by a number of factors and is likely to vary over time and space. These aspects have received little attention for most marine habitats. The assessment of ecosystem services in this study was, therefore, generic rather than location specific and it was assumed that delivery was homogenous over a habitat extent.
- Assessment of provision was categorical (none/negligible, low, medium, high). The assessments largely consider the potential to provide services rather than the level to which the service is realised. For example, habitats and associated species may support the sequestration or breakdown of wastes and contaminants but where water quality is high and these are absent, the service potential is not realised.
- Similarly, if target species are not fished from a habitat then the habitat is not providing that service, although it may of course support this indirectly through migration of adults and juveniles, propagule supply or nursery functions.

Tysite (Black Guillemot), Bonxie (Great Skua) and Atlantic Puffin (Fratercula arctica) in Orkney. *Photos ©Andrew Want*