BRIEFING NOTE

SEASCAPES – IMPORTANCE AND TRANSLATION INTO MANAGEMENT

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Objective – A briefing note aims to provide a concise outcome based synopsis of recent research or expert opinion that may inform decision making and activities by authorities, NGOs and NPOs. The briefing note series complements the academic peer reviewed literature published by SAIAB.

1) BACKGROUND

Seascape ecology is an emerging science that applies ideas and methods from landscape ecology to marine environments in order to try to understand complex patterns in space and time and the vulnerability of ecosystems to human activity. Seascapes are basically mosaics of connected habitats (such as seagrass, macroalgae, coral reefs, mangroves, sand patches, etc.) viewed from scales of metres to kilometres. Coastal habitats provide a number of important ecosystem services, such as the provision of nursery and feeding areas for fishes and other species (which underpin fisheries), filtering of sediment and contaminants, as well as carbon storage and climate change refugia.

One of the most critical ecosystem functions provided by shallow coastal habitats is as nurseries for the juveniles of marine fish, many of which are targeted in fisheries as larger individuals. The seascape nursery approach recognizes that multiple habitat types are functionally connected, and within habitat mosaics you need to identify core areas of high juvenile abundance (core nursery habitats), which are often structurally complex vegetated habitats. The nursery provision of structurally complex vegetated habitats within coastal seascapes is attributed to increased survival of fish through protection from predators and also the provision of substrate for food to grow.Ca

Habitat degradation and loss of structural complexity seriously threaten coastal habitats, with impacts associated with climate change (such as habitat and species loss) placing additional pressures on these important systems and threatening resource health and productivity. Although climate change may negatively impact coastal seascapes, some habitat forming biota have the potential to mitigate aspects of climate change. For example, seagrass and macroalgae can raise pH on a local scale by taking up carbon through photosynthesis. These localised zones of elevated pH associated with seagrass and macroalgal beds could potentially serve as ocean acidification refugia (Figure 1). Identifying and valuing critical habitats within seascapes, as well as quantifying impacts is critical if these habitats are to be constructively managed and/or conserved, and also affords managers the evidence-based resources needed to target and protect or restore these areas.

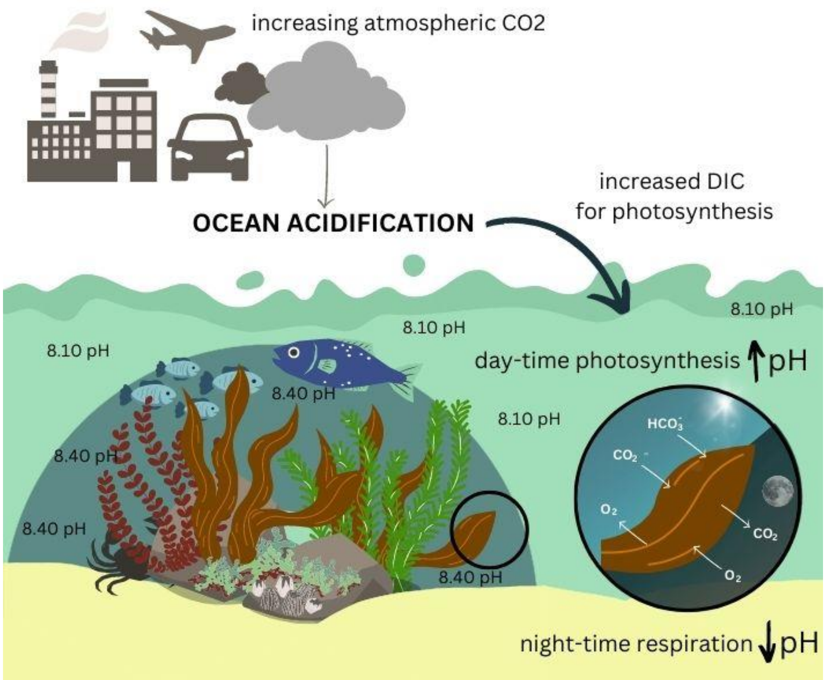

Figure 1. The potential role of structurally complex vegetated habitats in coastal seascapes as ocean acidification refugia (after Edworthy et al. 2023).

2) SEASCAPE ECOLOGY RESEARCH

The seascape ecology group at SAIAB strives to understand multi-scale linkages between seascape structure, function and change to better support sustainable development, biodiversity protection and help to understand the consequences of human activity on ecosystem services. Focussing on shallow nearshore and estuarine environments, the group 1) maps and models seascape spatial structure; 2) assesses core nursery areas and connectivity of select fish species within seascapes, and 3) studies the impact of climate change in seascapes (seascape change), as well as the role that seagrass and macroalgae may have in mitigating the effects of ocean acidification. By better understanding these linkages and impacts, the group aims ultimately to inform effective management and conservation strategies for these important, yet often overlooked, coastal habitats.

3) RECENT FINDINGS

Using a multi-method seascape approach, the group first focussed on a mosaic of habitats in Algoa Bay, Eastern Cape, such as soft-bottom benthic habitats (sand and mud) in the Sundays and Swartkops estuaries and the adjacent nearshore environment, seagrass beds in the Swartkops Estuary, and subtidal red macroalgae-dominated reef (near Cape Recife).

Although unstructured habitat often receives less research attention than vegetated habitats as nursery areas for fishes, it is vital for fish that live just above or within the sediment. Soft-bottom habitats in estuaries and the nearshore of Algoa Bay were both dominated by early-life stage fishes (larvae and juveniles), indicative of nursery function. There was, however, a 5-6 fold greater abundance of early-life stage fishes in the estuarine environment (particularly in the middle and upper estuarine reaches), highlighting the importance of estuaries for demersal (bottom-dwelling) fishes within the Algoa Bay nursery seascape. Estuarine species (gobies) and estuarine-dependent marine species (Cape stumpnose *Rhabdosargus holubi* and blackhand sole *Solea turbynei*), comprised a large proportion of the overall density of early life-stages in the estuarine environment (both Sundays and Swartkops). Even in the marine environment, freshwater from estuaries impacts the nursery function of benthic habitats, as higher abundances of marine fishery species like silver kob (*Argyrosomus inodorus*) and tonguesole (*Cynoglossus zanzibarensis*) were recorded nearer to estuaries and freshwater outlets (Figure 2).

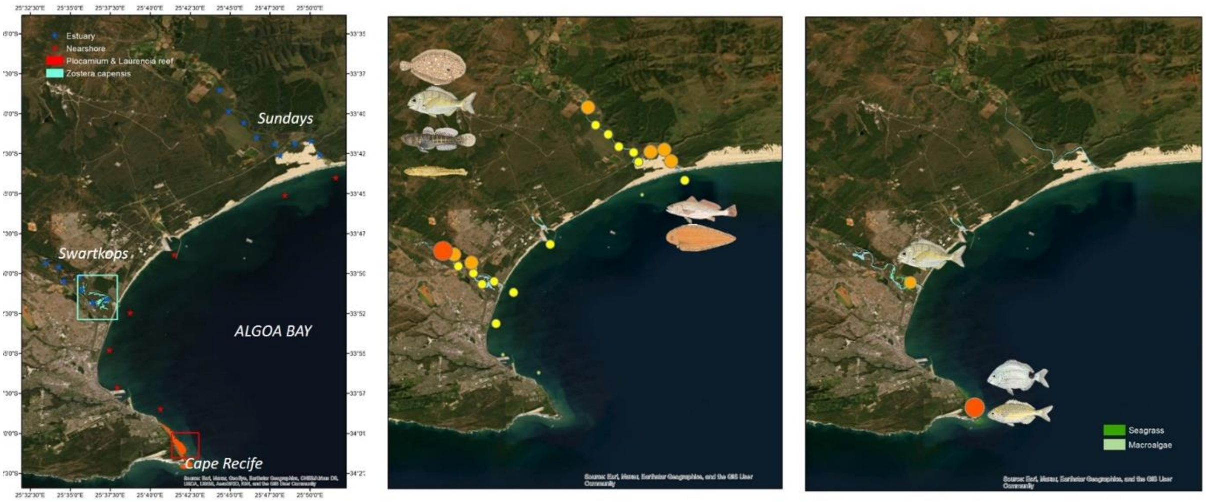

Figure 2. The Algoa Bay shallow-water nursery seascape

Although globally studies have highlighted that structurally complex macroalgae (particularly canopy forming brown-algae) may perform a similar nursery function to seagrass, studies on nursery provision in southern Africa have not focused on macroalgae. Research from the group showed for the first time in temperate South Africa that the nursery provision (in terms of availability of food, shelter and abundance of juveniles) of red macroalgae-dominated reefs may be as important as seagrass – especially for sparids (commonly known as seabream), which are the dominant family of marine fishes using these vegetated habitats (seagrass and macroalgae). These include blacktail seabream (*Diplodus capensis*) and strepie (*Sarpa salpa*), which use macroalgal reefs and gullies, and seagrass beds within certain permanently open estuaries, and Cape stumpnose, which is strongly dependent on seagrass beds in estuaries as nurseries (shown in Figures 2 & 3). All sparids are targeted by recreational and subsistence fishers as adults.

Figure 3. Small young-of-the year blacktail (left) and strepie (right) are abundant in seagrass (*Zostera capenis*) and macroalgae (*Plocamium corallorhiza*) habitats in Algoa Bay.

When examining variability in pH regimes in Algoa Bay, consistently higher than average pH levels were also recorded around macroalgal-dominated reefs relative to other nearshore sites, indicating the potential role that macroalgae may have in mitigating ocean acidification effects for organisms residing in these habitats.

Ongoing work has broadened to include other seascapes (St Francis Bay, Knysna and Natures Valley) and strives to answer questions around seascape configuration and connectivity, such as the spatial arrangement of nursery habitats and connectivity with nearby deeper/offshore adult habitats, the effect of shelter/wave exposure on nursery provision, seascape change and ecosystem services beyond nursery provision in a changing ocean.

4) IMPLICATIONS FOR MANAGAMENT

- Seascape data should be incorporated into marine and estuarine spatial and management plans and has been shared with researchers working on the marine spatial plan for Algoa Bay, as well as the ecological status and restoration options for the Swartkops Estuary.
- These findings reiterate the importance of vegetated habitats (seagrass and macroalgae) for both nursery provision and climate change adaptation.
- The ecosystem services provided by coastal habitats need to be managed as a seascape continuum with the inclusion of interconnected and diverse habitats important in the preservation of coastal fish populations and the livelihoods dependent on them.

5) KEY PAPERS FOR CONSIDERATION

Beck MW, Heck KL, Able K et al. (2001) The identification, conservation and management of estuarine and marine nurseries for fish and invertebrates. Bioscience 51: 633-641.

Edworthy C, Potts WM, Dupont S, Duncan MI, Bornman TG and James NC. (2022) A baseline assessment of coastal pH variability in a temperate South African embayment: implications for biological ocean acidification research. African Journal of Marine Science. African Journal of Marine Science 44, 367-381.

Edworthy C, Steyn P-P and James NC. (2023) The role of macroalgal habitats as ocean acidification refugia within coastal seascapes. Cambridge Prisms: Coastal Futures, 1 e22, 1-10.

James NC and Whitfield AK. (2022) The role of macroalgae as nursery areas for fish species within coastal seascapes. *Cambridge Prisms: Coastal Futures*, 1-27.

Nodo P, Childs A-R, Pattrick P and James NC. (2023) The nursery function of shallow nearshore and estuarine benthic habitats for demersal fishes. Estuarine, Coastal and Shelf Science 280, 108168

Whitfield AK and Mann BQ (2023) Life-history styles of eight morphologically similar estuary-associated sparid species from southern Africa. Environmental Biology of Fishes 106: 597-611.

6) AGENCIES THAT SHOULD BE CONTACTED

Department of Forestry, Fisheries and the Environment (DFFE)

South African National Parks (SANParks)

Wildlife and Environment Society of South Africa (WESSA)

Zwartkops Conservancy

Cape Nature

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