

# **BRIEFING NOTE SERIES**

CLIMATE CHANGE IMPACTS ON SOUTH AFRICA'S COASTAL AND ESTUARINE FISH

1 March 2022



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) OBJECTIVE OF BRIEFING NOTE

Climate change in the coastal environment (estuaries and nearshore) results in changes in temperature variability, increasing winds and ocean currents, increased freshwater flow (rainfall), sea level rise; ocean acidification and other extreme weather events such as droughts; all of which are having profound consequences for marine fish. This briefing note summarizes some of the research undertaken by SAIAB in order to update estuary and coastal managers on the impacts of climate change for coastal and estuarine fish.

# 2) KEY ISSUES/FINDINGS

- The egg and larval phase of marine species takes place in the subtidal marine environment, with juvenile fish migrating to shallow nursery areas (such as estuaries and rock pools), where abundant food and shelter allows them to grow rapidly before moving to deeper habitats as adults. In these highly dynamic nursery environments (estuaries and rock pools) where temperatures fluctuate on an hourly scale, juvenile fish are able to tolerate temperatures well above and below those to which they are currently exposed.
- Despite the tolerance of juvenile fishes in their nursery habitats to extreme temperatures, the distribution of marine fishes may still be impacted by changing sea temperatures as the distribution of marine fishes is strongly linked to subtidal sea surface temperatures and temperature tolerance during the subtidal larval phase. The larval phase of most species are far less tolerant of extreme temperatures than the hardy juvenile stage. This was found for southern African mullet species.
- Changes in wind strength and direction, associated with climate change, influence water circulation (currents), and the strength and duration of upwelling. Upwelling intensities have been increasing along the south coast of South Africa. Upwelling occurs when southerly winds drive cooler water from the deep towards the surface and can result in rapid temperature changes at the ocean surface. Extreme variability in temperatures is often lethal to fish.
- In estuaries where sampling was conducted after major flooding, flooding resulted in a decrease in the number of species recorded and density of fishes. Recovery of the fish community in estuaries to pre-flood conditions was fairly rapid in all systems studied, but when consecutive flood events occurred recovery was slower. Unfortunately, the frequency and intensity of extreme events, such as droughts, sea storms and river floods is already increasing along the southern African coastline and fish communities may not recover rapidly if these extreme events occur frequently.
- The fish fauna inhabiting intermittently open estuaries may be less resilient to the effects of droughts and floods than those inhabiting permanently open estuaries. In the intermittently open East Kleinemonde Estuary, analysis of a 20-year dataset indicated that the abundance of most marine species declined in recent years. This was attributed to an increase in the intensity and duration of floods and droughts, which affected the availability of subtidal habitat for fishes.
- Exploitation potentially alters the response of targeted species to climate change with marine protected areas harboring fish which are more resilient to climate change associated marine heat waves. This is because fishing tends to remove stronger, more resilient individuals from the population.

#### 3) KEY PROCESSES THAT THE FINDINGS MAY INFLUENCE

Understanding the regional vulnerability of marine ecosystems to climate change is important in planning for a future climate and to highlight the potential that marine protected areas may have in increasing the resilience of targeted species to climate change. This research is timeous as the Intergovernmental Panel on Climate Change (IPCC) has recently published a special report on changing oceans, marine ecosystems and dependent communities. Findings from this work are incorporated into a policy brief (produced by the African Group of Negotiators Experts Support) unpacking the implications of the IPCC special report for Africa.

## 4) KEY PAPERS FOR CONSIDERATION BY SAIAB & OTHERS

- Duncan MI, Bates AE, James NC, Potts WM. 2019. Exploitation may influence the climate resilience of fish populations through removing high performance metabolic phenotypes. *Scientific Reports* <u>https://doi.org/10.1038/s41598-019-47395-y</u>
- Duncan MI, James NC, Bates AE, Goschen WS, Potts WM. 2019. Localised intermittent upwelling intensity has increased along South Africa's south coast due to el Niño-Southern Oscillation phase state. *African Journal of Marine Science* 41, 325-330 https://doi.org/10.2989/1814232X.2019.1656105
- James NC, Adams JB, Connell AD, Lamberth SJ, MacKay CF, Snow G, van Niekerk L, Whitfield AK. 2020. High flow variability and storm events shape the ecology of the Mbhashe Estuary, South Africa. *African Journal of Aquatic Science* 45:1-2, 131-151. <u>https://doi.org/10.2989/16085914.2020.1733472</u>
- James NC, Cowley PD, Whitfield AK. 2018. The marine fish assemblage of the East Kleinemonde Estuary over 20 years: declining abundance and nursery function? *Estuarine, Coastal and Shelf Science* 214, 64-71. <u>https://doi.org/10.1016/j.ecss.2018.09.010</u>)
- James NC, van Niekerk L, Whitfield AK, Potts WM, Götz A, Paterson AW. 2013. Effects of climate change on South African estuaries and associated fish species. *Climate Research* 57, 233-248. <u>https://doi.org/10.3354/cr01178</u>
- James NC, Whitfield AK, Harrison TD. 2016. Grey mullet (Mugilidae) as possible indicators of global warming in South African estuaries and coastal waters. *Marine Environmental Research* 122, 188-195. <u>http://dx.doi.org/10.1016/j.marenvres.2016.11.002</u>)
- Van der Walt KA, Porri F, Potts WM, Duncan MI, James NC. 2021. Thermal tolerance, safety margins and vulnerability of coastal species: Projected impact of climate change induced cold water variability in a temperate African region. *Marine Environmental Research* 169 <u>https://doi.org/10.1016/j.marenvres.2021.105346</u>

# 5) LIST OF ENTITIES

Western Cape Estuary Task Team