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Impact of climate change and fishing on ecosystem dynamics – UCT study

Climate change and overfishing are putting massive pressure on marine ecosystems, including that of the southern Benguela, which ranges from approximately the Orange River in the west around the coast of South Africa to East London.

Research by UCT PhD graduate Dr Katherine Watermeyer aims to improve the understanding of implications of changes in the distribution of key species in the southern Benguela upwelling ecosystem for ecosystem structure and functioning, particularly the increased relative abundance of small pelagic fish east of Cape Agulhas since the mid-1990s.

The Benguela ecosystem (which also includes the northern Benguela, located along the Namibian coastline) is one of four highly productive eastern boundary upwelling systems globally. Wind-driven upwelling of cold, nutrient rich water along the results in plentiful food and conditions for fish, marine mammals and seabirds to thrive. Sardine and anchovy are particularly important in the southern Benguela because they are so abundant that their dynamics affect both their food and their predators.

Experts agree that overfishing around the world has become a threat to marine ecosystems and the southern Benguela, which supports a number of economically important fisheries, is no exception. Fishing and other pressures not only impact a specific population but also the upward food chain, as many bigger fish and mammals depend on the affected fish species for food and survival. There are also economic effects on fishermen to consider, who may

now have to work even harder to catch fewer fish.

Dr Watermeyer's thesis, *Ecosystem implications of the recent southward shift of key components in the southern Benguela* could therefore provide vital insight into the impact of overfishing and climate on marine life in the southern Benguela and help to identify solutions.

Results showed an increase in the proportion of a number of fish species east of Cape Agulhas since the 1990s, as previous only shown for sardine and anchovy, supporting the need to consider the ecosystem as a whole when weighing management options. A frame-based modelling approach was also successfully used to describe spatial and population dynamics of sardine and anchovy, and to explore the implications of possible management options. The approach highlighted the importance of the spatial distribution of fishing pressure across the system, as well as the need to increase our understanding of how relative environmental conditions on the west and south coasts affect sardine and anchovy, if our capacity to predict trends is to be expanded.

Dr Watermeyer graduated with a PhD from UCT at the Faculty of Science graduation ceremony on 12 June 2015. Her doctoral thesis was supervised by UCT Professor Astrid Jarre, Dr Lynne J. Shannon and Honorary Professor L Hutchings in the Department of Biological Sciences and the Marine Research Institute.

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