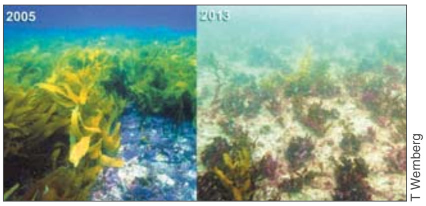
Kelp, mangroves fall victim to ocean warming

Claire Miller

Marine warming is taking its toll around the Australian coast, well beyond the Great Barrier Reef bleaching that made international headlines this year. Almost 10,000 hectares of mangroves also died last summer, across a 1000-km stretch in the Gulf of Carpentaria, while more than 100 km of kelp forests along the Western Australian (WA) coast have collapsed following a 10-week heatwave in 2011, with water 2–5°C warmer than normal (*Prog Oceanogr* 2016; doi:10.1016/j.pocean.2015.12.014).

"Afterwards, species characteristic of tropical and subtropical ecosystems increased, and species associated with kelp forests decreased", explains study author Thomas Wernberg (University of Western Australia, Perth, Australia). "The biggest change was in herbivorous fish common on coral reefs. Their abundance increased 400%. The kelp couldn't regenerate because it was nipped away, and now a dense cover of algae and low turf seaweeds is creating a blanket that the kelp can't grow through."



Kelp forest before and after the 2011 marine heatwave.

The result is a "novel" and impoverished marine community. "We've lost the most attractive components of the temperate community [the kelp]", continues Wernberg. "But they haven't been replaced by the most attractive components of the subtropical community [the coral reefs]."

Norm Duke (James Cook University, Townsville, Australia) links the mangrove dieback to prolonged, severe heat and drought conditions and a temporary 20-cm drop in sea level, all in late 2015. "The current extent, type, and timing of this mangrove dieback has never been reported before, anywhere in the world", Duke says. "This response is what I expect climate change will look like for mangroves, based on the idea it will be during extreme events that ecosystems like mangroves will be tested. If survival limits are exceeded, then we will observe a notable response. We've just observed a highly notable and severe response!"

The mangroves are essential breeding grounds for valuable stocks including prawns, crabs, and barramundi, while lobster and abalone fisheries worth hundreds of millions of dollars a year depend on the temperate kelp forests that dominate the Great Southern Reef around Australia's bottom half.

The same heatwave that killed the kelp also killed up to 90% of seagrasses in WA's World Heritage-listed Shark Bay, which has since recovered only 7–20% of its historical averages. "This is a wake-up call", warns Wernberg. "It's important to take stock of what's at risk and understand what we can lose. Australian marine biodiversity is more than just the Great Barrier Reef. We're seeing changes in coral reefs, kelp forests, and mangroves – all coastal systems are starting to change." ■

Chickens: the latest mosquito repellent

Ken Ferguson

A consortium of Swedish and Ethiopian researchers has identified an unusual ally in the war against malaria-carrying mosquitoes: chickens, it turns out, are natural mosquito repellents.

"*Anopheles arabiensis* is the major malaria vector in Ethiopia, and a primary malaria vector throughout sub-Saharan Africa", explains Rickard Ignell, a chemical ecologist at the Swedish University of Agricultural Sciences (Alnarp, Sweden) and a member of the research team. "But it is a difficult species to control with existing methods, such as bed nets and indoor residual spraying."

The inadequacy of conventional control techniques is what prompted the scientists to focus on the mechanisms regulating mosquito feeding behavior and host selection, information that would be highly useful for the development of novel control measures.

As part of this broader research aim, Ignell and his colleagues tested host-preference behavior in *A arabiensis* by examining whether these mosquitoes respond differently to the various scent cues emanating from the human and livestock – predominately chickens, goats, cattle, and sheep – inhabitants of several villages in western Ethiopia (*Malaria J* 2016; doi:10.1186/s12936-016-1386-3). Expectations were that *A arabiensis* would feed indiscriminately on the blood of any available animal, but much to the researchers' surprise, this was not the case. "Our blood-meal analyses revealed that *A arabiensis* do not feed on chickens, even though they are the third most abundant animal in the villages", says Ignell.

Using linked-gas chromatography and other methods for identifying the volatile compounds that are detectable by *A arabiensis*, the researchers isolated 11 distinct volatile compounds from chicken feathers; additional field trials confirmed that six of these compounds had mosquito-repellent qualities, with four having roughly the same degree of mosquito deterrence as chickens themselves. Moreover, the compounds appeared to repel mosquitoes over a considerable distance.

Ignell believes that "after optimizing ways of releasing these compounds over long time periods, say 3–6 months, we could potentially use them to reduce mosquito–human interactions, and so reduce malaria prevalence", but cautions that such methods should be viewed as complementary to, and not replacements for, mosquito netting and other more conventional strategies for reducing exposure to mosquitoes. ■