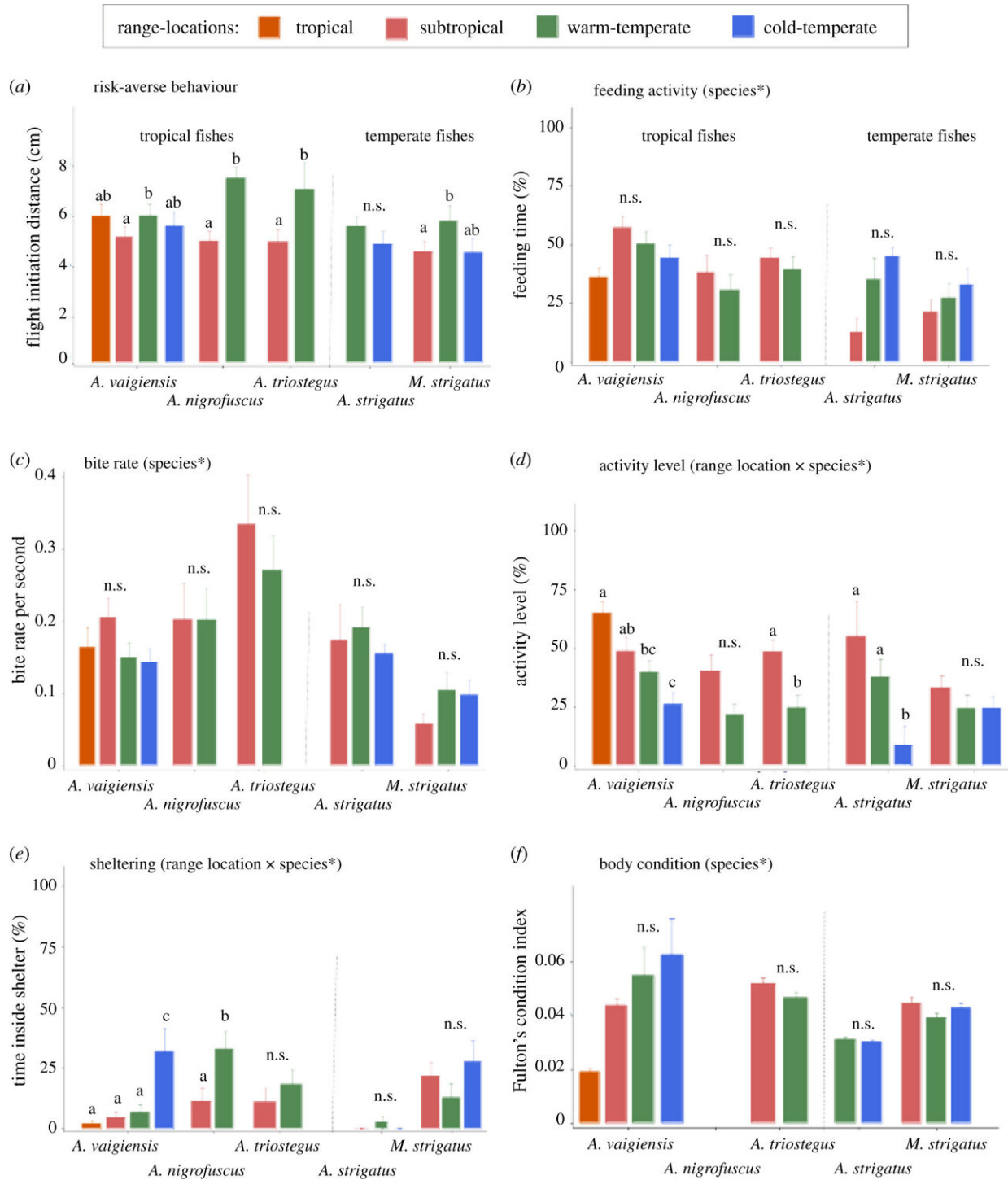


Coral-reef fish can become more risk-averse at their poleward range limits

March 28 2022, by Stan Denham



In situ behaviors (mean + s.e.): (a) flight initiation distance as a proxy for risk-averse behavior towards a threat stimulus, (b) proportion of the time feeding, (c) bite rate per second, (d) proportion of time active, (e) proportion of the time sheltering and (f) body condition of tropical and temperate species as a function

of distributional range locations (tropical only for *A. vaigiensis*, subtropical, warm-temperate, cold-temperate). Different letters above bars indicate significant differences and asterisks indicate when factors such as species or the interaction between range position \times species were statistically significant (see electronic supplementary material, tables S2–S4). n.s. = not significant. Credit: *Proceedings of the Royal Society B: Biological Sciences* (2022). DOI: 10.1098/rspb.2021.2676

University of Adelaide research shows the effect of warming is becoming increasingly obvious as water heats up off the coasts of Australia—and is especially noticeable in the way tropical fish are behaving as they migrate south to more temperate waters.

"Scientists are seeing a movement of [tropical fish](#) from water heating up in the tropics to zones at higher latitudes regarded as temperate or subtropical but which are now warming too," says the University's Professor Ivan Nagelkerken. "In the Pacific waters of Australia's east coast, tropical fish and other [marine animals](#) are migrating south at a rate that is ringing alarm bells.

"Everything from micro-organisms to sharks and turtles—and perhaps more worryingly, possibly even irukanji jellyfish and [saltwater crocodiles](#)—are slowly moving to higher latitudes, and this kind of change is occurring right around the world."

Professor Nagelkerken's latest research, published in the journal *Proceedings of the Royal Society B: Biological Sciences*, looks at the intrinsic and learned survival behavior of two types of tropical fish (damselfish and surgeonfish) forced to become more risk averse as they are pushed to exist in an environment that is both unfamiliar and very different than their native coral reef habitats—and where they are faced with new and previously unknown predatory threats.

He says: "The oceans absorb warmth like a giant sponge, and redistributions of marine species to [higher latitudes](#) is in an order of magnitude faster than on land, (so) [climate change](#) is allowing coral reef fishes to invade cold temperate Australian waters.

"However, these fish are not familiar with these novel environments, and therefore they are more frightened and adjust their behaviors to fit in—for instance, they will spend more time hiding or are quicker to flee from any danger."

Meanwhile, Professor David Booth of the University of Technology Sydney, who collaborated on the research, explains that the ecosystems themselves are affected as well, and adds: "With ongoing warming we also see more corals starting to grow in [temperate waters](#), with native kelp disappearing due to [heat stress](#) and consumption by tropical herbivores. So it's not only the fish communities that are 'tropicalizing' in the waters of south-east Australia, but also the marine habitats.

"This phenomenon can now be seen all the way down the coast of NSW and there are patches of coral establishing themselves as far south as Sydney. Meanwhile, coral reef bleaching and degradation becomes a serious concern in areas such as the waters of far-north Queensland and the Great Barrier Reef.

"While some of the fish can now survive the [winter temperatures](#) around Port Stephens (just north of Newcastle) and some also around Sydney, the waters further south are still too cold now to overwinter and this new environment is still very unfamiliar to deal with."

Professor Nagelkerken says while the temperate fishes are less affected in their behavior by ocean warming so far, they need to interact increasingly with novel species, including predators, and this study explains how they are doing that, adding that earlier research showed

they are still "dealing well with that as tropicals and temperates segregate their food sources and behaviors to avoid too much overlap."

He says: "Understanding the behavior of fish in dangerous or novel environments in a [social context](#) is important to our understanding of the science of climate change and is not very different to how we look at human behavior in that regard.

"Fish aren't stupid—they'll do what they need to do to survive. What we are looking at here as they extend to their poleward range limits is almost a real-life version of Finding Nemo."

More information: Ericka O. C. Coni et al, Coral-reef fishes can become more risk-averse at their poleward range limits, *Proceedings of the Royal Society B: Biological Sciences* (2022). [DOI: 10.1098/rspb.2021.2676](#)

Provided by University of Adelaide

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