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Rotational harvesting is a risky strategy for vulnerable marine animals

Sea cucumber fisheries exemplify resource systems under intense exploitation pressure from lucrative Asian markets. Plagányi et al. (1) model the performance of rotational harvests of sea cucumbers on the Great Barrier Reef (GBR) and advocate it globally. We support their aim to evaluate management models but believe the tenets of the strategy are flawed, key model inputs bias the outputs, and inferences to other coastal fisheries are overreaching. These shortcomings set a risky approach for managing coastal resources, especially those with vulnerable life-history traits, such as sea cucumbers (2).

Rotational harvesting is an agricultural concept and the analogy for wild fisheries is off target. Marine animals are neither seeded nor have predictable production times nor are grown in controlled conditions, and are subject to natural reproductive limitations and variability. Crop rotations either fallow the soil or vary cultured species, neither of which is applicable. The cited successful examples (fish, trochus) involve periodic (intermittent, undefined), not rotational (cyclical, defined), closures and those species have life-history traits far more robust than sea cucumbers (2).

Plagányi et al. (1) model a multispecies fishery on the GBR, concluding that the rotational zoning scheme (RZS) led to improvement in performance indicators. However, catches of white teatfish and prickly redfish, both threatened species (2), have declined under the present RZS in the fishery. Plagányi et al. (1) draw support from a Canadian sea cucumber fishery, yet recent surveys of fishers indicate declining stocks under that RZS (3).

Flawed assumptions and data inputs of the RZS model result in overly short rotational cycles, which overestimate the resilience (ability of populations to recover from fishing) of slow-recovering species. For example, Plagányi et al.'s (1) assumption of constant annual harvests spread across all areas every year if there was no RZS would be unlikely because of fishing costs. Data on age at maximum length for most species are unsupported; for example, 5–10 y for black teatfish, contrary to empirical evidence of slow growth (4). Inferences about the rotational strategy are also unrealistic because Plagányi et al.'s (1) model includes burying blackfish (*Actinopyga spinea*), which comprises two-thirds of the overall fishery catch, but most of that arises from non-RZS zones where that species is fished every year.

Plagányi et al. (1) advocate RZSs for "coastal and reef systems globally" without considering fundamental governance issues that predominate in such fisheries. Planning and coordinating fishing in rotational zones will be arduous in most tropical sea cucumber fisheries, which have open-access property rights, and weak technical and enforcement capacity of management institutions. The requisite "cap on total catch (or effort)" (1) per locality has repeatedly proven unworkable in most sea cucumber fisheries globally. RZSs in low-income and developing countries will be costly and risky, especially for species threatened with extinction or with vulnerable life histories. Thus, the modeling remains theoretical and decoupled from real world application. We counter that conservative and adaptive management involving regulation of fishing effort, to curtail fishing to <5% of virgin biomass per annum, and shortlists of allowable species with robust populations (2, 5) would cost less and better safeguard biodiversity.

Steven W. Purcell[a,1], **Sven Uthicke**[b], **Maria Byrne**[c], **and Hampus Eriksson**[d,e]

[a]*National Marine Science Centre, Southern Cross University, Coffs Harbour, NSW 2450, Australia;* [b]*Sustainable Coastal Ecosystems and Industries in Tropical Australia, Australian Institute of Marine Science, Townsville, QLD 4810, Australia;* [c]*Schools of Medical Sciences and Biological Sciences, University of Sydney, NSW 2006, Australia;* [d]*Natural Resource Management, WorldFish, Penang 11960, Malaysia; and* [e]*Australian National Centre for Ocean Resources and Security, University of Wollongong, Wollongong, NSW 2522, Australia*

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