

Correspondence

# Changes in illegal fishing dynamics in a large-scale MPA during COVID-19

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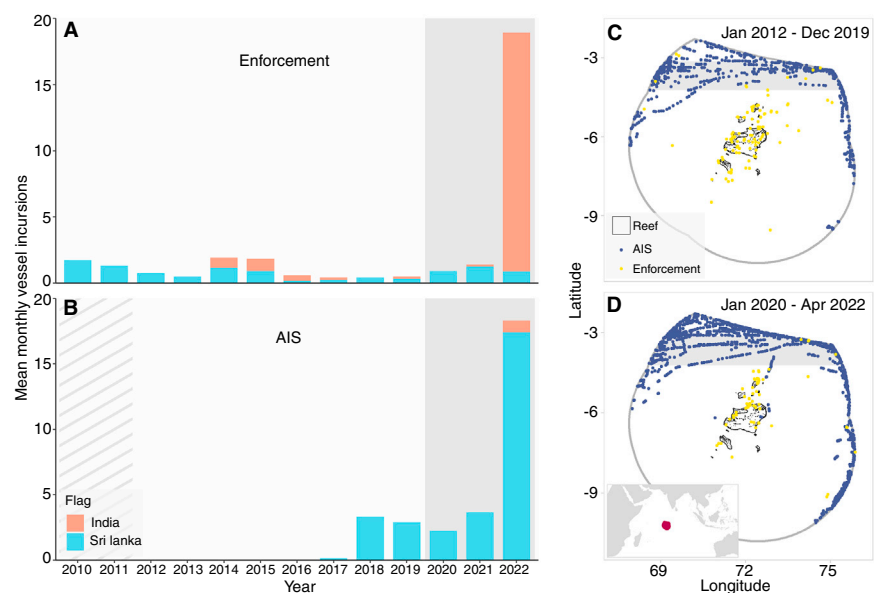
Global socio-ecological shocks, such as the COVID-19 pandemic, can threaten progress in protecting vulnerable marine environments by altering behaviour of resource users<sup>1</sup>. When government priorities shift from environmental protection towards safeguarding human populations, control of illegal activity in protected areas can alter. Resulting increases in illegal fishing in large-scale marine protected areas (MPAs) are of particular concern as they contain a large proportion of marine protected area globally<sup>2</sup>. Here, we report on average 19 times as many suspected illegal fishing vessels per month in 2022 ( $n = 19$ ) compared with 2010 to 2020 ( $n = 1$ ) in an Indian Ocean MPA. Although illegal fishing has been a pervasive problem, the current spike in Indian vessels targeting a broad trophic diversity of reef-associated species is of particular concern and we suggest such changes in illegal activity in MPAs globally may persist over long timescales unless management is broad and adaptive to individual context. When considering potential solutions, widespread adoption of technology, such as remote surveillance of vessels, can mitigate illegal activities but remains unfeasible for many MPAs globally due to financial and political barriers. Instead, we suggest broader approaches, including a renewed focus on regional approaches to combating illegal fishing, formal bilateral agreements between competent authorities in relevant countries and an increase in community-based work.

The Chagos MPA, located in the Western Indian Ocean, is a large (640,000 km<sup>2</sup>) no-take MPA implemented in April 2010. Until 2020, data from enforcement show detected incursions of vessels suspected or convicted of

illegal fishing activity within the MPA were relatively stable, averaging one monthly (Figure 1A). Historically, these vessels were primarily Sri Lankan (72%) targeting sharks, although Indian vessels (28%) targeting a broader taxonomic diversity of catches, including reef fish, were also seen<sup>3</sup>. However, in 2022, incursions, primarily of Indian vessels (95%), spiked to 19 per month on average. Indian vessels have considerably larger hulls than Sri Lankan (~30,000, and ~3,500 kg, respectively), posing a greater potential threat. Limitations in the ability to detect and investigate illegal activity means illegal incursions are likely considerably higher than reported (Supplemental information). Enforcement is conducted by a single patrol vessel whose activity is informed by vessel Automatic Identification Systems (AIS) detections and historical patterns of illegal activity. AIS detections of illegal activity increased in 2022, averaging 19 per month compared to five from 2018 to 2021 (Figure 1B). However, in contrast to enforcement data, AIS detections were primarily Sri Lankan (97%), with

only two Indian vessels detected in 2022 (Figure 1B). Further, spatial distribution of AIS detections suggest illegal activity is clustered around MPA boundaries and transit routes (Figure 1C,D), and not on reef systems as suggested by enforcement data and research in fisher communities<sup>3</sup>. Relatedly, AIS data for the surrounding area suggests increased detection of legal fishing activity by Sri Lankan vessels during the study period and an almost complete absence of detections of Indian vessels (Figure S2). These observations highlight issues with inferring trends in fishing activity solely from AIS data due to low uptake and disabling of systems as well as potentially erroneous classification of vessel activity (Supplemental information).

Increased illegal activity in protected areas during COVID-19 has been linked to altered monitoring and control by authorities<sup>4</sup>. In the Chagos MPA, COVID-19 protocols prevented enforcement personnel from boarding apprehended vessels to collect evidence about activities from April 2020 to August 2022. This reduced the likelihood of



**Figure 1. Changes in suspected illegal fishing activity indicated by enforcement and AIS data.**

(A) Mean monthly incursions by flag, from January 2010 to 10th April 2022, as reported by enforcement patrols. (B) Mean monthly incursions by flag from January 2010 to 10th April 2022, as reported by AIS<sup>10</sup>. The diagonally lined area signifies a period for when no data were available and greyed-out area indicates 'post-COVID' (defined as January 2020 to 10<sup>th</sup> April 2022). (C) Detections of suspected illegal fishing incursions from enforcement patrols (yellow) and AIS data (purple) for Sri Lankan and Indian vessels for 'pre-COVID' (defined as January 2012 to end of December 2019) and (D) for 'post-COVID' (as previously defined). The typical route for legal transit is shown in grey, and reef systems are outlined in black. Map inset shows the location of the Chagos MPA (red).



convictions (Supplemental information). Knowledge of such changes may have reduced fear of sanctions amongst fishers, an identified contributing factor to illegal activity deterrence<sup>5</sup>. Relatedly, available enforcement data suggest that between August 2020 and April 2022, 94% of Indian fishers originated from one group of villages in southern Tamil Nadu. Increased illegal activity has also been observed where enforcement effort has remained stable<sup>1</sup> and has been linked more widely with changes in livelihoods caused by COVID-19<sup>5</sup>. Our observations, that illegal activity only increased after 1.5 years and for one vessel flag state, emphasises the potential role of broader socio-political factors and historical MPA management in fisher responses to COVID-19-related changes. For example, fluctuating fuel prices during the recent Sri Lankan economic crisis may have impacted economics associated with long-distance fishing trips (Supplemental information). India also has stronger diplomatic ties with Mauritius, meaning fisher perceptions of the UK's sovereignty of the Chagos MPA may have been influenced by ongoing diplomatic and legal disputes (Supplemental information). Importantly, management of illegal activity by Indian and Sri Lankan vessels in the Chagos MPA has differed considerably historically. Notably, a bilateral agreement enacted in 2009 between Sri Lanka and British authorities means vessels are prosecuted under Sri Lankan laws if sufficient evidence of illegal fishing in the MPA is provided. No agreement currently exists with India, meaning there is no established mechanism by which Indian vessels are sanctioned.

Successful adaptive management of illegal activity requires understanding broader socio-economic context and how MPA policy and management deter illegal activity. The scale and remoteness of the Chagos MPA means surveillance through patrolling is preventatively costly (Supplemental information). Nevertheless, increased reliance on data from vessel tracking systems is unlikely to improve enforcement in the short term as targeting fleets are composed of medium-sized vessels (<20 metres) with low coverage of AIS or Vessel Monitoring Systems (VMS). In Sri Lanka, VMS is mandatory for all vessels leaving national waters, but non-compliance, such as disabling installed systems,

has been reported and AIS coverage is also incomplete<sup>3</sup>. Neither AIS nor VMS are mandatory for Indian vessels under national laws, and widespread uptake is limited by socio-political factors such as financial resources, fisher hesitation and political opposition (Supplemental information).

Instead, we suggest continued efforts to enact participatory and formal bilateral agreements with India and Sri Lanka at both national and state level. Transnational collaborations between governments to enforce maritime boundaries are increasingly important, especially where boundaries are disputed, and enforcement capabilities are limited<sup>7</sup>. Successful bilateral and multilateral agreements can reduce illegal fishing through means such as collaborative monitoring and enforcement of rules<sup>8</sup>. Here, enforcement personnel reported that the existing bilateral agreement with Sri Lanka has stimulated successful prosecution of vessels under Sri Lankan national law, circumventing the need to detain and process fishers in the Chagos MPA. As well as reducing the negative socio-economic impacts of physically detaining fishers, bilateral agreements can also ensure sanctions are context appropriate. However, such agreements take considerable investment to negotiate and require consistent law enforcement and monitoring of illegal fishing<sup>9</sup>.

Importantly, action should also be taken at the community level, and, where possible, be co-developed with fishers and representative organisations to shift from a reliance on top-down policies. Communicating policy changes is key to successful management and existing research suggests that Sri Lankan fishers possess highly varied perceptions of risk and sanctions associated with fishing in the Chagos MPA<sup>3</sup>. Further research is therefore needed to understand the drivers of illegal fishing and the deterrence effect of MPA policy and management.

COVID-19 has resulted in incidental experiments on how changes in enforcement might alter the decision-making of resource users<sup>2</sup>. To this end, we suggest adaptive management measures that recognise the context of the Chagos MPA within a highly dynamic region with expanding offshore fleets and livelihoods under pressure from socio-ecological shocks such as COVID-19.

## SUPPLEMENTAL INFORMATION

Supplemental information including two figures and methods can be found with this article online at <https://doi.org/10.1016/j.cub.2023.05.076>.

## DECLARATION OF INTERESTS

The authors declare no competing interests.

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