Key informant perceptions on wildlife hunting during the first COVID-19 lockdown in India

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We studied the effects of the COVID lockdown in India on illegal hunting of wildlife using on-line interviews with key informants. Household consumption, and sports and recreation were identified as the main motivations, and logistical challenges for enforcement, disruption of food supply and the need for recreational opportunities as key factors associated with increased hunting during lockdown. These insights were corroborated by the statements made by experts extracted from media articles. Our findings suggest that the lockdown potentially increased hunting across much of India, and emphasize the role of livelihood and food security in mitigating threats to wildlife during periods of acute socio-economic perturbation.

Keywords: COVID-19 pandemic, food security, illegal hunting, lockdown, wildlife.

THE COVID-19 pandemic has posed unprecedented challenges to humanity. Starting March 2020, countries across the world attempted to contain transmission of the COVID-19 virus by imposing nationwide lockdowns[1]. These led to unemployment, income loss, disruptions in food supply chain and impacted the daily life and mental health of people in a myriad of ways[2,3]. In India, for example, strict lockdowns during March–May 2020 were associated with widespread unemployment and supply-chain disruptions leading to food insecurity – a survey of Indian wage workers found that 80% households consumed less food during the lockdown than before[4]. Death and suffering were compounded by large-scale migration of the urban work force, who embarked on long and arduous journeys to return to their rural homes[5,6].

Globally, the COVID-19 lockdowns had a number of other impacts, including that on wildlife. On the one hand, preliminary reports showed wildlife benefitting from reduced human mobility and habitat disturbance during the 'Anthropause'[7]. On the other hand, the intensification of natural resource extraction, including wildlife hunting during this period[8], particularly across African and Asian nations, was reported[9–12]. For example, illegal hunting and trade of pangolins in India[9], and that of the critically endangered Giant Ibis in Cambodia, reportedly spiked during the lockdown[13]. In India, where hunting of all wildlife barring a handful of 'vermin species' (e.g. certain rodents and bats) is prohibited by law[14], reports of hunting in the media doubled during lockdown[10].

Impacts of pandemics on human societies and the economy are in many ways akin to those of war[15,16]. It might therefore be expected that pandemic-related lockdowns and resultant disruptions of food-supply chains might increase the demand for wild meat in landscapes where wildlife is available[17–19]. As in the case of war, the pandemic and lockdown could also hamper the functioning of enforcement agencies responsible for wildlife protection[20]. For example, if patrolling by field staff is constrained by lockdown[21], as it is often by war and civil strife[22,23], this too could contribute to increased hunting. Thus, documenting the impacts of the COVID-19 lockdown on wildlife hunting, and examining the socio-economic and institutional factors that potentially underlie these impacts, can help conservation practitioners prepare better for future pandemics, lockdowns and other such socio-economic shocks.

In this study, we use on-line surveys of key informants, combined with analyses of news media reports, to explore perception of the COVID-19 lockdown on hunting in India. Given that logistical constraints precluded primary data collection on hunting or interviews with hunters, we interviewed wildlife experts and conservation practitioners who were either stationed within focal landscapes themselves, or were in touch with colleagues and teams stationed in these landscapes during lockdown. Specifically, we examined perceptions regarding the impact of the lockdown on: (i) locations, targeted species and groups responsible for hunting, (ii) motivations and other

socio-economic factors associated with hunting, and (iii) functioning of wildlife law enforcement and other counter-hunting strategies.

Materials and methods

COVID-19 lockdown in India

The Government of India implemented a strict nation-wide lockdown from 24 March to 3 May 2020, which comprised a first phase from 24 March to 14 April and a second phase from 15 April to 3 May. This lockdown featured strict regulations that suspended all non-essential economic activities and public transport systems, which greatly reduced movement of people. The cessation of economic activity led to the loss or suspension of employment for millions of migrant workers in urban centres, many of whom travelled thousands of kilometres on foot or by bicycle to return to their rural homes. The strict lockdown was followed by a series of 'unlocking' steps over which regulations on economic activity and human movement were lifted in a phased manner.

Questionnaire

An on-line questionnaire (via Google forms; Supplementary material 1) was used to record the perceptions of wildlife researchers and conservation practitioners on the impacts of the COVID-19 lockdown (25 March to 3 June 2020) on wildlife hunting in their respective regions of familiarity within India. The survey was circulated through e-mails to individuals, institutions and groups associated with wildlife research and conservation, and a snow-ball approach helped expand the key informant network. The survey comprised 12 structured and five open-ended questions on how the lockdown affected: (i) patterns of hunting, (ii) motivations and factors associated with hunting, and (iii) counter-hunting strategies, including enforcement (Table 1; Supplementary material 1). Respondents were only permitted to report regarding locations at which they were stationed during the lockdown (direct), or those at which colleagues, assistants or collaborators with whom they were in contact were stationed during the lockdown (indirect; see Question 5 in Supplementary material 1). The two-month period prior to the lockdown (23 January to 24 March 2020) was used for comparison.

This survey was reviewed and approved by a research ethics committee at the Nature Conservation Foundation, Mysuru, prior to circulation (NCF-EC-29/04/2020-(49)). No personal identification information was included in the survey (Supplementary material 1) and all data had been anonymized.

A total of 99 key informants responded to the survey (79 male, 20 female), including 64 respondents aged 18–34 years and 29 respondents aged 35–54 years. Key

informants identified themselves as working with conservation NGOs ($n = 45$), universities ($n = 23$), Government staff ($n = 12$), journalists and researchers ($n = 10$), and commercial enterprises associated with wildlife landscapes such as tourism, agriculture and plantations ($n = 9$). Sixty-four respondents were at the location that they were reporting for, and the information was based on their observations alone (21), or combined with that from colleagues, assistants and collaborators (43). Thirty-five respondents based their responses on information provided to them by colleagues, assistants and collaborators at the location during the lockdown. Forty-one respondents had direct sighting or first-hand knowledge of hunting events. Illegal fishing ($n = 29$), presence of snares and traps ($n = 22$), and enforcement action ($n = 17$) were some other indicators of hunting.

Media reports

Using on-line searches, we compiled 98 media articles that reported on hunting during the lockdown from across India. Articles dated between 3 May and 31 May (phases 3 and 4 of the lockdown) were also included given the expected lag in reporting. Search phrases included 'India', 'lockdown', 'COVID-19', 'wildlife hunting' and 'wildlife poaching'. From each article, we extracted and coded statements by experts as responses to questions 8, 10, 12 and 13 of the on-line survey (Supplementary material 1). In cases where expert statements could not be objectively assigned to the survey question categories, these were coded as 'Don't know'. To avoid duplication, we discarded statements by individual experts that were repeated across multiple media outlets – totally 95 unique statements by 75 experts were thus retained.

Analysis

For the key informant interviews and the coded expert statements from media reports, we calculated the percentage of respondents who selected each response category. For the interviews, we also bootstrapped with replacement (10,000 iterations) and estimated means and 95% confidence intervals. We used chi square to explore associations between motivations for hunting and focal taxa, and motivations and lockdown-related factors (see questions 8, 10 and 12 in Supplementary material 1). We used R 4.0.3 (ref. 24) and QGIS 3.6 for analysis[25].

Results

Questionnaire survey: patterns of hunting

The 99 unique, key informant responses came from 74 districts across 23 Indian states (Figure 1). Over half of the respondents (56%; 95% CI: 40–74%) perceived hunting

Table 1. Major objectives of the study along with the corresponding topics covered by the questionnaire (Supplementary material 1 provides the complete survey form)

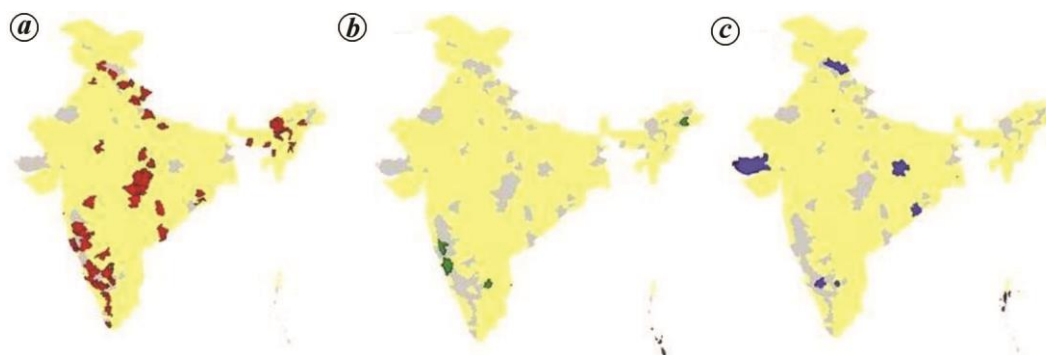| Objective	Q. no.	Topics covered
Patterns of hunting	4–9, 11	Locations, target taxa, hunting groups, changes in hunting during lockdown
Motivations and factors	10, 12	Change in motivations to hunt, factors affecting hunting during lockdown
Counter-hunting strategies	13–16	Lockdown impacts on enforcement and other counter-hunting strategies

Figure 1. Districts from which data were collected are marked in grey. *a*, Reports of increase in hunting during lockdown are marked in red (*n* = 43). *b*, Reports of decrease in hunting during lockdown are marked in green (*n* = 6). *c*, Reports of no change in hunting levels are marked in blue (*n* = 9).
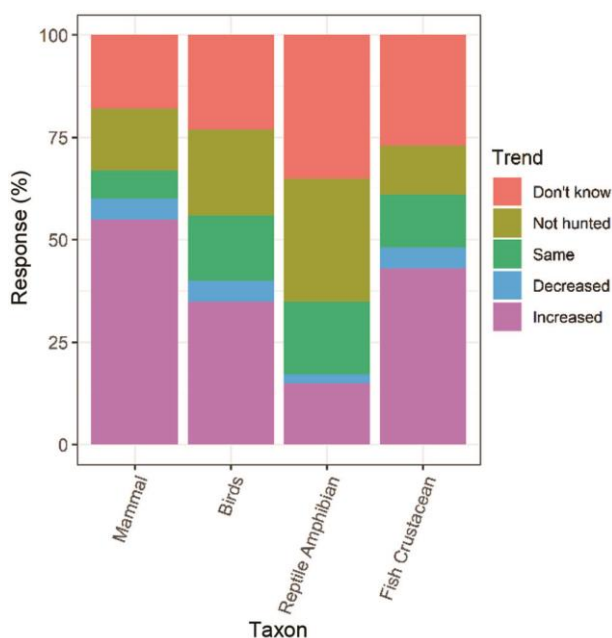

Figure 2. Change in hunting levels of different taxa during the lockdown based on answers by 99 respondents for each taxon (Q8, Supplementary material 1).

to have increased during the lockdown relative to the pre-lockdown period, 10% (95% CI: 5–16%) reported no change and 6% (95% CI: 1–13%) reported a decrease, whereas 27% (95% CI: 19–36) were uncertain ('don't know'; Supplementary material 2; Table 1). Increased hunting during lockdown was reported from 43 districts across 19 states, whereas 15 districts across 11 states either reported no change or a decrease in hunting (Figure 1).

According to the key informants, hunting of mammals (55%; 95% CI: 45–66%), fish and crustaceans (43%; 95% CI: 34–54%) and birds (35%; 95% CI: 26–44%) was higher during lockdown (Figure 2; Supplementary material 2, Table 2). For reptiles and amphibians, information on hunting levels was sparse, with 34% (95% CI: 25–43%) picking 'don't know' regarding changes in hunting levels (Supplementary material 2, Table 2).

Sixty-four per cent (95% CI: 54–72%) stated that hunting during lockdown was carried out by residents who were known to hunt regularly even before the lockdown, whereas 39% (95% CI: 29–49%) attributed hunting to residents who had lost employment due to the lockdown. Twenty per cent (95% CI: 12–28%) reported hunting by individuals who moved back to this location during lockdown (returnees), 17% (95% CI: 10–24%) reported that hunting was by mixed groups and 6% (95% CI: 2–11%) that it was by outsiders (Figure 3 *a* and Supplementary material 2, Table 3). There was an overlap in reported locations of hunting in Reserve Forests (43%; 95% CI: 34–53%), village revenue land (32%; 95% CI: 23–41%), Protected Areas (28%; 95% CI: 19–37%), private land (27%; 95% CI: 18–36%) and Territorial Forests (22%; 95% CI: 14–31%) (Figure 3 *b*, Supplementary material 2, Table 4).

Questionnaire survey: motivations and factors

Over half the respondents (53%; 95% CI: 43–63%) considered that hunting for household consumption had increased during lockdown, 34% (95% CI: 25–43%) reported increased hunting for sport and recreation, followed by trade in local (14%; 95% CI: 8–21%) or outside (11%;

95% CI: 5–17%) markets. A further 12% (95% CI: 6–19%) reported increase in medicinal use (Figure 4, Supplementary material 2, Table 5).

There was no association between perceived change in motivation and perceived change in hunting pressure of different taxa (chi square test, $\chi^2 = 6.8128$, d$f = 15$, P-value = 0.9626; Supplementary material 2 and Figure 1 b),
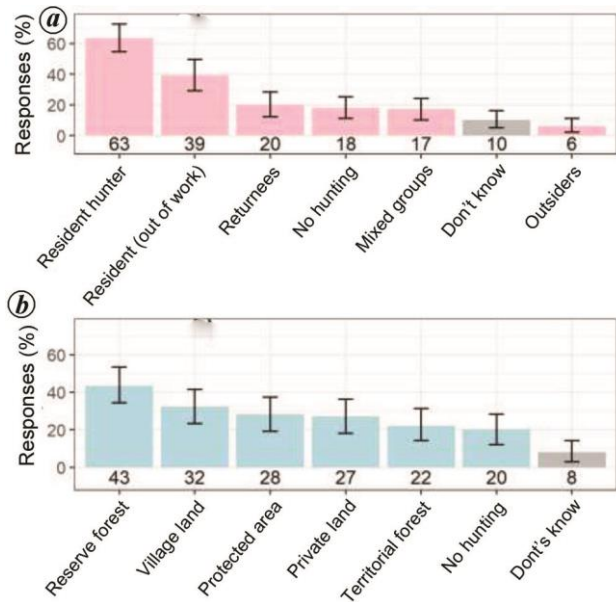

Figure 3. Bootstrapped mean and 95% CI of 99 respondents' answers regarding (*a*) who was hunting (Q11, Supplementary material 1) and (*b*) hunting location (Q9, Supplementary material 1). Each respondent could choose more than one option for each question. The numbers below each bar indicate the respondents who choose that particular answer.
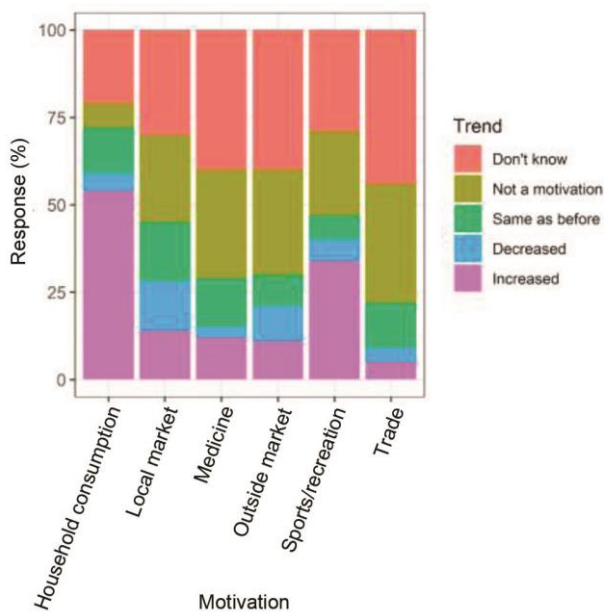

Figure 4. Change in motivation for hunting during the lockdown as answered by 99 respondents for each motivation (Q10, Supplementary material 1).

indicating no clear targeting of any particular taxon during lockdown.

There were overlapping factors associated with increase in hunting. More than one-third of the respondents (36%; 95% CI: 27–45%) considered that lack of enforcement during lockdown resulted in the increase in hunting, and 32% (95% CI: 23–41%) mentioned disruption in food supplies, whereas another 32% (95% CI: 23–41%) stated the need for recreation. Other factors were collapse of traditional seasonal occupations (24%; 95% CI: 16–33%), lack of income from tourism, handicrafts and other local industries (21%; 95% CI: 14–29%), the need for community bonding (18%; 95% CI: 11–26%) and the need to supplement household income to sustain an influx of individuals from urban areas (7%; 95% CI: 2–12%, Figure 5 and Supplementary material 2, Table 6).

The chi-square test ($\chi^2 = 13.784$, d$f = 20$, P-value = 0.8413) indicated that no single local factor was associated with the change in motivation to hunt during lockdown (Supplementary material 2 and Figure 1 a).

Questionnaire survey: counter-hunting strategies

Many respondents mentioned that enforcement action did not decline much across the different agencies with efforts remaining either the same for the Forest Department (34%; 95% CI: 25–44%) and police (29%; 95% CI: 20–38%), or increasing for the Forest Department (20%; 95% CI: 12–28%) and Police (9%; 95% CI: 4–15%; Supplementary material 2, Table 7).
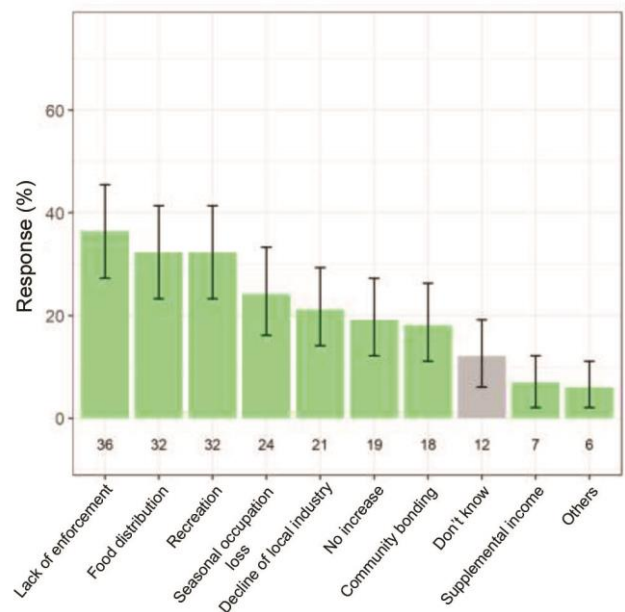

Figure 5. Bootstrapped mean and 95% CI of 99 respondents' answers regarding the local factors associated with hunting (Q12, Supplementary material 1). Each respondent could choose more than one option for each of the questions. The numbers below each bar indicate the respondents who choose that particular answer.

Respondents listed lack of staff strength (46%; 95% CI: 39–60%), lack of mobility (38%; 95% CI: 29–48%) and logistical constraints (38%; 95% CI: 29–48%), along with increased instances of hunting (36%; 95% CI: 27–45%) as the major challenges for enforcement (Figure 6 and Supplementary Material 2, Table 8).

Information regarding strategies implemented by the administration and NGOs was sparse with a majority of respondents choosing 'don't know' for most options. However, nearly half ($n = 47$) of the respondents mentioned that 'provisioning of essential food supplies' was implemented at their focal location, and of these 17% (95% CI: 10–25%) stated its efficacy at regulating hunting during lockdown (Figure 7 and Supplementary material, Table 9).

Media analysis

Eighty-two per cent of media statements (78 statements by 60 unique experts) suggested an increase in hunting during lockdown, 11% (10 unique expert statements) stated no change, 4% (four statements by two unique experts) stated no hunting, whereas 3% (three unique expert statements) suggested a decrease in hunting during lockdown. Increased hunting was recorded for mammals (19 statements), birds (six statements) and reptiles/amphibians (five statements) across sites in 12 different states (see Supplementary material 3.1 for information regarding media articles and statements used to analyse the data).

In terms of motivations behind increased hunting, most statements (18 statements by 16 unique experts) indicated household consumption followed by sport and recreation (six statements by five unique experts). Household consumption was primarily linked to food supply disruption (nine unique statements) and lack of income (five unique statements), whereas sport and recreational hunting was linked to the need of a hobby during lockdown (five unique statements, Supplementary material 3.2, Table 2).

The media articles also had information on changes in enforcement by the Forest Department (34 unique statements), community patrols (15 unique statements) and Police Department (three unique) statements. The answers varied for each agency, as highlighted for the Forest Department, wherein 10 unique statements suggested that their enforcement against hunting remained the same, 18 unique statements suggested increased enforcement during lockdown, whereas seven unique statements suggested a decrease during lockdown (Supplementary material 3.2, Table 3). Broadly, the qualitative media analysis corroborated the findings of our questionnaire surveys.

Discussion

Our study of key informant perceptions suggests that many parts of India may have witnessed an increase in hunting during the COVID-19 lockdown. This increase seems to have been predominantly for household consumption, and to a lesser extent for sport and recreation. Factors such as lower enforcement and disruption of food supply may have contributed to the perceived increase in hunting during lockdown. Sale in local markets and trade in animal body parts do not seem to have been affected significantly by the lockdown. Although increase in hunting
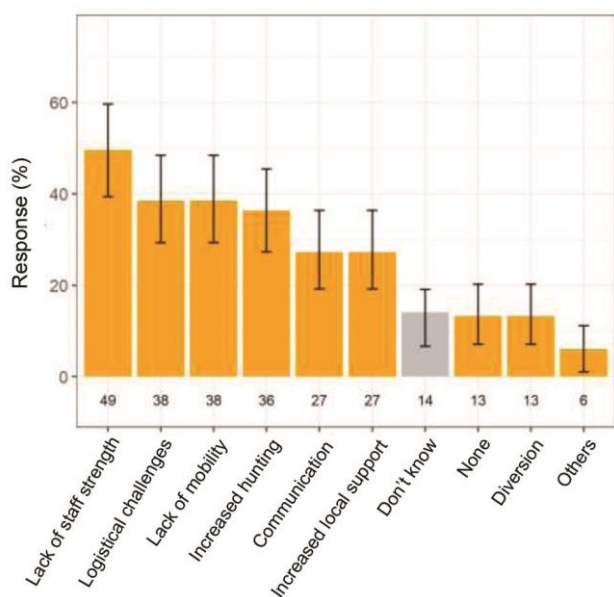

Figure 6. Bootstrapped mean and 95% CI of 99 respondents' answers regarding the challenges faced by enforcement agencies during the lockdown (Q14, Supplementary material 1). Each respondent could choose more than one option for each of the questions. The numbers below each bar indicate the respondents who choose that particular answer.
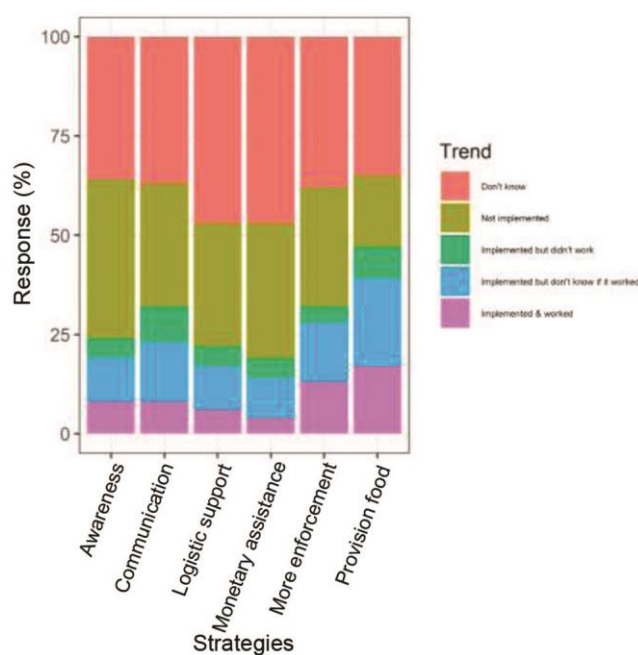

Figure 7. Strategies used to combat hunting during lockdown and their effectiveness as answered by 99 respondents for each strategy (Q16, Supplementary material 1).

during the COVID-19 lockdowns has been reported by other studies[9,10,12], the present study provides unique insights into the motivations for this hunting and the effect of the lockdown.

We would like the readers to consider the following caveats: (i) data were collected from key respondents and media reports and not directly from hunters and therefore reflect perceptions rather than a real measure of hunting or motivations[26]; and (ii) there were a number of 'don't know', responses, which might be attributed to lack of access to information during lockdown, and hunting being understudied and a sensitive subject, especially within the Indian conservation scenario. We also acknowledge that the coarse scale of our data cannot reflect local nuances and, tends towards oversimplification; for instance, it is hard to distinguish illegal fishing from legal fishing[27].

We posit that one reason for the increase in hunting during lockdown was the disruption of food-supply chains. Shutting down of meat shops may have increased bushmeat demand, a possibility that has also been highlighted by 11 respondents in the open-ended section of our survey. Dietary habits vary dramatically across India. Some regions within the country are predominantly vegetarian and in other parts up to 90% of the households consume meat[28]. The protein needs of people are met by inexpensive and easily accessible domestic protein options in most cases. However, in its absence it is possible that many would have turned to bushmeat consumption. Listing domestic meat shops as essential businesses along with grocery stores, especially in areas with high meat demand and during festivals that are marked with meat consumption becomes an important on-ground consideration.

The lockdown also affected the food purchasing ability of millions of people across the country, especially those employed in the unorganized sector. We know that loss of jobs, especially among migrant workers, and the resulting food insecurity faced can have significant effects on the use of natural resources[29,30]. It is important for countries like India, which have numerous marginalized and poor groups, to consider measures to prevent widespread food insecurity during future lockdowns. Responses to our section related to strategies that worked to prevent hunting suggest that provisioning of essential food supplies may have worked to some extent, similar to recommendations from other experts[31].

One-third of our survey respondents stated that there was an intensification in sport and recreational hunting during lockdown. This was also corroborated by hunting videos from our media analyses[32]. Although prevalence of recreational hunting, even in the Indian context has been acknowledged[33,34], our understanding of the value and motivation of recreational hunting and its effect on wildlife is still understudied[35].

Our effort to understand the role of enforcement in preventing hunting during lockdown was met with mixed results. Although over half of the respondents stated that there was no change or even an increase in the presence of enforcement agencies at their location, lack of enforcement was cited as a factor contributing to an increase in hunting by over one-third of the respondents. Some of this disparity can be explained by the fact that 16% of the respondents mentioned that increased instances of hunting during lockdown was a challenge for the enforcement agencies. An increase in hunting linked to socio-economic factors occurs despite sustained enforcement[36], implying that in addition to providing logistical support for enforcement, such as patrolling, there is a need to identify and address the socio-economic drivers of hunting.

Another possible factor that may have played some role in increased non-compliance to hunting prohibitions might be resentment towards the Government, as has been suggested by one of the respondents who cited 'anger against the Government' as a motivation. Studies have suggested that non-compliance with conservation regulations can stem from resentment towards the administration, especially the enforcement agencies[26,37].

Together, the multitude of reasons related to hunting that unfold in this study highlight the significance of moving away from the notion of a singular mechanistic driver and to better cope with future socio-economic shocks that may result from pandemics, extreme climatic conditions, recessions, war and civil unrest.

Conclusion

For the foreseeable future, pandemic-related restrictions and lockdowns are likely to have significant economic and social repercussions, which will create new challenges to effectively manage and conserve natural resources[38]. It is imperative that in a COVID-19 world and beyond, alleviating shocks and setbacks will require developing rapid and novel response plans that include wildlife conservation and human well-being around wildlife areas[39,40]. Given the challenges of conducting field research during such times, interviews with key informants and the study of media reports, and other forms of virtual or contactless data collection could play an important role in monitoring wildlife and conservation threats.

Designing research based on these methods to generate reliable information at scales relevant to policymakers and law enforcement agencies represents a key future direction.

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