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### Short Communication

## Spear-fishing with surface supplied diving disturbs the ecological balance in Gulf of Mannar, southeast India

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Gulf of Mannar in southeast coast of India is considered an important biodiversity hotspot providing a variety of fishery resources. Spear-fishing, involving surface-supplied diving has become a significant threat in the Tuticorin region of Gulf of Mannar and was documented in August 2018. It is understood from the fishermen that spear-fishing is used as an opportunistic fishing method when the visibility is good. Using an iron rod of about 1.5 m, they catch commercially important fin- and shell-fishes including groupers, cat fishes, parrot fishes, rays, squids, trigger fishes, lobsters, crabs, etc. The practitioners of this harmful method target the ecologically important fishes such as parrot fishes, and this targeted collection adversely impacts the ecosystem by disturbing the ecological balance. This study makes a strong case for banning this activity before it spreads to other regions.

[**Keywords:** Destructive fishing, Gulf of Mannar, Spear-fishing, Surface-supplied diving]

### Introduction

It was thought in the 19<sup>th</sup> century that fish resources of the world are potentially inexhaustible<sup>1</sup>, but the scenario has now changed significantly as there is an obvious global decline of fishery resources due to overexploitation and habitat destruction<sup>2</sup>. This decline is especially felt keenly, as fish and fisheries have been an integral part of the socio-cultural and economic fabric of the ancient Asian civilizations<sup>3</sup>. Gulf of Mannar along the southeast coast of India is a major marine biodiversity hotspot with dynamic ecosystems like coral reefs, seagrasses and mangroves. Because of the significant biodiversity, Gulf of Mannar has been brought under Gulf of Mannar Biosphere Reserve (GoMBR) in 1989 by the Government of India under the Man and Biosphere (MAB) programme and Gulf of Mannar Marine National Park (GoMMNP) by the Government of Tamil Nadu in the year 1986. Technology has greatly

influenced the fishing practices in Gulf of Mannar, especially after the introduction of trawlers for fishing. The extent and volume of the resources in Gulf of Mannar have been dwindling over the years due to the adoption of various destructive fishing methods including mechanized bottom trawling, push net operation, trap fishing, the use of shore seine, purse seine, etc.<sup>4,5</sup>.

Traditionally, Gulf of Mannar has been well-known for its pearls, shells and skilled skin divers who collect these resources by breath-hold diving. These skin divers are highly skilled and they can reach a depth of more than 20 m in search of oysters or shells<sup>6</sup>. Pearl collection in Gulf of Mannar was stopped in 1961 because of the depletion of oysters<sup>7</sup> and also due to the arrival of destructive bottom trawling activity<sup>2</sup>, though shell collection is still continued. It has been reported that about 28,440 people were engaged in skin diving operation during the 1990's<sup>8</sup>. Surface-supplied diving, an unscientific method, has come into vogue recently in Tuticorin region of Gulf of Mannar for collecting sacred chank *Turbinella pyrum*<sup>6</sup>. This activity allows fishermen to stay longer under water and it causes significant damage to the sea bottom. Further, this activity has caused substantial casualties among the fishermen due to the lack of knowledge on diving related injuries such as lung over expansion and nitrogen decompression sickness<sup>6</sup>.

### Spear-fishing with surface supplied diving

During an underwater monitoring in Tuticorin region of Gulf of Mannar in August 2018, dives were made adjacent to surface supplied divers and it was observed that these surface-supplied divers have started spear-fishing (Figs. 1 – 3). Immediately, underwater documentation of spear-fishing was carried out adopting scuba diving. Key informant interviews (KII) were conducted with 25 surface-supplied divers from Thirespuram fishing village in Tuticorin. It is understood that spear-fishing is undertaken as an opportunistic fishing method when the visibility is good. According to the fishermen, all the surface-supplied divers do spear-fishing occasionally. It has been estimated that around 2,000 fishermen in Tuticorin region are involved in this activity<sup>6</sup>. Spear-



Fig. 1 — The spear is handed over to the diver

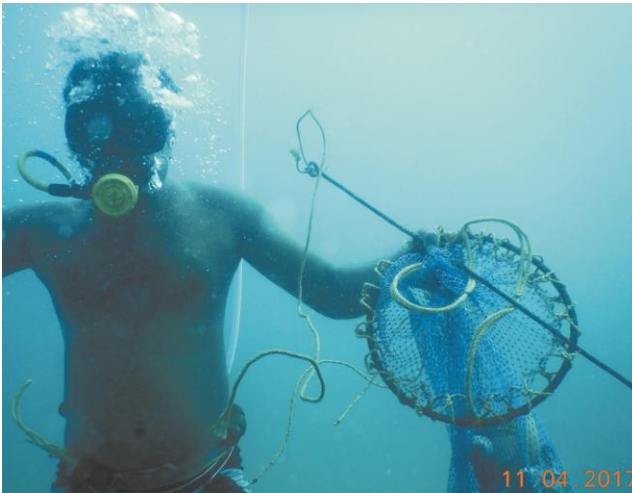


Fig. 2 — A surface-supplied diver underwater with spear and mesh bag



Fig. 3 — A surface-supplied diver with his catch

fishing is one of the common artisanal fishing methods in many countries<sup>9</sup> and has been reported to cause significant damage to the fish communities<sup>10-13</sup>. Generally breath-hold divers cannot do spear-fishing effectively due to the limited time under the water.

But the recently evolved surface-supplied diving method enables the fishermen to stay longer under water to undertake spear-fishing extensively. The spear they use is a simple iron rod of about 1.5 m; one end of the rod is sharp to pierce the fish and the other is rounded. With the spear in hand they attack the big-sized fishes that are mostly territorial and sluggish in movement. To deposit the catch, divers carry a mesh bag locally made of nylon nets. It is learnt from the fishermen that *Turbinella pyrum*, their primary targeted collection, has decreased significantly in number because of rampant collection over the past few years. Hence, they have taken to spear-fishing activity applying surface-supplied diving.

### Ecological impacts of spear-fishing

Employing the technique of spear-fishing, the fishermen harvest commercially important fin- and shell-fishes that include groupers, cat fishes, parrot fishes, rays, squids, trigger fishes, lobsters and crabs, which are not fast movers and hence can easily speared. The offshore reef patches in Gulf of Mannar have been the fishing grounds where corals and fishes are abundant<sup>14</sup>. It is argued by certain researchers that spear-fishing has minimal direct impact on non-target species as it is highly selective in terms of species and size<sup>11,12,15</sup>. But it is largely accepted that it is more destructive than other gear types as it disturbs the ecological balance<sup>10,12,16</sup>. Parrot fishes in particular have been linked to the maintenance of the reef ecosystem as they help in coral growth and abundance<sup>17</sup>, but are extensively caught using spear-fishing. Coral-algal phase shift due to mass bleaching and disease outbreaks have become more common in reef areas around the world<sup>18</sup> including Gulf of Mannar<sup>19</sup>. Parrot fishes help the corals by grazing on the macroalgae which compete with corals for space and hence their decline would damage the reef ecosystem significantly<sup>17,20</sup>. Depletion of parrot fishes in a reef area would allow the increase of macroalgae which in turn would damage the corals. Moray eels are common inhabitants in a reef ecosystem. These carnivorous fishes are traditionally known to be aggressive and they attack humans<sup>21</sup>. Hence, the fishermen wish to get rid of moray eels by killing them with their spears primarily. Reduction in the number of these carnivorous eels would directly impair the balance of the ecosystem. Likewise, groupers and trigger fishes are macro-carnivores that are critical in the maintenance of reef ecosystem.

Considering the negative impacts caused by spear-fishing, it is very clear that this activity is destructive and adds to the existing list of destructive fishing activities in Gulf of Mannar. Though culture fishery is increasing day by day, capture fishery is inevitable considering the growing population and increasing demand for protein<sup>5</sup>. But the decline in fishery resources is very obvious around the world due to overexploitation and destructive fishing activities<sup>2</sup>. It has been reported that there is a definite and steady decline in marine fishery resources of Tuticorin region of Gulf of Mannar<sup>22</sup>. Proper fisheries management in the wake of technological advancement is critical in sustaining the resources. In view of the adverse effects of spear-fishing, there are many articles written around the world recommending the ban of this activity<sup>9,16,23</sup>. To curb spear-fishing in Gulf of Mannar, it is imperative that surface-supplied diving is curbed. As of now, there is no regulation on surface-supplied diving activity in Gulf of Mannar though it has already cost many human lives<sup>6</sup> and is damaging the ecosystem. Further, it is more likely that these surface-supplied divers would develop more destructive tools and gears in the near future. Currently, this activity is carried out only in Tuticorin region of Gulf of Mannar but it is more likely to spread to other regions shortly. Hence the study strongly recommends the ban of surface-supplied diving activity in Gulf of Mannar to control further damage to the resources. Destructive fishing and the livelihood of the fishermen are directly linked and hence alternate livelihood options should be developed to preserve the ecosystem and the dependant fishermen.

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### Conflict of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

### Author Contributions

KDR: Conceptualization, investigation and writing; PDK and GM: Investigation; JKPE: Writing - review & editing, and funding acquisition.

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