

Overview on bycatch from harvesting systems

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The term bycatch refers to the non-targeted species retained, sold or discarded for any reason (Alverson et al., 1994). Target catch is the species that is primarily sought after in the fishery and incidental catches is the retained catch of non-targeted species and the discarded catch is that portion of the catch that is returned to the sea due to economic, legal or personal considerations. Global bycatch by the world's marine fishing fleets was estimated at 28.7 million t in 1994, of which 27.0 million t (range: 17.9-39.5 million t) were discarded annually and shrimp trawling alone accounted for 9.5 million t (35%) of discards annually (Alverson et al., 1994). In 1998, FAO estimated a global discard level of 20 million t (FAO, 1999a). Average annual global discards, has been re-estimated to be 7.3 million t, based on a weighted discard rate of 8%, during 1992-2001 period (Kelleher, 2004). Davies et al. (2009) redefined bycatch as the catch that is either unused or unmanaged and re-estimated it at 38.5 million tonnes, forming 40.4% of global marine catches. The recent global estimates of bycatch are 9.1 million tonnes, with highest contribution from bottom trawls of about 4.2 million tonnes, with tropical shrimp trawl fisheries contributing the most.

The first study on the fisheries bycatch along the Indian waters was by George *et al.*, (1981) who had reported that bycatch formed about 55% of the total trawl landings at Shakhikulangara and 56% at Cochin fishing harbours of Kerala. Sukumaran *et al.*, (1982) had reported that shrimps contribute only 13% of average annual trawl catches from Malpe and Mangalore in Karnataka state (India) during 1980-82 and the trawl by-catch was as high as 85% during this period. The total bycatch generated along the east coast of India by shrimp fisheries was reported by Gordon, (1991) to vary between 99–130 thousand tonnes annually. The bycatch generated by the shrimp trawlers along Vishakhapatnam coast was reported by Rao, (1988). The estimate of the total bycatch was 40,410 tonnes of which 32,420 t was discarded and the rest 8,258 t was landed. Sujatha, (1995) reported 288 species belonging to 68 families and constituting about 11% of the total trawl landings off Vizhakatnam. Total of 87 species constituted the low value bycatch generated by commercial trawlers operating from the Veraval coast (Pravin and Manohardoss, 1996a). Pillai, (1998) described the bycatch generated along the Indian coast and the total bycatch was found to be highest along the Gujarat coast and around 40% of the bycatch comprised of juveniles. The bycatch generated by the shrimp trawlers along the upper east coast of India was reviewed by Dixitulu, (2003). The constituents of the trawl bycatch along south east coast was reported as 38.1% of the total catch by Jagadis *et al.*, (2003). Sciaenids (15.6%), engraulids (12.8%) and ribbonfishes (8.9%) formed the major species in the trawl bycatch along Veraval coast, as reported by Zynudheen *et al.*, (2004). Kelleher (2004) had estimated total bycatch discards in Indian fisheries at 58000 t, which formed about 2% of the total landings. The trawl bycatch generated along Mangalore was reported by Zacharia *et al.*, (2005) as 56,083t in 2001 and 52,380t in 2002. Kumar and Deepthi, (2006) had reviewed the bycatch problem in the Indian context and different steps available for

bycatch mitigation were discussed. The economic loss due to juvenile fishing along the Indian coast was estimated at US\$ 19,445 million/year by Najmudeen and Sathiadhas, (2008). The bycatch generated by shrimp trawling along the central Kerala coast was reported by Boopendranath et al., (2008). Total of 283 species were reported as trawl bycatch component off central Kerala by Gibinkumar, (2008). Mohamed et al. (2009) have shown that the percentage of juveniles exploited by trawl ranges from 20 to 60% in case of seer fishes and groupers and as 12% in case of squids. Pramod (2010) estimated the bycatch discards from mechanised trawlers operating in Indian EEZ at 1.2million tonnes. The same study estimated 56.3% of the total catch of shrimp trawlers as bycatch. Recent estimate by Dinesh babu et al. (2013), showed that landing of low value bycatch (LVB) in trawl fisheries, increased from 14% in 2008 to 25% in 2011. A recent study carried out among the multi-day trawlers operated operating along Visakhapatnam coast showed that juveniles of 20 species formed 12,757.16 t and 286.86 million numbers per year and their contribution to the total landings of these species in trawl by-catch were 55.30% by weight and 57.03% by numbers (Ghosh et al., 2021). Abdul Azeez et al., (2021) estimated that bycatch constituted about 53.36% of the total catch from mid water trawlers operating along Gujarat coast.

The reduction in bycatch discards globally, in recent years could be attributed to (i) increased use of bycatch reduction technologies, (ii) anti-discard regulations and improved enforcement of regulatory measures, and (iii) increased bycatch utilization for human consumption or as animal feed, due to improved processing technologies and expanding market opportunities. Also, equally important as the issue of bycatch is the un-quantified impacts of different fishing systems on the ecosystem, with active fishing gears like trawls causing the most damage. FAO has brought out International guidelines on bycatch management and reduction of discards, in view of its importance in responsible fisheries (FAO, 2011). Life under water (14th Goal) among the Sustainable Development Goal (SDG) has different targets for sustainable use of fisheries resources.

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