Observations on Experimental Two-boat Bottom and Midwater Trawling in Gandhisagar Reservoir*

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Among the two trawl designs employed for two-boat bottom trawling 12.50m dual purpose trawl caught 33.22% more fish than 12.50m large mesh high opening trawl. The increase in the average catch/h of fish is 60.53% in dual purpose trawl due to attachment of false head rope. The influence of trawling speed of 2-4 knots, on the specieswise catch composition of fish obtained during experimental two-boat bottom and midwater trawling is discussed.

Fresh water trawling is yet to make a beginning in Indian Reservoirs. George *et al.*, (1982, 1986) and Kartha & Rao (1987) carried out single boat bottom trawling in Hirakud and Gandhisagar reservoirs respectively for weeding out both predators and trash fishes which are of less economic importance. In the present work two-boat bottom and midwater trawling operations were carried out for the capture of carp and other commercial freshwater fishes to assess the feasibility of such fishing methods in large Indian reservoirs.

Materials and Methods

The fishing areas covered in two boat bottom and midwater trawling were Dhabla, Jallod and Nanor and two-boat midwater trawling were Modi and Nimod during November-December 1985 and May 1986 respectively. Kartha and Rao (1987) and Rao *et al.*, (1988) have described the topography and morphometry of the fishing ground.

Comparative trawling experiments were conducted using two identical wooden fishing boat of 9.20 m OAL powered with 26 hp BUKH inboard marine diesel engine. The trawling speed of the boat was measured by the time taken by the boat to travel its length from a floating object thrown overboard from the bow of the vessel which again was corrected and adjusted to the corresponding RPM of the engine. The towing tension on warp was measured by following the method suggested by Satyanarayana & Nair (1965).

The design, construction and rigging details of 12.5 m large mesh high opening trawl (LMHOT) were given by Kartha & Rao (1987). The same for dual purpose trawl (DPT) of bottom (12.5m) and midwater (7 m) are given in Figs. 1 & 2 respectively. Basically

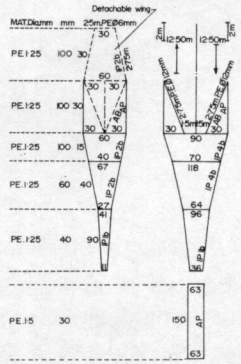

Fig1 Dual purpose trawl (Bottom)

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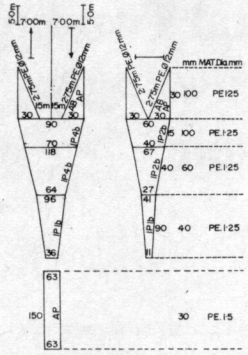

Fig.2 Dual purpose trawl (mid-water)

the two nets are the same, the former is having a detachable wing of 2.75 m on either side to operate as bottom trawl and the latter is without wing to operate as midwater trawl. For bottom and midwater operation the net was provided with 15 and 11 numbers of 15.20 cm dia aluminium floats and 6 mm dia chain weights of 12.50 kg and 7.00 kg respectively.

Special type of rigging was adopted by providing long sweeps of 26 m for HR and 27 m for FR made of 12 mm dia HDPE rope (Fig. 3). The foot rope sweep was provided

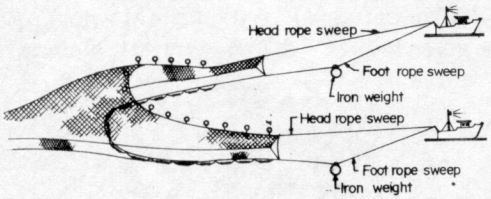

Fig.3 Rigging of two boat bottom trawl

with two pieces of 20 and 7 m length and 10 kg spherical iron weight on each side in between the free ends of 7 and 20 m. In addition to this, chain weights of 10 kg were tied to the entire length of net to avoid undue lifting of the net while in operation. The shooting and hauling operations were carried out by following the method suggested by Varghese & Nair (1975) and Kartha & Sadanandan (1985). On each day large mesh high opening trawl and dual purpose trawl were operated in rotation keeping almost all the fishing parameters constant at a trawling speed of 2.00 to 2.50 knots.

The 12.5 m dual purpose trawl which was found to be relatively good was again rigged with and without false head rope. The mode of attachment of false head rope to the net is shown in Fig. 4. The rope used for false

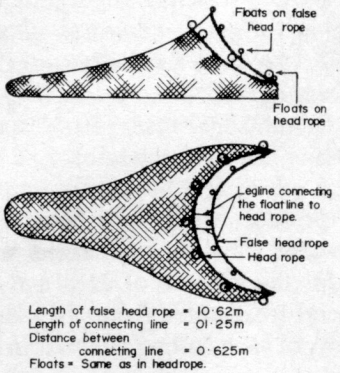

Fig.4 Mode of attachment of false head rope

head rope is similar to the specification of HR and rigging details are worked out following the method suggested by Satyanarayana *et al.*, (1970). The procedure adopted for false head rope study at trawling speed of 2.5 - 3.00 knots using two boats was similar to the one described earlier.

The shooting and hauling-in operation of two-boat midwater trawling was also conducted with 7 m trawl in the same manner as in two boat bottom trawling with modifications in scope ratio from 1:7 to 1:2.5-3.00 and trawling speed from 2-3 to 3-4 knots. The weight of iron block suspended on each side in between free end of 7 and 20 m sweeps and chain weights tied to the entire length of

the net were changed to 20 kg each respectively (Fig. 5).

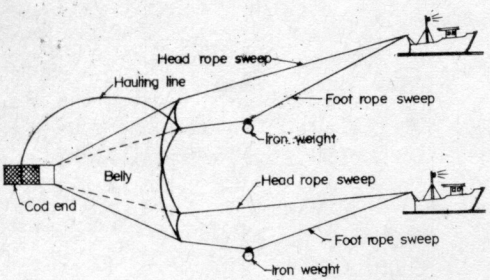

Fig.5 Rigging of two boat midwater trawl

Results and Discussion

The particulars of 35 comparative fishing operations conducted with 12.5 m LMHOT and DPT and specieswise composition of fish recorded are given in Tables 1 & 2 respectively. The average catch/h of fish 26.84 and 35.7 kg for LMHOT and DPT respectively.

The data collected is analysed statistically by using paired 't' test. The mean paired difference (DPT-LMHOT) for 35 pairs of observations is 3.752 ($p<0.001$) indicating that the catch of dual purpose trawl is significantly higher than that of large mesh high opening trawl.

Under marine condition Kartha & Sadanandan (1973) have observed that the dual purpose trawl is most suitable and yielded 2.10 and 1.30 times more fish in depth range of 5-10 and 10-20 m respectively when compared to bulged belly trawl. Earlier attempts of Parrish (1959), Barraclough & Needler (1959), Okonski (1964) and Scharfe (1968) have recommended that a dual purpose trawl for operation at bottom and midwater would prove to be more economical. The use of high opening trawl was found to be effective for the exploitation of both bottom and off bottom fishes in Hirakud

Table 1. *Particulars of two boat bottom trawl operation with two trawl designs*

Type of gear	Large mesh high opening bottom trawl	Dual purpose trawl (bottom)
Depth of fishing ground, m.	5-15	5-15
Length of warp paid out, m	15-100	15-100
Trawling speeds, knot	2.00-2.50	2.00-2.50
Number of hauls	15	35
Total duration of hauls (h, min)	17.30	17.30
Warp tension, kg	146.00-158.00	122.00-136.00
Catch details, kg		
Total catch	470.00	626.00
Average catch/h	26.84	35.76

Table 2. *Specieswise composition of fishes landed by two boat bottom trawling with two trawl designs*

Name of species	12.5 m Large mesh high opening trawl		12.5m Dual purpose trawl (bottom)	
	weight, kg	%	Weight, kg	%
Carps				
Labeo calbasu (Ham)	61.50	13.50	77.00	12.30
Labeo gonius (Ham)	24.50	5.20	52.00	8.30
Labeo boggut (Skyes)	19.00	4.04	33.00	5.27
Cat fishes				
Mystus seenghala (Skyes)	49.00	10.40	20.50	4.55
Mystus aor (Ham)	41.75	8.90	26.00	4.15
Wallago attu (Schn)	54.50	9.70	27.00	4.30
Silonia silondia (Ham)	26.00	5.55	24.50	3.90
Ompok bimaculatus (Block)	24.75	5.26	24.00	3.83
Forage fishes				
Rasbora daniconius (Ham)	41.00	8.70	67.00	10.70
Ambassis ranga (Ham)	47.00	10.00	52.00	8.37
Ambassis nama (Ham)	32.00	6.78	58.00	9.26
Spiny eels				
Mastacembelus armatus (Lac)	9.00	1.90	-	-
Miscellaneous				
Glossogobius giuris (Ham)	25.00	5.30	74.00	11.82
Xenentodon cancila (Ham)	24.00	5.19	83.00	13.25
Total	470.00	100.00	826.00	100.00

reservoir and yielded 42% more fish than in bulged belly trawl (George *et al.*, 1986). According to Steinberg (1971) two-boat bottom trawling would be of great interest and more economical than single boat trawling in fresh water and coastal fisheries of developing countries as an efficient method. The existing boats with small engines or canoes already equipped with outboard motors of sufficient power can serve as towing boats. The special advantage of dual purpose net is the possibility of the operation of one and the same net in both bottom and midwater by effecting slight modifications in the rigging and method of operation.

Table 3. *Particulars of two boat bottom trawling with and without false head rope*

Type of gear	Dual purpose trawl (Bottom)	
Depth of fishing ground, m	10-20	
Length of warp, m	70-130	
Trawling speed, knot	1.50 to 3.00	
Type of rigging	with false head rope	without false head rope
Number of hauls	30	30
Total duration, h	15.00	15.00
Warp tension, kg	136-148	126-138
Catch details, kg		
Total catch	662.00	413.00
Catch/h	44.13	27.53

The particulars of 35 comparative fishing operations conducted to study the effect of false head rope on gear efficiency and species wise percentage composition of fish landed are given in Tables 3 and 4 respectively.

Table 4 *Specieswise composition of fishes landed during two boat bottom trawling with and without false head rope*

Name of species	With FHR Weight, kg	%	Without FHR Weight, kg	%
Carps				
Labeo rohita (Ham)	90.00	13.59	50.00	12.14
Labeo calbasu (Ham)	62.00	9.40	42.50	10.29
Labeo gonius (Ham)	35.00	5.36	21.00	5.08
Labeo boggut (Skyes)	22.00	3.32	11.50	2.78
Cirrhinus mrigala (Ham)	25.00	3.78	10.50	2.54
Cirrhinus reba (Ham)	10.00	1.50	3.50	0.85
Cat fishes:				
Silonia silondia (Ham)	17.00	2.56	14.50	3.50
Ompok bimaculatus (Bloch)	23.00	3.37	12.50	3.50
Forage fishes:				
Rasbora daniconius (Ham)	57.00	8.61	43.50	10.53
Ambassis ranga (Ham)	62.00	9.36	45.00	10.89
Ambassis nama (Ham)	34.00	5.13	20.50	4.96
Danio devario (Ham)	28.00	4.20	11.00	2.66
Miscellaneous fishes:				
Glossogobius giuris (Ham)	65.00	9.82	35.00	8.47
Xenentodon cancila (Ham)	62.00	9.40	37.00	8.96
Nandus nandus (Ham)	70.00	10.60	55.00	13.31
Total	662.00	100.00	413.00	100.00

The average catch/h of fish by 12.5 m dual purpose trawl with and without false head rope rigging is 44.13 and 27.53 kg respectively. The *Labeo rohita, Cirrhinus mrigala and Cirrhinus reba* were also caught along with the other species at a slightly higher speed of 2.5 to 3.00 knots.

In the present study a false head rope was attached to 12.5 m dual purpose trawl. In marine conditions Satyanarayana *et al.*, (1970) could increase the landings of a bottom trawl by 100% by using false head rope.

Table 5. *Particulars of two -boat midwater trawling*

Type of gear	Dual purpose trawl (midwater)
Depth of fishing ground, m	20 - 30
Length of warp, m	50 - 100
Trawling speed, knot	3.00 - 4.00
No. of hauls	35
Total duration h, min	17.30
Warp tension, kg	125.00 - 132.00
Total catch, kg	555.00
Average catch/h, kg	31.71

Table 6. *Specieswise composition of fishes landed by two-boat midwater trawling*

Name of species	Weight, kg	%
Carps		
Catla catla (Ham)	111.00	20.00
Labeo rohita (Ham)	58.50	10.54
Labeo gonius (Ham)	74.00	13.33
Labeo boggut (Skyes)	55.50	10.00
Cat fishes		
Silonia silondia (Ham)	27.50	4.95
Ompok bimaculatus (Bloch)	21.50	3.87
Murrels:		
Channa straiatus (Bloch)	35.00	6.30
Channa maurlius (Ham)	31.00	5.58
Channa punctatus (Bloch)	58.00	10.45
Mullets:		
Liza corsula (Ham)	29.00	5.26
Miscellaneous fishes:	54.00	9.73
Total	555.00	100.00

The particulars of fishing operations conducted with 7 m midwater trawl (12.5 m dual purpose trawl without wings) and specieswise composition of fish recorded are shown in Tables 5 and 6 respectively. The average catch/h of fish is 31.71 kg. Commercial varieties of *Catla catla* (20%), *Labeo rohita* (10.54%), *Labeo gonius* (13.33%), *Labeo boggut* (10%), Murrels (22.33%) and mullets (5.26%) were represented in the landings. The present study indicated the suitability of two-boat midwater trawling at 3-4 knots for the exploitation of commercial varieties of catla, rohu, murrels, mullets etc. in Indian reservoirs.

A preliminary study was taken up to ascertain the influence of trawling speed on the catch composition. Specieswise percentage composition of fish obtained are furnished in Table 7. Aron & Collard (1969) reported that changes in net speed through water produced changes in catch composition. In Hirakud reservoir 38.20% of the total catch consisted of six species of cat fishes and the rest were two species of trash fishes (George *et al.*, 1982) at a trawling speed of 1.94 knots. Kartha & Rao (1987) reported that the percentage composition of fish in Gandhisagar reservoir at a trawling speed of 2 knots were four species of cat fishes (46.80%), five species of trash fish (44.20%) and one species of minor carp *Labeo calbasu* (9.00%). In the present study during two boat

Table 7. *Specieswise selectivity percentage at different trawling speeds/different methods*

Fish species	Two boat bottom trawling at 2-2.5 knots	Two boat bottom trawling at 2.5-3 knots	Two boat midwater trawling at 3-4 knots
Catla catla	-	-	20.00
Labeo rohita	-	12.86	10.54
Labeo calbasu	13.15	9.84	-
Labeo gonius	6.75	5.22	13.33
Labeo boggut	4.65	3.05	10.00
Cirrhinus mrigala	-	3.16	-
Cirrhinus reba	-	1.67	8.82
Cat fishes	30.75	5.60	-
Forage fishes	26.90	28.17	-
Murrels	-	-	22.33
Mullets	-	-	5.26
Feather backs	-	-	1.89
Miscellaneous fishes	17.80	30.43	7.83
Total	100.00	100.00	100.00

bottom trawling the percentage composition of trash fishes reduced with the increase in trawling speed from 2-2.5 to 2.5-3.00 knots. Non-commercial species of predatory and trash fishes in two boat bottom trawling at two speed ranges and midwater trawling were 75.45%, 64.30% and 7.83% respectively. It was significant to note that 92.17% of total catch in midwater trawling was constituted by catla, rohu, mullets and other commercial fishes (Table 7). The results of the study might prove useful for introduction of selective fishing for both commercial and non-commercial species though further data would be required to establish a definite relationship between fish catch and trawling speed.

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