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Quantification of juvenile fish species incidentally killed in bonga Purse seine fishery

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Abstract
A study was conducted in the inshore Atlantic ocean with a view to quantifying by-catch species from bonga purse seine fishery. The research was done through a fishery observer programme that lasted for one year. Sampling was done fourthnightly, 20 replicate landings from five boats where used for analysis. Sixteen species of fin fishes belonging to 12 families constitute the by-catch, majority are juvenile with a total length range of 2-25cm caught in their nursery ground. The target species, bonga, *Ethmalosa fimbriata* have a total length range of 10-30cm. However, the mean weight of bonga (506.84kg) was predominantly more than the mean weight of all fin fish by-catch species (91.01kg) with an averaged ratio of 10:1 respectively. T-test detected a significant difference ($P<0.05$) between the weight of target bonga fish and fin fish by-catch. Application of by-catch reduction technologies rather than reduction in effort is suggested for fishery sustainability.

Keywords: inshore sea, By-catch, Sustainability, Purse seine, bonga.

1. Introduction
By-catch are non-targeted animals and non-living materials which are caught while fishing. FAO has recently estimated that nearly seven million tons of fish by-catch is discarded globally by commercial fishers every year (Earys, 2005) [1]. This is equivalent to about 8% 0f the global catch from marine capture fisheries. Purse seine are not selective, capturing any animal within the reach of the net. In gear ranking, purse seine is the fourth offender in by-catch capture and mortality especially the Northwest Atlantic Capelin purse seine fishery (Alverson *et al*., 1994 [2] By-catch is widely recognized as one of the most serious environmental impacts of modern commercial fisheries (Hall, 1996) [3]
Bonga, *Ethmalosa fimbriata* is a pelagic schooling clupeids caught predominantly by drift gill nets and purse seine nets. It is a phytoplankton feeder, occurring in estuaries and shallow seas when dense diatom blooms appear (Fagade and Olaniyan, 1972) [4]. It is the second most abundant fin fish caught in Nigeria inshore sea (FDF, 2007) [5]
There is a decline in capture fish production globally and in Nigeria; 6688 MT in 1995 to 3405.16MT in 2007, (FDF, 2007) [5]. This is attributed to factors such as climate change, pollution, anthropogenic activities, biodiversity erosion and recruitment failure. Incidental mortality of juvenile fish as by-catch in bonga purse seine fishery, which about 350 boats have open access operation in Nigeria inshore sea, contributed greatly to the later two factors, because if these fishes are allowed to grow, it would be caught by other commercial fisheries like trawl and gill net targeting mature species (Kenelly *et al*., 1998) [6]. Hence, identification and quantification of by-catch species is a prelude to mitigate the problem.

2. Materials and Methods
A fisheries observer programme (Liggins and Kennelly 1995 [7]; Kenelly *et a*l., 1998) [6] was conducted from January to December, 2013 to quantify by – catch species from bonga purse seine fishery operating in inshore water with depth range of 20-30m. A total of 20 replicate landings from five boats were sampled at Ibaka sea fishing village in Akwa Ibom State and Akodo sea fishing village in Lagos State for target species and by catch species compositions.
A fishery dependent survey (Ambrose, *et al*., 2005) [8] was carried out with; (1) oral interview with fishers (2) sampling of catch compositions at landing site.
Upon landing, all organisms were sorted into target bonga and total by-catch (Liggins and Kennelly, 1995) [7]. Those in the by-catch were further sorted according to species and higher

taxa, and identified using morphometric and meristic features. The following data were collected from all landings; (1) Total weight of bonga (2) Total weight (kg) of by-catch and (3) weights, numbers and sizes of commercially important fin and shell fishes.

The total weight of by-catch and bonga from 20 landings were used in the analysis. A two tailed t-test was used to test the hypothesis that the total weight of by-catch species and target bonga fish from each of the same population do not differ.

3. Result

3.1. By-catch Compositions

During the observer programme survey, 20 landings from five boats were censused. All by catch organisms were identified to species level. Sixteen species of fin fishes belonging to twelve families make up the by-catch of bonga purse seine fishery in Nigeria (Table 1). The total length of majority of fishes ranges from 2 to 25cm. The target bonga fish *Ethmalosa fimbriata* has a total length of 10-30cm.

Vessels employed in the fishery are half dugout canoes with length overall 18-19m, powered by 40 HP out board engine. The purse seine net used has a head rope length of 0.8 to 1.1km and 50m deep with body mesh size of 25mm stretched. Eighteen to twenty crew members operate the boat.

The common and scientific name of by-catch species encountered in the survey are; normal croaker (*Pseudotholitus senegalensis);* long neck croaker (*P. typus);* short croaker (*P. elongatus)*: African shad *(Ilisha africana)*; Silver fish (*Trichiurus lepturus*); Grouper (*Epinephelus aeneus)*; Spade fish (*Drepane africana)*; Royal threadfin (*Pentanemus quinquarius)*; shiny nose (*Galeoides decadactylus)*; Cuttlefish (*Sepia elegans)*; Catfish (*Arius latiscutatus)*; Caranx (*Chloroscombrus chrysurus);* Moon fish (*Selene dorsalis)*; Red snapper (*Lutjanus dentatus);* Grunter (*Pomadisis jubelini)*; Shark (*Carcharhinus brachyurus)*; Logger head turtle (*Caretta caretta)*; common dolphin (*Delphinus delphis).*

3.2. By-catch Species Abundance

The percentage weight compositions of important commercial by-catch species are; *Pseudotolithus typus* (24.9%), *P. senegalensis* (21.42%), *Galeoides decadactylus* (19.50%), *Pentanemus quinquarius* (17.5%); *P. elongatus* (2.49%), *Carcharhinus brachyurus* (2:43%) and *Lutjanus dentatus* (2:33%). The croaker family (*Sciaenidae)* is the most abundant by-catch family followed by *Polynemidae, Carcharhinidae, Lutjanidae, Trichiuridae, Pomadasydae, Ariidae, Drepanidae, Clupeidae* and *Serranidae.* The trend is consistent numerically and gravimetrically.

Comparison of weight of by-catch species with weight of target bonga fish using t-test detected a significant ($P<0.05$) difference. In all the 20 landings censused, the weight (kg) of bonga were consistently more than the weight of all by-catch species, with an average ratio of 10.1kg of bonga and by-catch respectively (Table 2).

4. Discussion

The bonga fishery consists exclusively of one species, namely *Ethmalosa fimbriata* and in Nigeria the fishery is more or less localized along the coast, and numerous estuaries of the Niger Delta Region. It is extensively fished in the wider estuary of the Cross River. The species also forms the main fishery all year round in the open sea off this section of the delta coastline, but these open sea fisheries are very much affected by weather conditions.

Bonga sea fishery reported in this work is a semi-industrial fisheries exploited by migrant Ghanaian fishermen using "Watsa boat". The minimum size of maturity and the various length distribution usually, represented in the catches of 'Watsa' boat studied ranges from 10 to 30cm. this compares favourably with the work of Fagade and Olaniyan (1972) [4] that bonga landed by fishermen in Nigeria have a length range of 10-40cm.

Like trawl net, conventional purse seine gears are poor selective fishing gears and so retain large quantities of non-target species, collectively termed by-catch (Saila, 1983) [9]. Purse seine impound and catches many group of marine animals considered to be charismatic e.g. dolphin; endangered species e.g. sea birds, sea turtles, elasmobranches; commercial species e.g. croakers, shinynose and several juvenile of teleots thereby reducing future recruitment of fish into both the stock and fishery. The eighteen different species, (Table 1) incidentally killed by purse seine in the study is of concern in both nutritional and conservation points of view. Dolphins are caught and discarded at sea and some brought ashore for human consumption. This is against global campaign for dolphin safety and conservation. Incidental mortality of dolphins in the tuna purse-seine fishery in the Eastern Pacific Ocean during the 1960s was the first by-catch problem that generated intense public interest (Hall, 1996) [3]

Majority of teleosts caught are juveniles (2-25cm TL, Table 1) and are caught in shallow sea (depth < 20cm) which is their nursery ground. The activities of purse seine net fishers are not regulated because it is an open access fishery, the fishers therefore operate at any depth and catch juvenile of fin fishes.

As the quantity of target bonga caught increases, the weight of by-catch species generated also increases (Table 2). The ratio of by-catch to target bonga fluctuate per landings, this is attributed to the fact that purse seine impound all schooling fish of the same year class, some juvenile and some mature species, thus leading to daily different in the weight of by-cateh species. The averaged bonga to by-catch ratio of 10:1 obtained in the study called for urgent intervention aimed at reducing the by-catch abundant. As Alverson (1998) [10] point out, the emergence of by-catch as a major management issue can be traced to the rapid growth of world fisheries and their increasing competition, the rise of environmental groups and the resulting efforts to protect populations of marine mammals, birds, turtles, teleots and elasmobranches affected by commercial fisheries.

Table 1: List of Commercially Important By-catch Composition from 20 Replicate Landings by 5 Boats.

S/N	Family	Scientific name	Common Name	Wt.(kg)	%wt	No	%no	Total length range (cm)
1	*Sciaenidae*	*Pseudotolithus senegalensis*	Normal croaker	390	21.42	255	8.93	5-50cm
2	*Sciaenidae*	*P. elongatus*	Short croaker	45.5	2.49	160	5.6	2-20
3	*Sciaenidae*	*P. typus*	Long neck croaker	455	24.9	360	12.6	12-25
4	*Clupeidae*	*Ilisha africana*	African shad	12	0.65	105	3.67	8-12
5	*Trichiuridae*	*Trichiurus lepturus*	Silver fish	30.5	1.65	190	6.65	10-30
6	*Sciaenidae*	*Epinephelus aeneous*	Grouper	11	1.67	95	3.32	6-14
7	*Drepanidae*	*Drepane africana*	Spade fish	15.5	0.60	510	17.85	3-14
8	*Polynemidae*	*Pentanemus quinquarius*	Royal threadfin	320	0.85	110	3.85	5-25

9	*Polynemidae*	*Galeoides decadactylus*	Shiny nose	355	17.5	75	2.62	10-30
10	*Sepiidae*	*Sepia elegans*	Cuttle fish	15.5	19.5	60	2.10	2-m(ML)
11	*Ariidae*	*Ariidae latiscutatus*	Catfish	24	0.85	100	350	5-21
12	*Carangidae*	*Chloroscombrus chrysurus*	Caranx	15.5	1.31	360	1.26	2-14
13	*Carangidae*	*Selene dorsalis*	Moon fish	14.5	0.85	155	5.42	2-10
14	*Lutjanidae*	*Lutjanus dentatus*	Red snapper	42.5	0.79	80	2.8	10-20
15	*Pomadasydae*	*Pomadasys jubelini*	Grunter	29.5	2.33	165	5.77	5-20
16	*Carcharhinidae*	*Carcharhinus brachyurus*	Shark	44.3	1.62	75	2.62	15-30
17	*Cheloniidae*	*Caretta caretta*	Logger head turtle	-	-	2	-	-
18	*Delphinidae*	*Delphinus delphis*	Common dolphin	-	-	1	-	-
	Total			1820.3	97.57	2855	100	
	Mean			91.01	143	143		

Table 2: Summaries of mean weight, Total Weight and Difference in Weight of Fish By-catch and Target Bonga from Purse Seine net that was used in T-test paired Comparison (N = 20).

No of Landings	Weight of Bonga (kg) A	Weight of by-catch Species (kg) B	Difference in Weight (kg) C=A.B	Total Weight (kg) D=A+B	Ratio (kg) E = A/B
1	369	138	231	507	3:1
2	658	152	506	810	4:1
3	196.7	121	75.7	317.7	10:1
4	210	10.1	199.9	220.1	20:1
5	336	25.8	330.2	381.8	13:1
6	521.1	92	429.1	613.1	5:1
7	480	21.8	458.2	501.8	22:1
8	570	28.1	541.9	598.1	20:1
9	781.5	167	614.5	948.5	4:1
10	251.6	16.9	234.7	268.5	14:1
11	126	27	99	153	4:1
12	520	151	369	671	3:1
13	781	25.5	755.5	781.3	30:1
14	456	56	400	512	8:1
15	896.6	123	771.6	1021.6	7:1
16	620	24.3	595.7	644.3	25:1
17	681.2	99.1	582.1	780.3	6:1
18	589	320	269	269	2:1
19	443	57.9	385.1	500.9	7:1
20	621.1	161.8	459.3	782.9	3:1
Total	10.136	1,820.3	8.309.5	11,282.9	210:20
Mean	506.84	91.01	415.47	564.14	10:1

Facing the task of reducing the multi-species by-catch in this fisheries, it quickly became apparent that there are two levels that could be used to achieve reductions. Hall (1996) [3] also observed two ways namely reduction of effort and technological changes in gear design and operations, the former option may lead to reduction in the income of the fishery and impoverishment of fishers. This option may not be endorsed by fishers themselves and managers of the fishery. Technological changes in equipment may be used. This has proved very successful in many fisheries, provided that some conditions are met during the experimental stage. Such technological changes in fishery practices may involve the introduction of back down fishing methods used in US to reduce dolphin captured in tuna purse seine fishery (Hall, 1996) [3], and the incorporation of square mesh panel below the cork line of purse seine. (Earys, 2005) [1].

5. References

1. Earys S. A guide to by-catch reduction in tropical shrimp trawl fisheries. Published by Food and Agriculture Organization, Rome, 2005, 110.
2. Alverson DL, Freeberg MH, Murawski SA, Pope JG. A global assessment of fisheries by-catch and discards. FAO Fisheries Technical, 1994, 339-233.
3. Hall MA. On by-catch. Reviews in Fish Biology and Fisheries 1996; 6:319-352.
4. Fagade SO, Olaniyan CIO. The Biology of the West African Shad. *Ethmalosa fimbriata* (Bowdich) in the Lagos Lagoon, Nigeria Journal' of Fish Biology. 1972; 4:519-533.
5. Federal Department of Fisheries (FDF). Fishery Statistics of Nigeria: Published by Federal Department of Fisheries, Area II Garki, Abuja, 2007, 49.
6. Kennelly SJ, Liggins GW, Broadhurst MK. Retained and discarded by-catch from Oceanic prawn trawling in New South Wales; Australia. Fisheries Research. 1998; 36:217-236.
7. Liggins GW, Kennelly SJ. By-catch from prawn trawling in the Clarence river estuary, New South Wales, Australia. Fisheries Research. 1995; 25:347-367.

8. Ambrose EE, Solarin BB, Isebor C, Williams AB. Assessment of fish, By-catch species from coastal artisanal shrimp beam trawl fisheries in Nigeria. Fisheries Research. 2005; 71:125-132.
9. Saila SB. Importance and assessment of discards in commercial fisheries. Food and Agriculture Organization, Fisheries, 1983, 765-62.
10. Alverson DL. Discarding practices and observed fishing mortality in marine fisheries: An update. Washington Sea Grant, 1998, 78-86.