INSTITUT ZA OCEANOGRAFIJU I RIBARSTVO - SPLIT
SFR JUGOSLAVIJA

No. 44 BILJEŠKE - NOTES 1981

The catching efficiency of four different plankton nets relative to ichthyoplankton objects

Komparacija ulova ihtioplanktonskih objekata pomoću četiri različite planktonske mreže

Slobodan Regner

Institute of Oceanography and Fisheries, Split

The aim of this paper is to compare the relative catchability of the Helgoland and Hensen plankton nets used widely for ichthyoplankton studies in the Adriatic for more than thirty years (Karlovac, 1967; Karlovac *et. al.*, 1974; Regner, 1972; Regner, 1974; Vučetić, 1964; Vučetić, 1971; Vučetć, 1971a; Vučetić, 1975), with the Bongo-20 net which is used for ichthyoplankton studies more recently (Piccinetti *et al.*, 1979 and 1980). Similar comparisons were already done in the Western Mediterranean by Dicenta *et. al.*, (1976). Among the other gears they compared Bongo-20 and Hensen nets. But the mesh size of the Hensen was different of that used in the Adriatic, as well as the diameter of the mouth opening.

The investigations were carried out from April to June of 1980, at the three stations (Stončica /43°00'N 16°20'E/, Pelegrin /43°12'N 16°19'E/ and Kaštelanski zaljev /43°31'N 16°22'E/) in the central Adriatic. The material was collected once a month and for every net two hauls were towed at each station. 70 hauls were done in total.

The characteristics of the nets were:

— *Bongo-20:* made of two PVC cylinders of 20 cm diameter, i. e. 0.03249 m^2 of mouth surface. One cylindric-conical net is made of monofilament Polymon material PES/46 of 0.250 mm mesh size. The other net is made of polyfilament nylon of 0.333 mm mesh size.

— *Helgoland:* biconical net with the linen reduction cone with the mouth diameter of 143 cm or 1.6 m^2 of the mouth area. The net is made of polyfilament nylon with 0.516 mm mesh size.

— *Hensen:* biconical net with the linen reduction cone and 73 cm mouth diameter or 0.42 m^2 of mouth area. The net is made of polyfilament nylon with 0.333 mm mesh size.

The double-oblique hauls were done with Bongo-20 nets at a towing speed of 1.5—2 knots. The maximal depth attained was 50 m at Stončica and Pelegrin stations and 25 m at the station Kaštelanski zaljev. The mean volume filtered was 20.6 m^3 for all the stations. Helgoland and Hensen nets were towed vertically at a speed of 1 knot. The sampling depth was 75 m at the stations Stončica and Pelegrin and 35 m at Kaštelanski zaljev station. The volume filtered by Helgoland net was 120 m^3 at Stončica and Pelegrin and 56 m^3 at the Kaštelanski zaljev station. For Hensen these values were 31.5 m^3 and 14.7 m^3 respectively.

For the comparison, anchovy eggs, larvae and postlarvae from the length group of 6—9.99 mm LS, as well as the quantity of the eggs and larvae of other fishes were chosen. The volume of zooplankton expressed in cm^3 was taken into consideration too, as a relative measure of the catchability in general. The numbers under 1 m^2 were calculated for all the parameters.

The comparisons had to be done between the different types of the nets and between the replications of the hauls of each net. For that reason the »two-level nested analysis of variance«, according to Stokal and Rohlf (1969), vas applied. The results obtained are shown in Table 1.

Table 1. The results of the analysis of variance between Bongo-20/333, Helgoland and Hensen nets. (ns = non significant).

Source of variation	Between the nets				Between the replicated hauls				Within the sets of replicated hauls	
	SS	MS	Fs	P	SS	MS	Fs	P	SS	MS
Parameter										
Nr. of anchovy eggs/m^2	10 173.63	3 391.21	3.76	ns	1 516.86	379.22	0.22	ns	107 516.40	1 734.14
Nr. of anchovy larvae/m^2	1 719.11	573.04	14.04	0.01	163.25	40.81	0.18	ns	13 886.70	223.98
Nr. of anchovy post-larvae 6—9.99 mm LS/m^2	49.92	16.64	1.95	ns	14.71	3.68	0.34	ns	672.58	10.85
Nr. of other fish eggs/m^2	3 705.04	1 235.01	1.39	ns	3 566.53	891.63	0.87	ns	63 898.62	1 030.62
Nr. of other fish larvae/m^2	225.17	75.06	3.49	ns	86.43	21.16	0.29	ns	4 682.72	75.53
Zooplankton volume (cm^3/m^2)	12 231.33	4 077.11	1.48	ns	11 067.16	2 766.79	0.74	ns	221 031.64	3 766.30

It is quite clear that there is no statistically significant difference between the nets, with the only exception of anchovy postlarvae, where the difference is found to be significant for 99% probability level (Tab. 1). The variability within the replicated hauls, which is the consequence of month — to — month and station — to — station changes, is found to be much more large than the variability between the gears or between replicated hauls. Furthermore, the MS values between the replicated hauls are found to be relatively small

(Tab. 1). As the diferences between two hauls, towed with the small time gape, should be caused by the non-random distribution of the plankton, it may be supposed that the spatial distribution of the analysed parameters within the restricted area of the single station was relatively uniform.

Although there were no significant differences of catchability between the tested nets, it was of interest to find out which of the gears gives the best results. For this purpose was used the Student-Newman-Keuls test (SNK) of multiple comparisons among means (Sokal and Rohlf, 1969). The results obtained are shown in Table 2.

Table 2. The catchability ranks of the tested nets against the parameters compared (B2 = Bongo-20/250; B3 = 20/333; Hl = Helgoland; He = Hensen; LSR = least singificant range)

Parameter	Locality rank:	1	2	3	4	LSR (Q .05 /4, 66/)	P
Nr. of anchovy	Net	B3	B2	He	Hl		
eggs/m²	$\overline{X}$	45.44	43.97	26.07	16.96	107.40	ns
Nr. of anchovy	Net	He	B2	B3	Hl		
larvae/m²	$\overline{X}$	17.61	7.84	6.35	5.27	39.23	ns
Nr. of anchovy post-	Net	B2	B3	He	Hl		
larvae 6—9.99 mm LS/m²	$\overline{X}$	3.23	1.93	1.06	0.49	8.20	ns
Nr. of other fish	Net	He	B2	B3	Hl		
eggs/m²	$\overline{X}$	38.22	31.06	22.94	19.74	84.49	ns
Nr. of other fish	Net	He	B2	B3	Hl		
larvae/m²	$\overline{X}$	11.65	9.91	9.64	6.72	22.46	ns
Zooplankton volume	Net	B2	B3	He	Hl		
(cm³/m²)	$\overline{X}$	51.03	47.49	40.58	15.96	160.39	ns

The data from Table 2. show that in general, although there were no significant differences, Bongo-20/.250 mm and Hensen nets are the most efficient gears. Excluding the case of anchovy larvae, these two nets are practically akin to each other. On the other hand, the Helgoland net was found to underestimate the quantities of all the parameters to a large extent. The results obtained are similar to those of Dicenta et al. (1976), who also did not find statistically significant differences in most analysed parameters. But, inspite of the statistical insignificance, Bongo-20/.250 mm net seems to be the most convenient for use as, together with the relatively small absolute catches, which make the further elaboration of material easy, it gives almost the best quantitative results.

The total catchability (or efficiency) of the gear should be the complex function of mesh size, towing speed and the radius of the opening. The mesh size affects active and passive escapement (Vannucci, 1968), while towing velocity and radius of opening affect the avoidance by forming the »lethal cone« (Barkley, 1972). Towing speed also affects the filtration pressure which, consequently, affects the passive escapement (Tranter and Smith 1968). The radius of the net opening, as compared to the mesh size and towing speed, in our tests seems to be les significant. This supposition can be derived from the fact that Helgoland net, with large opening and mesh size, but with

slow towing speed, is found to be of the least catchability for all the parameters. In contrary, Bongo-20/.250 mm with very small opening (only 2% of Helgoland's opening surface), but with small meshes and higher towing speed, is found to be of almost the best efficiency for all the parameters, particularly for the anchovy postlarvae which were among the fastest objects tested (Tab. 2).

The mean conversion factors for the conversion of the quantities obtained by Bongo-20/.333 mm, Hensen and Helgoland nets into the values of Bongo-20/.250 mm were calculated. To obtain the approximative values of Bongo-20/.250 mm, the quantities under 1 m^2 obtained by the other nets have to be multiplied as follows:

Parameter	Bongo-20/.333	Hensen	Helgoland
Anchovy eggs	0.97	1.69	2.59
Anchovy larvae	1.23	0.45	1.49
Anchovy postlarvae	1.67	3.05	6.59
Other fish eggs	1.35	0.81	1.57
Other fish larvae	1.03	0.85	1.47
Zooplankton volume	1.07	1.26	3.20

Finally, although the number of samples is relatively small, it may be concluded that:

— There were no statistically significant differences between the tested nets, except for the anchovy larvae.

— Although the results were not significant, Bongo-20/.250 mm and Hensen were found to be more efficient than the other two nets. Bongo-20/.250 mm seems to be the most convenient gear, especially if older anchovy postlarvae have to be studied.

— The mesh size and towing speed seem to be more important for the catching efficiency of all the parameters tested, than the radius of the net opening.

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Received: October 9, 1981

KOMPARACIJA ULOVA IHITIOPLANKTONSKIH OBJEKATA POMOĆU ČETIRI RAZLIČITE PLANKTONSKE MREŽE

Slobodan Regner

Institut za oceanografiju i ribarstvo, Split

KRATAK SADRŽAJ

Uspoređivane su količine jaja, larvi i postlarvi brgluna, količine jaja i larvalnih stadija ostalih riba, te količine ukupnog zooplanktona ulovljene pomoću planktonskih mreža tipa Bongo-20/.250 mm, Bongo-20/.333 mm, Hensen i Helgoland. Nađeno je da razlike u ulovima svih analiziranih parametara nisu bile statistički značajne. Ipak, usporedba je pokazala da su mreže tipa Bongo-20/.250 mm i Hensen dale najbolje rezultate.