Methods for Comparison of Potentialities of Fishing Grounds and Efficiencies of Gears

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The potentialities of fishing grounds were studied using the non-parametric methods; Wilcoxon test, Sign test, Run test and Median test and the two fishing grounds tested were found equipotential. Gear efficiency was also studied by non-parametric methods.

The classical paired t-test is based on the fundamental assumption that the parent population is normal. But a non-parametric test does not depend on the particular form of the parent population (Blum & Tattu, 1954; Siegel, 1956). When a classical parametric method fails to analyse phenomenon, the non-parametric approach, because of its flexibility, suits for such analysis. The use and effectiveness of the non-parametric methods - Wilcoxon test, Sign test, Run test and Median test - are illustrated to study the comparative aspect of the potentialities of fishing grounds and the efficiencies of fishing gears.

Materials and Methods

The necessary data required for the present study was collected from the demonstration cum survey units controlled by the Fisheries Training Institute, Kakinada. The potentialities of fishing grounds and gear efficiency were examined by analysing the catch data of three fishing grounds (I) 17°00′ to 17°10′ latitudes, 82°20′ to 82°30′ longitudes (II) 16°50′ to 17°00′ latitudes, 82°20′ to 82°30′ longitudes and (III) 17°30′ to 17°40′ latitudes, 83°20′ to 83°30′ longitudes. The data at station I and II were obtained from the operation of 12m trawl net (Table 1). At station III, 10 and 15 cm mesh size gill nets were operated and their catch data were collected.

To examine the efficiencies of the gears, catch statistics were collected from the fishing ground III where 10 and 15 cm gillnets were operated. Catch data is presented in Table 2.

Let X_1 X_2, ...X_{n_1} and Y_1, Y_2, ...Y_{n_2} be two independent random samples of sizes n_1 and n_2 drawn from two populations with probability density functions f(x) and g(y) respectively. Suppose it is required to test the null hypothesis.

H_o : f(x) = g(y)

i.e. to test whether the two samples have come from the same population. This hypothesis can be tested by using any one of the non-parametric tests like the Sign test, Wilcoxon test, Median test and Run test. Application of these tests has been demonstrated in this paper.

Results and Discussion

These tests were applied first to test whether the fishing grounds I and II are equipotential. The catch data and the paired differences are shown in Table 1. To apply Wilcoxon test, the difference 'd_i' the ranks of d_i and T-values are to be calculated. T-value is the smaller of the two sums of ranks, that is the smaller of the sum of positive ranks and sum of negative ranks. The calculated value of T (28), is greater than the table value of T (21). Therefore the

Table 1. *The catch data for stations I and II and the results of statistical analysis for paired difference*

No.	Catch per hour in kg		Differences	Rank of (d_i)	
	Station I	Station II	d_i	(+)	(-)
1.	36	31	5	2	-
2.	71	50	21	9	-
3.	29	87	-58	-	14
4.	48	67	-19	-	8
5.	119	76	43	12	-
6.	62	110	-48	-	13
7.	98	136	-38	-	11
8.	60	77	-17	-	7
9.	50	43	7	4	-
10.	31	29	2	1	-
11.	54	65	-11	-	6
12.	20	30	-10	-	5
13.	28	58	-30	-	10
14.	43	49	-6	-	3

hypothesis H_0 is not rejected at 5% level of significance showing that the two fishing grounds I and II of Kakinada are equipotential, when 12m trawl net is operated.

The Sign test

From Table 1, the number of positive signs = 5 and the number of negative signs = 9. The number of fewer signs, x = 5. The number of differences, d_i's which are non-zero is n = 14. For n = 14, x = 5, the tabulated value of p is 0.212. 2p is 0.424 < 0.05. Therefore the null hypothesis is not rejected at 5% level of significance leading to the conclusion that the fishing grounds are equipotential.

Run test

The average catches per hour in kg of the fishing grounds I and II of Kakinada are arranged in ascending order of magnitude as follows:

1			2			3
I	I	I	II	II	II	I
20	28	29	29	30	31	31

		4	5	6		7
I	I	II	I	II	II	I
36	43	43	48	49	50	50
	8	9		10		11
I	II	I	I	II	II	I
54	58	60	62	65	67	71
12			13	14	15	16
II	II	II	I	II	I	II
76	77	87	98	110	110	136

The number of runs r = 16

For $n_1 = n_2 = 14$, the table value of r is 9.

Since the observed value of r > the table value, the null hypothesis H_0 is not rejected at 5% level of significance and it is concluded that the fishing grounds are equipotential.

The Median test

The median of the above combined and ordered sample = 52

The number of catches of fishing ground I > 52 is 6

The number of catches of fishing ground II > 52 is 8.

λ^2 turns out to be 0.2857. The critical value of λ^2 for 1 degree of freedom at 5% level of significance is 3.841. Therefore the hypothesis is not rejected at 5% level of significance. Thus the above non-parametric methods lead to the same conclusion that the fishing grounds I and II of Kakinada are equipotential, when 12 m trawl net is operated.

Next, these methods were applied for comparison of gear efficiency. For the data presented in Table 2, it is proposed to test the null hypothesis, H_0 : The two populations are the same, that is, the two gears are equiefficient.

Table 2. *Catch statistics of fishing ground III*

No.	Catch per hour per unit in g	
	10 cm gill net	15 cm gill net
1.	906	187
2.	440	208
3.	240	180
4.	351	887
5.	385	870
6.	1399	259
7.	1248	880
8.	1705	828
9.	1354	975
10.	662	225

From Table 2, for Wilcoxon test, T works out to 13.

For n = 10, the Table value of T at 5% level of significance is 8. Hence the null hypothesis cannot be rejected at 5% level of significance and it can be concluded that the two gears are equiefficient.

For the Sign test, x = 2, n = 10. For n = 10, x = 2, the Table value is 0.055. Therefore the null hypothesis cannot be rejected at 5% level of significance.

For the Run test, r = 8. For $n_1 = n_2 =$ 10, the table value of r at 5% level of significance is 6. Therefore the hypothesis H_0, is not rejected at 5% level of significance.

Thus the above non-parametric tests show that 10 and 15 cm gill nets are equiefficient, when they are operated in the fishing ground III of Visakhapatnam.

The potentialities of the fishing grounds were studied by using the non-parametric methods, Wilcoxon test, Sign test, Run test and Median test. These tests showed that the fishing grounds 1 and 2 of Kakinada were equipotential when 12 m trawl net was operated.

Gear efficiency was also studied by applying these non-parametric tests. All the tests showed that 10 and 15 cm gill nets are equiefficient when they are operated in the fishing ground III of Visakhapatnam.

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