Analysis of The Influencing of Producttion Factors on Superior Fish Catches Using the Analytical Hierarchy Process Method (Case Study of PPN Karangantu, Banten)

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Abstract

The Indonesian marine and fisheries sector is still under development, especially in the capture fisheries sector. Capture fisheries are one of the alternative livelihoods of fishermen. However, the development of marine and fisheries is still not accompanied by an understanding of sustainability, as a result of which the existing potential is utilized excessively and continuously without regard to sustainability. Fishermen who depend on marine products depend heavily on uncertainty due to various factors. One of the factors that can affect the catch is the economy and climate. Both aspects need to be a serious focus for local governments in making decisions that ease the burden on fishermen. One of the directions that researchers are aiming for is to identify production factors that affect fish catches by knowing in advance the types of superior fish in PPN Karangantu using Location Quotien (LQ). The research methods used in research are quantitative and qualitative approaches, with research flows, namely: problem identification, literature study, data collection (interviews, observations and literature studies), data processing (Location Quotien (LQ), Decision Support System (DSS) with the Analysis Hierarchy Processes (AHP) method), AHP consistency test and report generation. The method used is to identify factors that affect the catch of superior fish processed with a Decision Support System (DSS) or Decision Support System (SPK) in which there is an Analysis Hierarchy Process (AHP) method. It is known that the leading types of fish in PPN Karangantu can be based on the calculation of the highest LQ value by ranking are Peperek, Gulamah, Squid, Tembang, Teri, Red Snapper and Mullet. Production factors that affect the superior fish catch in PPN Karangantu there are seven criteria including capital, ships, labor, season, selling price, market demand and quantity, then of the seven production factors the most influential is the krteria of capital at sea.

Keywords: AHP, fish catch, karangantu, capture fisheries.

A. INTRODUCTION

Indonesia is a maritime country whose territory is partly a water area with abundant potential marine resources (Rahardjo, 2021). Basically, the sea has many functions, roles and benefits for human life and other living things because in and above the sea there are many wealth of natural resources that can be used including as recreation and entertainment, as a power plant for waves, tides, wind, also as a place for fish budidaaya, pearl shells, seaweed, and so on (Hanim &; Noorman, 2017). One of them is the capture fisheries sector which some people use as the main source of livelihood. The main job as a fisherman is faced with uncertainty factors that increase over time both natural and economic factors. Natural factors include seasons that are difficult to predict while economic factors are the higher cost of fishing, catches that tend to decline and fluctuations in fish prices (Ompusunggu *et al* 2022).

Continuous fishing is feared to disrupt the life cycle and become the reason for the population to decline if it is not accompanied by growth and reproduction even to release

eggs, there is no longer a conducive place (Mulyani *et al* , 2021). Capture fisheries in Indonesia itself have an important and strategic role, namely as a source of economic growth, a source of food as well as a provider of employment (Kusdiantoro *et al* 2019). Indonesia's capture fisheries sector if utilized optimally can become one of the important assets of the State and provide many benefits to its people. The availability of fish resources and their environment is very important to support capture fisheries activities.

The condition of fish resources is a carrying capacity that must be managed wisely in order to maintain its sustainability based on the right management strategy. External and internal factors of fisheries management have an influence on existing fishing activities. Effective and appropriate management strategies have a positive influence on the economy and social conditions of fishing communities, especially where ensuring the sustainability of capture fisheries can be implemented with integrated management.

The Nusantara Fishing Port (PPN) Karangantu accommodates the activities of fishing communities, especially in the aspects of production, management, and marketing, as well as the development of fishing communities (Suherman *et al* , 2020). Services to fishing vessels as a means of production include providing a home base for fishing fleets, ensuring the smooth unloading of fish from fishing, providing logistical supplies for fishing vessels such as fresh water, fuel oil, ice for supplies and others. Meanwhile, aspects of service to fishermen as elements of production personnel include management aspects, marketing aspects, and community development aspects (Suherman *et al* 2020).

Determination of superior fish commodities in a region is needed as the first step in capture fisheries management based on the concept of efficiency to achieve comparative and competitive advantages in the face of trade globalization (Pregiwati *et al* 2017). This study was conducted to identify production factors that affect fish catches in PPN karangantu. Using a Decission Support System (DSS) in which there is an Analytical Hierarchy Process (AHP) is a decision support model that helps see the factors that affect superior fish catches. The urgency in the research is related to information about superior catches needed as information for investors (entrepreneurs) to invest, as well as optimizing the potential of superior fishing in PPN Karangantu.

B. METHODS

The research flow includes literature study, data collection, data processing to report generation. This research combines quantitative and qualitative approaches. Quantitative research is a research approach that represents positivism, while qualitative research is a research approach that represents naturalistic (phenomenological) understanding (Jasmine *et al* 2021).

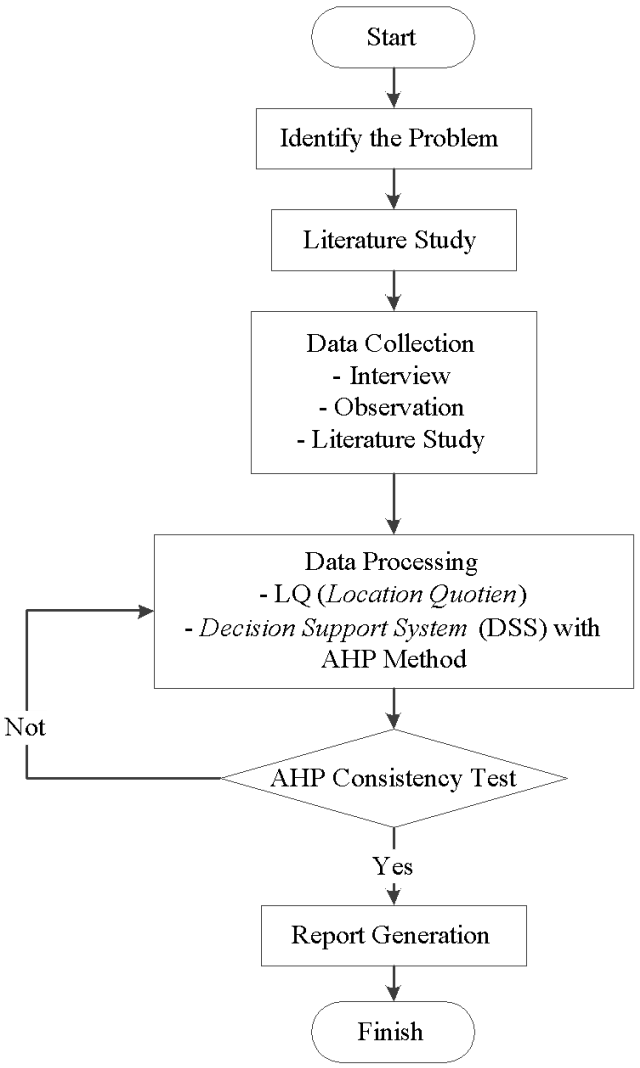

Figure 1. Research Flow

Based on the table above, the stages in the study are conducting qualitative research with observational and interview data collection techniques. Observation and interviews are one of the main data collection techniques in a qualitative approach that serves as material in conducting in-depth data analysis. The results of the analysis are expected to appear presumptions of the phenomena that have occurred so far and then a consistency test is carried out for the method. The creation of hypotheses is carried out to show the alleged relationship between one fact and another based on empirical data from the field that has been collected, analyzed and synthesized. The second stage in this way of research is to test what has been made with the aim of whether there is an influence / relationship of variables that affect the affected variables (Mulyadi 2011). The data collection used in this study consists of primary data and secondary data that become a reference and calculation processing.

1. The primary data obtained from this study is related to the results of fishing in PPN Karangantu by conducting observations and interviews. The number of interviewees required to conduct interviews is two people using the AHP method of sampling. The interview is conducted using a semi-structured type, namely by preparing in advance a list of questions that will be asked to the resource person, but for the submission of

these questions are flexible depending on the direction of the conversation. The determination of interview sources is related to goals and situations such as information level, time availability, willingness and ability (Susilarini, T 2021).

2. Secondary data obtained in this study are sourced from literature reviews of journals and previous research related to factors and analysis of fish catches.

The analysis conducted to determine the featured fish in PPN Karangantu uses LQ (Location Quotient) with time series fish catch data for the last 5 years from 2017-2021. LQ formula used:

$$LQ = \frac{\frac{Qa}{Qb}}{\frac{TQa}{TQb}}$$

Information:

Qa : Production volume of the j-th type of fish in PPN Karangantu
Qb : Production volume of j-type fish in Banten Province
TQa : Total production volume of all types tested in PPN Karangantu
TQb : Total production volume of all types tested in Banten Province
j : 1, 2, ..., n (many types of fish tested)

a. If the LQ value > 1, indicates a positive growth value
b. If the LQ value < 1, indicates a negative growth value

According to (Puluhulawa *et al* 2016) in their research to produce a product, knowledge is needed between production factors and products where the production factors consist of capital, boats, labor, season, selling price, market demand and quantity / production of catches where at the same time in research it is used as an influential alternative in determining fish catches. To determine the main criteria in determining fish catches, observations and interviews are used. The number of respondents in the AHP method does not have a specific formulation, but there is only a minimum limit of two respondents (Saaty 1993).

Some steps that need to be considered in the use of the AHP method according to Suryadi, R *et al* 1998 include:

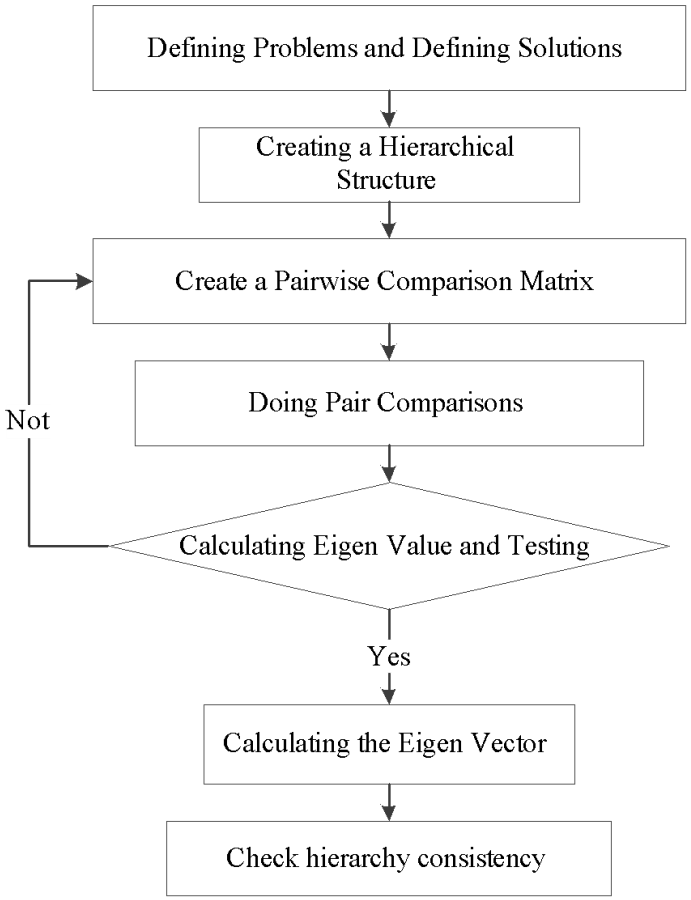

Figure 2. AHP Method Steps Flow

Based on the figure above, the steps in the AHP method have the following order:

1. Define the problem and determine the desired solution
2. Create a hierarchical structure beginning with a general purpose followed by subobjectives, criteria and possible alternatives at the lowest level of criteria.
3. Create a pairwise comparison matrix that describes the relative contribution or influence of each element to each goal or criterion of the level above. Comparisons are made based on the judgment of decision makers by assessing the importance of one element compared to other elements.
4. Compare in pairs so that the total judgment value is obtained as much as n x [(n-1)/2] fruit with n is the number of elements compared.
5. Calculate eigenvalues and test, if inconsistent, repeated data retrieval
6. Repeat steps 3,4 and 5 for all levels of the hierarchy.
7. Calculates the eigenvector of each pairwise comparison matrix. The eigenvector value represents the weight of each element. This step is to synthesize judgment in prioritizing elements at the lowest level of the hierarchy until the achievement of the goal.
8. Check hierarchy consistency. If the value is over 10% or 0.1 the rating should be corrected.

C. RESULT AND DISCUSSION

LQ analysis is used to see the leading types of fish in PPN Karangantu based on statistical data on PPN Karangantu fish catches and also statistical data on DKP fish catches in Banten Province. Ranking is done to make it easier to see the highest average LQ value (Table 1). The five species of fish with the highest LQ value based on the average LQ ranking of PPN Karangantu's catch are pepperfish, sugar, squid, tembang and anchovies. The LQ value < 1 indicates a negative growth value or can be said to be non-base which means it is not a superior type of fish, namely layur and swanggi fish. 23 species of fish in PPN Karangantu have a positive growth value, where these types of fish can be a potential that is very possible for PPN Karangantu to continue to be developed.

Table 1. LQ Value of PPN Karangantu Fish Catch 2017-2021

No	Jenis Ikan	Tahun					Rata-rata Pertumbuhan LQ	Rangking
		2017	2018	2019	2020	2021		
1	Layur	0,10	0,07	0,47	0,55	0,19	0,28	26
2	Layang	0,38	1,42	3,08	11,34	1,79	3,60	20
3	Teri	30,67	27,88	52,87	25,52	25,23	32,43	5
4	Tenggiri	1,71	1,72	48,36	2,71	10,88	13,07	12
5	Tongkol	0,32	0,99	3,18	1,88	3,37	1,95	23
6	Tembang	50,50	32,55	48,47	21,78	26,05	35,87	4
7	Belanak	0,18	0,15	43,91	22,52	18,54	17,06	7
8	Kembung	0,06	0,09	28,25	8,68	21,90	11,80	14
9	Peperek	139,59	83,95	57,47	27,89	25,10	66,80	1
10	Selar	6,60	9,59	27,94	12,98	10,33	13,49	10
11	Kerapu	0,19	0,37	7,53	4,49	2,13	2,94	21
12	Kakap Merah	42,65	52,51	12,19	6,14	1,38	22,97	6
13	kwe	1,24	1,29	21,47	4,39	2,59	6,20	17
14	Manyung	0,70	1,05	25,55	7,51	6,50	8,26	15
15	Cumi-cumi	52,31	30,30	51,08	27,96	18,41	36,01	3
16	Bawal Hitam	8,38	4,02	2,76	2,81	0,06	3,61	19
17	Ekor Kuning	1,41	2,95	2,57	1,69	2,20	2,17	22
18	Rajungan	0,25	0,53	0,06	36,81	27,91	13,11	11
19	Kurisi	1,99	0,66	9,84	4,17	2,57	3,85	18
20	Pari	10,40	21,15	22,37	11,95	4,39	14,05	8
21	Bawal Putih	0,00	0,01	63,91	3,77	0,64	13,67	9
22	Gulamah	58,44	138,38	48,82	35,49	30,15	62,26	2
23	Kakap Putih	0,22	0,28	15,86	4,65	15,14	7,23	16
24	Swanggi	0,00	0,00	1,90	0,08	0,00	0,40	25
25	Kuro	0,04	0,03	44,77	13,68	4,97	12,70	13
26	Lain-lain	3,75	3,95	1,55	0,24	0,12	1,92	24

The LQ value from 2017-2021 shows that 25 species of fish from 52 species landed in PPN Karangantu have base results because the LQ value > 1 which shows a positive growth value and it can be said that the types of fish landed relatively concentrated in PPN Karangantu. When compared with previous research conducted by Hamzah *et al* 2016 to see the strength of the fish species contained in PPN Karangantu, 7 of the 42 species of fish caught that have a positive growth value can be seen, changes can be seen such as the

increase in the number of fish species landed in PPN Karangantu, as well as the number of fish species that have positive growth value. This degree of concentration determines that this type is a superior commodity because fishery commodities are classified as superior if the products produced are in great demand by consumers, affordable prices, production exists throughout the year, the continuity of production and the production value of these commodities is higher than all important fish fishery commodities landed in a fishing port area (Raharjo *et al* 1999 in Irham *et al* 2021).

AHP analysis is used to determine what factors are suspected to be the influence of determining the superior fish catch in PPN Karangantu. After knowing what types of fish are superior, proceed with data processing using AHP.

1. Defining the problem

   Define the problem and define the desired solution. Define goals, criteria and alternatives.

   a. Define the problem and define the desired solution. Define goals, criteria and alternatives. Objective: Identify factors affecting fish catches
   b. Criteria: Capital, Ships, Labor, Season, Selling Price, Demand, Quantity
   c. Alternatives : pepper, sugar, squid, tembang, teri, red snapper, mullet

2. Hierarchical structure

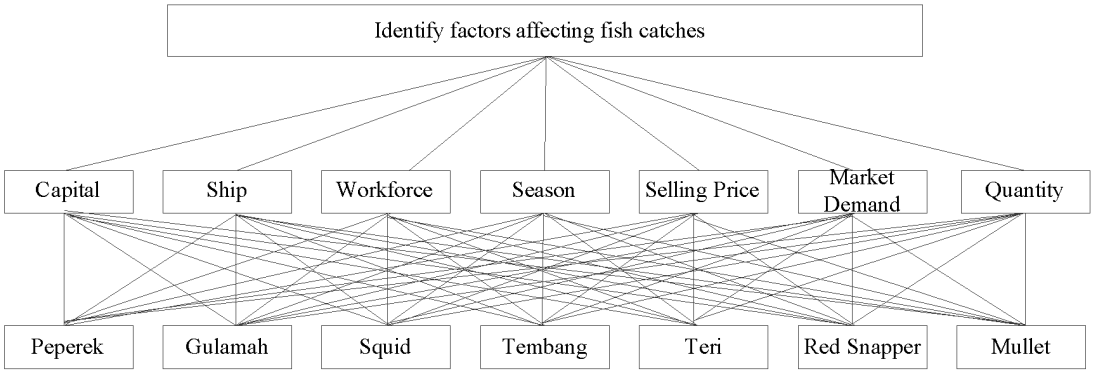

Figure 3. Hierarchical Structure Paired Matrix

In this case it has 7 criteria, namely C = {Capital, Ship, Labor, Season, Selling Price, Market Demand, Quantity} and 7 alternative pieces, namely A = {Peperek, Gulamah, Squid, Tembang, Anchovies, Red Snapper, Mullet}. From each of these calculations we will calculate the normalized eigenvector and check the consistency of the hierarchy. Before obtaining a comparison matrix of paired criteria, it is necessary to assume experts in determining the weight of each criterion as follows:

a. Capital is slightly more important than Ships, Scale 3
b. Capital is slightly more important than Labor, Scale 3
c. Capital is slightly more important than Season, Scale 3
d. Capital is more important than Selling Price, Scale 5
e. Capital is more important than Selling Price, Scale 5
f. Capital is absolutely important than quantity, Scale 9
g. Ships are slightly more important than Manpower, Scale 3

h. Ships are slightly more important than Seasons, Scale 3
i. Ship is more important than Selling Price, Scale 5
j. Ship Is Definitely More Important Than Demand, Scale 7
k. Ship is absolutely important than quantity, Scale 9
l. Labor is slightly more important than Season, Scale 3
m. Labor is slightly more important than Selling Price, Scale 3
n. Labor is slightly more important than Demand, Scale 3
o. Labor is absolutely more important than quantity, Scale 9
p. Season is as important as Sale Price, Scale 1
q. Season is slightly more important than Demand, Scale 3
r. Season is absolutely more important than quantity, Scale 9
s. Selling Price is as important as Demand, Scale 1
t. Selling Price is absolutely more important than quantity, Scale 9
u. Demand is absolutely more important than quantity 9

Referring to the statements of the experts above, the pairwise comparison matrix for each of the criteria is as follows:

Table 2. Pairwise Comparisons

kriteria	C1	C2	C3	C4	C5	C6	C7
C1	1	3	3	3	5	5	9
C2	0,33	1	3	3	5	7	9
C3	0,33	0,33	1	3	3	3	9
C4	0,33	0,33	0,33	1	1	3	9
C5	0,2	0,20	0,33	1,00	1	1	9
C6	0,2	0,14	0,33	0,33	1,00	1	9
C7	0,11	0,11	0,11	0,11	0,11	0,11	1
	2,51	5,12	8,11	11,44	16,11	20,11	63,41

Based on the table above, an equation is obtained to find a comparison of criteria with criteria with the following description:

a. Ship versus Capital
   $a_{21} = 1/ a_{12} = 1/3 = 0,33$
b. Labor versus Capital
   $a_{31} = 1/ a_{13} = 1/3 = 0,33$
c. Labor versus Ship
   $a_{32} = 1/ a_{23} = 1/3 = 0,33$
d. Season versus Capital
   $a_{41} = 1/ a_{14} = 1/5 = 0,2$
e. Seasons versus Ships
   $a_{42} = 1/ a_{24} = 1/5 = 0,2$
f. Season versus Labor
   $a_{43} = 1/ a_{34} = 1/9 = 0,11$
g. Selling Price versus Capital
   $a_{51} = 1/ a_{15} = 1/3 = 0,33$
h. Selling Price versus Ship

$a_{52} = 1/ a_{25} = 1/3 = 0,33$

i. Selling Price versus Labor
$a_{53} = 1/ a_{35} = 1/5 = 0,20$

j. Selling Price versus Season
$a_{54} = 1/ a_{45} = 1/7 = 0,14$

k. Demand versus Capital
$a_{61} = 1/ a_{16} = 1/9 = 0,11$

l. Demand versus Ship
$a_{62} = 1/ a_{26} = 1/3 = 0,33$

m. Demand versus Labor
$a_{63} = 1/ a_{36} = 1/3 = 0,33$

n. Demand versus Season
$a_{64} = 1/ a_{46} = 1/3 = 0,33$

o. Demand versus Selling Price
$a_{65} = 1/ a_{56} = 1/9 = 0,11$

p. Quantity versus Capital
$a_{71} = 1/ a_{17} = 1/1 = 1$

q. Quantity versus Ship
$a_{72} = 1/ a_{27} = 1/3 = 0,33$

r. Quantity versus Labor
$a_{73} = 1/ a_{37} = 1/9 = 0,11$

s. Quantity versus Season
$a_{74} = 1/ a_{47} = 1/1 = 1$

t. Quantity versus Selling Price
$a_{75} = 1/ a_{57} = 1/9 = 0,11$

u. Quantity versus Demand
$a_{76} = 1/ a_{67} = 1/9 = 0,11.$

After obtaining the value of the pairwise comparison matrix, it can be continued by finding the normalized eigenvector, with the following results:

Table 3. Eigen Vektor Normalisasi

kriteria	C1	C2	C3	C4	C5	C6	C7	TOTAL	**EVN**
C1	7	10,71	20,31	31,67	43	55	189	356,714	0,32844
C2	6,07	7	13	24,33	31,67	55	183	304,733	0,28058
C3	3,98	4,70	7	13	16,33	23	105	173,006	0,15929
C4	2,69	3,41	5	7	10,33	12	63	103,429	0,09523
C5	2,11	2,59	3,53	5,53	7	9,4	42,61	72,7651	0,06701
C6	0,38	2,31	3,14	4,70	6,05	7	36,09	61,146	0,05631
C7	0,38	0,67	0,67	1,37	1,89	2,33	7	14,305	0,01317

SOMME	1086,1

After obtaining the results of the normalization vector eigen, we must calculate the consistency ratio of the comparison assessment criteria as follows:

a. Determine maximal eigen values (λ_{maks})

Maximal eigen value (λ_{maks}) obtained by multiplying the sum of each row on the pairwise comparison matrix with the normalized eigenvector.

λ_{maks} = (2,51*0,32) + (5,12*0,28) + (8,11*0,15) + (11,44*0,09) + (16,11*0,06) + (20,11*0,05) + (63,41*0,01) = 7,690

b. Suppressing the Consistency Index (CI)

CI = λ_{maks} – n/n-1 = 7,690 – 7/7 – 1 = 0,690 / 6 = 0,115

c. Calculating the Consistency Ratio (CR)

Based on the consistency index table. Retrieved IR for matrices 7x7 be 1,32 So obtained :

CR = CI/IR = 0,115/1,32 = 0,087

Since the CR < 0.1, the weighting preference is consistent. The results of the calculation above can be illustrated in a sub-hierarchy that compares the criteria with the criteria, as follows:

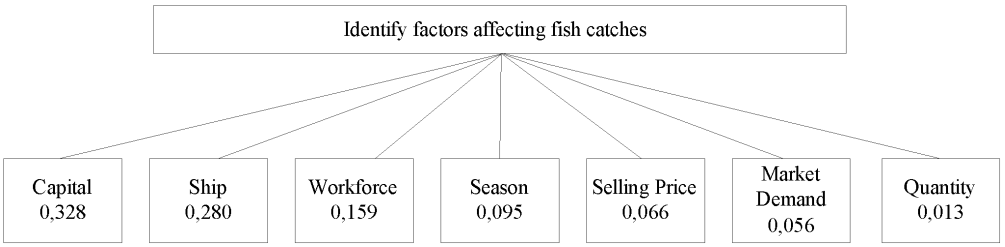

Figure 4. Hierarchy with Weight Score

Qualitative assessment given by decision making after processing produces a value that states that:

Criteria, namely: Capital : 0.328; Ship: 0.280; Labor Force: 0.159; Season : 0.095; Selling Price : 0.066; Market demand 0.056; Quantity: 0.013 (value taken from EVN normalized eigenvector value). The conclusion of the AHP calculation process above for the factor that affects the highest fish catch is Capital with a value of 0.328. Without capital, the factors of production as fishermen cannot be fulfilled, because they cannot pay labor, finance or buy the tools needed (Puluhulawa *et al* 2016). The value of the criterion is obtained for logical decision making because all factors and their effects must be considered simultaneously (Saaty 1998).

D. CONCLUSION

Based on research that has been conducted in finding factors that affect the superior fish catch in PPN Karangantu, it was found:

23 of the 52 species of fish landed at PPN Karangantu have a positive LQ value which means that these types of fish are superior commodities. The leading types of fish that have the highest LQ values are Peperek, Gulamah, Squid, Tembang, Anchovies, Red Snapper, Mullet, Ray, White Pomfret, Selar, Rajungan, Mackerel, Kuro, Bloated,

Manyung, White Snapper, Kwe, Kurisi and so on based on Table 1. which has previously been analyzed using LQ (Location Quotient) because the degree of concentration determines that the type is a superior commodity.

The use of the Analytical Hierarchy Process method is carried out to obtain the highest weight of the criteria that are considered to have an influence on superior fish catches with the results of the AHP calculation obtained, namely the Capital criterion has the largest score and it can be concluded that the factor that affects the superior fish catch in PPN Karangatu is the capital factor.

REFERENCES

Hamzah, A., Pane, A. B., Lubis, E., Solihin. (2015). Potensi Ikan Unggulan Sebagai Bahan Baku Industri Pengolahan di PPN Karangantu. Marine Fisheries. 6(1):45-58

Hanim, L., Noorman, M. S. (2017). Kebijakan Kelautan Dalam Rangka Menjaga dan Mengelola Sumber Daya Alam Laut Sebagai Upaya Mewujudkan Indonesia Sebagai Poros Maritim Dunia. *LEGALITY Jurnal Ilmiah Hukum*. 25(1), 1-12

Irham., Iksan, K. H. (2021). Pengembangan Perikanan Tangkap Berbasis Komoditas Unggulan di Kabupaten Kepulauan Sula. Jurnal Ilmu Kelautan Kepulauan. 4(2), 435-445

Jasmine, R., Febriani, R., Hartanto, D. D. (2021). Pengaruh Segmentasi Demografis dalam Strategi Membangun Brand Silvertote. Jurnal DKV Adiwarna. 1(18)

Kusdiantoro., Fahrudin, A., Wisudo, S. H., Juanda, B. (2019). Perikanan Tangkap di Indonesia: Potret dan Tantangan Keberlanjutannya. *Jurnal Sosial Ekonomi KP*. 14(2), 145-162

Mulyadi, M. (2011). Penelitian Kuantitatif dan Kualitatif Serta Pemikiran Dasar Menggabungkannya. *Jurnal Studi Komunikasi dan Media*. 15(1), 127-137

Mulyani, S., Hadijah., Hitijahubessy. (2021). Potensi Pengembangan Budidaya Ikan Kerapu Perairan Teluk Ambai Provinsi Papua. Pusaka Almaida. Sulawesi Selatan

Ompusunggu, Y. A., Zamdial. (2021). Deskripsi Teknis, Ekonomi dan Sosial (Teksos) Usaha Perikanan Tangkap di Kelurahan Malabero. SEMNAS IKL UNIB. 194-202

Pregiwati, L. A., Wiryawan, B., Wisudo, S. H., Satria, A. (2017). Seleksi Komoditas dan Teknologi Penangkapan Ikan Unggulan di Kabupaten Kepulauan Anambas. *Marine Fisheries*. 8(1), 113-122

Puluhulawa, J. N., Rauf, A., Halid, A. (2016). Analisis Faktor-Faktor yang Mempengaruhi Hasil Tangkapan di Kecamatan Bilato Kabupaten Gorontalo. *Jurnal Ilmiah Agribisnis*. 1(1), 43-50

Rahardjo, C., Arifin, W. A., Lestari, D. A., Malik, A., & Buchori, S. S. B. S. (2021). Analisis Kandungan Klorofil-A Sebagai Fishing Ground Potensial (Ikan Pelagis Kecil) Di Sekitar Perairan Desa Sungsang Kabupaten Banyuasin Provinsi Sumatera Selatan. Pena Akuatika: Jurnal Ilmiah Perikanan dan Kelautan, 20(2).

Saaty, T. L., (1988). What Is the Analytic Hierarchy Process?. NATO AS! Series. Vol. F48

Suherman, A., Boesono, H., Muzakir, A. K. (2020). Kinerja Pelabuhan Perikanan Nusantara Karangantu – Banten, Indonesia. *Jurnal Ilmu-Ilmu Perairan, Pesisir dan Perikanan*. 9(2), 344-355

Suryadi, R., Ramdhani M. A. (1998). Sistem Pendukung keputusan. Bandung. PT. Remaja Rosdakarya

Susilarini, T. (2021). Interview – Wawancara. Universitas Persada Indonesia Y.A.I. 2021