

Analysis Of Food Composition of Yellowstripe Trevally (*Selaroidesleptolepis*) In Paciran Waters, Lamongan, East Java

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ABSTRACT

Paciran is one of the regions in East Java with great fisheries potential. Yellow Stripe Trevally is well known for its abundance in waters and categorized as high economic value within fisheries commodity. The abundance of yellow stripe trevally highly depends on food availability within its living habitat. The aim of this study was to analyse yellow stripe trevally food composition and its relationship with plankton abundance. The result of this study shows that phytoplankton abundance ($21,600 \times 10^3$ cell/m³) was found higher than zooplankton abundance (9.093×10^3 ind/m³). The highest abundance of phytoplankton was found in *Bacillariophyceae* ($21,552 \times 10^3$ cell/m³) and the lowest was found in *Coscinodiscophyceae* (48.197×10^3 cell/m³). Between two classes of zooplankton found in this study, the abundance of *Maxillopoda* class (8.184×10^3 ind/m³) was found higher than *Oligotriceae* class (0.909×10^3 ind/m³). The composition of plankton in the stomach of yellow stripe trevally have similar pattern with the compositions of plankton in the waters. Based on the calculation of electivity index, there were seven genus that have a value $0 < E_i < 1$ and it was considered as food options of yellow stripe trevally. The selected food compositions were divided into six genus of phytoplankton, those were *Asterolampra* sp, *Coscinodiscus* sp, *Cyclotella* sp, *Dinophysis* sp, *Oscillatoria*. sp, *Pleurosigma* sp, *Prorocentrum* sp, and a zooplankton genus, *Calanus* sp. The result of main component analysis shows that

water clarity parameter had significant impact on the water quality, while pH was correlated with phytoplankton abundance within in the Paciran waters.

Keyword: Paciran, plankton abundance, food composition, yellow stripe trevally.

INTRODUCTION

Indonesia is a country with a very large ocean's area, approximately 2/3 part of this country consists of an ocean. As a national commodity, Indonesia's sea has a very good potential due to its natural resources' high diversity and high economical value such as fisheries, coral reefs, seagrass and seaweed. Lately, Fisheries resources in Indonesia encounter a serious problem that needs to be taken care seriously. Especially those fisheries resources are considerably as a high economic value commodity within Indonesia's sea that can be used to enhance the national income. Paciran waters in Lamongan, East Java has a strategic location in Indonesia's ocean area. Paciran waters have a very big impact on the coastal community's livelihood income in Lamongan due to its strategic location and fisheries potential's abundance. Fisheries' sub sector can be used as a main sector to trigger the economic growth of Lamongan. Lamongan waters are categorized as an open ocean area, which is very suitable for the natural habitat of pelagic and demersal fish. Yellow stripe trevally is one of the examples of high commodity pelagic fish that can be found abundantly in Lamongan sea.

Yellow stripe trevally is a schooling small pelagic fish with a low relative activity, small migration coverage and relatively low endurance to fishing practice. Living as a pelagic fish has made yellow stripe trevally get used to eat plankton as its main food. According to Venkataraman (1960), 0,2 mm-200 mm sized zooplankton (meroplankton and holoplankton) such as flagellates, cnidarians, rotifers, chaetognates, veliger larvae, copepods, cladocerans, euphausiids, shrimps and zoobenthos such as molluscs, crustaceans and echinoderms are the most consumed food by yellow stripe trevally. However, phytoplankton, algae filament, fish juveniles, small fish and crustacean juveniles are also oftenly found as a yellow stripe trevally's food. For that reason, yellow stripe trevally is also well known as a carnivore pelagic fish.

The aim of this research was to find out the specific food composition of yellow stripe trevally, remembering that food is an ecobiology factor that highly affects the

livelihood and growth of yellow stripe trevally. Furtherly, within ecosystem's concept, food is the main factor that determines the living continuance and availability of the fish's population.

METHODS

Place and Time of Research.

The data was obtained in Paciran sea area, Lamongan, East Java. Sample observation was done at the Laboratory of Fisheries Product's Safety and Hidrobiology Laboratory of Fisheries and Marine Science Faculty, University of Brawijaya from January 18th to March 11th 2016

Yellow stripe trevally's sample extraction was done between 07.00 - 11.00 a.m within 5 points of fishing ground that was determined by local fisherman (Figure 1). Sample extraction was done horizontally and vertically up to 5 meters deep at all sampling stations. Physical and chemical ocean parameters were also measured at the same time during sample extraction.

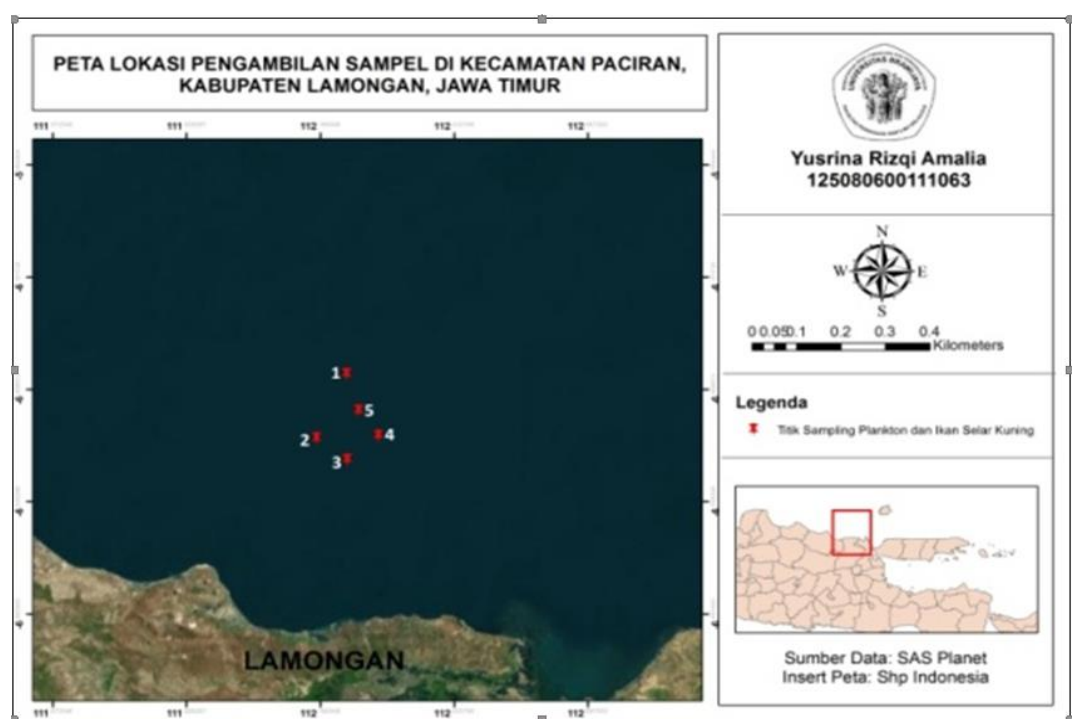


Figure 1. Location Points of Sampling.

Materials and Tools.

The tools used in this research consist of plankton net, digital thermometer, secchi disc, current meter, salinometer, DO meter, pH meter, GPS, cool box, microscope, sedgewick rafter counting cell, haemocytometer, pipette, surgical tools, petri dish, camera and hand counter. While the materials used in this research consist of yellow stripe trevally sample, sea water sample, ice cube, aquades, 1% concentration lugol, sterilized sea water, plastics, labelling paper and tissue paper.

Measurement of Sea Parameter.

The measurement of sea parameter was divided into two parts, physical parameters (temperature, water clarity, current) and chemical parameters (salinity, DO, pH) measurement. The measurement was performed in situ with three times repetitions at each sampling points with five minutes intervals between repetitions.

Extraction of Plankton Sample.

Plankton's sample extraction was done vertically and horizontally. That thing was done in order to figure out the distribution and variation of phytoplankton's type in both surface and water column.

Dragging the plankton net using boat with a low velocity from one spot to another consecutively did the horizontal sampling. Plankton net then pulled when the sampling bottles had already fully filled. Vertical sampling was done when the boat stopped by putting the plankton inside the water up to 5 meters deep by using weight. Plankton net was then pulled to the surface when the sampling bottle was fully filled. The filtered water was then put into 600 mL sampling bottle. Using 15 ml of 1% lugol then preserved it. The water sample was then put into a cool box for then observed at the laboratory.

Extraction of Yellow Stripe Trevally Sample.

The extraction of yellow stripe trevally sample was done using drifting gill net catching tool at five fishing points that was determined by local fisherman based on the location of *rumpon*. There were total of 21 yellow stripe trevallies that were caught in all five fishing points.

Analysis of Gastric Composition of the Yellow Stripe Trevally.

The obtained yellow stripe trevally was then measured (cm) and weighed (gram). Yellow stripe trevally's sample was then cut open using the surgical scissor. The cut started from the anus into the lower dorsal underneath the line a literalis, to the back of the operculum and then to the ventral until the abdominal. Abdominal's muscle was opened so the inner organ of the fish can be seen. The gastric organ of the fish was then pulled out and put on the petri dish. The edge of gastric organ was then slightly cut in order to take out the gut the inside of gut was then diluted by using sterilized sea water then was put inside into the plastic and preserved by adding 2 drops of 1% concentration lugol, then stored inside the refrigerator, to be observed next. The sample of gut was taken by using dropper pipette, and dropped twice on both side of the *haemocytometer* then observed by using microscope with 40 times zoom with three repetition.

The observation of the gut was done in order to figure out the food type composition that was eaten by yellow stripe trevally. Food type composition was analysed using direct calculation methods. According to Bassiri (2013), direct calculation method is a method to count the total number of cells within the sample. The analysis was then continued using *Ivlev's Electivity Index* in order to find out the main choice of Yellow stripe trevally's food.

According to Torgersens et al. (1999), stated that index of food selection is a value that state the selectivity in determining the abundance of food eaten by particular animal compared to the abundance of that food within the waters. The index of food selection was calculated using this following formula

$$Ei = \frac{ri + pi}{ri - pi}$$

Annotation:

- Ei : The index of food selection.
- ri : Relative number of the type of eaten organism.
- pi : Relative number of the type of organism within the waters.

If value of the index of food selection is $0 < Ei < 1$ means that type of food is preferred. If value of the index of food selection is $1 < Ei < 0$ that means that type of food is not preferred. Contrary, if value of the index food is $Ei = 0$, means that the type of food is unselected.

Identification of Plankton Sample.

The preserved plankton sample was taken for 1 ml by using dropper pipette and dropped on sedgewick rafter counting cell to be counted and observed using microscope. Observation and count was done by using a zigzag method with 40 times zoom. Plankton was counted per cell not chain because the chain can easily unattached and the counting result was stated in cell/m³ (Arinardi et. al., 1997).

The observed plankton sample was then identified. Procedure of identification of the plankton sample both from water and gastric

inside was done visually by matching the observed plankton’s morphology to the plankton’s identification book. Plankton’s identification book was referring to (Davis, 1955), (Prescott et. al., 1970) and (Yamaji, 1966). Data analysis was then performed to the counted plankton’s sample within waters by counting the abundance of the cells. The abundance of plankton’s individual was defined as amount of plankton’s individual per volume (m³). The unit of phytoplankton’s abundance was stated in cell/m³ while the zooplankton was stated in ind/m³ (Putri et al., 2013). Plankton’s abundance was calculated using this following formula referring to (Agustiadi et al., 2013).

$$N = \frac{1}{Vd} \times \frac{Vt}{Vs} \times ni$$

Annotation:

- N : Number of total individual (cell/m³) or (ind/m³).
- Vd : Volume of water that is being filtered (m³) (Vd=π.r².t).
- Vt : Number of total individual (cell/m³) or (ind/m³).
- Vs : Water volume on *sedgewick rafter counting cell* / Sample’s volume (ml).
- ni : Number of sliced plankton (cell or individual).

RESULT AND DISCUSSION

The Result of Measurement of the Sea Parameters.

The result of measurement of the sea parameter was stated based on the average of five fishing ground points. The result of sea parameter’s measurement can be seen in Table 1.

Table 1. Environmental Parameters.

	Temp (°C)	Water clarity (m)	Surface current (m/s)	Salinity (ppt)	DO (mg/l)	pH
Ave.	28,2	5,29	0,29	32	15,58	8,98
Water Quality Std.	Natural	Coral: >5m Seagrass: >3m	-	Natural	>5	7 – 8,5

According to Decree of the Ministry of Environment and Forestry Number 51, 2004 about the Sea water's standard value for marine biota, the result of sea parameter's measurement in Paciran water was categorized as in good condition. However, the result of pH measurement exceeds the standard value. That thing was assembly caused by the photosynthesis process of phytoplankton and marine algae. According to Effendi (2003), the photosynthesis process and fast growth of algae can depleted the existence of carbondioxyde within the waters, causing the pH value to increase.

Composition and Abundance of Phytoplankton within Waters.

The composition of plankton within water samples consist of phytoplankton and zooplankton. Two classes of phytoplankton were found, *Bacillariophyceae* (14 genus) and *Coscinodiscophyceae* (2 genus). *Bacillariophyceae* had the abundance of $21,552 \times 10^3$ cells/m³ and *Coscinodiscophyceae* had the abundance of 48.197×10^3 cells/m³. The abundance proportion of phytoplankton class can be seen in Figure 2. *Bacillariophyceae* class is oftenly found dominant within the ocean all over the world due to its good adaptation to a different sea condition. According to Hartoko (2013), *Bacillariophyceae* is a class

of phytoplankton that oftenly found within both fresh and sea water throughout the seasons. Besides that, *Bacillariophyceae* consist of combination of several cells that formed a chain. So, the *Bacillariophyceae* found abundant within waters.

The result showed that total of the abundance of phytoplankton was $21,600 \times 10^3$ cells/m³. The proportion of the total abundance of phytoplankton based on observed genus can be seen in Figure 3.

The result of the observation shows that *Pseudo-nitzschia* sp. genus phytoplankton has the highest abundance that reached $13,589 \times 10^3$ cells/m³, followed by *Chaetoceros* sp. that reached $6,587 \times 10^3$ cells/m³, *Leptocylindrus* sp. 609×10^3 cells/m³, *Asterionella* sp. 376×10^3 cells/m³. Diatoms genus that had smaller proportion was *Skeletonema* sp. by 152×10^3 cells/m³, *Thalassiothrix* sp. 94.575×10^3 cells/m³, *Lauderia* sp. 70.022×10^3 cells/m³, *Thalassionema* sp. 38.201×10^3 cells/m³, *Bacteriastrum* sp. 32.738×10^3 cells/m³, *Rhizosolenia*. sp. 30.010×10^3 cells/m³, *Dactyliosolen* sp. 18.187×10^3 cells/m³, *Cyclotella* sp. 2.728×10^3 cells/m³, *Hemiaulus* sp. 2.727×10^3 cells/m³, *Eucampia* sp. 0.909×10^3 cells/m³, *Ditylum* sp. 0.909×10^3 cells/m³ and *Odontella* sp. 0.909×10^3 cells/m³.

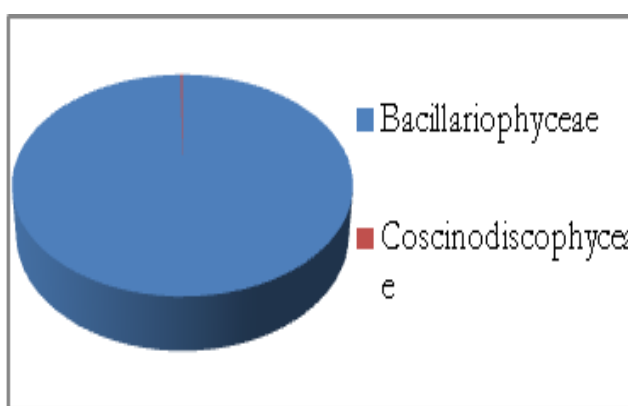


Figure 2. Proportion of Phytoplankton Class Abundance in Paciran Water, Lamongan on June 2015

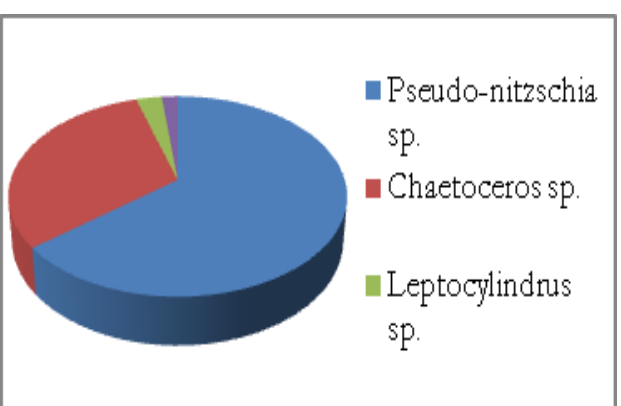


Figure 3. Proportion of Phytoplankton Genus in Paciran Water, Lamongan on June 2015

High abundance of *Pseudo-nitzschia* sp. genus within Paciran waters, Lamongan was mainly caused because this phytoplankton genus was generally found within all part of the sea including coastal area and open ocean. According to Suwartimah et. al. (2012), *Pseudo-nitzschia* sp. genus is oftenly found with a wide distribution in estuaries, fresh water and sea water. *Pseudo-nitzschia* sp. genus is a colony cell in chain form which is marked by a stacking cell (Parsons et. al., 2012).

The abundance of *Pseudo-nitzschia* sp. genus was also affected by environmental and seasonal factor. *Pseudo-nitzschia* sp. has the ability to live within every condition and every layer of waters. Based on research done by Jewel et al (2005), Genus *Pseudo-nitzschia* sp. lived in Maheshkhali River, Benggala Bay, Bangladesh with salinity varied from 22-35‰ and temperature varied from 22-33°C.

The composition of obtained zooplankton was found two class, *Maxillopoda* (3 genus) and *Oligotrichea* class (1 genus). *Maxillopoda* class has the abundance of 8.184×10^3 ind/m³ and

Tintinnopsis class as much 0.909×10^3 ind/m³. Proposition of the total abundance of zooplankton can be seen in Figure 4.

The high abundance of zooplankton from *Maxillopoda* class (copepods) is mainly caused by its active moving organelles, fast reproduction rate, many productions within generation and long live cycle that it gives a better chance of this kind of zooplankton to breed.

Copepods are an organism with a wide distribution pattern. Generally, the abundance of copepods is affected by several factors such as the availability food resources, environmental condition and preys or predators. Besides that, the high percentage of copepods is assumed related to its ability in adapting into the oceanographic condition within a dynamic waters (Mulyadi and Radjab, 2015).

The result of total calculation of the zooplankton abundance was 9.093×10^3 ind/m³. Proportion of total abundance of the maxillopods based on observed genus can be seen in Figure 5.

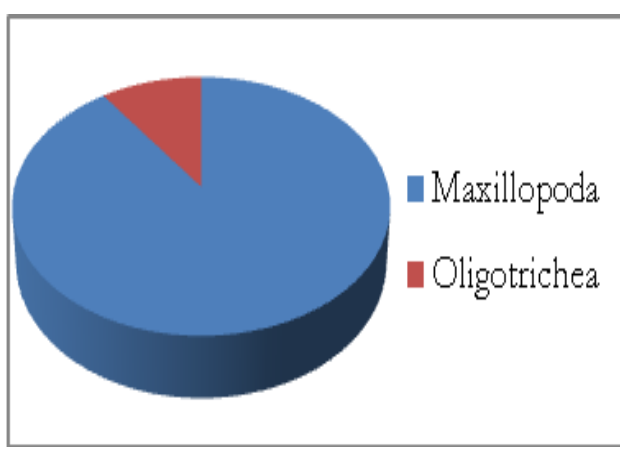


Figure 3. Proportion of Zooplankton Class in Paciran Water, Lamongan on June 2015

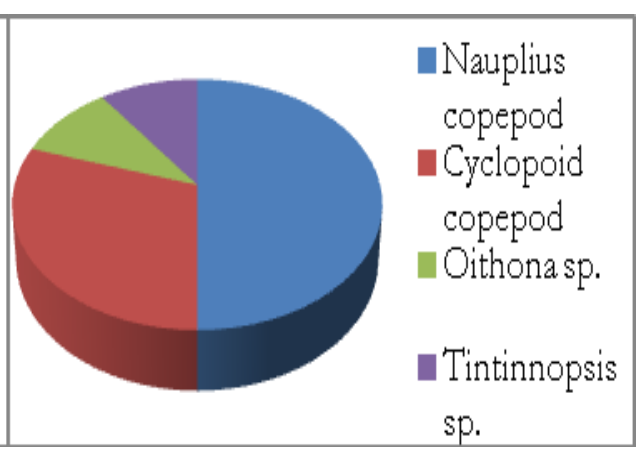


Figure 5. Proportion of Zooplankton Genus in Paciran Water, Lamongan on June 2015

The result of observation shows that zooplankton genus from *Maxillopoda* class, *Nauplius copepod* has the highest abundance that reached 4.547×10^3 ind/m³, followed by *Cyclopoid copepod* with 2.728×10^3 ind/m³, *Oithona* sp with 0.909×10^3 ind/m³ while genus from *Oligotrichea* class, *Tintinnopsis* sp has the abundance of 0.909×10^3 ind/m³.

The high abundance of *Nauplius copepod* genus within Paciran waters, Lamongan was mainly caused by this zooplankton genus was easily found within all parts of the ocean including coastal area and open ocean. Seasonal and vertical factors are several factors that can affect the abundance of *Nauplius copepod* within waters. Based on the previous research done by Takahashi and Uchiyama (2008), within Toyama Bay, it was found that the abundance of *Naupliuscopepod* genus occurred in every seasons. However, that thing is highly depend on the endurance of each species into changes within environment's condition. The abundance of *Nauplius copepod* in June to July 2008 reached the maximum peak at the same time with high chlorophyll-a concentration in Toyama Bay. Generally, the abundance of *Naupliuscopepod* is higher within 20-25 °C temperature. Within that range, the life cycle of *Nauplius copepod*, especially growth rate, tend to happen faster. Besides that, the abundance of *Nauplius copepod* within waters is highly affected by

vertical migration of *Nauplius copepod* itself. Vertical migration of *Nauplius copepod* changes seasonally which has a strong relationship with breeding season (*breeding cycle*) and day-night periods. *Nauplius copepod* will place a various depth, depends on the phase of its life cycle. Based on the previous researched done by Kršinić and Grbec (2012), in Adriatic Sea showed that the lowest abundance of *Nauplius copepod* occurred on the surface of the waters during daylight. *Nauplius copepod* will be in between 50-100 meter, while during the night *Nauplius copepod* will be more found in every water layer. The abundance of *Nauplius copepod* dominantly found in depth 5–50 meter.

Composition of Plankton in the Gastric Organ of Yellow Stripe Trevally

Based on the analysis result, food compositions within gastric organ of yellow stripe trevally consist of phytoplankton and zooplankton. Phytoplankton genus that was found within the gastric organ consist of *Prorocentrum* sp (610 cells), *Oscillatoriasp* (565 cells), *Pseudo-nitzschiasp* (72 cells), *Pleurosigma* sp (16 cells), *Coscinodiscus*. sp (7 cells), *Cyclotella* sp (7 cells), *Dinophysis* sp (4 cells), and *Asterolampra* sp (4 cells), while zooplankton consist of *Calanus* sp (5 cells). The proportion of yellow stripe trevally food compositions can be seen in Figure 6.

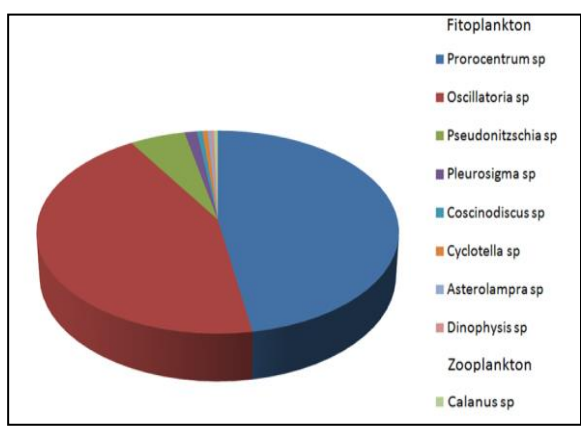


Figure 4. Proportion of Food Compositions in Gastric Organ of Yellow Stripe Trevally

Figure 6 shows us that phytoplanktons were found more compared to zooplankton. Catching time of the yellow stripe trevally is assumably the main caused that affects the abundance of phytoplankton within water column and surface. Phytoplankton used the sun light as a main energy source to photosynthesis. According to Asriyana et al (2004), the type of food eaten by fish can change according to catching time of fish sample. Based on research done by Favian (2009), food availability in waters can affect the food composition within gastric organ of yellow stripe trevally. Phytoplankton that is found within gastric organ of yellow stripe trevally can be assumed as a replacement food, or the only food that can be eaten while the main food is not available, so the yellow stripe trevally alter its food behaviour from zooplankton to phytoplankton due to its abundance within the waters. Based on the research done by (1960a), in Mannar Bay, India, showed that generally yellow stripe trevally food consist of crustaceans such as *Acetes*, *Lucifer*, *Acartia*, copepod eggs, decapods larvae, *Euterpina* and *Oithona*. Mollusc larvae, marine plants fragment, algae filament and other diatoms

were also found within the digestive system of yellow stripe trevally although the numbers were not many.

The number of phytoplankton that was found within yellow stripe trevally's gastric organ can be affected by seasonal factor. Catching practice that is normally done in East Season has caused the fish to consume phytoplankton. Based on the research done by Hendiarti et. al. (2004), around Java Sea, explained that during East Season (June-September) the high abundance of phytoplankton is mainly caused by upwelling phenomena that can also affect the distribution and abundance of phytoplankton within waters.

Analysis of Food Behaviour of the Yellow Strip Trevally (*Selaroidesleptolepis*).

The analysis used in this research was Electivity Index by seeing the comparison of phytoplankton composition within waters and gastric organ of yellow stripe trevally. The result can be concluded that the existence of plankton within the waters can affect the consumption behaviour of yellow stripe trevally. The result of the electivity index can be seen in Table 2.

Table 1. Electivity Index of Yellow Stripe Trevally

Phytoplankton Class	Genus of Phytoplankton	Pi	ri	e
<i>Bacillariophyceae</i>	<i>Asterionella</i> sp	414	0	-1
	<i>Bacteriastrum</i> sp	36	0	-1
	<i>Chaetoceros</i> sp	7234	0	-1
	<i>Cyclotella</i> sp	3	7	0,4
	<i>Ditylum</i> sp	1	0	-1
	<i>Eucampia</i> sp	3	0	-1
	<i>Hemiaulus</i> sp	3	0	-1
	<i>Lauderia</i> sp	77	0	-1
	<i>Leptocylindrus</i> sp	670	0	-1

Phytoplankton Class	Genus of Phytoplankton	Pi	ri	e
	<i>Odontella sp</i>	1	0	-1
	<i>Pleurosigma sp</i>	0	16	1
	<i>Pseudo-nitzschia sp</i>	14944	72	-0,99
	<i>Skeletonema sp</i>	168	0	-1
	<i>Thalassionema sp</i>	15	0	-1
<i>Coscinodiscophyceae</i>	<i>Asterolampra sp</i>	0	4	1
	<i>Coscinodiscus sp</i>	0	7	1
	<i>Dactyliosolen sp</i>	20	0	-1
	<i>Rhizosolenia sp</i>	33	0	-1
<i>Cyanophyceae</i>	<i>Oscillatoria sp</i>	0	565	1
<i>Dinophyceae</i>	<i>Dinophysis sp</i>	0	4	1
	<i>Prorocentrum sp</i>	0	610	1
Zooplankton Class	Genus of Zooplankton	Ri	pi	Ei
<i>Maxillopoda</i>	<i>Calanus sp</i>	0	5	1
	<i>Cyclopoid copepod</i>	3	0	-1
	<i>Nauplius copepod</i>	5	0	-1
	<i>Oithona sp</i>	1	0	-1
<i>Oligotricheae</i>	<i>Tintinnopsis sp</i>	1	0	-1

The result of index electivity in Table 2 showed that there were six genus of phytoplankton which become the main food of Yellow Stripe Trevally, *Asterolampra sp*, *Coscinodiscus sp*, *Cyclotella sp*, *Dinophysis sp*, *Oscillatoria sp*, *Pleurosigma sp*, *Prorocentrum sp*, and one zooplankton species *Calanus sp*, where the seven species of plankton had $(E_i) 0 < E_i < 1$ in the index of electivity, which means all those are categorized as preferred food.

According to Asriyana et. al. (2004), preferred food does not always mean the food is an important part of the food composition. The food availability within

waters also determined the type of food eaten by fish.

Phytoplankton genus that is found gastric organ of yellow stripe trevally were mostly difference with the phytoplankton genus found within water sample. It is assumed that yellow stripe trevally has its own preferency to a particular phytoplankton genus or consume the most available within its living habitats so all phytoplankton genus that in water sample was found in gastric organ of yellow stripe trevally.

Preference food that is eaten by yellow stripe trevally can be affected of food availability within the waters, not the width

of mouth or the size of body. According to Effendie (1997), factors that can affect fish in consuming food are the size of fish in utilizing available food, living habitats, preference in one particular food, seasons, size of the food, age of the fish, daily period of food hunting and competitors.

Another factor that can affect the differences of plankton within gastric organ and waters was assumably the migration of yellow stripe trevally during breeding phase. Breeding is done by yellow stripe trevally that has already reached maturity phase. In this study, fish sample were assumed had reached the maturity phase, given the size of caught fish sample varied from 15.5-20.3 cm. According to the research done by Sharfina (2014), in Sunda Strait, the yellow stripe trevally reached the maturity phase when they reach the size of 13.19-13.46 cm on female and 15.61-15.97 cm on male fish.

While, according to the researched done by Andriani et al (2015), in Pemalang Waters, showed that the size of fish when they first reach maturity phase was 13.38 cm on male fish and 13.36 on female fish. According to Tandon (1960b), stated that

breeding periods of yellow stripe trevally happen based on the periods of maturity phase of each fish population and right ecologic condition with the yellow stripe trevally physiology. Generally, the first breeding period happen on January to March with temperature value varied from 23.5-30 °C and salinity varied from 24.76-33.08 ppt while the second breeding period happens on May to October with temperature value varied from 25.5-30.5° C and salinity from 33.04-37.45 ppt. This research was done on June 2015 where the found Yellow Stripe Trevally has entered the second breeding periods.

Principal Component Analysis (PCA)

In this research, PCA is used in order to give the information about the characteristic of sampling stations and its relationship with various environmental parameters. This analysis involving three main components, biplot, loading factor and matrix correlation pearson. Biplot has a function to see the distribution of sampling stations and environmental factors that affect it. Biplot analysis of sampling stations and environmental parameters can be seen in Figure 7.

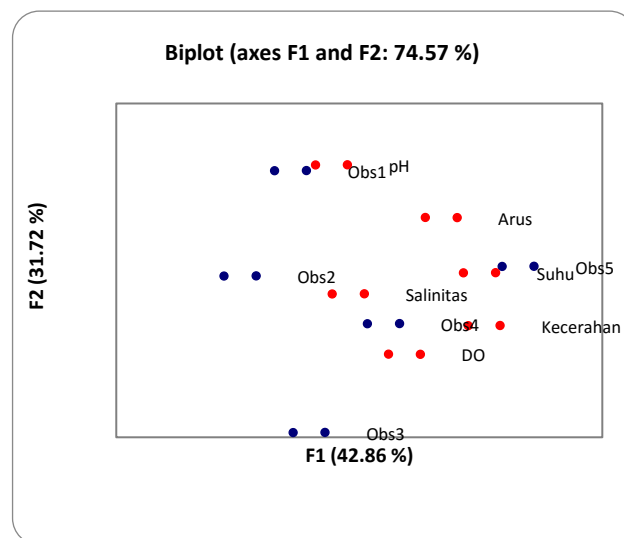


Figure 5. Biplot of Sampling Points with Environmental Parameters

Figure 7 explains that temperature, current and station 5 are all within quadrant 1. It means that temperature and current has a strong relationship with the abundance of plankton within station 5. Water clarity, DO and station 4 were all within quadrant 2, that means both water clarity and DO has a strong relationship with the abundance of plankton in station 4. There is only station 3 within quadrant 3, which means that station 3 had no significant impact from any observed

environmental parameter. pH parameters, station 1 and station 2 were all within quadrant 4, which means that pH gives a significant impact on the abundance of plankton in both stations

Loading factor was done in order to know the main variable that impact the observed object (sampling points) by seeing the value of loading factor that is closest to 1. The result of loading factor can be seen in Table 3.

Table 2. Factor loading of Environmental Parameters in Paciran Sea on June 2015.

	F1	F2	F3	F4
Temperature	0.8791	0.1606	-0.3466	-0.285
Water Clarity	0.9101	-0.2406	-0.2942	0.1653
Current	0.6227	0.5788	0.462	0.2525
DO	0.3758	-0.4581	0.7807	-0.1984
pH	-0.1129	0.9785	0.0767	-0.1548

Table 3 shows us that the value of F1 describes the condition of waters in general. Within all F1 columns, water clarity is the main variable that has the closest value to 1, with 0.9101. It can be summed up that water clarity is the environmental factor with highest impact in Paciran water, Lamongan on June 2015.

Solar radiation determines the clarity in particular waters and affect the water temperature as well. Direct or indirect solar radiation will affect the biological activity of marine organisms. Solar intensity is an environmental factor that affect the

photosynthesis of phytoplankton. According to Asmara (2005), high water clarity can sustain an optimum primary productivity due to its relationship with photosynthesis process of phytoplankton which is the basic component of food chain. Photosynthesis rate will increase along with high water clarity. Oppositely, it will decrease if the water has low clarity. Matrix correlation pearson was done in order to know the relationship of environmental and biological parameters (plankton). The result of matrix correlation pearson can be seen in Table 4.

Table 4. Matrix Correlation Pearson of Variables of Environmental Parameter.

	Suhu	Kecerahan	Arus	DO	pH	Fito	Zoo
Suhu	1						
Kecerahan	0,8163	1					
Arus	0,4082	0,3333	1				
DO	0,0428	0,1897	0,2795	1			
pH	0,0754	-0,3863	0,4924	-0,4	1		
N Fito	-0,1468	-0,6154	0,2117	-0,5111	0,9500	1	
N Zoo	-0,0003	0,33	-0,7454	-0,1562	-0,8258	-0,7013	1

Table 4 shows that pH value has a significant correlation with the abundance of phytoplankton within waters. Generally, marine algae, including phytoplankton will utilize carbondioxyde until its maximum pH limit, that it is no longer possible for them to utilize them. Usually the maximum value is around 10-11 because within this pH value, free carbondioxyde can no longer be found Effendi (2003).

pH value is affected by several factors, *i.e.*, biological activity such as photosynthesis, respiration, temperature and the existence of ions within waters (Pescod, 1973). The higher pH value is, the lower phytoplankton growth will be and finally lead to deceased cell. Furthermore, Hansen (2002) stated that generally the average pH value for maximum phytoplankton growth is 8.6-9.6, where diatoms phytoplankton has higher tolerance to high pH within waters, that can reach 9.4. It can be assumed that the abundance of phytoplankton within Paciran Waters is mainly caused by the high growth rate of Phytoplankton due to optimum pH value in the waters.

The value of temperature and water clarity were also correlated significantly, with 0.8163 correlation value. Weather can really affect the temperature value in particular water. The brighter the weather is, the higher solar radiations it gives. High solar radiation caused the sunlight penetrates deeper below the surface. Therefore, the sea temperature gets higher. Water clarity is very important due to its relationship with photosynthesis process and primary production within waters. According to Effendi (2003), water clarity is heavily affected by the weather condition, turbidity and suspended materials. The average value of water clarity in Paciran Waters shows a good value due to the fine weather during measurement time. Further-

more, temperature value can also affect distribution and the live of organism within waters. Indirectly, temperature will affect enzymatic reaction and photosynthesis rate. The optimum temperature for best phytoplankton growth is between 29-30 °C (Prescott *et. al.*, 1970). Precipitation, evaporation, humidity, wind velocity and solar radiation intensity are factors that can affect the change in temperature value. (Nontji, 1987).

CONCLUSIONS

1. The result of this research shows more phytoplankton was found than zooplankton, where the phytoplankton for 21.600×10^3 cells/m³ and zooplankton for 9.093×10^3 ind/m³. *Bacillariophyceae* class phytoplankton has as high abundance of $21,552 \times 10^3$ cells/m³ and low abundance was found for *Coscinodiscophyceae* of 48.197×10^3 cells/m³. Higher abundance of zooplankton was found for *Maxillopoda* class, 8.184×10^3 ind/m³ and low abundance of zooplankton was found for *Oligotricae* class of 0.909×10^3 ind/m³.
2. The difference was found within the composition of plankton in waters and gastric organ of yellow stripe trevally. Composition of plankton in waters is dominated by *Pseudo-nitzschia*. sp genus. This genus was also found within the gastric organ of yellow stripe trevally. However, the composition of plankton within gastric organ of yellow stripe trevally was dominated by *Prorocentrum* sp. genus.
3. Seasonal factors, catching time and migration affects the number of phytoplankton eaten by yellow stripe trevally. Yellow stripe trevally alters its food behavior from carnivore to

herbivore based on the food availability in waters.

4. The result of PCA analysis showed that water clarity parameter has big impact on Paciran Waters, while pH parameter (pH) correlated with abundance of phytoplankton in Paciran waters on June 2015.
5. There were six genus that become the main food of yellow stripe Trevally. Those are *Asterolampra* sp., *Coscinodiscus* sp., *Cyclotella* sp., *Dinophysis* sp., *Oscillatoria* sp., *Pleurosigma* sp., *Prorocentrum* sp., zooplankton genus, *Calanus* sp where all seven planktons have electivity index of (E) $0 < E < 1$ which means those foods are categorized as preferred food.

REFERENCES

- Agustiadi, T., Hamzah, F., Trenggono, M., 2013. Struktur Komunitas Plankton di Perairan Selat Bali. Balai Penelitian dan Observasi Laut, Balitbang KP, KKP, Bali.
- Andriani, N., Saputra, S.W., Hendarto, B., 2015. Aspek Biologi dan Tingkat Pemanfaatan Ikan Selar Kuning (*Selaroides leptolepis*) yang Tertangkap Jaring Cantrang di Perairan Kabupaten Pematang. Manag. Aquat. Resour. J. 4, 24–32.
- Arinardi, O.H., Sutomo, A.B., Yusuf, S.A., 1997. Kisaran Kelimpahan Plankton dan Komposisi Plankton Predominan di Perairan Kawasan Timur Indonesia. LIPI Press, Jakarta.
- Asmara, A., 2005. Hubungan Struktur Komunitas Plankton Dengan Kondisi Fisika-Kimia Perairan Pulau Pramuka dan Pulau Panggang, Kepulauan Seribu. Institut Pertanian Bogor, Bogor.
- Asriyana, Sulistiono, Rahardjo, M.F., 2004. Kebiasaan Makanan Ikan Tembang (*Sardinella fimbriata*) Val. (Fam. Clupeidae) di Perairan Teluk Kendari Sulawesi Tenggara (Study on Food Habits of Fringescale *Sardinella fimbriata*) Val. (Fam. Clupeidae) in Kendari Bay, Southeast Sulawesi. J. Iktiologi Indones. Vol. 4 Nomor Juni 2004.
- Bassiri, E., 2013. Methods of Enumeration Of Microorganisms.
- Davis, C.C., 1955. The Marine and Fresh-water Plankton. Michigan State University Press, Michigan.
- Effendi, H., 2003. Telaah Kualitas Air Bagi Pengelolaan Sumber Daya dan Lingkungan Perairan. Kanisius, Yogyakarta.
- Effendie, M.I., 1997. Biologi Perikanan. Yayasan Pustaka Nusatama, Yogyakarta.
- Favian, H.A., 2009. Aspek Biologi Pertumbuhan, Reproduksi dan Kebiasaan Makan Ikan Selar Kuning (*Caranx leptolepis*). Institut Pertanian Bogor, Bogor.
- Hansen, P.J., 2002. Effect of High pH on The Growth and Survival of Marine Phytoplankton: Implications for Species Succession. Aquat. Microb. Ecol. 28, 279-288. doi:10.3354/ame028279
- Hartoko, A., 2013. Oceanography Characters and Plankton Resources of Indonesia. Graha Ilmu, Yogyakarta.
- Hendiarti, N., Siegel, H., Ohde, T., 2004. Investigation of Different Coastal Processes in Indonesian Waters Using SeaWiFS Data. Deep Sea Res. Part II Top. Stud. Oceanogr. 51, 85-97. doi:10.1016/j.dsr2.2003.10.003.
- Jewel, M.A.S., Khan, S., Haque, M.M., 2005. Seasonal Dynamics in the Occurrence and Abundance of Pseudo-nitzschia Species in the Maheshkhali Channel of

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- the Bay of Bengal, Bangladesh. Bangladesh J. Fish. Res. 9, 169-174.
- Kršinić, F., Grbec, B., 2012. Spatial Distribution of Copepod Abundance in the Epipelagic Layer of the South Adriatic Sea. Acta Adriat. 53, 57-69.
- Mulyadi, H.A., Radjab, A.W., 2015. Dynamics of Spatial Abundance of Zooplankton in Morella Coastal Waters, Central Maluku. J. Ilmu Dan Teknol. Kelaut. Trop. 7.
- Parsons, M.L., Okolodkov, Y.B., Aké-Castillo, J.A., others, 2012. Diversity and Morphology of The Species of Pseudonitzschia (Bacillariophyta) of The National Park Sistema Arrecifal Veracruzano, SW Gulf of Mexico. Acta Bot. Mex. 98, 51-72.
- Pescod, M., 1973. Investigation of Rational Effluent and Stream Standards for Tropical Countries. Asian Institute of Technology Bangkok, Bangkok.
- Prescott, G.W., Bamrick, J., Cawley, E., Jaques, W., 1970. How to Know The Fresh Algae. W.C.Brown Company Publisher, Dubuque.
- Suwartimah, K., Widianingsih, W., Hartati, R., Wulandari, S.Y., 2012. Komposisi Jenis dan Kelimpahan Diatom Bentik di Muara Sungai Comal Baru Pematang. ILMU Kelaut. Indones. J. Mar. Sci. 16, 16-23.
- Takahashi, T., Uchiyama, I., 2008. Seasonal Changes in the Density and Vertical Distribution of Nauplii, Copepodites and Adults of the Genera Oithona and Oncaea (Copepoda) in the Surface Water of Toyama Bay, Southern Sea of Japan. Plankton Benthos Res. 3, 143-151.
- Tandon, K., 1960a. Biology and Fishery of "Choo Parai" Selaroides leptolepis (Cuvier and Valenciennes) Food and Feeding Habits. Department of Zoology of Panjab University, Chandigarh.
- Tandon, K., 1960b. Biology and Fishery of "Choo Parai" Selaroides leptolepis (Cuvier and Valenciennes) Population Studies. Department of Zoology of Panjab University, Chandigarh.
- Torgersens, C.E., Price, D.M., Li, H.W., McIntosh, B.A., 1999. Multiscale Thermal Refugia and Stream Habitat Associations of Chinook Salmon in Northeastern Oregon. Ecol. Appl. 9, 301-319.
- Venkataraman, G., 1960. Studies on the Food and Feeding Relationships of the Inshore Fishes Off Calicut on the Malabar Coast. Indian J. Fish. 7.
- Yamaji, I., 1966. Illustration of The Marine Plankton in Japan. Hoikusha, Osaka. Michigan.