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Optimum allocation unit catching small pelagic fish in the water in Kei Island Southeast Maluku

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Abstract. Small pelagic fish is one of the fish are potential resources and high compared to other kinds of fish in Kei Island Southeast Maluku. The aim of this research is to determine the optimum allocation unit arrest in the utilization of small pelagic fish in the Kei Island waters. An instrument grap used for catching small pelagic fish in the waters Kei Island is a lift net, purse seine, drift gill net and encircling gill net. A method of collecting data covering data resources fish, fuel, operational cost labor, the number of units arrest, and tracing of references pertaining to an object research. Analysis of data using linear goal programming (LGP) to provide information is important in allocating a unit of catching small pelagic fish optimally, and that is how allocation grap, optimal an instrument used how big achievement the purpose of which is willed according to the target, and just how much resources be used in achieving its goal. A kind of small pelagic fish widely distributed in Kei Island waters is *Decapterus* sp., *Rastrelliger* sp., *Selaroides* spp., *Sardinela* sp., *Clupea* s.p and *Stolephorus* sp. The result of this research is optimum allocation unit catching small pelagic fish in the Kei Island waters for the implementation of allocation technology usually in the utilization of resources fish.
***Keywords*:** Optimum Allocation, a unit of catching, small pelagic fish, Kei Islands

Introduction

Small pelagic fish is the fish that live at the surface layer till the depth of 30-60 meters, depends on depth of concerned sea. The group of small pelagic fish usually live in clustered, live in the neritic waters (near the coast) . If its live in the waters which is periodically/ seasonally experiencing upwelling, Pelagic fish can form great biomass (Mukhsin 2003).

Small pelagic fish is one of resource potential and great fishes compared to other kinds of fish in Kei Southeasthern Moluccas. Kinds of small pelagic fish which is important economic that dominant fished in Kei island waters are *Decapterus* sp., *Rastrelliger* sp., *Clupea* sp., *Stolephorus* sp., *Sardinella* sp., *Selaroides* sp. Fishing gear that used in fishing small pelagic fish Kei Island are lift net, purse seine, gill net and encircling gill net. Picture 1 provides number of fishing unit that operated in Kei Island waters.

Table 1 Kinds and number of fishing gear small pelagic fish in Kei Island Waters.

Year	Purse seine	Gill Net	Encircling Gill Net	Lift Net
2006	10	240	435	175
2007	10	364	352	96
2008	10	365	349	96
2009	10	369	357	98
2010	10	284	332	95

Source: Fisheries Affair of Maluku Tenggara District

One of the characteristic of small pelagic fish is communal (common property) which implicates to the level of the excessive utilization (overfishing). Therefore, it is necessary to regulate the optimum allocation each of fish resources and each fishing gears that used.

The purpose of this research is to determine the optimum allocation fishing unit in the use of small pelagic fish in Kei Southeastern Moluccas waters.

Materials and Methods

The method of collecting data includes the data of fish resources, fuel, worker operational cost, number of fishing unit and library research that relates to the research object. Analysis data using linear goal programming (LGP) to provide important information in allocating fishing unit small pelagic fish optimally that is several optimum allocation fishing gear, how big the achievement of wanted goal, and how big the resource are used in achieving its goal. In model goal programming, there is variable deviational infunction of obstacle. That variable serves to accommodate the deviation final result to targets that will be achieved. In the process of that model processing, quantity of deviational will be minimized in function purpose (Siswanto 1993).

Results and Discussion

The purpose of fisheries development in Southeastern Moluccas is optimize source production of fishery biodiversity to achieve sustainable potential, and on its development not separate from the available potential resources, worker and supporting factors like infrastructure, institution and much more. However, it is difficult to reach the goal simultaneously because it is contradictory to each other. An approach needs to allocate fishing optimally and therefore it used technique linear goal programming (LPG). LPG used to determine the amount of allocation fishing unit, deviate purpose of fishing fishery management and the use of resources.

LPG consists of equation purpose, function of obstacle and determine variable. The equation function express variable deviational from obstacle goals which have to be minimize. Variable deviational on function useful purpose to accommodate the deviation final result above the target and variable deviational that serves to accommodate the deviation final result below target results. That variable deviational would change obstacle be means to achieve wanted targets. The application of LPG substantially will give essential information in allocating fisheries resources fishing, optimally namely: 1) how much optimum allocation fishing gears that used 2) how big the wanted goal achievement due to the target and 3) how big the resources that used achieve its goal.

1) Optimizing availability of fish resources (SDI)

Small pelagic fish resources that caught in Kei island waters is *Decapterus* sp, *Rastrelliger* sp, *Clupea* sp., *Stolephorus* sp., *Sardinella* sp., *Selaroides* sp. An equation obstacle purpose to optimize supply that SDI based on TAC (total allowable catch) and abilities each fishing gears to catch small pelagic fish.

(1) *Decapterus* sp.

Sustainable potensial*(MSY) Decapterus* sp 8,071,54 ton/year withTAC about 6,457,2353. *Decapterus* spare caught byusing purse seine and lift net. The capability of purse seine to catch *Decapterus* sp is about 299,56 ton/unit/year and lift net about 58,04 ton/unit/year. The equation obstacle purpose is to optimize the available of D*ecapterus* sp resource is :

299.56 X1 + 58.04 X2 + DBI – DA1 = 6457.2353

(2) *Rastrelliger* sp.

Sustainable potensial (MSY) *Rastrelliger* sp. 10.172,26 ton/year with TAC about 8,137,8119. Rastrelliger sp are caught by using purse seine,lift net, gill net and encircling net. The capability of purse seine to catch *Rastrelliger* sp. is about 96.78 ton/year and lift net about 140.77 ton/year, gill net about 0.64 ton/year and encircling net about 0.31 ton/year. The equation obstacle purpose is to optimize the available of *Rastrelliger* s. resource is:

96.78 X1 + 140.77 X2 + 0.64 X3 + 0.31 X4 + DB2 – DA2 = 8137.8119

(3) *Sardinella* sp.

Sustainable potensial*(MSY) Sardinella* sp 832,20 ton/year with TAC about 665,76204. *Sardinella* sp are caught by using fishing gear gill net and encircling net. The capabilityof gill net to catch *Sardinella* sp is about 1,06 ton/year and encircling net about 0.7 ton/year. The equation obstacle purpose is to optimize the available of *Sardinella* sp resource is :

1.06 X3 + 1.7 X4 + DB3 – DA3 = 665.76204

(4) *Clupea* sp.

Sustainable potential *(MSY) Clupea* sp., 657.52 ton/year with TACabout 526.01386. *Clupea* sp., are caught by using fishing gear lift net. The capability of lift net to catch tembang fish is about 15.63 ton/year. The equation obstacle purpose is to optimize the available of *Clupea* sp., resource is:

15.63 X2 + DB4 – DA4 = 526.01386

(5) *Selaroides* sp.

Sustainable potensial *(MSY) Selaroides* sp. 1,491.11 ton/year with TAC about 1192.8913. *Selaroides* sp. are caught by using fishing gear purse seine, lift net, gill netand encircling net. The capability of purse seine to caught *Selaroides* sp. is about 47.47 ton/year, lift net about 5.99 ton/year, gill net about 0.19 ton/year and encircling net about 0.08 ton/year. The equation obstacle purpose is to optimize the available of *Selaroides* sp resource is:

47.47 X1 + 5.99 X2 + 0.19 X3 + 0.08 X4 + DB5 – DA5 = 1003.904

(6) *Stolephorus* sp.

Sustainable potensial *(MSY Stolephorus* sp 1,101.16 ton/year with TAC about 880.93098. *Stolephorus* sp. in Kei island waters caught by using fishing gear lift net. The capability of lift net to catch *Stolephorus* sp is about 18.84 ton/year. The equation obstacle purpose is to optimize the available of *Stolephorus* sp. resource is :

18.84 X2 + DB6 – DA6 = 880.93098

2) To minimize the use of fuel oil (BBM)

Fuel oil (BBM) that used fisherman to run a boat or fishing vessel in Kei island waters is using kerosene and gasoline. The equation obstacle purpose of this problem is as follows:

(1) 11.88 X1 + 7.920 X2 + DB7 – DA7 = 70000 (gasoline)

(2) 1.8 X1 + 1.2 X2 + 3.0 X3 + 3.0 X4 DB8 – DA8 = 45000 (kerosene)

3) Maximize the worker absorption

The amount of fisherman in Kei island based on statistical data region of southeastern Moluccas in 2008 is about 7,069 fisherman that spread in6 districts. The needs of worker for each fishing gears is vary, due to the kinds of fishing gears that used as purse seine needs about 17 workers, lift net needs workers while gill net and encircling net needs 3 workers in each because only using boat in fishing operation.

The equation obstacle purpose of this problem is as follows:

17 X1 + 4 X2 + 3 X3 + 3 X4 DB9 >=2474

4) Minimize the operational cost

Operational cost for each fishing gears is different due to the size and loading capacity of those fishing gears. For purse seine, operational cost that needs is 500,000, for lift net required 200,000 then to gill net and encircling net each required 50,000.Then for the obstacle operational cost that used it needs 14.831 million which is obtained from the total overall actual cost from all fishing unit of small pelagic in Kei island.

The equation obstacle purpose of this problem is as follows:

500 X1 + 200 X2 + 50 X3 + 50 X4 – DA10 <= 14831150

In this research requires subjective constraint (Simbolon 2003), that is obstacle policy to utilize all fishing gear of small pelagic fish based in Kei island waters in the last year. Therefore, the determine variable is X1 ≥ 10; X2 ≥ 33; X3 ≥ 284 and X4 ≥ 332 (all fishing unit which is operating in Kei island). Based on output from LPG analysis that done is obtained from allocation fishing gear optimally to utilize small pelagic fish resources in Kei island waters, each for purse seine (XI) about 12 units, lift net (X2) about 46 units, gill net (X3) abut 408 units and encircling net about 332 units. Based on output LPG (Enclosure 3) shows that purposes that wats to be achieved almost done overall, those showed by the analysis result that done is obtained deviational value (DA and DB) which equal to zero. Except for the value of *Clupea* sp. resource utilization which has over the TAC value about 202,472 ton, this shows on LPG output on DA4 value (Enclosure 3). However *Sellaroides* sp. resources show the contrary, the utilization of that resources still bellow TAC value that obtained about 25,904 ton, according to LPG output from DB5 value.

Fisheries business can achieve optimal and sustainable if available fish resources is utilized until the balance point of sustainable potential. To achieve that, it needs to optimized the use of the existing resource like natural resources and human resources which available and not exceed its capacity. The development in fishery activity, for instance add the worker and the other production factors. Hiariey (2009) said that the application of LGP analysis substantially will give essential information in allocating resources fishing gears, optimally namely: 1) how optimum allocation the use of fishing gears 2) how big the achievement of wanted goal which has been set due to the target, and 3) how much resources are used in achieving its goal.

Optimization fishing unit of small pelagic fish in Kei island waters analyzed through approach Linear Goal Programming (LGP). This analysis serves to determine the optimum fishing unit of small pelagic fish for good in continuing fishing business. It obtained that the optimal amount of fishing gears in Kei island waters to exploit the resources small pelagic fish seine, is 12 units purse seine, 46 units lift net, 408 units gill net and 332 units encircling net. In seeing at condition of the number of optimal fishing gears, compared to the number of actual fishing gears units which are currently exists in Kei islands waters shows that it is necessary to add fishing gear units. Purse seine needs to add 2 units, lift net 13 units and for gill net 124 units. On the other hand, the number of encircling net which exists are already fulfilled the optimum number.

Fisheries using purse seine, lift net, gill net and encircling net are recommended to develop based on the result of LGP calculation. In this case, these fourth fishing gears are chosen with consideration status on small pelagic fish resources utilization, worker absorption and opportunity for increasing production. The addition of fishing gear is necessary consider to the fishing area which very large in Kei island territorial waters.

Conclusion

Appropriate fishing technology that prioritized in Kei island waters is purse seine with optimum allocation 12 units, lift net with allocation 46 units, gill net with optimum allocation is 408 units encircling net with optimum allocation 332 units.

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