Lampiran 10

LEMBAR
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KARYA ILMIAH : JURNAL ILMIAH

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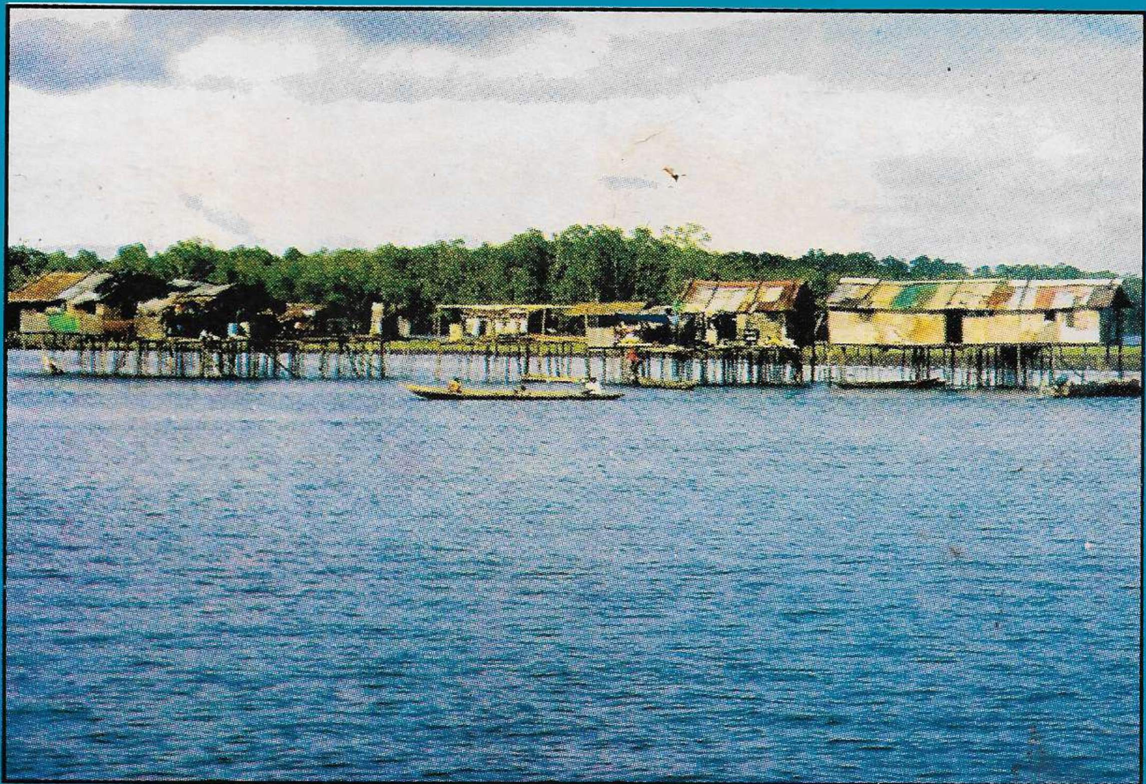

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Original paper

THE ROLE OF ZOOPLANKTON PREDATOR, CHAETOGNATHS (*SAGITTA* SPP) IN BAGUALA BAY WATERS, AMBON ISLAND

By: Niette.V. Huliselan *)
Faculty of Fisheries, Pattimura University, Ambon - Indonesia

Received: August 8, 2002 ; Accepted: September 20, 2002

ABSTRACT

Study on the chaetognaths of the Baguala bay waters, Ambon island has been done at approximately monthly intervals during January to March and May to September 1994. Sampling was carried out during the day time by using a 200 µm meshed WP2 zooplankton net at 7 fixed stations. Eleven species of chaetognaths belonging to the genus Sagitta and 2 other species (Pterosagitta draco and Krohnitta pacifica) were recorded. A total of 23,960 individuals of chaetognaths were examined and of these 4,546 individuals contained prey in their guts. The copepods were the dominant prey of Sagitta enflata, accounting for 73.80% of the diet. It was found that the food containing ratio (FCR) of stage 2 of S. enflata was higher than the other stages, while the number prey per chaetognath (NPC) of stage 3 of S. enflata was higher than other stages, and the daily feeding rate (DFR) of S. enflata (all stages) recorded at stations in the mouth of the bay was slightly higher than at stations inside of the bay. The FCRs, NPCs, and DFRs of P. draco were lower than S. enflata, therefore the impact on the copepods community structure would be greatest in this season and the stations in the mouth of the bay.

Key words: Chaetognaths, zooplankton, predators, prey, diet

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INTRODUCTION

Chaetognaths or arrow worms are common in the zooplankton of marine waters throughout the world and they are present from coastal waters and estuaries to open oceans, and from shallow depths to deep sea (Pierrot-Bults and Nair, 1991 and Bone *et al.,* 1991). The numerical dominance of chaetognaths over other pelagic predators suggests a potentially important role for chaetognaths (Williams and Collins, 1985; Øresland, 1987). The species diversity of chaetognaths gradually decrease from the lower epipelagic to bathypelagic layers, and the maximum diversity is generally found at a depth of 150 – 250 meter (Pierrot-Bults and Nair, 1991).

There has been a tendency to assume as many of marina fauna consuming plankton are unselective filter feeder, that there is limited scope for predation to structure the community. However, in a number of studies (Terazaki and Marumo, 1982; Øresland, 1986, 1987; Feigenbaum and Maris, 1984; Canino and Grant, 1985; Gibbons, 1992; Steele and Henderson, 1992; Frid *et al.,* 1994) predatory members of the zooplankton

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Original paper

COMPARISON OF *ESCHERICHIA COLI* CONCENTRATION BETWEEN BENGKALIS COASTAL WATERS AND ESTUARY BANTAN TENGAH RIVER

*By: Nursyirwani**) *and B.A. Moestomo*

Laboratory of Marine Microbiology, Faculty of Fishery and Marine Sciences, Riau University.

Received: June 17, 2002 ; Accepted: August 19, 2002

ABSTRACT

Bengkalis coastal waters and estuary Bantan Tengah River have been evaluated for bacteriological pollution level from November 2000 to April 2001. The objective was to compare Escherichia coli concentration as an indicator organism in the two ecosystems. The results indicated that E. coli concentration was higher in Bengkalis coastal waters than at estuary Bantan Tengah River, either at spring or at ebb tides. E. coli concentration, in Bengkalis coastal waters was higher at spring tide (993 cfu/100 ml) than that at ebb tide (775 cfu/100 ml). On the contrary, the E. coli concentration in estuary Bantan Tengah River was higher at ebb tide (247 cfu/100 ml) than at spring tide (22 cfu/100 ml).

Key words: Comparison, *Escherichia coli*, coastal waters, estuary, spring and ebb tides.

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INTRODUCTION

Coastal waters and estuarine are open ecosystem to the entry of domestic and industrial wastes. These will directly or indirectly influence the coastal and estuarine water quality (Ubbe, 1992). Among the domestic wastes, feces of human and warm-blood animal are dangerous to the life of aquatic animal and human health.

Feces of human contain more *Escherichia coli*, which is pathogen opportune than that of animal. Of 100–150 grams feces produced by human and animal, approximately contain 3×10^{11} (300 billions) of coliform bacteria (Suriawira, 1993). Meanwhile, *E. coli* concentration in 1 gram of feces is approximately 10^7– 10^8 organisms (Schaechter, 1992).

E. coli might cause diarrhea with some possibilities: (1) producing enterotoxin that indirectly cause lose of liquid; (2) investing on ephitellia membrane of intestine, which results in allergic syndrome and lose of liquid (Volk and Wheeler, 1990).

Concentration of *E. coli* in coastal waters is assumed distinct to that at estuarine due to various activities along the ecosystems. The research aims to study the different on *E. coli* concentrations between Bengkalis coastal waters and estuarine of Bantan Tengah River in Bengkalis Island of Riau Province.

Interactions of Squid and Small Pelagic Resources in the Alas Strait, Indonesia.

by Abdul Ghofar

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Original paper

INTERACTIONS OF SQUID AND SMALL PELAGIC RESOURCES IN THE ALAS STRAIT, INDONESIA

By: A.Ghofar *)

Faculty of Fisheries and Marine Science, Diponegoro University, Semarang - Indonesia

Received: August 21, 2002 ; Accepted: September 25, 2002

ABSTRACT

Small pelagic and squid fisheries of the Alas Strait in Indonesia are compared, to explore potential interactions between major components caught, which may then be taken into management consideration. The data time series used for analysis were taken from major fishing harbours and landing places, and go back as far as 1970s.

The small pelagic fishery in Alas Strait is mainly targeted upon squid (mostly Loligo edulis) by means of 'jala-oras' (payang-type) fishing, which is also used to catch small pelagic fishes during squid-off season. The small pelagic catches consist primarily of lemuru (Sardinella lemuru), tembang (Sardinella fimbriata), layang scad (Decapterus spp), and kembung (Rastrelliger spp), which are usually taken by various pelagic fishing gears. There was a general increase in the small pelagic catches from around 4,000t in 1976 to nearly 12,000t in 1990, after which a considerable fluctuation occurred, reaching a level of 8,000t in 1999. Squid catches increased steadily from <100t to 1,700t prior to1978 due to "jala-oras" boat motorization, but fluctuated sharply afterward. Another peak catch may be observed to approach 1,900t in 1997. During this period of large fluctuation, again, the landings of small pelagic fishes tend to replace squid position.

There is a strong indication of the existence of interaction between squid and small pelagic fisheries. In general the overall small pelagic exhibits a strong linear relationships with a correlation coefficient, r, of 0.5270 (highly significant). More specifically their species components also shows even stronger correlations, with coefficient correlation of 0.5898, 0.6686 and 0.6358 respectively for layang, kembung and lemuru. Interactions of the species group and their substantial implication in fisheries research and management are discussed in this paper.

Key words: small pelagic, squid, interactions

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INTRODUCTION

Studies of the interaction among the small pelagic resources in Indonesian seas are extremely lacking. Previous studies, which are very recent, including Mathews et al (2001a,b), Ghofar et al (2001a,b,c), Ghofar et al (2000), Ghofar and Mathews (1996), shows that small pelagic fish resources are affected substantially by climate variability in the Lesser Sunda islands and, in particular, the Bali Strait. Previous studies generally are concerned with biological aspects and fishery of the resources (Bandie, 1982; Bailey, 1982; Burhanuddin and Praseno, 1982; Burhanuddin et al, 1984; Budihardjo et al, 1990; Dwiponggo, 1982; Harmony, 1982; Merta

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et al, 1992, 1997; Ritterbush, 1975, Sujastani and Nurhakim, 1982 and Venema, 1996).

The Alas Strait is situated among the lesser Sunda Islands, between the islands of Lombok and Sumbawa, in the west and east respectively, and is connected to the Flores Sea in the north and the Indian Ocean in the south. Geographically it is bordered by 08005'S/ 116020'E to 08005'S/ 117030'E in the north, 09005'S/ 116020'E to 09005' S/ 117000' E in the south, 08005' S/ 116020' E to 09005' S/ 116020' E in the west and 08005' S/ 117030' E to 09005' S/ 117000' E in the east (Figure 1). Most of the bordering coasts of the Alas Strait are hilly areas which include the southern and northern coasts of Lombok and almost all coastal parts of western West Sumbawa. Only a minority of the coasts is low laying, and these are parts where major squid landings are made, including a major landing place at Tanjung Luar. The Strait has some shallow parts, especially those approaching the two coasts having depths of 1-20 m, but most of the Strait are more than 200 m deep, i.e. those approaching the Flores Sea and the Indian Ocean. Daily changes occur in water masses transporting from the south to north, and back; this alternating current is usually strong.

The Alas Strait fisheries are supported almost entirely by artisanal fishers. Several fishing gears operating in the area include the 'jala-oras' (a light lured, lampara-type seine net), 'bagan perahu' (boat lift-net), 'pukat pantai' (beach seine), 'jaring klitik' (drift gillnet), 'jaring insang tetap' (set gillnet), 'rawai tuna' (tuna long line) and fish traps. The catches usually consist of about 40 fish species and about 20 others (crustaceans, molluscs, mammals and sea weeds). These include clupeids, carangid, scombroids, sphyrhaenids, mugilidae, sharks, rays, histiophoridae, stromateids, exocoitidae, belonidae, pomadasyidae, lutjanidae, leiognathidae, squids, cuttlefishes, clam, mussels, cockles, prawn, crabs and lobsters. Observations on stomach contents of major component of the ecosystems. Showed that whereas cephalopods are predators of most of these fish species, they are preyed upon by major commercial fishes, i.e. *Katsuwonus pelamis, Thunnus albacares, Euthynnus affinis, Selar crumenopthalmus, Decapterus macrosoma, Rastrelliger brachysoma*, *Epinephelus fuscoguttatus, Argyrops spinifer, Lutjanus russelli, and Charcarhinus amboinensis*.

The Alas Strait has been one of the major contributors to the country's cephalopod landings identified 15 species of cephalopods occurring in the area, but the landings consist predominantly upon two loliginid squid, *Loligo edulis* and *Uroteuthis bartschi*. The existing fishery runs on artisanal basis, using 'Jala-Oras', a payang-like gear which employs light to attract the scattered squid. Other significant fishery is the small pelagic multigear fishery which predominantly catches lemuru (*Sardinella lemuru*).

The fisheries data of the Alas Strait had been recorded since the early 1960s. Geographically the Strait links the districts of East Lombok and West Sumbawa. The fishery in West Sumbawa is almost exclusively directed toward the Flores Sea, and there is no landings' partition between the Strait and the Flores Sea. Collection of the latter district's fisheries statistics started later in 1976. Since the West Sumbawan contribution to the Alas Strait squid fishery is relatively little, the East Lombok statistics may be regarded as representative of the whole Alas Strait.

MATERIAL AND METHODS

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Data Collection

Catch data for small pelagics and squid are published annually by the *Dinas Perikanan, Tingkat I* (Provincial Fisheries Offices) located in Mataram for Lombok and the province of West Nusa Tenggara (including landings from the Alas Straits and the west coast of Sumbawa). The data collected covers a period of 24 years time series from 1976 to 1999. Data are also collected from *Dinas Perikanan Kabupaten* (Lombok Timur and Sumbawa Barat) and major landing places in Tanjung Luar and Labuhan Lombok. Catch data from these sources were combined so as to obtain data by stock/fishery, rather than by province or *kabupatens*.

Fishing effort data are produced annually by the same sources, but need an even more careful review. Depending on the Province and the fishery, effort data may be quite precise and involve the number of gear or fishing units; or, alternatively, only the number of permits issued maybe recorded; some times the type of data recorded change during the time series: such changes can only be ascertained through direct interviews with informed and sympathetic officers.

Data on Alas Straits squid and lemuru landings are available from 1975 onwards. Lemuru are taken here using small purse seines, but, as for the squid effort data, critical details on how the fishery has changed are lacking.

Data Analysis

Plots were made to explore potential interactions between small pelagic, its components, and squid catches. Linear correlation and regression models are applied further to examine the extent and the forms of their relationships.

$$Y = a - b . X$$

Where Y is the dependent variable (squid catches in metric tons), X is the independent variable (small pelagic catches, in metric tons, including total small pelagic and three major species: layang, kembung and lemuru), a is the intercept and b is the slope.

RESULTS AND DISCUSSION

Trends and Interactions in Landings

The development of squid and the small pelagic fisheries in the Alas Strait from 1976 to 1999 is shown in Figure 1. There was a general increase in the small pelagic catches from around 4,000t in 1976 to nearly 12,000t in 1990, after which a considerable fluctuation occurred, reaching a level of 8,000t in 1999. The small pelagic is basically caught by small purse seines and 'jala oras' and other pelagic gears. The strait is exclusively the only place in Indonesia where a clearly-targeted squid fishery occurs. The number of 'jala-oras' boats was 60 units in 1960 (Badarudin, personal communications). In 1976 the number of jala oras was almost 700 units. This approximately twelve-fold increase of fishing effort has had an impact on squid landings, which increased roughly seventeen times from 70 tons to over 1,200 tons during this periods. However, when fishing effort was pushed further to about 730 units by means of fishery motorization in 1979, the landings declined to about 1,000 tons as a result. Unfortunately, the increase of fishing effort during the successive years was uncontrollable, reaching a record of over 1,700 units in 1981. As a result a drop to almost a half in squid landings was unavoidable, and the following years were marked by remarkable fluctuations in landings.

Unlike squid which almost entirely fished by 'jala oras', small pelagic are usually captured by a number of fishing gear: (most to less important) purse seine,

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'jala oras', 'jala rumpon', 'jaring bendera' and 'bagan tancap'. During the period of big squid landings at Tanjung Luar, there is usually less lemuru landed. Squid landings decreased from 106 tons to 38 tons in 1993-1994, during which lemuru landings increased from 3,476 tons to almost 3,900 tons. The following years were marked by significant increases in squid landings to 446 tons (1995) and 1,257 tons (1996), but decreases in lemuru landings were also observed to 1,760 tons and 49 tons, respectively. In 1997 landings were about 300 tons of squid and 1,466 tons of lemuru.

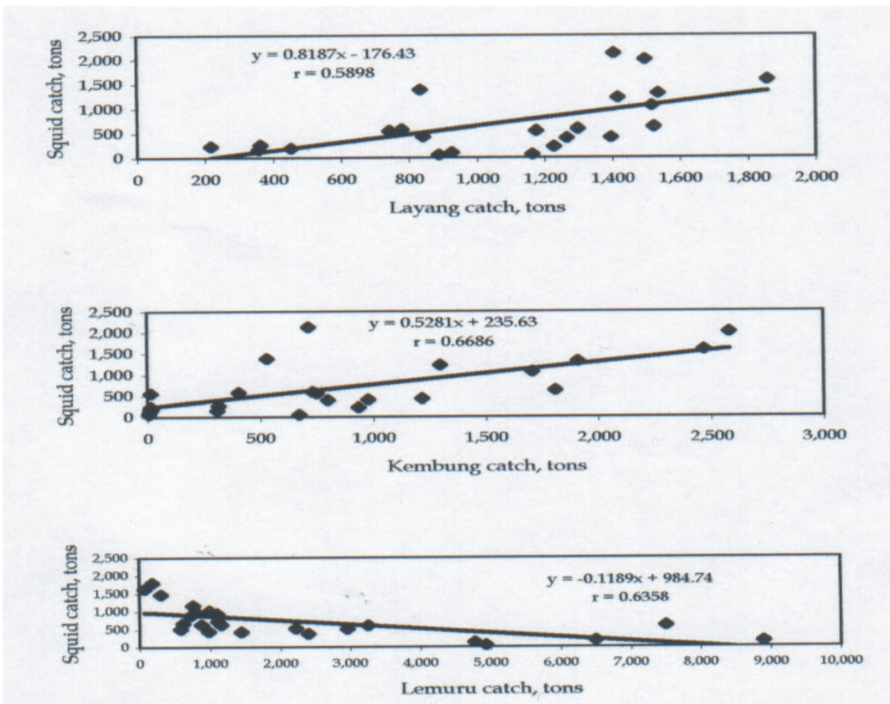

Fig. 1. Comparisons of squid and small pelagic catches in the Alas Strait

There is a strong indication of the existence of interaction between squid and small pelagic fisheries. Figure 2 shows in general that the overall small pelagic exhibits a strong linear relationships with a correlation coefficient, r, of 0.5270 (highly significant, $P < 0.01$). More specifically their species components also shows even stronger correlations, with coefficient correlation, r, of 0.5898, 0.6686 and 0.6358 respectively for layang, kembung and lemuru (Figure 3 and Table 1).

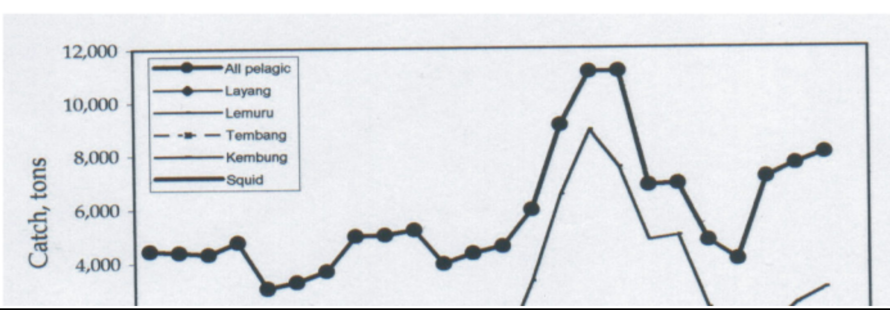

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Fig. 2. Relationships between small pelagic and squid catches in the Alas Strait

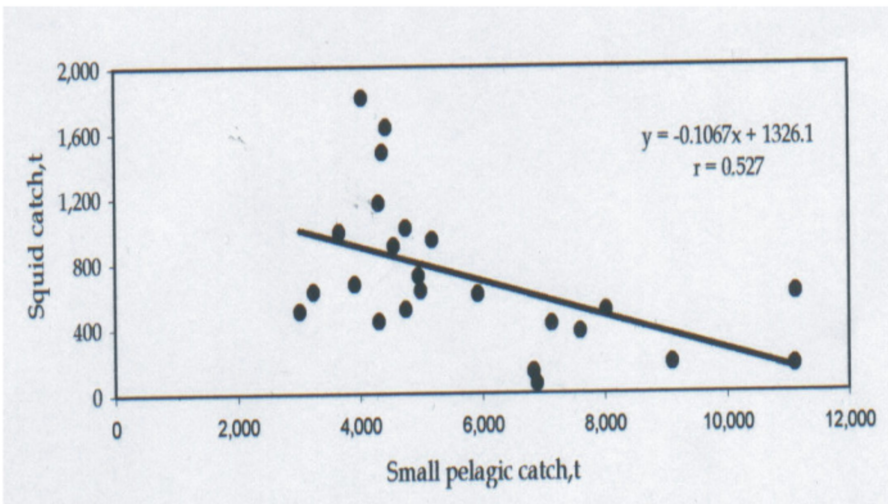

Fig. 3. Relationships between 3 small pelagic species and squid In the Alas Strait

Table 1. Correlation and regression representing the relationships of Small pelagic resources in the Alas Strait

Relationship	Regresion	*r*	*Remarks*
Squid-Small pelagic	Y = -0.1067X + 1326.1	**0.5270**	P < 0.01
Squid-Kembung	Y = 0.5281X + 235.63	**0.6686**	P < 0.01
Squid-Layang	Y = 0.8187X – 176.43	**0.5898**	P < 0.01
Squid-Lemuru	Y = -0.1189X + 984.74	**0.6358**	P < 0.01

The results (Figure 2, Figure 3 and Table 1) suggest that kembung and layang which are taken in squid catches, probably share the same ground and at the same time with squid (indicated by positive slope of the regression line, b). The squid

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uses the southern part of the strait, in the vicinity of Tanjung Luar and southward, to spawn, while kembung and layang probably feed in the same area and at the same time of the year. It is also evident that young squid is one of the most important constituents in the diet of kembung (*Rastrelliger brachysoma*) and of layang-scad (*Decapterus macrosoma*). On the contrary, lemuru is usually taken during the squid-off season, although primarily by the same (jala-oras, plus small purse seine), and this results in negative slope. This is undoubtedly a natural fishing strategy taken by the fishermen, to sustain their incomes.

Similarly all small pelagic combined show the negative slope, as they mostly consist of lemuru. In any way, all the above evident of the strong relationships among small pelagic and squid fisheries suggests that no single measure would be effective for their rational management. Impacts on one fishery will certainly further affects other fisheries, and vice versa. Careful monitoring program will be effective in providing strong basis for management, as long as the above components are equally considered.

Implication to Research and Management

The above evidence of interactions suggests that changes in landings of one species affect the other species, and therefore management should take into account such interactions. Careful, continuous monitoring of the biology of major constituents of small pelagic and squid resources should be carried out. The data collected should include length, weight, hard parts (otolith for fish and statolith for squid) examination, stomach content and reproductive aspects. Also there is a need to collect climatic and oceanographic data and to identify which of these potentially affect the landings of any of the above species.

These attempt would support application of more dynamic fisheries models, such as CLIMPROD and ECOPATH.

For the Alas Strait squid resource which features mass post spawning mortality, plus the given artisanal nature of the fishermen and existing socio-economic conditions, limitation and regulation of fishing or mesh size do not seem realistic. As far as the biological data are concerned, there is a need for continuous monitoring of size frequency data, preferably through maintaining better communication with 'gudang' owners, which makes it possible to use 'gudang' as research sites. Carefully designed monitoring program would allow the state of the fishery to be assessed more appropriately (i.e. to determine whether the resource is recovering or continuing to decline) and to establish a fishery forecasting plan. A thorough study of the ecology of cephalopods also need to be performed. Suggested the links between a number of tuna species and the cephalopods. As the tuna fishery has been expanded, there is an immediate need for quantitative studies of the stomach contents of the tunas. The study should also involve tuna resource assessment, and the interaction which probably occurs between the existing squid and small pelagic fisheries and the developing tuna industry.

Increasing fishing pressure upon squid and small pelagic resources of the Alas Strait clearly associated with the fulfilment of basic demand (livelihood) of the fishermen.

The almost complete dependence of local fishermen to outside capital providers, who are interested merely on immediate profit gain, is clearly responsible for the continuous destruction to the fishery sustainability. Some actions are required to prevent the fishery from further depletion; these may involve: (1) replacement of existing capital owners by public company; (2) consistent

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enforcement to control irresponsible fishing. There is also an increasing need to establish a better relationship between the management and the local informal leaders (particularly the powerful *Pak Guru*), through whom programs of improving community's education and life standard may be expected to be performed to a great part.

In 1983, the Directorate General of Fisheries initiated the so-called "Small-Scale Fisheries Development Project (SSFDP)" in Lombok (1983-1993) with German technical assistance in: (1) resources monitoring, fishing technology, fish processing and socio-economic considerations; (2) support and guidance given to fishing groups (30 groups in total) established by local fishers at the east coast of Lombok (Lombok Timur). Each group consisted of four members, operating a newly designed fishing boats, equipped with tuna drift gillnets, acquired on a credit basis. During the last years of SSFDP implementation, independent boat owners operating at the east and south coast of Lombok started to equip their units with drift nets recommended by the project, adding to the 30 existing assisted-project boats.

In 1979 introduction of purse seine in Tanjung Luar by the Fisheries Office through *KUD Mina Bahtera Hidup*. Strong negative responses from artisanal fishers fighting against it, but due to better catch, some fishers (juragans, prosperous fishers) were attracted to use the new fishing gears. In March 1993 the Village Master intended to develop a Muncar-type purse seine, and lead to a mass strike against it in 1994, delivering their request to the District's Parliament to solve accelerating conflict and to regulate the fisheries. In November 1994 an agreement (locally called "Awiq-Awiq", issued in the Village Master Decree No. 04/LMD/1994) was set up between conflicting parties and supported by all components within the community at Tanjung Luar so as to: Set up fishing borders and zones in Tanjung Luar: artisanal ('payang oras") fishers reserved the right to fish within Zone 1 (0-3 nm), and as far as no friction (with others, more developed-fishers) they are allowed to fish in Zone 2 (3-6 nm). Purse seiners are allowed to fish in Zone 2, or 3 without friction. Gillnets are allowed to fish in Zone 3 (6-12 nm), or Zone 4 without friction. Tuna long line are allowed to fish in Zone IV (12 nm up to EEZ). Artisanal fishers are basically allowed to fish in all zone so long as no conflict arises and they can afford.

Sanction to the misconducts against the rules as of (1): caught purse seiners operating in Zone 1 will be subject to the submission of their catches to Village for people's need. If the case is performed 3 times by individual fishers or purse seines, all cathes will be taken for Village need and their seines will be taken by law.

All of the above processes will be performed with inclusion of existing community participation, including "*Hukum Adat*".

Establishment of a Committee for Marine Fisheries Management (*Komite Pengelolaan Perikanan Laut, KPPL*) at Tanjung Luar, 20 November 1999, major components include: Bupati Lombok Timur, Head of District Fisheries Office at Selong, and informal leaders with major task of running its mission of harmonious systems in coastal and marine environments, establishing a Fisheries Forecasting Center and MCS systems.

Equally important is to note that the general regional development policy of establishing: "*Gerbang Masa Depan*" (the Future Gate), namely "*Gerakan Pembangunan Masyarakat Pantai*" as a theme, with many other programs such as Community-based Fisheries Management (*Pengelolaan Perikanan Berbasis Komunitas* (as in Tanjung Luar: Awiq-awiq), *Komite Pengelolaan Perikanan Laut*, Fisheries Co-management Project, Coastal Fisheries Resources Management

(*Pengelolaan Sumberdaya Perikanan Pesisir dan Laut*), would likely to be ineffective, unless these are managed properly in an integrated scheme, which so far has not been an easy task.

The "many phrases" as the projects usually name would puzzle the simple, modest fishing communities, until these projects prove to be addressing the actual need of the people. Only by this can they be expected to sustain their resources and to follow critically the on-going activities.

CONCLUSION

There is a strong indication of the existence of interaction between squid and small pelagic fisheries. In general the overall small pelagic exhibits a strong linear relationships with a correlation coefficient, r, of 0.5270 (highly significant). More specifically their species components also shows even stronger correlations, with coefficient correlation of 0.5898, 0.6686 and 0.6358 respectively for layang, kembung and lemuru. There is a clear need of: (a) continuous monitoring of biological data of major species in the fishery; (b) more focused, effectively managed coastal and fisheries programs that regionally exist, so as to revitalize the development of the fisheries involving the real participation of all the stakeholders.

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