The fishing activity of the coastal seiners of the Java Sea an approach by individual schedule of activity

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Abstract: This article offers a new approach of study about the fishing activity of the coastal seiners operating in the Java Sea. In 1995, about 20,100 investigations were carried out from some villages located along the north coast of the Isle of Java. From these investigations, the fishing activity of some individual fishing units is analyzed daily; it allows to describe the different biases issued from this survey.
From these individual schedule of activity, the main fishing strategies of this coastal fleet are presented.

Keywords: purse seine, artisanal fishery, fishing activity, methodology, Java Sea, Indonesia.

The global fishing activity of the coastal seiners fleet of the Java Sea was studied by using a global schedule of activity (Ecoutin and Dharmadi, 1998). This study describes the global activity of the fishing units without individualizing them by following the landing catches. It allowed us to show that this traditional fishing fleet depicts a steady global activity as in 1995 it worked between 330 and 340 days (Ecoutin and Dharmadi, 1998). The study on the global activity of the fleet has also permitted the observation of differentiated activity dynamics depending on the ports investigated. Such differences can be explained either by the physical configuration specific to each port or by the social behavior of the units related to the owners (Ecoutin and Dharmadi, 1999).

Although this global approach gives us a lot of information on the dynamics of the fleet it does not enable us to estimate the parameters necessary to evaluate the contribution of this fleet to the fishing production of the Java Sea. An estimate of the fishing effort, eventually expressed in numbers of outings by unit of time, is inevitable to get this information.

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The size of this inshore fleet is now known thanks to the censuses carried out in 1995 (Jung, 1998; Jung and Ecoutin, 1999). About 1,500 to 1,600 mini seiners share out the North coast of Java Island between Sunda Strait in the West and the Strait of Bali in the East (fig. 1). The geographic distribution of these units is known now and a stratification by large geographic zone is possible (Jung, 1998; Jung and Ecoutin, 1999).

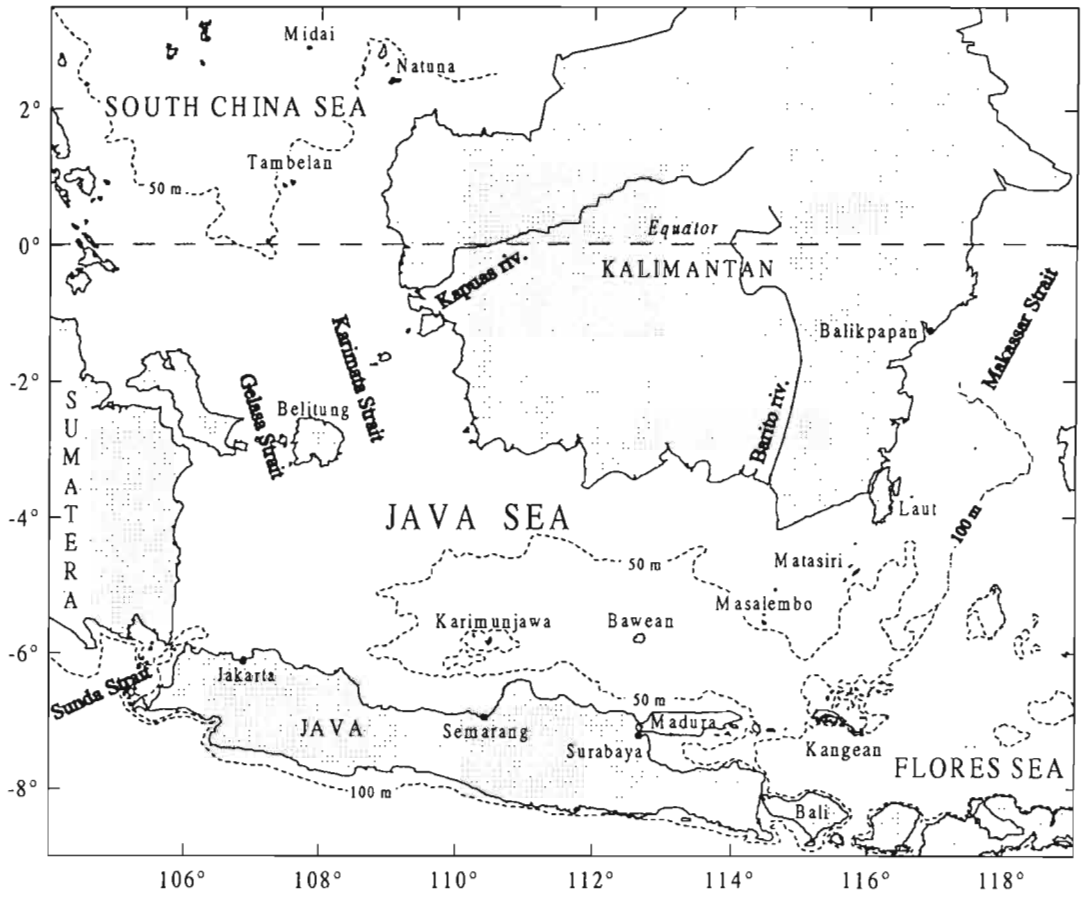


Figure 1: The Java Sea and its environment

The purpose of this study is to take the first steps to comprehend the fishing effort of this inshore fleet in methodological terms. An important part of this work deals with the analysis of biases leading to an undervaluation of this parameter.

The approach using individual schedules allows the study of long-distance migrations or moving between nearby ports. The aforementioned authors have already brought up these aspects.

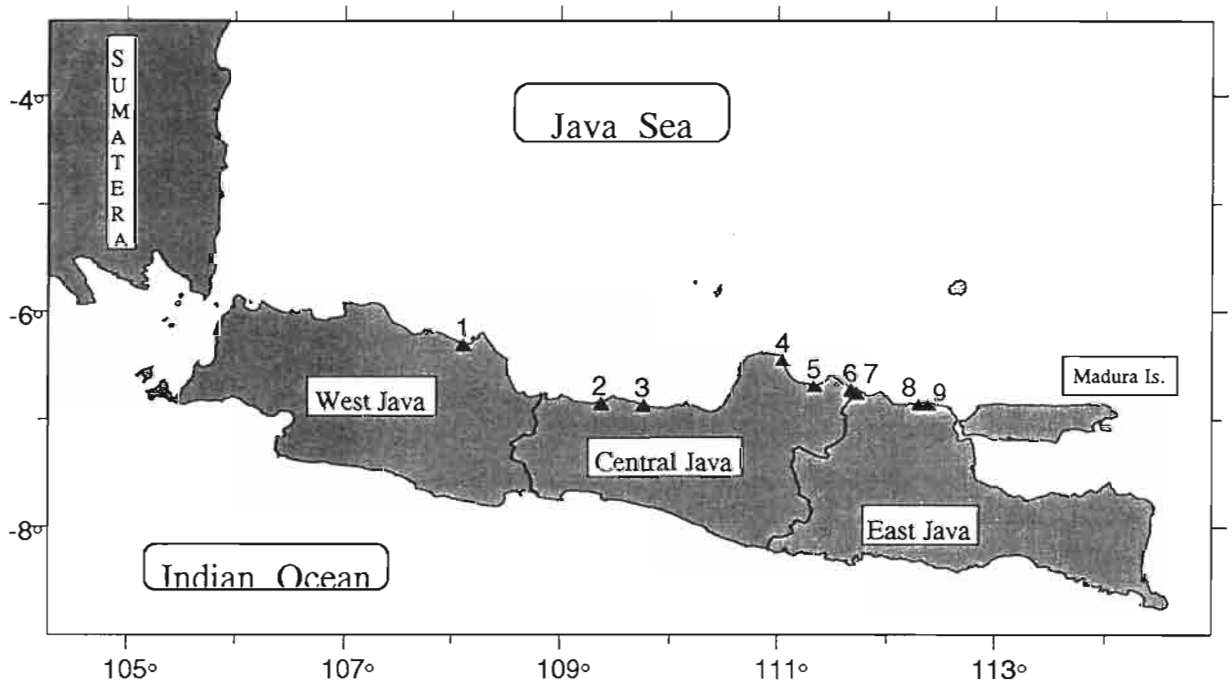
During the year 1995, many investigations on the landings of these units in various places along the coast allowed the estimation of how important the landings were both in weight and revenue (Ecoutin and Atmaja, 1999). These landings are described in global quantity and according to the main marketing categories (grouping together of close species, both biologically and commercially). The average yields may as well be presented according to a geographic stratification.

Material and methods

1. Presentation of the investigations

The study is carried out from daily statements of the unloading of the inshore small seiners. In 1995 these investigations were made in eight important ports of the North coast of Java Island (fig. 2). This choice draws on the first censuses taken of the coastal small seiners, which operate in the Java Sea (Ecoutin *et al.*, 1997).

The selection plan included a ninth point of inquiry, the port of Brondong situated in the province of East Java (fig. 2, n°8). This port was the object of a specific monograph (Luong, 1997); its results could not be taken into account in this article.



Port n°1 - Eretan Wetan
Port n°2 - Pekalongan
Port n°3 - Batang
Port n°4 - Banyutowo
Port n°5 - Tasik Agung
Port n°6 - Sarang
Port n°7 - Bulu
Port n°8 - Brondong
Port n°9 - Kranji

Figure 2: Geographic zones of the ports in the study

Each sale of a part of a fish landing per fishing unit is registered in a buyer 's book[4] by the administration of each auction (TPI, *Tempat Pelelagan Ikan).* The investigations are then regrouped by fishing units and copied out on specific sheets. On these sheets indications may be found allowing the identification of the fishing unit (names of the boat, the owner and the captain; the fishing unit place of origin), information on the fishing outing (location, time spent at sea, possible use of fishing aggregating device), as well as the composition of the catches by species categories, generally ranging from 6 to 8. The composition is given in weight and often in value (Ecoutin and Atmaja, 1999).

[4] This book is called *buku bakul.*

In 1995 about 20,100 investigations[5] were carried out and validated for six villages taking part in the study. The investigations of the port of Batang (fig. 2 n°3) are partially validated and can be used for a study on the fishing activity; they will be used case by case depending on their level of validation. The data on Bulu village (n°7, fig. 2) were far too incomplete in 1995 to be taken into account for this study.

2. Observation unit

The observation unit is made up of a fishing unit, which lands its catches one day of the year in one of the investigated points. This analysis is based on the individualization of each fishing unit by a unique identifier composed of a name describing the boat and, if possible, the village of origin of the unit. The village of origin is defined by the owner's place of residence (Jung, 1998).

The notion of village of origin of a fishing unit allows linking the study files of the daily landings of the units to that of the three censuses conducted in March, June and November 1995 (Jung, 1998; Jung and Ecoutin, 1999). The last series of investigations may help the validation of the activities observed and has the great interest of having been registered independently of the collection of data on the *buku bakul.* Indeed, Pelfish teams conducted the censuses; therefore the results are independent of those provided by the fishing services in authority over the auctions.

3. Analysis principle

The principle of this analysis is based on the creation of a 365-day chart describing the daily information collected for each fishing unit. This chart is filled in with the code of the observed location where a daily investigation was conducted for the studied fishing unit. This schedule of yearly investigations (activity diagram) is completed with the information on sea outings lasting more than one day. Some investigators point out the fact when the unit spends more than one day at sea, therefore the days before landing are registered as days at sea.

Example n.1[6]: during the 12 months of 1995, the unit *Tambah Sumber* was under investigation 72 times in the auction place of Tasik Agung (Rembang), 6 times in Tayu and twice in Sarang (fig. 2). On this group of investigations, 70 days with the observation of landings (see the 1st of January, code 'TAA' of the chart in annex) and 7 days spent at sea (code 'sea', the 28th of January) were positioned without any problem. The ten investigations that are not positioned on this chart (80 investigations – 70 days of landing shown on the activity schedule) describe the first two problems encountered during this analysis:

- The information on a landing day may be completed by an indication of presence at sea that very day. This indication comes from an investigation subsequent to this landing day. For the example studied, this case was noted 6 times (see code 'TAA*' on the February 19th: that day the fishing unit landed at Tasik Agung auction and the day after at Sarang 's while the investigator of the latter village pointed out that the unit was out at sea the day before, that is to say the whole of the 19th).

[5] An investigation corresponds to different information describing the full unloading of a fishing unit; indications on the unit identification, information about the fishing outing and the composition of the catches from this fishing outing.

[6] All the examples cited in the article, are described in final annex.

- Two investigations may be recorded on a same day[7] for a same fishing unit identifier (example on February 3 where code 'TATA' shows the presence of two inquiries for the same auction at Tasik Agung). This problem was here observed twice (February 3rd and March 12th).

An intermediate case was noted by code 'sea*' (observed once, December 17th). It points out that for the same day, two different investigations give an indication on the presence at sea of unit *Tambah Sumber*: investigated on December 18th, the unit is seen out at sea the day before, investigated on the 19th as well, it is said to be at sea on the 17th and the 18th.

Example n.2: the fishing unit *Akar Sakti* was observed 77 times during the 12 months of 1995 (74 at Sarang, its port of origin, twice at Tasik Agung and once at Tayu, fig. 2). For 56 of the landings there is no problem whatsoever; these observations are completed by 30 indications of presence at sea. Moreover 4 indications of investigation of landing are associated the same day to an indication of presence at sea and 6 indications of multiple daily investigations are observed. Three days describe new major problems:

- indication '****' (observed on August 21st) shows a minimum of three pieces of information for the day: that is to say, one landing of the catches at Sarang on the 21st and two indications of presence at sea due to two landings observed on the 22nd at this same auction;

- on March 25rd (code 'SAS*') with two landings observed the same day at Sarang and an indication of presence at sea via the investigation of the 26th. We have three different indications for a same day here as well;

- finally on October 14th (code 'SATA') this same fishing unit is pointed out as landing both at Sarang and at Tasink Agung. Despite the short distance between the two auction places, the case is usually considered as abnormal.

Although they may be explained in the example above-mentioned, the three problems demand that the status of uniqueness of the fishing unit studied should call for caution.

Their repetitions along the year indicate that the unique identifier might not describe only one fishing unit but several units identified under the same name.

Example n.3: the case of *Hasil Laut* where 24 days show a discrepancy among information to which 45 days describing problems of interpretation as encountered in the first example should be associated; under this denomination at least 4 units *Hasil Laut* numbered from 1 to 4; they are all originated from the same village and probably belong to the same owner. The existence of these four fishing units *Hasil Laut* was confirmed by the results of the 1995 censuses. The distinction between these units said composite unit is not necessarily noted on the *buku bakul* by the staff of the fishing department during registration of the landing.

4. Analysis of the biases

The three examples above-mentioned describe the main difficulties encountered in the context of this study of the fishing activity using daily activity diagrams. Most of these problems are related to the identification of the fishing unit; they may be divided into two groups:

[7] In this article, two (or more) investigations conducted the same day, in the same port or in two different ports, are called "multiple daily investigations".

- copying or translating mistakes of data capture at the auction places or eventually during the data keyboarding;
- omissions in the collection of the information making a proper identification of the units impossible.

The analysis of these difficulties that generate biases in the handling of the information still allows the information to be sorted out in order to find out what may be used and what may not be used later on.

In 1995 the file with the data collected in the six ports of study contains 1,693 denominations of fishing units, which would mean that the fishing units investigated in those ports would represent the whole fleet listed in Java Island, including the one observed in Madura Island and in the ports located in the South of Madura Bay (Jung, 1998). Yet according to censuses conducted in 1995, about 50% of the inshore seiners are to be found in those two geographic zones.

The number of fishing units investigated less than 10 times represent 75% of the whole number of units observed in the six points of investigation. Only 17% of the units present over 20 observations during the year 1995 (tab. 1). This aspect is a real problem for a study on the fishing activity of the mini-seiners fleet.

Table 1: Distribution of the number of denomination of fishing units by category of investigations conducted

Number of investigations conducted	Number of unit denominations		
	original file	after validation	including composite units
1-9	1295	1185	0
10-19	122	124	2
20-29	65	67	3
30-39	48	51	7
40-49	32	32	7
50-59	28	29	4
60-69	27	27	6
70-79	18	17	8
80-89	13	17	6
90-99	14	9	8
100-109	8	9	8
110-119	4	3	3
120-129	4	6	5
130-139	3	2	2
140-149	4	2	2
150-159	1	2	1
160-169	1	0	0
170-179	2	2	2
180-189	3	4	4
190-199	1	0	0
260-269	0	0	0
Total	1693	1588	78

4.1. Comparing the names of fishing units

The summation of the information contained in the activity schedule allows to spot if two names with only slightly different spelling may correspond to a same fishing unit. By comparing only the cases where the number of grouping is over 50 investigations, it is possible to make a distinction between the following situations:

- Presence of an identifier observed several times with two or several similar names together with a figure listing versions of this identifier. Even if the number observed by numbered unit is low, it always regards a description of several real units that the investigators have not necessarily differentiated (example *Hasil Laut* above-mentioned). The schedule of the composite unit[8] always shows difficulties of interpretation such as the observation of two inquiries a same day at a same auction, and very often discrepancies, major errors, such as the presence of a same unit at two different auctions. This composite unit may correspond to:

  - either the grouping of units that are not well identified but described in theory by an additional identification characteristic; this composite unit does not actually exist (unit *Hasil Laut* is present in four instances identified from 1 to 4 but the term *Hasil Laut* describes no actual fishing unit);
  - or the grouping of units to which a real fishing unit using the composite name should be associated.

- Presence of a basis identifier and of a similar name together with a figure or a letter, still in very low numbers (ex: *Akas Perkasa* and *Akas Perkasa* 2). The two units are first merged under one and same fishing unit denomination.

A first validation of the names of fishing units (1,693 denomination) took into consideration errors in the data capture and information processing linked to a situation explained above. The result of this validation gives a data file with 1,588 different appellations. The hundred of names that have vanished mostly concern the units that were not often investigated upon (fewer than 10 investigations within the year, tab. 1).

The part of the composite units, that is to say the ones, whose denomination matches the presence of several actual units, is predominant in the observed categories in high numbers (tab. 1). They represent over three quarters of the observations for the categories superior to a number surveyed in 100 yearly investigations and 100% of the observations for the two most important categories (more than 170 yearly observations).

4.2. Study of the multiple daily investigations[9]

The fishing units investigated twice or more within a day are spotted out from the 1995 date files. These different observations come either from a same place or different places of investigation.

After the validation of the names, 251 units present at least one observation of multiple daily investigations within the year 1995 (tab. 2), which still represents 1,115 days with this indication.

In 1995, 12% of the investigations encounter this type of problem. Some units are described as making as many as 5 landings the same day; but 90% of these days with multiple investigations report only two landings.

For some of these units it is not really a problem, it corresponds mostly to the observation of composite fishing units that are not identified properly by the investigators; they are not described with their complementary numbers (example n.3, unit *Hasil Laut*). Consequently, all the descriptions of composite units were removed, which corresponds to 78 names of fishing units (tab. 2).

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[8] A composite unit describes a boat whose denomination corresponds to the identification of several actual units.

[9] A multiple daily investigation describes the observation on a given day of several pieces of information, eventually contradictory, regarding one and only fishing unit (example n.2).

This withdrawal represents only 31% of the names, but 66% of multiple investigations and 67% of the number of investigations.

Table 2: Description of the multiple daily investigations before and after the withdrawal of the composite units

	fishing units	Number of days with multiple investigations	investigations
Before the withdrawal	251	1155	2441
After the withdrawal	173	393	812

Regarding the rest, two cases were considered depending on whether the multiple investigations were or were not carried on the same landing spot. About 4/5 correspond to investigations from a same place.

* Landing at a same location

In this case the interpretation takes into consideration the geographic situation of the port as well as the available knowledge on its mode of functioning. About half of the multiple investigations are observed at Tasik Agung with half of the quadruple investigations observed. The example of Eka Perkasa of March 30th shows that it is often an arbitrary creation by the investigator, from two investigations where in fact there must be only one: similar description of the characteristics of the outing, short time between the registrations of the landing, fishing location; moreover at Tasik Agung, an landing in the morning followed by another in the afternoon seems to be rather uncommon. The landing of these fishing units may have taken longer than usual. The investigator, using the files of the *buku bakul* may arbitrarily set up two investigations for one landing.

The observation of these combined investigations at the auction at Sarang is slightly different, as the fishing units may develop, daily, two types of tactics called *anggas* and *tendak*. They correspond to different choices of fishing aggregating device[10] (size, equipment, lifespan, fishing place; Jung, 1998). The former takes place at night and the catches are landed in the morning; the latter takes place during the day and the landing takes place in the afternoon. Some daily multiple investigations correspond to the series of the two tactics within a day. In 1995, 245 investigations involving 119 cases of multiple investigations were observed at Sarang, that is to say about 3% of the total of the investigations. If this bias slightly reduces the estimation of the total yield, on the other hand it interacts with the yield by marketing category.

Among these 119 observations, 40% correspond to changes of tactics within the day. Time proximity of the multiple investigations indicates that the remaining 60% are due to copying errors by the investigator who justifies two investigations when there most probably is only one. For the following handlings the description of two investigations within a day at a same location is therefore taken as only one day of activity, the objective being the validation of the activity diagrams. On the other hand this correction will have to be discussed for other analysis, particularly the ones opposing tactic *anggas* to tactic *tendak*.

The analysis of the few multiple daily investigations conducted at Tayu (1 observation), Eretan Wetan (4), Pekalongan (20) and Kranji (19) draws the same conclusion: the grouping of the investigations whenever there are only one landing location. In the study of fishing activities, only the first investigation is taken into account.

[10] Fishing aggregating device called *rumpon* in Indonesian.

* Landing on different investigation locations

The presence of one unit in at least two different locations is first considered as a major error invalidating the investigation of the fishing activity. This case is observed slightly less than a hundred times in 1995 (0.4% of the investigations conducted) and concerns about fifty fishing units. Some descriptions are made impossible due to the distance between the two points. Others might eventually be given, as some TPI are only distant from 40 to 50 km. Among the fifty fishing units, 34 correspond to:

- either units usually well individualized but belonging to a family of composed names (*Sumber Baru* 1 to 14) a mix-up with two unit numbers may explain the problem;
- or units allowing uncertainty to persist on their individuality status.

These investigations are invalidated for the analysis of fishing activity, therefore the choice of treating this case as a major error remains.

4.3. Study of the double information landing-presence at sea

During the investigations, some investigators give a parameter called "Number of days spent at sea". This parameter was systematically registered at Sarang, at Tasik Agung and at Tayu for the first seven months of the year. Unfortunately the information cannot be fully compared for the three locations.

At Tasik Agung[11], the fishing outing is mainly defined as leaving in the afternoon, spending one or two nights at sea and coming back early morning to unload and sell the catches. For a well-identified unit, code 'TAA*', which represents 1.3% of the observations, should not be observed in an activity chart, for it would mean that a fishing unit unloading its catch one day is registered the day after in a new investigation as fishing two nights in a row. The situation "only one night at sea" does not cause any problem as it means a departure in the afternoon and coming back the following morning, this sequence may be repeated several days in a row.

At Sarang, the outings at sea lasting more than 2 days represent 7.5% of the investigations. It describes two different situations depending on whether the fishing units were registered for a *tendak* or *anggas* outing. The *tendak* outings only can exceed two days (13.7% of specific observations). This sends us back to the study of these two outing tactics.

At Tayu, the outings exceeding two nights represent about 2% of the observations.

This difficulty of interpretation may have several explanations; the first would take into account the possibility of having a fishing unit sell another unit's catches (Luong, 1997). The unit concerned would then remain at sea for an extra fishing night without having to commute from its fishing location to its port. For its captain, this unit is considered as having spent at least 2 nights at sea, whereas according to the TPI it landed twice.

Another explanation may be linked to a succession of different landing places. For various reasons, a captain may choose to say that he spent only one several-day outing at sea, especially if his last catches landing takes place at the unit's port of origin.

Such a problem is considered a small bias if it is not observed on a same activity diagram on the one hand (eventually associated with actual errors) and on the other hand when the various auction places are close enough.

[11] At Tasik Agung, between December 16th and December 22nd, a night was withdrawn for the data of this period.

5. Calculation mode of the activity

The number of potential working days is calculated for each fishing unit. This number corresponds to the period between the first and the last investigation conducted in the year. The activity period in 1995 was recorded without including the days known as showing no activity; these days are defined as days without the slightest observation of landing of mini seiners, whichever the PTI (Ecoutin and Dharmadi, 1998). According to this article, in 1995, eleven days are reported without the slightest activity for this fleet: one day in January and February 6 in March and 3 in December. However, the authors bring to attention the fact that, in 1995, 40 days may be considered as days with low or no activity at all, but the calculations are made on a basis of 11 days without activity.

First, the activity is calculated in two complementary ways: on the one hand by the calculation of the investigation rate defined as the ratio of the number of validated investigations to the number of potential working days; on the other hand by the estimation of a total ratio of activity defined as the proportion of nights at sea[12] compared with the total number of nights that could be spent at sea. For the calculation of the global activity rate, the number of days with a priori validated landing is taken into account as well as the days with the observation of double landing at a same landing place (therefore validated a posteriori) and the days unquestionably spent at sea.

Three types of variables are decided on to analyze the activity of the inshore mini seiners of the Java Sea:

- descriptive variables: name of the fishing unit, number of months of observation in 1995, number of landing places observed in the year, number of registered villages of origin, number of potential working days,
- informative variables: those are different parameters described above: number of investigations conducted, number of validated landings, of days at sea, of days with discrepancy, ...
- synthetic variables: those are the proportions calculated between the informative variables, the calculation of the investigation rate and the rate of global activity.

Results: analysis of the fishing activity of the seiners fleet

Following the different choices resulting from the analysis above (proofreading of the names of the fishing units, withdrawal of the composite units, adding up of the multiple investigations conducted on a same location, specific study of the time spent at sea according to each location, yearly number of observations exceeding 20, ...), the reference file is composed of 197 fishing units

The average global rate of activity calculated from this population is 19% lower for an interval ranging from 5 to 46%. At this level of the analysis, the fishing units would be active less than one day out of five and they would land every eight days.

To continue the analysis on the fishing activity, some specific cases are selected from the database. The units chosen are then studied case by case to interpret the time sequences of the activity described. It is at this stage of the analysis that the results of the various censuses conducted on this fishing fleet in 1995 (Jung, 1998; Jung and Ecoutin, 1999) may be used. They allow the interpretation of the activity diagrams and the validation of the resulting rates.

[12] The fishing operations take place almost exclusively at night.

1. Units landing in 5 different locations

In 1995, three units[13] respecting the identification criterion landed their catches at least once in five different ports. They were investigated over 80 times during the year and observed in the same five villages (Sarang, Tasik Agung, Tayu, Pekalongan and Eretan Wetan, fig. 2).

Although they were first considered as non-composite units in the activity file, the analysis of the activity schedule of these units, together with information from the censuses, requires reconsidering the status of two of them[14].

Example n.4: unit *Sumber Urip*, observed 99 times during the year presents time sequences of landing places which are hard to explain (see the one given from May 26th to June 3rd). It can not possibly land its catches the same day or with a 24-hour interval at Pekalongan on the one hand and Tasik Agung on the other hand (fig. 2). Moreover, its activity diagram points out that 6% of the observation consists in major discrepancy, throwing a doubt on its status of uniqueness. The further information from the auction at Batang puts the error rate at 23%. The analysis of the censuses file points out the existence of three units spotted under the same name; if one of the three is not involved in our study zone, because observed in the South of Madura Bay, the other two, originated, one from Sarang (Central Java), the other from the province of East Java, must be part of our activity sampling. The merging of the information regarding two fishing units is most probably responsible for these difficulties of interpretation; the analysis of the information collected only at auctions of Rembang Bay produces a legible activity diagram.

Only one unit of this selection seems to meet the criteria allowing the study of the inshore seiners fishing activity, it is *Jaya Sakti*, originated from Sarang. Only one investigation conducted at Eretan Wetan, on February 23rd, might cast doubt on the uniqueness of this fishing unit; this observation is noted down in an activity sequence in Rembang Bay (fig. 2). This unit listed as one and only, originated from Sarang, is taken into account as not composite and the investigation conducted at West Java is invalidated. Once this correction is accepted, the activity global rate may include the days involving landing together with an indication of presence at sea (cf. 1.4.3), this rate is then estimated at 29%.

2. Units landing in four surveyed villages

A few units were observed at four different auction places during 1995. Two of these locations, Sarang and Tasik Agung, are always represented and constitute the majority of investigations forming the activity diagrams. The other three (Pekalongan, Eretan Wetan and Tayu) of close importance in numbers of described units, present two patterns: at Tayu, the units land alternately with the two main villages; for the two other ports, the activity diagram describes either one or two yearly observation of presence within a pattern centered on the two main ports, or a time sequence superior to one month.

Three validation outlines are identifiable for the six units in this case:

- two units must be interpreted as composite units[15] as, in the censuses file, they refer to more than three fishing units presenting the same identifier (*Barokah*, *Jati Kembar*);

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[13] A fourth fishing unit should have integrated this selection, unit *Rahayu* , which is observed at Eretan Wetan, as a mini seiner unit as well as a unit *chantrang*. From the results of the landing in this port, this fishing unit is considered as a *chantrang* and therefore withdrawn from the lists. Moreover, during each census, at least nine units *Rahayu* are well identified as inshore mini seiners.

[14] *Sumber Urip*, *Usaha Jaya* and *Sumber Jaya*.

- a second group is composed of fishing units that are individualized clearly during the censuses: they pointed out the presence of two units under the same identifier; one of these units is generally listed in the Tasik Agung- Sarang sector, and the other is observed in the West of Pekalongan, but often originated from East Java province (*Eka Jaya*, *Mulyo Jaya*). This concurs with the example described with *Sumber Urip* (example 4). The presentation of two different activity diagrams allows a better legibility of the information.

- finally a last group is formed by units identified as unique during the censuses, without major discrepancy in their activity sequences, but with one or two observations of presence in an inexplicable location during one of these periods. These few observations are invalidated in the activity diagram (*Mekar Jaya 3* and *Sumber Hidup*).

3. Units describing the highest activity rate

Out of the whole reference file, 18 fishing units present a validated activity rate superior to 30%. Among these eighteen seiners, three probably represent composite units that could not be spotted before: time sequence of landing on distant locations, high rates of major errors, steady indications of discrepancy and multiple daily investigations (*Nusantara*, *Sumber Baru 1*, *Sumber Baru 3*).

Among the remaining units, seven represent a perfectly legible activity diagram; these diagrams are confirmed by the information on the censuses, indicating the status of unique identity of the fishing unit. The other eight units are adopted as representative units, but give in their activity diagrams some information that is hardly consistent with the rest of the diagram: one fatal error in a diagram, in fact quite legible and confirmed by the censuses; the presence of the fishing unit, once or twice during the year, in zones that are far away from the main landing sector. Removing one or two investigations from a group of hundred by unit makes the activity diagram perfectly understandable. This type of validation was presented for unit *Jaya Sakti* (above).

Fifteen fishing units were finally adopted (tab. 4). In 1995, they were under investigation between 3 to 12 months; five units were registered within eight months or less, the other ten were observed during nearly the whole year. Their validated activity rate (column %act tab. 4) ranges from 30 to 46% for investigation rates ranging from 22 to 35% (%invest, tab. 4).

The average activity rate calculated for the validated fishing units, the most active of our group of fishing units, is on the order of 36%, which means that these fishing units were at sea one day out of three in 1995. Seasonal variations may be observed around this average (tab. 5). The average monthly values go through two optimum: on the one hand in March-April, on the other hand from July to November with a value superior to 40% in September.

[15] A composite unit describes a boat whose denomination corresponds to the identification of several actual units without possible selection among these fishing units.

Table 4: *Main parameters describing the activity of the most active fishing units (15 validated units, 3 invalidated units, see text)*

Name of the fishing units	Invest	month	place	origin	landing	at sea	day	m.d.i	%act	%inv	discr
Agung Jaya	77	12	2	3	69	26	348	10	30	22	0
Akas Baru	93	11	2	1	78	41	318	12	41	28	0
Bentul	91	12	2	1	74	24	342	11	32	27	1
Bintang Hikmah	75	12	2	1	67	33	343	6	30	22	0
Jawa Pos	87	8	1	Unkn	87	0	245	0	35	35	0
Liberal	25	3	1	1	23	4	73	2	39	34	0
Maju Mapan	94	12	3	3	82	32	351	7	35	27	0
Manteb	70	8	1	1	66	23	221	4	42	32	0
Othak	36	4	1	1	30	9	118	5	37	31	0
Perkasa	91	12	2	1	71	37	346	18	36	26	1
Sumber Baru 14	37	4	2	1	31	12	106	6	46	35	0
Sumber Baru 5	106	12	3	1	89	20	348	12	34	30	3
Sumber Hidup	84	12	3	1	66	30	351	14	31	24	1
Tambah maju	86	12	2	1	66	30	343	17	32	25	0
Usaha Jaya	91	12	3	1	84	23	349	7	33	26	0
Sumber Baru 1	142	12	3	1	98	24	353	22	40	40	8
Sumber Baru 3	161	12	3	1	96	16	352	31	40	46	11
Nusantara	109	12	3	3	71	26	351	22	33	31	7

Table 5: *Seasonal variation (in%) of the activity rate of the 15 validated units*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Agung Jaya	37	26	8	43	45	23	29	29	47	26	20	18
Akas Baru		48	40	20	29	30	48	**71**	**50**	39	43	25
Bentul	10	26	40	27	35	20	48	32	43	35	23	32
Bintang Hikmah	10	22	28	43	19	10	35	45	40	48	43	11
Jawa Pos			32	43	42	17		32	**53**	48	27	
Liberal										26	**50**	21
Maju Mapan	43	26	40	23	23	23	32	35	27	35	43	46
Manteb					13	27	39	45	**53**	**52**	43	29
Othak									47	35	40	21
Perkasa	40	26	40	**50**	35	40	23	45	23	39	47	21
Sumber Baru 14									40	35	37	**50**
Sumber Baru 5	33	22	24	37	26	13	35	39	47	48	37	**57**
Sumber Hidup	27	30	**68**	37	29	27	29	19	23	35	37	18
Tambah maju	3	22	**60**	13	32	10	32	45	**57**	39	43	29
Usaha Jaya	30	18	44	30	32	30	42	35	40	23	23	39
Average	26	27	39	33	30	22	36	39	42	38	37	29

3.1. The example of *Akas Baru*

Akas Baru (example n.5) is the typical example of a fishing unit noted down in the village where it lands its catches: during the 11 months of known activity, 97% of the landing are observed at Sarang without the slightest discrepancy or serious error. The average rate of activity in 1995 (the month of January not taken into account) is of 41% and it lands about one day out of four. Its monthly activity changes from 20% and 71%, this figure being the highest monthly value noted in 1995 for a fishing unit. During these activity months we may observe 66 periods without investigations, lasting from 1 to 18 days. These periods without investigation may be observed every month at the rate of 4 to 9 times a month and the average length of this halt is on the order of 3 days; two thirds are inferior to this average. Most

periods without activity is very short with a few longer periods, some of which correspond to the general non-activity period of the fleet (Ecoutin and Dharmadi, 1998).

The activity diagram for the fishing unit *Akas Baru* serves as an example for 6 other units of the selection studied[16]. These units are observed six times out of seven in the port of Sarang, originated from the same auction place. The seventh case, which lands almost exclusively at Tasik Agung, is originated from Kragan.

These fishing units correspond to units whose village of origin is identified either the landing investigations or during the censuses. Almost all their landings are carried out at the same auction throughout the year and it mainly concerns the auction place of the unit village of origin: however the unit may change its landing place to an auction place closer to its usual spot, which is observed in at least 10% of the investigations.

Following his study in 1997, Jung (1998) describes a type of fishing strategy under the term strict *tetap* strategy that might correspond to the results described above. For this author, "units using a strict *tetap* strategy have a steady and uniform fishing activity throughout the year, with a fishing rhythm based on one or two nights at sea, without distinction of lunar phases".

3.2. Unit *Sumber Baru* 14

This fishing unit (example n.6) is originated from Pandangan like all the units named *Sumber Baru*; it was never noted down in a census before November 1995 whereas in June units *Sumber Baru* 1 to 12 were all seen. It must be a new fishing unit. During the last four months of the year, it shows a steady activity close to 47%. During this activity period, *Sumber Baru* 14 shows 18 periods without investigation for an average halt of 3.3 days. As for the previous unit, the short-timed periods are dominant (75% under average). The interesting point of this unit is its landing time sequence at Tasik Agung and at Banyutowo. This example shows how easy and fast it is to change landing place , the locations never being far one from each other.

The activity diagram of this unit is representative of the diagrams established for 5 or 6 units of our sampling[17]. These fishing units are originated from different villages of this part of the coast: they land their catches according to the exploited fishing zones. In his study, Jung notes down this type of strategy under the term *tetap pindah pindah.*

3.3. Unit *Jawa Pos*

This fishing unit, originated from Weru (example n.7) is noted down in the census in its village of origin beginning of March 1995, then it is observed in activity exclusively at the auction place at Pekalongan. It goes out 5 to 16 times a month during its months of activity: from mid-March to June, from August to November. This fishing unit has the feature of spreading its activity depending on a lunar cycle; it goes out at sea only from the sixth or seventh day after the full moon until the 20th or 21st day of the cycle. During these activity phases, it works almost every day. If the monthly activity rate is inferior to 50%, it strives to 100% in the activity phase linked to the lunar cycle. While at Pekalongan, *Jawa Pos* shows only one or two halts a month, one of them, the one centered around the full moon lasts from 14 to 16 days.

The story of this unit in 1995 is that of a migrant unit originated from Weru (East Java); during two four-month periods, it operates in the fishing zones close to Pekalongan and it goes back to its village of origin during the rainy season and *Lebaran,* both periods merging

[16] *Bintang hikmah, Bentul, Liberal, Manteb, Othak, Perkasa.*
[17] *Agung Jaya, Maju Mapan, Sumber Baru 5, Sumber Hidup, Tambah Maju* and *Usaha Jaya.*

in 1995. According to the interviews conducted during the censuses, the crew of a migrating unit takes advantage of the inactivity period of 14 to 16 days, centered on the full moon, to go back to their villages. They go back by road as the boat is moored at the fishing activity port. July is a month of low activity of this unit at Pekalongan and corresponds to the season between the rainy season and the dry season, it is a period of high hydroclimatic activity (strong winds and currents, Durand and Petit, 1995).

This activity cycle, modeled on the lunar cycle, has already been described for the whole of the activities observed at Pekalongan (Ecoutin and Dharmadi, 1998). This activity diagram applies to the fishing units landing at Batang. The sampling plan established for 1995 makes it possible to spot well-identified fishing units, among which *Jawa Pos* is the typical example:

- activity cycle modeled on the lunar cycle,
- 17 to 20 days of steady activity and 10to 12 days off,
- two main yearly activity periods from mid-March to mid-June and from mid-August to the beginning of November; some units are observed before the first period or after the second one, but it is rather uncommon,
- steady daily landing in different ports of Central Java or West Java during the seasonal migration,
- landing of the catches mostly in the same location during a lunar cycle,
- activity diagrams never describing difficulties of interpretation or major errors, the observed investigations correspond to the validated investigations,
- the boats used by these units are mainly kranji-shaped (Ecoutin *et al.,* 1997)
- units generally originated from the area of Lamongan.

Further to interviews conducted in 1997, Jung (1998) describes a diagram of migrating fishing units originated from this part of the province of East Java; these units head towards a port located in the province of Central Java, West Java or even South Sumatra. These fishing units operate according to the lunar cycle; Jung uses the Indonesian word *amen* to name this diagram.

4. Discussion

Despite a description of various biases and after discussion on the activity modes of the seiners, the highest activity observed in our inquiries never exceeds 50%. Our results are quite different from Jung's (1998) following the interviews conducted with the captains and owners of Javanese inshore seiners. According to Jung, the number of activity days during the month would be of 211 for the *tetap* type units and 188 days for the strategic *amen* units that is to say activity rates of respectively 72 and 65%.

Adding up the activity schedules of the whole of the migrating units investigated in 1995 to remove some individuals, the number of activity days is about 110 days. There is no observation of fishing outings for the period starting on November 20th and ending on February 20th; from February 20th to March 20th, from June 30th to August 15th and from November 1st to November 20th, the number of inquiries conducted seems to point out a lack of activity; from March 20th to November 1st, 10 days a month are days off. The difference between the value observed in 1995 (110 days) and the results gathered in 1997 (188 days) may be the fact of not taking into account the activity of a migrating fishing unit coming back to its village of origin; this period of presence in the village of origin is included between December and March; it corresponds on the one hand to the three inactivity sequences observed for the inshore mini seiners fleet (Ecoutin and Dharmadi, 1998), on the other hand to the winter monsoon season, time when the fishermen are less active. The difference of 70-80

days of activity seems too big to correspond only to the activity of the unit once back at its location of origin. The study of the 1995 data based on the adding up of fishing activities, the results involve only the most active migrating units, that is to say landing every day catches registered at an auction place, which makes an even bigger difference between the data.

The comparison of the results collected for the strategy *tetap* units (sedentary) is more difficult to establish. If we seem to have observed that some units describe a strict strategy *tetap* nothing can prove that no information means no activity; it might correspond to:

- unloading at auction places that are not under investigation, which would be contrary to the notion of fishing units with strict strategy *tetap* as described by Jung and confirmed here,
- unloading in the village under investigation, but not passing through the auction: low value landing, sale to a privileged buyer (Luong, 1997; Jung, 1995),
- no actual fishing outing, inactivity linked or not to the maintenance of the fishing unit.

Therefore the problem lies at the level of the estimation of the second proposition. The difference observed between the two sources of data is still quite important; in 1995, very few units describe a monthly validated activity rate equal or superior to the average rate calculated from the observations collected in 1997 (67%, a value reconstituted with the figures provided).

Comparing the two series of data is difficult for the units using a *tetap pindah pindah* strategy as the very definition of the strategy might explain the lack of information.

Elements of comparison

One comparison with close studies either in term of geographic zone, or in term of similar fishing techniques, may allow to put the results into perspective.

Pet *et al.* (1997) worked on a study on the coastal seiners of East Java area. Part of their data comes from the seiner fleet operating in Madura Bay and landing at Probolinggo (East Java). This fleet was taken into account during the 1995 censuses (Ecoutin *et al.*, 1997; Jung, 1998; Jung and Ecoutin, 1999). By reconstituting the information from the effort estimations provided by the District Fisheries Service in Probolinggo, the yearly activity would be of 44% for units going on one night fishing outings. This effort estimation is calculated from the average number of fishing units observed on a given day in the port of this province. Moreover, the official statistics come up with a total effort of 5,000 outings for 1993. Given a population estimated between 40 to 70 units[18] (Pet *et al.*, 1997), the activity rate would range between 20 to 35%, data similar to the observations collected on the North Coast of Java Island.

For the period between 1965 and 1967, Unar (1988) reports a yearly activity estimated to 169 days for a fleet of fishing unit using *chantrang* nets (identical to a Danish seine). It operates on the seabed between 5 to 30 meters in the Batang zone (Central Java). It represents a 46% activity rate. This figure is only slightly higher than the values above mentioned for the most active units. Unar has followed a small number of fishing units, all of new construction, registered in a fish cooperative; this activity may correspond to fishing

[18] The 1995 census provides the same kind of figures, between 48 and 71 units observed.

units of an active type: wish to reimburse the investment, coming up of a new fishing technique leading to the exploitation of a new option,...

At Pekalongan (Central Java area), the activity of a sampling of fishing units using gillnets is estimated at 132 days in 1993 (44 outings with an average of three-days outings, Wiratno and Mudiantono, 1995)

Although they are scattered and fragmentary, the three Indonesian studies give estimations that are of the same kind as those provided for the units estimated as the most active.

In the Ivory Coast, a seven-year study described a rather similar fleet in terms of fishing device, as it refers to purse seines (Ecoutin, 1992). The yearly effort of this unit, effort calculated on the whole fleet, ranges from 120 to 150 outings. But reported to an individualized fishing unit that is active throughout the year, this average effort is then superior to 190 outings, that is to say a rate of about 62%.

In Guinea, several traditional fishing fleets were investigated upon early 1990. The yearly estimated outing and activity rates are presented table 6. They are average values calculated for fleets composed of 50 to 200 units. Outing rates different from activity rates show that the fleet concerned goes at sea for several days and therefore, in terms of activity, the time spent at sea is taken into account.

Table 6: *Average activity values observed in 1991-1993 for a few traditional fishing units in Guinea (data not published)*

Type of fleet	Number of outings	Outing rate	Activity rate
Purse seine	197	54%	54%
Purse seine	131	36%	36%
Fixed gillnet	53	14%	53%
Fixed gillnet	149	41%	41%
Encircling gillnet	229	63%	63%
Hand line	48	13%	70%
Hand line	72	20%	33%

Discussion

The main problem raised by the results provided for the fifteen most active units in 1995 is linked to the low activity rate values. The few comparative values given above show the problem since the comparison applies to maximal observed values following our sampling protocol in Indonesia and to average values for the other fleets.

For the fifteen units, a monthly activity superior to 50 % is observed only twelve times (tab.5). During an activity month, there may be many days off, in the order of one out of three days for the migrating units, more for the sedentary units. These days off include halts linked to maintenance (boat, engine, net). But what can be thought about the activity of the other months? Does the lack of information on the activity for a given month mean actually no activity or a mere lack of information?

For example, what does the lack of information for the *Jawa Pos* unit in June-July mean (example n.8)? Is it or is not it inactive? June is a month submitted to strong winds therefore with low yields; does the yearly attitude of the unit match the attitude linked to the lunar cycle? Has it migrated to another landing place with better environmental conditions?

Two main hypotheses may be discussed to explain the poor activity:

- The values observed are close to the reality; the individual activity is low, in the order of one working day for an average of two days off. This hypothesis may be reinforced by the observations on the other Indonesian fleets (Unar, 1988; Wiratno and Mudiantono, 1995; Pet *et al.*,1997). This low activity concerns seasonal variations too. The months when the environmental conditions are unfavorable, the activity is lower, not to say nil. In this case, how can we interpret units whose activity observed is inferior to 15%? What is their economic yield if this parameter is decisive in the fishing unit management? What are the social consequences for crews that work at best one day out of three and who land catches at best one day out of five? In this hypothesis, the pattern of allotted time of the fishing activity would be a rare and unique case of limitation of the fishing effort in the world of small scale fishery.

- The units observed in 1995 can land their catches at auction places that are not being investigated; concentrating our investigation only on some auctions would therefore minimize the values described. This could be the case of migrating units originated from Lamongan area and which during their four months of presence in their village of origin (December-March) would go out at sea from their respective villages. We may consider as well that the units originated from Pandangan (Rembang), even though they land regularly at Tasik Agung would sometimes land in their port of origin.

A variant of this second hypothesis would be that the units may not have all their fishing outings systematically registered at the TPI: low result of the outing, privileged commercial circuits, keeping off the TPI to avoid taxes,... all sorts of biases that have direct consequences on the yield estimation and on the fishing units activity.

Bibliography:

Durand J.R. and D. Petit, 1995.The Java sea environment. *in:* BIODYNEX: Biology, Dynamics, Exploitation of the Small Pelagic Fishes in the Java Sea. Potier M. and S. Nurhakim (eds), AARD/ORSTOM: 15-38.

Ecoutin J.M., 1992. La Dynamique des flottilles en pêche artisanale: l'exemple des sennes tournantes de Côte-d'Ivoire. Thèse d'université, Montpellier USTL, Etudes et thèses, Paris, ORSTOM, 208 p.

Ecoutin J.M., S.B. Atmaja, M. Potier and Wijopriono, 1997. Description of the small seiner fleet in the Java Sea. *Indonesian Fisheries Research Journal*, 3: 47-63.

Ecoutin J.M. and S.B. Atmaja, 1999. Catches of the Javanese mini seiners fleet: the main fishing statistics. Java Sea Pelagic Fishery Assessment Project, *Sci. and Tech. Doc.*, 31: 5-55.

Ecoutin J.M. and Dharmadi, 1999. The mini seiner fleet of the Java Sea, a first approach to their fishing activity. Java Sea Pelagic Fishery Assessment Project, *Sci. and Tech. Doc.*, 31: 76-90.

Hariati T., M.M. Wahyono, Suwarso and D. Krissunari, 1995. North Java coast fisheries: preliminary observations on small seine nets exploitation. *in:* BIODYNEX: Biology, Dynamics, Exploitation of the Small Pelagic Fishes in the Java Sea. Potier M. and S. Nurhakim (eds), AARD/ORSTOM: 185-194.

Jung A., 1998. Typologie des Mini-senneurs de la Mer de Java (Indonésie): dynamique d'une flottille artisanale. Mém. DESS 'gestion des ressources vivantes côtières', Univ. Basse-Normandie (Caen, France), 132 p.

Jung A. and J.M. Ecoutin, 1999. The dynamic of the Javanese coastal seiners fleet according to the 1995 censuses. Java Sea Pelagic Fishery Assessment Project, *Sci. and Tech. Doc.*, 31: 56-75.

Luong, N. 1997. The fishing harbour of Brondong (East Java, Indonesia). Java Sea Pelagic Fishery Assessment Project, *Sci. and Tech. Doc.*, 30: 68 p.

Pet, J. S., Van Densen, W. L. T., Machiels, M.A. M., Sukkel, M., Setyohadi, D., Tumuljadi, A., 1997. Catch, effort and sampling strategies in the highly variable sardine fisheries around East Java, Indonesia. *Fish. Res.*, 31: 121-137.

Unar M., 1988. The "chantrang" danish seine fishery of the North Coast of Java. *Proc. Indo-Pacific Fish Coun.*, 13(III): 546-553.

Wijopriono, J.M. Ecoutin, S.B. Atmaja and J. Widodo, 1996. Heterogeneity of mini purse seine net fleet in Java Sea. Fourth Asian Fisheries Forum, Beijing, China, 16-20 October 1995, Java Sea Pelagic Fishery Assessment Project, *Sci. and Tech. Doc.*, 25: 46-51.

Wiratno and Mudiantono, 1995. Cost and returns analysis of gillnets and purse-seine in Central Java, Indonesia. *in*: Proceedings of the 7th conference of the International Institue of Fisheries Economics and Trade, Liao D.S. (eds.), Taiwan, 1: 53-64.

Example n.1 *Tambah Sumber*

I. Data from auction places

Ports of investigation	origin	Number of investigations	month
BAY		6	2
SAR	PAN	2	2
TAA	KRA	14	6
TAA	PAN	55	12
TAA	SAR	3	2

Day	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	TAA			TAA								
2				TAA			TAA	TAA		BAY		
3		TATA		TAA			TAA			BAY		
4						TAA			TAA			
5												
6									TAA			
7	TAA											
8												
9					TAA							
10					TAA			TAA				
11			Sea	TAA				Sea		TAA		
12			TATA			TAA		TAA	TAA*	TAA		
13						TAA			TAA			
14											TAA	
15							TAA	TAA*		TAA*	TAA	
16								TAA		TAA	TAA	
17				TAA		Sea			BAY			Sea*
18						TAA	TAA	TAA				TAA*
19		TAA*						TAA	TAA			TAA
20		SAR					TAA					
21									BAY			
22					TAA		Sea					
23		TAA				TAA	TAA	TAA				
24			TAA	TAA		TAA		TAA				
25			TAA	TAA			TAA		BAY	TAA*	TAA	
26							TAA			TAA		TAA
27	Sea							TAA				
28	Sea						TAA					
29	SAR						TAA	TAA			TAA	Sea
30			TAA	TAA				TAA	BAY		TAA	TAA
31			TAA									

Recorded landings: 80

II. Data from censuses

This unit was observed at Pandangan during the 1995 censuses on the 10th of March, the 15th of June and the 8th of November.

Example n.2 *Akar Sakti*

I. Data from auction places

Ports of investigation	origin	Number of investigations	month
BAY		1	1
SAR	SAR	74	12
TAA	SAR	2	2

Day	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1								SAR	Sea	SAR		SAR
2	Sea			SAR					SASA		SAR	
3	Sea											
4	SAR	Sea				Sea		Sea	Sea	SAR*		
5	Sea	Sea				SAR		SAR	SAR	SASA		
6	Sea	SAR									SAR	
7	SAR											
8									TAA			
9										SAR		
10				SAR					SAR		SAR*	
11	SAR		Sea	SAR							SAR	
12			SAR							SAR		
13			Sea							Sea		
14			SAR			SAR		SAR		SATA		SAR
15									SAR			
16											SAR	SAR
17		Sea					SAR				Sea	
18		SAR		SAR					Sea	SAR	SAR	
19									SAR	SAR		
20								Sea			SAR*	
21								****	SASA		SAR	
22								SASA				
23			Sea						SAR		SAR	
24			Sea		Sea						Sea	Sea
25			SAS*		SAR			Sea	SAR	SAR	SAR	SAR
26			SAR				SASA	SAR	SAR			
27						Sea				SAR		
28			Sea			SAR	SAR	Sea				SAR*
29	Sea		SASA					SAR		Sea	SAR	SAR
30	Sea									SAR	Sea	
31	SAR				SAR							

Recorded landings: 77

II. Data from censuses

This unit was observed at Sarang during the 1995 censuses on the 10th of March and the 15th of June.

Example n.3 *Hasil Laut*

Ports of investigation	origin	Number of investigations	month
BAY		1	1
SAR	SAR	139	12
TAA	SAR	45	10

Day	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	****			TAA				SAR*				
2	SAS*			TAA				Sea	SAR*	SAR	SAR*	SAR
3	Sea*			TAA		TAA		SASA	SAR	SAR	SAR	
4	SAR*				Sea				****			
5	SAR				SAR	TAA	SATA		SATA	SAR		
6		SAR*				Sea		Sea			SAR*	
7	TAA	SAR				BAY	SASA	SAR*			SAR	
8							Sea	SAR			SAR	
9			Sea	Sea			SAR					
10			SAR	SAS*		TAA	Sea*		SAR	SAR		
11			Sea	SAR*		TAA	TATA	Sea*		SAR		
12			****	SAR		TAA	SAR	****				
13			****	SAR			Sea	Sea	SAR	Sea	SAR	SAR*
14							SAR	SAR*	SAR	SAR	TAA	SAR
15		Sea*						SAR*			SAR	
16		SAR*					Sea	SAR*	Sea	SAR*		
17		SAR					SAR	SATA	TATA	SAR	SAR	
18		Sea		SAR		TAA	SAR		TAA		SAR	SASA
19	Sea	Sea							TAA*	SASA		
20	SAR*	SAR*				TAA		Sea*	TAT*	SASA	SAR	
21	SAR	SAR	Sea					SAS*	TAA		Sea	
22		TAA	SAR			Sea	Sea	SAR*	Sea	SAR	SAR	
23		****	SAR*			SAR	SAR	****	SAR	SAR	SAR	SAR
24		SAR*	****		TATA	SAR*	SAR	SAR	SAR	SAR		SAR
25		SATA	****			SASA		TAA		SAR	TAA	
26	Sea	*****	SAR*		Sea		Sea	Sea	TAA	SAR		SAR
27	Sea	Sea*	SAR*		TAA	SAR*	SAR	****	TAA	SASA	SAR	SAR
28	SAR*	SASA	****			TATA		****	SAR	SAR		
29	Sea		SAR*		TAA	SAR	SAR	SAR*	Sea		TAA	
30	SAR		SAR		TAA		Sea	****	SATA	Sea	SAR	Sea
31							SAR	SAR		SATA		SAR

Recorded landings: 185

Example n.4 *Sumber Urip*

I. Data from auction places

Ports of investigation	origin	Number of investigations	month
BAY		4	2
ERW		4	3
PK		33	6
SAR	SAR	42	11
TAA	SAR	16	8

Day	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	PK *			PK		PK		TAA		TAA		
2	SAR			PKPK		PK			ERW	SAR		
3				PK		TAA		Sea	ERW		BAY	
4				PK				TAA	SAR			
5								Sea		Sea		
6					TAA			SATA		SAR		
7	PK										ERW	
8							SAR		SAR			
9								TAA				
10	Sea										SAR	
11	TAA							SAR*	SAR	Sea	SAR	
12								SASA		SAR	Sea	
13			Sea				TAA				SAR	
14			Sea	TAA						SAR*	SAR	
15			SAR					Sea		SAR		
16								SAR		SAR		
17		Sea								ERW	SAR	
18		Sea										
19		SAR							Sea	Sea		
20									SAR*	SAR		
21									SAR			SAR
22					PK				Sea		BAY	
23			PK	PK	PK	SAR			SAR	Sea		
24			PK	PK		TAA*				TAA		
25			****	PK		TAA*			SAR		BAY	
26	Sea		****		PK	SAR						
27	Sea		PK *	PK	TAA		SAR	PK	Sea	BAY		
28	SAR		SAR*		SAPK		SAR	PK	SAR			
29	TAA		SAPK	PK	PK			PK				Sea
30			SAR*		SAR				Sea			TAA
31			SAPK		PK							

Recorded landings: 99

II. Data from censuses

From the 3 censuses, a first unit was observed on the 7th of November at Ngemplak originated from Ngemplak. A second unit was observed at Pekalongan on the 9th of March and the 11th of November, originated from Pekalongan. The third unit was seen at Weru (East Java) the 9th of March and at Kalimenir (West Java) the 12th of November originated from Weru.

Example n.5 *Akas Baru*

I. Data from auction places

Ports of		Number of	
investigation	origin	investigations	month
SAR	SAR	91	11
TAA	SAR	2	2

Day	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1								TAA			SAR	
2							SAR					
3						TAA			SAR		SAR	SAR
4		Sea					Sea	Sea		SAR		
5		SAR					SAR	SAR				
6					SAR	SAR		Sea		Sea		
7							SAR	SAR	Sea	SAR	SAR	
8					SAR				SAR			
9				Sea			Sea	Sea			Sea	
10		Sea		SASA			SAR	SAR		SAR	SAR	
11		SAR	Sea		SAR							
12			SAR					Sea				
13						SAR		SASA		SAR		
14					SAR							
15		SAR	SAR				SAR					
16		Sea					Sea	Sea				
17		Sea					SAR*	SAR		SAR	Sea	
18		SAR		SASA	Sea		SAR		Sea*		SAR	
19					SAR		Sea		SASA			
20		SAR*		SAR			SAR	Sea	Sea	Sea	SAR	
21		SAR	Sea			Sea	SAR	SAR*	SAR	SAR		
22			SAR			SAR		SAR	Sea			SAR
23		Sea*	Sea		SAR	Sea		Sea	SAR			
24		SASA	SAR			SAR		SAR*	Sea	SAR	SAR	SAR
25				SAR		SAR		SAR	SAR			
26				SAR			SAR					SAR
27		SAR			Sea			Sea	Sea	SAR		Sea
28			Sea		SAR	SAR		SAR*	SAR		SAR	SAR
29			Sea					SAR	Sea		Sea	
30			SAR					Sea	SAR	SAR	SAR	SAR
31							Sea	SAR		Sea		

Recorded landings: 93
After validation, the 5 multiple daily investigations ('SASA') are moved into simple investigations ('SAR').

II. Data from censuses

This unit was observed at Sarang during the 1995 censuses on the 10th of March and the 15th of June.

Example n.6 *Sumber Baru 14*

I. Data from auction places

Ports of investigation	origin	Number of investigations	month
BAY		7	3
TAA	PAN	31	4

Day	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1										TAA*		
2										TAA		Sea
3												TAA
4												
5												
6												
7											TAA	
8												
9												
10												
11									BAY	BAY	TAA	
12												
13												
14										TAA*	TAA	
15									Sea	TAA		Sea
16									TAA	TAA	BAY	TAA*
17									Sea	TAA	TAA	Sea
18									TAA			TAA
19											BAY	
20									BAY*	Sea	BAY*	Sea
21									TAA	TAA	TAA	TAA*
22									Sea	BAY*	Sea	TAA
23									TAA	TAA	TAA	
24												TAA
25												
26												Sea
27									TAA			TAA*
28									TAA		Sea	TAA*
29											TAA*	TAA
30									Sea		TAA	
31												

Recorded landings: 38

II. Data from censuses

This unit was observed at Pandangan during the 1995 censuses on the 8th of November.

Example n.7 *Jawa Pos*

I. Data from auction places

Ports of investigation	origin	Number of investigations	month
ERW		3	2
PK		87	8

Day	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1				PK	PK				PK		ERPK	
2				PK	PK	PK			ERW			
3				PK	PK				ERW			
4				PK	PK							
5				PK	PK							
6												
7												
8												
9												
10												
11												
12												
13												
14											PK	
15												
16									PK	PK	PK	
17									PK	PK	PK	
18									PK	PK	PK	
19									PK	PK	PK	
20									PK	PK		
21				PK		PK			PK	PK		
22				PK	PK			PK	PK		PK	
23						PK		PK	PK	PK		
24			PK			PK		PK	PK	PK	PK	
25			PK	PK	PK	PK		PK	PK	PK		
26			PK	PK	PK			PK	PK	PK		
27			PK	PK				PK	PK	PK		
28			PK	PK	PK			PK	PK	PK		
29			PK	PK	PK			PK	PK	PK		
30			PK	PK	PK			PK	PK	PK		
31			PK		PK			PK		PK		

II. Data from censuses

This unit was observed at Weru: on the 9th of March.

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By : Ecoutin J.M. and Dharmadi

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