

The mini seiner fleet of the Java Sea A first global approach to their fishing activity¹

Ecoutin J.M.² and Dharmadi³

Abstract: Fishing effort is often a difficult parameter to identify in fisheries studies and even more so if the study involves coastal fisheries spread along a coast more than 1,000 km long. This is the case of the study of the mini seiner fleet operating in the Java Sea. In order to estimate this descriptive parameter of the fishing effort, it has been suggested to use the method of calculating the average activity rate and at the expense of given on certain hypotheses, to translate these rates into estimates of the number of fishing trips.

This article offers a first global approach of the mini seiner fleet operating in the Java Sea from ports located on the north coast of the island of Java. It is thus demonstrated that this fleet's operating activities although more or less significant, were uninterrupted all through the year 1995, the landmark year for this study.

This study also describes the first reason for the heterogeneity of the fleet from the dynamics of utilization of the landing ports by mini seiner fishing units.

Keywords: fishing activity, purse seine, fleet dynamic, small-scale fishery, Java Sea, Indonesia.

From the definition by Poinsard and Le Guen (1975) adapted by Laurec and Le Guen (1981), the fishing effort applied to a stock of aquatic animals is a measure of all the different methods used to catch this stock by the fisherman during a specific time interval. This definition implies that one must take into consideration the number of vessels and their characteristics, the fishing gears used, the level of activity and the human capacities in play, etc (Laurec and Le Guen, 1981).

According to these authors, the fishing effort therefore corresponds to a quantification of the fishing activity in a time interval that relates to the exploitation of one stock or unit of management (Laurec and Le Guen, 1981) taking into consideration isolation and homogeneity hypotheses.

For coastal or small-scale fisheries, the study of the fishing effort is complicated by the heterogeneous nature of this fishing effort, by the difficulty of setting standards in order to integrate the different fleets of small scale fishery, by the relationship of this activity between

¹ This article was submitted to the Indonesian Fisheries Research Journal with a little different presentation.

² Address: IRD-HEA, PO 5045, 34032 Montpellier Cedex 1, France.

³ Address: RIMF Jl. Muara Baru Ujung, Jakarta 14400, Indonesia.

different target species and a sharing of the stocks between small-scale and industrial fisheries (Charles-Dominique, 1991).

The study of the fishing activity conducted on the whole of the small scale fishery, or on a stratum thereof, aims at understanding the importance of the activity deployed either by a global approach of all the fishing units, or on an individual basis by fishing unit or group of fishing units.

By using this approach, the entire small-scale fishery can be characterized by the potential fishing units in activity, by an average number of trips by unit, by the number of days in activity, by the average or individual length of fishing units; it is also possible to establish a diagram that describes the activity by worked days and idle days and possibly explaining the reasons of inactivity of both short and long duration.

The estimated parameters are indicators of the dynamics of each of the different areas of small-scale fishery. They allow the geographic and temporal variations of these areas to be identified and to estimate their evolutionary capacities.

In the Java Sea, the mini seiner fleet can be compared to a fleet of small-scale fishery: the numerical potential is greater than 1,500 units (Potier and Sadhotomo, 1995); the number of landing points is significant, more than 80 (Ecoutin *et al.*, 1997); the possibility of rapidly changing the landing site introduces a major difficulty in following individual fishing units (Hariati *et al.*, 1995); the presence among this fleet of vessels in a variety of shapes describes a notion of heterogeneity and the possibility of partitioning this fleet into more homogeneous subgroups (Wijopriono *et al.*, 1996; Ecoutin *et al.*, 1997).

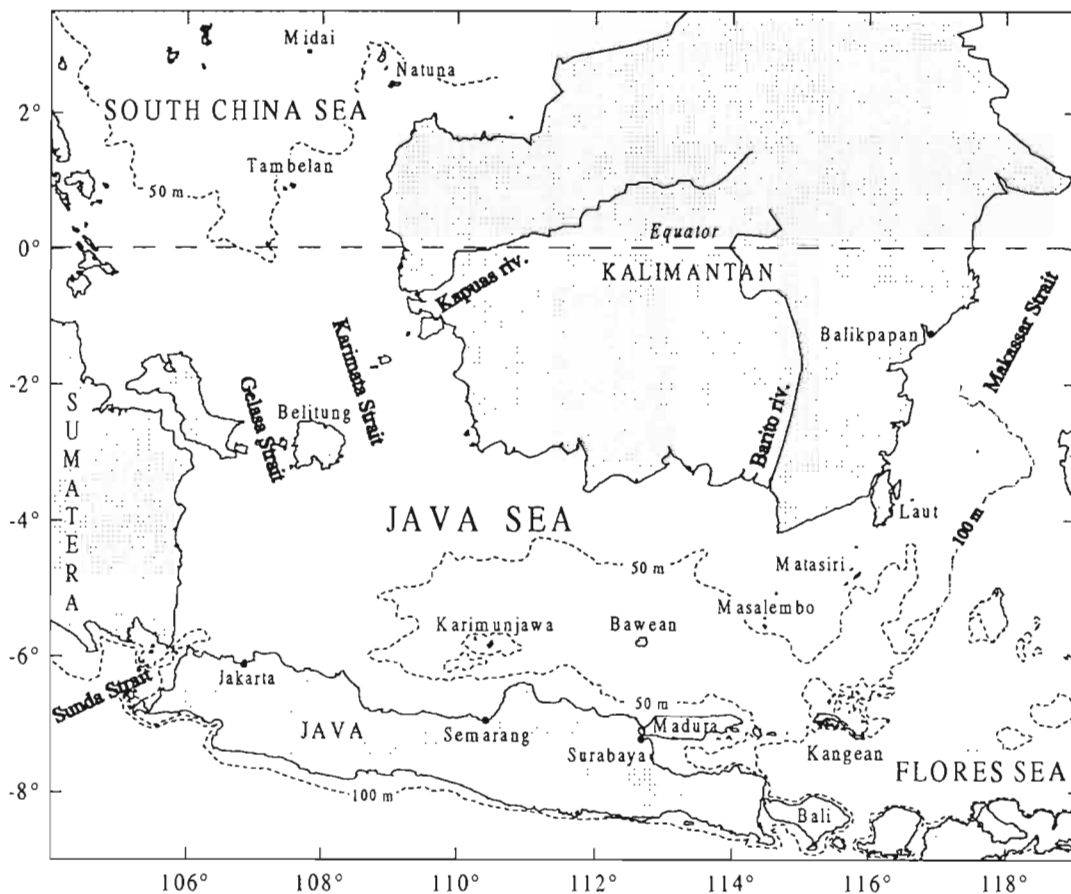


Figure 1: The Java Sea and its surroundings

In order to estimate the fishing effort by mini seiners operating in the different areas of the north shore of the Island of Java (fig. 1) by studying their activities, a regular survey of a sample of fishing units would have been necessary. Because of the significant number of units of the fleet and a lack of time to complete the study, only a global approach could be accomplished. Nevertheless, by this global approach, it is possible to define certain descriptive parameters useful for a first approach of the fishing activity such as the number of active days during a year; explanations for the main fishing idleness, information on the spatiotemporal variability of the distribution of this activity, ... This is not sufficient to translate the results obtained by the units of this fleet into an estimate of the total catch, but it does allow the completion of certain hypotheses to estimate a conversion factor of the results into total catches.

Material and methods

1. Presentation of the ports

Daily listings of landings by mini seiners were used to complete the study. During 1995, these listings were recorded in eight important ports on the north shore of Java (fig. 2). Different censuses of the mini seiner fleet operating in the Java Sea (Ecoutin *et al.*, 1997; Jung, 1998) were used to make this choice. The sampling plan included a ninth location, the port of Brondong located in the province of East Java (fig. 2, n°8); this port was the subject of a specific monograph (Luong, 1997) and its results could not be taken into account for this work.

From West to East, these entries were recorded in:

* Eretan Wetan (Fig. 2, n°1), the only port of the study located in the province of West Java, is a landing and commercial destination for fish from fleets using different fishing techniques: gillnets, Danish seines, mini seines, ... In 1994, the units of medium seiners unloaded more than 2,000 tons of pelagic species at this location, or 5% of the total landings by this fleet (Potier *et al.*, 1995). This location is both an auction place (TPI or *Tempat Pelelangan Ikan*) and a village cooperative (KUD or *Koperasi Unit Desa*). It is representative of the neighboring villages for the study of mini seiners of the Java Sea.

* Pekalongan (n°2) is the largest fishing port in the province of Central Java. It is part of an administrative structure grouping the principal ports of the Indonesian archipelago (PPN or *Pelabuhan Perikanan Nusantara*). Several auction places operate in this port with one that only deals with landings of mini seiners. Pekalongan is the principal landing port for the fleet of large and medium seiners with approximately 50% of the landings of large seiners and 70% by the medium seiners (year 1994, Potier *et al.*, 1995).

* Batang (n°3), not far from the previous port, is a TPI where large, medium and small seiners exploiting the pelagic fish of the Java Sea are unloaded.

* Banyutowo, also called Tayu (n°4), is a small TPI situated north west of the Bay of Rembang. The fishing units from the villages located between Rembang and Sarang regularly visit this port. Mini seiners dock at the end of a long pier built on a beach where the water level is very low.

* Tasik Agung (n°5) is one of the auction places of the village of Rembang. This TPI is different in that it trades pelagic fish caught mainly by mini seiners and secondly by large and

medium seiners (57 landings for 2,300 tons in 1994 or 1.5% of the total catches by this fishing fleet, Potier *et al.*, 1995).

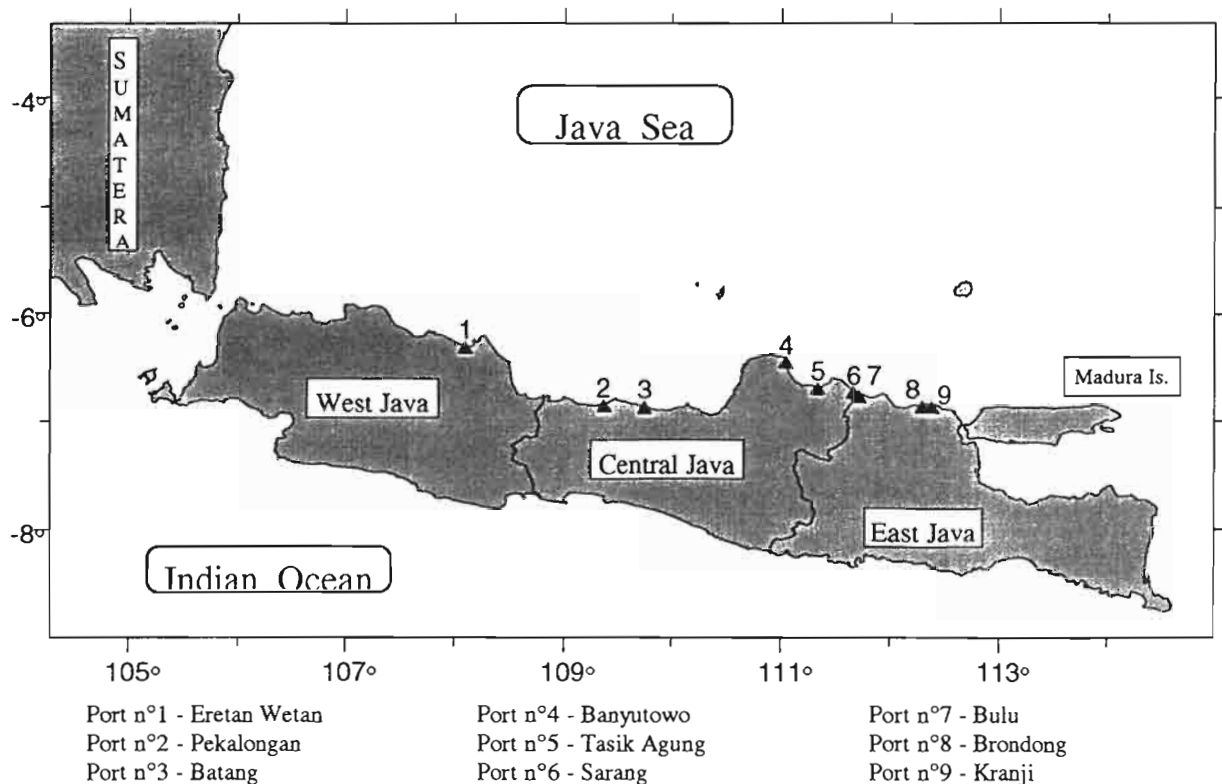


Figure 2: Location of the main ports of inquiries in 1995

* Sarang (n°6) is the more eastern TPI of this study for the province of Central Java. Many fishing techniques were observed there. For this reason, Sarang can be compared to Eretan Wetan (n°1).

* Bulu (n°7) is a landing place located in the province of East Java. It is different in that the mini seiner units that unload their catch here almost exclusively originate from this village and few fishing units registered in Bulu moved to other locations on the north shore of the island of Java during the year.

* Kranji (n°9) is a small TPI located east of the port of Brondong (Luong, 1997) where fishing units using many fishing techniques land.

2. Presentation of the surveys

Each sale of fish landed made by the mini seiners is recorded by the administration of the TPI in a book called in Indonesia *buku bakul*. The different listings are then grouped by fishing unit and recorded on specific sheets for this study. The type of data collected on these pages was information needed to identify the fishing unit (name of the boat, name of the owner, the captain, origin of the fishing unit), information on the fishing trip (fishing location, duration, possible use of fishing aggregating devices) in addition to contents of the catch by category of species; usually, 6 and 8 categories of species were written up. This content is done by weight and often by economic value.

By comparing the lists of fishing units on these study sheets to the data of the *buku bakul* (description by unit sale, daily sales for each unit that landed), there are no differences in the number of mini seiners that arrived each day. The information recorded by each TPI is therefore correctly carried forward in the data acquisition chain of this study.

3. Unit of observation

The landing of one fishing unit as a result of a fishing trip represents the unit of observation. Because of the unit of observation chosen - the landing of catches recorded by the TPI as an indicator of a fishing trip - there exist some bias for the fishing trips whose landings were not recorded by the TPI: catches of small quantity, direct sales to a preferred buyer,...

In addition, the choice of this unit of observation, which is based on a fishing trip, does not allow the extrapolation of the fishing activity of mini seiners into number of days at sea. This latter parameter is often considered a more precise indicator of the level of fishing activity. Depending on the landing location and the fishing seasons, the duration of a trip can vary from a few hours to 3 or 4 days. In a few cases, the length of a trip can be even greater; this is the case of mini seiners that sell their catch directly at sea to specific ships, the *gendong* boats (Luong, 1998). These *gendong* boats sell later the catches at Brondong harbor (Luong, 1997).

In 1995, more than 25,500 entries were recorded in the eight villages described above. Two of them were not taken into consideration in this study of fishing activity. One is the TPI of Batang (n°3, fig. 2) where the data are not validated and the other is the village of Bulu (n°7, fig. 2) where the data for 1995 are too incomplete to be able to conduct this analysis.

Results and discussion

1. Global analysis of the activity

Of the remaining six villages in our sample (one in West Java, four in Central Java and one in East Java) and after validating the inquiries (approximately 0.5% of the inquiries were invalidated), the sample contains more than 20,100 entries spread unevenly over the 12 months of the year (tab. 1).

1.1. Activity calendar

The number of inquiries recorded each day varies from 0 (value observed 11 times during the year or 3%) to 160 inquiries (observation of March 29th, 1995). The average number of daily entries recorded is 55 with a standard deviation of 35. The histogram of the distribution of the number of daily entries does not show any specific shape to the distribution of the values between 15 and 90 entries per observation day (fig. 3).

A little more than 10% of the observations correspond to days with no or few entries (less than 10 landings recorded). They are defined as days or periods with low activity. In the same manner, approximately 10% of the observations correspond to days or periods with high activity with a maximum of entries recorded (more than 100 daily inquiries, fig. 3).

Table 1: General activity calendar of mini seiner fishing units

Low daily activity High activity

| Day | Month | | | | | | | | | | | | Total |
|---------|-------|------|------|------|------|------|------|------|------|------|------|------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| 1 | 47 | 13 | 4 | 121 | 116 | 76 | 15 | 66 | 55 | 62 | 104 | 73 | 752 |
| 2 | 68 | 16 | 0 | 114 | 88 | 75 | 16 | 89 | 70 | 59 | 69 | 36 | 700 |
| 3 | 53 | 54 | 0 | 123 | 71 | 67 | 19 | 82 | 32 | 71 | 62 | 31 | 665 |
| 4 | 58 | 11 | 0 | 111 | 59 | 34 | 88 | 98 | 78 | 66 | 43 | 53 | 699 |
| 5 | 68 | 23 | 0 | 86 | 70 | 52 | 89 | 74 | 68 | 65 | 41 | 44 | 680 |
| 6 | 65 | 19 | 0 | 43 | 61 | 33 | 75 | 63 | 76 | 55 | 46 | 3 | 539 |
| 7 | 52 | 8 | 0 | 6 | 36 | 21 | 51 | 76 | 76 | 43 | 48 | 3 | 420 |
| 8 | 34 | 1 | 8 | 1 | 48 | 15 | 36 | 65 | 55 | 27 | 74 | 0 | 364 |
| 9 | 27 | 7 | 43 | 37 | 44 | 15 | 40 | 64 | 48 | 33 | 36 | 0 | 394 |
| 10 | 28 | 0 | 28 | 138 | 7 | 16 | 33 | 59 | 42 | 38 | 38 | 0 | 427 |
| 11 | 41 | 2 | 31 | 119 | 7 | 29 | 47 | 53 | 51 | 78 | 38 | 2 | 498 |
| 12 | 8 | 1 | 96 | 36 | 32 | 33 | 53 | 66 | 58 | 59 | 49 | 18 | 509 |
| 13 | 1 | 2 | 88 | 65 | 70 | 21 | 23 | 41 | 47 | 32 | 72 | 9 | 471 |
| 14 | 4 | 19 | 68 | 55 | 35 | 18 | 35 | 59 | 32 | 70 | 104 | 12 | 511 |
| 15 | 2 | 20 | 47 | 43 | 39 | 10 | 28 | 56 | 36 | 64 | 106 | 43 | 494 |
| 16 | 0 | 13 | 26 | 25 | 24 | 17 | 8 | 86 | 38 | 91 | 125 | 43 | 496 |
| 17 | 4 | 36 | 6 | 37 | 19 | 20 | 33 | 60 | 85 | 108 | 89 | 36 | 533 |
| 18 | 6 | 24 | 11 | 36 | 4 | 31 | 43 | 26 | 113 | 88 | 80 | 41 | 503 |
| 19 | 26 | 48 | 18 | 39 | 15 | 54 | 37 | 14 | 108 | 106 | 77 | 55 | 597 |
| 20 | 21 | 40 | 8 | 35 | 25 | 40 | 97 | 88 | 128 | 116 | 83 | 83 | 764 |
| 21 | 17 | 92 | 55 | 53 | 55 | 29 | 66 | 91 | 140 | 73 | 52 | 67 | 790 |
| 22 | 14 | 59 | 66 | 63 | 56 | 58 | 76 | 114 | 99 | 107 | 127 | 68 | 907 |
| 23 | 6 | 36 | 104 | 57 | 38 | 87 | 60 | 90 | 108 | 112 | 94 | 84 | 876 |
| 24 | 8 | 52 | 137 | 97 | 61 | 110 | 45 | 78 | 98 | 101 | 60 | 72 | 919 |
| 25 | 2 | 69 | 157 | 93 | 49 | 110 | 36 | 92 | 100 | 150 | 38 | 73 | 969 |
| 26 | 17 | 67 | 119 | 73 | 95 | 93 | 62 | 95 | 86 | 148 | 19 | 98 | 972 |
| 27 | 57 | 22 | 113 | 87 | 79 | 67 | 60 | 92 | 105 | 82 | 24 | 85 | 873 |
| 28 | 38 | 15 | 139 | 64 | 56 | 41 | 73 | 84 | 109 | 44 | 22 | 76 | 761 |
| 29 | 19 | | 160 | 43 | 90 | 34 | 71 | 81 | 74 | 28 | 111 | 68 | 779 |
| 30 | 20 | | 141 | 73 | 66 | 21 | 75 | 71 | 73 | 78 | 84 | 70 | 772 |
| 31 | 55 | | 116 | | 66 | | 39 | 60 | | 140 | | 40 | 516 |
| Total | 866 | 769 | 1789 | 1973 | 1581 | 1327 | 1529 | 2233 | 2288 | 2394 | 2015 | 1386 | 20150 |
| Average | 27.9 | 27.5 | 57.7 | 65.6 | 51.0 | 44.2 | 49.3 | 72.0 | 76.3 | 77.2 | 67.2 | 44.7 | 55.2 |

*** Study of the periods with low activity**

During 1995, four main periods of low activity were observed (tab. 1, days circled by a thick line). These sequences are formed with a minimum of six consecutive days of reduced activity following the definition stated above. They are the periods:

- from January 12 to 18 with an average of 3.5 landings per day,
- from February 7 to 13, 3 landings per day,
- from March 1 to 8, 1.5 daily landings and 6 consecutive days without a single inquiry,

- and finally from December 6 to 11, to which period we can add the 13, with a little less than 2.5 daily landings and three days with no entries.

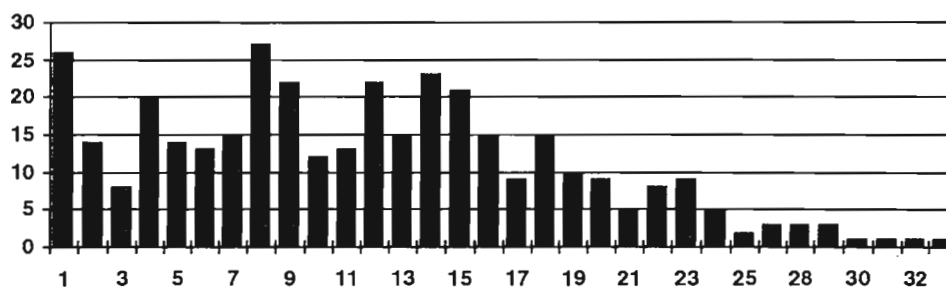


Figure 3: Distribution of the number of daily inquiries (by class of 5 inquiries)

The second and third periods correspond to important religious holidays (tab. 2): the beginning of *Ramadan* for the second period and the end of this fasting month and the *Idul Fitri* holiday at the beginning of March. The two other periods can not be explained by religious or civil events. One of the explanations given by the fishermen related these periods of low activity to the full moon phases during the rainy season, these conditions would therefore not be favorable for catching fish. One other is that, in Indonesia each year, fishermen organize some traditional celebrations named *pesta laut* (celebration of the sea). They last a week but the date of these celebrations is different between each village.

Of the remaining days of the year where the fishing activity seems reduced, May 10 and 11 correspond to the *Idul Adha* holiday (tab. 2). Finally, it must also be mentioned that except for July 16, there are no other days of low activity between the months of June and November.

* Study of the periods with strong activity

During 1995, three main periods of high fishing activity were observed (slashed boxes in table 1):

- from March 23 to the beginning of April, with 13 consecutive days,
- the second half of September with 8 non consecutive days,
- the second half of October also with 8 non-consecutive days.

There were no days of strong activity observed in January (maximum observed, 68 entries), February (92), July (97) and December (98). A few days meeting the criteria for strong fishing activity are found on an isolated basis during the months of April, May and June and between August and November in addition to the periods mentioned above.



* A first picture of the fishing activity

In 1995, the mini seiners operated all year long (only 3% of days with no landings) on a more or less regular basis. This annual calendar of the fishing activity can be broken down into different main periods.

The period between the beginning of December and March 20 corresponds to a period of low activity for mini seiners. This season includes the four main periods of low activity described above; in addition, the general activity observed, by the landings, is low: besides these four periods, the average number of landings is around forty. This low activity is

explained by two main phenomena: the first explanation relates to *Ramadan*, the Muslim fasting month during which the general activity of the country is often reduced, this period, in 1995, was in February and March. This explanation is not a seasonal constant as the dates of this holiday change from year to year. The second explanation is of a seasonal nature and could correspond to lower catches during the rainy season, especially during the full moon phase but also to unfavorable environmental conditions for fishing activity (wind, waves, swells, currents, desalinization of the coastal border, ...).

Table 2: Relationship between the periods of low activity for the mini seiner fishing units (X less than 11 entries; XX less than 6 entries; XXX no entries) and explanatory hypotheses

 Official civil and religious holidays
  Full moon

| Day | Month | | | | | | | | | | | |
|-----|-------|-----|-----|----|----|---|---|---|---|----|----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | | | XX | | | | | | | | | |
| 2 | | | XXX | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | XXX | | | | | | | | | |
| 6 | | | XXX | | | | | | | | | XX |
| 7 | | X | XXX | X | | | | | | | | |
| 8 | | XX | X | XX | | | | | | | | XXX |
| 9 | | X | | | X | | | | | | | XXX |
| 10 | | XXX | | | | | | | | | | XXX |
| 11 | | XX | | | | | | | | | | XX |
| 12 | X | XX | | | | | | | | | | |
| 13 | XX | XX | | | | | | | | | | X |
| 14 | XX | | | | | | | | | | | |
| 15 | XX | | | | | | | | | | | |
| 16 | XXX | | | | | | X | | | | | |
| 17 | | | | X | | | | | | | | |
| 18 | X | | | | XX | | | | | | | |
| 19 | | | | | | | | | | | | |
| 20 | | | X | | | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | |
| 23 | X | | | | | | | | | | | |
| 24 | X | | | | | | | | | | | |
| 25 | XX | | | | | | | | | | | |
| 26 | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | |

In 1995, the period between mid-March and mid-April is a period of strong and constant activity.

From mid-April to the beginning of August, the activity varies greatly from days of big activity to days of low activity. The average number of landings is slightly greater than the number calculated during the rainy season. The fishermen justify this strong variability of their activity to local climatic conditions that can disturb the fishing activity (Allain, 1996).

The last period, from the beginning of August to the end of November, corresponds to a period of very high activity. No days of reduced activity were observed and the average number of daily entries recorded is greater than 70.

1.2. Variability of the activity due to the lunar cycle

At first glance of table 2, there does not seem to be an obvious relationship between the days of weak activity and the full moon periods. However, compared to an average lunar cycle, these days are spread over most of the lunar days, but 60% of days without much activity are grouped between the five days before and 4 days after the full moon. The remaining days correspond to the *Idul Fitri* period, a holiday which always falls on a new moon phase.

The days or periods with strong activity usually occur, on a lunar month cycle, between the 8th and 16th day therefore surrounding the new moon phase (79% of observations). No days of this kind were observed during the week surrounding a full moon.

These two observations are found on the evolution curve of the average rate of trips by lunar day, which has been corrected for the seasonal effect (fig. 4). This relationship which divides the number of trips recorded on a given day in one port by the average number of trips recorded for the same port for the lunar month describes two main temporal phases: from the eight to the twenty fifth day of the lunar month with activity slightly greater than the average activity for the month; around the full moon, with less activity than the average.

These observations seem to contradict the appearance of an absence of lunar effect on the variation of the activity of mini seiners. However, temporal series greater than one year must be used to test this phenomenon and determine whether there exist a real lunar effect affecting the behavior of fishermen, whether it is a climatic event related to the lunar effect or whether the rainy season is considered a resting season.

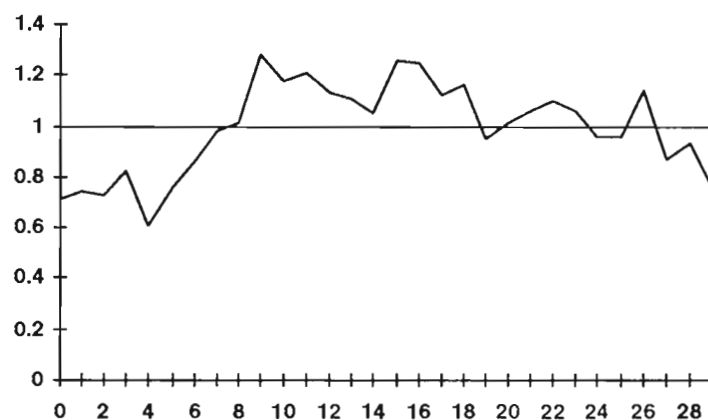


Figure 4: The deseasonalized average rate of trips by lunar day (year 1995, all ports)

2. Analysis by landing site

The analysis of the fishing activity of mini seiners by landing site is presented from West to East.

2.1. Eretan Wetan

Eretan Wetan is a constant and regular landing site throughout the year since activity at this TPI was observed 93% of days during the year 1995 (tab. 3). Approximately 70% of days with no landings are within the four periods of weak activity for mini seiners (2.1) and the remaining days are either before or after these same periods. More precisely, the general activity at the auction place in Eretan Wetan, whatever the fishing techniques used, is reduced during two periods (January 15-24 and December 5-18) corresponding to two of the periods of inactivity observed for the mini seiner fleet; this seems to confirm that these two periods are not favorable for coastal fishing activities.

The fishing units recorded at the auction place in Eretan Wetan use diverse fishing techniques: gillnets, Danish seines, mini seines, ... Although the maximum entries recorded for one day is close to 50, it seems that this auction place saturates at 22-25 daily landings, all fleets included.

In 1995, mini seiner units landed at this port only two thirds of the working days of the auction place with an average number of daily landings of 3.35 calculated for this period of 216 days (tab. 3). In Eretan Wetan, there are no days where a large number of mini seiners was seen landing; in general, there were less than 7 daily landings (95% of observations).

The study of the seasonal variation of the number of entries highlights two main periods; on one hand, from May to October (75% of annual entries of mini seiners, tab. 3) the units landed almost every day (84% of working days) with an average number of landings generally greater than the annual average (3.83 observations by day studied); on the other hand, from December until March where the average number of landings is weak (1.83) with a small number of days present along the dock (tab. 3).

2.2. Pekalongan

During the year 1995 in Pekalongan, entries for mini seiner fishing units were recorded less than one out of every 2 days (45%) for an annual average of a little more than 12 daily entries (tab. 3). Contrarily to the preceding port, there is a very large variability in the number of daily entries with a maximum observed of 56. One fifth of the days observed registered more than 20 observations.

The annual activity calendar describes two periods with strong landing activity of mini seiner units separated by periods with very minimal activity:

- from March 20 to the end of June with activity two out of every three days, and an average of 21 entries per working day;
- between September 15 and the end of October having the same activity rate as the previous period but with an average number of landings per working day much lower, around 11 or 12 entries.

Between these two periods, the number of landings observed in Pekalongan is very weak (20 to 50% of days are worked for an average of approximately 5 entries per day).

More than 90% of units that land in Pekalongan originate from towns located in the province of East Java.

One particularity of Pekalongan is the almost complete absence of landings during the week that includes the full moon and this for periods of both high and low activity. Pekalongan is the only one of the six ports studied where the activity of fishing units measured by their landings is directly or indirectly related to the lunar cycle.

As a landing site for mini seiners, Pekalongan therefore shows a strong variability in terms of presence-absence of these units and in terms of numerical significance of their presence. This strong variability is explained, directly or not, by an activity cycle related to the lunar cycle.

2.3. Banyutowo

The port of Banyutowo, also called Tayu, is a small landing site for fishing units using various techniques and making fishing trips very close to the coast. It is used by the fleet of mini seiners when these units are fishing in areas near this village. A large majority of these units are not from Tayu; in 1995, 60% of the entries recorded were units coming from Pandangan, a village located close to Tasik Agung (fig. 2) and almost 40% from the village of Sarang (fig. 2).

In 1995, mini seiner units landed their catches a little more than 2 days out of 3 (except for the month of May that was not studied) and for each day recorded, approximately 4 units were observed arriving. Here, as in Eretan Wetan, although the activity seems sustained all year long, the daily variation of the number of landings is weak: for 80% of days recorded less than 5 fishing units landing.

For the period from August to November, the activity of these units at the port of Tayu seems to be a little stronger both in terms of days present and the number of units landing.

No lunar effect seems visible since the landings were observed both on full moon days and days surrounding this lunar phase.

2.4. Tasik Agung

In 1995, at Tasik Agung more than 8,100 entries of mini seiner landings were recorded during 329 working days (tab. 3). The percentage of days with entries is greater than 90%. This auction place therefore has regular activity all year long.

With the exception of a few landings by large and medium size seiners (Potier *et al.*, 1995), this TPI only records mini seiner landings. The fishing units that unload their catch here are not native. In 1995, 41% of landings recorded were units from Pandangan (another TPI of Rembang), 48% from Kragan and 11% from Sarang.

The average number of entries per working day is around 25 entries recorded (tab. 3). The variation of this parameter is strong since the daily maximum observed in 1995 was 88 entries.

During 1995, it is possible to pinpoint two main operating periods for this TPI:

- from December to the end of February (before the *Ramadan* period): the rate of days worked is close to 80% and daily activity is clearly inferior to the annual average with approximately 15 entries per day;

- from mid-March (after *Idul Fitri*) to the end of November: activity is constant, almost 100%, and the monthly average number of sales recorded is close to or greater than the annual average. During the months of June and July, there is a slight decrease in the average number of daily entries.

In terms of activity, Tasik Agung, an auction place in the village of Rembang is similar to Eretan Wetan with regular and sustained annual activity however this activity is limited to mini seiner units whereas Eretan Wetan also records catches by pluri-technical units. Another difference between these two ports is the variability of specific landings by mini-seiners; the port located in the province of West Java has a low daily variability, which was not observed in Tasik Agung.

Table 3: Main information on the activity observed at the ports under study (Ne; number of mini seiner entries; Nje, number of days with mini seiner landings recorded; Ne/Je, average number of entries by days with entries; Nje tot, total number of days with entries recorded during the month for the pluri-technical TPI of Eretan Wetan and Kranji)

| | Month | | | | | | | | | | | | Total |
|------------------------------|-------|------|------|------|------|------|------|------|------|------|------|------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Eretan Wetan | | | | | | | | | | | | | |
| Ne | 28 | 18 | 6 | 68 | 152 | 63 | 86 | 58 | 112 | 95 | 72 | 4 | 762 |
| NJe | 14 | 7 | 5 | 14 | 24 | 23 | 24 | 25 | 29 | 27 | 20 | 4 | 216 |
| Ne/Je | 2.00 | 2.57 | 1.20 | 4.86 | 6.33 | 2.74 | 3.58 | 2.32 | 3.86 | 3.52 | 3.60 | 1.00 | 3.35 |
| Nje tot | 23 | 27 | 26 | 30 | 30 | 30 | 30 | 30 | 30 | 31 | 30 | 24 | 341 |
| Pekalongan | | | | | | | | | | | | | |
| Ne | 79 | 49 | 393 | 538 | 247 | 240 | 6 | 81 | 162 | 218 | 96 | 10 | 2119 |
| NJe | 13 | 8 | 15 | 20 | 18 | 19 | 3 | 15 | 18 | 18 | 15 | 6 | 166 |
| Ne/Je | 6.08 | 6.13 | 26.2 | 26.9 | 13.7 | 12.6 | 2.00 | 5.40 | 9.06 | 12.1 | 6.60 | 1.67 | 12.81 |
| Banyutowo | | | | | | | | | | | | | |
| Ne | 87 | 54 | 51 | 56 | | 38 | 53 | 90 | 120 | 170 | 151 | 66 | 936 |
| NJe | 18 | 17 | 15 | 20 | | 16 | 20 | 27 | 26 | 30 | 28 | 21 | 238 |
| Ne/Je | 4.83 | 3.18 | 3.40 | 2.80 | | 2.38 | 2.65 | 3.33 | 4.62 | 5.67 | 5.39 | 3.14 | 3.93 |
| Tasik Agung (Rembang) | | | | | | | | | | | | | |
| Ne | 256 | 206 | 656 | 882 | 824 | 677 | 641 | 902 | 974 | 822 | 749 | 485 | 8143 |
| NJe | 20 | 20 | 22 | 29 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 24 | 329 |
| Ne/Je | 12.8 | 10.6 | 29.9 | 30.6 | 26.8 | 22.7 | 20.8 | 29.4 | 32.7 | 26.6 | 25.2 | 20.3 | 24.75 |
| Sarang | | | | | | | | | | | | | |
| Ne | 382 | 439 | 675 | 415 | 323 | 303 | 666 | 1010 | 791 | 873 | 812 | 732 | 7451 |
| NJe | 28 | 25 | 25 | 24 | 29 | 29 | 31 | 31 | 30 | 31 | 30 | 27 | 340 |
| Ne/Je | 13.6 | 17.6 | 27.0 | 17.2 | 11.1 | 10.5 | 21.5 | 32.7 | 26.3 | 28.6 | 27.1 | 27.1 | 21.91 |
| Kranji | | | | | | | | | | | | | |
| Ne | 34 | 3 | 8 | 14 | 35 | 6 | 77 | 92 | 129 | 216 | 135 | 89 | 838 |
| NJe | 12 | 3 | 8 | 9 | 13 | 5 | 25 | 23 | 29 | 28 | 25 | 19 | 199 |
| Ne/Je | 2.83 | 1.00 | 1.00 | 1.55 | 2.69 | 1.20 | 3.35 | 4.00 | 4.45 | 7.71 | 5.40 | 4.68 | 4.21 |
| Nje tot | 15 | 16 | 14 | 14 | 15 | 12 | 29 | 25 | 29 | 29 | 25 | 24 | 247 |

2.5. Sarang

Sarang, a TPI located on the eastern fringe of the province of Central Java (fig. 2, n°6), shows an activity slightly greater than in Tasik Agung as 93% of days in the year 1995 were worked. On average during the year, a little less than 22 mini seiner landings were recorded on active days of this auction place. Here, as in Tasik Agung, the daily variability is high between observations of only one landing (7 times during the year) and 70 landings on the same day.

As with the previous location, there are two main activity periods:

- the first semester with sustained activity but always below 100% (from 80 to 96%). The average number of daily entries is always clearly inferior to the annual average. Only the period in March, after the end of the *Lebaran* holidays, shows a daily activity greater than the annual average;

- the second semester when 100% of days are worked, with a daily rate of entries greater than the annual average.

In Sarang, more than half of the landings are for fishing units registered in Sarang, 44% in Kragan and only 2% in Rembang.

2.6. Kranji

Kranji is a location where fishing units using various techniques land, with a predominance of mini seiners. They represent two thirds of the 1,428 entries recorded in 1995 (amount calculated for the period May-December). During that year, entries were made on 247 days (67%, tab. 3) and mini seiners landed during three quarters of these working days.

On days with activity, an average of more than 5 mini seiners land their catch at this auction place. These units are mainly from Kranji or bordering villages.

Conclusion

The units from the mini seiner fleet operate all year long with a few short periods of inactivity generally corresponding to the beginning and the end of the Indonesian *Lebaran* period.

This general activity can be divided into an annual cycle with strong activity from July to November and reduced activity during the rainy season from December to March.

The landing ports for the fleet of mini seiner units can be broken down into four different operating methods:

- Eretan Wetan, Banyutowo and to a lesser degree, Kranji: they are ports where pluri-technical fishing units land; never representing large numbers of mini seiners and the fishing units are generally migrant.

- Sarang, Kranji: the landings are dominated by native fishing units. Mini seiner units from neighboring villages are unloaded at these ports. The activity is busy, sometimes very busy.

- Tasik Agung is a special case in that it is an auction place that specializes in large, medium and above all mini seiner fishing units; this specialization concentrates mainly in the commercialization of small pelagic species. These units are all from other neighboring ports and the activity is constant and very busy.

- The port of Pekalongan which does not fit into any of the above descriptions. This port welcomes mostly migrating fishing units and the variability of the landing activity of mini seiners is very strong during the month.

For 1995, the mini seiners landed their catches from the Java Sea during approximately 325 to 330 days: this indicates a relatively high global activity rate for the fleet since more than 90% of days during the year were worked. Now this maximum duration of activity for the fleet, its potential activity, must be translated into an average annual activity

rate calculated by fishing unit. This future analysis will have to use the known information on the activity of the units by establishing activity calendars by fishing units and taking into consideration the peculiarities of each port where the catches were landed. In effect, these peculiarities can determine the different exploitation dynamics by large groups of fishing units (Wijopriono *et al.*, 1996).

Acknowledgements:

The present study was supported by the Pelfish project (Java Sea Pelagic Fishery Assessment Project, ALA/INS/87/17) financed by EU and conducted by Doctor J.R. Durand and Doctor J. Widodo. We wish to thank our Indonesian colleagues who were part of this project: S.B. Atmaja, S. Nurhakim, B. Sadhotomo, Suwarso and Wijopriono.

We would like to thank all the surveyors team from different TPI from where we had to collect data. This work could not be presented without Miss Rika who realized all the keyboarding and validation.

Bibliography

- Allain, J.C. 1996. La pêche indonésienne et les mini-senneurs de la *kabupaten* de Rembang. Mémoire de DEA, Université Paris IV, France
- Charles-Dominique, E. 1991. Halieutique et pêches artisanales: anciennes méthodes, nouvelles problématiques ? (le cas de la pêche en lagune Aby, Côte-d'Ivoire). *in*: Symp. Int. "La Recherche face à la Pêche Artisanale", Montpellier, 3-7 juillet 1989, Durand J.R., Lemoalle J., Weber J. (eds), Paris, ORSTOM: 965-974.
- 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(1): 47-63.
- 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.
- Laurec, A. and J.C. Le Guen. 1981. Dynamique des populations marines exploitées, tome I: concepts et méthodes. CNEXO, *Rapp. Sci. Tech.*, 45: 118 p.
- Luong, N. 1997. The fishing harbour of Brondong (East Java, Indonesia). Java Sea Pelagic Fishery Assessment Project, *Sci. and Tech. Doc.*, 30: 68 p.
- Luong, N. 1998. Fish commercialization through the *Gendong* system. *in*: SOSEKIMA, Socio-economics, innovation and management of the small pelagic fishery of the Java Sea. Roch J., Nurhakim s. and J. Widodo (eds.), AARD/ORSTOM: 213-224.
- Poinsard, F. and J.C. Le Guen. 1975. Observations sur la définition d'une unité d'effort de pêche applicable à la pêcherie de thon de l'Atlantique tropical africain. *Rapp. PV réunion Cons. int. Explor. Mer*, 168: 39-43.
- Potier, M. and S. Nurhakim (eds). 1995. BIODYNEX: Biology, Dynamics, Exploitation of the Small Pelagic Fishes in the Java Sea. AARD/ORSTOM: 281 p.
- Potier, M., S. Nurhakim and B. Sadhotomo. 1995. Big purse seiners fishery statistical collection: year 1994. Java Sea Pelagic Fishery Assessment Project, *Sci. and Tech. Doc.*, 22: 46 p.

- Potier, M. and B. Sadhotomo. 1995. Seiners fisheries in Indonesia. *in*: BIODYNEX: Biology, Dynamics, Exploitation of the Small Pelagic Fishes in the Java Sea. Potier M. and S. Nurhakim (eds), AARD/ORSTOM: 49-66.
- 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.

AGENCY FOR AGRICULTURAL RESEARCH AND DEVELOPMENT
RESEARCH INSTITUTE FOR MARINE FISHERIES



JAVA SEA PELAGIC FISHERY
ASSESSMENT PROJECT
(ALA/INS/87/17)

THE SMALL COASTAL SEINERS OF THE JAVA SEA

THE MAIN FISHING STATISTICS
and
APPROACH of THE DYNAMICS of THE FLEET

By : Ecoutin J.M. and Dharmadi

Scientific and Technical Document No. 31
November 1999