

INCOME UNCERTAINTIES MANAGEMENT BY THE JAVA PURSE SEINERS' FISHERMEN

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ABSTRACT

The paper seeks to assess the various determinants of the income earned by individual fishermen. The first challenge is to evaluate both the risks that collective and personal fishing activities represent, i.e. their variability over time and to ascertain the limits within which fishermen behave as if the two risks are complementary or mutually exclusive. The second challenge is to identify the patterns of social segmentation that account for differences in the three incomes derived from personal fishing, from the sharing system and from the various incentives earned by individual sailors. These differences reflect the differential organisation of boat owners, the local labour markets and the strategies of individual skippers. They also reflect the social origin of sailors, their formal schooling and their occupational history, including their current skill level.

KEYWORDS : income, personal fishing, sharing system, bonus, risks, formal schooling, skill level.

ABSTRAK

Makalah ini menggambarkan berbagai faktor penentu bagi pendapatan yang diperoleh nelayan individu. Faktor penentu utama adalah evaluasi resiko baik pada kegiatan penangkapan kolektif maupun individu, yaitu keragaman resiko berdasarkan waktu dan batas perilaku nelayan bila resiko yang timbul adalah sebagian atau sepenuhnya terpisah antar individu. Faktor penentu kedua adalah identifikasi pola segmentasi sosial yang mempengaruhi perbedaan tiga pendapatan yang berasal dari penangkapan individu, sistem bagi hasil dan berbagai insentif yang diperoleh pendega secara individual. Semua perbedaan ini mencerminkan perbedaan organisasi pemilik kapal, pasar tenaga kerja lokal dan strategi nahkoda kapal secara individual. Selain itu juga mencerminkan asal-usul sosial pendega, pendidikan formal, latar belakang keluarga dan tingkat keterampilan yang dimiliki.

KATA KUNCI : pendapatan, penangkapan individual, sistem bagi hasil, bonus, resiko, pendidikan formal, tingkat keterampilan.

For the most part, fisheries remain heavily dependent on natural factors that remain uncontrolled. In this sense, fisheries stay, alike hunting and gathering, subjected to uncertainties. Crews may lose their material investments (boats or nets) or their lives. They may experience economic losses due to their ignorance of the reproductive capacity or of the migratory patterns of the species they seek. Finally, their profits may shrink because of the poor handling of their catch or of unfavourable market conditions. The result of auctions is not necessarily as conspicuously rational as is often claimed by neo-classical economists. In short, the term of fishery is a misnomer to the extent that fishing activities do not lend easily themselves to a systematic organisation.

Our purpose is to identify the social factors that affect the management of the array of the collective and personal uncertainties that govern fishing activities. The analysis is based on interviews conducted in 1994 among 155 crewmen attached to 56 boats and living in three villages located around Tegal, Pekalongan and Juwana, the three major harbours of purse seiners operating from Northern Jawa coast line.

Primarily, we evaluate the relative importance of the three major sources of the income earned by fishermen, that are :

- the money owed to them as a result of the sharing system at work on their boats;
- the bonus they receive as a function of the amount of the boat's catch;
- the products of the sale of their own personal fishing.

Secondly, we posit that the uncertainties faced by fishermen may be assessed in terms of the variability of the incomes earned as a result of the successive trips undertaken during a given period. Some of these trips are very productive, others are total or partial failures. To translate the risks encountered in economic terms, one may assess the difference between the incomes from the best and the worst trips. Even if some crewmen earn a same average income, their earnings may undergo dramatic up and downswings during the period of reference. Assessing long term risks requires measuring the instability of the incomes per trip over several years¹. Assessing short term risks (which we do here) requires measuring the same instability during one single year and hence, focusing on the impact of seasonal variations. The objective assessment of the short term risks consists in evaluating the variability of the individual incomes resulting from the trips completed during one single year². In subjective terms, these risks may be evaluated by asking fishermen to indicate the highest and the lowest sums they bring home during the same period³. As they are reported, the minimal results may be closer to the average than their maximal counterparts, but the reverse pattern may also be obtained. So, the difference between the highest and the lowest values indicated by respondents differ necessarily from the average they report. As this average is not necessarily half way in between the two extremes, the distributions of both the average and the range of incomes reported constitute partially independent dimensions⁴.

Further, because of inter-individual variations in this range, the issue is to ascertain whether the distribution of this range helps identifying significant social categories. We intend to determine whether the uncertainties faced by fishermen, as a result of their participation in the collective activity required for maximising the catch of the boat, and as a result of fishing on their own, follow identical patterns. In

¹ This assessment is primarily focused on uncontrolled changes of the biomass as well as on the impact of the technological innovations which modify some of the uncertainties faced by fishermen, notably those concerning the quality of the fish, since innovations modify the duration of each trip.

² This assessment can be done at least in macroscopic terms by looking at the accounts held for each boat by their owner. Indeed, such accounts detail for each trip the volume and the value of the catch as well as the various expenditures generated.

³ The distinction between the objective and subjective assessments of short term risks corresponds to two distinct theoretical concerns. The first assessment is focused on an orthodox economic approach; the second one emphasises more the social determinants of the evaluations by the actors themselves. Of course, we acknowledge the limitations of self-reports in this regard. We assume that even though errors due to a faulty memory are randomly distributed, self-reports are still systematically related to some aspects of the conditions of the life of our respondents which need to be identified. In any case, the importance of the range of incomes likely to be claimed by individual fishermen explains the role played by their skipper whom they often consider as having the moral obligation of providing them with a stable income.

⁴ Partially only, insofar as the minimal value is automatically lower than the average, the maximal being automatically higher than the same average.

concrete terms, does the stability of the incomes corresponding to the sharing system and the incentives present the same patterns as the stability of the earnings derived from personal fishing ?

Thirdly, we speculate about the extent to which the management of collective and individual risks responds to a logic of co-operation or follows conversely a logic shaped by a zero-sum game (Hardin, 1968). In the first perspective, correlation between the variability over time of the two incomes with a collective origin (sharing system and bonus), and of the income from personal fishing should be positive or at least non significant. In addition, the standard deviations of the three distributions (sharing system and bonus on the one hand, personal fishing on the other) should be alike, since the prevailing logic of co-operation implies that all crewmen adopt similar behaviours toward the risks. Conversely, in the second perspective, the patterns underlying the stability of the earnings derived from participating in the collective catch and those resulting from fishing on one's own are seen as being mutually exclusive. Correspondingly, correlation between the variability over time of collective and individual incomes should be significantly negative. Further, the standard deviations of the relevant distributions should differ, since the underlying zero-sum games are not uniformly chosen as strategies by individual crew members as a result of their status or of their background⁵.

At last, we will analyse the determinants that influence the management of the risks faced by crewmen both as individuals and as members of a collective entity. We do so by evaluating the weight of the factors related to the formal and informal organisation of boats or of fishing companies and the weight of the experiences acquired by individual crew members. In contrast to a neo-classical economic approach which posits arbitrarily that the uncertainties generated by fishing can be treated in aggregate terms, we adopt a more empirical viewpoint. We evaluate the extent to which both the risks taken by crews and by individual fishermen and the management of risks are shaped by the technical and social profile of the boats involved, by the policies of their owners, by the constraints of local labour and fish markets and by the socio-cultural profile of individuals.

In conclusion, the analysis will enable us to speculate on the role played by both socio-cultural reproduction and the diversity of economic activities of individuals and of their families in shaping the management of the risks taken by fishermen. This management may depend on the factors that condition the adaptation of individual crewmen to a set of ever changing constraints. Hence, it should reflect the entrepreneurial qualities of the individuals under study, the experience acquired by their predecessors, or a combination of these two factors. This management may also consist in diversifying the sources of income necessary for the survival of familial groups, which means that fishermen are engaged in this activity only on a part time basis or that their relatives derive their incomes from other sources.

THE VARIETY OF SOURCES OF INCOME TAPPED BY FISHERMEN

Crews tap three independent sources of earnings. First, modes of division of labour aboard entail the differentiation of the economic rewards allocated to individual crewmen. Thus, the income generated by the auction of the catch is divided into a number of shares determined by the number of individuals aboard. The number of shares assigned to each crewman is contingent on the significance imputed to the functions he performs aboard. This number ranges from one to four and more, a little over one fourth of the entire crew, unskilled deck hands (called *ABK* in Indonesia) receiving only one single share. At the top, almost 16 per cent of both mechanics and skippers claim three shares or more. In between, specialists such as *juru lampu*, *juru arus*, *juru rumpon* are entitled to a number of shares that varies from one and a quarter to two. In monetary terms, this form of income averages Rp. 106,450. As we shall see, the corresponding distribution is relatively concentrated. One fourth of the crew earn Rp. 60,000 per trip, while one third of them receive Rp. 120,000 or more, the highest value being Rp. 300,000. In a nutshell, income derived from the sharing system vary from one to ten across individual crew members.

In contrast to this income whose value is determined by agreement between the boat owner and the skipper acting on behalf of his crew, each fisherman receives a bonus whose value is a function of the

⁵ As an illustration, since skippers and chief motorists are not allowed to fish, they cannot experience the dilemma to which we have alluded.

price obtained at the auction place and of his contribution to the boat's overall result⁶. As this bonus reflects the risks taken by participants to maximise the results of the catch, it varies within a much broader range. It averages Rp. 143,000, but varies between a minimum of Rp. 10,000 and a maximum of way over Rp. 1,000,000, hence from 1 to 100. No less than 22 per cent of those crew members whose income can be ascertained earn a bonus greater than Rp. 170,000, but no less than 22 per cent earn a bonus inferior to Rp. 30,000.

Since these two sources of income depend on the productivity of the boat and on the efficiency attached to the division of labour operating aboard, they represent the risk faced by an individual as a result of his participation in a collective venture. But this collective venture is not a full-time activity, since the boats lower their nets once or twice a day, whenever the schools of fishes are sufficiently concentrated. Thus, individuals may compensate their share of the "collective risks" by fishing on their own. To be sure, the skipper and the motorist are not allowed to do so. Some crewmen do not seize this opportunity offered to them, only a little over one half of the individuals interviewed fishing on their own. The value of their personal catches averages Rp. 27,000, or a little over one fourth of the income attached to the sharing system, which is far from being negligible. Indeed, three individuals earn an average Rp. 70,000 from their own personal catch.

THE EFFECTS OF RISKS ON THE INSTABILITY OF THE INCOME EARNED

The typical uncertainties of fisheries imply a marked instability of incomes across the successive trips undertaken during the year. The existing division of labour and the differentiation of rewards that aim at dividing the ensuing risks fairly among all crewmen blunt only partially over time variations in the three earnings acquired by a same person.

Such variations reflect distinct factors. The 56 seiners studied here have made an average of almost 9 trips during the year 1993, with a minimum of four trips in the case of 5 boats and a maximal of twelve trips in the case of 19 boats. Risks increase systematically with the frequency and the duration of the trips undertaken. Yet, the distribution of these risks is also contingent on factors such as the selection of fishing grounds and, hence, on the type of boat. As a consequence, there are considerable variations in the tonnage as well as in the value of the catch harvested by individual boats. Hence originates the gap between the maximal and the minimal values attached to the income that each crew member derives from the sharing system operating. Thus, the income per trip derived from the sharing system ranges across crewmen, between about one third of its self assessed yearly average value for its minimal, to slightly less than twice the same yearly average for its maximal. In other words, this type of income varies from 1 to 6.

In contrast, as far as the bonus is concerned, the corresponding range stretches between two thirds of and twice the self assessed average for the year. In other words, this type of income varies from 1 to 3. As we could expect, however, the standard deviation of the distribution of intra-individual differences between maximal and minimal earnings is almost three times larger in the case of bonuses than in the case of the basic salary attached to the sharing system. This is because the function of a bonus is to underline the differential contribution of individual crew members to the collective achievement of the boat.

The personal risks taken by crewmen with regard to fishing on their own follow the same general pattern⁷. The value of the personal catch per trip stretches between a minimum less than one half of the self reported average, and a maximum over twice as large as the same average value. Thus, this type of income varies from one to almost five. Further, the relevant risks are also quite differentiated, the

⁶ No less than 40 per cent of the crews of the 21 boats attached to Juwana believe that the sharing system is managed by owners exclusively.

⁷ We have eliminated from our computations the individuals who have not answered, or who have not fished on their own, either because they do not want to or because they are forbidden from doing so by existing regulations or traditions (as is the case for skippers and motorists).

standard deviation of the variability over time being twice as large as its mean (Rp. 46,530 versus Rp. 24,020).

To conclude, intra-individual variations in the three forms of income that fishermen earn highlight the danger of limiting the analysis to an evaluation of average values. Indeed, even though the instability of the various incomes approximates the risks the fishermen incur (Scott, 1976), this instability varies by type of income. Earnings from the sharing system or from the personal fishing are more unstable than the bonuses. But, the ups and downs of bonuses and of the products of private fishing vary also more markedly across individuals than the variations resulting from the sharing system. This raises the issue of whether the allocation of the three types of risks among the various categories of the crew corresponds to specific logic.

INTER-RELATIONS BETWEEN COLLECTIVE AND INDIVIDUAL RISKS AND THEIR MANAGEMENT

The three types of risks may be reinforcing one another, operate independently or be mutually exclusive. While the distribution of risks seems to follow here a zero-sum game, the strength of the evidence depends on the procedures followed.

Indeed, we may take into consideration the entire crew, including skippers who are barred from fishing on their own. In this case, zero-order correlations between the variability over time of the income generated by individual fishing and the income derived from the sharing system and the bonuses approximate -0.32 and -0.38 respectively, both significant at the 0.05 level⁸. Put it simply, then, the more standardised the two individual incomes resulting from the productivity of the entire crew, the less standardised the income derived from personal fishing.

However, when we exclude skippers from our evaluation, the corresponding coefficients drop to -0.12 and -0.20. The second value is the only one to remain statistically significant, even though both are still running in the negative expected direction. Regardless of the measure used, the mutually exclusive nature of collective and personal risks is more evident for the bonus than for the sharing system. A bonus rewards the initiatives taken by individuals on behalf of the entire crew⁹. In contrast, the sharing system reflects the constraints of an institutionalised division of labour and of power. Indeed, it limits risks by endowing them with a fixed value contingent on the roles assigned to crewmen.

The negative association between collective and individual risks may be the result of opposite factors. Thus, correlations between the length of the boat or the size of the crew and the variability over time of personal fishing on the one hand, the variability of the incomes generated by the sharing system or the bonus allocated, on the other, run in opposite directions. The coefficient of association between the length of the boat and the variability over time of personal income is -0.13, but the parallel coefficient is of 0.11 and of 0.13 in the case of the variability over time of the two "collective" incomes distributed by boat owners. Similarly, the coefficient between the number of sailors and the first form of variability is also negative (-0.21), in contrast to those obtained for the variability of the income from the sharing system or from the bonus that are both positive (0.32 and 0.13 respectively). So, an increase in the length of the boat or in the number of crewmen reduces peaks and troughs in the earnings that crewmen derive from their own fishing activities. On the contrary, it expands the ups and downs that characterise shares

⁸ The correlations involved here concern the distribution of the absolute differences between the maximal and the minimal values of the three types of income reported by individuals. Three caveats are in order at this juncture. First, there is the issue of determining whether we should have standardised such differences for each distribution. We do not think so insofar as we are primarily interested in what counts for the individuals studied. In effect, they are concerned with the absolute terms of the differences. Secondly, there is the issue of considering the impact of inter-individual differences on correlations and notably, the impact of the differential hierarchical differentiation of the incomes derived from bonuses and from the sharing system. This should lower their association. Finally, even we consider the distributions of the differences between maximal and minimal values without standardising them in a common framework, the fact remains that a zero-order correlation, when statistically significant, should not be considered as an evidence of a causal relationship. It suggests nevertheless that the two variables considered are co-varying.

⁹ The two forms of collective risks are also highly positively inter-correlated (0.72).

and bonuses during a year. In short, the effects of the division of labour (the length of the boat and the number of its sailors acting as proxies for this variable), do not affect similarly the personal and the collective risks taken by the crewmen.

In addition, although the instability of the various types of earnings varies as a direct function of their average value, the underlying relationship is more marked for the two collective incomes than for the products of private fishing¹⁰. The correlation between the average income that fishermen derive from fishing on their own and its variability over time is lower (0.84) than the correlation between the average earning they derive from the bonuses and the changes over time of these two types of collective income (0.94). This set of statistical associations suggests that an individual has more leeway to standardise the income he generates by himself than to standardise the income he generates in association with others.

Finally, the determinants of this instability are not alike. To give an example, there are significant disparities in the logic governing the influence of the number of shares assigned to a crewman on the average value and on the variability over time of the three types of earnings. Thus, the number of shares allocated to individual crewmen has a greater negative impact on the average proportion of their income attributable personal fishing than on the variability of this specific form of earnings (with correlations dropping from -0.44 to 0.17). Conversely, the same number of shares has a positive and uniformly higher influence on the average value and the yearly range of the premiums (0.79 and 0.85). Last, the same independent variable has a greater positive impact on the average earnings derived from the sharing system (0.80) than on the variability of this type of income (0.61). In other words, the risks faced by a fisherman vary with the position he occupies aboard.

THE DETERMINANTS OF THE MANAGEMENT OF INDIVIDUAL AND COLLECTIVE RISKS

We have suggested that the labour market of fisheries is segmented. This segmentation could be informed by rational forces. This is not the case, because the determinants of the quality and of the quantity of fish often operate at cross purposes. As an illustration, as larger boats operate further away from the coast, they exploit new fishing grounds, but encounter new hurdles to maintain the fish quality. Thus, there is hardly any relationship between the average price per ton that boats obtain and the average or the variability of the different components of their crew's income¹¹. For instance, the coefficient of correlation between the average value of the fishes caught and average individual bonuses is only -0.03, and it is 0.02 with the variability over time of the same measure¹².

Analyses of the cross-tabulations between type of seiners and the characteristics of the various components of the incomes earned by crews highlight the "irrational" character of segmentation processes. Whereas the crew of small and medium purse seiners tends to enjoy higher but more differentiated incomes, the relevant contrast are hardly significant (Tab. 1).

Whereas bonuses tend to be slightly more stable in the case of larger boats, the reverse tends to be true as far as the income of individual fishing is concerned. It is among the crewmen of these largest seiners that this particular source of money follows the sharpest ups and downs. In short, the advantages attached to the ability of fishing further away are not uniform.

¹⁰ Both the direction and the statistical significance of this association represent an empirical rather than a logical or statistical problem.

¹¹ This is to be concentrated with the high correlation between the aggregate sums distributed to the crew as a whole and the overall value of the boat output that one obtains from the analysis of the boat accounts recorded by owners. The lack of correlation observed here may be related to the biases that characterise the sample of boats and of fishermen used in the analysis. It may be that the data we collected independently on the production of individual boats are not reliable.

¹² Cross tabulation confirm that the relationship is linear but insignificant.

This is confirmed by an inspection of the correlation coefficients between the length of the boat and the size of the crew on the one hand, and the central tendencies of the income earned by the boat as a whole or by its individual crew members (Tab. 2)¹³.

Table 1 : Income distributions (in thousand rupiahs) by type of seiner
Distribusi pendapatan menurut jenis pukat cincin (dalam ribuan rupiah)

	Small and medium seiners	Large seiners
Overall yearly income		
Mean	2,307	1,939
Standard Deviation	2,485	2,157
Income due to sharing system (per trip)		
Mean	108	106
Standard Deviation	61	51
Range (1)	164	158
Standard Deviation	112	82
Income due to incentive (per trip)		
Mean	220	154
Standard Deviation	287	236
Range (1)	241	150
Standard Deviation	316	223
Number of fishermen (2)	58	91

(1) Difference between best and worst individual trips.

(2) The number varies after elimination of inappropriate cases, for example of skippers and motorists in the case of personal fishing. For this particular variable, the numbers are respectively 27 and 51 .

Table 2 : Zero order correlation between the length of boats and income distribution
Korelasi linier antara ukuran panjang kapal dengan distribusi pendapatan

	Income	Length of boat
Overall yearly income		0.04
Percent of overall income owed to personal fishing		-0.24*
Annual range of the personal fishing		-0.13
Income due to sharing system		0.31*
Range of the income due to sharing system		0.11
Income due to incentives		0.17
Range of the income due to incentives		0.14
Price per ton landed		-0.25*

significant at the $P \leq 0.5$ level

In this sense, larger boat is less productive than a smaller one. Indeed, correlations between the average value of fish caught on the one hand, and the length of the boats or the number of their crewmen on the other, are both negative. More important for our purpose, as differences in the fishing sites exploited by large and small purse seiners affect the importance of the earnings derived from personal fishing, they modify the dilemmas encountered by crewmen in the management of the risks they incur.

¹³ It is noteworthy that the number of crewmen varies for each trip and that this number is not influenced by the importance of the catch anticipated, but rather by the solidarity operating in fishermen communities, the fishermen without job being temporarily employed. In other words, the analysis of variations in the number and the profile of crewmen both over time and across boats should tell us something about the relative "socialisation" of the risks encountered by the population as a whole and hence about the techniques by which the community prevents individual and collective risks from being a zero-sum game.

In the same vein, as our two measures of the importance of a boat are less correlated with the bonus distributed to their crew than with the income they can claim as a result of the sharing system, we may infer that the greater constraints resulting from a sharper division of labour are not necessarily associated with a parallel increase in the productivity that is expected to result from the ensuing complexity¹⁴.

In short, the structure of the segmentation process governing the distribution of the various incomes earned by crewmen reflects social logic that are shaped by both the organisational structure of the enterprises involved in the activity and the socio-cultural profile of individual crew members.

THE SEGMENTATION OF COLLECTIVE RISKS

Fishing activities do not take place in a physical vacuum. The economic rewards allocated to fishermen depend on the division of labour prevailing in the harbours from which purse seiners operate. The fewer the alternative employment in a community, the lower the pressures exerted on boat owners to maximise the money they should offer to their crews. In other words, the structure of the labour markets should affect both the central tendencies and the variability over time of the distinct components of the income enjoyed by crewmen. As expected, there are significant contrasts in the income policies of the owners located in Tegal, in Pekalongan and in Juwana (Tab. 3).

Table 3 : Income distribution by location of the owners' headquarters (thousand rupiahs)
Distribusi pendapatan menurut lokasi pusat kegiatan pemilik (ribuan rupiah)

	Tegal	Pekalongan	Juwana	Others
Overall yearly income				
Mean	2,434	2,425	1,270	2,871
Standard Deviation	2,748	2,485	866	2,791
Income due to sharing system (per trip)				
Mean	114	99	102	143
Standard Deviation	63	61	35	65
Range (1)	177	174	126	186
Standard Deviation	113	90	58	133
Income due to incentive (per trip)				
Mean	233	140	148	271
Standard Deviation	317	238	159	300
Range (1)	220	160	99	261
Standard Deviation	274	269	59	310
Number of fishermen (2)	50	44	49	7

(1) Difference between best and worst individual trips.

(2) The number varies after elimination of inappropriate cases.

The average bonus is sharply lower in the case of the boat owners of Pekalongan or Juwana than elsewhere. Alternatively, the proportion of the personal fishing in the overall annual income of crewmen is significantly higher at Pekalongan or Juwana than elsewhere. Not only this, but as the standard deviations of the relevant sets of distributions are minimal in the case of Juwana, we can infer that inter-individual differences are lower there than anywhere else and hence, that there is less differentiation in the salaries actually distributed by the enterprises of this town. However, while the income from personal fishing is significantly more stable among the crews working for the Tegal owners than among their counterparts based elsewhere, the reverse is true for the income derived from bonuses. Since this later

¹⁴ While one can expect that the largest boats seek to attract the more qualified segments of the labour force, the pressures of the heightened competition across various types of seiners may have the opposite effect.

type of income is more unstable for the crews of Tegal than for their colleagues employed elsewhere, we can infer that the corresponding "collective" risk is not uniformly distributed across harbours.

Independently of the harbours, boat owners and skippers seem to adopt differing income policies. In the case of four owners for which we have sufficient data, we can differentiate two pairs in terms of the high incomes they distribute and the marked differentiation of the policies they follow (Tab. 4).

Table 4 : Income distributions (thousand rupiahs) by owners (for 4 individual owners)
Distribusi pendapatan (ribuan rupiah) menurut pemilik (untuk 4 individu pemilik)

	A	B	C	D
Overall yearly income				
Mean	2,255	2,117	1,758	1,700
Standard Deviation	2,641	2,322	1,902	1,663
Income due to sharing system (per trip)				
Mean	93	135	78	98
Standard Deviation	53	55	43	10
Range (1)	150	177	198	124
Standard Deviation	101	75	89	44
Income due to incentive (per trip)				
Mean	177	257	64	271
Standard Deviation	307	265	132	327
Range (1)	107	293	67	110
Standard Deviation	252	301	132	
Number of fishermen (2)	10	15	12	10

(1) Difference between best and worst individual trips.

(2) The number varies after elimination of inappropriate cases.

Owners offering the highest salaries are those who are the most discriminating. The same social segmentation characterises the policies followed by skippers. Despite the limited number of cases (three boats whose at least ten crew members belonged to our sample), our data suggest that they differ in terms of (1) the average amount of overall income earned by their sailors and its differentiation, (2) the central tendency and the variance of their distributions of "shares". The boat with the lowest variance in this regard offers average salaries that differ moderately from those provided by the most generous unit (the first boat has a standard deviation of Rp. 9,000 for a mean of Rp. 97,000, contrasting the second boat which has a standard deviation of Rp. 60,000 for a mean of Rp. 138,000).

The data suggest the pre-eminence of cultural forces in shaping not only the average values of the various forms of income earned by individual crewmen, but also the extent of both inter-and intra-individual variations. Despite or because of the uncertainties attached to fisheries, the economic status of crewmen seems to be as tightly influenced by the social definitions that employers propose of the rewards they offer as by constraints related to the market or to natural contingencies.

THE INDIVIDUAL SEGMENTATION OF INDIVIDUAL AND COLLECTIVE RISKS

Insofar as the amount and the stability of the various forms of income claimed by crewmen depend on a bargaining process, they are also contingent on the social profile of fishermen themselves.

First, their bargaining power is reduced by the diversity of the human capital they are expected to acquire. Correspondingly, while the possession of any desirable type of human capital may raise the central tendencies of the major forms of income coveted by fishermen, the same possession is also often associated with an accentuation of the dispersion of such incomes. For example, as formal schooling

involves the acquisition of "universalistic skills", it facilitates adaptation to a variety of environments and it should enhance accordingly the bargaining power of the most educated fishermen. To be sure, as Table 5 shows, crewmen with any form of post primary formal schooling earn over twice as much as their counterparts who never attended any educational institution.

Table 5 : Income distribution (thousand rupiahs) by level of schooling
Distribusi pendapatan menurut tingkat pendidikan (ribuan rupiah)

	Illiterate	Some primary schooling	Primary schooling	Beyond primary schooling
Overall yearly income				
Mean	1,235	2,547	1,551	2,834
Standard Deviation	839	2,649	1,563	3,079
Income due to sharing system (per trip)				
Mean	83	120	116	96
Standard Deviation	31	62	60	46
Range (1)	121	181	186	138
Standard Deviation	43	115	116	63
Income due to incentive (per trip)				
Mean	58	224	353	94
Standard Deviation	74	284	374	122
Range (1)	80	250	285	109
Standard Deviation	128	294	280	234
Number of fishermen (2)	13	57	62	19

(1) Difference between best and worst individual trips.

(2) The number varies after elimination of inappropriate cases.

But, as the same table shows also, any additional year of schooling tends also to be associated with a widening of the variance of the distribution of various forms of individual earnings. For instance, it is the crewmen with post-primary education who reap the highest average bonus, but it is also among the same crewmen that this source of earnings is both most differentiated and unstable (with an average variation of Rp. 285,000 throughout the year as opposed to only Rp. 80,000 in the case of their illiterate counterparts). The average amount, and the extent of inter as intra individual variations in the various types of fishermen income are all contingent on the job they perform aboard. As shown by Table 6, while a skipper (*nakhoda*) earns as a whole seven times more than an unskilled sailor (*ABK*), contrasts among skippers along these lines are over four times larger than those observed among unskilled labourers.

Differences between the two populations in this regard originate primarily from the bonuses they receive. Thus the average bonus enjoyed by skippers is over eleven times greater than that enjoyed by *ABK*, but the basic income claimed by the first sub-population is only less than three times larger than that claimed by the second one. Interestingly enough, however, it is not among skippers that the relevant inter-individual variations are most significant and thought provoking. Rather, it is among motorists, the standard deviation in the distribution of their basic salaries being almost three times as large as in the case of the *ABK*. At the same time, the higher bonuses enjoyed by *nakhoda* reflect the higher risks they incur. Thus, the average gap between the highest and the lowest bonus received throughout a year is much higher in their case than in the case of motorists (about six times higher) or of *ABK* (over twenty times).

Table 6 : Income distributions by skill (thousand rupiahs)
Distribusi pendapatan menurut keterampilan (ribuan rupiah)

	<i>ABK</i>	<i>Motoris</i>	<i>Wakil nahkoda</i>	<i>Nahkoda</i>	<i>Others</i>
Overall annual income					
Mean	988	2,009	2,145	7,500	1,147
Standard Deviation	331	1,402	1,001	1,330	428
Income due to sharing system (per trip)					
Mean	73	115	132	208	98
Standard Deviation	24	60	31	47	29
Range (1)	109	181	192	334	131
Standard Deviation	43	77	80	98	52
Income due to incentive (per trip)					
Mean	59	74	140	668	73
Standard Deviation	55	69	206	201	56
Range (1)	25	91	161	649	54
Standard Deviation	8	33	113	190	45
Number of fishermen (2)	64	17	11	19	37

(1) Difference between best and worst individual trips. (2) The number varies after elimination of inappropriate cases.

SOME CONCLUDING REMARKS

Let us summarise our theoretical and empirical findings concerning both the risks incurred by the crew of Javanese purse seiners and the way they manage these risks in function of the socio-cultural profile of boat owners and of their own trajectories.

First, it is possible to assess the collective and individual risks incurred by the various categories of actors involved in fisheries by evaluating the stability of the collective and individual incomes derived from the activity throughout a particular year. These risks are not only seasonal, but they are also historical, contingent as they are on positive factors such as technological innovations (notably the use of radiotelephones, electronic navigational aids and echo sounders) and on negative forces as well such as the over-exploitation of existing resources. Thus, we have shown not only how the distinction between individual and "collective" risk implies parallel variations in the instability of the corresponding forms of income, but also how these risks differ across skill levels.

Secondly, while the management of collective risks rests upon the formal or informal distinction that boat owners establish between the sharing system *per se* and the allocation of bonuses contingent on the results attained by a boat after each trip, most crew members have the choice of overcoming the ensuing constraints by playing their own game and maximising the earnings they derive from personal fishing activities. Our data suggest the complexity of the responses offered to this particular dilemma. Indeed, these responses vary with the type of boat under study, the socio-cultural characteristics of boat owners, and with the background, the age, the schooling and the occupational trajectory of their crews¹⁵.

Having sketched the overall profile of the various strategies available to individual crew members, notably as a function of the position they occupy aboard, two types of task remain ahead of us :

- First, it remains necessary to validate further our conclusions by relying on a multivariate analysis. In the present case, the size of our sample has prevented us from going beyond bi-variate cross tabulations. In order to evaluate the relative impact of the variables symbolic of the owners' environment and of those symbolic of the cultural, educational and occupational trajectories of individual crew

¹⁵ Here, we analyse exclusively the management of the risks incurred by fishermen in rational terms. The very uncertainties they face induce them to seek the assistance of irrational sources such as the *dukun* that helps decide the date of departure of a boat or chose her fishing site.

members, we need to run appropriate multiple regressions. This requires the use of a larger and more systematic sample. More systematic, insofar as we need a sufficiently large range of variations in the samples of owners, of boats and of their crewmen, which means a more complex and more risky data collection process¹⁶.

• Secondly, it is equally clear that we have considered only one aspect of the management of the risks associated with fishing. An other aspect concerns the impact of risks on the management of family resources. However limited our analysis may be in this regard, it yields socially significant results. Indeed, analyses of variance show that the value of the income resulting from the sharing and from bonuses account respectively for 34 per cent and for 47 per cent of the variance of the distribution of reported daily expenses. The corresponding percentage drops to 6 per cent in the case of personal fishing. Further, while the correlations between daily expenses and the first two types of earnings are positive, the association between the average product of personal fishing and daily expenses is negative, which confirms that this activity play a role apart in the life of fishermen.

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¹⁶ Any analysis of a fishermen community raises methodological issues that are difficult to solve. To use villages as a basis for interviewing facilitates the fieldwork but introduces easily biases in the sample effectively utilised. Alternatively, to use boats as the basis for interviewing data gathering process renders the task more difficult since crewmen keep coming and going, which slows the data gathering process.