COMMERCIALISATION AND SPECIALISATION IN ARTISANAL FISHERIES: THE CASE OF PEARL LAGOON, NICARAGUA

Raymon van Anrooy and Mariska Weijerman
Proyecto DIPAL II, Desarrollo Integral de la Pesca Artesanal
R.A.A.S, Nicaragua

ABSTRACT

Commercialisation and specialisation of 450 artisanal fishermen of the Pearl Lagoon, on the Atlantic Coast of Nicaragua, was measured over three consecutive years (October 1995- September 1998). The level of commercialisation of the fishermen differed more within years than between years, largely due to seasonal effects. The conventional wisdom that commercialisation leads to specialisation is not supported by the results from the present study. On the contrary, correlation analysis showed an inverse relation between commercialisation and the degree of specialisation of the fishermen, indicating that commercialisation supposedly will result in a more heterogeneous artisanal fishery production in the area.

RESUMEN

Comercialización y especialización de 450 pescadores artesanales en la cuenca de Laguna de Perlas, en la Costa Atlántica de Nicaragua, fueron medidas durante tres años consecutivos (octubre 1995 – septiembre 98). El nivel de comercialización de los pescadores varía más entre meses que entre años, lo que indica un efecto de temporada. La opinión corriente de que la comercialización va a llevar a la especialización, no se pudo confirmar en este estudio. El análisis de correlación demostró que la comercialización tenía una relación negativa con el nivel de especialización de los pescadores, por lo que se concluye que la comercialización probablemente va a resultar en una producción mas heterogénea de la pesca artesanal en el área.

INTRODUCTION

The Pearl Lagoon situated on the Atlantic coast of Nicaragua provides a classic example of an under exploited fishing area. The Lagoon with a surface of 542 km^2 has two outlets to the Caribbean sea, and many rivers flow into the lagoon on its west coast. The lagoon is the breeding area of many fish species (e.g. catfish *Bagre marinus,* common snook *Centropomus undecimalis,* jack *Caranx hippos,* fat snook *Centropomus paralellus,* tarpon snook *Centropomus pectinatus*), crustaceans (e.g. blue crab *Callinectus sapidus,* white shrimp *Penaeus schmitti,* seabob *Xiphopenaeus kroyeri*) and shellfish species as the oyster *Crassostrea rhizophorae* and the cockle *Polymesoda solida.* The total population of the 10 villages situated around the lagoon is around ten thousand. Fishing is the main economic activity, however, it must be noted that remittances from family abroad form a significant part of many household incomes. Like artisanal fishery activities in most developing countries, those of the Atlantic coast of Nicaragua can be characterised by the simultaneous existence of subsistence- and a commercial fishery production. Many households that are involved in fishing activities also cultivate agricultural products like pineapple, cassava, bananas and rice. Households producing solely for their own consumption hardly exist in the Pearl Lagoon area.

Commercialisation of the rural sector is considered to be one of the fundamentals of successful economic development (JANSSEN and VAN TILBURG 1997) implying participation of rural households in the exchange economy (VAN ANROOY *et al.* 1998). For Nicaragua with two long coastlines the fishery sector as part of the rural sector is one of the most important. In 1998 the export of the fishery sector was the primary source of foreign income as a result of the hurricane Mitch, which destroyed part of the coffee plantations and caused a drop in the countries' meat production.

Commercialisation of artisanal small-scale fisheries is many times associated with increasing surpluses marketed, better quality production, efficiency improvement, knowledge of technical improvements and awareness of the environment. Commercialisation can be regarded as a process, in which the step from subsistence to surplus production has to be made. GRABOWSKI (1995) and KENNEDY and COGILL (1988) suggest that commercialisation is positively related to specialisation, i.e. a fundamental economic process whereby division of labour and concentration of effort on a single task can increase efficiency and output (KOHLS and UHL, 1990). Specialisation of artisanal fishermen in the Pearl Lagoon area is likely to have its consequences for the fish stocks. Identification of processes of commercialisation and specialisation of artisanal fishermen may be crucial for the implementation of management plans in fisheries and to establish a sustainable fishery.

An attempt is made here to distinguish between commercial artisanal fishermen and subsistence artisanal fishermen. Furthermore, this paper aims to describe some expected consequences of commercialisation for the management of the fish and shellfish resources of the Pearl Lagoon.

MATERIALS AND METHODS

Description of the dataset

Data were obtained from a database produced by the co-operation of the Nicaraguan ministry of fisheries (AdPESCA) and the Dipal Project (Desarrollo integral de la pesca artesanal). The database contains data of all artisanal fishermen in Pearl Lagoon, the weight of the species sold and the price received at the fish processing plants in the area. The fish used for home consumption of the fishermen is therefore not included in the database. The fish processing plants only accept fish of half a pound and upward, therefore smaller fishes are refused, and neither included in the database nor in the analysis. The database contains data from May 1995 till today. In total 2,722 fishermen were identified till November 1998 and 38 fish and shellfish species were recorded. The data were collected in 4 different processing plants, which cover together 98 percent of the sales of artisanal fishermen in the area. Only those fishermen involved in selling some of their production to these processing plants during each of the three years of the investigated period were selected for the analysis (N = 450). The analyses were based on the data over the three-year period October 1995 – September 1998.

Method of Analysis

Commercialisation of the agricultural sector is generally defined as the total gross farm sales divided by the gross value of farm output (VON BRAUN and KENNEDY 1994) and is frequently converted to an index by multiplying the outcome by one hundred (LINDERT 1978; Van Anrooy, 1997). However in fisheries, this way of measuring commercialisation is difficult to apply as a result of the fact that fishermen cannot live in pure food autarchy if only fishing. Therefore fishermen need to cultivate other products or buy these products. Furthermore, it is practically impossible to measure commercialisation of artisanal fishermen in the Pearl Lagoon area at household level, involving all household activities, because men and women in the communities enclosing the lagoon hardly share their households' incomes and expenses. Therefore an alternative method of measuring commercialisation of artisanal fishermen is needed. The method proposed and practised by this paper is the following:

As a first indicator of commercialisation the number of times per month a fisherman sold any product to one of the processing plants was measured. This number was transformed into a percentage according to the following rule: no sale is 0%, 1 sale is 25%, 2 sales are 50%, 3 sales are 75% and 4 sales or more indicate a commercialisation of 100%.

However, since the use of the above commercialisation indicator does not account for the dependence on fisheries activities of the household income, a second commercialisation indicator is introduced: the income in Cordobas (C$) received from selling the product divided by 10, to transform it to a percentage. This method can be motivated by the fact that C$ 1,000 was considered a necessary monthly income for an average household to survive in the area during the period investigated. For instance, if a fisherman earned in a single month C$ 376 it is assumed this fisherman was only partly engaged in fishing activities (estimated at 38%). A fisherman with an income received from the processing plants which surpasses the C$ 1,000 limit, is considered as 100% dependent on fisheries.

The level of commercialisation is estimated as follows:

$$Commercialisation(\%)=\frac{indicator1(\%)+indicator2(\%)}{2}$$

(i.e. the average)

Example: a fisherman who sells in one month 2 times some production to processing plants and earns a total of C$ 800 in the same period will have a commercialisation level of 65%,

$$((50\% + 80\%)/2)\text{ in that month.}$$

Based on the above a broad spectrum of fishing households can be distinguished, with at one end pure subsistence and at the other end the situation of pure commercialisation (e.g. LINDERT 1978). RUTHENBERG (1968) used a commercialisation index in an agricultural context to distinguish four classes with equal ranges 0-25%, 25-50%, 50-75% and 75-100%.

In addition, this type of classification can be used in a fisheries context:

- Subsistence fishermen's main purpose is covering their households' needs and their sales are therefore low. The share of sales in relation to their other activities and therefore their level of commercialisation is estimated at less than 25%.
- Partly commercialised fishermen sell a few times a month, indicating only part of their activities is in the fisheries sector. The households' income is not mainly dependent on sales from fisheries activities. Commercialisation is estimated between 25 and 50%.
- Semi commercialised fishermen are fishing more frequently, indicating that the greater part of their time is dedicated to fishing and that their income from fisheries is the most important source of household income. Commercialisation is estimated between 50 and 75%.
- Highly commercialised fishermen are fishermen who fish at least once a week and thus can be considered full time fisherman who earn (almost) all of their income from fishing activities. Commercialisation is estimated between 75 and 100%.

Pearson correlation analysis is used to investigate whether there exists any relation between the number of different species sold per month and the level of commercialisation. Regression analysis is applied to allow analysis of the relationship between the sale in different months (dummy = 1 if sale in that month), the mean level of commercialisation in the year before and the mean level of commercialisation in the years 2 and 3. The level of commercialisation, which ranges initially from 0% to 100%, was logit transformed (HU and CHEN 1993) in order to account for heteroscedasticity (MADDALA 1992).

RESULTS AND DISCUSSION

The Ruthenberg classification gives insight into the commercialisation practices of the selected

73

Table 1.
Distribution of fishermen according to the Ruthenberg classification

	Subsistence	Partly Commercialised	Semi Commercialised	Highly Commercialised	Total
	Percentage	Percentage	Percentage	Percentage	N
Year 1	77	15	7	1	450
Year 2	61	28	8	3	450
Year 3	65	26	7	2	450

fishermen in the Pearl Lagoon area. The percentage of highly commercialised fishermen in all measured years is low and averages 2 % (table 1). The majority of the fishermen can be regarded as subsistence fishermen. Neither their income from selling fish nor their frequency of selling could qualify them as commercialised.

Mean commercialisation increased from Year 1 to Year 2, but showed a decline in Year 3. Reflected in percentages an increase of 40% between Year 1 and 2 was followed by a decrease of 6% from Year 2 to 3. The increase can be imputed to the start of more fish buying and processing companies in the area and to the higher availability of credit for the fishermen. The decline in Year 3 (October 1997- September 1998) must mainly be attributed to El Niño which caused a very long dry period in the first semester of 1998 (table 2). It is expected that the high salinity during this period temporarily changed the reproduction cycles of many fish and crustacean species. In ordinary years the dry period starts in January and lasts till half of April. Overall, July has been the month with on average highest mean commercialisation during the last years. In that month a small shrimp species called seabob (or chacalin) generally enters the lagoon and everybody who has access to trawl nets is using them just outside the lagoon (inside the lagoon it is prohibited to trawl). This seabob is mostly directly sold to one processing plant. Although showing a decline in mean commercialisation from year 2 to 3 the mean commercialisation of the artisanal fishermen has never been as high as in July and August of the third year.

In this context it is useful to investigate if higher levels of commercialisation of the fishermen synchronise with the fishing season.
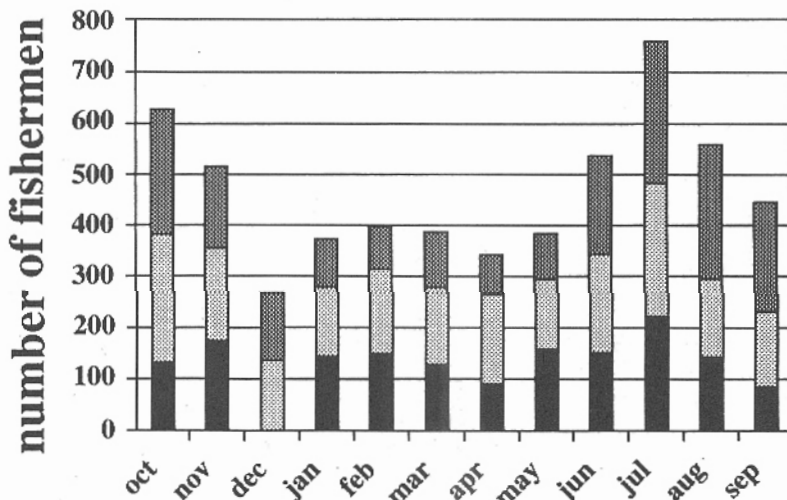
Figure 1 shows that the months June till November can be regarded as the peak-fishing season. The number of fishermen selling product to the processing plants is significantly higher (P<0.05) in the months June, July, August, October and November than in the period December to May. July was the peak month for fishing in the

Figure 1. Number of fishermen selling any fish to the processing plants per month.

Table 2.
Mean commercialisation level (std.error) per month (N=450)

	Year 1	Year 2	Year 3
OCT	13.14 (1.23)	31.61 (1.72)	32.42 (1.82)
NOV	21.88 (1.64)	27.04 (1.82)	20.95 (1.66)
DEC	0.00(a)	17.57(1.50)	19.20(1.65)
JAN	17.12 (1.46)	16.94 (1.46)	10.36 (1.16)
FEB	15.31 (1.34)	23.18 (1.69)	7.56 (0.98)
MAR	13.58 (1.26)	18.59 (1.48)	12.01 (1.26)
APR	8.22 (0.99)	23.66 (1.66)	9.05 (1.09)
MAY	16.90 (1.39)	16.92 (1.44)	8.87 (1.07)
JUN	15.82 (1.34)	26.33 (1.72)	24.59 (1.68)
JUL	29.05 (1.76)	36.84 (1.88)	45.33 (2.04)
AUG	16.97 (1.47)	18.51 (1.52)	42.42 (2.01)
SEP	17.00 (1.42)	25.38 (1.72)	31.32 (1.87)
MEAN	16.82 (0.85)	23.55 (1.01)	22.01 (0.90)

(a) indicates no data available

Pearl Lagoon area. Mean commercialisation levels were low from December to May (table 2), months when the number of fishermen selling any product to the processing plants is small. To analyse in which months the sale of fish is very important in the determination of the level of commercialisation and to find out if the level of commercialisation of the year before has some effect a regression analysis is carried out (table 3).

The months February and May show lower regression coefficients compared to the other months, indicating that the sale of fish by the fishermen did not contribute as much as in other months to the mean level of commercialisation of this fishermen. In addition, July appeared to be a month in which the sale of fishery products affected to a great extent the mean level of commercialisation. In the third year the months August and September appeared to affect most the mean level of commercialisation of the fishermen. However, differences are minor and all variables showed a significant relationship. Table 3 therefore strengthens the earlier finding of a positive relation between commercialisation and the fishing season.

The description of commercialisation and its seasonal aspects so far does not include any expected consequence of this process. Table 3 does not present any evidence that the process of commercialisation weakens the seasonality in artisanal fisheries, or in other words distributes the fishing activities more equal over the year. One of the expected consequences of commercialisation is specialisation in the catch of certain species. Therefore, the acceptance of the range of products by the processing companies needed to be measured first. Although this acceptance varied it did not cause differences in the sale of the number of different species. In general, November, February, March and July appeared to be the months where the fishermen sold relatively more species. An explanation for this variation has not been found yet, but it is expected that the variation of species present in the lagoon is higher in these months.

Interestingly subsistence fishermen sell significantly ($P<0.05$) fewer different species than the more commercialised fishermen (table 4). In contrast to expectations, the number of species sold seemed to be positively related with commercialisation of the fishermen. These results suggest that commercialised fishermen fish and sell their catch without aiming at any species in particular. Investigation of the fishing gears revealed no significant ($P<0.1$) differences between subsistence and more commercialised artisanal fisherman in the types of gear used. It should be noted here that increasing fishing periods are in general positively related to the number of fish species caught and sold. However, the number of species regarded as by-catch in the sales of the artisanal fisherman did not significantly ($P<0.1$) increase with rising levels of commercialisation.

Furthermore, an overall decline in the number of different fish species sold to the processing plants can be seen in the third year compared with

Table 3.
Results of the linear regression analysis for the mean level of commercialisation in the second and the third year (N=450)

Variable	Coefficient	t-value	Coefficient	t-value
Constant	-3.494	-28.301	-3.475	-43.906
October	.412	5.158	.413	6.865
November	.361	4.035	.445	6.596
December	.527	5.692	.446	6.215
January	.505	5.160	.269	3.325
February	.382	4.069	.183	2.187*
March	.457	4.943	.367	5.132
April	.440	4.744	.280	3.368
May	.296	3.017	.263	3.315
June	.498	5.537	.368	6.013
July	.566	6.746	.456	7.152
August	.405	4.596	.682	11.427
September	.334	4.104	.615	10.467
Year $^{-1}$	8.767E-02	3.027	6.431E-02	3.345
R-adj.	0.774		0.825	
F-value	118.990		163.548	

*significant at 5% level; all other t-values are significant at 1% level.

Independent variables of months are dummies (i.e. sale in that month = 1) and Year^1 is the logit transformed commercialisation level of the year before.

Table 4.
Mean number of species sold on monthly basis per class of fishermen

	Year 1		Year 2		Year 3	
	Mean	N	Mean	N	Mean	N
Subsistence	2.4	347	2.6	274	2.0	294
Partly commercialised	3.6	68	3.5	128	3.1	116
Semi commercialised	4.4	31	4.5	34	3.9	30
Highly commercialised	7.1	4	5.6	14	4.7	10

the previous years. Regarding the increase in the number of species accepted by the companies during the last years, this result is very surprising.

To substantiate the above results a correlation analysis is carried out (table 5). Almost all correlation coefficients were significant at the P<0.01 level, indicating an existing positive relation between the level of commercialisation and the number of species sold to the processing plants. However, the strengths of the positive relation varied much among the months. Only February and November showed an average positive correlation

of 0.60 or higher. Assuming an ongoing process of commercialisation in artisanal fisheries in the Pearl Lagoon, diversification of the production will continue to take place. However, a limiting factor in the process of diversification maybe the small number of fish processing companies in the region.

In the short term this diversification can be considered positive for the fishery resources and the catches by artisanal fishermen. It will provide the time for the government, institutions (eg. AdPesca, Dipal II Project) and fishermen to con-

Table 5.
Pearson correlation coefficients of the relation between the number of different species and the level of commercialisation

	Year 1	Year 2	Year 3
Oct	0.339	0.526	0.578
Nov	0.734	0.594	0.608
Dec	-a)	0.450	0.619
Jan	0.676	0.521	0.496
Feb	0.670	0.687	0.643
Mar	0.450	0.642	0.584
Apr	0.738	0.381	0.554
May	0.558	0.208	0.579
Jun	0.570	0.156*	0.480
Jul	0.709	0.551	0.425
Aug	0.681	0.643	0.239
Sep	0.496	0.544	0.428

*significant correlation at 0.05 level; All other data show significant correlation
coefficients at the 0.01 level.
a) indicates data not available.

sider and discuss their management opportunities for the Pearl Lagoon area without risking the immediate overexploitation of certain species.

In the long run, however, it is likely that specialisation of the artisanal fishermen in the Pearl Lagoon area will occur anyway because: (1) some species as blue crab and jack require specialised types of gear, respectively crab traps and long line; (2) profit maximising behaviour generally replaces risk aversion as fishermen become more prosperous and technology like GPS and fishfinders are adopted; (3) uncertainty about the status of different stocks will decrease as a result of the database of the Dipal II project; and (4) the transformation of a common property resource into a state property by the introduction of fisheries input regulations (licences) or output regulations (quotas) to achieve sustainability.

CONCLUSIONS

The mean level of commercialisation of the artisanal fishermen in the Pearl Lagoon area is low. It is increasing but the process seems to fluctuate and depends mainly on activities during the fishing season from June to October. Associated with the phenomenon El Niño there was a decline in commercialisation during the first months of 1998. In contrast to agriculture, commercialisation in Pearl Lagoon fisheries did not induce specialisation in the catch and sale of certain fish or shellfish species over the investigated period. The information on commercialisation and specialisation generated by this study will be of considerable value in the implementation of the management plan for artisanal fisheries in the Pearl Lagoon. Linking the results of this study with the general production data of the Pearl Lagoon will provide a trend for commercialisation and resource use, which can be used to estimate the development of artisanal fisheries for the near future. An interesting topic for further research may be to analyse the inflow of new entrants in artisanal fisheries in the Pearl Lagoon. Birth rates of more than 3% in some fishery communities in the area are likely to have their consequences for artisanal fisheries, fisheries resource use and its sustainability.

REFERENCES

Grabowski, R. 1995. Commercialization, nonagricultural production, agricultural innovation and economic development. Journal of Development Areas 30: 41-62.

Hu, M.Y. and H. Chen. 1993. Foreign ownership in Chinese Joint Ventures: a transaction analysis. Journal of Business Research 26: 149-160.

Jansen, W.G. and A.Van Tilburg. 1997. Marketing analysis for agricultural development: suggestions for a new research agenda. In: B. Wieringa *et al.*, Agricultural marketing and consumer behavior in a changing world. Kluwer Academic Publishers, p.57-74.

Kennedy, E. and B. Cogill. 1988. The commercialization of agriculture and household-level food security: the case of southwestern Kenya. World Development 12: 1075-1081.

Kohls, R.L. and J. N. Uhl. 1990. Marketing of agricultural products. Prentice Hall International. Englewood Cliffs, New Jersey, 545 pp.

Lindert, P. 1978. Agrarische Kommercialisiatie. Geografisch Tijdschrift 12: 442-451.

Maddala, G.S. 1992. Introduction to econometrics, second edition. Prentice Hall, Englewood Cliffs, USA. 631 pp.

Ruthenberg, H., ed. 1968. Smallholder farming and smallholder development in Tanzania.Afrika Studien 24. IFO-Institut für Wirtschaftsforschung, München. Germany, 360 pp.

Van Anrooy, R. 1997. Commercialisation in Ghana: a comparative study of maize, cocoa and cassave farmers. Thesis for the Department of Economics and Management, Wageningen Agricultural University, The Netherlands. 98 pp.

Van Anrooy, R., A. Van Tilburg, V. Nyanteng, and N. Heerink 1998. Commercialisation in rural West-Africa: a comparative analysis of maize, cocoa and cassava farming households in Ghana. In: A. Kuyvenhoven, H.A.J. Moll and A. Van Tilburg eds., Agricultural markets beyond liberalization: Proceedings of the 57th seminar of the European Association of Agricultural Economists, Wageningen, The Netherlands.

Von Braun, J. and E. Kennedy. 1994. Agricultural commercialization, economic development and nutrition. International Food Policy Research Institute, Baltimore, USA. 411 pp.