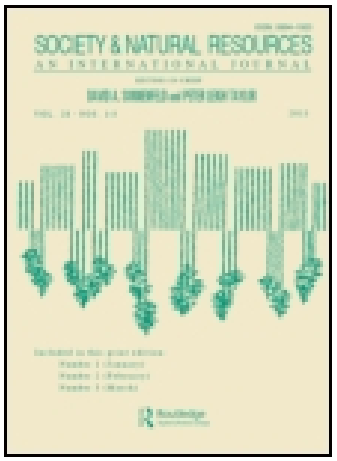

Society & Natural Resources: An International Journal

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/usnr20

The Importance of Selected Individual Characteristics in Determining Market Prices for Fishers and Traders in Kenyan Small-Scale Fisheries

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Published online: 15 May 2015.

To cite this article: A. W. Wamukota, B. Crona, K. Osuka & Tim M. Daw (2015) The Importance of Selected Individual Characteristics in Determining Market Prices for Fishers and Traders in Kenyan Small-Scale Fisheries, Society & Natural Resources: An International Journal, 28:9, 959-974, DOI: 10.1080/08941920.2015.1014600

To link to this article: http://dx.doi.org/10.1080/08941920.2015.1014600

Society & Natural Resources, 28:959–974

ISSN: 0894-1920 print/1521-0723 online
DOI: 10.1080/08941920.2015.1014600

Routledge
Taylor & Francis Group

The Importance of Selected Individual Characteristics in Determining Market Prices for Fishers and Traders in Kenyan Small-Scale Fisheries

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This article examines how selected socioeconomic characteristics of fishers and traders shape market prices at five coastal communities in Kenya. Focus groups elicited perceived factors affecting market prices, which were then tested using quantitative analysis. Ownership of fishing gear by fishers negatively influenced the prices taken. Fish traders who bought larger quantities paid a higher price. There was no significant relation between the choice of fish market by traders and fish price due to the diffused nature of the fish market. Although fish traders had relatively high income than fishers, the link between individual characteristics, market prices, and the outcomes of such interactions is more complicated than commonly perceived. The complexity is enhanced by the heterogeneity in different fisheries and of the prices at different markets and underlines the importance of continued documentation and exploration of the relationships between social and economic status and market prices for fishers and traders.

Keywords fisher, market price, socioeconomic characteristics, trader

The link between small-scale fisheries and poverty is well recognized and discussed in the literature (for a comprehensive review see, e.g., Béné 2003) despite the wealth-generating potential of highly valuable and widely traded products (Eide,

Received 20 December 2013; accepted 12 September 2014.
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Bavinck, and Raakjaer 2011). Common perspectives on this paradox portray resource overexploitation as a primary reason (Gordon 1954; Copes 1989; Pauly 1990; Kurien 1993; Béné 2003) and that fishers are unable to generate wealth from fisheries due to limited market access and exploitative relationships with trading actors (Platteau and Abraham 1987; Toufique 1997 in Crona et al. 2010). While resource exploitation levels and stock status have been extensively researched, empirical examination of the structural and individual factors that determine market prices is rarely conducted. These factors determine how wealth is distributed among actors and are essential to the debate around poverty and fisheries.

Previous work has shown that the nature of social relations and power dynamics among fish market actors can influence both behavior and economic benefits (Platteau 1995; Nguinguiri 2000). For instance, Nguinguiri (2000) describes the relationships between fishers and patrons in Pointe-Noire in Congo, where patrons control the Vili fishers through a complex mixture of generosity-redistribution, pressure, influence, and even intimidation. In Kenya, fish traders employ labor-tying arrangements that revolve around ownership of fishing vessels and credit extension (Karuga and Abila 2007). These examples demonstrate the importance of broadening analysis of poverty in fisheries from a primary focus on resource extraction to include social and economic attributes of fishers and traders (Mignot, Tedeschi, and Vignes 2012) that can influence market prices, help shed light on the complex dynamics behind the fisher–poverty paradox often cited (Béné 2003), and help understand the underlying direction of causality for this puzzle.

This article contributes to this academic endeavor by examining how selected individual socioeconomic characteristics of fishers and traders shape market prices. We focus on a set of fisheries linked to increasingly international trade (exported or sold to tourist hotels) and therefore commanding comparatively high prices locally, while also involving a wider set of trade actors than locally consumed fish of low value. In doing so, we ask the following questions: What individual characteristics influence the price at which (1) traders buy fish from fishers and (2) traders sell fish to other market actors? The focus on high-value fish species is due to lack of data for many of the lower value fish species landed. We pursue these questions by first using an inductive approach to generate hypotheses, which are subsequently tested using quantitative analysis. Our key aim is to examine what local fisheries actors believe are the key determinants of market prices (and thus economic benefits derived from the fishery) and to then test the validity of how these assumed individual characteristics influence market prices using independently collected data.

Methods

Data were collected by interviewing fishers and traders targeting three species groups, octopus (*Octopus* spp.), lobster (*Panilurus* spp.), and kingfish (primarily *Scomberomorus* spp.), at five sites along the Kenyan coast, Kipini, Malindi, Bamburi, Shimoni, and Vanga (Figure 1), between June 2010 and August 2012. In coastal Kenya, artisanal fishing is highly dependent on monsoonal wind patterns. Consequently, fishing mainly takes place during the northeast monsoon (NEM), which occurs between September and April, when the sea is relatively calmer (Ochiewo et al. 2010). Our surveying of fishers and traders over a period covering 2 years, at five sites using a uniform sampling frame, increases the chances of capturing

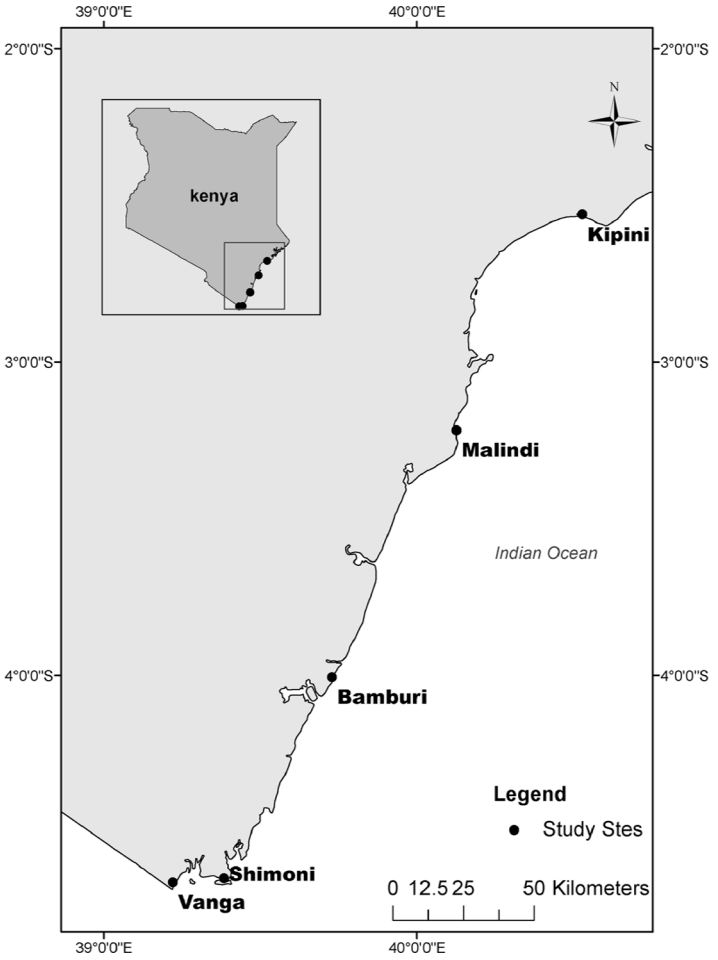

Figure 1. Map of the study sites.

seasonal variations (although this is not our focus). Also, while the sampled sites represent multigear, multispecies artisanal coral reef fisheries characteristic of coastal Kenya (McClanahan and Mangi 2004), time and resources limited our scope to the three species groups just outlined.

Fishing in this area is primarily a male activity, where women's low participation in fishing activities is in part influenced by dominance of the Muslim faith (as practiced in this area). Hence, all fishers sampled were men.

Trade in coral reef fishery has been described to involve many actors (Brewer et al. 2009; Wamukota 2009; Crona et al. 2010). In particular, traders in Kenyan small-scale fisheries have previously been categorized into small and large scale based on volumes of fish traded, value addition, and ownership of marketing infrastructure (Wamukota 2009; Crona et al. 2010). While many female traders exist, they are primarily engaged in small-scale trade with focus on frying or reselling of fresh fish for local consumption (Wamukota 2009). Some women are also involved in larger scale trade of seafood but their representation in this market segment is low. Given our

focus on highly commercial fish types, our study automatically includes primarily male respondents. Women are also represented but we did not conduct any specific gender analysis, as our sample is necessarily biased by our selection of fish types. No fish auctions exist at any of the sites sampled for this study particularly for the fish studied. Rather, fish is sold directly between fishers and traders, often through preagreed contractual agreements (Karuga and Abila 2007; Crona et al. 2010).

Data Collection

Data were collected in two stages. The first stage included eight focus-group discussions (FGDs), two organized separately at each site (except Malindi, due to time constraint). Focus-group participants (5 to 10 per site) were actors involved in the fishery either as fishers or as traders. Effort was made to involve both male and female participants, although in all discussions male participants were in the majority (79%), reflecting the nature of the small-scale fishery in the area. Discussions were based around three broad themes: (1) characteristics of fishers that influence the price at which they sell fish to traders, (2) characteristics of fish traders that influence the price at which they buy fish from fishers, and (3) characteristics of fish traders that influence the price at which they sell fish. At each site, focus-group discussions were held separately with fishers and fish traders in order to avoid each actor group being influenced by the other. Focus-group informants, who were selected on the basis of their likely possession of representative knowledge about the target fish species and their markets, were identified with the help of the Beach Management Unit (BMU) leaders, as well as village leaders and fisheries officials. In total, 30 male fishers, 12 female fish traders, and 16 male fish traders participated in the FGDs. Narratives arising from these discussions were then used to develop three main groups of hypotheses with nine subhypotheses to examine the mechanisms through which characteristics of fishers and fish traders influence market prices. These are listed here, and the underlying analysis of FGDs behind their development is outlined in the Results section:

H1: Fishers' characteristics affect the price per kilogram at which they sell their catch.

- H1.1: Contractual relations between fishers and traders create a dependency of fishers on the trader and this negatively affects their ability to negotiate higher prices.
- H1.2: Vessel ownership positively affects fishers' ability to negotiate higher selling prices.
- H1.3: Lack of storage facilities and high perishability of fish means that fishers who land larger quantities of fish settle for comparatively lower prices per kilogram.
- H1.4: Level of education positively affects the price per kilogram that fishers are able to negotiate for their catch.

H2: The characteristics of fish traders determine the price per kilogram at which they buy fish from fishers.

- H2.1: Traders who own fishing vessels are more likely to buy fish at lower prices per kilogram.
- H2.2: Traders who buy large quantities of fish are able to negotiate lower prices per kilogram from fishers.
- H2.3: Traders with higher level of education are able to negotiate lower buying price per kilogram from fishers.

H3: The characteristics of fish traders determine the price per kilogram at which they sell fish.

H3.1: Traders who sell their fish at an export hub market (or to a tourist hotel) are more likely to fetch a higher price per kilogram.

H3.2: Fish traders who deal in larger quantities of fish are able to receive a higher price per kilogram.

In addition to these hypotheses about the individual characteristics influencing selling and buying prices, we added a fourth hypothesis (H4) to test the often-assumed hypothesis that fishers on average earn less income than traders (MacKenzie 1979; Panayotou 1982; Nyeko 2005) and that fish traders exhibit a larger range of material assets. This idea stems from observations that market actors further up the value chain earn more than producers by adding value through various means (market access, transport, cold storage, product refinement, etc.), putting them in a relatively powerful position vis-à-vis the producers, sometimes resulting in exploitative relationships (Platteau 1995; Nguinguiri 2000). To address this hypothesis we examineed the difference in gross income between fishers and traders on one hand, and the correlation between gross income and material style of life (MSL) of fishers and traders on the other. MSL uses principal component analysis to generate an index of relative wealth based on the presence or absence of household possessions (Pollnac and Crawford 2000).

The second stage of data collection constituted quantitative data collection using a survey instrument to test the hypotheses developed during the FGDs. Consequently, at each site, a full list of fishers and traders was developed with the help of local fisheries officials and BMU leaders. Using systematic random sampling, a sample was drawn from the list where every *i*th respondent was interviewed (where $i =$ population/sample size) (Scheaffer, Mendenhall, and Ott 1996). In cases where the identified respondent declined or was unavailable a substitute was selected using the same procedure. In total, 161 surveys were conducted comprising 82 fishers and 79 traders (see Table 1 for a detailed breakdown of sample size per site).

Table 1. Sample sizes of fisher ($n = 82$) and trader ($n = 79$) respondents by fishery type at five sites along the Kenyan coast

		Fishery type			
Site	Respondent	Kingfish	Lobster	Octopus	Total
Kipini	Fishers	1	7	2	10
	Traders	1	2	4	7
Malindi	Fishers	6	1	6	13
	Traders	11	15		26
Bamburi	Fishers			7	7
	Traders	2		6	8
Shimoni	Fishers	11	10	12	33
	Traders	5	6	7	18
Vanga	Fishers	7		12	19
	Traders	7	6	7	20
All sites	Fishers	25	18	39	82
	Traders	26	29	24	79

Table 2. Household possessions included in the Material Style of Life (MSL) measure

Fridge	Radio cassette	Kerosene wick (L)	Charcoal	Soil (F)	Cement bricks (W)
TV	Radio	Electricity (L)	Kerosene (C)	Cement (F)	
DVD/ VCR	Borehole water	Bicycle (T)	Thatch (R)	Soil-mud (W)	
Satellite dish	Chimney lamp (L)	Motorbike (T)	Iron sheet (R)	Soil bricks (W)	
Mobile phone	Candle (L)	Firewood (C)	Stone (F)	Chalk stone (W)	

Note. L = lighting, T = transport, C = cooking, R = roof type, F = floor type, W = wall type.

Data were collected for the following key variables identified as important in the FGDs: level of education (number of years in a formal school), ownership of fishing vessel, dependent trader relationships (contractual relationship to supply fish), the fish species targeted, quantities (kilogram) of fish sold/bought, average selling prices (fishers) of fish, average buying and selling prices (traders) of fish, and choice of marketplace (local village market or export hub market). An export hub market is the term used here to denote a marketplace where fish are sold with the primary aim of direct export to international markets or trade with international tourism hotels.

Data for the MSL index were collected by asking respondents to indicate the presence/absence of 26 culturally appropriate household items, defined for this study area through previous work (Cinner, McClanahan, and Wamukota 2010) (Table 2).

Analysis

Focus-group discussions were qualitatively analyzed (using thematic coding of transcripts) to identify important variables and their hypothesized causal relationship with buying and selling prices of traders and fishers. The relative importance of variables and causal relationships was arrived at by scoring them on the basis of frequency of mention. If a variable or relationship was mentioned in all the four FGDs, it was assigned a score of 1, and if it was only mentioned in one FGD, it was assigned a score of 0.25, and so on. Factors that received a score of ≥ 0.5 were used to develop hypotheses that were then tested using quantitative methods. This process of inclusion was deemed justified, as we wanted to test hypothesized relationships that were broadly shared across sites, not ones that were particular to a specific site (and although mentioned multiple times during one FGD).

Based on the FGDs and the variables identified therein, a conceptual framework was developed to help guide the analysis (Figure 2). The independent variables were grouped into three categories: those that influenced the price taken by fishers, those that influenced the traders' buying price, and lastly those that influenced the traders' selling price (H_1, H_2, and H_3 respectively). Each of these categories thus has its own dependent variable (see Figure 2), corresponding to the three prices already outlined.

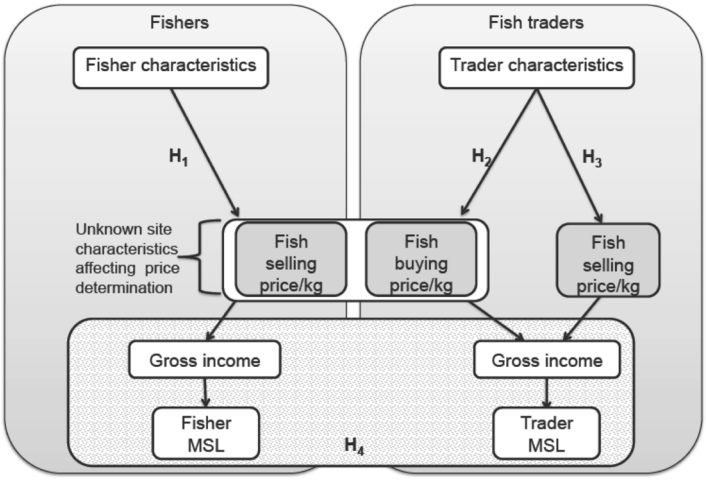

Figure 2. Model of fisher–trader interactions and their effects on MSL. Relationships corresponding to the hypotheses outlined are indicated in the figure. Dependent variables (fish selling and buying prices per kilogram) for each of the hypotheses (H1, H2, and H3) are shaded in gray.

Price data were initially explored using scatter plots. This revealed that differences between three fish species dominated variation in market prices, with lobster fetching higher prices than octopus or kingfish. As we were interested in the effect of individual characteristics on market prices, rather than the relative prices of different fish species, we standardized the market prices for each hypothesis and used pooled data from all fish species as our dependent variables. This strengthened the statistical power to evaluate the effects of interest across all fisheries, while accounting for the well-known and straightforward variation of price between species. Standardization was achieved using the formula $p_{yi} = \frac{(y_i - \overline{y})}{\sigma_y}$, where p_i is the standardized market price of sample i from fish species y, y_i is the actual price of the ith sample of fish species y, $\overline{y}$ is the mean of price of fish species y, and σ_y the standard deviation of y. This standardization procedure was done for fishers' selling prices, traders' buying prices, and traders' selling prices.

Before running statistical analysis, variables were examined for the presence of stochastic trends (Gujarati 1995) using normality, multicollinearity, and heteroscedasticity tests. Using the Jarque Bera statistic (Jarque and Bera 1980), the data were found to be normally distributed ($p > .05$). The variance inflation factor (VIF) test for multicollinearity (O'brien 2007) returned a VIF of <2, indicating no severe multicollinearity. Heteroscedasticity was tested for using the White test (White 1980), and data that did not initially conform to a F-statistic probability $>.05$ (fishers' level of education and fish selling price by fishers) were treated through log transformation to induce homoscedasticity. Socioeconomic characteristics of fishers and traders were then regressed against standardized prices (pooled for all fish types) using multiple regression to represent all hypothesized relations within a single fitted model. This approach was chosen rather than separate bivariate regressions to allow the different hypothesized variables to act as covariates to one another and more reliably identify the relationship between each independent variable and the dependent variables.

While our primary focus is on the effect of selected socioeconomic characteristics on prices received by fishers and traders, it is also important to examine the income of each respective group, as this will also reflect variation in volume traded by different actors. For fishers, this was done by calculating the product of quantity (kilogram) of fish sold during an average day and standardized selling price (Ksh), and for traders by calculating the product of quantity (kilogram) of fish bought during an average day and standardized buying price (Ksh) minus the product of quantity (kilogram) of fish sold and standardized selling price (Ksh). The prices used to calculate gross incomes were first converted into U.S. dollars (US$) using the average exchange rate between June 2010 and August 2012 (Ksh 79.5 to US$1) based on historical exchange rates (OANDA Corporation 2012). Differences in gross income between fishers and traders were examined using a *t*-test. The motivation behind the use of gross income, as opposed to net income, was that fishers and traders did not maintain records of costs, a common practice in small-scale fisheries with limited regulation such as income taxation (Brewer 2011). This is an unfortunate weakness of using gross income, as it does not allow us to accurately determine the income available to generate material wealth.

The MSL of respondents was evaluated by computing respective MSL factor loadings using principal component analysis (PCA) (Cinner, McClanahan, and Wamukota 2010). PCA factor loadings were rescaled positively to remove negative loadings in order to use the MSL loadings for correlation analyses. The difference between fisher and trader MSL was examined using a *t*-test.

Results

Focus-Group Discussions and Analysis Behind Hypotheses Development

Fifty percent of the fisher FGDs mentioned education as an important fisher characteristic that could positively influence price taken by fishers. Fishers with higher levels of education (above primary level) were thought to have the confidence and ability for negotiating higher fish prices. Ownership of fishing vessel was mentioned by 50% of FGDs as another important characteristic in positively influencing the price taken by fishers. Participants pointed out that a fisher who owned a fishing vessel was likely to land more fish, but more importantly such a fisher was not beholden to a vessel owner. Essentially, lack of ownership of fishing vessel by fishers means that the fishers have to share a significant portion of the catch with the vessel owner, and also that they have a weaker negotiating power vis-à-vis the trader.

Seventy-five percent of FDGs indicated that the quantity of fish was important in determining the price at which fishers sold fish to traders. The mechanism behind this is related to access to fish storage facilities, which improves negotiating power of fishers vis-à-vis traders. Fishers who do not have storage facilities may therefore accept low fish prices to avoid post-harvest losses especially if they landed larger quantities of fish. Another characteristic highlighted as important in influencing fish price taken by fishers was the level of dependence (in terms of credit for fuel, gear repairs, and a multiplicity of other amenities) on the trader. About 75% of the FGDs suggested that fishers who were dependent on traders in this way were in many cases at the mercy of the prices offered by the traders and therefore likely to accept lower prices per kilogram of fish.

Three variables were identified by FGDs as influencing the price at which traders bought fish from fishers. Like fishers, the level of education of traders was identified as important during price negotiation, with more educated traders paying lower prices. A fish trader who did not own a fishing vessel was thought to have a weaker bargaining position and to be likely to pay higher prices than one who owned a vessel and even employed fishers as crew. Vessel ownership was therefore perceived to help traders negotiate for lower fish price. Finally, traders who bought large quantities of fish from fishers were perceived to be able to negotiate a lower price, especially if fishers lacked storage facilities.

The last set of relationships addressed by FGDs related to factors influencing the price at which traders sell their fish. Here, 75% of FDGs felt that the choice of market (either national or regional, also referred to as export-hub markets on one hand or local markets on the other) was important in influencing prices taken by fish traders. While almost all fishers reported selling fish at landing sites, traders were more likely to have the ability to transport and sell fish to regional or national markets. Some of these markets, particularly those situated in the bigger urban centers, where there is also a higher concentration of tourist hotels, enable traders to sell fish at higher prices. Half of FGD also identified the quantities of fish sold by traders as an important factor in positively influencing the prices at which they sell. Essentially, higher quantities were associated with cost advantage (and not high prices in absolute terms); that is, the greater the quantity of a fish dealt in (sold in this case), the lower was the per-unit fixed cost, because these costs are shared over the whole stock.

Testing of Hypotheses

Reported (untransformed) market prices for first point of sale (reported as fishers selling price and trader buying price) from the survey show that lobster prices were on average higher (fisher mean 663 ± 186 SD, trader 686 ± 234 SD) than octopus (fishers 128 ± 43 SD, trader 133 ± 43 SD) or kingfish (fishers 124 ± 26 and trader 102 ± 33).

Hypothesis 1: Fisher Characteristics Influencing Fish Selling Price
Dependency on a trader had a positive significant influence on fishers selling price ($p < .05$), contrary to expectations. Likewise, ownership of fishing vessel by fishers had a weakly significant ($p < .1$) but negative influence on selling price at a significant level (Table 2). The level of education and quantity of fish sold by fishers did not significantly influence fish selling price.

Hypothesis 2: Trader Characteristics Influencing Fish Buying Price
Ownership of fishing vessel by traders had a weakly negative influence on fish buying price ($p < .1$). In other words, results indicate that traders who own a fishing vessel pay less per kilogram of fish bought. Quantity of fish bought by traders had a marginal positive influence ($p < .1$, Table 3). However, as indicated, the effect was very small. The level of education had no measurable effect on price of fish bought by traders.

Hypothesis 3: Trader Characteristics Influencing Fish Selling Price
The hypothesis that traders who sell fish at an export hub market (or to a tourist hotel) are more likely to fetch a higher price per kilogram was not supported by

Table 3. Fisher characteristics influencing fish selling price

Variable	Coefficient	Std. error	*t*-Statistic	Probability
C	−0.12	0.39	−0.29	.77
Level of education	0.05	0.05	0.99	.33
Ownership of fishing vessel	−0.50	0.27	−1.87	.07*
Log_{10} quantity (kg) of fish sold	0.01	0.08	0.12	.91
Dependency	0.56	0.22	2.60	.01**

Note. Dependent variable = standardized log transformed fishers' selling price. $R^2 = .15$, Adj $R^2 = .10$, $F = 3.28$, $n = 82$; significance: $^*p < .1$, $^{**}p < .05$.

Table 4. Trader characteristics influencing fish buying price

Variable	Coefficient	Std. error	*t*-Statistic	Probability
C	1.00	0.13	7.51	0.00**
Log_{10} level of education	−0.01	0.07	−0.11	0.92
Ownership of fishing vessel	−0.19	0.09	−1.91	0.06*
Log_{10} quantity (kg) of fish bought	0.05	0.03	1.69	0.09*

Note. Dependent variable = standardized log_{10} trader buying price. $R^2 = .06$, Adj $R^2 = .02$, $F = 0.21$, $n = 79$; significance: $^*p < .1$, $^{**}p < .05$.

findings, as there was no significant relationship between the choice of market or quantities of fish and the price received by fish traders (Table 4).

Hypothesis 4: Fishers' and Traders' Incomes

The use of gross income is not ideal, as it is not necessarily indicative of net earnings. Nevertheless, traders earned on average relatively higher incomes (US$237) compared to fishers (US$153), although the comparison of gross income between fishers and traders (using *t*-test) showed no significant difference ($p > .05$). In addition, fish traders exhibited a larger range of assets comprising the MSL index. An examination of the relationship between gross income and MSL found a very weak correlation between gross fisher income and MSL ($R^2 = .07$, $p > .05$). Correlation between gross trader income and MSL was higher ($R^2 = .24$, $p > .05$) but still weak.

Discussion

Dissecting Relationships Between Personal Characteristics and Fish Trading Prices

To better understand the social and economic dynamics determining poverty in small-scale fisheries, scholars have called for a broadening from a primary focus on resource extraction, to also include social and economic attributes of fishers and traders (Mignot, Tedeschi, and Vignes 2012) and how they may affect economic benefits derived from the fishery. This article contributes to understanding this complexity specifically by examining how selected socioeconomic characteristics of fishers and traders influence market prices and income of actors involved.

Prices at which fishers sell fish and those at which traders buy and sell fish were influenced by the different individual characteristics. These characteristics come into play within the interacting space where exchange takes place and may be critical in influencing the direction of causality linking fisheries and poverty. To empirically ground our selection of testable hypotheses, we drew on the local knowledge and perceptions of individuals working in the studied system to inductively derive propositions and combine these with insights from literature by developing three groups of hypotheses. The findings of these analyses are discussed in turn in the following.

The level of dependence of fishers on traders was highlighted by focus groups as important in influencing fish price taken by fishers. Discussions suggested that fishers who were dependent on traders in this way were often forced to accept prices offered by traders and were therefore likely to receive lower prices per kilogram. However, quantitative analysis of survey data showed that dependency on a trader had a positive significant influence on fishers' selling price ($p < .05$) (Table 3). This result is contrary to expectations, but could be explained by the context of fish marketing in coastal Kenya. While exploitative patron–client relationships have been observed in many small-scale fisheries around the world (Platteau 1995; Nguinguiri 2000; Béné 2003), the relations between traders and fishers in coastal Kenya are not necessarily of such a nature. Traders often provide fishers with credit for fuel, gear repairs, and other amenities in return for an assured supply of fish, sometimes at a prenegotiated price, and thus tie the fishers to their operation. However, there is competition between small-scale traders for access to fish (Crona et al. 2010), which may increase the bargaining power of fishers vis-à-vis traders. The secure supply of fish may be so important that traders are willing to pay a premium to fishers who loyally supply them. Thus competition among traders for marketable fish may explain the positive relationship between "dependency" as defined here and higher prices taken by fishers.

FGDs also proposed a positive link between vessel ownership and price taken by fishers, but the survey data suggested the opposite relationship, that vessel owners received a lower price for their fish. We can only speculate around two reasons for this relationship. Previous research has shown that traders often own fishing vessels and fishers merely work as crew (Crona et al. 2010). Therefore, fishers who own vessels may be less likely to rely on traders for informal credit arrangements. As such, they may operate as independent actors and sell to different traders at various times. Traders may be less willing to pay higher prices to such fishers and instead promote the long-term mutualistic relationship with fishers as already described. Second, previous analysis has found that vessels owned by fishers are mostly dugout canoes (Karuga and Abila 2007) that have been perceived to land small, low-value fish (Bah, Tobey, and Drammeh 2010). However, lack of comparative data on these other factors affecting the value of fish landed by fishers limits our deeper evaluation of the same.

The quantity of fish sold and the level of education were also deemed important by focus groups, but neither of these showed any effect on prices taken by fishers. The mechanism behind the relationship between quantity of fish sold and price is related to access to fish storage facilities, which was perceived by focus groups to improve negotiating power of fishers vis-à-vis traders by increasing the shelf life of fish. Fishers who do not have storage facilities may accept low fish prices to avoid postharvest losses. Therefore, the lack of significant relationship between the quantity of fish sold and prices taken by fishers could be attributed to the general paucity

of storage facilities in the studied fishery (Wamukota 2009). With regard to education, previous work has shown that education levels within Kenyan coastal fisher communities is low (Degen, Hoorweg, and Wangila 2010), with the majority of fishers in some areas not having more than primary-level education (McClanahan, Davies, and Maina 2005). Therefore, the lack of a measurable effect between education of fishers and traders and price received could be attributed to (1) a large percentage of respondents with low education levels and (2) the fact that the ability to negotiate for higher prices is less dependent on formal education but has more to do with the ability to convince customers and negotiate prices.

The negative relationship observed between vessel ownership among traders and fish buying price supports previous findings (Karuga and Abila 2007) and highlights the power traders have in influencing the price they pay for fish from fishers, particularly fishers who do not own their own fishing vessels and are forced to work as fishing laborers. Such fishers therefore only rent a space on the fishing vessel and are likely to accept low price offered for the catch by traders. This is achieved through the labor-tying relationships and credit extension described by Crona et al. (2010), as well as the process through which the catch is shared between fishers and traders (Karuga and Abila 2007). In addition, in most cases, fishers do not have information about end fish market prices and therefore commonly accept prices offered by traders. All these factors are likely to favor fish traders, particularly by putting them in a position where they decide prices they offer to fishers in order to increase their own profit margins.

The positive (albeit weak) relationship between the quantity of fish bought by traders and price paid could be an indication of high competition among traders referred to earlier (Crona et al. 2010). Traders who would buy large quantities of fish are likely to also have contractual agreements with other large-scale traders or hotels to supply a given quantity of fish at particular times. In order to ward off competition and secure the required amount of fish, such traders may offer fishers relatively higher prices.

The hypothesis that traders who sell fish at an export hub market are more likely to fetch a higher price per kilogram was not supported by empirical findings (Table 5). Other work on the fish marketing structure from the area has shown that most traders (small-scale) sell fish close to the landing sites or nearby villages (Wamukota 2009; Degen, Hoorweg, and Wangila 2010). While many of the sites in the current analysis (apart from Malindi and to some extent Bamburi, which are located in urban or periurban areas) are rural, these rural sites nonetheless have agents collecting fish for big companies like Sea Harvest, AMCO, and others. Although they operate competitively but independently, the presence of such

Table 5. Trader characteristics influencing fish selling price

Variable	Coefficient	Std. error	*t*-Statistic	Probability
C	0.98	0.13	7.50	0.00**
Market	0.02	0.12	0.15	0.88
Log_{10} quantity (kg)	0.01	0.03	0.54	0.59

Note. Dependent variable = Log_{10} trader selling price, $R^2 = .01$, Adj $R^2 = .02$, $F = 0.84$, $n = 79$; significance: $^{*}p < .1$, $^{**}p < .05$.

companies in both rural and urban centers undermines any clear distinction between rural and urban market prices and may explain the observed lack of relationship between choice of market and prices.

The lack of a significant relationship between the quantity of fish sold and fish selling price by traders is surprising. Economic theory postulates that the intersection between demand and supply determines the market price of a commodity (Hoxie 1906). However, the lack of data on demand limits our understanding of whether the positive (but lack of significant) effect could be an indication of changes in demand or a downward shift in supply resulting in some increase in prices. Furthermore, the aggregate price analysis is likely to have obscured our understanding of the magnitude of fish quantities supply necessary to significantly influence market prices.

Income and Wealth Differentials

Gross income does not differ significantly across fishers and traders, although the average income of traders is higher than that of fishers. Furthermore, fish traders exhibit a larger range of assets comprising the MSL index. Although gross income may not be ideal to use (as it is not necessarily indicative of net earnings), the finding, particularly income inequality, is less surprising. Such income disparities have previously been found in coastal Kenya (Wamukota, Brewer, and Crona 2014). These findings also support previous findings from other regions (MacKenzie 1979; Panayotou 1982; Kaplinsky 2000) where income inequalities between fishers and traders have been observed.

Conclusions

This article examines how selected socioeconomic characteristics of fishers and traders, and the social dynamics they give rise to in the marketplace, shape market prices for both buyers and sellers. More specifically, we explore how relative power between fishers and traders in fish markets can provide insights that contribute to the bigger fisheries–poverty discourse for three commercially valuable commodities (lobster, octopus, and kingfish) in Kenya.

We employ a multimethod approach, using inductive qualitative research both to elicit understanding of local perceptions of causality between socioeconomic characteristics of market actors and fish prices, and to develop hypotheses that are subsequently tested using quantitative survey methods.

Findings show that several of the hypothesized relationships perceived by local actors are not well supported by the quantitative empirical analysis. For instance, dependency of fishers on traders positively influenced market prices, contrary to what focus group participants thought. Also, ownership of fishing vessels by fishers negatively influenced the price at which fishers sold fish and lowered the price at which traders bought fish from fishers.

We conclude that while the mechanisms appear to be different for fishers and traders, social relations and power dynamics do influence market prices for both groups. Therefore, policy interventions seeking to address poverty and distribution of economic benefits in small-scale fisheries need to acknowledge this heterogeneity and the importance of social relations in differentially affecting market structure and behavior and economic benefits of actors.

The complex interaction between socioeconomic characteristics and social relationships observed here is further enhanced by the heterogeneity inherent in the different fishery types and in the prices at different markets, and indicates that broadening analysis of poverty in small-scale fisheries from a primary focus on resource extraction to include social relations and structural attributes of actors will further help shed light on the complex dynamics behind the fisher–poverty paradox often cited. Such exploration could contribute to the larger fisheries-poverty debate by (1) disaggregating fish species as well as actors (different categories of fishers and traders) and (2) analyzing fish prices at different markets along the value chain. Incorporation of these factors in future analyses (focusing on representative small-scale fisheries across the region) is likely to not only enhance understanding of livelihood outcomes resulting from interaction between fishers and traders, but also address obscurity inherent in aggregated analyses and provide a better understanding of causality in the fisheries–poverty puzzle.

Some important insights can also be gleaned from the multimethod approach employed here. First, it indicates the limitations of using only a single method and supports the value of multimethod approaches to enhance the robustness of findings, especially in highly complex and variable settings such as small-scale fisheries in developing countries. Second, it suggests that erroneous conceptions about causal relationships related to fisheries and economic benefits may flourish even among actors deeply engaged in a fishery, highlighting that the link between socioeconomic characteristics and fish prices is more complicated than perceived by both local communities and scholars.

Acknowledgments

An anonymous reviewer who provided insightful comments on the initial draft is acknowledged. Also acknowledged are field assistants who assisted in data collection and compilation. The Kenyan Fisheries Department officials at respective sites facilitated field data collection.

Funding

Financial support was provided by the Western Indian Ocean Marine Science Association through the Marine Science for Management (MASMA) grant, while the first author's PhD fellowship was supported by Linnaeus University. The input of the second author was made possible by funding from the Erling-Persson Family Foundation through Global Economic Dynamics 500 and the Biosphere, the Royal Swedish Academy of Sciences, and through core funding to Stockholm Resilience Center by MISTRA.

References

Bah, M., J. Tobey, and O. Drammeh. 2010. *Artisanal shrimp (prawn) fishery value chain assessment*. Kingston, RI: Coastal Resources Center, University of Rhode Island.

Béné, C. 2003. When fishery rhymes with poverty: A first step beyond the old paradigm on poverty in small-scale fisheries. *World Development* 31(6):949–75. doi:10.1016/S0305-750X(03)00045-7

Brewer, T. D. 2011. Coral reef fish value chains in Solomon Islands: market opportunities and market effects on fish stocks. Report to Solomon Islands Ministry of Fisheries and

Marine Resources and Secretariat of the Pacific Community. Townsville, Australia: ARC Centre of Excellence for Coral Reef Studies.

Brewer, T. D., J. E. Cinner, A. Green, and J. M. Pandolfi. 2009. Thresholds and multiple scale interaction of environment, resource use, and market proximity on reef fishery resources in the Solomon Islands. *Biological Conservation* 142:1797–807. doi:10.1016/j.biocon.2009.03.021

Cinner, J. E., T. R. McClanahan, and A. Wamukota. 2010. Differences in livelihoods, socio-economic characteristics, and knowledge about the sea between fishers and non-fishers living near and far from marine parks on the Kenyan coast. *Marine Policy* 34:22–28. doi:10.1016/j.marpol.2009.04.003

Copes, P. 1989. Why are fishing incomes often low? A critical review of the conventional wisdom. Discussion paper 21/89–1. Burnaby, Canada: Institute of Fisheries Analysis, Simon Fraser University.

Crona, B., M. Nyström, C. Folke, and N. Jiddawi. 2010. Middlemen, a critical socio-ecological link in coastal communities of Kenya and Zanzibar. *Marine Policy* 34:761–71. doi:10.1016/j.marpol.2010.01.023

Degen, A. A., J. Hoorweg, and B. C. C. Wangila. 2010. Fish traders in artisanal fisheries on the Kenyan coast. *Journal of Enterprising Communities: People and Places in the Global Economy* 4(4):296–311. doi:10.1108/17506201011086101

Eide, A., M. Bavinck, and J. Raakjaer. 2011. Avoiding poverty: Distributing wealth in fisheries. In *Poverty mosaics: Realities and prospects in small-scale fisheries*, ed. S. Jentoft and A. Eide, 13–25. Dordrecht, The Netherlands: Springer.

Gordon, H. S. 1954. The economic theory of a common-property resource: The fishery. *Journal of Political Economy* 62:124–42. doi:10.1086/257497

Gujarati, N., ed. 1995. *Basic econometrics*, 3rd ed. New York, NY: McGraw Hill Publishers.

Hoxie, R. H. 1906. The demand and supply concepts: An introduction to the study of market price. *Journal of Political Economy* 14(6):337–61. doi:10.1086/251231

Jarque, C. M., and A. K. Bera. 1980. Efficient test for normality, homoscedasticity and serial independence of regression residuals. *Economic Letters* 6:255–59. doi:10.1016/0165-1765(80)90024-5

Kaplinsky, R. 2000. Globalisation and unequalization: What can be learned from value chain analysis? *Journal of Development Studies* 37(2):117–46. doi:10.1080/713600071

Karuga, S., and R. Abila. 2007. Value chain market assessment for marine fish sub sector in Kenya's coast region. Mombasa, Kenya: Mombasa Coastal Developnment Authority (CMDB).

Kurien, J. 1993. Ruining the commons: Coastal overfishing and fishworkers' actions in South India. *Ecologist* 23(1):5–11.

MacKenzie, W. C. 1979. Rational fishery management in a depressed region: the Atlantic groundfishery. *Journal of the Fisheries Research Board of Canada* 36:811–26. doi:10.1139/f79-119

McClanahan, T., J. Davies, and J. Maina. 2005. Factors influencing resource users and managers' perceptions towards marine protected area management in Kenya. *Environmental Conservation* 32(1):42–49. doi:10.1017/S0376892904001791

McClanahan, T. R., and S. C. Mangi. 2004. Gear-based management of a tropical artisanal fishery based on species selectivity and capture size. *Fisheries Management and Ecology* 11:51–60. doi:10.1111/j.1365-2400.2004.00358.x

Mignot, S., G. Tedeschi, and A. Vignes. 2012. An agent based model of switching: The case of Boulogne s/mer fish market. *Journal of Artificial Societies and Social Simulation* 15(2):3.

Nguinguiri, J. C. 2000. La pêche des migrants: un modele de croissance pour la pêche locale? A propos du dualisme des therories du developpement. In *Les pêches piroguieeres en Afrique de L'Ouest: Pouvoirs, mobilitees, marches*, ed. J.-P. Chauveau, E. Jul-Larsen, and C. Chaboud, 281–97. Paris, France: Editions Karthala and Institut de Recherche et de Developpement.

Nyeko, J. I. 2005. Co-management and value chains: The role of the Nile perch exports in poverty eradication in lake Victoria fishing communities. Fisheries Training Programme. Reykjavik, Iceland: United Nations University.

OANDA Corporation. 2012. Currency converter. OANDA Corporation, London, UK. t www.oanda.com

O'brien, R. M. 2007. A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity* 41(5):673–90. doi:10.1007/s11135-006-9018-6

Ochiewo, J., M. de la Torre-Castro, C. Muthama, F. Munyi, and J. M. Nthuta. 2010. Socio-economic features of sea cucumber fisheries in southern coast of Kenya. *Ocean & Coastal Management* 53:192–202. doi:10.1016/j.ocecoaman.2010.01.010

Panayotou, T. 1982. Management concept for smallscale fisheries: Economic and social aspects. Fish technical paper 228. Rome, Italy: FAO.

Pauly, D. 1990. On Malthusian overfishing. *Naga, the ICLARM Quarterly*, 13(1):3–4.

Platteau, J.-P. 1995. A framework for the analysis of evolving patron–client ties in agrarian economies. *World Development* 23(5):767–86. doi:10.1016/0305-750X(95)00011-Z

Platteau, J.-P., and A. Abraham. 1987. An inquiry into quasi-credit contracts: the role of reciprocal credit and interlinked deals in small-scale fishing communities. *Journal of Development Studies* 23:461–90. doi:10.1080/00220388708422044

Pollnac, R. B., and B. Crawford. 2000. *Assessing behavioral aspects of coastal resource use*. Narragansett, Rhode Island: Coastal Resources Center, University of Rhode Island.

Scheaffer, R. L., W. I. Mendenhall, and L. Ott, eds. 1996. *Elementary survey sampling*. Belmont, CA: Wadsworth PWS-Kent Publishing.

Toufique, K. A. 1997. Some observations on power and property rights in the inland fisheries of Bangladesh. *World Development* 25(3):457–67. doi:10.1016/S0305-750X(96)00108-8

Wamukota, A. 2009. The structure of marine fish marketing in Kenya: The case of Malindi and Kilifi districts. *Western Indian Ocean Journal of Marine Science* 8(2):215–24. doi:10.4314/wiojms.v8i2.56983

Wamukota, A., T. D. Brewer, and B. Crona. 2014. Market integration and its relation to income distribution and inequality among fishers and traders: The case of two small-scale Kenyan reef fisheries. *Marine Policy* 48:93–101. doi:10.1016/j.marpol.2014.03.013

White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48:817–38. doi:10.2307/1912934