

# **HETEROGENEITY AND RULE CONFORMANCE IN THE MANAGEMENT OF THE KAPENTA FISHERY AT LAKE KARIBA – ZIMBABWE**

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## **ABSTRACT**

Socio economic and biophysical heterogeneity has an important impact on collective conformity to resource management measures. Within the kapenta fishery of lake kariba, there are several types of heterogeneity. These include differences in appropriation skills, political influence, initial endowment and local resource endowments. Kapenta operators have somewhat different preferences regarding resource management, assign different priorities to various objectives of resource management and have different access negotiating capacities. The differences in personal objectives regarding resource management and the differences in degree of control and access over the fishery have led to situations where users have varying incentive structures. This study shows that the social political and economic situation of users leads to variations on how different users relate with the kapenta resource.

## **INTRODUCTION**

Fishery resources used in common have two important characteristics that make their management difficult. The migratory nature of the resource such as fish and wildlife makes it costly to exclude individuals from using the resource either through physical barriers or legal instrument (Janssen & Ostrom, 2001). The second characteristic is that each person's use of the natural resource subtracts from the welfare of the others. The nature of the resource is such that, even if users cooperate to enhance the resource productivity, the level of exploitation by one user adversely affects the ability of another users to exploit the resource (Feeny et al, 1990). Subtractability is one of the major sources of the potential divergence between individual and collective rationality (ibid). Resources that share the above characteristics are susceptible to depletion and degradation because the rational individual's choice is inconsistent with the long-term interest of either the individual or society

According to Coase (1960) theorem, if rational people can come together and bargain in the absence of transaction costs, they will always reach an efficient outcome that would maximise their wealth. The iterated prisoner's dilemma shows how cooperation and trust can

emerge from self interested interactions when actors anticipate they will interact again in future. Both the Coarse theorem and the prisoners' dilemma games have been criticised for explicitly assuming a homogeneous set of players facing a homogeneous biophysical environment (Janssen & Ostrom, 2001)

Introducing heterogeneity in regard to the attributes of users and the biophysical environment complicates the capacity of people to collectively conform to the management rules. While commons users in homogeneous communities can rely on their institutions<sup>1</sup> to monitor and enforce cooperative behaviour this might be difficult to establish and maintain in settings where social, political or ethnic divisions occur within a fishing community (Bardhan & Dayton – Johnson, nd). Where communities are internally divided (for example, between the rich and the poor, blacks and whites, and political factions) systems based on consensus may not be effective. The concept is not sufficient for it does not account for different patterns of human behaviour and motivation that influence fishing. The social, economic dimensions of users and the biophysical environment that they face structure the human behaviour. Heterogeneity in these dimensions provides differential incentives to users giving rise to divergences in their attitude and responses towards the management regulations.

This study seeks to discuss how heterogeneity among users and of the biophysical environments affect users' attitude towards the area closure and the zoning regulations. The paper also shows that besides the technical rationale of management regulations based on ecological and biological factors, there are economic, political and social considerations that affect collective conformity with management regulations.

## **STUDY SITES AND DATA COLLECTION TECHNIQUES**

The kapenta fishery of lake Kariba occupies a deep pelagic zone of the Lake. About 360 000 live fish were imported from Tanganyika to occupy the ecological niche created by the formation of Lake Kariba. To date the kapenta fishery accounts for 95% of the total fish production from Lake Kariba.

The kapenta fishery constitutes an international resource since they move between Zambia and Zimbabwe. In both countries access to the fishery is regulated through licensing. The kapenta on the Zimbabwean side is defined as state property. The state decides on level and

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<sup>1</sup> Social norms, customs, and obligations Hviding and Larsen, 1995

nature of exploitation. Those licensed to fish are also expected to observe some management regulations. These include area closure and area zoning.

The research focuses on the kapenta fishing industry specifically on the Zimbabwean side. This study was undertaken in two selected sites, these are Chalala and Kariba. See Map 1. These areas represent locations with different population densities and different economic and environmental conditions as reflected in stereotype notions.

Kariba has an urban environment and nearly all inputs, spare parts and the kapenta market are readily available. In terms of kapenta productivity, this basin is considered the highest. On the other hand, Chalala is in a rural setting. Inputs, spare parts and the market for kapenta are not readily available. Chalala becomes impassable during rainy season. The basin is considered to be the least in terms of kapenta productivity.

### **Data Collection**

The unit of analysis in this study is the kapenta fishing companies of which heterogeneity is a basic characteristic. In each of the two sites, were stratified into three strata in terms of company sizes and the basin. The number of rigs/companies was used as proxy to size. The first group comprises of companies operating less than three fishing vessels and the second groups comprised of those operating four and five fishing rigs. The last group comprise of companies with six or more boats.

**Table 1: Showing the Sample sizes by Basin**

<b>Size of Company</b>	<b>Number of licences</b>	<b>Chalala Basin</b>	<b>Sanyati Basin</b>
<b>Small</b>	<b>1 – 3</b>	3	16 (6)
<b>Medium</b>	<b>4 – 5</b>	6	8 (3)
<b>Big Companies</b>	<b>6+</b>	7	7 (2)
	<b>Total</b>	15	31 (11)

In the proceeding discussions, the first category would be referred as ‘Small Companies’ and the last one as ‘Big Companies’. The medium category proved difficult to deal with. With good management a company in the second category shows the characteristics of a big company and with poor management a company in the same category displays

characteristics of a small company. The categorisation allows for the examination of how economies of scale and the area of operation could serve as explanatory variable to differences in patterns of interaction.

In Chalala efforts to undertake the whole population were made. In Kariba because of the large number of operators, I sampled a few operators for interviews. The numbers in brackets are the sample sizes per category. Operators were asked to explain how historical, socio economic, and biophysical environment shaped their motives and behaviour. Interviews with operators solicited how they perceived and interpret their personal circumstances and action of others. Operators were also asked to give costs estimates.

Besides individual interviews, key informants were selected through purposive sampling. This was designed to obtain information from key informants such as chairpersons of co-operatives, Department of National Parks and Wild Life Management (DNPWLM) and the Lake Kariba Fisheries Research Institute (LKFRRI) officials, leaders of fishing associations and managers of fishing companies. Key informants were interviewed on the morality of fishing rules and regulations and the adequacy and appropriateness of the regulatory framework and the experience with operators' conduct.

Key informants were complimented with observational research. The observational research method was used to identify patterned behaviour among operators and boat crew that occurred in less or regular cyclical fashion. Observational research was particularly useful in understanding how patterns of interaction relate to incentives or disincentives that are structured by the socio economic and biophysical environment.

The findings of this study are discussed in three sections. The first section discusses the sources of socio economic and biophysical heterogeneity within the kapenta fishery. The second section discusses how the breeding area closure regulation poses disproportionate constraints on different operators and how operators in particular situations respond to the management regulation. The second section of this paper discusses the biophysical asymmetries structure the incentives of different users in different locals. This is followed by a brief conclusion.

### **Sources of Heterogeneity within the Kapenta Fishing industry**

Before discussing the impact heterogeneity on the success of kapenta fishery management, the next section seeks to highlight two sources of heterogeneity that are apparent with the

fishery. This section therefore does not claim to exhaust all kinds of heterogeneity within the kapenta fishery.

### **Socio economic Heterogeneity**

Historically there was lack of cooperation between the white and black communities in the then Rhodesia. Even before the war of liberation there was separate development initiatives between the black and white fishing communities. In Rhodesia, fisheries development fell under two authorities. Extension in European controlled fishing water was done through Conex. In tribal areas, extension was a responsibility of ministry of internal affairs, which had a unit with just one fisheries officer (Rhodesia Herald, 26 August 1975). The DNPWLM, which carried out research and development, worked closely with conex. This resulted in disparities in fishing skills and expertise between the white and black fishers.

The Zimbabwean government inherited a dual socio economic system based on racial privilege. At independence white commercial operators dominated the kapenta fishery. Blacks were employed as boat crew, fish dryers and packers within the kapenta fishing industry. The government wishing to redress racial imbalances in access to kapenta fishery embarked on policies aimed at promoting equitable distribution of resources. The restructuring process resulted in companies of different sizes, with varying organizational forms (mergers, sole proprietors, and cooperatives).

After the war of liberation in Zimbabwe the separate development initiative for the disadvantaged blacks further widen the right. Non-governmental organizations, and the government through Ministry of Cooperatives instituted training programmes for the cooperatives that were introduced to advance the socialist ideology. While these institutions have technical knowledge regarding bookkeeping, they had very limited knowledge of the planning and the economics involved in kapenta fishing.

### **Biophysical Heterogeneity**

Each license is issued to fish in locality (basins) (Bourdillion, Cheater & Murphree, 1985). According to fisheries managers at LKFRI, the idea of linking licenses to specific basins (Exclusive Fishing Zone) is designed to ensure that fishing effort is equitably distributed along the lake. This ensures that a specific pressure is operative in a known area of the lake and the local performance of the fishery and the local management practices can be monitored.

### ***Spatial Variations in Productivity***

The productivity of these basins varies significantly due to variations in the zooplankton levels. According to ecological studies, the total zooplankton densities are always highest in Basin 1 (Mlibizi) followed by basin 2 (Binga). Basins 3, 4 and 5 (Sengwa, Bumi and Sanyati) always have lower densities than basin 1 and 2. However, basin 5 (Sanyati) usually has higher densities than basin 3 and 4. The plankton density gradient observed from Mlibizi to Bumi is expected of river-fed man made reservoirs because of the gradient in nutrients concentrations. The Sanyati Basin, the most downstream of the five basins should be the least productive but it is not so because of the effect of high nutrients inflow from Sanyati River. The Sengwa, and Ume do not have much effect on pelagic zooplankton because they drain smaller catchment with lower levels of nutrients (Masundire, 1991, Moreau, 1997). The heterogeneity in the physical characteristics of the lake causes variations not only in resource productivity but also in patterns of interactions.

### ***Locational differences and Performance variations***

The regulation did not consider other important issues that affect the economic performance of the operators fishing different basins. These include, (a) the influence of waves that disrupts fishing, reduce fishing time and increase wastage; (c) physical isolation and transport costs involved when acquiring inputs and distributing the product. Operators in the Sanyati basin operate from Kariba, otherwise most operators are in remote areas. Some of these areas are impassable during rainy season. Transport difficulties and other intermediation costs and bottlenecks have led to ill integrated markets with significant price differences between the two areas.

In sum several types of heterogeneities are apparent within the fishery. These include economic heterogeneity, which encompasses inequality in wealth or income among resource users. There are differences in cost structures resulting from locational differences and variations in economies of scale. The other type heterogeneity is of organisational forms.

I acknowledge that heterogeneity is a multidimensional phenomenon, with different facets, which may carry varying implications for collective conformity capacities (Baland & Platteau, 1996). The focus of heterogeneity in this study is limited to differing economic endowments and organisational set up. Although social asymmetries as reflected in lack of shared norms and social cohesion are very important; these are dealt with in as far as they enhance economic inequalities. In many cases ethnic and social heterogeneity will be correlated with economic heterogeneity, as certain ethnic groups are also more likely to be

richer or poorer than other groups (Baland and Platteau, 1999). Although collective conformity is also a multi dimensional phenomenon, in this study it is measured by the extent to which users adhere to rules or the level of rule conformance by different operators in various locals.

## **HETEROGENEITY AND CONFORMITY TO MANAGEMENT REGULATIONS**

This section discusses operators' attitude towards fisheries management regulations. It argues that operators are more influenced by the size, location and organisational set up of their operation when deciding whether to violate management regulations than the fear of being apprehended.

### **Breeding Area Closures**

Shallow areas that are less than twenty metres deep, rivers and river mouths are considered to be breeding areas. These areas are closed to fishing. The primary objective of this regulation is to improve upon the productivity of the kapenta resource by protecting the juveniles. It is argued that if operators fish in these areas, they catch not only small fish but also breeding female fish. Although the regulation has reduced conflicts between gill net inshore fishers and the kapenta operators, it is considered to be of paramount importance in enhancing resource productivity.

### Operators' perception towards the regulation

When kapenta operators were asked to list factors that affect the productivity of the kapenta, it is surprising that most fishers do not perceive the importance of the casual link between their illegal action (fishing in breeding area) and the level of the stock. Most operators believe that kapenta stock sizes are more influenced by environmental factors such as river flows, and lake levels that influence the level of nutrients in the pelagic. There is a generally belief that kapenta is an inexhaustible resource and that the number available is independent of the previous harvest. One kapenta operator

*'You know only a bucket full of kapenta was put in water and four years later the fish had colonized the whole lake. For sure you cannot tell me that we can over fish kapenta given such high rate of reproduction'.*

Operators and fisheries managers have somewhat different perception regarding the area closure regulation. Their visions of the likely effects of different courses of action on the status of the resource are divergent.

### Operators' Respond to breeding area closures

It would appear that the size of operation, and the organisational structure of the fishing entity have a bearing on how different operators react to the management regulation. It seems the location of the operation has very little influence on operators' respond to the breeding area regulation. Therefore this section discusses how companies of different sizes and organisational forms respond to the breeding area closure.

### Big established companies

Managers and owners of big companies appear to comply with the breeding area closures. They even discourage their workers from fishing in shallow areas. Company managers gave two reasons why they forbid their workers to poach in these areas. Firstly, big companies do not want kapenta from shallow areas because they are general small and are of poor quality. Small kapenta easily disintegrate with poor handling. Such a product is of low value and hence difficult to sell through their long established marketing channels. The second reason is that fishing in these areas may deplete the resource as juveniles and breeding fish would be caught. However very few mostly inexperienced operators support the contention that indiscriminate poaching in these areas can lead to recruit over fishing.

Some of these companies have devised some disincentives to discourage their workers from fishing in breeding areas. The most popular is not paying bonus to workers who land immature kapenta. In this regard, the basic motive behind the restraint behaviour is not conservation per se. Operators in this category are more concerned with the production of a good quality product that can fetch the highest price on the market.

It would appear the level of compliance with the breeding area closure regulation depends on two things. Firstly, the success depends on whether the boat crew who do the fishing have the incentives to comply with the management regulations. Secondly, it also depends on how much the operators and law enforcement agents remain in control of the workers who do the actual fishing. In any case, workers have incentives to circumvent the regulation even though the employers are against such action. Great financial pressures are forcing workers to supplement the legitimate income by poaching. They poach in breeding areas where they are guaranteed to catch a sizable amount of juveniles and breeding kapenta. The workers interviewed said that they would rather risk fishing in closed areas on their own account rather than to fish for their employers who in any case would not accept small kapenta.

Workers also fish in these shallow areas to catch other fish species. Most fish are attracted to light and they form considerable by catch if fishing is done in shallow areas. In cases where operators allow their workers to take the by catch, there is even greater incentives to fish in shallow areas where they are assured of such species.

Workers are aware that fishing in shallow areas and catching juveniles is against their employers and the law. They have evolved certain practices to avoid arrest, thus sustaining illegal fishing in breeding areas. Poachers and sympathizers have established networks. People in a network forewarn one another of the presence of law enforcers. When the law enforcers are in the area, boat crew workers alert each other not to go into those areas where fishing is prohibited

### Co-operatives

Most cooperatives violate the breeding area closure regulation. Some cooperatives admitted that they poach because they cannot afford to travel long distances to legal fishing grounds. They are aware that poaching is illegal and punishable by law. However, this does not deter them from continuing to poach. There are several economic factors pointed out by co-operative leaders that tied members to very circumscribed and in most cases illegal fishing ground. Firstly, 94% of the co-operatives operate less than three fishing rigs, which are supposed to fend for the members (twelve on average). Therefore the very limited profit that they make has to be spread over a larger number of people. Secondly, cooperatives also need to service their loans with financial institutions. They therefore poach because they are assured of good catches of juvenile, breeding kapenta and inshore stocks. Thirdly, fuel shortages and the ever-rising prices of fuel have forced many cooperatives to fish in circumscribed illegal fishing grounds. Some co-operatives save on fuel by not traveling long distances to designated fishing grounds. Cooperatives that are struggling to meet operating costs cannot afford to contribute to the conservation initiatives of the kapenta fishery. It would appear that for most cooperatives the main concern is to meet their basic needs first. Poaching in breeding areas seems to be also rife among the new entrants that have not developed market relations with big wholesalers that emphasis on quality. These new entrants mostly target small traders who emphasis more on quantity than on quality.

### Effects of breeding area closure

As discussed earlier there is no evidence to suggest that poaching in breeding areas has caused a reduction in young fish entering the fishing grounds (recruit over fishing).

However, the requirement to land mature fish has led non-deviant workers to become violators. Small kapenta can also be caught in the deep waters of the lake although such cases are rare. If this happens, workers who know that their employers would question the size of the fish, sell the fish to illegal buyers before they are landed. Therefore in some cases where workers are honest and trustworthy, the requirement to land mature kapenta has induced dishonest behaviour in some workers.

### **Heterogeneity in Biophysical environment and the distribution of fishing effort**

It appears that the regulation of assigning a license to a specific fishing basin is based on unsubstantiated research. The regulation was designed to create an appropriate environment of self-management through the establishment of community ownership over a commonly owned basin. This argument is based on some empirical evidence. Many scholars (Murphree, 1991, Ostrom, 1995) were cited to justify the fact that only small groups can organise effectively if the boundaries are clearly defined (Machena & Moinuddin, 1993). It seems that fisheries managers did not take into account the ecological variability, accessibility and productivity of these basins. There are different kinds of constraints (that hurt some more than others) in different ecological areas. It would appear the centrality of science in the process of deciding on management has led to poor considerations of the environments under which operators conduct their business. Biophysical differences have led to eco specific strategies that are not normally available simple as a result of wealth differences.

### Exclusive Fishing Zones and Structural problems

The zoning approach did not take into considerations other important issues that affect the economic performance of the kapenta operators. These include distance to the urban centre where operators get inputs such as salt, fuel, spare parts, and other services such as mechanics and accounting. Most of the fishing companies in Kariba are performing well. There are several factors contributing to the good performance. In Kariba, there are so many qualified mechanics, easy access to fuel, spare parts, and the communication networks are well developed. The kapenta market is very well developed and competitive.

However, the same cannot be said about operators in Chalala. The regulation seems to hurt those operating in remote basin. One operator even suggested that the minimum number of licenses per operator in Chalala should be higher than that for operators in kariba. His argument was that there are so more structural problems of operating in Chalala than they

are in Kariba. This section discusses how economic inequalities influence production strategies through differences in costs of extraction.

### Cooperatives in Chalala

Of the three cooperatives all have not more than three rigs. Fishing license were issued to cooperatives on the assumption that they will use public water-based transport to ferry input from Kariba and outputs to Kariba. Not only does this increase transport costs but it has also caused a lot of delays. Lately the operation of the ferry has become very unreliable because of shortage of fuel. This has made it difficult to transport both the inputs from suppliers and the kapenta to consumers.

Therefore cooperatives are not always in supply of many of the essential inputs. Once cooperatives have a breakdown it takes time to repair the boat or engine and start fishing again. All the cooperatives are too small to afford the services of qualified mechanics and their workshops are poorly equipped. In Chalala, spatial isolation, low density of operators, high transport costs have combined to reduce the market for mechanical servicing. Qualified technicians and mechanics are reluctant to live in faraway places.

The problems of operating in Chalala have once in a while forced some cooperatives to join big companies that are performing well. Under this arrangement, the cooperative members would be employed as workers (at least they are assured of a salary). The ownership of licenses remains with the cooperative members who then transfer the management of their vessel to more efficient operators. The managing company provides transport to bring fish from the lake to the premises. It also provides, fuel, maintenance of fishing rigs, and kapenta drying space. The company also markets the cooperative kapenta. The marginal units are being forced out of the fishery through unequal competition from larger, more powerful fishing units.

The leasing of licenses is in violation of the conditions of non-transferability of licenses. Though licenses are non-transferable in Zimbabwe, it is *de facto* the situation. One can operate several vessels that may still be formerly owned by another operator. There are, however, some costs attached to these arrangements. Firstly the managing company has to prepare separate accounts for each of the companies under its management. Secondly, the managing company also has to prepare and submit separate catch and effort data to LKFRI. This further complicates the supervision of the industry by the authorities.

### Big Companies in Chalala basin

Despite these structural problems of operating in Chalala, the lack of other non-fishing activities in chalala basins has resulted in more specialist strategies in which big operators work full time, fish further away and have become professionals.

One kapenta operator in Chalala said

*‘There is a high level of professionalism here in Chalala. We have no entertainment here. The hotels in this area are expensive and cater mostly for foreign tourists. Fishing is real full time with a professional attitude’.*

It would appear that professionalism in fishing has detrimental effects. Most operators have limited ways of investing or using their money. They have therefore tended to increase the catching power of their vessels in order to increase their profit margins through capital staffing. On average fishing vessels in Chalala area are better looked after than those in kariba. Eighty percent of the fishing rigs (in this category) in Chalala are fitted with eco sounders as compared to sixty-six in Kariba. Besides, these big companies and mergers have their own water-based transport, fuel storage facilities, and stocks of spare parts. Although it is difficult to attract professional mechanics in this area, big companies can afford to so. Therefore their workshops are well equipped with the state of the art technology and manned with qualified people.

### Biophysical Heterogeneity And Resource Productivity

Area zoning regulation fails to acknowledge the fact that the productivity of kapenta, like many tropical fisheries in river fed lakes, depends more on environmental factors. Therefore fish population and hence catch vary by area. Chalala is considered to be the least productive basin and Sanyati the most productive basin. On the other hand fishing vessels are more congested in Kariba. The normal practice would be for operators to move to other sites when yields are low in one area. However, under the area zoning regulation there is a limit on the extent of fishers’ mobility. Nevertheless, operators travel from basin to basin in search of better fishing grounds.

### Operators in Kariba

Catch per unit effort is lower in Kariba than in other basin probably due to congestion of fishing rigs. Companies in Kariba have very limited alternative fishing areas within Zimbabwean waters. Nevertheless, some operators (of all sizes) violate international boundaries and poach in the Zambian waters of the lake. Operators argue that kapenta

productivity is high on Zambia waters (that is basin 4 near Siavonga). They gave two reasons to support their argument. Firstly the south-easterly winds and the Sanyati water currents blow and sweep most nutrients into the Zambian side. Therefore kapenta is more concentrated on the Zambian side. Secondly, operators argue that there are few operators in the Siavonga area. Only eleven companies are based at Siavonga exploit this part of the basin. The part of the lake on the Zambia side that is preferred by Zimbabwean is a few hours by boat. Therefore travelling costs are not deterrent factor to operators that want to violate the international boundary regulation.

When caught in these areas most workers were able to get away with it. Some workers always claim that they were drifted by the wind into the Zambia side. Some always argue that the international boundary though easy to notice during the day using islands, it becomes very difficult to see at night.

#### Operators in Chalala

As mentioned earlier Chalala is the least productive basin in the lake. Some operators fish in adjacent areas in search of better catches. In Chalala, travelling costs are a major determinant factor of how far a company can go to fish. The mobility of fishing companies in this basin seems to vary with company sizes

#### Big Companies in Chalala

Big established companies and mergers are able to travel long distances in search for better fishing grounds. The most common destination for operators in Chalala is the Sengwa basin. Although fishing in the Sengwa is in violation of area zoning regulation operators, argue that catches within Chalala basin are improving as fishing boats are more spread out. Sengwa is more productive than Chalala with high level of nutrients and there are fewer boats in the basin. However, there are uncertainties and risks associated with fishing in the Sengwa. These include the risk of earning zero income on a particular day if fishing operations are made impossible by rough weather, or if fish are absent or if law enforcement agents are in the area.

Under such situations information becomes vital for efficient planning and organising fishing operations. Operators who fish in Sengwa basin have developed networks to cope with risks and uncertainty. Through the network operators communicate previous night's catches that some operators would use to judge if they can go fishing in remote fishing sites or not. They forewarn each other of the presence of law enforcement agents in the area. In

Chalala, maybe because of closeness of fishing companies, information flow among established companies is not limited and operators are more inclined to share information about the location and the movements of the stock of fish. In kariba, where there are so many users who are dispersed over a larger area and are competing over the resource within a circumscribed area, operators tend to regard the location of their fishing sites as their own secret. Bourdillion, Cheater & Murphree (1985), noted that some operators try to deliberately mislead rivals. Other operators forbade their crew to release such information.

### Cooperatives in Chalala

Most cooperatives in Chalala have very limited sources of information and advice on how to organise their labour over space and time to take advantage of fish concentrations. These operators base their action on incomplete information because of the inherent randomness of the natural system and lack of knowledge of the fishery system. Such cooperatives concentrate their fishing operations within the designated fishing ground. It appears that they cannot afford costs associated with travelling long distances to the Sengwa basin.

It is surprising that there are no infightings between those operators from Chalala (who violate the area zoning regulations) and the operators in the Sengwa (to whom the basin was assigned). This seems to contradict the notion that users will guard their resources vigilantly if they have a sense of ownership to a given clearly delineated resource (Baland and Platteau's 1999). The reluctance to self-police and exclude others can be explained by the fact that those operators (both in Chalala and Sengwa) with the means also violate the territoriality regulation. Operators in Sengwa basin also violate the territoriality regulations as they sometimes fish within the Binga basin (which is even more productive).

### Locational Heterogeneity And Marketing Arrangements

The establishment of exclusive fishing zones focused on the distribution of fishing effort along the lake shore without due regards to inequalities in marketing costs. Kapenta operators interviewed said that the influx of cheap kapenta from Mozambique and the theft of kapenta also affected the demand and price of kapenta from Lake Kariba. It appears that Mozambique has a comparative advantage in the production of kapenta than Zimbabwe. There are several factors highlighted by Zimbabwean kapenta operators who are also fishing in Mozambique to support this contention. Firstly the density of kapenta in Lake Kabora Basa is higher than that in Kariba. This means that catch per haul is higher in Lake

Kabora Basa than in Lake Kariba. Secondly, labour is cheaper and is of higher quality (does not steal and is hardworking) in Mozambique than in Zimbabwe. These two factors suggest that kapenta production is cheaper in Mozambique than in Zimbabwe.

The kapenta from Mozambique and the stolen kapenta from lake Kariba have flooded the local kapenta market. These factors have depressed the demand of kapenta from Kariba. Moreover people are getting poorer and cannot afford to buy kapenta from kariba. Different sizes of fishing industries in different locations have searched for market systems that best suit them. It appears the choice of marketing arrangements is heavily influenced by the location, the size and the organisational structure of the companies.

### **Spatial variations in Prices for kapenta**

High transport costs, uncertainty of transport services due to long distances is reflected in wide differences between prices paid by the final consumer and those received by the primary producer. See table 2 below.

**Table 2: Showing Spatial Variations in price of Kapenta**

<b>Explanatory factors</b>	<b>Chalala</b>	<b>Kariba</b>	<b>Difference</b>
<b>Average Producer Price</b>	Z\$ 90.00 per kg	Z\$105 per kg	Z\$15 per kg
<b>Transport and associated costs</b>	Z\$45.00 per kg	Z28 per kg	\$17.00 per kg
<b>Tax</b>	Z\$13.50 per kg	Z\$13.50 per kg	0
<b>Average Consumer price</b>	\$200.00 per kg	Z\$200.00 per kg	0

On average operators in Chalala area receive a much smaller proportion (45%) of the price paid by the final consumer of kapenta. On the other hand operators in kariba receive 52% of the price paid by the final consumer. About 20 % and 15 % of the variations between producer price and consumer price is accounted for by transport costs in Chalala and Kariba respectively. On average, the producer prices prevailing at the two places differ significantly. The remoteness, underdeveloped infrastructure, inefficient transport services and other transaction costs prevent many traders from buying kapenta from these

areas. Therefore faced with low demand and high supply operators are forced to sell their kapenta at lower prices than those offered at Kariba.

#### Kapenta marketing in Kariba

Kariba offers a good market for kapenta. There are many traders of different sizes who come to buy kapenta. Big companies in Kariba have over the years accumulated high social capital that has enabled them to enter into more capital-intensive marketing activities such as wholesaling and packaging. Most of the companies sell their kapenta at their premises. They therefore do not incur transport costs. In contrast, small operators with poor social networks face high barriers to entry into more lucrative market segments. Most of the companies under this category depend on small-scale traders who come to buy kapenta for repacking. A major wholesaler in Harare argues that there are high transaction costs involved in screening for trustworthy partners, obtaining information about prices and product quality and enforcing new contracts. This has forced many wholesalers to resort to dealing with a tight network of sellers. These tend to be linked through racial relationships or historically established contracts. Some cooperatives alleged that there is institutional racism in the kapenta market. They describe institutional racism as a tendency by a wholesaler to refuse to buy kapenta from them on racial grounds. Those who alleged institutional racism in the kapenta market argue that some wholesalers deny blacks access to their market by undue emphasis on quality.

#### Kapenta marketing in Chalala

Very few kapenta traders are prepared to incur additional costs traveling to these areas when they can get kapenta from Kariba. Lack of competition among buyers has also had an effect on the price received by operators in Chalala. Vigilant marketing strategies are therefore needed. The bargaining power of a few buyers who visit Chalala is strengthened by the fact that they come when most companies have cash flow problems and large stocks of kapenta in their warehouses. As a result, big established companies in remote areas such as Chalala have their own retail and wholesale outlets for kapenta in urban areas. Access to urban market has increased prices of kapenta and dampens price fluctuations.

On the other hand, cooperatives in Chalala sell the bulk of their kapenta to small traders who use local transport to come in the area and buy small quantities of kapenta. The volume of trade depends on the amount of money available (to traders) when other responsibilities are met. It has been difficult for these cooperatives to produce a constant

supply of kapenta, as production is disturbed by fuel shortages and vessel or engine breakdowns. This has prevented wholesalers and retailers from making marketing arrangements with cooperatives. Cooperatives are therefore forced to sell their kapenta to established operators who have established markets in urban areas. Under this arrangement cooperatives receive at producer prices.

The variations in relative prices received by small and big companies have further widened the gap in income inequalities between the two categories. The big companies have been able to invest in vessel improvements/maintenance off shore facilities, more drying racks. They have been able to offer more services to the local communities in terms of jobs (both full time and casual workers).

## **CONCLUSION**

As shown within the kapenta fishing industry heterogeneous users have different production and marketing strategies, and priorities in resource use. It becomes difficult to design governance arrangements that are supportive of diverse needs of heterogeneous users. The problem with management regulation is that they cannot be tailored to particular situations of each kapenta operator in different biophysical environment. Instead, management regulations are based on average characteristics of both the biophysical environment and the users.

The umbrella approach to the management of the kapenta fails to consider how the management scheme impact on different users. Boyce (2001), argued that inequalities compress the rate of time preferences of the poor forcing them to violate the management regulations in order to survive. According to Baland and Platteau (2001), it is the operators with the largest number of fishing rigs and therefore with the largest share of total catches who might suffer in the long run if kapenta is caught before it matures to the acceptable sizes. Hviding & Larsen (1995), hypothesized that where this is the case, the affected fishers organize to improve upon surveillance and compliance with management regulations. Within the sport fishing industry, when tiger fish was threatened, sport fishermen took measure to ensure sustainability of their sport by raising some money to assist in the improvement of surveillance within the inshore fishery (Nyikahadzo, 1998).

It is surprising therefore to note that the established operators have not taken it upon themselves to institute the enforcement of the breeding area closure regulation that is believed to enhance resource productivity. Although the big users comply with the

regulation, the reason behind their compliance behaviour has very little to do with resource conservation otherwise the preoccupation of these operators has been the production of a good quality product. There seem to be no correlation between operators' ability to cooperate in the management of the resource and the profitability of the fishery. It becomes difficult to connive in measures that have little evidence that measures actually deliver real long term benefits.

When the resource productivity is spatial and temporal variable, the need to insure against such variability may militate against the area zoning measure (Baland & Platteau, 2001). To avert uncertainties and insure against income variations associated with these wide spatial variations in yields resulting from climate and other environmental factors, operators need to have a larger and diverse fishing area (Baland & Platteau, 2001). Where there are spatial variations in catch, territory prevents operators from smoothening bad and good catches, as they cannot change fishing sites.

Janseen & Ostrom, (2001) hypothesised that when carrying capacity differ, the region with highest carrying capacity are more vigilant in defending their territory than the region with lower carrying capacity. However, the collusion of operators within a region (especially where users have differences in level of trust and social norms) is difficult. The costs involved are prohibitively high. Under these circumstances highly differentiated strategies of kapenta management are needed.

As it stands government is ill equipped to regulate and manage multi participant resource systems with spatial and temporal variations in benefit streams. Operators respond spatially to resource distribution when allocating their fishing intensity over space and time. The challenge is to devise governance arrangements that are supportive of diverse needs of heterogeneous users and heterogeneity in resource distribution in space and in time and also protect the long-term productive capacity of the resource.

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