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A Geographic-Economic study of Sluice gate fishing at select islands of River Mandovi, Goa, India

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Abstract

Goa, a coastal state is famous for marine as well as inland fishing. Inland fishing is very common in Goa and is practised in the Khazan lands. There are many methods of inland fishing which are carried out in Khazan's of Goa like Kathalin, Khun, Koble, Angling, etc. The focus of this research paper is on Sluice gate or Manos fishing. The aim of this paper is tostudy the geographic, economic and socio-political aspects of sluice gate fishing on select islands of River Mandovi.Out of several islands in River Mandovi, Chorao and St. Estevam Islandare selected for this study. The primary data is collected through survey method while secondary data in the form of maps and satellite images is also used. Lunar cycleand strategic locations of sluice gates are the important geographic factors that have a direct bearing on the fish harvest and structure of gates. The economic aspects of sluice gate fishing for both the islands have slight variations in amount of fish catch, market, labour conditions and drying fish. The auctioning prices of sluice gates of Chorao Island are higher than those on the St. Estevam Island. The local socio-political scenario plays a very important role in changing the auctioning prices. The main problems of sluice gate fishing are siltation of poiems, destruction of mud bunds by crabs, certain institutional norms against the favour of fisherman, growth of weeds in the poiem which lead to overall decrease in the fish catch.

Keywords: *Khazan, Sluice gates, lunar cycle, poiem, inland fishing*

1 Introduction

Goa being a maritime state has a long coastline of 105 km. Fish is the staple food of people hence fishing is practised on a large scale. Many communities living in coastal as well as inlandareas of Goa are actively involved in fishing. Hence fishing has become an important source of livelihood for majority of the people in Goa. Goan sea food has gained world popularity and many international tourists visit Goa to enjoy the Goan cuisine along with site-seeing.

Moreover, there are certain areas of Goa where inland fishing is practised and it forms a vital means of survival for local fisherman community. But this form of fishing has failed to gain the economic significance at the national as well as the international level. This system of fishing is done in the *Khazans* of Goa. *Khazans* are basically, saline flood plains along Goa's tidal estuaries, covering an area of 17,500 hectares, which have been reclaimed over centuries with an intricate system of bunds (dykes), canals and sluice gates (*manos*). *Khazans* are the integrated agro-aqua ecosystem, where both salt tolerant varieties of rice cultivation and fishing is done. These Khazan lands are managed by the local communities based

on their traditional ecological knowledge. Hence *Khazans* of Goa is a best example of community managed, agriculture and fishing, dual system.

The intricate system of agriculture as well as fishing in *Khazans* of Goa is being practiced since time immemorial. Even before the dawn of Portuguese Era, this system was in existence and it has continued and survived till today. Fishing in Khazan is done through traditional methods like sluice gate (*Manos)* fishing, *kathalin* (gill net), angling, *khun*, *koble*etc. Out of these, the focus of the paper is only on fishing through sluice gate or *manos* fishing.

According to Sonak (2014), the origin of *khazan* ecosystems can be traced to the first step in the history of civilisation that is to the transition from food gathering to food civilisation. *Khazan* ecosystems are a result of a combination of traditional indigenous ecological knowledge of *Gauda, Mithgaude* and *Brahmin* community. A study conducted by Sonaket. al. (2005), in Divar island of Goa has explained in detail, issues related to traditional aquaculture. Fernandes and Achuthankfully (2009), state that salinity and temperature are important factors responsible to make estuary as a nursery ground for fin fish and prawns.

According to Sreekant, Manju and Narendra (2015), estuaries are important coastal ecosystems that yield rich variety of fishes, crustaceans and molluscan resources. These ecosystems provide breeding, hiding and nursery grounds for more than 200 species of marine fishes and shellfishes. Kamat and S. Faria (2016), state that fish production today by traditional Goan fisherman is usually characterized by low individual catches within a limited coastal waterline, and a high instability of income. There have been plenty of government schemes to encourage fishing in the state; but very few takers in recent years.

Aim: **To study the geographic, economic and socio-political aspects of sluice gate fishing on selected islands of Mandovi River**

Objectives:

1. **To study the mechanism of sluice gate fishing in relation with the geography setup-**

   To understand the relation between tidal effect and fish harvesting, geographical location and structure of the sluice gate.

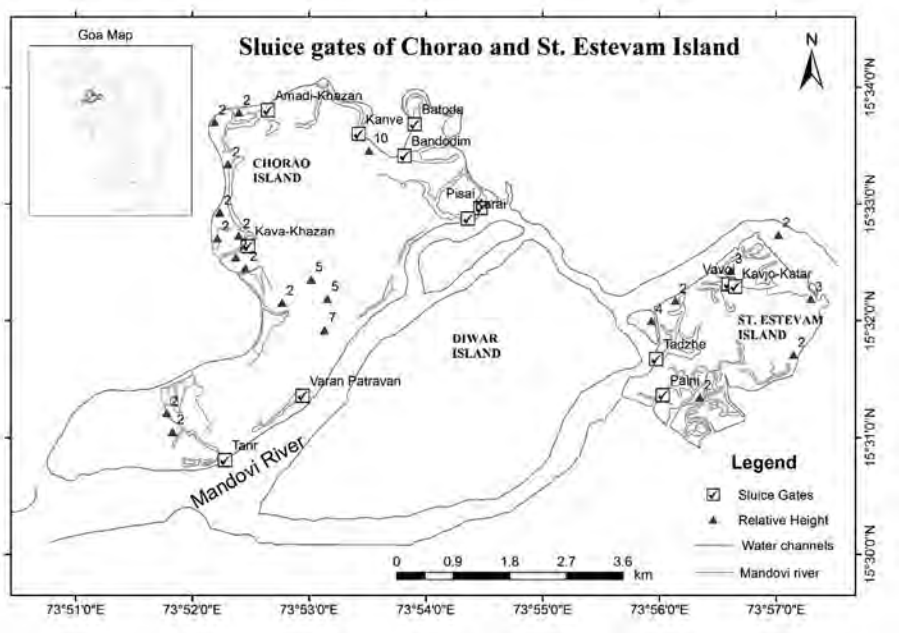
2. **To study the economic and institutional framework of the activity-**

   To understand the financial aspects, socio-political scenario and regulatory process.

Database and Methodology

This research paper is based on both primary and secondary data. Primary data is collected through interviews of the fishermen (socio-economic survey). A pilot surveyof the study area helped to understand the structure of the Khazan land and sluice gates. Based on the defined objectives, a questionnaire was prepared and the survey was conducted. Sluice gates owners from both, the Chorao and St. Estevam islands were interviewed to collect the data about fishing mechanism, fish catch, variations in fish catch, varieties of fish caught, auction prices and other

related aspects. Secondary data in terms of maps (toposheets) and satellite images is also used in this paper wherever necessary. Further, tabulation of collected data helped to arrange the data properly which facilitated to draw the inferences and arrive at the conclusion.



Map 1: The Study area

Introduction to the study area

The Mandovi River is the longest river of the state of Goa. It runs 52 kilometres in Goa flowing through its six talukas.It supports many domestic, commercial and transport activities. Apart from this, it also supports fishing activity. Hence it is called as lifeline of Goa. There are several islands along the river Mandovi, the exact number of which is not known. Two islands of river Mandovi i.e. Chorao and St. Estevam are selected to conduct the above study. Chorao and St. Estevam are estuarine islands.

Chorao, also known as Chodna, is an island along the river Mondovi. It is situated in the Tiswadi Taluka in the North Goa district. Chorao is the largest among all other 17 islands of Goa. It is located at 73°52'45.8" East and 15°32'50.7" North. It is 5 km away from the Panaji city, the capital of state of Goa [1]. St Estevam is an island in Tiswadi Taluka, North Goa district. It is encircled by the Mandovi River on all sides and was connected to the mainland by the bridge only in the mid-1980s. It is located at 76°56'28.0" East and 15°31'48.2" North. It is the fourth largest island in Goa which is

also known as *Juvem (juva* means island). It is 21 kms away from the Panaji city (Map 1).

Khazan: An introduction

'Khazan' is a Konkani term commonly used in the state of Goa for coastal saline soils. These salty low lying flat lands were originally mangrove swamps/mudflats lying along both the banks of the rivers of Goa[2]. The early settlers of this place who came down from the Ghats reclaimed the lands by constructing mud bunds all along the river and started cultivating them. These structures were made by considering tidal cycles, wave energy, sediment load, soil properties, drainage characteristics of esturine lands and anticipated increase in floodplains(De Souza, 2007). There are four main components of Khazan land (Fig.1 See page 201): the *bundh (bund)*, the *manos* (sluice gate), the *poiem* (internal water bodies) and the rice fields - elevated portion of land for cultivation (De Souza, 2007):-

A. ***Bunds***- The *bunds* or outer embankment are protective dykes which are made up of locally available laterite stones, mud and clay from fields. Thses *bunds* are usually of 2 to 2.5m high which protect the khazan land from indundation by brackish water from the estuary at high tide, and also help maintain water level in the khazan during monsoon. Mangroves are normally found near the outer *bunds* which act as a wave breakers, absorbing the impact of tidal waves. The inner embarkments or *bunds* are made up of mud, straw and poles which regulate the level flow, prevent soil erosion and protect fields from nutrient leaching. Now a days bunds are constructed using concrete and bricks because mud bunds are easily attacked by the crabs which create holes in the bunds, allowing water to pass from both the sides hence destroying the fields.

B. ***Sluice gates*** - Sluice gates (*manos*) are the wooden shutters, which connect the inner water reservoir to the estuarine water and maintain the water level in the fields. These wooden shutters are made up of 'Matti' tree (Crocodile Bark tree).

C. ***Poiem*** - On the landward side of the sluice gate is a depression called *poiem.* This protects the agaricultural fields from high tide. The sluice gate mechanism regulates water in the poiem. The size and depth of poiem determines the fish yields.

D. ***Paddy fields*** - The elevated portion of the khazan forms the cultivable area (the rice fields) where paddy is grown during the monsoon season. Some summer crops, like vaingann, pulses and vegetable, etc. are also grown under irrigation, on the lands not affected by saline water.

2. Geographic Setup and Sluice Gate Fishing

2.1 Fishing through sluice gates (*manos*) in *Khazan*

A sluice gate helps regulate the water level in fields. It controls the water fluxes allowing adequate water into the *khazan* fields, but avoiding inundation of the *khazan* lands. The wooden shutters open and close with the pressure of the tidal flow. During high tide, the shutters of the sluice gates close automatically allowing only a part of the water inside. (Fig: 3 See page 201) While during low tide, the gates open to let out the water from the fields. (Fig: 2 See page 201).

The *poiem*, which is located on the upstream direction of sluice gate, acts as a reservoir not only for water, but also for the eggs and larvae of the aquatic fauna. During high tides, anadromous fish and prawns swim to the less saline water to spawn. The larvae grow in these *khazan* fields, which are rich in nutrients due to the organic biomass supplied by the paddy straw from agricultural fields. The adult fish, which migrates back to the sea/more saline waters, in order to be recruited to the adult stock, is then caught at the sluice gate. This practice guarantees high yield while providing protection to the fish and prawns/ shrimps (Sonak, 2014).

2.2 Mechanism of Sluice Gatefishing

Fishing at the *manos* is done using a special type of net called bag net, which is fixed at the *manos* opening during the low tide (figs. 4 and 5 See page 202) when the water from the *poiem* flows out into the estuary. Hence owners put the net at the sluice gates during two times of a day. One, in the evening during the 6 to 7 p.m. and second in the morning 3 to 4 a.m.

During rainy season for the period of one month, between August to September the water in the poiem is stored by putting one more extra gate in front of the sluice gate to maintain the water level in the fields. The difference between the extra gate and sluice gate is - sluice gates have vertically placed shutters while these extra gates have horizontally placed planks. One more reason of protecting/storing water into poiem during monsoon season is, it allows fish breeding during that specific period thereby ensuring highest catch during the next successive months.

2.3 Structure of sluice gate

1. **Height:** Height of the sluice gate depends upon the many factors such asthelevelof water in the river channel, the level of high tide water, outer bund and the surrounding agricultural fields. Usually sluice gates are constructed one or two feet above the level of high tide water so that water will not enter into fields.

2. **Width**: Width of the sluice gate depends upon the area of *poiem* and surrounding agricultural fields. Depth of the *poiem* and width of the sluice gate are positively correlated. If the depth of the *poiem* is more, than the width of the sluice gate is also more and vice versa.

3. **Location**: The two factors are very important for the location of sluice gates in khazan land are:

i. Hardness of rock - Since khazan is a marshy and soft land; it is not possible to setup sluice gate all along the channel. So one has to identify the hard and rocky surface for its base so that it doesn't collapse and remains stable (Fig.6 see page 202).

ii. The steep slope - The slope between *poiem* towards down the channel has to be steep to allow smooth flow of the water and to also fix a fish net along it.

2.4 Types of fish found in Khazan land

Prawns, Tiger prawns, Chonak, Shevtale, Crabs, Mutre, Burate, Kharchane, Sangta, Kalunder etc. are the types of fish found in Khazan land of Goa through sluice gate fishing. Out of this Kharchane, Burate,

Shevtale are found in only during rainy season.Owners of sluice gate from both the islands reported that dominant variety of fish in terms of quantity and profit is **prawns.**

2.5 Seasonal variation in Fish Catch

Table 1: Seasonal Variations in Fish Catch

(Fish catch of Palni sluice gate at St. Estevam Island)

Sr. No.	Season	Rainy Season		Summer Season		Winter Season	
	Fish variety	Quantity (Catch in bucket (15 kg)/day)	Profit (Rs.)	Quantity (Catch in bucket (15 kg/ day)	Profit (Rs.)	Quantity (Catch in bucket (15 kg/day)	Profit (Rs.)
1	Prawns	4 buckets (Per day)	Rs. 8000 for 4buckets	2 buckets (per day)	Rs. 4000 for 2 buckets	1 to 1/5 bucket (per day)	Rs. 1000 to 2000
2	Tiger prawns	Total 800 (whole season)	Rs. 700-800 per kg	200 (for entire summer season)	Rs. 700-800 per kg	limited	Limited
3	Kharchane (only during rainy)	3 buckets	Rs. 250 per small bucket	Limited	----------	Limited	--------
4	Crabs	50-100 crabs for rainy entire season	Rs. 500	Limited	----------	Limited	---------

A seasonwise variation in fish catch is found in both the islands. The above table (Table 1) is just an example of fish catch of one sluice gate. It is observed rainy season is the most profitable season. Amount of fish catch increases during the rainy season. For example- approximately per day four buckets of prawns are caught. And on an average one bucket is sold for Rs 2000/-. Whereas the amount of prawns catch reduces further in summer and winter season. In summer season owners of sluice gate get two bucket of prawns which further reduces, one to half bucket in winter season (Table 1).

Similar scenario is found in case of the other fishes. For instance - approximately total 800 (in number) tiger prawns are found in entire rainy season while only 200 (in number) tiger prawns are found in summer season whereas the catch of tiger prawns is very limited in winter season. Rate of tiger prawns varies according to seasons. In rainy season as their supply is more, their price is comparatively low i.e. Rs. 700 per kg. On the other hand, during summer season especially during tourist season the price increases owing to the fact that the catch reduces. They are mostly sold at the rate of Rs. 800 rupees per kg.

Other prominent types of fishes are Kharchane which is found only during rainy season. On average owners get three buckets of Kharchane per day in rainy season. Crabs are the other types of fish variety which adds to the profit of owners of sluice gate.

2.6 Effect of lunar cycle on fish harvesting

The relative position of the moon and the sun, with respect to the earth, has direct bearing on the harvesting of fish through sluice gate. On the full moon (called as *'Punav'* in Konkani) and the new moon (called as '*Amas*' in Konkani), the moon and the sun are almost in a straight line with the earth. Hence they exert their combined pull on the earth giving rise to spring tide. The volume of water is more during this two periods, which prove advantageous to the fishermen. Six to seven days after the full moon and the new moon the fish catch is more.

During neap tide, when the moon and the sun make a right angle to the earth, the volume of water, at the time of high tide, is low (Neap tide). The attraction of the sun and the moon tends to balance each other, as a result low amplitude tides occur. Hence during neap tide, fish catch is negligible. The owners of the sluice gates reported that they rarely put net during neap tide.

3. Institutional and Economic set-up of Sluice Gate Fishing

Khazan's are commonly managed resources hence they come under Common Property Resources (CPRs). Before the Portuguese period, *khazan's* were managed by the self- governing village institution called *gaunkaris* (*Gaun* means village and *Kari* means association). Under this system, all the male members of the village who are above 18 years could be registered as *gaunkars*. The land in the village was owned collectively and the profit was shared among *gaunkars*. Under the Portuguese rule, this system was named as *Communities*, the functioning of which was governed by the Code of *Communidades* (Sonak, 2014).

In the Post-liberation in Goa(1961), *Khazan's* are managed by the Tenants Association after the enaction of Agricultural Tenancy Act, 1964. All the work of maintenance of bunds, repairing work of sluice gates, auctioning work, etc. is done by tenants' association of respective areas. The detailed reports of income and expenditure are submitted to the *mamlatdar* (administrative officer) by the association. *Mamlatdar* provides this association 50% subsidy for maintenance and repair of outer bunds and sluice gates. Owners of the sluice gates are allowed to practise fishing in the poiem only up to 200 m^2area from the sluice gate. Away from this, any villagers can get into the water to do fishing.

3.1 Auction

Every year in the month of December, auctioning of sluice gates is done by the tenants' association under the supervision of the mamlatdar office. Hence generally the owners of the sluice gates change every year or the previous year owner continues the ownership by putting forth the highest amount at the auction. The amount decided at the auction is paid in four instalments in the months of - January, April, July and October. 25% of the amount has to be paid within a month of the auction i.e. December.

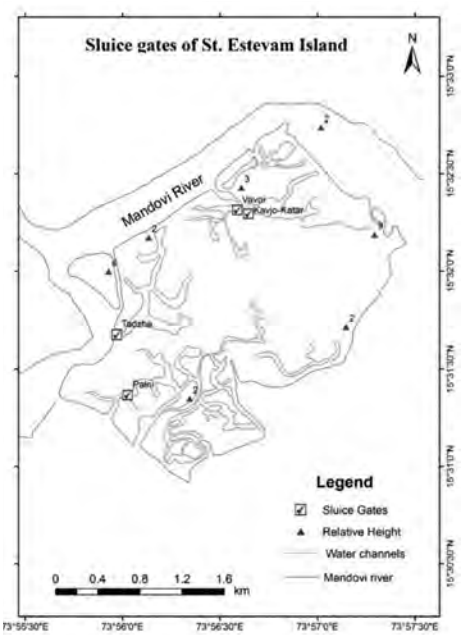
3.1.1 Auction Prices of sluice gates

St. Estevam Island

St. Estevam Islandhas total seven sluice gates. Out of which, five are auction-based and two are privately owned. One out of five auction-based sluice gates is not functioning because of repairing work. Privately owned sluice gates are not considered in the present study. Hence survey of four auction-based sluice gatesat St. Estevam Island was conducted. The details of auction price for these four gates aresummarized in Table 2.

Table 2: The auction prices for sluice gates at St. Estevam Island

Sr. No.	Name of the sluice gates	Name of the owner	Name of the tenant association	Auctioning price in 2016 (In Rs.)	Auctioning price in 2015 (In Rs.)
1	Palni	Raja Tari	Palni Tenant Association	2,67000/- Umala (10,000)	1,71000/-
2	Tarjem	Nishikant Halarnkar	Palni Tenant Association	2,56000/- Umala (10100)	3,30000/-
3	Kavjo Katar (Cupa)	Rohidas Narvekar	Kavjo Katar Tenant Association	2,08000/-	Not functioning due to repairing work
4	Vavoi	Devendra Sawant	Vavoi Tenant Association	1,01000/-	2,05000/-



Map 2: Sluice gates of St. Estevam Island

The auctioning prices of sluice gates of St. Estevam Island in the year 2016 have shown sharp fluctuations compared to 2015. The auctioning prices of two of the sluice gates have decreased whereas only one sluice gates price has increased as compared to that of 2015. Palni is the only sluice gate in the St. Estevam Island, whose auctioning price has increased by one lakh in 2016 compared to previous year. Two sluice gates i.e. Tarjem and Vavoi; their auctioning prices have decline compared to 2015.

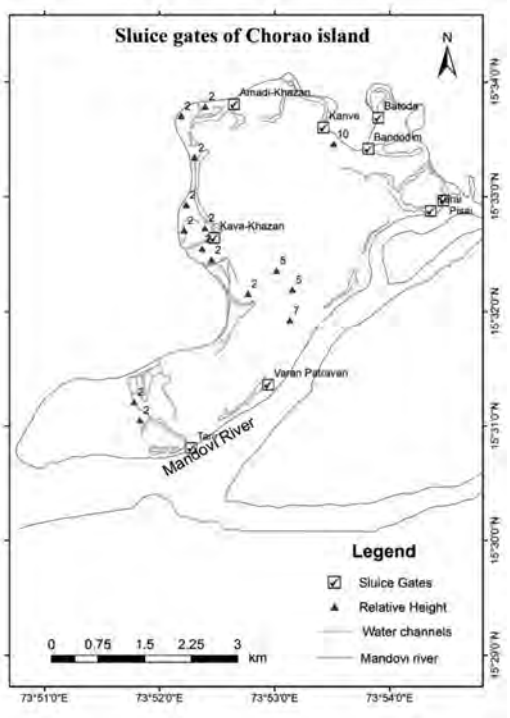
Whereas only one sluice gate i.e. Kavjo Katar was not functioning in 2015 due to repairing work. Hence its fluctuations of auction price for both the years cannot be stated.

Chorao Island

In Chorao or Chodna Island, there are total 14 sluice gates. Out of which, nine are auction- based and five are privately owned. Hence the survey of nine auction-based sluice gates was conducted. The details of auction price for these nine gates is summarized in Table: 3

Table 3: The auction prices for sluice gates at Chorao

Sr. No.	**Name of the sluice gate**	**Name of the owner**	**Name of the Tenants Association**	**Auctioning price in 2016 (in Rs)**	**Auctioning price in 2015 (in Rs.)**
1	Kava Khazan	Dinesh Naik	Kava Khazan Tenant Association	3,90000/-	1,80000/-
2	Bandodim	Mahadev Chodankar	Caraiem Bandodim Tenant Association	1,55000/-	1,45000/-
3	Kanve (Kanilem)	Mahadev Chodankar	Kanvem Tenant Association	1,65000/-	Not functioning due to bund construction
4	Amadi Khazan	Dasharat Phadte	Amadi Khazan Tenant Association	5,25000/-	2,50000/-
5	Batoda	Pradip Velankar	Batoda Tenant Association	200000/-	Not functioning due to bund construction
6	Varan-Patravan	Deepak Gaonkar	Varan-Patravan Tenant Association	2,01000/-	2,40,000/-
7	Pisai	Gitesh Maulinkar	Caraiem Bandodim Tenant Association	1,50,000/-	1,00000/-
8	Caraiem	Hari Bhomkar	Caraiem Bandodim Tenant Association	3,20,000	Data not available
9	Tarir	Nilesh Kudnekar	Tarir Tenant Association	60,000	51,000



Map 3: Sluice gates of Chorao Island

Sluice gates of Chorao Island have also experienced fluctuations in auctioning prices compare to 2015. Five of the sluice gates i.e. Kava Khazan, Bandodim, Amadi Khazan, Pisai and Tarir, auctioning prices have increased in 2016. Whereas the prices of two of the sluice gates i.e. Kava Khazan and Amadi Khazan has almost doubled up in 2016.

Two sluice gates, i.e. Kanve and Batoda were not auctioned in 2015, as bund construction work was going on near these sluice gates. As a result, siltation of poiem was taking place which is not a favourable factor for fish harvesting. Only one sluice gate i.e. Varan-Patravan suffered a decline in price of which explicit reason is not known.

The fluctuation in auctioning fees can be associated with the following fact:

1. Increase of fish catch in previous year leads to increase of auctioning price in the next year. While increase in fish catch is, in turn, associated with the geographic factors such as tidal effect, amount of water in poiem, etc.
2. Another reason isthe local socio-political situation. In some villages due to decrease in farming activities and increase in unemployment, the sluice gate fishing is looked upon as a major source of income. This has ledto competition in getting the auction which results in sharp increase in auctioning amount. In some cases the amount isreduced. This is possibly due to involvement of non-fishing community. Apparently such people face the loss due to lack of experience.

3.2 Comparison of auctioning prices of sluice gates from Chorao and St. Estevam Island.

In the study areas, the variation is found between auctioning prices of sluice gates. It has been reported that, the auctioning prices of Chorao Island is comparatively more than the St. EstevamIsland. In the Chorao island, one sluice gate i.e. Amadi Khazan has auctioning price above five lakhs whereas there is no sluice gate of St. Estevam island in same category. The four sluice gates from Chorao and three sluice gates from St. Estevam Islandhave the auctioning prices between two lakhs to five lakhs. Chorao Island has three sluice gates and St. Estevam Island have only one sluice gate with auction prices below two lakhs.

3.3. Market

St. Estevam Island:

Fishermen of sluice gate (manos) of St. Estevam Islandsells their fish at local markets, regional market and fish jetty at Betim. The market chosen by owners depends on the amount of fish catch. The amount of fish catch in turn depends on the size and depth of *poiem*. If the size and depth of *poiem* is more than the amount of fish caught is also more and vice versa. Based on this three patterns can be identified.

The sluice gate whose *poiem* is less, the fish catch is also less. Hence these fishermen depend on only local markets for selling their fish and earn less profit asthey get less price for fish in local markets. Juva, Marcel and Banastarim are local markets for St Estevam Island and only the owner of Vavoi sluice gatesells fish in the local market and earns less profit and their auctioning price is also low.

Rest of the three sluice gates in St. Estevam Island, have *poiem* area larger than Vavoi sluice gate and the volume of fish caught is also more. Hence thesefishermen prefer both - regional and local markets and earn good profit. For instance- The owner of Palni sluice gate sells fish in both regional i.e. Bicholim market and local markets. The owners of Tarjem and Kavjo Katar sluice gate sell their fish in local markets and fish jetty in Betim located in Tiswadi Taluka. Fishermen have reported that only tiger prawns are sold at fish jetty as they get good price.

Chorao Island

The selection of markets for selling of fish in Chorao Island is different from the St. Estevam Island. Out of nine sluice gates, the owners of seven sluice gates sells the fish at regional market i.e. Mapusa in Bardez taluka. The only one owner of Kava Khazan sluice gate sells fish at the Margao market in Salcete Taluka at the wholesale. Whereas the owner of Varan-Patravan sluice gate sells to the Kalvi; fish processing unit located in Bardez Taluka through *Dalas* or middlemen.

3.4 Labour

St. Estevam Island

The fishermen from St. Estevam Island do not employ any labour. Most of the fishing work is done with the help of family members. This is because fish harvesting is less in this island which can be done without the help of labours. Another reason stated by the fishermen is they are solely involved in this profession for earning livelihood and are not dependent on any other economic activity. Even the work of selling the fish in the local and regional markets is done by the women of the family. Hence they do not require any labours.

Chorao Island

Table 4: Labour employed at Sluice gates on Chorao Island

Sr. No.	Name of the sluice gates	Labours employed	Payment paid to labours
1	Kava Khazan	Yes (2 labours for entire year)	6000/- per month for each labour
2	Bandodim	No	NA
3	Kanve (Kanilem)	No	NA
4	Amadi Khazan	Yes (3 labours)	Data not available
5	Batoda	No	NA
6	Varan-Patravan	Yes (2 labours for entire year)	6000/- per month for each labour including food & stay
7	Pisai	Yes (during rainy season)	NA
8	Caraiem	No	NA
9	Tarir	No	NA

The scenario of employment of labours for fishing work is quite opposite in the Chorao Island compare to St. Estevam island. Out of the nine sluice gates, five of the fishermen reported that they don't employ any labours as they are only involved in this economic activity and all the work is done with the help of family members (Table 4). Three of the fishermen toldthey employ labours throughout the year while one owner told he appoints labours only during rainy season. Fishermen of Kava-Khazan and Varan-Patravan, employ two labours for entire year whereas Amadi Khazan fishermen employ three labours. The first two sluice gates owners sells their fish at wholesale rates in Margao and Kalvi-Bardez respectively whereas the Amadi Khazan is the largest sluice gate in the Chorao island with the highest auction fee. The owners of this sluice gate are not solely dependent on this activity for earning livelihood. They are also involved in other professions. Hence they employ labours to do the work. Right from the fish harvesting to selling of fish, is looked after by the labours. Only the owner of Pisai, employ the labours during rainy season as during this season fish harvesting is more hence more work to do. All the work cannot be done with the help of family members.

3.5 Storage and Processing of fish

Excessive fish caught, especially prawns are stored and dried for the purpose of selling in market. *Kadiyali, Pamsungat*and *Mazol* are the three types of prawns found through sluice gate fishing in*khazan* land**.** Out of which *Kadiyali*type of prawns are stored and sun-dried.The process of drying of fish is usually done in the month of March and February. According to observations, on an average around 10-15 % of total auctioning amount is recovered through selling of dry fishes. They are sold at the average price of Rs. 200/- to Rs. 350/- per kg depending on its types/size.

3.6 Capital investment

Any form of economic activity has some kind of investment at the initial stage. Fishing through sluice gate is very profitable business activity. Hence fishermen also have to put in their financialresources at the beginning of the year. Initially they have to pay 25% of the auction feewithin the month of the auction i.e. December. They can pay the remaining auction amount in three instalments. Some of the fishermen take loan to pay the auction money at the initial stage and mostly they prefer gold loan. For instance- Out of the four, two fishermen from St. Estevam Island took gold loan at the interest rate of 11 to15%. Whereas only one fisherman from Chorao island have taken an initial loan of Rs. 100000/- from the bank. Rest of the fisherman have reported that they have not taken any loan for the purpose of paying auction amount to the tenant association.

Addition to auction fee, fishermen have to pay Rs. 1400/- for the stamp duty as an agreement tax. Apart from this, other finance is required for the purpose of infrastructure cost. All the farmers have been reportedly said that initially they required Rs. 50,000/- exclusively for infrastructure. The bag net which is used for catching fish, approximately cost Rs. 20,000/-. Fishermen require such two nets. They have to spend also on buying buckets and other required things. Usually if a fisherman is new to this business, then he has to spend on this infrastructure. But if he is in this business from years before than he does not have to spend much on infrastructure.

3.7 Problems related to the sluice gate fishing

Based on the field observations, interviews of the fishermen and data analysis following problems are noted in case of sluice gate fishing on Chorao and St. Estevam islands in River Mandovi.

1. Siltation in poiem

   Production of fish is on the decline since past couple of years for which, siltation has been reported as a major cause on both the islands. Silt due to the surface run off during rainy season and mining activities, flows in the poiem which settles at the bottom of the *poiem* which in turn reduces its depth.In order to increase the fish catch, the de-siltation should be done on a regular interval. This work should be done by the tenant associations with the help of Department of Irrigation, Government of Goa. Sluice gate owners have raised the concern for not doing the work on time by tenant association even after collecting the huge amount of auction fees.

2. Auction fee transactions

   A few sluice gate owners especially of St. Estevam Island expressed their doubt about the transactions and utility of the auctioning fee by the tenants' association. Even though they present financial report during the annual auction, the sluice gate owners still showdistrust towards expenditure of the amount.

3. Institutional norms

   There are certain norms of sluice gate fishing which imposes limitations on

owners whereas it gives free hands to farmers for a domestic fish catch. These rules and regulations sometimes act as hurdles to the owners. For instance- As there are fields along the upper sides of the poiem, more water cannot be allowed to enter into poiem. If did so, it will increase the fish catch but will destroy the fields as the saline waters enters in to it. Another such rule is – owners of the sluice gate are allowed to do fishing in the poiem only up to 200 m^2area from the sluice gate beyond that farmers are allowed to do fishing in the poiem any time of the day. Hence, it affects the fish catch of main fishermen or owners.

4. Mud bunds

   As mentioned above, the *bunds* or outer embarkments are protective dykes which are made up of locally available laterite stones, mud and clay from fields. Mud crabs has been a major threat to such bunds. They creates several holes along the bunds which allows water to seeps out which in turn reduces the water level in the bund. Since it is difficult to trace the actual start of the opening, the repairing of it remains unsolved.

5. Other Problems

   Growth of weeds is commonly observed along the bunds of poiem which keeps encroaching the border area of poiem. If weeding is not done on time, it reduces the yields of fish. The other very common problem which has been reported in both the islands is, stealing of fish by other villagers. Usually the owners of sluice gate fix the net, during low tide and leave the place for about an hour or more.By the time they return to collect the fish some unknown people, most probably from the village, steal the fish caught in the net, adding to the vain of fishermen. Though it happens rarely, it's been considered to be a major concern.

3.8 Limitations

There are certain limitations of sluice gate fishing. The major one identified during the study is; the only way to increase the fish catch in sluice gate fishing is by allowing more water to enter into poiem during high tide. This will surely increase the fish catch but it destroys the surrounding agricultural fields. The excess water in the poiem overflow which harms the fields. Hence the owners of sluice gates are allowed to fill only specific amount of water into poiem which limits the fish catch.

Conclusions

The above research about Sluice gate fishing in Khazan land of Goa has been divided into two parts; influence of geographic set and that of institutional and economic setupon sluice gate fishing. Sluice gate fishing is such an activity which is entirely based on geographic factors. The lunar cycle has a direct bearing on the fish harvesting. Amount of water during high tide in poiem decides the fish catch. Even seasonwise difference in variation in fish catch is found in both the islands. Rainy, is the most profitable season as fish catch tremendously increase during this period. Tidal effect is more on Chorao Island then St. Estevam, as former is close by to sea and it gets more fish catch then later.

The institutional norms of sluice gate fishing are identical along both the island while economic factors have shown variation. The auction fee of sluice gates is higher of Chorao islands them St. Estevam island. In both islands, the fluctuations in the prices of sluice gate auctioning have occurred compared to the year 2015. With respect to market, the owners of sluice gates of St. Estevam Island sell their fish, both in regional as well as local markets at retail price. While out of 9, seven owners sell their fish in regional (Mapusa) market at retail while 2 owners sell fish at wholesale in Margao and Kalvi fish processing unit respectively. In terms of labour, owners of sluice gate in St. Estevam island doesn't employ any labours as they are involved in this economic activity only for earning livelihood. While in Chorao Island, five owners do not employ any labours while 3 owners employ labours for entire year and one owner employ labour only during rainy season.In terms of profit earned by the owners of sluice gate, they get 30 to 40% profit after recovering auction fee.

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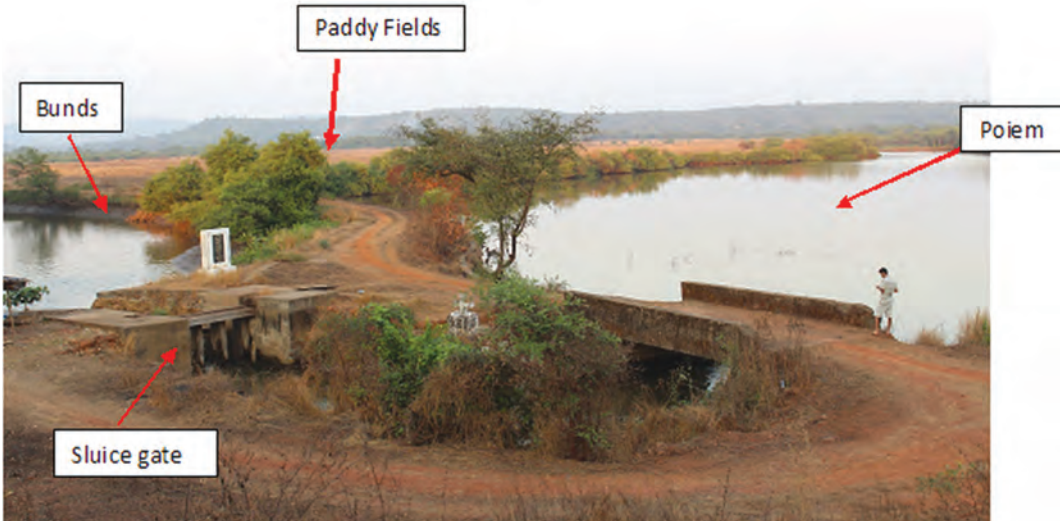

Plate 1: Components of Khazan land (See page 188 for the text)

Plate 2: Open sluice gate
(See page 188 for the text)

Plate 3: Closed sluice gate
(See page 188 for the text)

Plate 4: Bag net
(See page 189 for the text)

Plate 5: Bag net at the sluice gate
(See page 189 for the text)

Plate 6: Rocky surface (See page 189 for the text)