

## The Geographical Study of Fisheries in Zalun Township

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### Abstract

Zalun Township is located between North latitude 17° 20' and 17° 40' and East longitude 95° 24' and 95° 48'. The estimated total population in 2019 was 172,241. Fisheries provide an essential contribution to rural food and nutrition security. Fisheries also contribute significantly to rural livelihoods, in particularly in the delta. The contribution of inland capture fisheries one third of total fish production is economically and socially important. In the study area, 3 types of fisheries occur as leasable fisheries, aquaculture, and open access fisheries. These three types of fisheries contribute food supply as well as employment. There are 886 workers at the fish collection centers in Zalun Township and about 6000 of rural households depend on fishing in Ayeyarwady River. It is interesting to study how fisheries sector in the township contribute to local people and their economy. The main aim of the study is to assess the sites and situation of inland fisheries in Zalun Township. The main data used in the study is both primary and secondary types. Structured questionnaire, interview and discussion with fish pond owners, fisherman, and fish vendors are used to get facts and information. For the presentation of spatial distribution of aquaculture, farms and inns distribution maps are shown by using GIS. The facts and information obtained from questionnaires and interview are analyzed by using statistical method.

**Keywords:** rural food, livelihoods, fish production, inland fisheries, leasable fisheries

### INTRODUCTION

Fisheries plays a vital role in the culture and economy of Myanmar. Fish serves as major source of animal protein for people who largely consume rice and fish in their daily meals. With population of 51.5 million in 2016, the country's average fish consumption was 68 kg/person/year. Most of people in delta and hilly regions prefer to consume freshwater fishes and coastal people prefer the marine fishes. (Myat Khine Mar, 2017). The fisheries sector is one of the major components of the country's economy supporting thousands of households who are dependent on fisheries for their livelihoods. A total of 3,220,000 of the county's population are employed as full time and part time fishers, where 57% are engaged in freshwater fisheries, and 43% in marine (Myat Khine Mar, 2017). The fisheries sector of Myanmar is divided into marine fisheries and freshwater fisheries sectors. According to Myat Khine Mar 2017, marine fisheries are grouped into two sub-sectors of inshore and offshore, and the freshwater fisheries sectors divided into three sub sectors such as aquaculture, leasable and open fisheries sub-sectors. The present study is focused only on the freshwater fisheries as inland fishery.

Myanmar is endowed with rich natural resources both in freshwater and marine fisheries. Myanmar was the tenth highest producer of marine capture fisheries in 2012. Between 2003 and 2012, marine catch in Myanmar increased about 121 percent was the highest among the 18 major producing countries. Ayeyarwady Region is one of the important areas of fisheries sector in Myanmar. Aquaculture and leasable fisheries dominate at the townships in northern and eastern part of the Region while marine fisheries are at the southern townships. Zalun Township is located in Hinthada District, northeastern part of Ayeyarwady Region. As it is one of the township of Ayeyarwady Region and the Ayeyarwady River is

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flowing across nearly the center of township, it is interesting to study how fisheries sectors in the township contribute to local people and their economy.

**Study Area**

Zalun is one of the 26 - townships of Ayeyarwady Region. The location of Zalun Township is presented by Figure (2). Astronomical location of Zalun is located between North Latitude 17° 20' and 17° 40' and East Longitude 95° 24' and 95° 48'. Zalun Township is composed of 5 wards and 69 village tracts which include 459 villages. The area of Zalun Township is 640.9 square kilometers (247.44 sq miles). The Ayeyarwady River divides the township into two portions. The areas of these two portions are nearly the same but the portion located at the western bank of Ayeyarwady River is more developed. It is because of the efficient transportations that connect with other townships. The shape of township is compact. Northwestern and western part of township is bordered by Hinthada Township, Southern part is bordered by Danubyu Township. La Pa Dan and Tharyar Wady Township are at the northern and northeastern part.

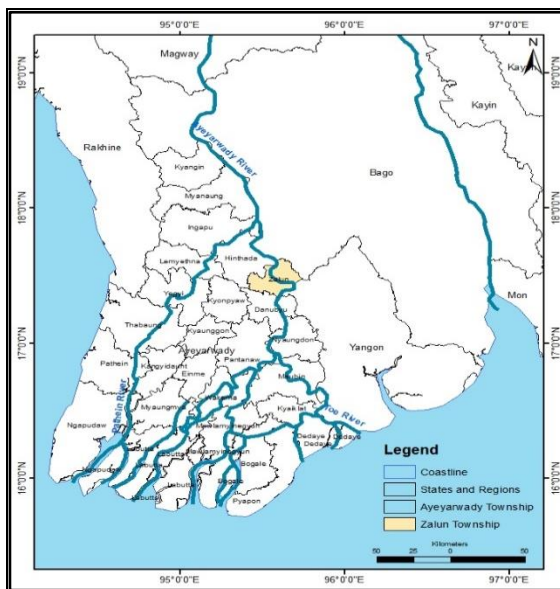


Figure 1. Location of Zalun Township in Ayeyarwady Region.  
Source: Myanmar Information Management Unit (MIMU).

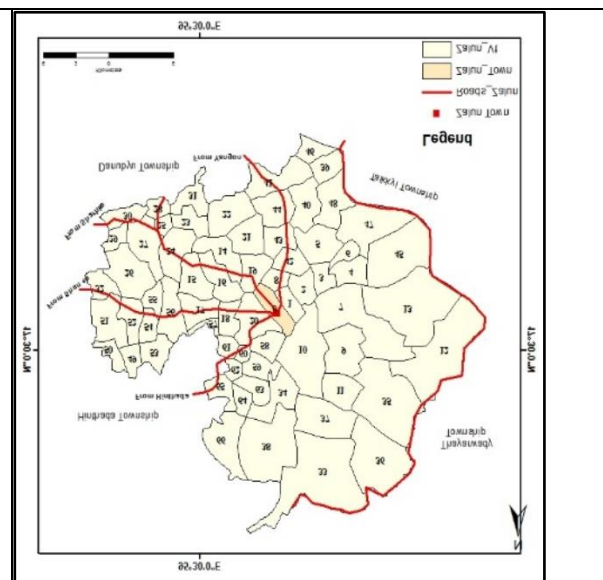


Figure 2. Location of Village Tracts and Town area in Zalun Township.  
Source: MINU and Administrative Office of Zalun Township.

**Research Question**

What are the controlling factors of fish and fish products and marketing of fish for the development of economy of fishing industry?

**Aim**

The main aim of the study is to assess the sites and situation of inland fisheries in Zalun Township.

**Objectives**

- (1) To study geographical location and spatial distribution of various types of fisheries.
- (2) To assess the production of fish and fish products in study area.

- (3) To study the nature of fish marketing in study area.
- (4) To survey the socio-economic condition of fishermen in the study area.
- (5) To evaluate the factors concerned with future development of fishery

**Data and Methods**

Primary data are collected from, in-depth interviews, field survey, focus group discussions with fishermen in Zalun Township in 2020 and key informants interviewed who are knowledgeable about the fisheries situation. Official data about the fisheries are obtained from the DOF in Zalun Township. The collection data about fishery production, transportation and trading were their main source of income. Fisheries especially leasable fisheries, aquaculture, and open access fisheries were used. To get the facts and information from these three sectors, three different field survey and questionnaire methods were used. The spatial distribution of aquaculture farms and inns distribution maps are shown by using GIS. The facts and information obtained from questionnaires and interview were analyzed by using statistical method, tabular forms, figure.

**RESULTS AND FINDINGS**

**Analysis on the fisheries in Zalun Township**

**Distribution of Inns (Leasable fisheries) in Zalun Township**

The original number of leasable fisheries traces back to 1905 with the Burma Fisheries Act and the identification of leasable sites (e.g., oxbow lakes). Prior to World War II, there were 4,006 leasable fisheries, with some erosion over time mainly due to siltation and conversion to agriculture. According to data from Department of Fisheries, there were 3,722 leasable fisheries in Myanmar of which 3,490 are still exploitable in 2014. Among these, 1 738 fisheries (52.3 percent) are located in Ayeyarwaddy Region (the lower floodplains and delta of the river). According to Department of Fisheries (DoF, 2015) reports, the number of leasable fisheries has declined slightly from 3,481 in 2000 - 2001 to 3,304 in 2014-2015 (DoF, 2015) in Myanmar. The number of Inns (leases) from 2008 to 2018 in Myanmar is shown in figure (3).

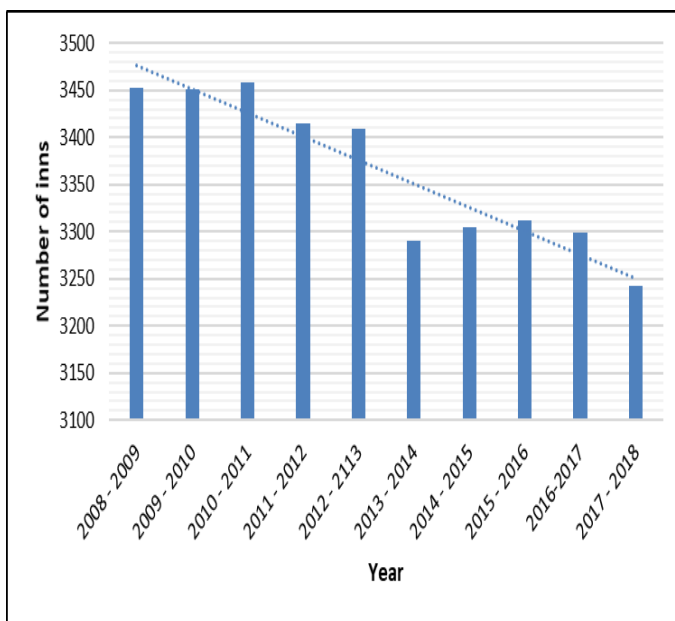


Figure 3. Number of Production (Lease areas) in Myanmar.

Source: Department of Fisheries

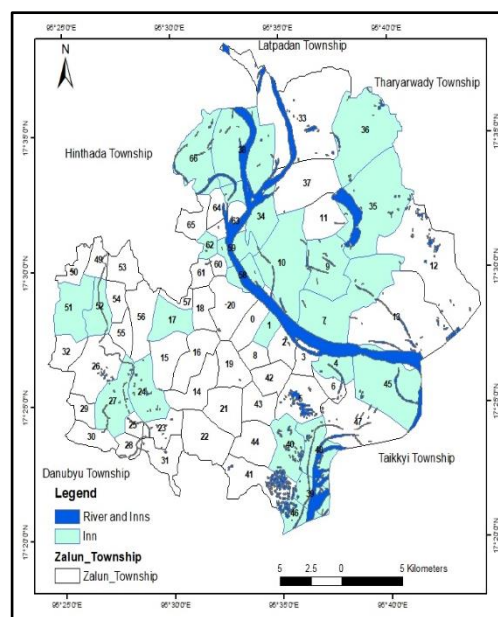


Figure 4. Number of Inns (Lease areas) in Myanmar.

Source: Department of Fisheries

The number of Inns in Myanmar is in decreasing trend. Over half of total number of inns (lease areas) exist in Ayeyarwady Region. There are currently 39 Inns (lease areas) in Zalun Township. All these inns are clustered in 23 village tracts and there are totally 45 lease holders who have rights to fish in the lease area including preventing access by others and a certain degree of environmental management and control. The area extents of these 39 Inns are about 2191.5 hectare (5413 acre) and location of these village tracts are illustrated in figure (4).

All these Inns (leasable areas) are grouped into three types of Inn in this study according to spatial analysis of their clusters: (1). Inns located at the eastern part of Ayeyarwady River, (2). Inns located at the western part of Ayeyarwady River, and (3). Tarkyin Inns.

Three leasable areas existed in Kaw Kat Kha Lay Village Tract have been fished by 5 share leaseholders. There are two inns in Ma Ha Thar and three in Inn Ta Yaw Village Tract and each in 11 village tracts. Two leasable areas of Inn Ta Yaw village Tract are granted by 3 shareholders. For the other areas, each is leased by one person. Of which the biggest inn area of 203.24 ha (502 acre) is located at Zaw Gyi Kwin Village Tract.

### Tarkyin Inns

The lowland located between two embankments is filled with floods when the high river water level of the river is high in rainy season and then left as reservoir during low river water level. This is locally known as Tarkyin inn. There are totally 6 Tarkyin inns in Zalun Township. Department of Fisheries designated them as fishing ground and leased to local businessman.

In a brief, there are 39 number of Inns in which 46 leaseholders (shareholders and individual holders) currently involves in leasable fisheries of Zalun Township. Village tracts with various leasable inn area extents are presented in figure (4). Hpar Let Kho Village Tract in eastern part has only one inn but it is largest area with 585.02 ha (1445 acre) followed by Nyein Aye Village Tract where 6 leasable area with 381.78 ha (943 acre) and Myit Wa Village Tract with 140.48 ha (347 acre) which are the largest in the eastern part of Zalun Township. In the western part of the Township, where Kaw Kat Ka Lay Village Tract with 242.11 ha (598 acre), Zaw Gyi Kwin 203.24 ha (502 acre) and Yin Taik Kone 76.92 ha (190 acre) possess the largest leasable areas.

These Inn areas are distributed in the 23 village tracts. The total Inn areas are 2191.5 hectare (5413 acre) in Zalun Township. 19 Inns with 1316.6 hectare (3252 acre) in eastern part of Ayeyarwady River and 14 Inns with 837.7 hectare (2069 acre) in western part of the River. Therefore eastern part of Zalun Township composed with more lowland and flooding area than the western area.

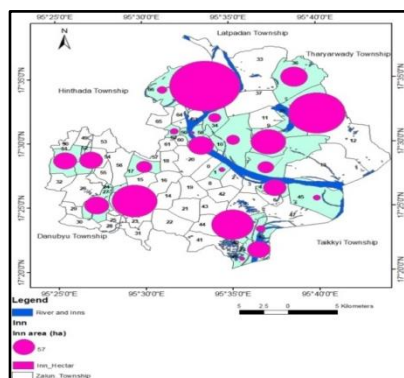


Figure 5. Various area extent of leasable Inns in Zalun Township.  
Source: Department of Fisheries

**Distribution of ponds (Aquaculture) in Zalun Township**

Zalun Township in Ayeyarwady Region is one of the important fish producing townships. There are 147 ponds in Zalun Township and currently the total pond area are 171.93 ha (424.7 acre). Only fishes are farming and the areas are located in 4 wards of Zalun Town area and 26 village tracts. In 2019 these ponds are owned by 117 license holders. And spatial distribution of ponds in these village tracts are illustrated in figure (5) and Variation in pond area.

Totally 147 number of ponds are located at the Zalun Town and 26 of 66 village tracts. There are 8 village tracts which have only each pond. Two and more ponds are other village tracts and town area. Kyon Ei Village Tract have 30 ponds with the area of 21.89 ha (54.064 acre) and Kyon Sha Village Tract have 29 ponds with the area of 61.07 ha (150.85 acre). These two village tracts possess the highest number of ponds and largest pond area. The followings are village tracts of Hpet Thaug, Kaw Kat Kha Lay, Zaw Gyi Kwin, Auk Ywar, Kyon Ta Naw North, and Zalun Town. Area of almost all ponds are at least 1.47 ha (1 acre). 11 out of 147 ponds are located at the village tracts of eastern part of Ayeyarwady River and the rests are located at the western part. Aquaculture fisheries are occurred evenly in Village tracts of both sides of Ayeyarwady River. However their area extents vary significantly as presented in figure (6).

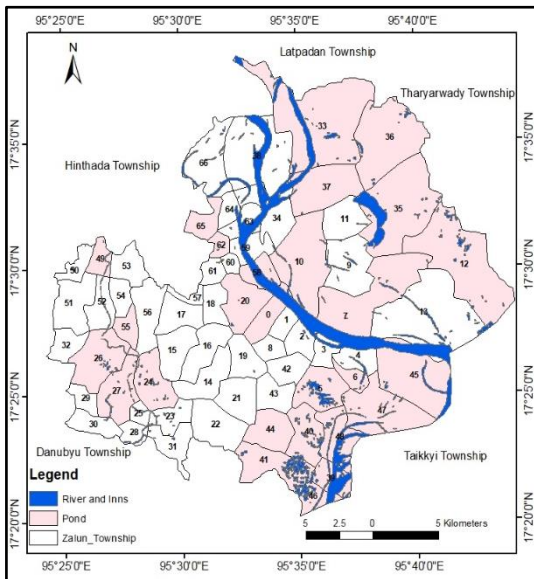


Figure 6. Location of fish ponds in village tracts, Zalun Township.  
Source: Department of Fisheries

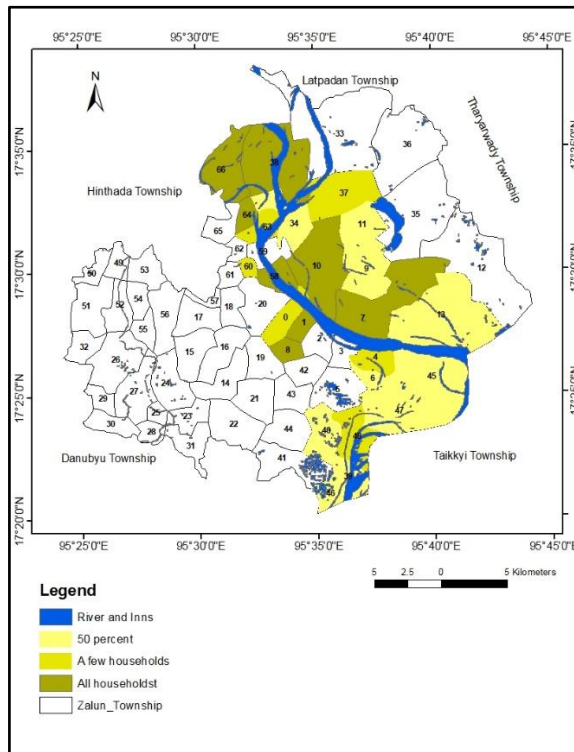


Figure 7. Village tracts which engaged to open fishery in Zalun Township.  
Source: Department of Fisheries

**Distribution of Villages with open fisheries in Zalun Township**

There are 66 village tracts in Zalun Township, Ayeyarwady Region. Of these village tracts, 24 village tracts engage in open fishery. These villages are located along the Ayeyarwady as shown in River Figure (7). More villages of open fishery occurred in the eastern part of Ayeyarwady River than in the western part. This portion is lower in elevation

and flooded in most areas where leasable areas and fish farms are located. Villagers who cannot effort to work in the leasable fishery have to work in open fishery.

**Types of Fish Captured in Zalun Township**

Fishing industry in Ayeyarwady Region is an important industry. Zalun Township is one of the fisheries dependent area of Ayeyarwady Region. Fishes captured differ from different times of a year as well as differ from different fishing grounds. According to interviews with fishers, and self-study by field observation, there are 53 types of fish catch in fisheries sector within the Zalun Township.



Plate 1. Some types of fishes captured in Zalun Township (Photos © by author, 2020)



C. Aquaculture (pond)      D. Leasable Fisheries (inn)

Plate 2. Some types of fish and prawn in captured and fishing work in Zalun Township (Photos © by author, 2020)

### Leasable (Inn) fisheries and Production in Zalun Township

At present, totally 39 lease areas (inns) are located in 23 village tracts of Zalun Township and there are Totally 46 lease holders who have been known as *Inn thugyi* in Myanmar words. The total lease area is 1390.95 hectare (5412 acre). Leasable area of eastern Ayeyarwady River is wider than western part of the River. As shown by Table (1)

Table (1)Field study village tracts, number of Inns and interviewees.

No.	Village tract	Number of Inns	Number of lease holders	Number of interviewees
1	Nyein Aye	6	10	10
2	Myit Wa	4	4	2
3	Taung Bo Ta Yar	2	2	2
4	Ku Toet Seik	1	1	1
5	Kawt Kat Ka Lay	3	5	3
6	Thae Kone	1	1	1
7	Inn Ta Yaw	2	3	3
8	Kyone Ta Naw (North)	1	1	1
9	La Maing	1	1	1
10	Hpar Let Kho	1	1	1
	Total	22	29	25

Source: Based on questionnaires

In eastern Zalun Township, there are 15 village tracts and leasable fisheries are occurred in 8 village tracts and totally 23 lease areas are located there. Department of Fisheries usually holds the auctions in study area in April. Mostly, each lease area has been auctioned by one lease holder but large inns have been auctioned by shareholders 2, 3, to 5 in study area. Presently there are 46 holders for 39 inns in study area. Lease cost varies from one inn to another and time also. Variations do not depend on the size of lease area but depend on productivity and types of fish of previous year of that lease area. Least costs noted from lease holders are between 9 lakh and 10 lakh for one leasable area per year in villages of western part of Ayeyarwady River and between 12 lakh and 15 lakh in eastern villages. Lease cost for Tarkyin inns is about Ks 300,000 (241.29\$), One dollar is equal to 1400 ks.

There are totally six Tarkyin Inns (leasable areas) in Zalun Township. Two of them are located at the western part and the rest are located at the eastern part of township. Investments for lease areas vary and the profit from them also vary and the activities in fisheries are also different. The following table presents the generalization figures of differences reviewed from the discussions with interviewees of study area. Freshwater prawn, a high valued crap like Ngatha lauk, Nga khu, Nga ginn, Nga htay, Nga yant, Nga mway doh, Nga dan, Nga gaung pwa, Nga pyeme ma, Nga myit chin, Nga nu than and various species of fingerlings etc. are caught.

In Zalun Township, the amount of fish production vary from one lease area to another. Figure (8) shows fish production of inns by village tract. Inns from Nyein Aye, Kawt Kat Ka Lay, and Yae Le village tracts are more productive than others in Zalun Township. The basic factor for cause of production amount is not variation in the area (size) of lease area. The management system determines the amount of fish production of that inn. The management system includes kind of fish feed and feeding system, erection the barrage of lease area after

flooding, suitable time of fish catch, and to supply good breeding ground. Climatic condition may be one of the factors that can affect the fish production amount of inns. The productivity also vary from year to year.

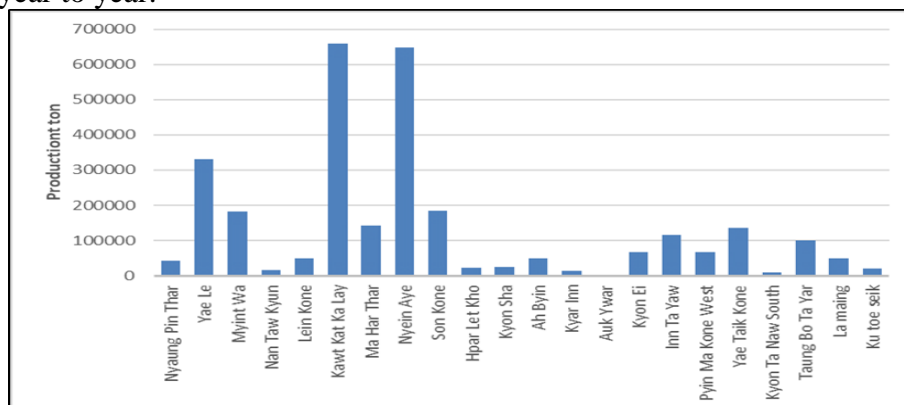


Figure 8. Annual production of fish in each village tract.  
Source: Recorded data from Department of Fisheries.

### Fisheries of Aquaculture ponds and production in Zalun Township

Aquaculture (fish farming) has grown rapidly in Myanmar over the last two decades and plays an increasingly important role in national fish supply (Belton et al., 2015), but its technical and economic characteristics have been inadequately studied. This report addresses this knowledge gap, presenting benchmark data from the first statistically representative survey of fish farms conducted in Myanmar - the Myanmar Aquaculture-Agriculture Survey (MAAS).

Aquaculture generates a considerable earning in Zalun Township. There are 147 fish ponds in Zalun Township. They exist in 4 wards in town area and 30 village tracts. These village tracts are Zaw Gyi Kwin, Kyone Sha, Kyone Ei, Yae Le, Lay Tu East, Mayi Lan, Pa Kew Yae Le, Yae Le, Ma Har Thar, Thar Du Chaung, Kaw Kat Ka Lay, Yin Taik Kone, Kyon Ta Naw North, Tha Yet Chaung, Kyar Inn, Kyon Mat, Son Pi, Auk Ywar, Thet Kei Kyun, Auk Ywar, Hpet Thaung, Ahtut, Nyein Aye, Byin Nyar, Pet Tan. 9 out of 147 ponds are located in 4 wards of town area. The other 138 ponds are in rural area. All fish ponds are operated by 117 owners. There are family labour, hired casual labour, hired long-term labour and these fish farms can provide job opportunities for local villagers.

To get specific knowledge and information on aquaculture fisheries in Zalun Township, field observations to fish ponds and open talk to fish pond owners, semi structure interview with fishermen were conducted during this study. Nyaung Bin Zay Ward in Zalun Town and 11 village tracts where 40 ponds were selected to conduct the interview. The number of interviewees were 28 and they own 40 number of ponds.



Table 2. Field study village tracts, number of ponds and interviewees (2019).

Village tracts	Number of fish ponds	Number of owners	Number of interviewees	Fish ponds owned by interviewees
Zaw Gyi Kwin	16	16	3	3
Kyone Sha	29	20	5	5
Kyone Ei	30	27	6	9
Kawt Kat Ka Lay	6	3	2	4
Kyone Ta Naw (North)	11	11	3	3
Tha Yet Chaung	3	2	1	2
Auk Ywar	5	5	2	2
Hpet Thoung	6	3	2	4
Nyayng Pin Zay (Town area)	3	1	1	3
Sun Pi	3	2	1	2
Pa Kew	3	3	1	1
Yae Le	2	1	1	2
	117	94	28	40

Source: Department of Fisheries, Zalun Township.

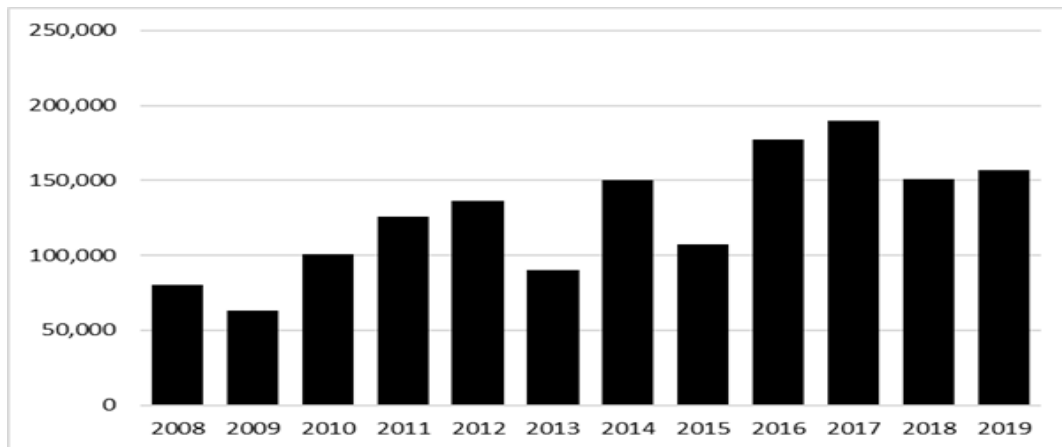


Figure 9. Annual fish production of ponds in Zalun Township (2008-2019)

Source: Based on Table

All households from 8 out of 24 village tracts with open water fisheries are fishing in the river. The total population of these village tracts are 28,583 and the total households are 4310 in 2020. There are 10 village tracts where about 50 % households are fishing for their livelihoods. A few households of 6 out of 24 village tracts are also fishing for their livelihoods. Currently there are over 6,000 fishermen in 24 village tracts who depend on open water fisheries for their families.

To get specific knowledge and information on River fishing in Zalun Township, field observations to fishing villages and open talk and structure interview to fisherman were conducted during this study. From the total number of 12 village tracts, 4 village tracts of each category (village tracts with all fisherman households, village tracts with 50% fisherman households and village tracts with a few fisherman households) were selected to conduct the interview. The number of interviewees were 119 fishermen (56, 37, and 26 by each category). The names of village tracts are Hpar Let Kho, Yin Taik Kone, Daunt Kyi, Taung Bo Ta Yar,

Ku Toe Seik, Kyone Sha, Auk Ywar, Thet Kei Kyun, Oe Bo, Ah Htut, Nyaung Bin Thar Ward, and Kannar Ward.

According to interview with fisherman, the most common fish species and large amount they could catch is Nga ginn, Nga gaung pwa, Nga lay daunt, Nga myit chin, Nga luu, Nga khone ma, Nga dan, Nga gaung, Nga zin yine and fingerlings. The most common catch fish vary a little from one finshing village tract to another in the study area. The fish species which become rare in recent years are Nga thalauk, Nga yaung, Nga natpuu, and Nga mote sate.

## **FINDINGS AND SUGGESTION**

Fisheries are the important business and it provide not only for the security of food, but also the employment opportunity to local residents. There are 3 types of fishing grounds; leasable fisheries (inn), aquaculture (fish ponds), and open access fisheries (river fishing) in Zalun Township. In Zalun, about 39 leasable fisheries sites including Tarkyin inns are located along the eastern and western part of Ayryarwady River. There are currently 39 inns (lease areas) in Zalun Township. All these inns are clustered in 23 village tracts and totally 45 lease holders who have rights to fish the lease area including preventing access by others and a certain degree of environmental management and control. The area extents of these 39 inns are about 2191.5 hectare (5413 acre). Fish ponds are located at the 30 village tracts of study area. Current total number of fish ponds are 147 in these village tracts. Aquaculture fisheries are occurred evenly in Village tracts of both sides of Ayeyarwady River. However their area extent vary significantly as presented in figure 8. The area of fish ponds are more in eastern part of the township than in the western part of the township. More villages of open fishery occurred in the eastern part of Ayeyarwady River than in the western part. This portion is lower in elevation and flooded in most areas where leasable areas and fish farms are located. Villagers, who cannot effort to work in the leasable fishery have to work in open fishery.

The number of 24 village tracts located along the Ayeyarwady River are the main open access fisheries areas. 7 village tracts like Yae Le, Nan Taw Kyun, Kyone Sha, Zaw Gyi Kwin, Kyar Inn, Auk Ywar, Kyone Ei have three types of fisheries. Two types of fisheries occur in 20 village tracts and villagers of 17 village tracts engage in one types of fisheries.

Nearly all people in rural area engage in agriculture and paddy and pulses are the main crops. Fisheries sector is the second most important for the business of the local people' and livelihoods. Residents from 44 village tracts engage in fisheries. The total populations of the town area and 44 village tracts were 130,200 person with 25750 households in 2019. Therefore, about two-thirds of population of Zalun Township depend on fishery sector for their livelihoods.

The different fishing grounds have to be different in types of fish catch, nature of fishing, methods and gears used in fishing. The following table 5.1 presents commercial fish stocks from different fishing grounds in Zalun Township. Fishers, either individually or a group, can access specific fishing grounds by paying license fees to leaseholders. These are fishing operations in areas outside of the 'Inn' or leasable fisheries and reserved fisheries. The right to fish is licensed out by DOF. All fishing gears require a license in open access fisheries.

Daily fishing operation entails 6 to 9 hours. Depending on gears, fishing may be done by the owner himself or with the assistance of hired fishers. Payment to crews may be in the form of profit sharing or direct cash payment. According to discussion with fishers, the general sentiment among fishers is accessible to fish every year and getting further away from their homes open access fishing grounds. Leaseholders and tender lot holders, on the other hand, are

also complaining that small fishers illegally fish in their areas and, as such, they have been losing money for many years.

## **CONCLUSION**

Zalun Township is one of the township with important fishing industry in the region. There are 66 village tracts in Zalun Township, Ayeyarwady Region. Of these village tracts, 24 village tracts engage in open fishery. More villages of open fishery occurred in the eastern part of Ayeyarwady River than in the western part. Open access fisheries are extremely important to local populations, particularly the landless for whom fishing requires little investment and is a source of food and possibly income. Most aquaculture area of Ayeyarwady Region are in Maubin, Hinthada, Zalun, and Phapon. The leasable areas in the study area are in 23 village tracts.

According to interview with fisherman, the most common fish species and large amount they could catch is Nga ginn, Nga gaung pwa, Nga lay daunt, Nga myit chin, Nga luu, Nga khone ma, Nga dan, Nga gaung, Nga zin yine and fingerlings. The most common catch fish are vary a little from one fishing village tract to another in the study area. The fish species which become rare in recent years are Nga thalauk, Nga yaung, Nga natpuu, and Nga mote sate. In the observation of study area, duration of one farm operating take times for 4 months or 6 months or 8 months. It depends on stock species of respective farm.

Myanmar households generally prefer freshwater fish than marine fish. According to FAO 2006 survey, fish account for about 22% of protein intake of Myanmar households. National average annual consumption of fish and fish products based on the same 2006 survey was 21.02 kilograms per capita. Inland species represented 31.5 % of fish consumption while marine species accounted for 23.5%. Fish paste (made of marine and freshwater fish) accounted for 45% of annual per capita fish consumption. Urban households eat fresh fish more than the rural populace. Dried fishes are more accessible to rural households especially those in the dry zone than fresh fish. Freshwater fish is generally more expensive than marine fish species (International Labour Organization, 2015). Therefore the study area is important for food supply for both crops production and fish production.

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