

**FISHERIES ADMINISTRATION
INLAND FISHERIES RESEARCH AND
DEVELOPMENT INSTITUTE**



**MEKONG RIVER COMMISSION
FISHERIES PROGRAMME**



Fisheries Yield at Landscape Scale in the Lower Mekong Basin in Cambodia in 2022

Touch Bunthang, Putrea Solyda, Meas Vichet,
Soeun Norng, Hom Radong, Tith Puthearath, Nut Savath and Kaing Khim

Inland Fisheries Research and Development Institute, Fisheries Administration, Cambodia

November 2022

Table of Contents

1. Introduction.....	2
2. Objective of the Survey.....	5
3. Methodology of the Survey.....	5
3.1 Survey area selection and description.....	5
3.2 Sampled fisher/HH selected	7
3.3 Approach to yield assessment	7
4. Results of the Survey	8
4.1. Result of HH/fisher surveys	8
4.2. Result of Fisheries Management Officer Survey.....	38
4.3. Result of focus group discussion	47
5. Key Summary Results and Recommendations.....	54
References.....	59
Appendix.....	60

1. Introduction

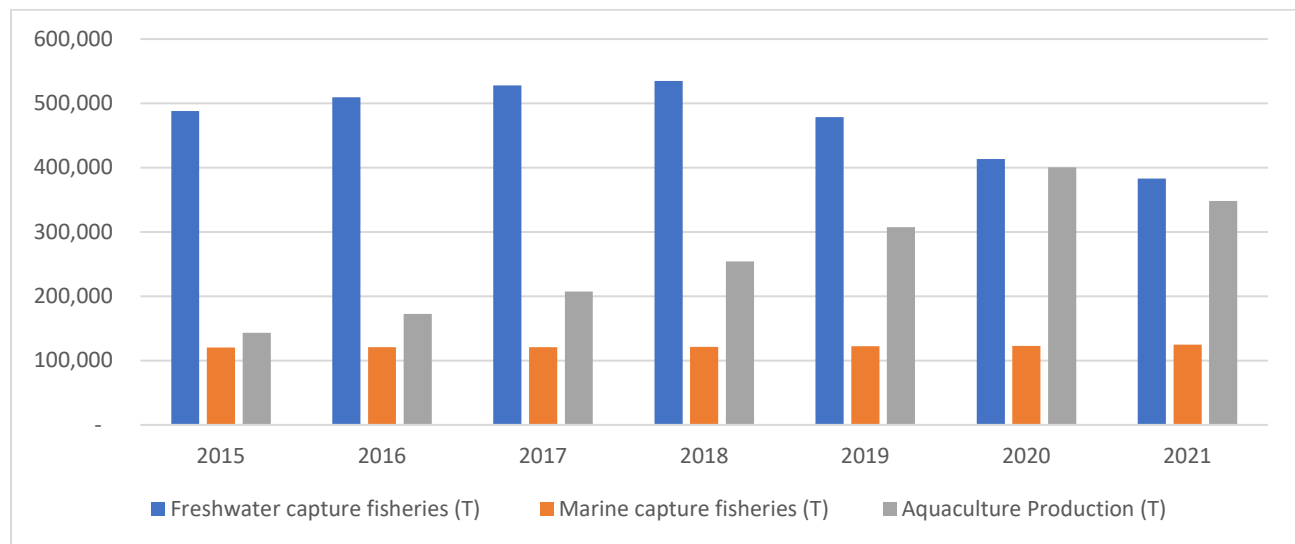
The Kingdom of Cambodia covers a total land area of 181,035 km² and shares its international borders with Lao PDR, Thailand, and Viet Nam (Figure 1). The capital city is Phnom Penh which is the center for politics, economy, and culture. The official language is Khmer, official currency is Riel, and official religion is Buddhism. In 2019, the population was 15.3 million comprised of 48.5 % male and 51.5 % female. The average size of households was 4.6 person, and the population density was 86 per km² (NIS, 2019). The country has a tropical monsoon climate with two seasons. The dry season starts from November to April which sends drier and cooler air with the northeast monsoon. The wet season starts from May to October, in which rainfall is derived from the southwest monsoon.

The Mekong and the Tonle Sap Great Lake create a vast inland water system, comprising numerous deep pools, river and lakes, extended into flooded forest, grasslands rice fields and swamps, which support an extensive fisheries biodiversity. The Mekong River system is one of the most diverse and prolific inland fisheries in the world. Cambodia's geography is dominated by the Mekong River, which is more than 500 kilometers in length. The Tonle Sap Great Lake is the largest lake in Southeast Asia and is a very important habitat for fishes. Located in central Cambodia, it is sustained by the annual wet-season flood of the Mekong River, which increases the lake's depth from 1 m to 10 m, and the lake's area from 3,000 km² to 15 000 km².

Today, about 500 inland fish species are known in Cambodia's Mekong and 300 fish species are in Tole Sap Great Lake, which the annual yield of inland fish amounts to 400-500 thousand tons, ranking 4th worldwide in inland fish production after China, India and Bangladesh. The natural resources provide a foundation for food security, income, and employment for most of the population in Cambodia. More than 15 million people live in rural areas of which about 85% depend on agriculture, fisheries, and forest resources to support their livelihoods.

Cambodia's freshwater capture fisheries are among the largest and most significant in the world. The annual freshwater fish catch keeps increasing which ranges between 487,000 t to 535,000t from 2015 to 2018 and decreasing between 479,000 t to 380,000t from 2019 to 2021 (FiA, 2021) (Graph 1). The marine capture fisheries are keeping increasing which ranges between 120,500t to 125,000t from 2015 to 2021 for last 7 years and aquaculture production are also keeping increasing from 2015 to 2020 which ranges from 143,141t to 400,400t but decreased in 2021 was only 348,350T. Marine fish and aquaculture production are small compared to other countries in Southeast Asia (Graph 1).

Graph 1. Trends of annual fish production in Cambodia (2015-2021)



Contribution of fisheries to livelihoods

Fisheries resources play a major role in the livelihoods of the people in Cambodia. For example, a survey of 5,117 households conducted in eight inland provinces along the main water bodies and inundated areas found that fishing was the primary occupation of 10.5% of the household while 34.1% of households that did not cite fishing as their primary occupation and reported a part-time involvement in fisheries (Ahmed et al., 1998). The study revealed that 13% of the farm labors were involved fishing activities and more than 18% of the value of their subsistence production come from fishing.

Cambodia's rice fields and floodplains produce a significant quality of aquatic products such as fish, shrimps, frogs, crabs and snails. Gathering of uncultivated vegetable food items and catching of fish from flooded areas act as a necessary buffer to the yearly of food and income whenever crop production fails, which is a common phenomenon. The average annual catch per household for family scale was 647 kg. Nearly 40% of the fish catch was consumed within the communes. In addition to food and employment, fishing provides cash to local fishers (Ahmed et al., 1998).

Contribution of fisheries to food and nutrition intake

About six millions of people work full-time in fisheries and fisheries related activities, and fish and rice are an integral part of national's staple foods for their daily consumption with an estimated fish consumption was 63kg/person/year. Fish and aquatic resources provide 85% of animal protein intake, 37% of animal iron intake, and 28% of fat intake to the Cambodian people (Bunthang T. et al., 2015).

However, the precise role of fish and fish products in the food security of Cambodia is difficult to assess. As with all other issues for which proper quantification of the volume is required, the lack of accurate production and availability figures have made it impossible to quantify some degree of confidence the contribution of capture fisheries and aquaculture to food security.

Hortle et al. (2007) reported per capita consumption rate of whole fresh fish and other aquatic animals (OAA) based on household surveys is 52.4 kg, including 42 kg freshwater fish, 1 kg marine fish and 9.4 kg other aquatic animals. The most recent estimate of fish consumption rate based on FiA Fisheries Statistics (excluding

OAA) is approx. 40 kg per capita per year, which is not significantly different from rate of Hortle et al. (2007) (Table 1). In summary, fish and OAA contribute more than 80% of the total protein intake in the diets of the Cambodian population.

Table 1 Distribution of per capita fish consumption by province and region in Cambodia

Region	Per capita fish consumption (kg/capita/year)	Author
Cambodia (Average)	40	So Nam estimate and Touch Bunthang (2011)
Cambodia (Average)	23 - 31	So Nam & Nao Thuok, 1999
Cambodia (Average)	60 – 66	Hortle et al., 2004
Cambodia (Average)	52.4	Hortle et al., 2007
Tonle Sap (up land Siem Reap)	32	Hong Hy, 1995
Tonle Sap (floating village)	71	FAO/PNRM, 1995
Tonle Sap and plains (8 provinces)	87	DoF/FCFMC, 1995
Tonle Sap (including Kandal and Phnom Penh)	67 - 80	Ahmed et al., 1998
Fishing household	80	Ahmed et al., 1998
Non-fishing household	67	Ahmed et al., 1998
Fishing dependent commune	71 - 76	Ahmed et al., 1998
Southeastern (Svay Rieng)	22 - 40	Tana, 1993; Gregory, 1997
Southwestern (Kampot)	38	APHEDA, 1997
South (Kandal and Takeo)	40	CIAP, unpublished

To update the Year 2022 assessments of the fish yield of the LMB requires that the size of the fishery is re-estimated. Relevant information on fish consumption and population are needed and some have already been obtained. These include large-scale surveys of the type that have recently been carried out by DOS (2009), IFREDI (2012).

Recognizing the importance of landscape scale fisheries assessment by different habitat types, MRC has put efforts to conduct this assignment every five years to estimate fisheries yields at different habitat types and to assess the condition of fisheries in the LMB landscape. The first assessment was for 2000 basin-wide fisheries (Hortle et al, 2007), the second one was for 2010 (Hortle et al, 2015), and the third one was for 2015-2016 (Hortle, 2017). The fisheries yield assessment in 2022 will be the fourth one being conducted by the MRC in collaboration with MCs' line agencies and implementing partners using the same approach and methodology applied in the previous studies.

The basin-wide fisheries yield assessment by habitat types embraces two main fundamental components to:

- (1) update the extents or areas of each type of fish habitat in the four MCs and the LMB using data from the MRC Land Cover and Land Use 2020.
- (2) update the estimates of fisheries yield by major habitat types in each MC and the LMB by conducting ground-truth data collection.

To meet the above fundamental work requirements, MRC proposes a regional study on the fisheries yield assessment by habitat types at the LMB landscape scale in 2022. The work component # (1) will be conducted by the MRC Secretariat with the support from a GIS and Remote Sensing international consultant, while the work component # (2) will include field surveys to be conducted by the relevant fisheries line agencies in the four MCs. This Work agreement is for Cambodia to update the estimates of fisheries yield by major habitat types in Cambodia by conducting ground-truth data collection.

2. Objective of the Survey

To achieve this overall objective, the three specific objectives of the field surveys are set as follows:

- (1) To collect and update information regarding fishing gears, fish/OAAs catch estimates by habitat types, main species caught and consumption, and market prices of fish/OAAs from the major types of fish habitat in Cambodia.
- (2) To provide demographic and occupation information of fishing communities down to district levels adjacent to major habitat types.

To provide local perspectives about Import - Export - Aquaculture - Animal feeds related to capture fisheries in Cambodia.

3. Methodology of the Survey

The survey would estimate catches over large areas of the landscape and apportion those catches by habitat. The approach is described briefly below. This survey follows the overall “**MRC Fisheries Yield at Landscape Scale in the Lower Mekong Basin in 2022**”, which are integral part of this study proposal.

3.1 Survey area selection and description

The survey was estimated catches over large areas of the landscape and apportion those catches by habitat. The zones to be surveyed cover the range of habitats at sufficient scale to reduce edge effects, i.e. to obtain a representative or average proportion of the types of habitat as well as the fishing effort and catches in the study areas. The range for survey areas is between 25-100 km².

The survey was conducted in the two districts, namely Kampong Svay District in Kampong Thom Province and Ba Phnum District in Prey Veng Province.

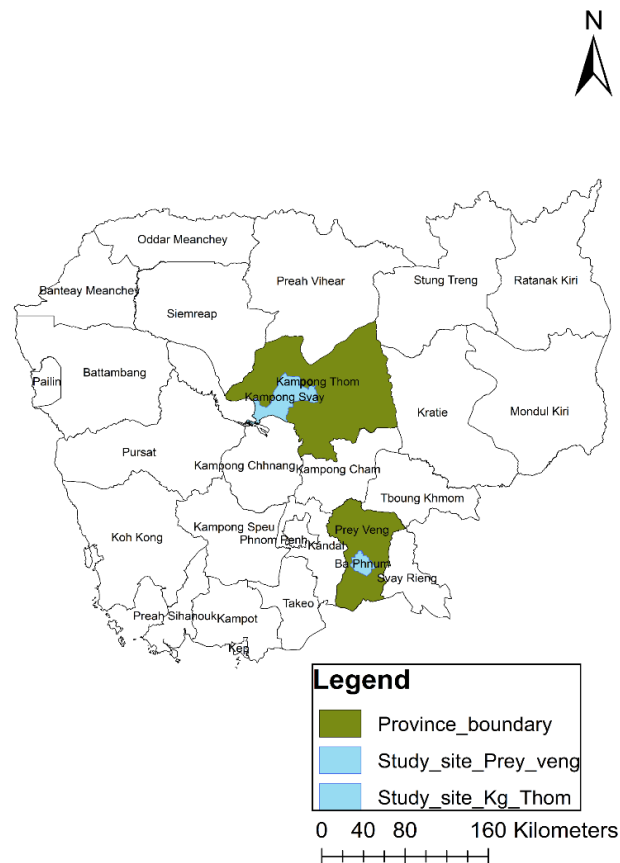
Kampong Thom is a province located at the central point of the Kingdom of Cambodia. The province has a total land area of 15,061 square kilometres divided into 8 districts, 81 communes and 737 villages. The province borders in the North with Preah Vihear and Siem Reap, to the east with Kratie, to the south with Kampong Cham and to the west with Kampong Chhnang. The province is divided into two parts:

- Eastern part of National Road 6: Covers 70% surface consisting of forests and plateaus, which are rich in natural resources for a good and profitable agriculture, forestry and animal husbandry.
- Western part of National Road 6: Covers 30% surface consisting of plain area extending to the famous Tonle Sap Lake. This area is one of the best areas in Cambodia for rice cultivation and fishing to support the needs of the province and to additionally export them to other areas or Countries. Two of the three core areas in Tonle Sap Biosphere Reserve are located in Kampong Thom: Boeng Chhmar (14,560 hectares), and Stung Saen (6,355 hectares).

Part of the province belongs to the Tonle Sap Lake and floodplains in the northeast. It is the second largest province in terms of area. It has a total population of 690,414 or 4.68% of the country's total population (Population Census 2013). Kampong Svay is a district in Kampong Thom Province. It borders with Tonle Sap Lake which is in Tonle Sap biosphere reserve. Kampong Svay District consists of 11 communes and 96

villages. Few communes are inundated and located in to the Tonle Sap Lake and other fews are located in highland areas with rain-fed zones (Map 1)

Prey Veng Province is located along the Mekong River. It covers an area of 4,883 Km² and located in the south of the country and bordering to the Kampong Cham, Kandal Svay Rieng Province and South Vietnam. It has a total population of 1,156,739 or 7.67% of the country's total population (Population Census 2013). The province consists of the typical floodplain areas, covering rice fields and other agriculture plantations. The province also features two of the biggest rivers of the country the Tonle Bassac and the Mekong. Ba Phnom District of the Prey Veng Province is selected as the target study area, because part of the district in located along the Mekong River floodplains and another part is rain-fed zone. The Ba Phnom District consists of 9 communes and 108 villages (Map 1).



Map 1: Study sites

3.2 Sampled fisher/HH selected

From within the target survey District a sample of 10 villages was selected (5 villages from each district), a method in which the chance of a village being selected is proportional to the number of people in the village. As larger villages have more chance of being selected, the sample is self-weighting. Within target district of Kampong Svay there are three fishing habitat type are rain-fed-rice field, flood plain, and reservoir habitats and Ba Phnom district has two fishing habitat type.

The total sampled 180 fisher/HH were randomly selected within two districts of Kampong Thom and Prey Veng provinces which are 90 fisher/HH from each district. 90 fisher/HH selected within Kampong Svay district of Kampong Thom province of which 30 fisher/HH from rain-fed-rice field habitat, 30 fisher/HH from floodplain habitat and 30 fisher/HH from reservoir habitat. 90 fisher/HH selected within Ba Phnom district of Prey Veng province of which 45 fisher/HH from rain-fed-rice field habitat and 45 fisher/HH from floodplain habitat.

3.3 Approach to yield assessment

1) The household/fisher surveys based on structured interviews (**Toolbox 1**) to collect data on household/fisher's fishing gears, fish/OAAs catch estimates by season and by habitat types, main species caught and consumption, and market prices of fish from the major types of fish habitats in the LMB.

Total 180 households/fishers were selected for interviewing spanning through 3 major habitat types rain-fed-rice field, floodplain and reservoir. Households/fishers selection for the survey based on a random basic. The survey team targeted to balance 50% of participants who are full-time fishers and another 50% is part-time fishers. Gender balance was considered when conducting the surveys.

(2) A questionnaire for fisheries management officers from national and provincials were based on semi-structure interviews (**Toolbox 2**) to provide information on local perspectives about Import - Export - Aquaculture - Animal feeds related to capture fisheries in Cambodia. A list of documents/information being collected and collated at provincial level is outlined in **Toolbox 5**.

(3) A focus group discussion was organized at selected villages of the same selected districts to validate the data and information collected from the household/fisher surveys and reflect on different perspectives that would not be recorded during the household/fisher interviews.

Each focus group discussion will include 6-10 people balancing men and women. Open ended questions used for group discussion with local/fisher communities are provided in **Toolbox 3**. Participants for the group discussion are those who did not take part in the HH/fisher's interview. Gender balance should be considered when conducting the group discussion.

(4) Excel spreadsheet using for data entry based on the above 3 surveys/interviews was provided in **Toolbox 4**.

(5) A template for synthesis report is provided in **Toolbox 5**.

4. Results of the Survey

4.1. Result of HH/fisher surveys

Table 2. Fishermen characteristic by gender of sampled household/fisher across fish habitat types

Province	District	Habitat Types	Sampled HH/Fisher	Female %	Male %
Prey Veng	Ba Phnom	Rain-fed rice-fields	45	11	89
		Floodplain	45	27	73
Kampong Thom	Kampong Svay	Rain-fed rice-fields	30	40	60
		Floodplain	30	30	70
		Reservoir	30	3	97
Total			180	22	78

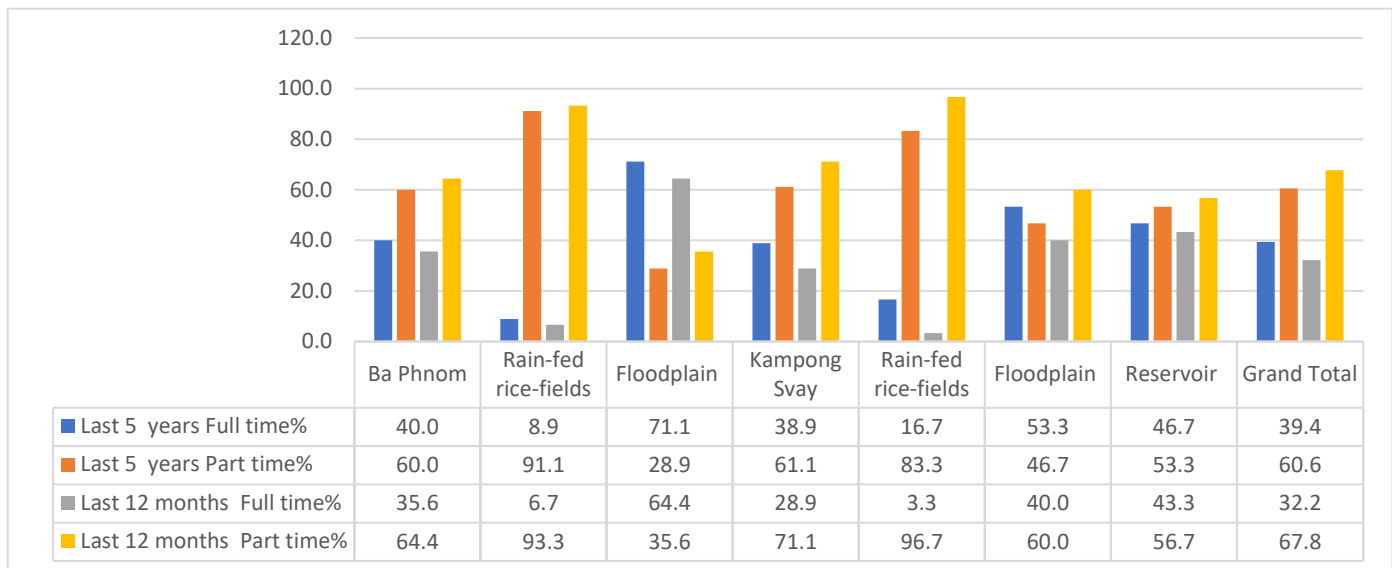
Total sampled 180 HH/fishers were selected within two districts of Kampong Svay and Ba Phnom of Kampong Thom and Prey Veng provinces with male (78%) and female (22%) with the sampled 90 HH/fisher were selected the same sampled 30HH/fisher from the rain-fed-rice field, floodplain, and reservoir habitats, respectively and the same sampled 45HH/fisher from the rain-fed-rice field habitat and 45 HH/fisher from floodplain and reservoir habitat (table 2)

Table 3. Fishermen characteristic by age and household number of sampled household/fisher across fish habitat types

Province	District	Habitat Type	Sampled HH/Fisher	Sampled Fisher Age				Sampled HH Fisher Member			
				Min	Average	Max	StdDev	Min	Average	Max	StdDev
Prey Veng	Ba Phnom	Rain-fed rice-fields	45	15	49.1	64	10.2	2	4.8	12	1.7
		Floodplain	45	22	42.8	74	12.2	2	5.1	10	1.7
Kampong Thom	Kampong Svay	Rain-fed rice-fields	30	25	43.8	63	10.5	2	5.2	11	2.2
		Floodplain	30	33	47.5	66	9.8	4	5.9	9	1.4
		Reservoir	30	15	42.1	64	12.4	2	4.4	7	1.5
Total			180	15	45.2	74	11.4	2	5.1	12	1.8

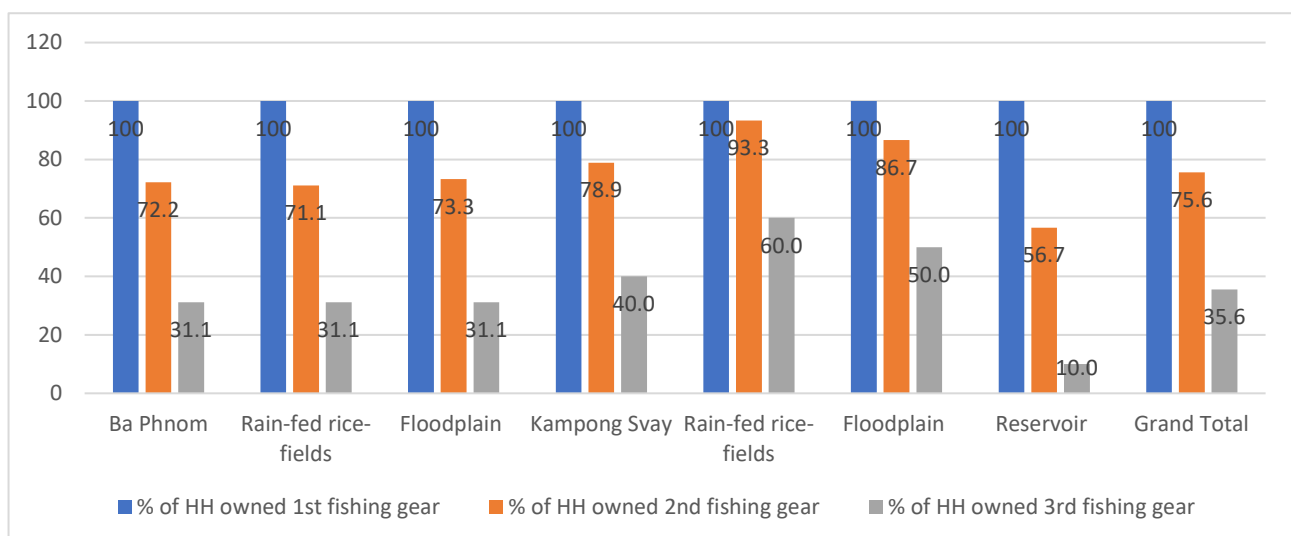
The average age of the sampled fisher was 45.2 years old with min and max age were 15 and 74 years old, respectively, and an average HH member was 5.1 persons per household and min and max of number of people was 2 people per HH and 12 people per HH, respectively (Table 3).

Graph 2. Fisher characteristic by occupation (full time and part time) for last 5 years and last 12 months across fish habitat types



In 2015 full time fisher was 39% (part time 61%) of which 40% in Ba Phnom district and nearly 39% in Kampong Thom district, compared to year 2020 the full-time fisher decreased to 32% (part time fisher increased to nearly 68%) of which 35.6% in Ba Phnom district and nearly 29% in Kampong Thom district (graph 2)

Graph 3. Percentage distribution of HH owning fishing gear types across fish habitat types



The sampled fishers owned multi different fishing gears: all fisher (100%) owned first fishing gears, more than three-fourths (75.6%) owned 2 second fishing gears and only 35.6% owned third fishing gears (Graph 3)

Table 4. Types of primary fishing gears used by fishing season across fish habitat types

Province	District	Habitat type and 1st fishing gear used	Both Season	Dry season	Wet season	Total
Prey Veng	Ba Phnom	Rain-fed rice-fields	3	1	41	45
		Catching fish by using hand		1		1
		Gillnet: Stationary gillnet (surface, bottom)	3		11	14
		Hand Dragged Seine Net			1	1
		Hook and line			1	1
		Hook long line			2	2
		Multi-pronged barbed spear			24	24
		One-pronged barbless spear			1	1
		Spear			1	1
		Floodplain	29	8	8	45
		Encircling Seine Net	1	2		3
		Fyke Net Made of Mosquito Netting			1	1
		Gillnet: Stationary gillnet (surface, bottom)	24	1	4	29
		Hand Dragged Seine Net		2		2
		Hook and line	2		1	3
		Hundred tread trap	1			1
		Seine Net With Footrope Bags		3		3
		Trap: Big bamboo vertical cylinder trap			2	2
		Trap: Horizontal cylinder trap	1			1
		Sun-total H1+H2	32	9	49	90
Kampong Thom	Kampong Svay	Rain-fed rice-fields	8	2	20	30
		Cast net	6	1		7
		Frog Cover Net			1	1
		Gillnet: Stationary gillnet (surface, bottom)	1		9	10
		Hook and line			1	1
		Hook and line: Pole and line for frogs			1	1

	Trap: Horizontal cylinder trap for rice fields	1		6	7
	Wedge-shaped scoop basket		1	2	3
	Floodplain	11	2	17	30
	Cast net	1	1	2	4
	Encircling Seine Net	1	1		2
	Fyke Net Made of Mosquito Netting	1		1	2
	Gillnet: Stationary gillnet (surface, bottom)	5		7	12
	Hook and line	1		3	4
	Hook long line			1	1
	Plunge Basket or Cover Pot	1			1
	Seine Net With Footrope Bags			1	1
	Trap: Arrow-shaped bamboo fence trap with horizontal cylinder trap			1	1
	Trap: Bamboo tube trap for eel	1			1
	Trap: Horizontal cylinder trap			1	1
	Reservoir	16	4	10	30
	Cast net	2	4	2	8
	Catching fish by using hand	1			1
	Gillnet: Stationary gillnet (surface, bottom)	8		1	9
	Hook and line	1		1	2
	Hook long line	1			1
	Hundred tread trap	2		4	6
	Seine Net With Footrope Bags	1			1
	Trap: Horizontal cylinder trap for rice fields			2	2
	Sun-total H1+H2+H3	35	8	47	90
Grand Total		67(37%)	17(9%)	96(53%)	180(100)

For the primary fishing gear used, more than half (53%) of sampled fishers went fishing in wet season, only 9% went fishing in dry season and 38% went fishing in both season (Table 4)

Table 5. Types of secondary fishing gears used by fishing season across fish habitat types

Province	District	Habitat type and 2nd fishing gear used	Both Season	Dry season	Wet season	Total
Prey Veng	Ba Phnom	H1	3	1	28	32
		Catching fish by using hand			1	1
		Frog gaff		1		1
		Gillnet: Stationary gillnet (surface, bottom)			9	9
		Hook and line	2		8	10
		Hook and line: Hook long line			4	4
		Multi-pronged barbed spear	1		4	5
		Nylon multi gillnet with small mesh size			1	1
		One-pronged barbless spear			1	1
		H2	15	2	16	33
		Brush bundle trap	2		4	6
		Cast Net		1		1
		Fyke Net Made of Mosquito Netting			1	1
		Gillnet: Stationary gillnet (surface, bottom)	4	1	4	9
		Hook and line	6		4	10
		Hook and line: Hook long line	1		2	3
		Trap: Big bamboo vertical cylinder trap			1	1
		Trap: Horizontal Cylinder Trap for Shrimp	1			1
		Wedge-shaped scoop basket	1			1
		Sun-total H1+H2	18	3	44	65
Kampong Thom	Kampong Svay	H1	4	6	20	30
		Cast Net		1	4	5
		Frog Cover Net			1	1
		Giant Lift Net		2		2
		Gillnet: Stationary gillnet (surface, bottom)			9	9

		Hook and line	1		2	3
		Hook and line: Hand line with feather lure			1	1
		Hook and line: Hook long line		1	1	2
		Multi-pronged barbed spear	1		1	2
		Plunge Basket or Cover Pot		1		1
		Seine Net With Footrope Bags		1		1
		Spear	1			1
		Trap: Horizontal cylinder trap for rice fields	1		1	2
		H2	6	3	15	24
		Cast Net	1		3	4
		Fyke Net Made of Mosquito Netting			1	1
		Gillnet: Drifting gillnet			1	1
		Gillnet: Stationary gillnet (surface, bottom)	2	2	4	8
		Hand Dragged Seine Net			1	1
		Hook and line	1		4	5
		Hook and line: Hook long line	2			2
		Hundred tread trap			1	1
		Trap: Horizontal Cylinder Trap For Snakehead		1		1
		H3	5	2	10	17
		Cast Net			1	1
		Gillnet: Stationary gillnet (surface, bottom)	2	1	8	11
		Hand Dragged Seine Net		1		1
		Hook and line	2		1	3
		Trap: Horizontal cylinder trap	1			1
		Sub-total H1+H2+H3	15	11	45	71
Grand Total			33	14	89	136

For the secondary fishing gear used, 136 fishers owned the secondary fishing gears, 89 fishers went fishing in wet season, only 14 fishers went fishing in dry season and 33 fishers went fishing in both season (Table 5)

Table 6. Types of tertiary fishing gears used by fishing season across fish habitat types

Province	District	Habitat type and 3rd fishing gear used	Both Season	Dry season	Wet season	Total
Prey Veng	Ba Phnom	Rain-fed rice field			14	14
		Gillnet: Stationary gillnet (surface, bottom)			2	2
		Hook and line			5	5
		Hook long line			1	1
		Multi-pronged barbed spear			6	6
		Floodplain	6	1	7	14
		Cast net		1	1	2
		Encircling Seine Net	1			1
		Hook and line	2		3	5
		Hook long line			1	1
		Trap: Big bamboo vertical cylinder trap			1	1
		Trap: Horizontal Cylinder Trap for Shrimp	3			3
		Wedge-shaped scoop basket			1	1
		Sub-total	6	1	21	28
Kampong Thom	Kampong Svay	Rain-fed rice field	2	2	14	18
		Cast net	1			1
		Frog Cover Net			3	3
		Gillnet: Stationary gillnet (surface, bottom)	1		1	2
		Hand Dragged Seine Net		1	1	2
		Hook and line		1	5	6
		Multi-pronged barbed spear			1	1
		Trap: Horizontal cylinder trap for rice fields			3	3
		Floodplain	2	4	8	14
		Cast net	1	2	1	4
		Frog Cover Net			1	1

		Hook and line	1	1	2	4
		Multi-pronged barbed spear			1	1
		Trap: Big bamboo vertical cylinder trap			1	1
		Trap: Horizontal cylinder trap			1	1
		Trap: Horizontal cylinder trap for rice fields		1	1	2
		Reservoir	1	2	1	4
		Gillnet: Stationary gillnet (surface, bottom)		1	1	2
		Hook and line	1	1		2
		Sun-total H1+H2+H3				
Grand Total			11	9	44	64

For the tertiary fishing gear used, only 64 fishers owned the tertiary fishing gears of which 44 fishers went fishing in wet season, very few fishers (9) went fishing in dry season and only 11 fishers went fishing in both season (Table 6)

Table 7. Fishing distance from HH of primary fishing gear used across fish habitat types

Province	District	Habitat type and 1st fishing gear used	Total	%	Min of Distance (Km)	Average of Distance (Km)	Max of Distance (Km)
Prey Veng	Ba Phnom	Rain-fed rice-fields	45	100	0.1	0.9	3
		Catching fish by using hand	1	2	0.1	0.1	0.1
		Gillnet: Stationary gillnet (surface, bottom)	14	31	0.2	0.9	3
		Hand Dragged Seine Net	1	2	2	2.0	2
		Hook and line	1	2	3	3.0	3
		Hook long line	2	4	0.4	0.6	0.7
		Multi-pronged barbed spear	24	53	0.1	0.8	2
		One-pronged barbless spear	1	2	1.5	1.5	1.5
		Spear	1	2	0.27	0.3	0.3
		Floodplain	45	100	0.1	2.5	17
		Encircling Seine Net	3	7	0.7	0.9	1
		Fyke Net Made of Mosquito Netting	1	2	2	2.0	2
		Gillnet: Stationary gillnet (surface, bottom)	29	64	0.1	2.7	17
		Hand Dragged Seine Net	2	4	0.3	4.2	8
		Hook and line	3	7	1	2.0	3
		Hundred tread trap	1	2	1	1.0	1
		Seine Net With Footrope Bags	3	7	0.3	0.9	1.5
		Trap: Big bamboo vertical cylinder trap	2	4	2	6.0	10
		Trap: Horizontal cylinder trap	1	2	1	1.0	1
Kampong Thom	Kampong Svay	Rain-fed rice-fields	30	100	0.1	2.9	25
		Cast net	7	23	1	5.7	25
		Frog Cover Net	1	3	1	1.0	1
		Gillnet: Stationary gillnet (surface, bottom)	10	33	1.5	2.5	7

		Hook and line	1	3	0.1	0.1	0.1
		Hook and line: Pole and line for frogs	1	3	2	2.0	2
		Trap: Horizontal cylinder trap for rice fields	7	23	0.1	1.7	3
		Wedge-shaped scoop basket	3	10	2	2.7	3
		Floodplain	30	100	0.3	9.0	50
		Cast net	4	13	3	4.3	6
		Encircling Seine Net	2	7	0.3	2.2	4
		Fyke Net Made of Mosquito Netting	2	7	15	17.5	20
		Gillnet: Stationary gillnet (surface, bottom)	12	40	0.3	10.1	50
		Hook and line	4	13	8	17.0	40
		Hook long line	1	3	2	2.0	2
		Plunge Basket or Cover Pot	1	3	1	1.0	1
		Seine Net With Footrope Bags	1	3	5	5.0	5
		Trap: Arrow-shaped bamboo fence trap with horizontal cylinder trap	1	3	3	3.0	3
		Trap: Bamboo tube trap for eel	1	3	10	10.0	10
		Trap: Horizontal cylinder trap	1	3	3	3.0	3
		Reservoir	30	100	0.5	11.1	45
		Cast net	8	27	2	3.0	4
		Catching fish by using hand	1	3	10	10.0	10
		Gillnet: Stationary gillnet (surface, bottom)	9	30	2	14.9	45
		Hook and line	2	7	2	19.5	37
		Hook long line	1	3	40	40.0	40
		Hundred tread trap	6	20	0.5	12.7	40
		Seine Net With Footrope Bags	1	3	5	5.0	5
		Trap: Horizontal cylinder trap for rice fields	2	7	2	2.0	2
Grand Total			180	100	0.1	4.7	50

The sampled fishers owned the first different fishing gears used with minimum, an average and maximum distances from their house were 0.1kg, 4.7km and 50km, respectively, (table 7).

Table 8. Fishing distance from HH of secondary fishing gear used across fish habitat types

Province	District	Habitat type and 2nd fishing gear used	Total	Min of Distance (Km)	Average of Distance (Km)	Max of Distance (Km)
Prey Veng	Ba Phnom	Rain-fed rice plain	32	0.2	0.7	3
		Catching fish by using hand	1	0.2	0.2	0.2
		Frog gaff	1	1	1.0	1
		Gillnet: Stationary gillnet (surface, bottom)	9	0.3	0.7	2
		Hook and line	10	0.2	0.8	3
		Hook and line: Hook long line	4	0.4	0.9	1
		Multi-pronged barbed spear	5	0.2	0.7	1
		Nylon multi gillnet with small mesh size	1	0.5	0.5	0.5
		One-pronged barbless spear	1	0.8	0.8	0.8
		Floodplain	33	0.3	2.0	10
		Brush bundle trap	6	0.3	0.7	2
		Cast Net	1	3	3.0	3
		Fyke Net Made of Mosquito Netting	1	2	2.0	2
		Gillnet: Stationary gillnet (surface, bottom)	9	0.5	2.4	10
		Hook and line	10	0.3	2.2	5
		Hook and line: Hook long line	3	1.2	3.1	5
		Trap: Big bamboo vertical cylinder trap	1	3.5	3.5	3.5
		Trap: Horizontal Cylinder Trap for Shrimp	1	1.5	1.5	1.5
		Wedge-shaped scoop basket	1	0.3	0.3	0.3
Kampong Thom	Kampong Svay	Rain-fed flood plain	30	0.1	2.7	15
		Cast Net	5	1	1.8	3
		Frog Cover Net	1	0.5	0.5	0.5
		Giant Lift Net	2	1.5	2.3	3

		Gillnet: Stationary gillnet (surface, bottom)	9	0.1	1.9	7
		Hook and line	3	1	7.7	15
		Hook and line: Hand line with feather lure	1	3	3.0	3
		Hook and line: Hook long line	2	2	2.5	3
		Multi-pronged barbed spear	2	1	2.0	3
		Plunge Basket or Cover Pot	1	1.5	1.5	1.5
		Seine Net with Footrope Bags	1	2	2.0	2
		Spear	1	1	1.0	1
		Trap: Horizontal cylinder trap for rice fields	2	2	4.5	7
		Floodplain	24	0.3	9.4	50
		Cast Net	4	3	14.3	40
		Fyke Net Made of Mosquito Netting	1	3	3.0	3
		Gillnet: Drifting gillnet	1	1	1.0	1
		Gillnet: Stationary gillnet (surface, bottom)	8	0.3	5.0	10
		Hand Dragged Seine Net	1	50	50.0	50
		Hook and line	5	2	7.8	20
		Hook and line: Hook long line	2	0.6	12.8	25
		Hundred tread trap	1	3	3.0	3
		Trap: Horizontal Cylinder Trap For Snakehead	1	7	7.0	7
		Reservoir	17	0.5	12.5	45
		Cast Net	1	2	2.0	2
		Gillnet: Stationary gillnet (surface, bottom)	11	0.5	10.3	40
		Hand Dragged Seine Net	1	5	5.0	5
		Hook and line	3	2	30.7	45
		Trap: Horizontal cylinder trap	1	0.5	0.5	0.5
Grand Total			136	0.1	4.5	50

136 sampled fishers owned the secondary different fishing gears used with min, average and maximum distance from house were 0.1kg, 4.5km and 50km, respectively, (table 8).

Table 9. Fishing distance from HH of tertiary fishing gear used across fish habitat types

Province	District	Habitat type and 3rd fishing gear used	Total	Min of Distance (Km)	Average of Distance (Km)	Max of Distance (Km)
Prey Veng	Ba Phnom	Rain-fed rice field	14	0.2	0.6	1
		Gillnet: Stationary gillnet (surface, bottom)	2	0.4	0.4	0.4
		Hook and line	5	0.2	0.4	0.5
		Hook long line	1			
		Multi-pronged barbed spear	6	0.2	0.7	1
		Floodplain	14	0.2	2.9	17
		Cast net	2	2	2.0	2
		Encircling Seine Net	1	1	1.0	1
		Hook and line	5	0.3	6.0	17
		Hook long line	1	2	2.0	2
		Trap: Big bamboo vertical cylinder trap	1	2	2.0	2
		Trap: Horizontal Cylinder Trap for Shrimp	3	0.2	0.3	0.4
		Wedge-shaped scoop basket	1	0.5	0.5	0.5
Kampong Thom	Kampong Svay	Rain-fed rice field	18	1	2.1	7
		Cast net	1	2	2.0	2
		Frog Cover Net	3	1	1.8	3
		Gillnet: Stationary gillnet (surface, bottom)	2	1	1.0	1
		Hand Dragged Seine Net	2	3	3.5	4
		Hook and line	6	1	1.5	2
		Multi-pronged barbed spear	1	2	2.0	2
		Trap: Horizontal cylinder trap for rice fields	3	1	3.7	7
		floodplain	14	0.3	5.9	20
		Cast net	4	3	9.5	20
		Frog Cover Net	1	7	7.0	7

		Hook and line	4	1	4.8	10
		Multi-pronged barbed spear	1	3	3.0	3
		Trap: Big bamboo vertical cylinder trap	1	2	2.0	2
		Trap: Horizontal cylinder trap	1	10	10.0	10
		Trap: Horizontal cylinder trap for rice fields	2	0.3	1.7	3
		Reservoir	4	1.5	5.9	10
		Gillnet: Stationary gillnet (surface, bottom)	2	1.5	1.8	2
		Hook and line	2	10	10.0	10
Grand Total			64	0.2	3.2	20

Only 64 sampled fishers owned the tertiary different fishing gears used with min, average and maximum distance from house were 0.2km, 3.2km and 20km, respectively, (table 9).

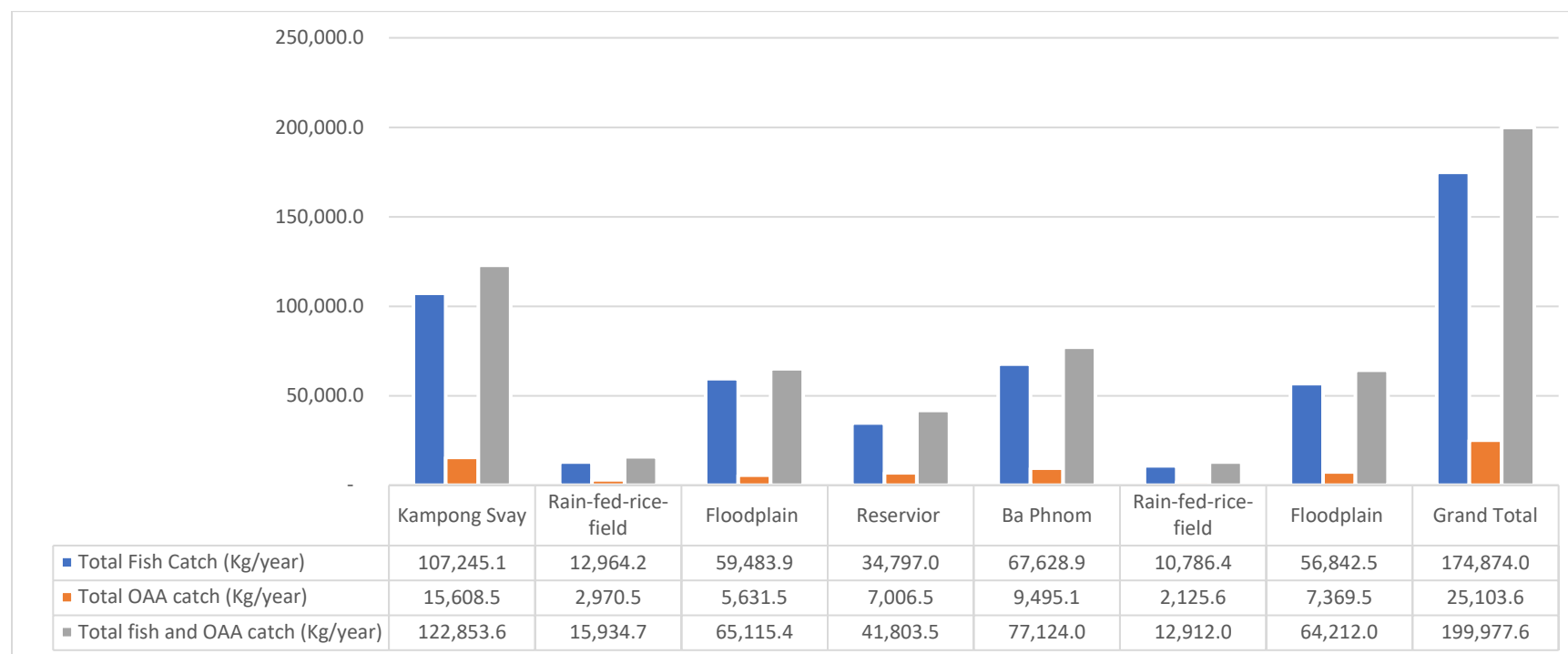
Table 10. Percentage of HH owned fishing gear across fish habitat types

Province	District	Habitat type and % of HH fishing gear used	%
Kampong Thom	Ba Phnom	Rain-fed rice field	
		one fishing gear used	29
		Two fishing gear used	40
		Three fishing gear used	31
		Floodplain	
		one fishing gear used	27
		Two fishing gear used	42
		Three fishing gear used	31
Kampong Svay	Kampong Svay	Rain-fed rice field	
		one fishing gear used	7
		Two fishing gear used	33
		Three fishing gear used	60
		Floodplain	
		one fishing gear used	13
		Two fishing gear used	37
		Three fishing gear used	50
		Reservoir	
		one fishing gear used	43
		Two fishing gear used	47
		Three fishing gear used	10

Table 10 shows percentage of HH used/owned types of fishing gears across the fishing habitats withing the two districts of Kampong Thom and Prey Veng provinces. The result showed that, Ba Phnom district, sampled fisher owned/used two fishing gears more that 40%, followed by fisher used three fishing gears more than 30%. In Kampong Svay district, in the rain-fed rice field and floodplain habitats fisher owned three different

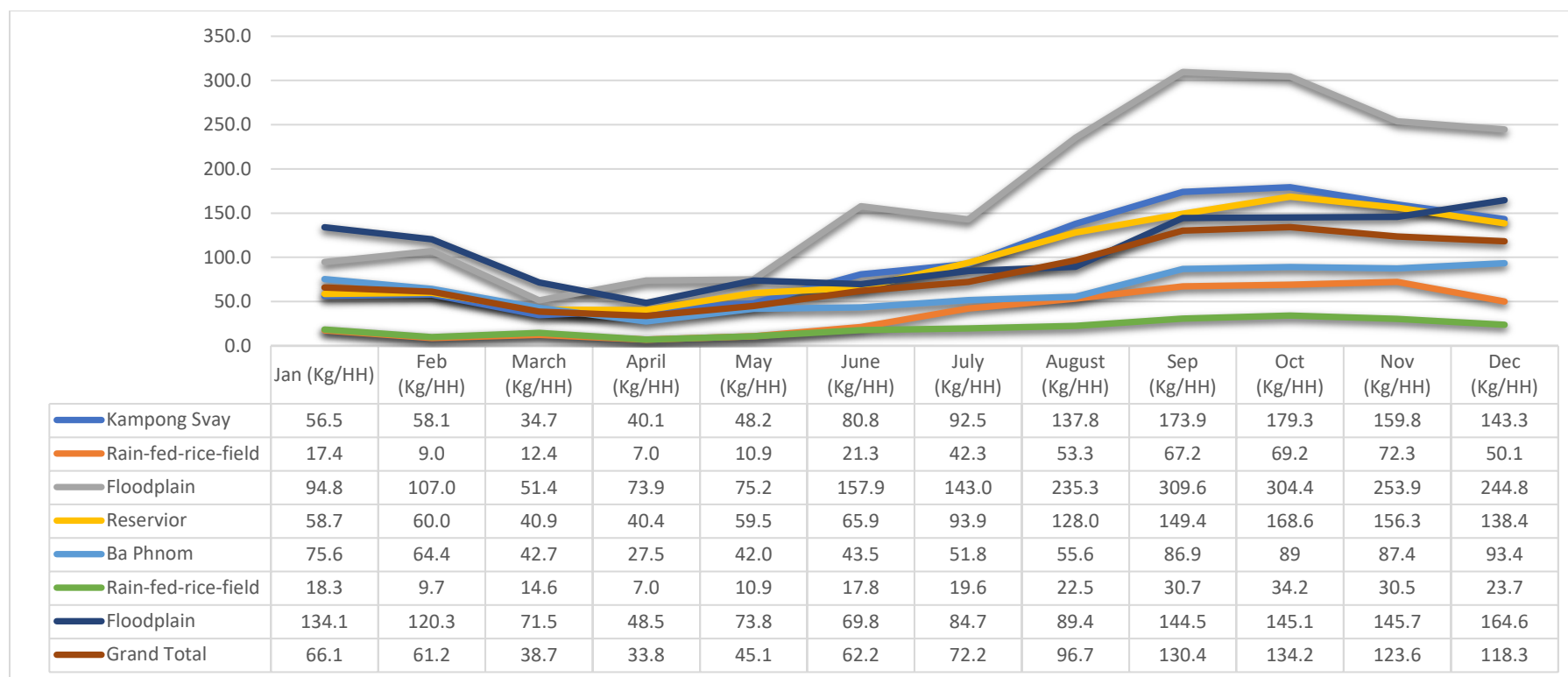
fishing gears were 60% and 50%, respectively, in reservoir habitat fisher owned two fishing gears are highest (47%), While fisher owed/used one fishing gear seemed to be low within the two districts and across all fishing habitats (Table 10).

Graph 4. Fish catch, OAA catch and total catch (fish and OAA) across fish habitat types (Kg/habitat/year)



Graph 4 Shows fish catch, OAA catch and total catch (fish and OAA) within two districts across the fishing habitats. In Kampong Svay district, survey found that the highest fish and OAA catch in floodplain habitat were about 59,48Kg/year and 5,631Kg/year, respectively with total catch (fish OAA) was 65,115Kg/year. While in Ba Phnom district, floodplain habitat was also the highest fish and OAA catch were around 56,842Kg/year and 7,369Kg/year, respectively, followed by reservoir habitat which fish and OAA catch was about 34,797Kg/year and 7,000Kg/year, respectively.

Graph 5. An average monthly fish catches across fish habitat types (Kg/HH/month)



Floodplain habitat was the most catch within both districts of Kampong Svay and Ba Phnom of which the month of September was the peak catch with an average monthly catch was around 300Kg/HH/month and 145Kg/HH/month, respectively. All habitat types within both districts, the catch started to increase from July to September and decrease from October to February. The least month catch was in April, March and May with an average monthly catch was 34, 39 and 45Kg/HH/month, respectively,

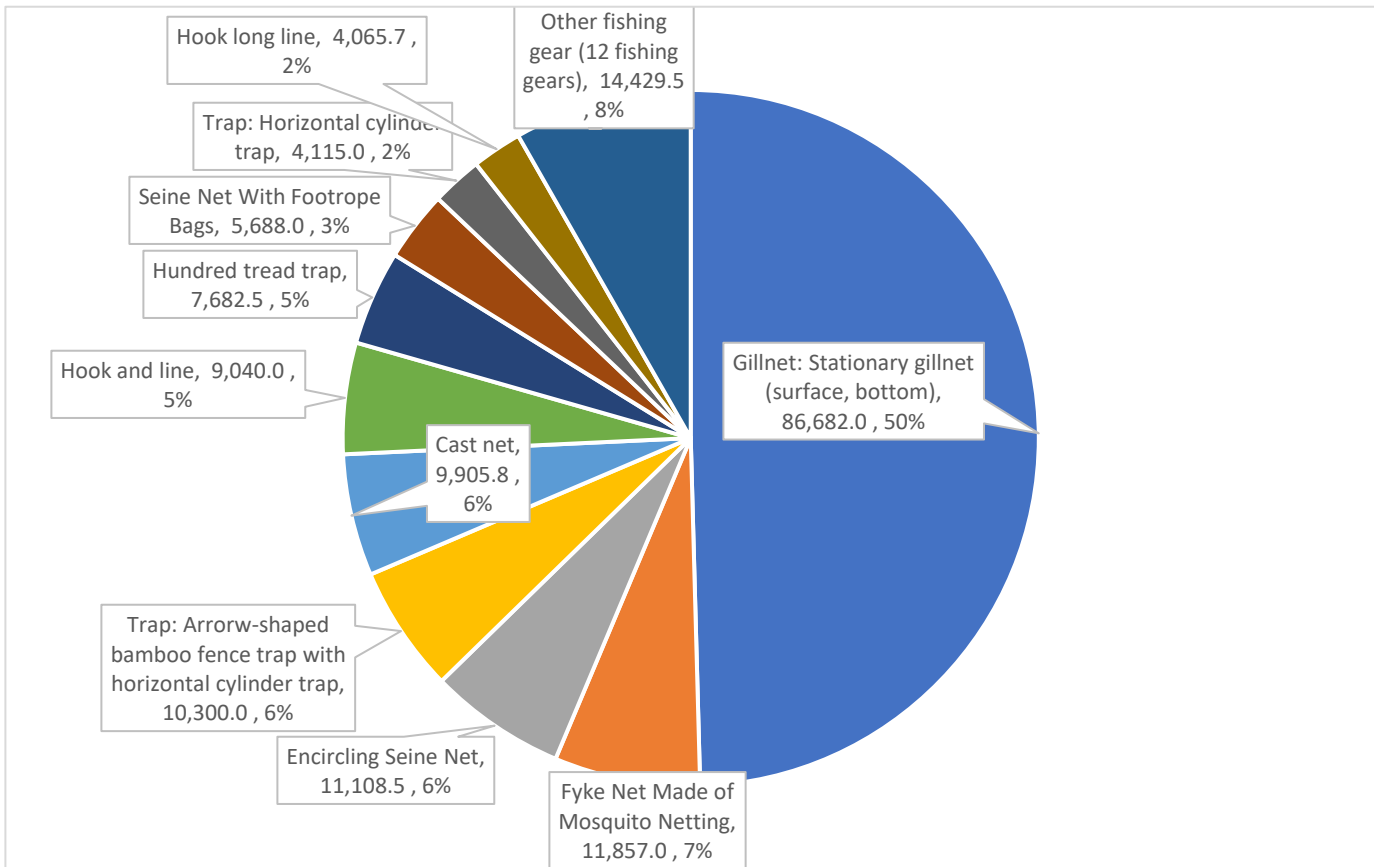
Table 11. Average monthly fish catch of fishing gear used across fish habitat types

Province	District and habitat types	Jan (Kg/HH)	Feb (Kg/HH)	March (Kg/HH)	April (Kg/HH)	May (Kg/HH)	June (Kg/HH)	July (Kg/HH)	August (Kg/HH)	Sep (Kg/HH)	Oct (Kg/HH)	Nov (Kg/HH)	Dec (Kg/HH)
Kampong Thom	Kampong Svay	56.5	58.1	34.7	40.1	48.2	80.8	92.5	137.8	173.9	179.3	159.8	143.3
	Ran-fed-rice field	17.4	9.0	12.4	7.0	10.9	21.3	42.3	53.3	67.2	69.2	72.3	50.1
	Cast net	43.9	22.9	36.9	23.9	35.3	42.9	48.3	51.5	59.4	92.9	78.0	41.0
	Frog Cover Net	0.0	0.0	0.0	0.0	0.0	26.0	24.0	24.0	18.0	31.0	0.0	0.0
	Gillnet: Stationary gillnet (surface, bottom)	8.3	7.1	10.2	3.7	3.2	14.5	37.5	54.2	63.4	81.8	100.1	76.8
	Hook and line	0.0	0.0	0.0	0.0	0.0	0.0	105.0	105.0	30.0	20.0	0.0	0.0
	Hook and line: Pole and line for frogs	0.0	0.0	0.0	0.0	0.0	87.0	75.0	65.0	120.0	150.0	120.0	105.0
	Trap: Horizontal cylinder trap for rice fields	14.4	3.1	0.6	1.0	6.4	9.4	47.5	70.6	113.2	56.6	69.9	47.6
	Wedge-shaped scoop basket	10.0	5.5	2.0	0.0	0.5	4.7	6.2	3.2	1.7	3.2	3.8	3.0
	Floodplain	94.8	107.0	51.4	73.9	75.2	157.9	143.0	235.3	309.6	304.4	253.9	244.8
	Cast net	5.0	23.3	28.3	126.3	42.3	58.3	30.0	30.3	41.7	46.7	45.0	46.3
	Encircling Seine Net	775.0	775.0	150.0	172.5	80.0	130.0	190.0	255.0	295.0	371.0	147.5	907.5
	Fyke Net Made of Mosquito Netting	50.0	100.0	37.5	150.0	75.0	333.0	300.0	783.0	1255.0	1390.0	555.0	120.0
	Gillnet: Stationary gillnet (surface, bottom)	70.6	80.8	53.1	19.6	59.1	71.5	81.5	104.6	168.0	162.7	213.4	163.3
	Hook and line	31.3	44.5	55.0	159.0	197.8	222.8	148.3	83.5	72.3	82.8	137.5	83.3
	Hook long line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	140.0	140.0	196.0	406.0	346.0
	Plunge Basket or Cover Pot	105.0	108.0	145.0	168.0	84.0	69.0	96.0	144.0	206.0	206.0	306.0	360.0
	Seine Net With Footrope Bags	0.0	0.0	0.0	60.0	100.0	40.0	0.0	0.0	300.0	200.0	120.0	60.0
	Trap: Arroww-shaped bamboo fence trap with horizontal cylinder trap	0.0	0.0	0.0	0.0	0.0	1200.0	900.0	1800.0	1950.0	1500.0	1200.0	1750.0
	Trap: Bamboo tube trap for eel	8.4	28.0	28.0	21.0	60.0	60.0	90.0	142.5	132.0	60.0	80.0	66.0
	Trap: Horizontal cylinder trap	0.0	0.0	0.0	0.0	0.0	360.0	420.0	840.0	720.0	720.0	600.0	30.0
	Reservoir	58.7	60.0	40.9	40.4	59.5	65.9	93.9	128.0	149.4	168.6	156.3	138.4
	Cast net	24.3	29.3	24.3	28.4	59.0	25.0	37.7	72.3	76.9	73.5	54.9	31.8
	Catching fish by using hand	30.0	60.0	72.0	50.0	15.0	26.0	60.0	80.0	50.0	50.0	60.0	80.0
	Gillnet: Stationary gillnet (surface, bottom)	92.2	96.2	62.4	61.6	82.6	111.8	156.3	200.4	215.3	227.1	239.7	236.7
	Hook and line	79.0	88.0	77.0	67.0	104.5	113.5	100.0	92.5	90.0	127.5	165.0	122.5
	Hook long line	130.0	105.0	113.0	89.0	155.0	202.0	239.0	245.0	315.0	315.0	315.0	280.0

	Hundred tread trap	54.8	41.7	8.3	5.8	17.3	44.1	91.8	145.7	206.0	252.0	209.2	158.8
	Seine Net With Footrope Bags	90.0	110.0	82.0	123.0	72.0	36.0	30.0	60.0	100.0	90.0	90.0	140.0
	Trap: Horizontal cylinder trap for rice fields	0.0	0.0	0.0	0.0	6.8	7.3	14.0	6.8	24.0	102.0	22.0	34.0
Prey Veng	Ba Phnom	75.6	64.4	42.7	27.5	42.0	43.5	51.8	55.6	86.9	89.0	87.4	93.4
	Rain-fed-rice field	18.3	9.7	14.6	7.0	10.9	17.8	19.6	22.5	30.7	34.2	30.5	23.7
	Catching fish by using hand	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
	Gillnet: Stationary gillnet (surface, bottom)	57.6	28.8	45.5	21.9	22.9	33.4	34.9	32.5	46.0	62.3	68.9	56.8
	Hand Dragged Seine Net	0.0	0.0	0.0	0.0	1.5	4.0	8.0	12.5	30.0	22.0	40.0	70.0
	Hook and line	0.0	0.0	0.0	0.0	0.0	30.0	42.0	39.0	48.0	24.0	36.0	20.0
	Hook long line	0.0	0.0	0.0	0.0	0.3	9.6	16.8	27.3	41.3	50.8	21.5	0.0
	Multi-pronged barbed spear	0.8	1.4	0.8	0.4	5.6	11.2	11.7	17.6	22.7	21.5	11.9	7.4
	One-pronged barbless spear	0.0	0.0	0.0	0.0	3.0	4.0	14.0	14.0	14.0	3.0	3.0	3.0
	Spear	0.0	0.0	0.0	0.0	0.0	9.0	18.0	17.5	16.0	0.0	0.0	0.0
	Floodplain	134.1	120.3	71.5	48.5	73.8	69.8	84.7	89.4	144.5	145.1	145.7	164.6
	Encircling Seine Net	308.7	236.0	73.3	26.7	23.8	27.0	11.5	12.2	8.7	20.0	59.0	63.7
	Fyke Net Made of Mosquito Netting	0.0	0.0	0.0	0.0	0.0	0.0	360.0	420.0	390.0	390.0	0.0	0.0
	Gillnet: Stationary gillnet (surface, bottom)	119.4	121.9	63.9	54.6	101.4	91.0	103.6	107.9	189.2	193.4	207.9	213.5
	Hand Dragged Seine Net	111.0	101.5	113.5	64.0	2.5	0.0	0.0	0.0	0.0	0.0	1.0	12.5
	Hook and line	18.0	16.0	14.3	6.7	7.3	8.0	14.7	25.3	33.3	38.7	47.3	42.7
	Hundred tread trap	12.0	18.0	14.0	6.0	12.0	24.0	35.0	21.0	36.0	18.0	49.0	24.0
	Seine Net With Footrope Bags	292.0	288.0	162.3	93.0	60.0	42.7	28.0	36.0	18.7	19.3	11.7	210.0
	Trap: Big bamboo vertical cylinder trap	217.5	12.5	167.5	27.0	28.0	102.5	125.0	115.0	205.5	143.0	77.0	114.5
	Trap: Horizontal cylinder trap	30.0	15.0	30.0	40.0	60.0	60.0	20.0	20.0	40.0	40.0	30.0	40.0
Grand Total		66.1	61.2	38.7	33.8	45.1	62.2	72.2	96.7	130.4	134.2	123.6	118.3

Table 11 shows an average monthly fish catch of different fishing gears used across fish habitats by fisher within both districts of Kampong Thom and Prey Veng provinces. The results showed that the catch started to increase from August to October and started to decrease from November to December of the year. The peak catch was the month of October of the year, the least catch was the month of March and April of the year.

Graph 6. Top 10 fishing gear used and fish biomass (%)



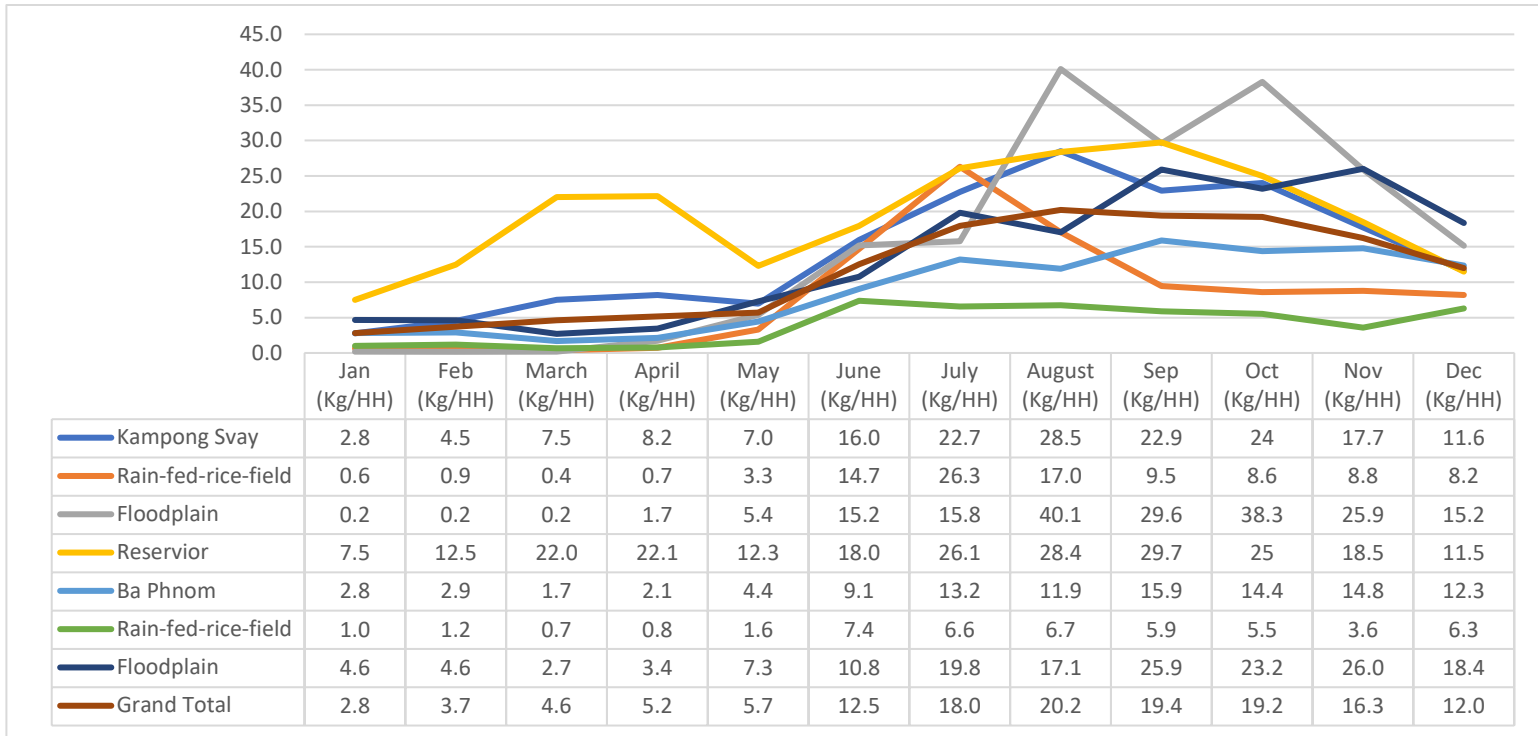
Top 10 fishing gears used by sampled fishers and fish biomass namely: 1. Stationary gillnet (86,682Kg/HH/year), 2. Fyke Net Made of Mosquito net (11,857Kg/HH/year), 3. Encircling Science net (11,108.5 Kg/HH/year), 4. Arrow-sharped bamboo fence trap with horizontal cylinder trap (10,300Kg/HH/year), 5. Hood and line (9,040Kg/HH/year), 6. Hundred tread trap (7,682Kg/HH/Year), 8. Seine net with footrope (4,115Kg/H/year), 10. Hook long line (4,065.7Kg/HH/year) and 11. Other 12 fishing gears (14,429.Kg/HH/year) (Graph 6).

Table 12. Lists of fishing gear used and fish biomass

No.	Types of Fishing Gear Used	Biomass (Kg/HH/Year)
1	Cast net	9,905.8
2	Catching fish by using hand	666.0
3	Encircling Seine Net	11,108.5
4	Frog Cover Net	123.0
5	Fyke Net Made of Mosquito Netting	11,857.0
6	Gillnet: Stationary gillnet (surface, bottom)	86,682.0
7	Hand Dragged Seine Net	1,000.0
8	Hook and line	9,040.0
9	Hook and line: Pole and line for frogs	722.0
10	Hook long line	4,065.7
11	Hundred tread trap	7,682.5
12	Multi-pronged barbed spear	2,710.7
13	One-pronged barbless spear	58.0
14	Plunge Basket or Cover Pot	1,997.0
15	Seine Net With Footrope Bags	5,688.0
16	Spear	60.5
17	Trap: Arroww-shaped bamboo fence trap with horizontal cylinder trap	10,300.0
18	Trap: Bamboo tube trap for eel	775.9
19	Trap: Big bamboo vertical cylinder trap	2,670.0
20	Trap: Horizontal cylinder trap	4,115.0
21	Trap: Horizontal cylinder trap for rice fields	3,515.4
22	Wedge-shaped scoop basket	131.0
Grand Total		174,874.0

Sampled fishers used 22 different fishing gear types, half of fisher (50%), they used stationary gillnet with fish catch estimated at 86,682 Kg/HH/year (Table 12).

Graph 7. Average monthly OAA catch of fishing gear used across fish habitat types



All habitat types in Kampong Svay district the OAA catch start to increase from June to September and decrease from October to December and the least OAA catch were in January, February, March, April and May, except reservoir habitat the OAA catch increased from January to May with catch estimated at 12.5Kg/HH/month, 22Kg/HH/month, 22.1Kg/HH/month and 12.3Kg/HH/month, respectively. In Ba Phnom district, the floodplain habitat was the most OAA catch which started to rise from May to November and the least OAA catch was January, February, March, and April with catch estimated at 4.6Kg/HH/month, 4.6Kg/HH/month, 2.7Kg/HH/month, and 3.4Kg/HH/month, respectively.

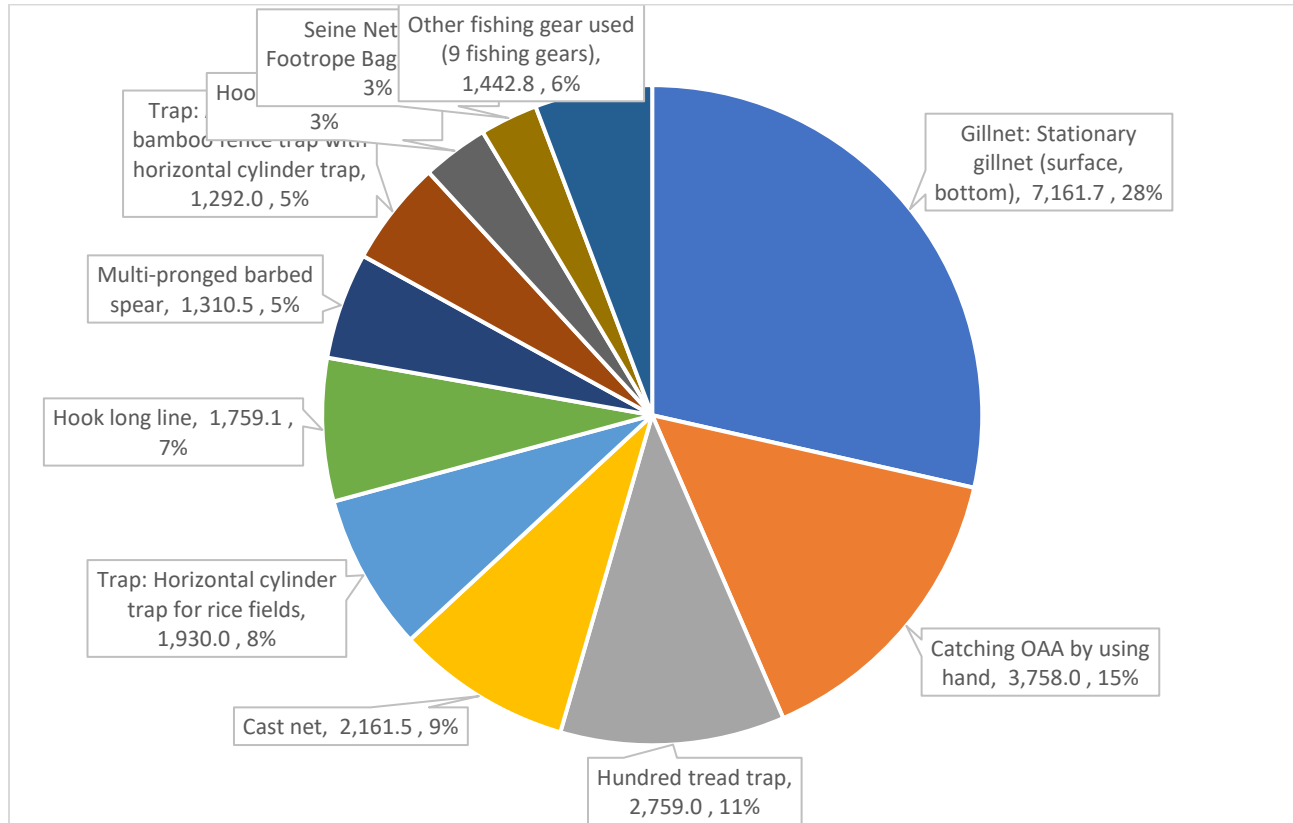
Table 13. Average monthly OAA catch of fishing gear used across fish habitat types

Province	District and habitat types	Jan (Kg/HH)	Feb (Kg/HH)	March (Kg/HH)	April (Kg/HH)	May (Kg/HH)	June (Kg/HH)	July (Kg/HH)	August (Kg/HH)	Sep (Kg/HH)	Oct (Kg/HH)	Nov (Kg/HH)	Dec (Kg/HH)
Kampong Thom	Kampong Svay	2.8	4.5	7.5	8.2	7.0	16.0	22.7	28.5	22.9	24.0	17.7	11.6
	Rain-fed-rice field	0.6	0.9	0.4	0.7	3.3	14.7	26.3	17.0	9.5	8.6	8.8	8.2
	Cast net	1.3	2.3	0.8	2.4	1.3	20.0	19.0	12.3	2.0	3.0	3.9	3.6
	Frog Cover Net	0.0	0.0	0.0	0.0	0.0	20.0	30.0	15.0	20.0	7.5	0.0	0.0
	Gillnet: Stationary gillnet (surface, bottom)	0.0	0.0	0.0	0.5	0.6	6.4	8.8	12.7	7.3	9.2	11.5	14.0
	Hook and line	0.0	0.0	0.0	0.0	0.0	25.0	30.0	50.0	0.0	0.0	0.0	0.0
	Hook and line: Pole and line for frogs	0.0	0.0	0.0	0.0	0.0	30.0	40.0	30.0	40.0	20.0	12.0	9.0
	Trap: Horizontal cylinder trap for rice fields	1.4	1.7	0.9	0.0	12.0	21.1	63.3	29.0	19.5	16.7	15.6	10.3
	Wedge-shaped scoop basket	0.0	0.0	0.0	0.0	0.0	4.7	8.3	0.0	0.0	0.0	0.0	0.0
	Floodplain	0.2	0.2	0.2	1.7	5.4	15.2	15.8	40.1	29.6	38.3	25.9	15.2
	Cast net	1.5	1.3	1.5	1.0	10.3	14.5	1.5	102.3	15.3	110.0	104.3	8.8
	Encircling Seine Net	0.0	0.0	0.0	0.0	1.0	4.5	4.5	0.0	0.0	0.0	0.0	0.0
	Fyke Net Made of Mosquito Netting	0.0	0.0	0.0	0.0	0.0	0.0	30.0	45.0	0.0	0.0	0.0	0.0
	Gillnet: Stationary gillnet (surface, bottom)	0.0	0.0	0.0	3.8	5.0	7.5	8.2	12.6	19.0	6.6	0.0	0.0
	Hook and line	0.0	0.0	0.0	0.8	11.5	9.8	13.0	19.5	26.3	12.5	0.0	0.0
	Hook long line	0.0	0.0	0.0	0.0	12.0	40.0	0.0	300.0	300.0	300.0	300.0	300.0
	Plunge Basket or Cover Pot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Seine Net With Footrope Bags	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	0.0
	Trap: Arroww-shaped bamboo fence trap with horizontal cylinder trap	0.0	0.0	0.0	0.0	0.0	220.0	246.0	172.0	195.0	279.0	60.0	120.0
	Trap: Bamboo tube trap for eel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Trap: Horizontal cylinder trap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Reservoir	7.5	12.5	22.0	22.1	12.3	18.0	26.1	28.4	29.7	25.0	18.5	11.5
	Cast net	0.0	0.0	0.0	0.0	0.0	2.0	0.0	9.4	10.0	0.0	0.0	0.0
	Catching fish by using hand	150.0	300.0	600.0	600.0	200.0	150.0	400.0	300.0	300.0	300.0	225.0	225.0
	Gillnet: Stationary gillnet (surface, bottom)	0.0	0.0	0.0	0.4	4.1	3.4	5.4	6.9	4.9	3.0	4.9	6.6
	Hook and line	0.0	0.0	0.0	0.0	0.0	17.5	50.0	50.0	50.0	0.0	0.0	0.0

	Hook long line	0.0	0.0	0.0	0.0	30.0	40.0	40.0	40.0	0.0	0.0	0.0	0.0
	Hundred tread trap	0.0	0.0	0.0	0.0	4.7	34.7	12.5	11.0	30.3	56.7	23.3	0.0
	Seine Net With Footrope Bags	75.0	75.0	60.0	60.0	60.0	45.0	30.0	30.0	30.0	30.0	60.0	60.0
	Trap: Horizontal cylinder trap for rice fields	0.0	0.0	0.0	0.0	6.8	6.8	44.3	89.0	78.0	27.0	43.0	0.0
Prey Veng	Ba Phnom	2.8	2.9	1.7	2.1	4.4	9.1	13.2	11.9	15.9	14.4	14.8	12.3
	Rain-fed-rice field	1.0	1.2	0.7	0.8	1.6	7.4	6.6	6.7	5.9	5.5	3.6	6.3
	Catching fish by using hand	0.0	0.0	0.0	0.0	2.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gillnet: Stationary gillnet (surface, bottom)	1.4	0.7	0.8	0.6	1.5	6.9	4.8	3.8	5.2	6.0	3.0	0.2
	Hand Dragged Seine Net	0.0	0.0	0.0	0.0	1.5	0.8	8.0	5.0	6.0	16.5	15.0	80.5
	Hook and line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hook long line	0.0	0.0	0.0	0.0	0.0	3.3	7.0	8.0	3.8	3.8	2.8	0.0
	Multi-pronged barbed spear	1.1	1.8	0.8	1.2	1.8	8.5	7.4	8.3	6.0	5.7	3.9	8.2
	One-pronged barbless spear	0.0	0.0	0.0	0.0	5.0	6.0	19.0	19.0	27.0	4.5	3.5	2.5
	Spear	0.0	0.0	0.0	0.0	0.0	12.0	11.0	11.5	8.0	0.0	0.0	0.0
	Floodplain	4.6	4.6	2.7	3.4	7.3	10.8	19.8	17.1	25.9	23.2	26.0	18.4
	Encircling Seine Net	0.0	0.0	0.0	0.0	0.0	2.7	10.8	6.7	9.0	10.0	3.3	0.0
	Fyke Net Made of Mosquito Netting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gillnet: Stationary gillnet (surface, bottom)	1.2	1.6	0.7	0.5	4.0	4.6	18.2	18.2	34.1	27.7	33.1	23.6
	Hand Dragged Seine Net	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hook and line	0.0	0.0	0.0	0.0	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
	Hundred tread trap	175.0	160.0	100.0	125.0	175.0	160.0	140.0	125.0	100.0	175.0	160.0	125.0
	Seine Net With Footrope Bags	0.0	0.0	0.0	4.0	11.7	2.0	0.7	2.7	3.0	3.3	0.7	2.3
	Trap: Big bamboo vertical cylinder trap	0.0	0.0	0.0	0.0	0.0	88.0	93.8	43.3	19.8	13.5	19.5	5.5
	Trap: Horizontal cylinder trap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand Total		2.8	3.7	4.6	5.2	5.7	12.5	18.0	20.2	19.4	19.2	16.3	12.0

Table 11 shows an average monthly OAA catch of different fishing gears used across fish habitats by fisher within both districts of Kampong Thom and Prey Veng provinces. The results showed that the catch started to increase from June to September and started to decrease from October to December of the year. The peak catch was the month of September of the year, the least catch was the month of January to May of the year.

Graph 8. Top 10 fishing gear used and OAA biomass



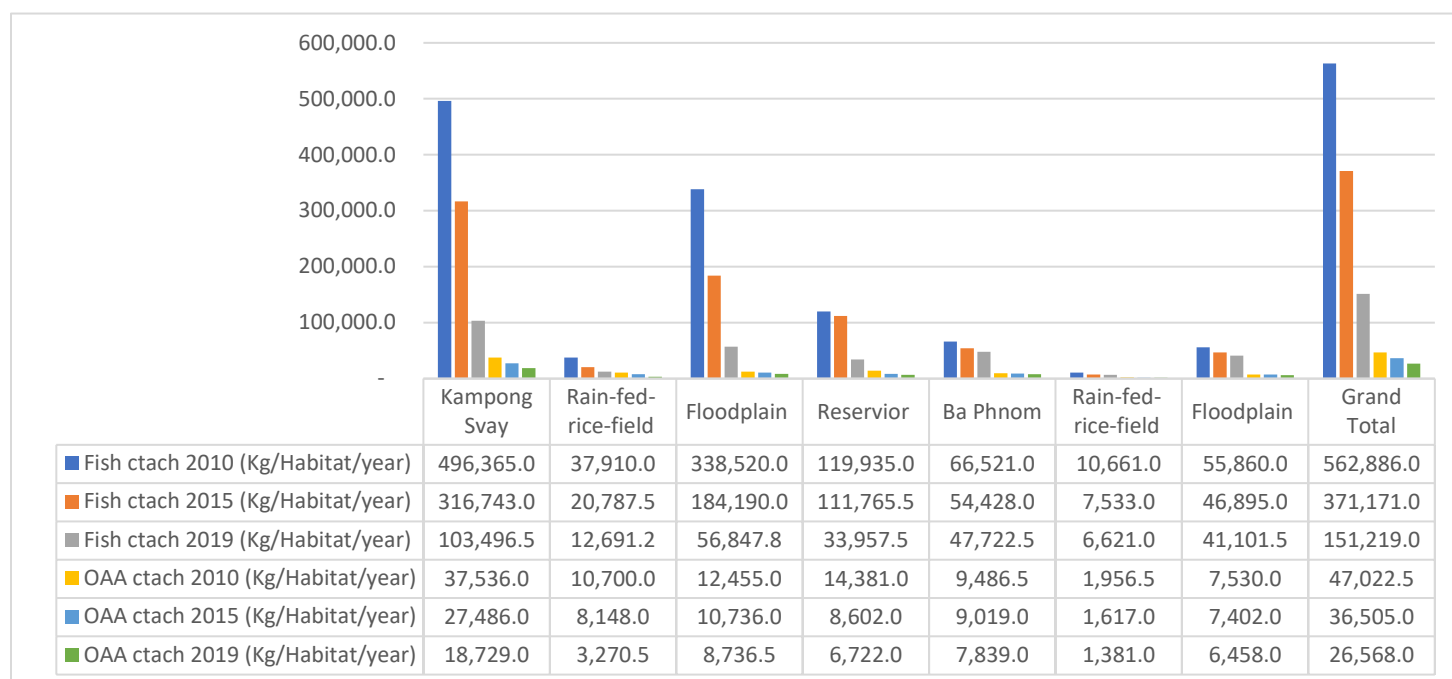
Top 10 fishing gears used by sampled fishers and fish biomass namely: 1. Stationary gillnet (7,162.7Kg/HH/year), 2. Catching OAA by using hand (3,758Kg/HH/Year) 3. Hundred tread trap (2,759Kg/HH/year), 4. Cast net (2,161Kg/HH/year) 5. Horizontal cylinder trap for rice fields (1,930Kg/HH/year) 6. Hook long line (1,759.1Kg/HH/year), 7. Multi-pronged barbed spear (1,310Kg/HH/year), 8. Arrow-sharped bamboo fence trap with horizontal cylinder trap (1,292Kg/HH/year), 9. Hook and line (817Kg/HH/year), 10. Seine Net With Footrope Bags (712Kg/HH/year), and 11. Other 9 fishing gears used (1,442.8Kg/HH/year)

Table 14. Lists of fishing gear used and OAA biomass by HH

No.	Types of Fishing Gear Used	Biomass (Kg/HH/Year)
1	Cast net	2,161.5
2	Catching OAA by using hand	3,758.0
3	Encircling Seine Net	147.5
4	Frog Cover Net	92.5
5	Fyke Net Made of Mosquito Netting	150.0
6	Gillnet: Stationary gillnet (surface, bottom)	7,161.7
7	Hand Dragged Seine Net	137.3
8	Hook and line	817.0
9	Hook and line: Pole and line for frogs	181.0
10	Hook long line	1,759.1
11	Hundred tread trap	2,759.0
12	Multi-pronged barbed spear	1,310.5
13	One-pronged barbless spear	86.5
14	Seine Net With Footrope Bags	712.0
15	Spear	42.5
16	Trap: Arrow-shaped bamboo fence trap with horizontal cylinder trap	1,292.0
17	Trap: Big bamboo vertical cylinder trap	566.5
18	Trap: Horizontal cylinder trap for rice fields	1,930.0
19	Wedge-shaped scoop basket	39.0
Grand Total		25,103.6

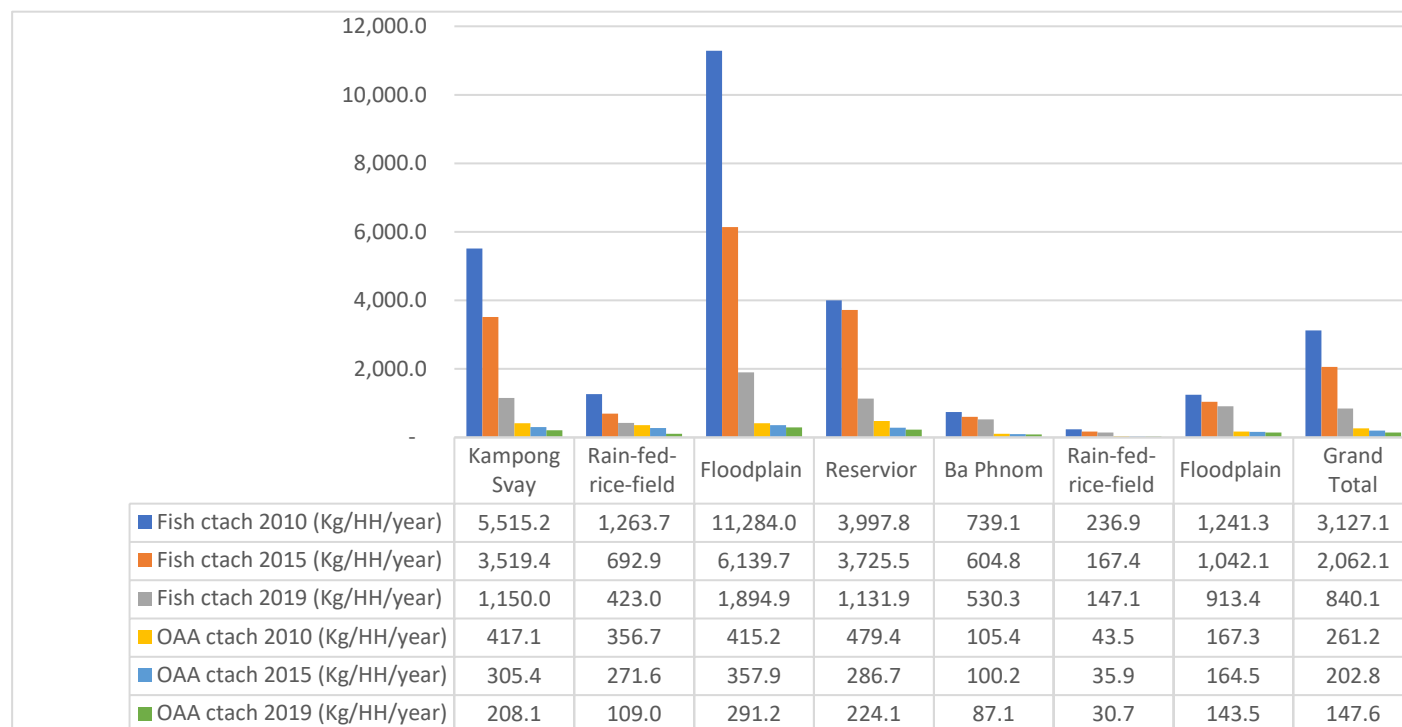
Sampled fishers used 19 different fishing gear types for OAA, stationary gillnet was the highest catch with estimated at 7,161.7 Kg/HH/year, followed by catching OAA by using hand (3,758Kg/HH/year), third catch was hundred tread trap (2,759Kg/HH/Year) and the lowest catch was wedge-shaped scoop basket (39Kg/HH/Year) (Table 12).

Graph 9. Change of fish and OAA catch for last 10 year (Kg/Habitat/year)



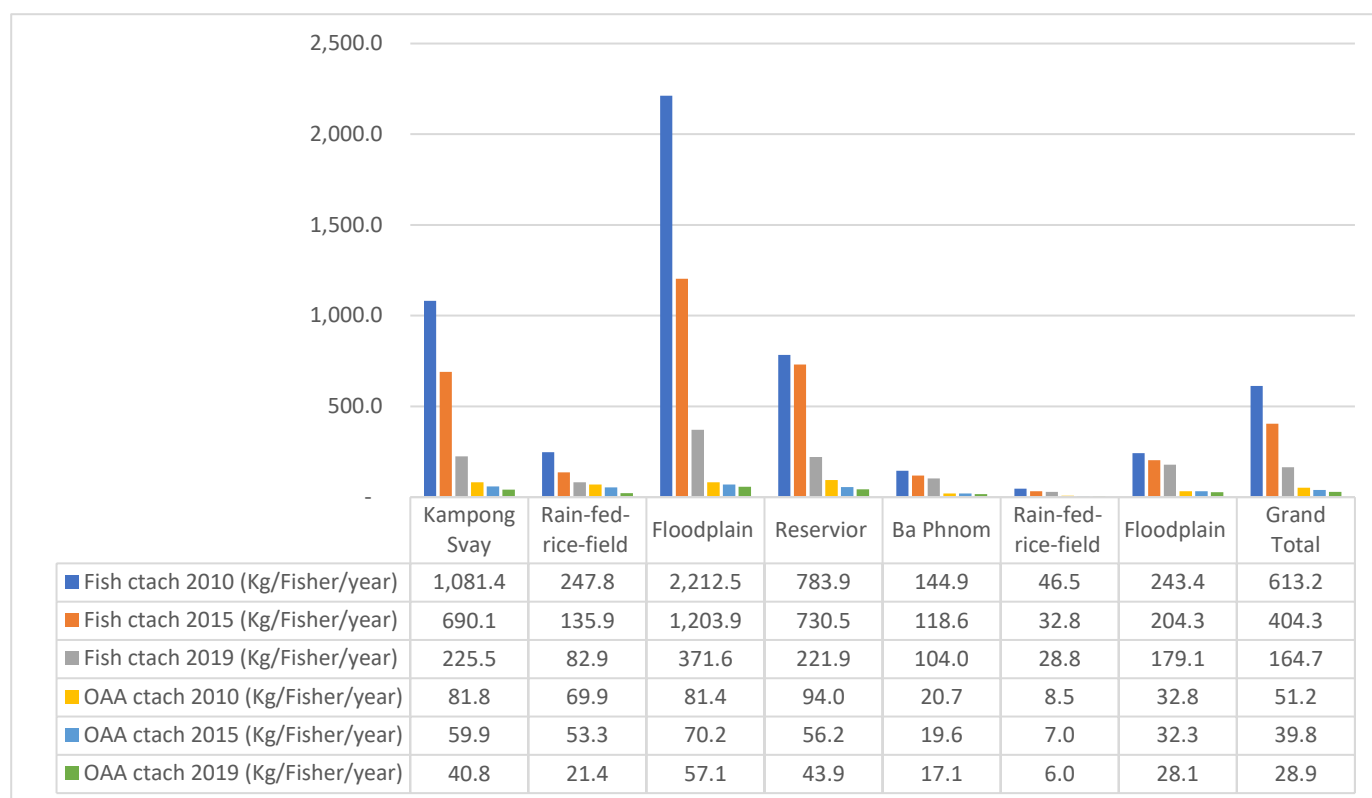
In last 10 year, the capture fish has continued to decline from 562,886Kg/habitat/year in 2010 to 371,171Kg/habitat/year in 2015 and only 151,219Kg/habitat/year in 2019/2020. While OAA has also continued to decline from 47,022Kg/habitat/year in 2010 to 36,505Kg/habitat/Year in 2015 and to 26,568Kg/habitat/year in 2019/2020,

Graph 10. Change of fish and OAA catch for last 10 year (Kg/HH/year)



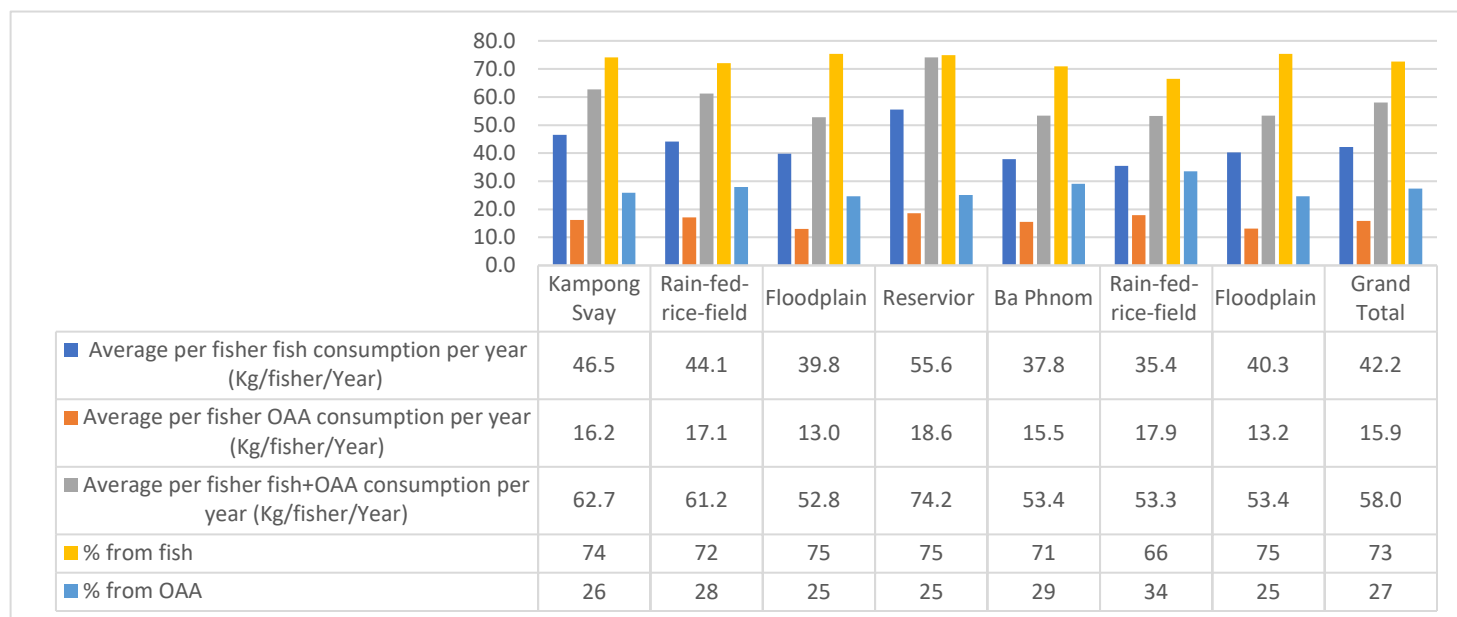
In last 10 year, the capture fish continued to decline from 3,127Kg/HH/year in 2010 to 2,062Kg/HH/year in 2015 and only 840Kg/HH/year in 2019/2020. While OAA are also continuing to decline from 261Kg/HH/year in 2010 to 202Kg/HH/Year in 2015 and to 147.6Kg/HH/year in 2019/2020,

Graph 11. Change of fish and OAA catch for last 10 year (Kg/Fisher/year)



In last 10 year, the capture fish continued to decline from 613 Kg/fisher/year in 2010 to 404 Kg/fisher/year in 2015 and only 164.7 Kg/fisher/year in 2019/2020. While OAA are also continuing to decline from 51Kg/fisher/year in 2010 to 40Kg/HH/Year in 2015 and to 29Kg/fisher/year in 2019/2020,

Graph 12. An average fish and OAA consumption (Kg/fisher/Year)



The total average consumption was 58Kg/fisher/year which shared from fish (42K) and OAA (16Kg) with contributing from fish 73% and OAA 27%. Across the fishing habitat types, the average fish consumption ranging between 35Kg/fisher/year to 55Kg/fisher/year. The reservoir habitat was the highest fish consumed at more than 55Kg/fisher/year and the rain-fed rice field habitat was the lowest consumed at around 35Kg/fisher/year. All fishing habitat types, the OAA consumption ranging between 13Kg/fisher/year to around 18Kg/fisher/yea. Rain-fed rice field in both districts were the highest OAA consumed was higher than 17Kg/fisher/year and the lowest consumed was around 13Kg/fisher/year.

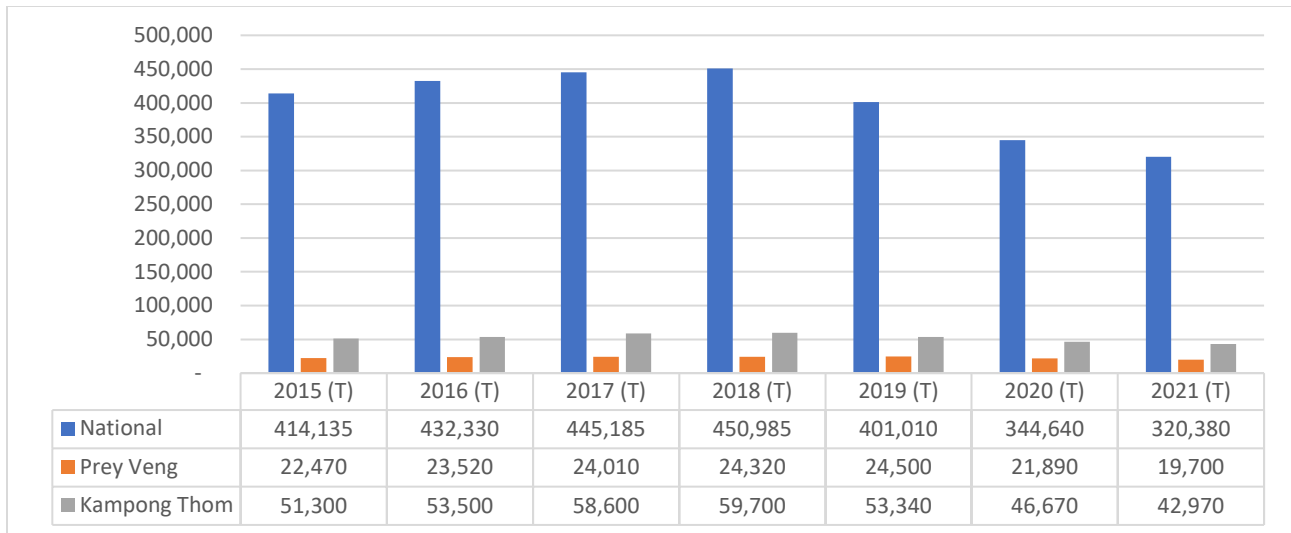
4.2. Result of Fisheries Management Officer Survey

Table 15. Officer information

Name	Age	Gender	Official Position	Department	Province
Mr. Hem Rady	45	M	Chief of Planning Office	Department of Planning, FiA	Phnom Penh
Mr. Oun Sinat	53	M	Chief of Fisheries Cantonment	Provincial Fisheries Cantonment of Prey Veng	Prey Veng
Mr. Chin Sitha	47	M	Chief of Fisheries Cantonment	Provincial Fisheries Cantonment of Kampong Thom	Kampong Thom

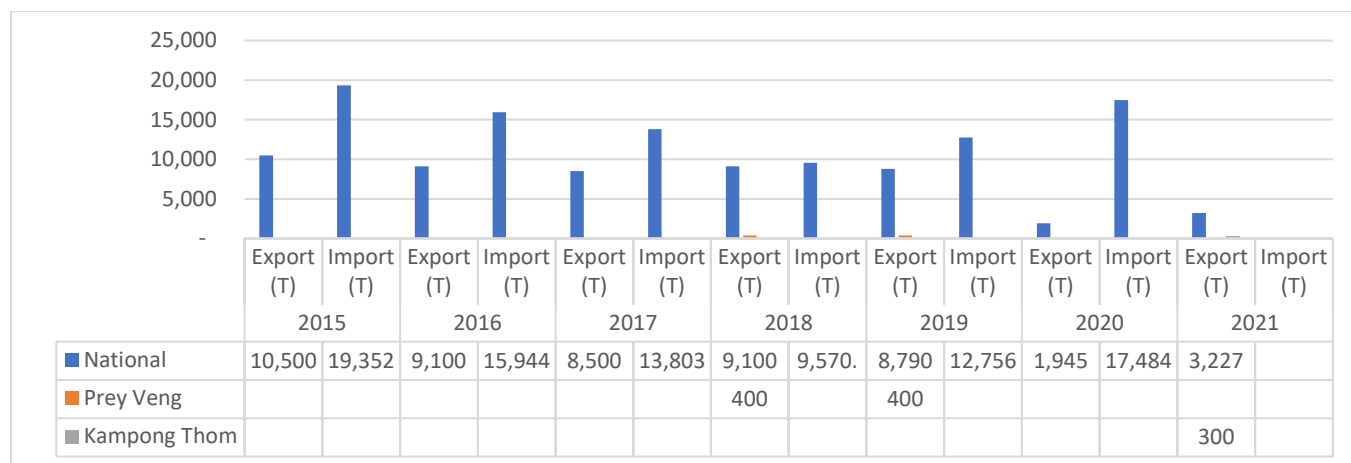
Fisheries management officer survey was conducted survey by constructed questionnaire interview. We conducted interview fisheries management officers namely: 1. Mr. Hem Rady, Chief of Planning Office, Department of Planning, Fisheries Administration, 2. Mr. Oun Sinat, Chief of Fisheries Cantonment, provincial fisheries cantonment, Prey Veng province, 3. Mr. Chin Sitha, Chief of Fisheries Cantonment, provincial fisheries cantonment, Kampong Thom province.

Graph 13. Fresh inland fish production (T) at national and target provinces



At national scale, the total inland fish production has increased from 414,135T in 2015 to 450,985T in 2018 and decreased from 401,010T to 320,380T in 2021. At provincial scale of Prey Veng and Kampong Thom inland fish production 22,470T and 51,300T in 2015 to 24,500T and 59,700T in 2018, respectively and started to decrease from 2019 to 2021 (Graph 13).

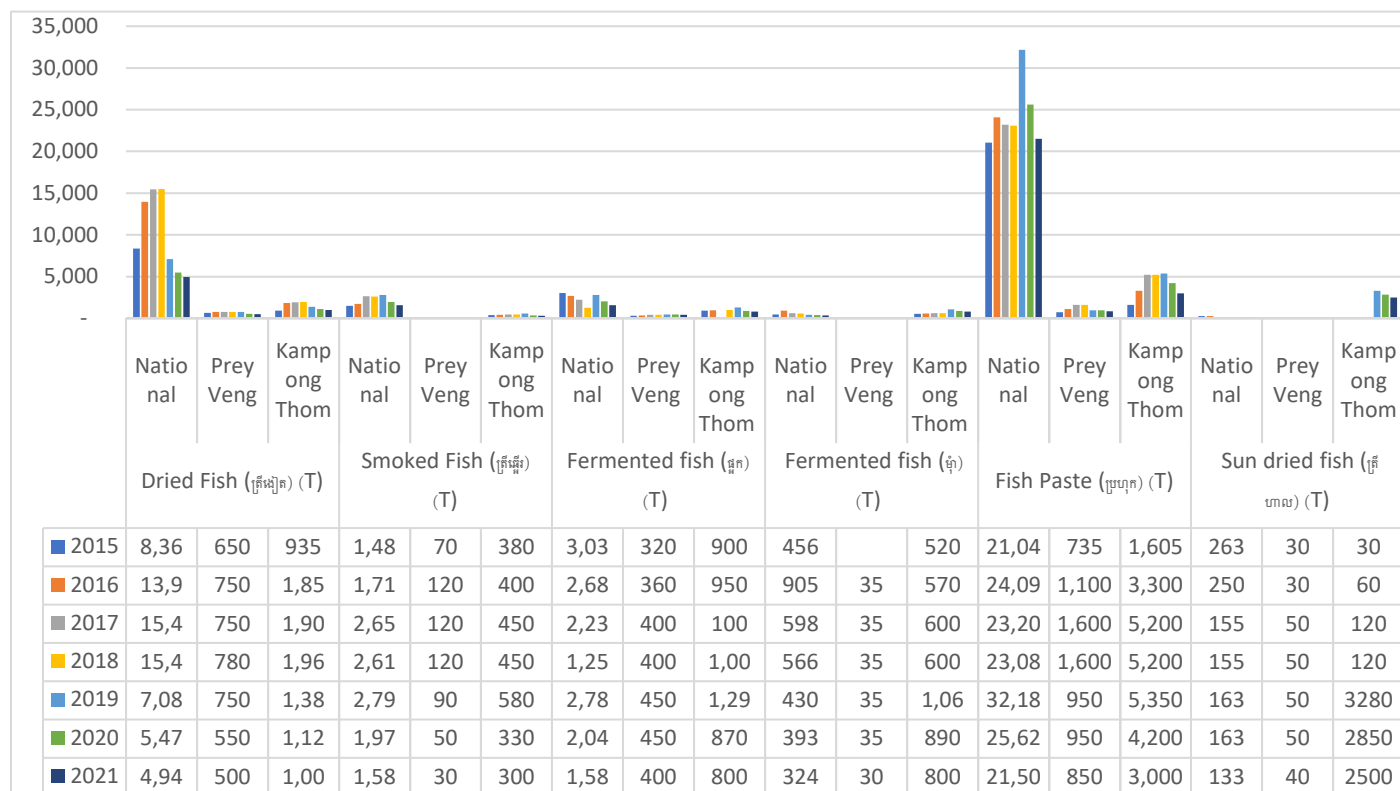
Graph 14. Export fresh inland fish and import fish and fishery products (T) at national and target provinces



Export of fresh inland fish ranged from 2,000T to 10,000T between 2015 to 2021 and import of fresh inland fish ranged from 9,000T to 17,000T between 2015 to 2020 (Graph 14).

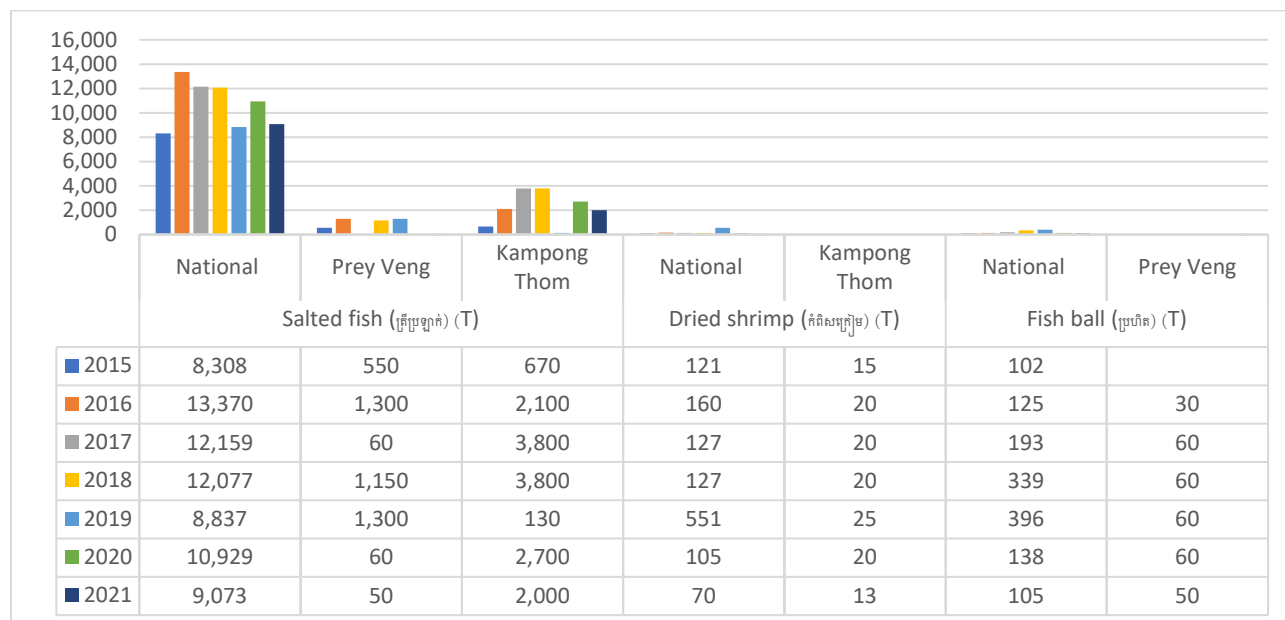
- Export to Viet Nam, Thailand, China, Japan, Canada, Germany, USA, Singapore, Indonesia.
- Import from Thailand, Viet Nam, Singapore, Malaysia, China, Hong Kong, Taiwan, Japan, USA, and Australia

Graph15. Production of dried fish, smoked fish, fermented fish (ផ្អក), fermented fish (ម៉ា), fish paste, and sun-dried fish at national and target provinces



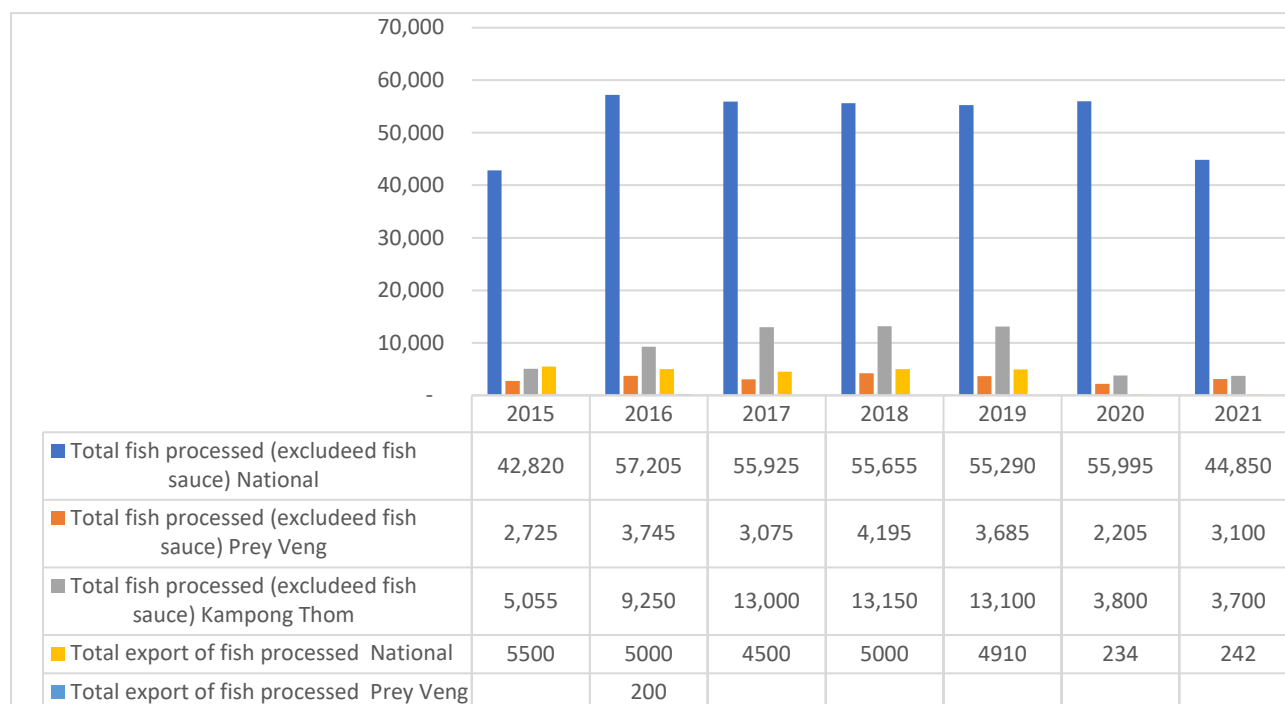
Graph 15 shows the fisheries processed products from 2015 to 2021 such as dried fish, smoked fish, fermented fish (pha ok), fermented fish (mam), fish paste and sun-dried fish at national level and at target province.

Graph 16. Production of salted fish, dried shrimp and fish ball at national and target provinces



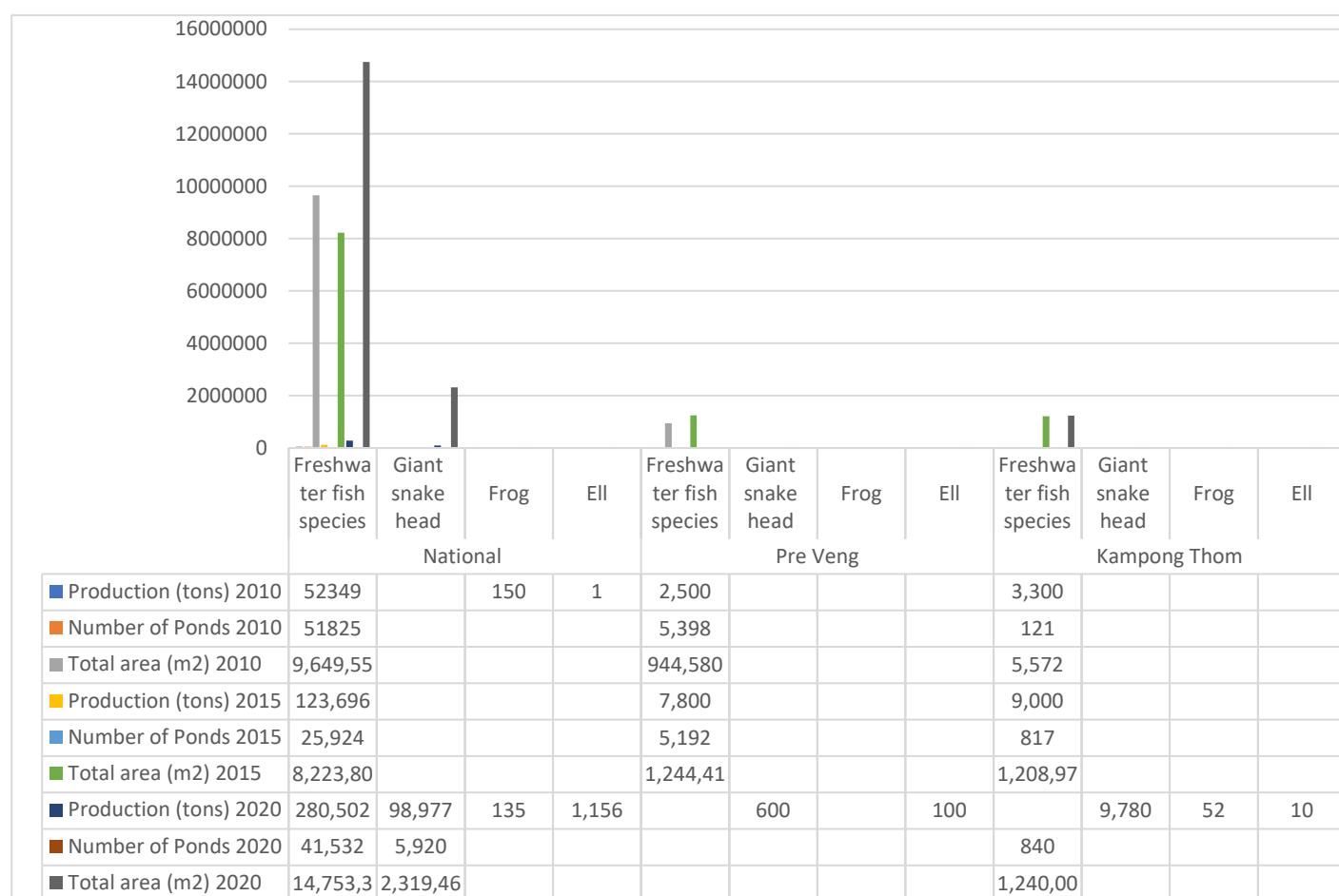
Graph 16 shows the fisheries processed production such as salted fish, dried shrimp, and fish from 2015 to 2021

Graph17. Total fish processed (T) and total export fish processed (T) at national and target provinces



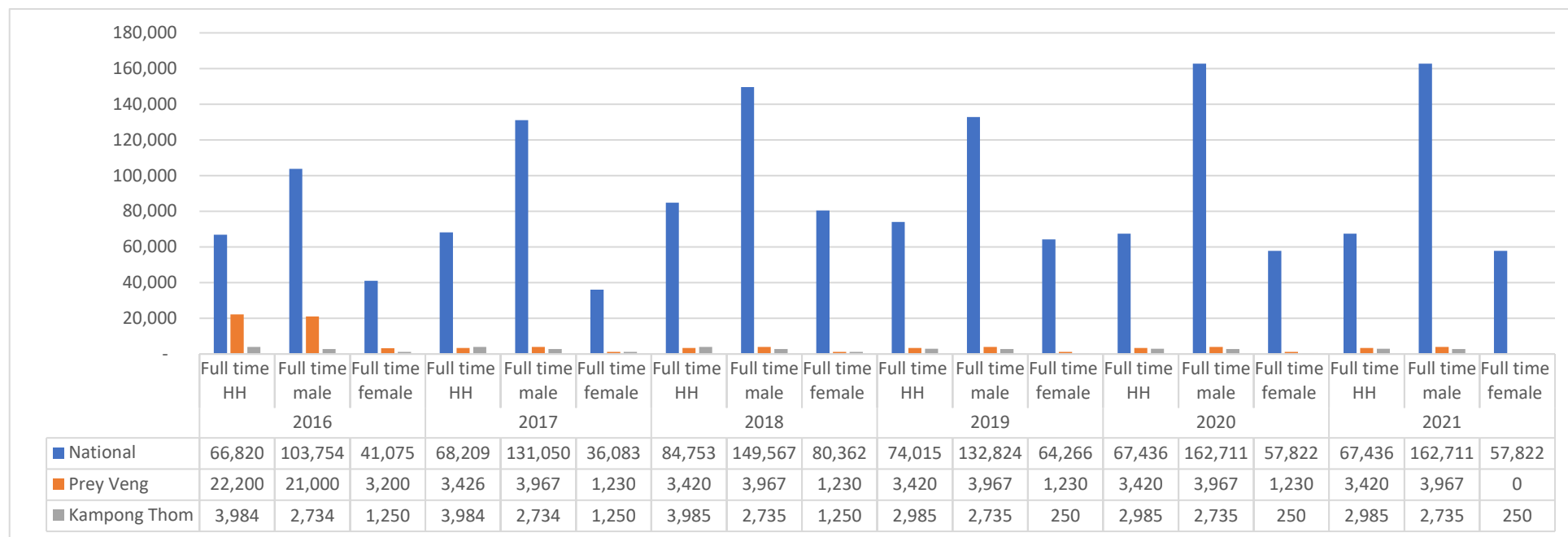
Graph 12 shows total fish processed, and total export fish processed at national and target province level from 2015 to 2021. The total fish processed, not include fish sauce, at national scale ranged between 40,000T to 60,000T, in Prey Veng province ranged between 2,000T to 4,000T and Kampong Thom ranged between 4,000T to 13,000T. Total export of fish processed ranged between 200T to 5000T.

Graph 18. Information on aquaculture in year 2010, 2015 and 2020 at national and target provinces



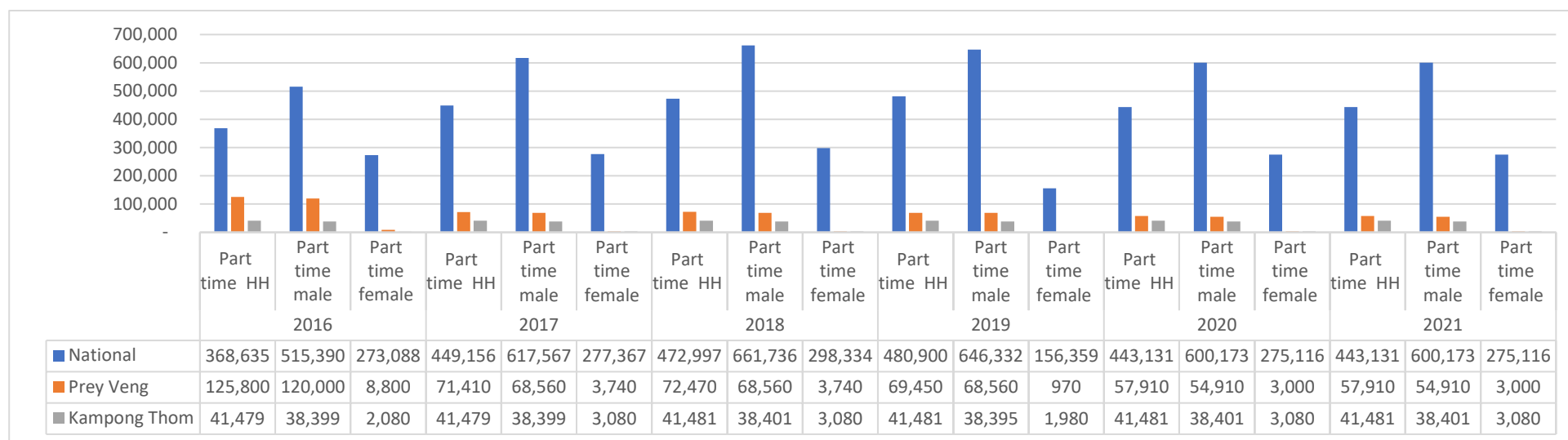
The freshwater aquaculture production, number of ponds, and land area in 2010, 2015 and 2020 at national and target province level. Fresh water aquaculture production has been sharply increasing from 52,349T in 2010 to 123,669T in 2015 and to 280,502T in 2020. While the number of pond and land area have been sharply increased (graph 18)

Graph 19. Full time fisher HH and gender (male and female) at national and target provinces



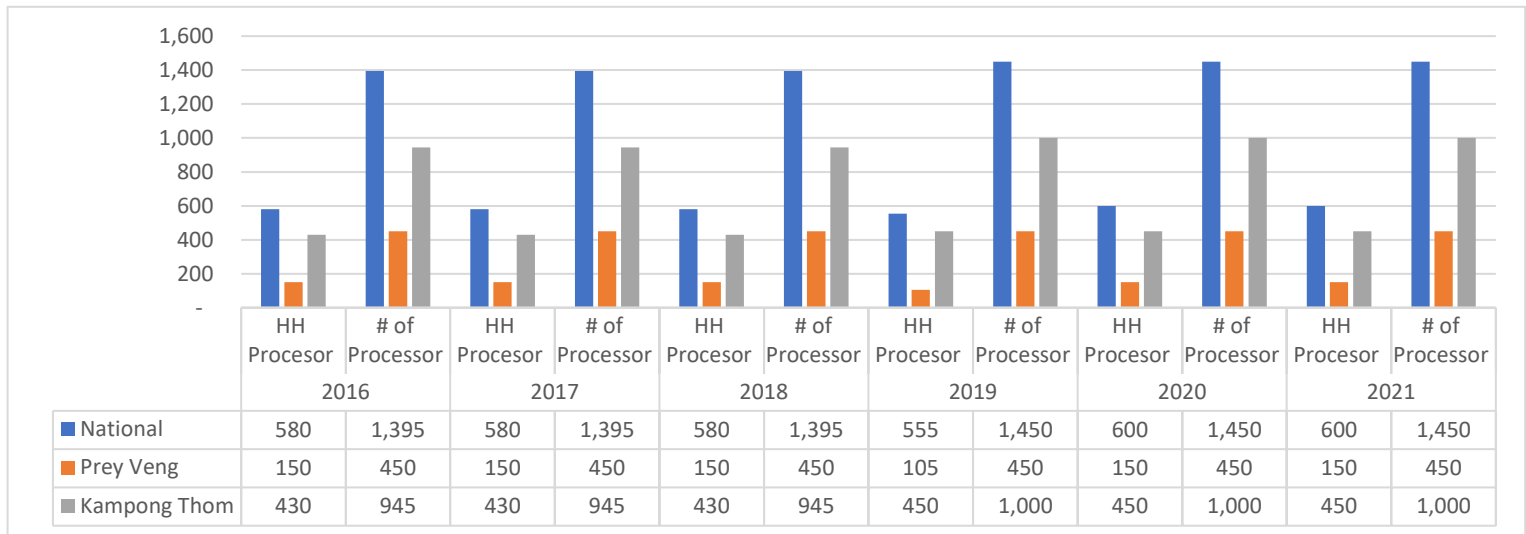
Graph 19 shows the full-time fisher HH and fisher gender (male and female) at national and target provinces from 2016 to 2021. At national scale the full-time fisher HH has been increased between 67,000 from 150,000 from 2016 to 2018 and decreased from 2019 to 2021. Full time fisher male ranged between 100,000 to 160,000 fishers from 2016 to 2021 and full-time fisher female ranged between 40,000 to 80,000 fishers from 2016-2021.

Graph 20. Part time HH fishers and gender (male and female) at national and target provinces



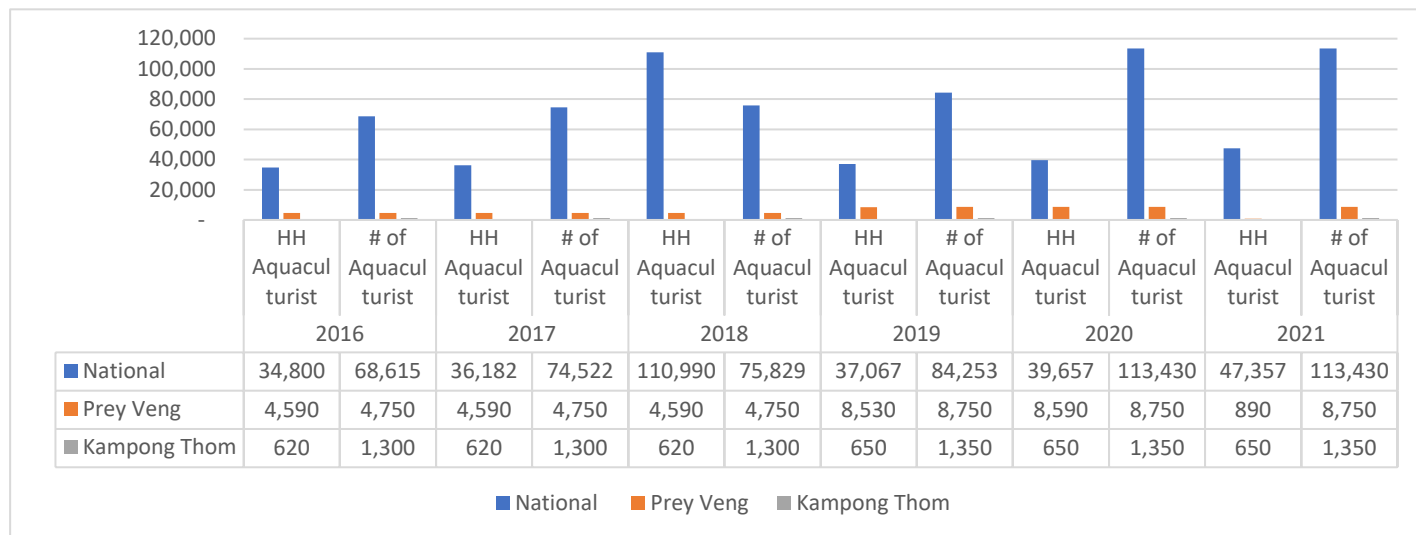
Graph 19 shows the part-time fisher HH and fisher gender (male and female) at national and target provinces from 2016 to 2021. At national scale the part-time fisher HH has been increased between 400,000 from 660,000 from 2016 to 2018 and decreased from 2019 to 2021. Part time fisher male ranged between 500,000 to 660,000 fishers from 2016 to 2021 and part time fisher female ranged between 270,000 to 300,000 fishers from 2016-2021.

Graph 21. HH fish processor and number of fish processor of fishery products at national and target provinces



Graph 21 shows the HH fish processor and number of fish processor of fisheries products at national and target provinces from 2016 to 2021. HH fish processor has around 600 HH and number of fish processor has around 1400 person. In Prey Veng province HH fish processor and number of fish processor are around 150HH and 450 people, respectively. In Kampong Thom province, HH fish processor and number of fish processor is around 450HH and 1,000 people, respectively

Graph 22. HH aquaculturist and number of aquaculturist at national and target provinces



Graph 22 shows the HH fish farming and number of fish farming at national and target provinces from 2016 to 2021. HH fish farming has between 34,000 to 110,000HH and number of fish farming has between 38,000 to 113,000 from 2016 to 2021. In Prey Veng province HH fish farming and number of fish farming are between 850 to 4,500HH and between 8500 to 4,500people, respectively. In Kampong Thom province, HH fish farming and number of fish farming is between 620-650HH and between 1,300-1,500 people, respectively

4.3. Result of focus group discussion

The five Focus Group Discussion (FGD) were conducted for each habitat types to validate the result from the household survey and reflect on fisher perspective.

Table 16. Number of participants participated in focus group discussion

Province	District/Habitat	Group	# of Participants
Kampong Thom	Kampong Svay		29
	Rain-fed-rice-field	1	8
	Floodplain	2	14
	Reservoir	3	7
Prey Veng	Ba Phnom		12
	Rain-fed-rice-field	1	6
	Floodplain	2	6
Grand Total			41

FGD was conducted one group per fishing habitat types with the total participants was 41 (Table 16).

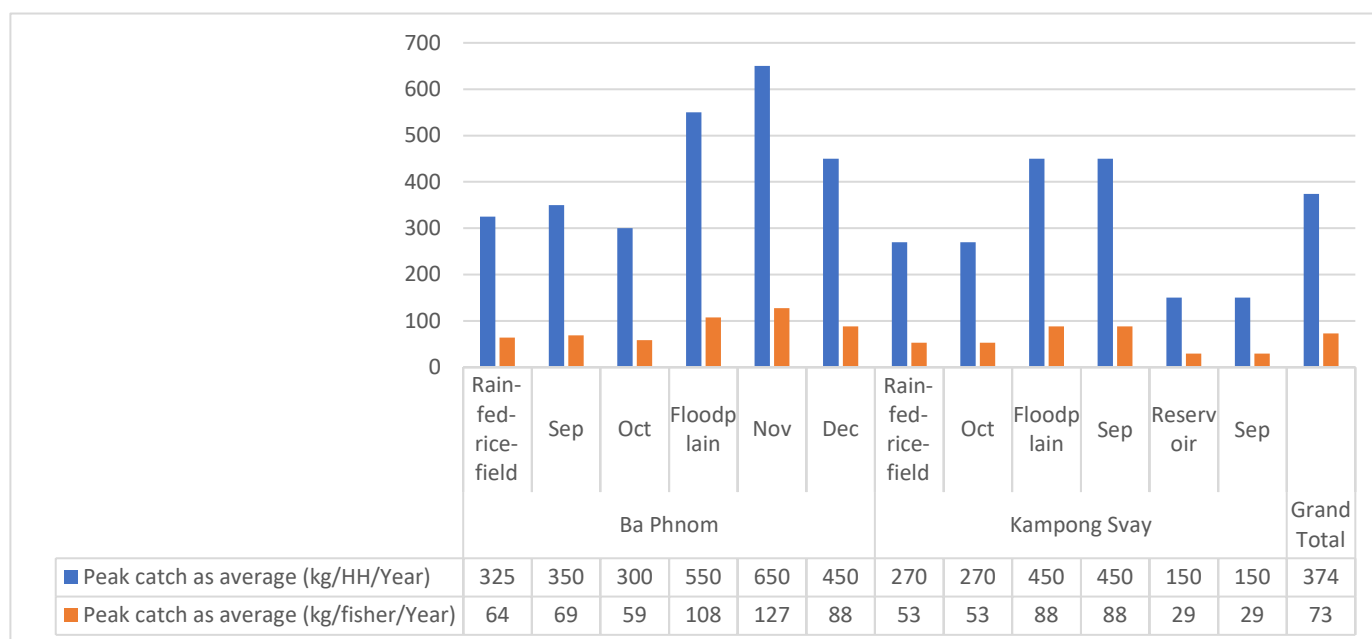
Table 17. Popular and efficient fishing gear used across fish habitat types

Province	District	Habitat and popular fishing gear	Habitat and efficient fishing gear
Prey Veng	Ba Phnom	Rain-fed-rice-field	Rain-fed-rice-field
		Gillnet	Gillnet
		Spear	Spear
		Floodplain	Floodplain
		Gillnet	Gillnet
Kampong Thom	Kampong Svay	Rain-fed-rice-field	Rain-fed-rice-field
		Cast net	Cast net
		Gillnet	Gillnet
		Hand-held life net	Hook long line
		Hook long line	
		Horizontal cylinder trap	
		Plunge basket or cover pot	
		Floodplain	Floodplain
		Gillnet	Cast net
		Single hook and line	Gillnet
			Single hook and line
		Reservoir	Reservoir
		Cast net	Cast net

		Gillnet	Gillnet
		Hook long line	Hook long line

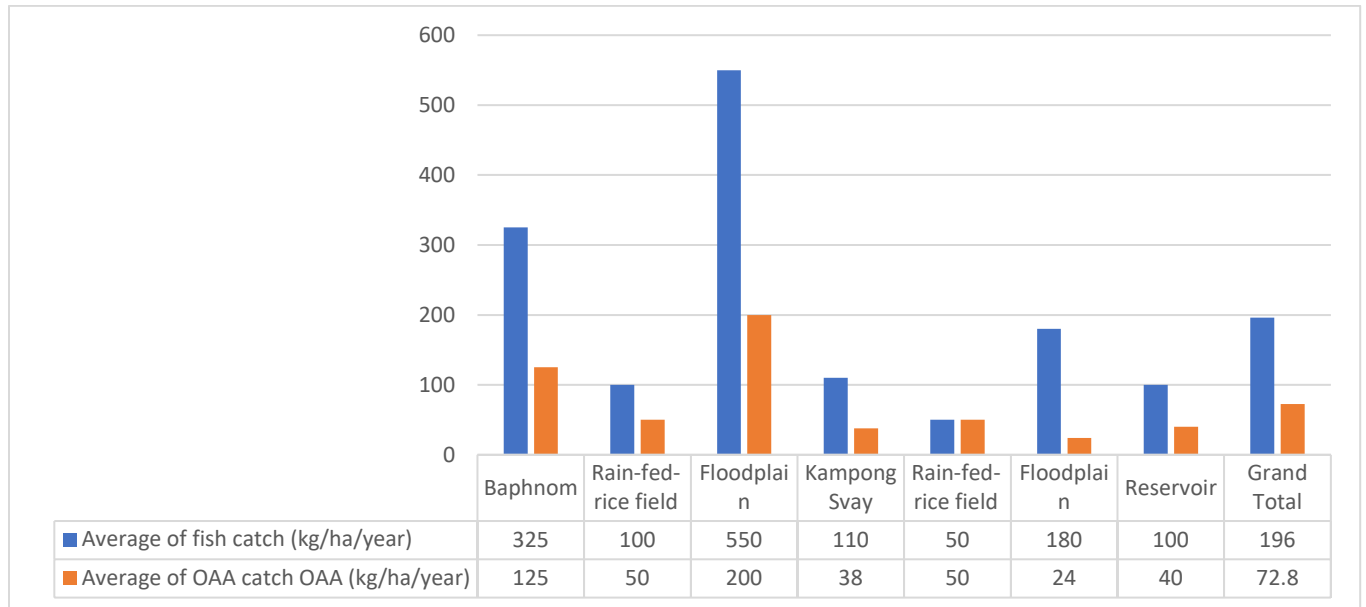
Table 17 shows the popular and efficient fishing gears across the fishing habitat types within both districts of Ba Phnom and Kampong Svay of Prey Veng and Kampong Thom provinces. Gillnet was the popular fishing gear that fisher used in all the fish habitat types within both districts. The other popular fishing gears used across fish habitat types such as cash net, hook, spear, trap. Gillnet was also the efficient fishing gear that fisher used in all the fish habitat types within both districts. Other efficient fishing gear used across the fish habitat types such as cast net, hook, spear.

Graph 23. Month of peak catch (Kg/HH/year)/(Kg/fisher/year) across fish habitat types



Ba Phnom district of Prey Veng province, in the rain-fed- rice field habitat, the month of September and October were the peak catch of the year with estimated at 350Kg/HH/Year, 69Kg/fisher/year and 300Kg/HH/year, 59Kg/fisher/year, respectively. While the floodplain habitat the month of November and December were the peak catch of the year with estimated at 127Kg/fisher/year and 88Kg/fisher/year, respectively. Kampong Svay district of Kampong Thom province, October was the peak catch of rain-fed-rice field habitat with caught at 53Kg/fisher/year, while September was the peak catch of floodplain and reservoir habitats with estimated at 88Kg/fisher/year and 29Kg/fisher/year, respectively (Graph 23).

Graph 24. An average fish and OAA catch across fish habitat types



Ba Phnom district, in rain-fed-rice field habitat, an average fish and OAA catch was 100kg/ha/year and 50kg/ha/year, respectively, while floodplain habitat, an average fish and OAA catch was 500kg/ha/year and 200kg/ha/year, respectively. Kampong Svay district, in rain-fed-rice field habitat, an average fish and OAA catch was 50kg/ha/year and 50kg/ha/year. Floodplain habitat, an average fish and OAA catch was 180kg/ha/year and 24kg/ha/year. Reservoir habitat an average fish and OAA catch was 100kg/ha/year and 40kg/ha/year (Graph 24).

Table 18. the least month catch across fish habitat types

Province	District	Habitat and least month catch
Prey Veng	Ba Phnom	Rain-Fed-Rice-field
		Jan
		Feb
		March
		April
		May
		Floodplain
		April
		May
		June
Kampong Thom	Kampong Svay	Rain-Fed-Rice-field
		June
		Floodplain
		March
		Reservoir
		March
		April
		May

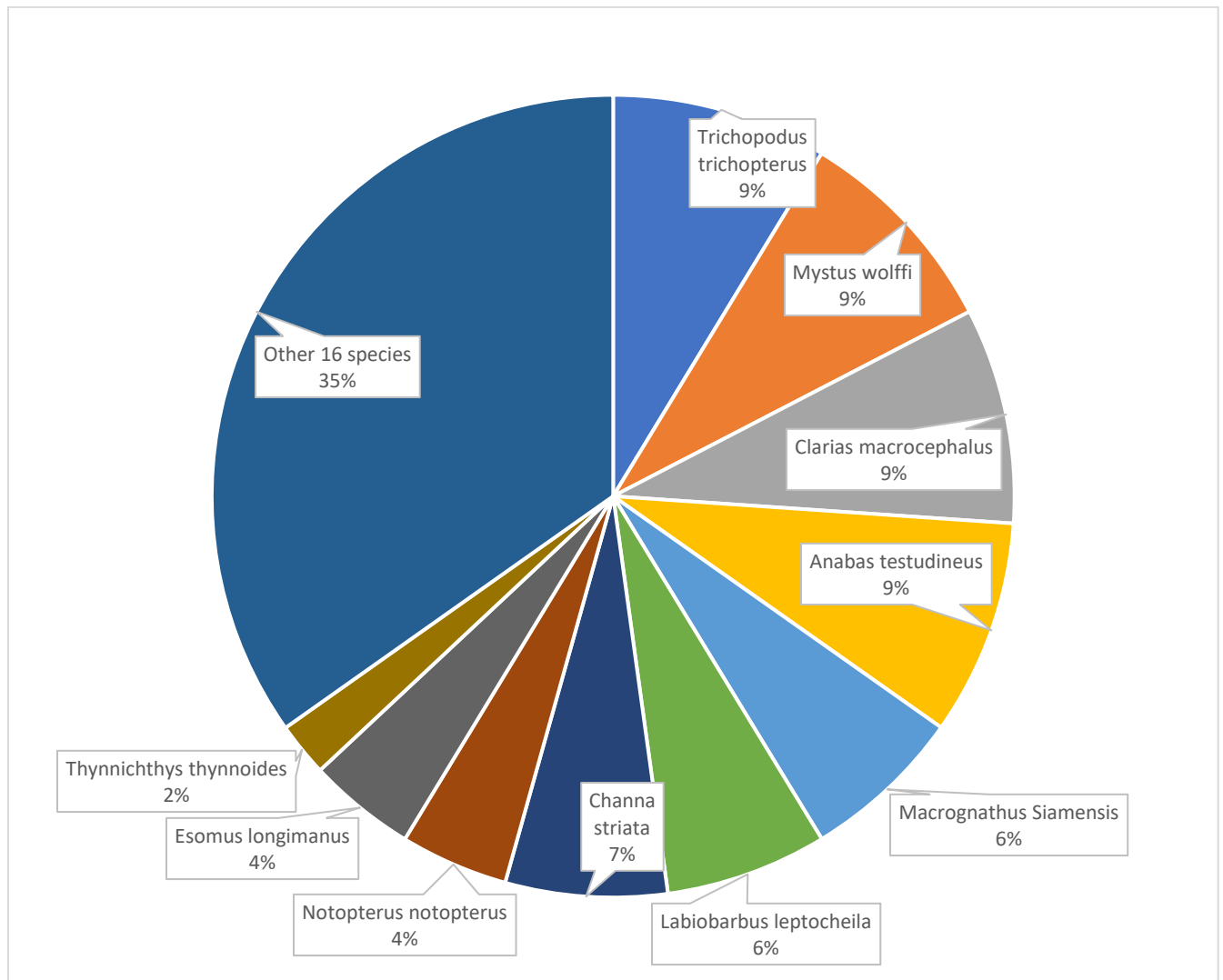
Ba Phnom district of Prey Veng province, in rain-fed-rice field habitat, the least catch of the month was from January to May of the year, in floodplain habitat, the least catch of the month was April, May and June. Kampong Svay district of Kampong Thom province, June was the least catch of rain-fed-rice field habitat, March was the least catch of floodplain habitat and March, April and May were the least catch of the reservoir habitat (Table 18).

Table 19. Full time and part time fisher

Province	District/Habitat	Full time (%)	Part time (%)
Prey Veng	Ba Phnom	20	80
	Rain-fed-rain field	0	100
	Floodplain	40	60
Kampong Thom	Kampong Svay	7	93
	Rain-fed-rain field	3	97
	Floodplain	15	85
	Reservoir	3	97
Grand Total		12.2	87.8

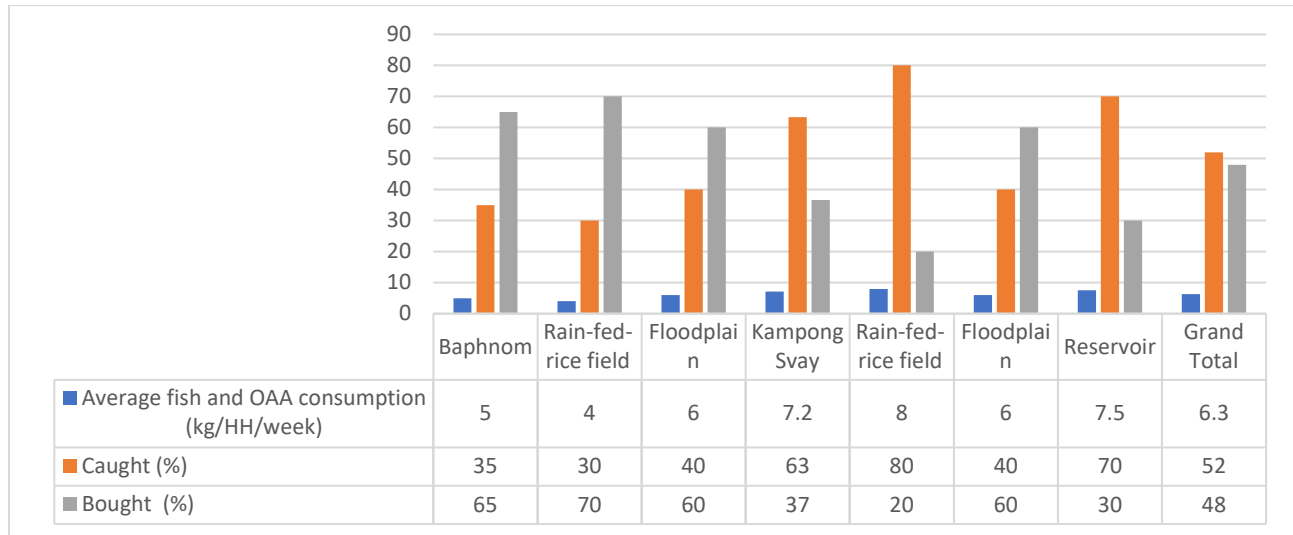
Ba Phnom district, full time fisher was 20% (part time fisher 80%), none full time fisher was in rain-fed-rice field habitat, while there was up to 40% full time fisher (part time fisher 60%) in the floodplain habitat. Kampong Svay the full time fisher was only 7% (part time 93%), while there were a few full time fishers across all fish habitats with 3% (part time 93%), 15% (part time 85%) and 3% (part time 97%) of rain-fed-rice field, floodplain and reservoir habitats, respectively.

Graph 24. Top 10 commonly caught fish species



The result of group discussion, there were 26 commonly caught fish species. The top 10 commonly caught fish species namely: 1. *Trichopodus trichopterus*, 2. *Mystus wolffi*, 3. *Clarias macrocephalus*, 4. *Anabas testudineus*, 5. *Macrogathus Siamensis*, 6. *Labiobarbus leptocheila*, 7. *Channa striata*, 8. *Notopterus notopterus*, 9. *Esomus longimanus*, and 10. *Thynnichthys thynnoides* (Graph 24).

Graph 25. Fish and OAA consumption (Kg/HH/week)



Total average fish and OAA consumption per HH per week was 6.3Kg/HH/week with contribution from their owned caught around more than half (52%) and bought from local market was 48%. Rain-fed-rice field and reservoir habitats of Kampong Svay district of Kampong Thom province were the most consumed at 8Kg/HH/week and 7.5 Kg/HH/week, respectively (Graph 25).

Table 20. Commonly caught Fish and OAA species and farm price across fish habitat types

Province	District	Habitats and fish Species	Price (\$/Kg)
Prey Veng	Ba Phnom	Rain-fed-rice-field	
		Anabas testudineus	3
		Clarias macrocephalus	3
		Macrogathus Siamensis	3
		Trichopodus trichopterus	3
		Channa striata	3
		Esomus longimanus	3
		Monopterus albus	3
		Enhydra enhydra	3
		Frog	3
		Floodplain	
		Cirrhinus lobatus	0.75
		Barbonymus gonionotus	2
		Cyclocheilichthys lagleri	0.75
		Kryptopterus micronemus	5
		Labiobarbus leptocheila	1
		Mystus wolffi	0.75

		Notopterus notopterus	0.75
		Oreochromis niloticus	1
		Osteocheilus hasseltii	1
		Puntioplites proetozyron	2
Kampong Thom	Kampong Svay	Rain-fed-rice-field	
		Anabas testudineus	2
		Clarias macrocephalus	2.25
		Hampala barp	2.5
		Hemibagrus filamentus	3.75
		Mystus wolffi	1.75
		Notopterus notopterus	1.2
		Ompok bimaculatus	5
		Pristolepis fasciata	2
		Trichopodus trichopterus	0.75
		Esomus longimanus	0.5
		Floodplain	
		Anabas testudineus	2
		Cirrhinus lobatus	1
		Clarias macrocephalus	1.2
		Labiobarbus leptocheila	1
		Macrognathus Siamensis	4.25
		Mystus wolffi	1
		Puntius rhombeus	1
		Thynnichthys thynnoides	1
		Trichopodus trichopterus	1
		Channa striata	1.2
		Reservior	
		Anabas testudineus	0.75
		Clarias macrocephalus	1.62
		Hypsibarbus peirrei	2.5
		Labiobarbus leptocheila	2.5
		Macrognathus Siamensis	3
		Mystus wolffi	1.5
		Trichopodus trichopterus	0.75
		Channa striata	1.62
Min (0.5Kg)	Average(1.97Kg)	Max (5\$/Kg)	

Within both districts of Prey Veng and Kampong Thom provinces, the farm market price of the commonly caught fish and OAA species ranged from 0.5\$/kg-5\$/kg, minimum price (0.5\$/kg), an average price (1.97\$/kg) and maximum price (5\$/kg), the price based on fish species caught.

5. Key Summary Results and Recommendations

2022 fisheries yield assessment at landscape scale in the LMB in Cambodia was conducted in Ba Phnom District of Prey Veng Provinces and Kampong Svay District of Kampong Thom provinces. The data collection was conducted from May to June 2022.

The overall objective is to conduct the field survey assessment to update the estimates of fisheries yield by major habitat types in Cambodia by conducting ground-truth data collection.

To achieve this overall objective, the three specific objectives of the field surveys are set as follows:

- To collect and update information regarding fishing gears, fish/OAAs catch estimates by habitat types, main species caught and consumption, and market prices of fish/OAAs from the major types of fish habitat in Cambodia.
- To provide demographic and occupation information of community fishery at district levels adjacent to major habitat types.
- To provide local perspectives about Import - Export - Aquaculture - Animal feeds related to capture fisheries in Cambodia.

The total sampled 180 fisher/HH were randomly selected within two districts of Kampong Thom and Prey Veng provinces. 90 fisher/HH was selected from each district. Of 90 fisher/HH selected within Kampong Svay district of Kampong Thom province (30 fisher/HH from rain-fed-rice field habitat, 30 fisher/HH from floodplain habitat and 30 fisher/HH from reservoir habitat) and of 90 fisher/HH selected within Ba Phnom district of Prey Veng province (45 fisher/HH from rain-fed-rice field habitat and 45 fisher/HH from floodplain habitat).

1) The household/fisher surveys based on structured interviews (**Toolbox 1**) to collect data on household/fisher's fishing gears, fish/OAAs catch estimates by season and by habitat types, main species caught and consumption, and market prices of fish from the major types of fish habitats in the LMB.

(2) A questionnaire for fisheries management officers from national and provincials were based on semi-structure interviews (**Toolbox 2**) to provide information on local perspectives about Import - Export - Aquaculture - Animal feeds related to capture fisheries in Cambodia. A list of documents/information being collected and collated at provincial level is outlined in **Toolbox 5**.

(3) A focus group discussion was organized at selected villages of the same selected districts to validate the data and information collected from the household/fisher surveys and reflect on different perspectives that would not be recorded during the household/fisher interviews.

Each focus group discussion will include 6-10 people balancing men and women. Open ended questions used for group discussion with local/fisher communities are provided in **Toolbox 3**. Participants for the group discussion are those who did not take part in the HH/fisher's interview. Gender balance should be considered when conducting the group discussion.

(4) Excel spreadsheet using for data entry based on the above 3 surveys/interviews was provided in **Toolbox 4**.

(5) A template for synthesis report is provided in **Toolbox 5**.

The result of household survey showed that total sampled HH/fishers were 180, male (78%) and female (22%) with an average age of the sampled fisher was 45.2 years old and min and max age were 15 and 74 years old, respectively. An average HH member was 5.1 persons per household.

In 2015 full time fisher was 39% (part time 61%) of which 40% in Ba Phnom district and nearly 39% in Kampong Thom district, compared to year 2020 the full-time fisher decreased to 32% (part time fisher increased to nearly 68%) of which 35.6% in Ba Phnom district and nearly 29% in Kampong Thom district.

The sampled fishers owned multi different fishing gears: all fisher (100%) owned first fishing gears, more than three-fourths (75.6%) owned 2 second fishing gears and only 35.6% owned third fishing gears.

For the primary fishing gear used, more than half (53%) of sampled fishers went fishing in wet season, only 9% went fishing in dry season and 38% went fishing in both seasons.

For the secondary fishing gear used, 136 fishers owned the secondary fishing gears, 89 fishers went fishing in wet season, only 14 fishers went fishing in dry season and 33 fishers went fishing in both seasons.

For the tertiary fishing gear used, only 64 fishers owned the tertiary fishing gears of which 44 fishers went fishing in wet season, very few fishers (9) went fishing in dry season and only 11 fishers went fishing in both seasons.

The sampled fishers went to fishing with minimum, an average and maximum distances from their house were 0.1km, 4.7km and 50km, respectively.

In Ba Phnom district, the sampled fisher owned/used two fishing gears more than 40%, followed by fisher used three fishing gears more than 30%. In Kampong Svay district, in the rain-fed rice field and floodplain habitats fisher owned three different fishing gears were 60% and 50%, respectively, in reservoir habitat fisher owned two fishing gears are highest (47%), While fisher owned/used one fishing gear seemed to be low within the two districts and across all fishing habitats.

In Kampong Svay district, survey found that the highest fish and OAA catch in floodplain habitat was about 59,48Kg/year and 5,631Kg/year, respectively with total catch (fish OAA) was 65,115Kg/year. While in Ba Phnom district, floodplain habitat was also the highest fish and OAA catch were around 56,842Kg/year and 7,369Kg/year, respectively, followed by reservoir habitat which fish and OAA catch was about 34,797Kg/year and 7,000Kg/year, respectively.

Floodplain habitat was the most catch within both districts of Kampong Svay and Ba Phnom of which the month of September was the peak catch with an average monthly catch was around 300Kg/HH/month and 145Kg/HH/month, respectively. All habitat types within both districts, the catch started to increase from July to September and decrease from October to February. The least month catch was in April, March and May with an average monthly catch was 34, 39 and 45Kg/HH/month, respectively,

An average monthly fish catches of different fishing gears used across fish habitats by fisher within both districts of Kampong Thom and Prey Veng provinces. The results showed that the catch started to increase from August to October and started to decrease from November to December of the year. The peak catch was the month of October of the year, the least catch was the month of March and April of the year.

Top 10 fishing gears used by sampled fishers and fish biomass namely: 1. Stationary gillnet (86,682Kg/HH/year), 2. Fyke Net Made of Mosquito net (11,857Kg/HH/year), 3. Encircling Science net (11,108.5 Kg/HH/year), 4. Arrow-sharped bamboo fence trap with horizontal cylinder trap (10,300Kg/HH/year), 5. Hood and line (9,040Kg/HH/year), 6. Hundred tread trap (7,682Kg/HH/Year), 8.

Seine net with footrope (4,115Kg/H/year), 10. Hook long line (4,065.7Kg/HH/year) and 11. Other 12 fishing gears (14,429.Kg/HH/year).

Sampled fishers used 22 different fishing gear types, half of fisher (50%), they used stationary gillnet with fish catch estimated at 86,682 Kg/HH/year.

All habitat types in Kampong Svay district the OAA catch start to increase from June to September and decrease from October to December and the least OAA catch were in January, February, March, April and May, except reservoir habitat the OAA catch increased from January to May with catch estimated at 12.5Kg/HH/month, 22Kg/HH/month, 22.1Kg/HH/month and 12.3Kg/HH/month, respectively. In Ba Phnom district, the floodplain habitat was the most OAA catch which started to rise from May to November and the least OAA catch was January, February, March, and April with catch estimated at 4.6Kg/HH/month, 4.6Kg/HH/month, 2.7Kg/HH/month, and 3.4Kg/HH/month, respectively.

An average monthly OAA catch of different fishing gears used across fish habitats by fisher within both districts of Kampong Thom and Prey Veng provinces. The results showed that the catch started to increase from June to September and started to decrease from October to December of the year. The peak catch was the month of September of the year, the least catch was the month of January to May of the year.

Top 10 fishing gears used by sampled fishers and fish biomass namely: 1. Stationary gillnet (7,162.1Kg/HH/year), 2. Catching OAA by using hand (3,758Kg/HH/Year) 3. Hundred tread trap (2,759Kg/HH/year), 4. Cast net (2,161Kg/HH/year) 5. Horizontal cylinder trap for rice fields (1,930Kg/HH/year) 6. Hook long line (1,759.1Kg/HH/year), 7. multi-pronged barbed spear (1,310Kg/HH/year), 8. Arrow-sharped bamboo fence trap with horizontal cylinder trap (1,292Kg/HH/year), 9. Hook and line (817Kg/HH/year), 10. Seine Net With Footrope Bags (712Kg/HH/year), and 11. Other 9 fishing gears used (1,442.8Kg/HH/year)

Sampled fishers used 19 different fishing gear types for OAA, stationary gillnet was the highest catch with estimated at 7,161.7 Kg/HH/year, followed by catching OAA by using hand (3,758Kg/HH/year), third catch was hundred tread trap (2,759Kg/HH/Year) and the lowest catch was wedge-shaped scoop basket (39Kg/HH/Year).

In last 10 year, the capture fish continued to decline from 562,886Kg/habitat/year in 2010 to 371,171Kg/habitat/year in 2015 and only 151,219Kg/habitat/year in 2019/2020. While OAA has been also continued to decline from 47,022Kg/habitat/year in 2010 to 36,505Kg/habitat/Year in 2015 and to 26,568Kg/habitat/year in 2019/2020,

In last 10 year, the capture fish has continued to decline from 3,127Kg/HH/year in 2010 to 2,062Kg/HH/year in 2015 and only 840Kg/HH/year in 2019/2020. While OAA has also continued to decline from 261Kg/HH/year in 2010 to 202Kg/HH/Year in 2015 and to 147.6Kg/HH/year in 2019/2020,

The total average consumption was 58kg/fisher/year which shared from fish (42kg) and OAA (16kg) with contributing from fish 73% and OAA 27%. Across the fishing habitat types, the average fish consumption ranging between 35Kg/fisher/year to 55Kg/fisher/year. The reservoir habitat was the highest fish consumed at more than 55Kg/fisher/year and the rain-fed rice field habitat was the lowest consumed at around 35Kg/fisher/year. All fishing habitat types, the OAA consumption ranging between 13Kg/fisher/year to around 18Kg/fisher/yea. Rain-fed rice field in both districts were the highest OAA consumed was higher than 17Kg/fisher/year and the lowest consumed was around 13Kg/fisher/year.

The result of fishery management officer at national and target provinces, the data/information we got such as: fresh inland fish production at national and target provinces; export fresh inland fish and import fish and fishery products at national and target provinces; production of dried fish, smoked fish, fermented fish (Pha ok), fermented fish (Mam), fish paste, and sun-dried fish at national and target provinces; production of salted fish, dried shrimp and fish ball at national and target provinces; total fish processed and total export fish processed at national and target provinces; information on aquaculture in year 2010, 2015 and 2020 at national and target provinces; full time fisher HH and gender (male and female) at national and target provinces; part time HH fishers and gender (male and female) at national and target provinces; HH fish processor and number of fish processor of fishery products at national and target provinces; and HH aquaculturist and number of aquaculturist by national and target provinces

The result of Focus Group Discussion, five Focus Group Discussion (FGD) were conducted for each habitat types to validate the result from the household survey and reflect on fisher perspective with total participation was 41 people.

Gillnet was the popular fishing gear that fisher used in all the fish habitat types within both districts. The other popular fishing gears used across fish habitat types such as cash net, hook, spear, trap. Gillnet was also the efficient fishing gear that fisher used in all the fish habitat types within both districts. Other efficient fishing gear used across the fish habitat types such as cast net, hook, spear.

Ba Phnom district of Prey Veng province, in the rain-fed- rice field habitat, the month of September and October were the peak catch of the year with estimated at 350Kg/HH/Year, 69Kg/fisher/year and 300Kg/HH/year, 59Kg/fisher/year, respectively. While the floodplain habitat, the month of November and December were the peak catch of the year with estimated at 127Kg/fisher/year and 88Kg/fisher/year, respectively. Kampong Svay district of Kampong Thom province, October was the peak catch of rain-fed-rice field habitat with caught at 53Kg/fisher/year, while September was the peak catch of floodplain and reservoir habitats with estimated at 88Kg/fisher/year and 29Kg/fisher/year, respectively.

Ba Phnom district, in rain-fed-rice field habitat, an average fish and OAA catch was 100kg/ha/year and 50kg/ha/year, respectively, while floodplain habitat, an average fish and OAA catch was 500kg/ha/year and 200kg/ha/year, respectively. Kampong Svay district, in rain-fed-rice field habitat, an average fish and OAA catch was 50kg/ha/year and 50kg/ha/year. Floodplain habitat, an average fish and OAA catch was 180kg/ha/year and 24kg/ha/year. Reservoir habitat an average fish and OAA catch was 100kg/ha/year and 40kg/ha/year.

Ba Phnom district of Prey Veng province, in rain-fed-rice field habitat, the least catch of the month was from January to May of the year, in floodplain habitat, the least catch of the month was April, May and June. Kampong Svay district of Kampong Thom province, June was the least catch of rain-fed-rice field habitat, March was the least catch of floodplain habitat and March, April and May were the least catch of the reservoir habitat.

Ba Phnom district, full time fisher was 20% (part time fisher 80%), none full time fisher was in rain-fed-rice field habitat, while there was up to 40% full time fisher (part time fisher 60%) in the floodplain habitat. Kampong Svay, the full-time fisher was only 7% (part time 93%), while there were a few full time fishers across all fish habitats with 3% (part time 93%), 15% (part time 85%) and 3% (part time 97%) of rain-fed-rice field, floodplain and reservoir habitats, respectively.

There were 26 commonly caught fish species. The top 10 commonly caught fish species namely: 1. *Trichopodus trichopterus*, 2. *Mystus wolffi*, 3. *Clarias macrocephalus*, 4. *Anabas testudineus*, 5. *Macrognathus Siamensis*, 6. *Labiobarbus leptocheila*, 7. *Channa striata*, 8. *Notopterus notopterus*, 9. *Esomus longimanus*, and 10. *Thynnichthys thynnoides*.

Total average fish and OAA consumption per HH per week was 6.3Kg/HH/week with contribution from their owned caught around more than half (52%) and bought from local market was 48%. Rian-fed-rice field and reservoir habitats of Kamponhg Svay district of Kampong Thom province were the most consumed at 8Kg/HH/week and 7.5 Kg/HH/week, respectively.

Within both districts of Prey Veng and Kampong Thom provinces, the farm market price of the commonly caught fish and OAA species ranged from 0.5\$/kg-5\$/kg, minimum price (0.5\$/kg), an average price (1.97\$/kg) and maximum price (5\$/kg), the price based on fish species caught.

Recommendations

The findings from this survey demonstrate the importance of landscape scale fisheries assessment by different habitat types for estimation fisheries yields at different habitat types and to assess the condition of fisheries in Cambodia and the LMB landscape. These benefits have implications for both national and regional policy and decision-making for informing and developing the national and regional strategy, policy, and planning, as well as improving national and sub-national systems of fisheries management. Recommendations can be drawn as following:

- Estimation of yield per unit area (kg/ha/year) should be further study. MRC should provide method/technical guidance.
- Fish and OAA consumption should be qualified by species, by processed products, OAAs by species and edible and non-edible part
- Protein consumption and other nutrient consumption should be considered
- Recall survey/interview by questionnaire which information from the respondents are highly depended on their memory. It should be used logbook approach to compare the catch between recall survey and logbook
- The fisheries monitoring programme should be conducted with the same sampling sites every five years in order to detect trends in fish catches as well as fish catch by habitat. This study is on the right direction with the beginning of baseline assessment which are essential to understand changes in key fisheries yield indicators and species diversity by habitats.
- The study is also a crucial important for building the capacity not only researchers of fisheries officers but also for local communities/fishers who voluntarily participates in the data collection activities. It is expected that such implementation the fisheries monitoring activity becomes sustainable.
- More training with support from MRC should be convened to let all data collectors be able to identify question and database on their own. Fish yield is the angle of this study. It is also acknowledged that the governance of access to and the use of the fisheries resources is of equal importance which should be critically studied; particularly, the establishment of community fisheries, institutional arrangements and legal framework should be take into consideration for further studies.

Lesion Learnt from the survey

- In some case, it is difficult to find fisher has wiliness to interview
- Difficulty to define the full time and part time fisher
- Difficulty in asking fisher for fish and OAA consumption and protein consumption from fish and OAAs and meet
- Fisher memory to recall in the long past catches and the long past consumption
- Participating fisher look not happy with long questionnaires
- Some difficulty with local authorities and fishermen to participate with the assessment activities due to didn't have incentive or souvenirs for them.
- They tend to underestimate their average catches because they do not take into account the large effect of seasonal peaks

References

- Ahmed M., Navy., Vuthy L., Tiongco M. 1998 Social-economic assessment of freshwater capture fisheries in Cambodia: Report on Household Survey. Mekong River Commission, Phnom Penh, Cambodia. 186 pp.
- DOS (2009). The Households of Lao PDR. Social and Economic Indicators. LECS4. Department of Statistics, Ministry of Planning and Investment, Vientiane, Lao PDR, 80 pages.
- FiA 2015.Fisheries Statistics. Fisheries Administration, Phnom Penh.
- FiA 2016.Fisheries Statistics. Fisheries Administration, Phnom Penh.
- FiA 2017.Fisheries Statistics. Fisheries Administration, Phnom Penh.
- FiA 2018.Fisheries Statistics. Fisheries Administration, Phnom Penh.
- FiA 2019.Fisheries Statistics. Fisheries Administration, Phnom Penh.
- FiA 2020.Fisheries Statistics. Fisheries Administration, Phnom Penh.
- FiA 2021.Fisheries Statistics. Fisheries Administration, Phnom Penh.
- IFREDI (2012). Food and nutrition security vulnerability to mainstream hydropower dam development in Cambodia. Synthesis report of the FiA/Danida/WWF/Oxfam project “Food and nutrition security vulnerability to mainstream hydropower dam development in Cambodia”. Inland Fisheries Research and Development Institute, Administration, Phnom Penh.
- HORTLE, K.G. (2007). Consumption and the yield of fish and other aquatic animals from the Lower Mekong Basin. MRC Technical Paper No. 16, Mekong River Commission, Vientiane. 87 pp.
- NIS. (2019). General Population Census of the Kingdom of Cambodia 2019. National Institute of Statistics. Ministry of Planning. Kingdom of Cambodia. Retrieved from http://www.nis.gov.kh/nis/Census2019/Provisional%20Population%20Census%202019_English_FINAL.pdf
- Touch Bunthang, Chheng Phen, So Nam, Wilma Hurdatta, 2011, Baseline Assessment of Diet and Nutrition in Cambodia, Inland Fisheries Research and Development Institute (IFReDI), Fisheries Administration. 122 pp.
- Touch Bunthang, So Nam, Chheng Phen, Pos Chhantana, En Net, and Robert Pomeroy, 2015, Food and Nutritional Consumption Survey: Women and Preschool-Age Children in Cambodia.

Appendix

Toolbox 1: Questionnaire for Households/fishers at key major habitats in the Lower Mekong Basin

Instruction for interviewer.

A clean version of questionnaire for the survey is provided separately.

1. Household and interview details

Table 1: Information of respondents (should interview person who oversees fishing activities). Example of filling information below:

Name	Age	Gender ¹	No # family member ²	Occupation ³		Address (Village, District/Province)/phone number
				Last 5 years	Last 12 months ⁴	
Nguyen Van A	45	M	4	Full time	Part time	Chau Thanh - An Giang VN - 0918425999

Purpose: the most important information from this table is the occupation, which later help understanding the family fishing activities and catches. The change of occupation from the last 5 years also elucidates some social aspects related to the catches and values. For example, in Mekong delta, there are not many fulltime fishers now since the catches have declined and the economic incentives from the fishing are much lower than other opportunities such as aquaculture or services, etc.

Instruction for interview and fill in questionnaire:

- ¹Gender: **M:** Male; **F:** Female
- ²No # family members: Number of family members who physically live in the house for last 12 month.
- ³Occupation: **Full time:** Goes fishing or collecting OAAS most days; usually some of the catch is sold; **Part time or Occasional:** Goes fishing or collecting OAAS – typically a few hours or < 1 day per week or occasionally, a few times per year. Most or all of the catch is for household consumption.
- ⁴Last 12 months: Could ask the HH's occupation in 2019 since the information in 2020 and 2021 could be biased due to COVID 19 pandemic.

2. Fishing gears

Table 2. Fishing gears, habitats, relative efforts and catches per year. Example of filling information below

Most frequent used gear ¹	Gear name ²	Habitat ³	Distance from HH (km) ⁴	Season ⁵	% Fishing days ⁶	% Catches ⁷
First	Trawl	H1	1	B	70%	80%
Second	Gill net	H1	3	W	30%	20%

Third						
Fourth						
Total					100%	100%

Purpose: To provide information on gear efficiency and likely habitat boundary where HHs fish and likely most productive habitats. Fishers intend to utilize most efficient gear and go to where they could get most fish. Therefore, the information in this table will help identifying likely habitat boundary where HHs fish and understanding and justifying which habitat is likely most productive.

Instruction:

- ¹Most frequent used gear: order of most frequent used gear, from most often (First) to less often (Second, Third, Fourth).
- ²Gear name: Refer to common gear types in the LMB in **Annex 2**. If some gear is special, please describe or take photo and please take photos of some gears used in the field if possible.
- ³Habitat: where the gear is used. Either use codes or habitat names below for input into questionnaires
H1: Rain-fed rice-fields and associated habitats
H2: Floodplain-large River
H3: Reservoir and permanent waterbodies
H4: Brackish - estuarine
- ⁴Distance from HH (km): Distance from home to fishing locations/grounds.
- ⁵Season: when the gear is used. Either use codes or names below for input into questionnaires
D: Dry season (from December to May)
W: Wet season (from June to November)
B: Both seasons
- ⁶Percent of fishing days: number of days using each kind of gear divide by total fishing days in a year. Interviewer should double check to make sure the total of Percent of fishing days by gear types is **100%**.
- ⁷Percent of catches: weight of catches using each kind of gear divides by total catches in a year. Interviewer should double check to make sure the total of Percent of catches by gear types is **100%**.

3. Fish catch estimated by the Households

Table 3. Estimated fishing effort and **fish catches** from each habitat by the HHs over the last 12 months

Most frequent visiting habitat ¹	Habitat ²	Parameter	Month												Total (kg/year)
			1	2	3	4	5	6	7	8	9	10	11	12	
First	H1	Fishing days/month ³													

		Catches (kg/day) ⁴																	
		Catches (kg/month) ⁵																	
Second	H2	Fishing days/month																	
		Catches (kg/day)																	
		Catches (kg/month)																	
Third	H3	Fishing days/month																	
		Catches (kg/day)																	
		Catches (kg/month)																	

Purpose: The information in this table will provide an estimation of possible total catch per HH/fisher/year in each habitat type by averaging catches per HH. Multiply this figure with total number of fishers then divide by areas (hectare) of habitat will provide likely a catch/yield per ha per year. Please double check with habitat information in the table 2 to make sure the habitat information is consistent.

Instruction:

- ¹Most frequent visiting habitat: order of most frequent visiting habitat, from most often (First) to less often (Second, Third, Fourth).
- ²Habitat: where to go fishing. Either use codes or habitat names below for input into questionnaires
H1: Rain-fed rice-fields and associated habitats
H2: Floodplain-large River
H3: Reservoir and permanent waterbodies
H4: Brackish - estuarine
- ³Fishing days/month: interviewer could ask the HH's fishing information in 2019 since the information in 2020 and 2021 could be biased due to COVID. Encourage HH/Fisher to remember the numbers of fishing day each month. All MCs should use sun calendar.
- ⁴Catches (kg/day): Estimate in average kg of fish caught a day each month. Interviewer should take note and convert local measuring unit into the standard unit **kg**.
- ⁵Catches (kg/month): Multiply fishing days by average daily catch to get monthly catch. If cannot remember catch per day, fill catch per month instead.

Table 4. Estimated fishing effort and **OAA's catches** from each habitat by the HHs over the last 12 months

Most frequent visiting habitat ¹	Habitat ²	Parameter	Month												Total (kg/year)
			1	2	3	4	5	6	7	8	9	10	11	12	
First	H1	Fishing days/month ³													
		Catches (kg/day) ⁴													

		Catches (kg/month) ⁵																	
Second	H2	Fishing days/month																	
		Catches (kg/day)																	
		Catches (kg/month)																	
Third	H3	Fishing days/month																	
		Catches (kg/day)																	
		Catches (kg/month)																	

Instruction: Same as fish catches in table 3.

Table 5. Change of catches for last 10 years. Example of filling information below

Parameter	2010	2015	2019	Note
Catch of fish per year (kg)	1000	900	1500	
Catch of OAAs per year (kg)	500	700	800	

Purpose: To understand the trend of fish catches in the area so that to justify the catches this survey with the previous survey. Please discuss with HHs for their options why the trend goes up or down. For example, trend goes down may be because of water quality, less fish, or trend goes up may be because of less fishers fishing in the area, etc.

Instruction: Interviewer should ask the HHs/Fishers to remember the total catches of the household in each year. The year could be relaxed to 1 year before or after 2010, 2015, 2019 but please note that information.

4. Main species caught and prices

Table 6. Species caught, sold and market data last 12 months

Parameters	Key species ¹	Total yearly caught (kg/year)	Total yearly sold (kg/year)	Most likely price (USD/kg)	
				Fisher price	Market price
Fish (total)					
1. Small-sized fish/individuals (<25 cm)					
2. Medium-sized fish (25-50 cm)					
3. Large-sized fish (> 50 cm)					

Crustaceans (total)				
1. Shrimps				
2. Crabs				
Molluscs (total)				
1. Clams				
2. Snails				
Amphibians and Reptiles (total)				
1. Frogs				
2. Turtles				
3. Water snakes				

Purpose: To get ideas of proportion of catch, sold and consumption and value of different fish species and OAAs. The information from this could help roughly estimate the economic values of fisheries in LMB. The consumption data (Consumption = Total caught - Total Sold) is from the HHs catches, other consumption is further discussion in table 7.

Instruction:

- ¹Key species name: please refer to the list of common species in the LMB in **Annex 3**.

Table 7: Consumption of inland fish products, and other aquatic animals

Average quantity (kg/HHs/week) consummned1	Per cent from different sources2				
	Captured Fish/OAAs		Aquaculture	Meat	Others
	Caught by the HH	Bought by the HH			

Purpose: This table is to provide information on HH consumption from different kinds of animal protein sources. This table should help estimating roughly the consumption of fish/OAAs (kg/HH/Week). Multiply the quantity of animal protein consumption per week by 52 weeks to have kg fish/OAAs/HH per year. Interviewer should discuss with HHs to make sure the consumption fish/OAAs (kg/HH/year) make logical sense. This figure could be double checked later with national consumption survey data, which survey team should collect from country national statistical office. The whole study bases on the assumption that

total inland capture fisheries were consumed in the LMB, so that the information from this table could be used to justify the yield of fish in the LMB.

Instruction:

- ¹Estimate roughly how many kg of fish and OOAs the family consume a week.
- ²Estimate percentage of the animal protein consumption a week from different sources.

Toolbox 2: Questionnaire for fisheries management officers at selected provinces for the HHs interviews in the Lower Mekong Basin

Instruction for interviewer.

A clean version of questionnaire for the survey is provided separately.

1. Officer information

Table 1: Information of respondents. Example of filling information below:

Name	Age	Gender	Official position	Department	Province
Nguyen Van B	45	M	Aquaculture extension	Department of Aquaculture and Rural Development	An Giang Province

2. Usage - Import - Export - Aquaculture

Table 2: Information of Usage of captured inland fish and OAAs in each MC in the LMB. Example of filling information below:

Fisheries products ¹	Usage of captured inland fish and OAAs from within country ²						Import quantity and country of origin	
	Quantity (tons) ³	Human consumption %	Aquaculture feeds %	Animal feeds %	Others %	Export %	Import (tons) ⁴	Country ⁵
Fresh fish (whole weight)	4500	70	10	20		10	50	Cambodia
Fresh trash fish (whole weight)	4000	0	70	30	10		45	Cambodia

Fresh OAAS (whole weight)	500	50	40	10				
Preserved fish								
Fish paste	100	100	0	0	0			
Fish sauce								
Other Fermented fish								
Dried/salted fish								
Smoked fish								
Total								

Instruction: Inland fisheries yields (i.e., all fish and OAAs caught and collected in LMB waters within each country) can be calculated as follows:

$$\text{Yield} = C + A + F + W + E - I$$

Where:

C = consumption by people

A = aquaculture feeds (inland fish and OAAs used to feed aquaculture fish)

F = animal feeds (inland fish and OAAs used to feed poultry and livestock)

W = wastage (losses of fish post-harvest and subsequently in the supply chain to domestic consumers)

E = exports (inland fish and OAAs exported from the LMB)

I = imports (inland fish and OAAs imported to the LMB).

¹Products: List all products including fresh and processed fisheries products

²Usage: Percent (%) of using the fisheries products, from within country sources, for each purpose

³Quantity (ton): This information could get from economic statistical office and explain in % of usage for each purpose including human consumption, aquaculture feeds, animal feed, export, etc.

⁴Import: how many tons of each product is imported.

⁵Country: where are the products imported from.

Table 3: Information of **aquaculture**.

Species	2010		2015		2019/2020		Remark
	Production (tons)	Total area (ha)	Production (tons)	Total area (ha)	Production (tons)	Total area (ha)	

Purpose: Many areas in the floodplain and rain feed rice field are converted into aquaculture ponds. The information from this table will help remove these areas and production out of the capture fisheries estimation, i.e., actual area of habitats used by wild fish and actual captured fisheries production.

3. Other information related to import and export of inland fisheries and OAAs

4. List of information needs to be collected

- Overall information about population, occupation and economic activities related to fisheries and aquaculture in all provinces within LMB boundary in Cambodia.
- Geographical data and information of survey sites (Province and district surveyed).
- Detail demographic and occupation at survey sites (Province and district surveyed).
- Other economic activities related to aquaculture and capture fisheries
- The importance of capture fisheries, fish products to food security, livelihood and economics.
- Information from the national expenditure and consumption survey.

Toolbox 3: Open ended questions use for group discussion with HHs/Fishers.

Instruction for interviewer.

A clean version of questionnaire for the survey is provided separately.

Instruction: The purpose of group discussion is to validate the result from the household survey and reflect on different perspectives that would not be recorded during household/fisher interviews. So basically, the groups will be asked the same questions as in Toolbox 1 and 2. Questions below are just general guideline. Interviewers are encouraged to come up with any questions to deepen our understand about fish and fisheries in the area.

1. Fishing gear

1.1. What is the most popular fishing gear used in your areas in dry or wet seasons and in different habitat types?

1.2. What is the most efficient fishing gear (catch most fish) used in your areas in dry or wet seasons and in different habitat types?

2. Fish catch estimates in last 12 months (could use 2019 if in 2020 and 2021 the fishing were interrupted by COVID-19).

2.1. What is catches range (**kg/month and kg/year**) of **fish** that a HH could get? Which months catch most/least fish? in which habitats (H1, H2, H3 or H4)?

2.2. What is likely yield (**kg/month/ha and kg/year/ha**) of **fish** in each habitats (H1, H2, H3 or H4)?

2.3. What is catch range (kg/month and kg/year) of **OAA**s that a HH could get? Which months catch most/least OAAs? in which habitats (H1, H2, H3 or H4)?

2.4. What is likely yield (**kg/month/ha and kg/year/ha**) of **OAA**s in each habitats (H1, H2, H3 or H4)?

3. How many HHs in your village are full time fishers (>70% income from capture fishery) and part time fishers?

4. Main species caught and market data for last 12 months

Fish species name	Small-sized fish/individuals (<25 cm) - Likely catch (kg/HH/year)	Likely fisher Price (USD/kg)	Medium-sized fish (25-50 cm) Likely catch (kg/HH/year)	Likely fisher Price (USD/kg)	Large-sized fish (> 50 cm) Likely catch (kg/HH/year)	Likely fisher Price (USD/kg)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						

10.						
-----	--	--	--	--	--	--

Instruction:

¹Key species name: please refer to the list of common species in the LMB in **Annex 3**.

5. Consumption of inland fish products, and other animal proteins

Average quantity of fish and OAAs consumed ¹ (kg/HH/week)	Per cent from different sources ²				
	Captured Fish/OAAs		Aquaculture	Meat	Others
	Caught by the HH	Bought by the HH			

Instruction:

- ¹Estimate roughly how many kg of fish and OAAs the family consume a week.
- ²Estimate percentage of the consumption of fish and OAAs a week from different sources.

6. Do villages export fresh fish and OAAs to other countries? Discuss more with villagers about this information?

7. Are there any fishing regulations applied in your fishing grounds? Describe about the fishing regulation.

8. How often do you encounter law enforcement for fishing regulation? How do they operate?

Toolbox 4: Database

Instruction for interviewer and for data entry.

A clean version of questionnaire for the survey is provided separately.

The link below is to database and data entry. See instruction in column head when entering your data.

https://mrcsmekong-my.sharepoint.com/:x/g/personal/quan_mrcmekong_org/Een-KbOKbiFIhKZHNuxiYnABIRgWsG8LQ8_onSI_0aPV1A?e=M9UtEA

Toolbox 5: Report template**1. Introduction**

1.1. The province under LMB boundary within the country

1.2. The survey sites

Please provide

- Geographical data and information of survey sites (Province and district surveyed).
- Detail demographic and occupation at survey sites (Province and district surveyed).

Example of desired table for demographic and occupation below

Survey sites	Population	Male	Female	# of HHs	Occupation (HHs)			
					Full time fisher	Part time fisher	Aquaculture	Others
District A								
District B								
....								

- Other economic activities related to aquaculture and capture fisheries
- The importance of capture fisheries, fish products to food security, livelihood and economics.
- Information from the national expenditure and consumption survey.

Example of desired information from the national expenditure and consumption survey below

	Consumption					Total inland aquaculture production (fresh)	Aquaculture production consumed in the LMB	Capture fishery (fish plus OAAs)
	Fresh Fish	Processed Fish	Total Fish	OAAs	Fish plus OAAs			

						plus brackish)		
Cam bodia	31 3	169	4 82	10 5	5 87	2 9	29	558
Lao PDR	85	83	1 68	41	2 09	4 2	42	166
Thail and	47 9	241	7 21	19 1	9 11	5 7	51	861
Viet Nam	47 9	213	6 92	16 1	8 53	3 15	134	719

2. Methodology

3. Results

3.1. Result of HH/fisher surveys

Please provide your own assessment and reasoning about the survey result and compare the result with previous survey, published information or gray reports.

3.2. Result of Fisheries management officer surveys

Please double check the information with other sources and please provide most reasonable justification if there are any disagreement between your information collected from the survey and published data.

3.3. Result of group discussion

Please provide your own justification and reasoning if there are any disagreement between HH survey and the result of group discussion.

4. Conclusions and Recommendations

5. Reference

Annex 1: Habitat definition and maps.

1. **The floodplain - large river** includes all land within the major flood. This zone includes most major rivers and floodplains, such as the Tonle Sap – Great Lake system, including their permanent waterbodies and recession rice fields as well as some former floodplains, particularly in northeast Thailand which now rarely flood because of damming. This zone is ‘water-resources rich’ and virtually all of it becomes wetlands during a very wet year, when unbroken or continuous sheets of water ‘drown out’ barriers, allowing fish and other aquatic animals (OAAs) to move freely. As floodwaters recede, aquatic animals migrate to permanent waterbodies, either on floodplains or in rivers.

2. **Rain-fed rice-fields and associated habitats** includes land outside the flood zone that is classed mainly as rice fields. Based on comparison with Google Earth images, about one third of this class includes other habitats which are not separately delineated such as small swamps, waterbodies, wetland crops and others. Most of this zone was formerly covered by forest which was cleared prior to being modified for rice farming, so most of this zone includes new (human- constructed) aquatic habitats. Rainfed rice fields are inundated by local rainfall or by water diverted laterally from watercourses into paddies which are typically 30-50 centimetres deep. Rainfed habitats are highly modified with numerous barriers that restrict migration of most aquatic animals, favouring amphibious species, predominantly black fishes such as snakeheads, walking catfish, swamp eels and climbing perch as well as OAAs such as frogs, snails and shrimps—all of which can travel over land to surmount or bypass barriers.

3. **Reservoir and permanent waterbodies** outside the major flood and rainfed zones mainly comprise large reservoirs/man-made lakes which have capacity to store water for irrigation or hydropower or turning large water body from lotic to lentic environment. The rivers in this zone could be further categorised as being upstream of and connected to reservoirs or connected to the major flood zone. It was not possible to further subdivide this habitat class using the GIS data, although this would have had only a minor effect on the overall assessment.

4. **Brackish - estuarine** includes all land bordering between coastal lines and the flood zone. This zone includes most southern part of Mekong delta, where water salinity is often maintained between 10 to 30 parts per thousand ‰ all year around.

Figure 1: Land-cover map for 2010 overlain with the major flood layer

Annex 2: Common gear types in LMB.

Code	International Name	in Cambodia	in Lao PDR	in Thailand	in Vietnam
2	Bag net liked gillnet			มอญ/ข้าบดุง	
3	Barrage	ផ្ទុស់			
10	Brush bundle filled in a basket trap (Brush Bundle Basket)	ឈ្មោះត្រីត្រា	ຂາ	ขา/กร้า/เขี้ยว/ส้อมกร้า	Chà mùng
13	Cast Net	សំណាញ់	ແຕ	ແຕ	Chài quăng
20	Deep Drag Net (Trawl)	តាម			
22	Eel clamp	កង្វារត្រីឆ្កែ			
37	Giant Lift Net	ឈ្មោះ	ກະព័ទ្ធចែត		Vó cật

38	Giant wedge cone trap	ລາຍໝູ່			Lộp đứng
39	Gillnet: Drifting gillnet	ຍຸບໂຊກ	ມອງໄຫຼ		Lưới rê trôi
40	Gillnet: Drifting gillnet-2 layers net	ຍຸບໂຊກ ໒ ສູງຈາບ		ດາຂ່າຍ/ ມອງໄຫຼ 2 ຂັ້ນ/ ຂ່າຍໄຫຼ 2 ຂັ້ນ	Lưới rê trôi 2 lớp
41	Gillnet: Drifting gillnet-3 layers net	ຍຸບໂຊກ ໓ ສູງຈາບ		ດາຂ່າຍ/ ມອງໄຫຼ 3 ຂັ້ນ/ ຂ່າຍໄຫຼ 3 ຂັ້ນ	Lưới rê trôi 3 lớp
42	Gillnet: Drifting gillnet-at bottom	ຍຸບໂຊກ ເສົາຖາດ		ດາຂ່າຍ/ ມອງປລົວ(ພື້ນນ້ຳ)/ ຂ່າຍໄຫຼ(ພື້ນນ້ຳນ້ຳ)/ ໄຫຼໂຈງ(ພື້ນນ້ຳ)	Lưới rê trôi tầng đáy
43	Gillnet: Drifting gillnet-at surface	ຍຸບໂຊກ ເສົາຜູ້ເບີ		ດາຂ່າຍ/ ມອງປລົວ(ຜືນນ້ຳ)/ ຂ່າຍໄຫຼ(ຜືນນ້ຳ)/ ໄຫຼໂຈງ(ຜືນນ້ຳ)	Lưới rê trôi tầng mặt
44	Gillnet: Encircling Gillnet	ຍຸບກຸຊຸກ			
45	Gillnet: Stationary gillnet		ມອງແຈ້		Lưới rê cố định
49	Hand Dragged Seine Net	ສູນສູນໄຜ			
52	Handle scoop net	ຜິກຕຸ້ກຜູ້	ສະຫວີງ		Đẩy xiệp
53	Hit gillnet		ມອງຕີ, ມອງໄລ	ຂ່າຍໄສ້/ມອງກວດ	
55	Hook and line	ສູນຮູບໂຊກ	ເບັດບັກ		Câu cá
72	Lift net	ຮູບ	ກະດຸ້ງ		Vó

76	Long handle scoop basket	ຜູງທາກັບຜູງ/ຜູງກະກຽມຜູງ			
79	Long line, bottom set			ເບີດຣາວ(ພື້ນນ້ຳ)/ເບີດຮັ່ງ	
101	Scoop net		ສະຫວີງ		Te
105	Seine net		ດາງກວາດ	ອວນທັບດຶງ	Lưới rùng bãi
111	Spear	ສູ່ງ	ແຫຼມ	ແທລນ/ສ້ອມ/ຈມວກ	Chĩa
115	Trammel net				Cào
150	Trap				
159	Water Pumping	ບູຮຸບ ບູຮຸບ ຖາຮຸບ	ມຸດນ້ຳ		Tát đĩa
160	Others				

Annex 3: List of common species in LMB.

FAO English Name	Scientific Name	Species Code	Photo page no.
African sharptooth catfish	Clarias gariepinus	180	27
Beardless barb	Cyclocheilichthys apogon	1139	29
Black sharkminnow	Labeo chrysophekadion	58	49
Black spotted catfish	Hemibagus spilopterus	84	41
Butter catfish	Ompok bimaculus	98	62
Climbing perch	Anabus testudineus	123	12
Common carp	Cyprinus carpio	19	30
Giant featherback	Chitala topsi	142	23
Giant gourami	Osphronemus goramy	127	63
Glass catfish	Kyrptopterus spp.	95	48

Goonch	Bagarius bagarius	91	15
Hampala barp	Hampala barp	51	39
Indonesia snakedhead	Channa micropeltes	129	22
Java Barb	Barbonymus gonionotus	39	17
Long pectoral -fin minnow	Macrochirichthys macro chirus	13	55
Malayan leafsh	Pristolepis facista	122	78
Mozambique tilapia	Oreochromis mossambicus	1560	64
Nile tilapia	Oreochromis niloticus	137	65
Nilem carp	Osteochilus spp	66	65
Red fin bargus	Hemibagus wyckioides	87	23
Red-tail tinfoil barb	Barbonymus altus	40	17
Royal knifefish	Chitala blanci	4	69
Silver barb	Barbonymus gonionotus	39	17
Striped catfish	Pangasianodon hypophthalmus	104	69
Striped snakehead	Chana striata	128	23
Tinfoil barb	Barbonymus schwanenfeldii	38	17
Torpedo-shaped catfish nei	Clarias spp.	116	26
Walking catfish	Clarias sp. (batrachus)	116	27
	Osteochilus spp	70	65
	Osteochilus spp	66	66
	Osteochilus spp	68	66
	Osteochilus spp	1824	67
	Hemibagus filamentus	1330	39
	Hemibagus capitulum	4016	39

Remark: referring to “Photos of Common fishes in the Lower Mekong Basin, Fisheries Programme, MRC, June 2016.