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# Thematic analysis

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**Aquaculture**

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## **General**

The number of aquaculture companies in Suriname is 63 with a total of 65 ponds (4 in rice paddies, 4 concrete ponds, 55 earthen ponds, and 2 other). Of the total land available for agricultural production (63,989.48 ha) only in 4% (2,296.11 ha) is used for aquaculture. Suriname does not have an aquaculture tradition as is the case in other agricultural branches such as livestock breeding and rice cultivation. Aquaculture products were initially a byproduct of irrigation sources in agriculture/ horticulture and animal husbandry.

Of the total production on the baseline day of aquaculture products fish occupies 2% with 5,451 kg. While the majority of the production 3,070,070 (98%) consists of shrimp. Shrimp are produced on an industrial scale by 2 farms that have specialized in their breeding. The other farms are small family farms that started in aquaculture as an initial phase to growing into large aquaculture farms.

The most important water sources that can be used by aquaculture companies are:

- river/canal (33 companies (51%))
- lake/swamp (14 companies (22%))
- groundwater (11 companies (17%))

As most important breeding medium 80% of the companies used freshwater and 6% brackish water.

For as far as the most important markets are concerned for the produce, 74% of the farms sells on the local market and 3% exports.

## **1. Thematic analysis.**

The results of the census are brought together in tables. Below the data from these tables are analyzed. The analysis per table are elaborated in the next chapter.

## 1.1 Farms by pond type and water surface

From table 1 (see Appendix 1) appears that 85% of the aquaculture farms have earthen ponds. This can be explained by the fact that the construction costs for the construction of concrete ponds are very high. The construction of earthen ponds also involves a lot of earthworks and thus high costs. Tanks and cages are not used. Cultivating aquaculture organisms in tanks and cages requires a high degree of knowhow and investment. The use of tanks and cages is mostly found in countries where there are limited opportunities for the construction of ponds. That is not the case in Suriname.

Furthermore, in Nickerie 2 types of ponds are found with a dualistic character, more in particular rice-fish culture. This type of cultivation system both yields fish and rice as a harvest and is very interesting for the small rice farmer. The Underdirector Fisheries had an ongoing project in the period 2004/2005 in cooperation with the FAO to promote this cultivation system (ODVIS, Aquaculture Department). The focal region was Nickerie, as rice cultivation has been engaged in on a large scale of old.

## 1.2 Types and species of aquaculture organisms

Table 2: Number Aquaculture Farms by type and species by District on the day baseline day

DISTRICT	TYPE EN SOORT					
	VIS				GARNALEN	
	KWI-KWI	TILAPIA	SIERVISSSEN	ANDERE	P.VANNAMEI	ANDERE
PARAMARIBO						
WANICA	7	2	2	5	2	
NICKERIE	29	10	1	12		1
CORONIE	3					
SARAMACCA	1			1		
COMMEWIJNE	2	2	1	2	1	1
MAROWIJNE						
PARA	2	1	2	3		
TOTAAL KUSTVLAKTE	44	16	6	23	3	2

Source : Static data Fifth Agricultural census

From table 2 appears that 95% of the total of the aquaculture companies has fish species as the cultivation organism. The choice of fish over the cultivation of shrimp can be found in the fact that there is little broodstock for shrimp available for small aquaculture farmers. Shrimp broodstock would have to be imported from abroad. In Suriname there are no hatcheries for the production of shrimp broodstock. The production of shrimp broodstock, especially *P. vannamei* in Suriname has as setback the high sediment dissolution in the sea water in front of our coast. For establishing a hatchery for shrimp species such as *P. vannamei*, the first requirement is clear and

clean seawater. The large specialist companies that import broodstock, would apparently be able to provide the small farmers with broodstock, so that shrimp farming by small farmers can be promoted. An umbrella organization would have to arrange the necessary contacts and take the initiative.

Furthermore, table 2 shows that the share of kwi kwi (*Hoplosternum littorale*) is 47% of all cultivated fishes. This fish is an armor-plated catfish that does well in Surinamese swamps and can easily survive low oxygen content of the water. The reproduction of this fish in captivity is simple to initiate, so that relatively a lot of broodstock of this type of fish is available. It is also easy to collect broodstock from swamps. *H. littorale* is a much appreciated fish and considered a delicacy in Suriname among all ethnic groups. Locally *H. littorale* has a good market and price.

### 1.3 Aquaculture Farms on the basis of water surface

Table 3: Number of aquaculture farms by size (water surface) in categories on the baseline day

DISTRICT	TOTAL NUMBER OF FARMS	TOTAL SIZE (WATER SURFACE) IN CATEGORIES (HA)				
		< 2	2 - < 5	5 - < 50	≥ 50	NOT MENTIONED
PARAMARIBO						
WANICA	16	15		1		
NICKERIE	29	27	1			1
CORONIE	3	2				1
SARAMACCA	1	1				
COMMEWIJNE	8	6		1		1
MAROWIJNE	1		1			
PARA	5	5				
TOTAL COASTAL PLAIN	63	56	2	2		3

Source : Statistic data Fifth Agricultural census

Table 3 shows that 89% of all aquaculture farms have a size of less than 2 ha. Two of the companies have a pond surface between the 2 and 5 ha, while 2 companies have a surface between 5 and 50 ha. From the data in Tables 1 (see Appendix 1) and 2 can be concluded that many more small companies are busy with aquaculture.

Furthermore, it appears that most farms, 46% of the total, are located in Nickerie. The construction of the ponds from old rice paddies requires relatively fewer costs. Nickerie further has a better climate for earthworks and further infrastructural works for rice cultivation that can easily be used for aquaculture. The project of the Ministry of LVV

(ODVIS) in cooperation with the FAO also had its impact on promoting aquaculture in Nickerie.

### 1.4 Yields of aquaculture farms

Table 4: Number of aquaculture companies by average yield (kg/ha/year) in categories per district

DISTRICT	TOTAL NUMBER OF FARMS	AVERAGE YIELD IN CATEGORIES (KG/HA/YEAR)			
		LOW [<1000 KG/HA/YEAR]	MEDIOCRE [1000 - 5000 KG/HA/YEAR]	HIGH [>5000 KG/HA/YEAR]	NOT MENTIONED
PARAMARIBO	0				
WANICA	16	12			4
NICKERIE	29	23	4	1	1
CORONIE	3	2	1		
SARAMACCA	1	1			
COMMEWIJNE	8	4		1	3
MAROWIJNE	1	1			
PARA	5	4			1
TOTAL COASTAL PLAIN	63	47	5	2	9

Source : Static data Fifth Agricultural census

Table 4 shows that most (almost 75%) of the aquaculture companies have a yield of less than 1000 kg/ha/yr. On the basis of their yield and from an aquaculture technical viewpoint these farms can be classified as extensive farms. Extensive farms are farms that try to achieve a high profit with a minimum input from an aquaculture enterprise. These companies invest minimally in knowledge and input such as fodder, aeration to the cultivation medium, etc.

Characteristics of extensive farms are:

- Use of large earthen ponds (0 - 100 ha)
- Low water replacement (0 - 5% per day)
- Low fish density (less than 5 individuals per m<sup>2</sup>)
- No artificial aeration
- Little or no fertilization
- Low labor input and low production costs (< 1 arbeider/10 ha)

- Low yields (<1000 kg/ha/year)
- Low investments
- Hardly any application of technology and no additional fodder.

There are 5 farms with an average yield of between 1000 and 5000 kg/ha/yr. Relatively these farms are more intensive than the other 75%. These farms have a greater input. These farms can be categorized as semi-intensive farms. The characteristics of semi-intensive farms are:

- Small to medium-sized earthen ponds (0 - 20 ha)
- Moderate water replacement (5 - 20% per day)
- Medium fish density (5 - 25 individuals per m<sup>2</sup>)
- Partial or continuous aeration
- Fertilization
- Moderate labor input and production costs (1 - 5 laborers/10 ha)
- Moderate investments
- Limited technology and additional to complete feeding
- Moderate yields (1000 - 5000 kg/ha/year).

There are 2 farms that have a yield of 5000 kg and more per ha per year. On the basis of their yield and from an aquaculture technical viewpoint these farms can be classified as intensive farms. In intensive farms a reasonable level of knowhow and inputs are invested in the company. Characteristics of intensive farms are:

- Small dressed ponds (0.1 - 2 ha) or supply canals or tanks
- High degree of water replacement (25 - 100% per day)
- Large fish density (> 25 individuals /m<sup>2</sup>)
- Partial or continuous aeration
- High labor and production costs (1 - 3 laborers/10 ha)
- Significant application of technology and use of complete balanced feed (containing all nutrients)
- Important investments
- High yields (>5000 kg/ha/year)

### ***1.5 Production of aquaculture farms by type and species***

Table 5: Estimated quantity by type and species per district on the baseline day

DISTRICT	TYPE AND SPECIES											
	FISH								SHRIMP			
	KWI KWI		TILAPIA		ORNAMENTAL FISH		OTHER		P.VANNAMEI		OTHER	
	KG	PCS.	KG	PCS.	KG	PCS.	KG	PCS.	KG	PCS.	KG	PCS.
PARAMARIBO												

WANICA		2		504		50		545		1		
NICKERIE	56	48.06	9	2.39			236	1,241			70	
CORONIE	1	2										
SARAMACCA		1						1				
COMMEWIJNE		380	4	60		300		800	3,000,000		70	
MAROWIJNE												
PARA		200		50		1	150	1,016				
TOTAL COASTAL PLAIN	1	54	4,009	63,744		1	386	4,702	3,000,000	1	70070	

Source : Static data Fifth Agricultural census

This shows that *P. vannamei* is the most produced species. Approximately 3000 ton This represents 98% of the total production of the sector. *P. vannamei* is being produced by 2 companies that focus on the (semi)-intensive method. The majority of the companies focuses on the cultivation of fish with much lower yields (2% of the total).

Table 6: Quantity produced in the last three months by type and species per district

DISTRICT	TYPE AND SPECIES											
	FISH								SHRIMP			
	KWI KWI		TILAPIA		ORNAMENTAL FISH		OTHER		P.VANNAMEI		OTHER	
	KG	PCS.	KG	PCS.	KG	PCS.	KG	PCS.	KG	PCS.	KG	PCS.
PARAMARIBO												
WANICA		560		800				160		9		
NICKERIE	50	11.39					400	60				
CORONIE	100											
SARAMACCA		400						500				
COMMEWIJNE		162	2	60				610	9		150	
MAROWIJNE												
PARA						50						
TOTAL COASTAL PLAIN	150	12,512	2	860		50	400	1.33	9	9	150	

Source : Statistic data Fifth Agricultural census

Table 6 indicates that in the past three months of the census shrimp of the *P. vannamei* species were produced most. This shrimp species represents almost 77% of the total weight of produced aquaculture products over a period of 3 months.

## 1.6 Water source of the aquaculture companies

Table 7: Number of aquaculture farms according to most important water source per district in 2008



DISTRICT	TOTAL FARMS	MOST IMPORTANT WATER SOURCE					
		RIVER / CHANNEL	LAKE/ SWAMP	GROUND WATER	SEA	OTHER	NOT MENTIONED
PARAMARIBO							
WANICA	16	5	4	4		3	
NICKERIE	29	25	3	1			
CORONIE	3		3				
SARAMACCA	1		1				
COMMEWIJNE	8	1	1	5			1
MAROWIJNE	1	1					
PARA	5	1	2	1		1	
TOTAL COASTAL PLAIN	63	33	14	11		4	1

Source : Statistic data Fifth Agricultural census

Table 7 shows that most companies (53%) use a river or channel as most important water source. The company is made or broken by the quality and quantity of the water source. The medium of cultivation is of the utmost importance for the company.

Second place as water source is the swamp/lake. The quality of the water in a swamp/ lake is less in comparison with a larger dynamic water source such as a river or canal. Swamp water has a relatively lower content of dissolved oxygen. For organisms that have a great need of dissolved oxygen in the water, this source is not suitable unless the quality of the water is improved by aeration, biofiltration, etc. Almost 22% have a swamp/ lake as most important water source.

Other types of water sources are less used (groundwater 17%). Ground water also is of lesser quality in comparison with other water sources. The quality depends on the location of the source.

The sea as water source is not used by any company. Apparently the companies are not located near the sea. Seawater in front of the coast of Suriname has a high content of dissolved sediment. This means that the direct use of seawater in aquaculture ponds could lead to the ponds becoming shallow because of the high sedimentation. Not all types of organism can support water with a high salinity and sediment content.

### ***1.7 The cultivation medium of aquaculture companies***

Table 8. Number of aquaculture farms according to cultivation medium per district in 2008

DISTRICT	TOTAL	CULTIVATION MEDIUM
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	FARMS	FRESH WATER	BRACKISH WATER	SEA	OTHER	NOT MENTIONED
PARAMARIBO						
WANICA	16	12	2		2	
NICKERIE	29	27	1		1	
CORONIE	3	2				1
SARAMACCA	1	1				
COMMEWIJNE	8	5	1		1	1
MAROWIJNE	1	1				
PARA	5	4			1	
TOTAL COASTAL PLAIN	63	52	4		5	2

Source : Static data Fifth Agricultural census

From table 8 appears that 83% of the farms use freshwater as the cultivation medium, followed by 8% of the total that uses another cultivation medium. The cultivation medium depends on the type of organism that is being cultivated. As most companies raise fish (*H. littorale* and *Tilapia*), use is also made of freshwater as cultivation medium as both are freshwater fishes. Tilapia could also survive in brackish water up to a content of 15 ppt. The reproduction, however, takes place in freshwater.

The breeding of *P.vannamei* shrimps takes mainly place in brackish water. The companies that focus on raising this shrimp species (the large aquaculture companies) use brackish water as cultivation medium. The range of salinity content for this species strongly varies from freshwater to even saltwater.

## 1.8 Aquaculture products

Table 9: Number of aquaculture farms according to most important aquaculture product per district in 2008

DISTRICT	TOTAL FARMS	MOST IMPORTANT AQUACULTURE PRODUCT				
		FISH	SHRIMP	BROODSTOCK (FISH FRY)	OTHER	NOT MENTIONED
PARAMARIBO	0					
WANICA	16	14		2		

NICKERIE	29	26			3	
CORONIE	3	3				
SARAMACCA	1	1				
COMMEWIJNE	8	5	1		1	1
MAROWIJNE	1	1				
PARA	5	5				
TOTAL COASTAL PLAIN	63	55	1	2	4	1

*Source : Static data Fifth Agricultural census*

The table shows that most aquaculture farms (87% of the total) have fish as most important aquaculture product. Very important is the information that only 2 companies (3%) have specialized in the production of broodstock. Such companies are called hatcheries and are very important for the further development of the sector. One of the important inputs in the aquaculture sector is the use of high-quality broodstock in the ponds. In general it is true that the broodstock strongly determines the output upon harvesting. The production of broodstock is a specialist task and requires a lot of knowhow. To further stimulate aquaculture such hatchery farms should be stimulated. This situation can be compared to the poultry sector. There are thousands of breeders that are supplied by specialized firms with chicks. The breeders are not occupied with the production of chicks, but especially focus on the production of the final product. The same system should be promoted in the aquaculture sector.

### ***1.9 Broodstock of aquaculture farms***

Table 10: Number of aquaculture farms according to most important source of broodstock per district in 2008

DISTRICT	TOTAL FARMS	MOST IMPORTANT SOURCE FOR BROODSTOCK (FISH FRY)				
		OWN PRODUCTIO N	PURCHAS E	WILD CAUGHT FISH	OTHER	NOT MENTIONED
PARAMARIBO						
WANICA	16	9	3	3	1	
NICKERIE	29	13	7	8	1	

CORONIE	3	1		2		
SARAMACCA	1	1				
COMMEWIJNE	8	5	1		1	1
MAROWIJNE	1		1			
PARA	5	4		1		
TOTAL COASTAL PLAIN	63	33	12	14	3	1

*Source : Static data Fifth Agricultural census*

Table 10 shows that most aquaculture farms (52%) produce their own broodstock. Approximately 22% has to resort to wild catch while 19% of the farms purchase their own brood. As stated earlier in Paragraph 1.8 broodstock of a high quality is one of the most important inputs for the aquaculture farm. Companies that produce their own broodstock could in case of good availability of broodstock on the market, invest their energy in raising the aquaculture organisms that they breed.

Harvesting broodstock from the wild is accompanied by a population decline of aquatic organisms in nature. With this method one strongly depends on the seasons and market demand can not be met in case of using broodstock in raising ponds. The broodstock from nature has in most cases a high genetic quality. There are always risks associated to parasites and other disease-causing organisms that are introduced into the farm together with the broodstock.

### ***1.10 Marketing method of aquaculture farms***

Table 11: Number of aquaculture farms according to most important marketing procedure per district in 2008

DISTRICT	TOTAL FARMS	MOST IMPORTANT MARKETING PROCEDURE		
		LOCAL	EXPORT	NOT MENTIONED
PARAMARIBO	0	.		
WANICA	16	12		4
NICKERIE	29	25	2	2
CORONIE	3	1		2

SARAMACCA	1	1		
COMMEWIJNE	8	6		2
MAROWIJNE	1			1
PARA	5	3		2
TOTAL COASTAL PLAIN	63	48	2	13

Source : Static data Fifth Agricultural census

The table shows that most aquaculture companies (76%) sell their produce. The *P.vannamei* shrimps are mostly exported. Based on the fact that shrimp constitute the larger part of the production in the sector, it can be stated that the larger part of the production is exported. Companies that mainly focus on fish breeding sell their product locally. The demand for fish products on the local market is great considering the high prices that are paid for certain fishes, such as kwi kwi (*H.littorale*).

### 1.11 Markets for aquaculture farms

Table 12 (see Appendix 2) shows that all 8 markets are equally important.

### 1.12 The use of feed sources on aquaculture farms

Table 13 (see Appendix 3) shows that aquaculture farms that use local and imported feed sources is equal to 50% to 50%. The choice of using a local feed source has to do with price and quality of the feed. Locally fish feed is available.

### 1.13 Energy use on aquaculture farms

Table 14: Number of aquaculture farms according to most important energy source per district in 2008

DISTRICT	MOST IMPORTANT ENERGY SOURCE		
	GOVERNMENT	GENERATOR	OTHER
PARAMARIBO			
WANICA		1	
NICKERIE	1		1
CORONIE			
SARAMACCA			

COMMEWIJNE	1		
MAROWIJNE			
PARA	1		
TOTAL COASTAL PLAIN	3	1	1

*Source : Static data Fifth Agricultural census*

Table 14 shows that 3 of the companies use the government as the most important source of energy. The government is much cheaper as source of energy in comparison with the use of a generator. The companies that use a generator do not have the possibility to be connected to the grid.

### **Sources:**

- Report: Doorrekening Fiscale voorzieningen voor de agrarische sector (2008).
- Annual Reports LVV: 2005, 2006, 2007, 2008.
- Agricultural Statistics 2004 - 2009
- Statistical Analysis Fifth Agricultural Census Suriname 2008



## Appendix 1:

Table 1: Number of aquaculture farms by type of pond and water surface of the ponds in categories (m<sup>2</sup>) per district on the baseline day.

DISTRICT	TYPE OF POND AND WATER SURFACE OF THE PONDS IN CATEGORIES (M²)																														
	EARTHEN PONDS					CONCRETE PONDS					TANKS					CAGES					RICE PADDIES					OTHER					
	<50	50 -249	250 -999	1000 -1999	≥2000	<50	50 -249	250 -999	1000 -1999	≥2000	<50	50 -249	250 -999	1000 -1999	≥2000	<50	50 -249	250 -999	1000 -1999	≥2000	<50	50 -249	250 -999	1000 -1999	≥2000	<50	50 -249	250 -999	1000-1999	≥2000	
PARAMARIBO																															
WANICA		8	2	1	2		1																					2			
NICKERIE	4	10	9		2																		1		2						
CORONIE		1			1																		1								
SARAMACCA		1																													
COMMEWIJNE	1	4	2		1					1																					
MAROWIJNE		1																													
PARA	1	1	2		1	2																									
TOTAL COASTAL PLAIN	6	26	15	1	7	2	1			1													2		2		2				

Source : Statistic data Fifth Agricultural census



## Appendix 2:

Table 12: Number of aquaculture farms according to market per district and percentage categories of the total production in 2008

DISTRICT	PERCENTAGE CATEGORIES (%)	TYPES OF MARKETS							
		SUPERMARKET/ STORES	RESTAURANTS/ HOTELS	OWN CONSUMPTION/ GIFT	PROCESSORS	SOLD BY THE ROAD	PET SHOP	INTERMEDIARY	OTHER
PARAMARIBO	0-25								
	26-50								
	51-75								
	76-100								
WANICA	0-25	1	2	1	2	2	2	2	1
	26-50								1
	51-75	1							
	76-100			1					
NICKERIE	0-25	5	6	2	6	5	6	6	5
	26-50								1
	51-75	1		1					
	76-100			3		1			
CORONIE	0-25	1	1	1	1	1	1		1
	26-50								
	51-75								
	76-100							1	
SARAMACCA	0-25	1	1	1	1	1	1	1	
	26-50								
	51-75								
	76-100								1
COMMEWIJNE	0-25			1	1	1	1	1	1
	26-50	1	1						
	51-75								
	76-100								
MAROWIJNE	0-25								
	26-50								
	51-75								
	76-100								
PARA	0-25	1	1	1	1	1	1	1	
	26-50								
	51-75								
	76-100								1
TOTAL COASTAL PLAIN	0-25	9	11	7	12	11	12	11	8
	26-50	1	1						2
	51-75	2		1					

Source : Statistic data Fifth Agricultural census

### Appendix 3:

Table 13: Number of aquaculture farms according to feed source per district and percentage categories of local/ import feed source in 2008

DISTRICT	PERCENTAGE CATEGORIES (%)	FEED SOURCE	
		LOCAL	IMPORT
PARAMARIBO	0-25		
	26-50		
	51-75		
	76-100		
WANICA	0-25		4
	26-50		
	51-75		
	76-100	4	
NICKERIE	0-25		5
	26-50		
	51-75		
	76-100	5	
CORONIE	0-25		
	26-50		
	51-75		
	76-100		
SARAMACCA	0-25		
	26-50		
	51-75		
	76-100		
COMMEWIJNE	0-25	1	2
	26-50		
	51-75		
	76-100	2	1
MAROWIJNE	0-25		1
	26-50		
	51-75		
	76-100	1	
PARA	0-25	1	3
	26-50		
	51-75		
	76-100	3	1
TOTAL COASTAL PLAIN	0-25	2	15
	26-50		
	51-75		



*Source : Statistic data Fifth Agricultural census*