



GHANA CENSUS OF AGRICULTURE

THEMATIC BRIEF



AQUACULTURE

GHANA STATISTICAL SERVICE
AUGUST 2023

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FOREWORD

The 2017/18 Ghana Census of Agriculture (GCA) is the fourth census of agriculture carried out in the country. Earlier agricultural censuses were conducted in 1950, 1970 and 1984/85. Unlike the previous censuses, the 2017/18 GCA was an electronic census that deployed tablets and the Computer Assisted Personal Interview (CAPI) technique to collect nationwide information on households and institutions engaged in agricultural activities.

The GCA was conducted to provide benchmark data for planning and monitoring the national development agenda-the Coordinated Programme of Economic and Social Development Policies 2017-2024 and the Medium-Term National Development Policy Framework 2018-2021. The census will help policymakers set targets to assess progress towards the attainment of the Sustainable Development Goals (SDGs) and the African Union Agenda 2063. Additionally, the GCA will enhance the understanding of the effectiveness of the various agricultural interventions and other national policy initiatives, such as the "Planting for Food and Jobs" with its five modules by government and development partners to improve the livelihood of citizens and ensure food security for the country.

The census was a collaboration between the Ghana Statistical Service and the Ministry of Food and Agriculture. The data collection consisted of two broad phases. Phase one- the Listing Phase -entailed listing of all structures to identify all agricultural households and institutions. Phase two consisted of the administration of the core and community modules, and the collection of data on all agricultural households and institutions identified in Phase one. Appropriate statistical procedures and controls were put in place during the data collection to ensure that data from the census are of high quality.

ACKNOWLEDGEMENTS

The Ghana Statistical Service (GSS) and the Ministry of Food and Agriculture (MoFA) acknowledge the invaluable contribution of institutions and individuals to the successful implementation of the 2017/18 Ghana Census of Agriculture (GCA).

Special gratitude goes to the following: The Food and Agriculture Organisation (FAO), the World Bank (WB), the Government of the Netherlands, and the Department for International Development (DFID) of the United Kingdom for financial and technical support. Further gratitude goes to the Monitoring, Evaluation and Technical Support Services (METSS) of USAID for logistical support. We further acknowledge the Vice-Chancellor of the University of Ghana and the Institute of Statistical, Social and Economic Research (ISSER) of the same University, and the Birth and Death Registry for their material and technical support during the preparation and implementation of the GCA.

We acknowledge with thanks the support of the Ministry of Finance; the Ministry of Communications; the Ministry of Information; the Ministry of Fisheries and Aquaculture Development; and the Ministry of Trade and Industry. In addition, sincere thanks and acknowledgement are extended to the Ministry of Local Government and Rural Development; the Ministry of Lands, Mines and Natural Resources; the Ministry of Gender, Children and Social Protection as well as the Regional and District Management Committees of the GCA.

The Management of GSS is grateful for the exemplary and inspiring leadership provided by the National Steering Committee and in particular the Minister for Food and Agriculture, Honorable Dr. Owusu Afriyie Akoto, the Chairman of the Steering Committee and his co-chair, Honorable Vincent Sowah Odotei (MP) and Deputy Minister for Communications. The passion and technical support provided by the GSS Board made an indelible impact in ensuring the successful conduct of the GCA.

Finally, GSS is particularly grateful to Prof. Simon Mariwah whose reviews and comments have contributed to enriching this report. We are indebted to all who contributed in diverse ways to the successful implementation of the Census, especially management of GSS, the data processing and analysis team and report writers.



PROF. SAMUEL KOBINA ANNIM

ACRONYMS

| | |
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| CPESDP | Coordinated Programmes for Economic and Social Development Policies |
| FAO | Food and Agriculture Organisation |
| FASDEP | Food and Agriculture Sector Development Policy |
| GCA | Ghana Census of Agriculture |
| GDP | Gross Domestic Product |
| GFAP | Ghana Fisheries and Aquaculture Policy |
| NFAP | National Fisheries and Aquaculture Policy |
| SDG | Sustainable Development Goals |

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1.0 INTRODUCTION

According to the 2014-2017 Coordinated Programmes for Economic and Social Development Policies (CPESD), the structure of fish production in Ghana is projected to change significantly over the period 2017-2025 with marine production estimated to reduce from 71% to 52%, aquaculture rising to 28% from 13% and inland production from 16% to 20%, with a heightened emphasis on aquaculture development and sustainable management of aquatic fisheries resources. This transformation agenda reflects SDG Goal 12, which seeks to ensure sustainable consumption and production patterns.

Aquaculture has great potential to feed and nourish the world's growing population. But growth must be sustainable. In 2020, global aquaculture production reached a record 122.6 million tonnes, with a total value of USD 281.5 billion. Around 54.4 million tonnes were farmed in inland waters and 68.1 million tonnes came from marine and coastal aquaculture. However, while this is significant, growth must be sustainable. Aquaculture growth has often occurred at the expense of the environment. Sustainable aquaculture development remains critical to supply the growing demand for aquatic foods (FAO, 2022).

Globally, millions of lives and livelihoods are supported by aquatic food systems. An estimated 58.5 million people were employed in the primary sector. Including subsistence and secondary sector workers, and their dependents, it is estimated that about 600 million livelihoods depend at least partially on fisheries and aquaculture (FAO, 2022). In Africa, Aquaculture employs about 634,000 people. The fisheries and aquaculture sector plays a key role in the socio-economic development of Ghana by contributing to Gross Domestic Product (GDP), job and wealth creation, and food and nutrition security. The average contribution of the sector to GDP, and Agriculture GDP for the period 2015-2020 is estimated at 1.1% and 5.4% respectively (Fisheries Commission, 2021). The sector also provides raw materials to the fish canneries and other fisheries-related industries in the country.

Furthermore, it provides direct and indirect job opportunities for an estimated 20% of the active labour force along the fisheries and aquaculture value chain (Atta-Mills et al., 2004), thereby aiding in ending poverty in all its forms everywhere (SDG Goal 1).

According to FAO (2022), global consumption of aquatic foods (excluding algae) increased at an average annual rate of 3.0 percent from 1961 to 2019, a rate almost twice that of annual world population growth (1.6 percent) for the same period, with annual per capita consumption reaching a record high of 20.5 kg in 2019. Indeed, the annual per capita fish consumption in Ghana, over the last decade

ranged between 20 and 25kg, which is much higher than the global average of 20kg per year. In 2020 and 2021, the per capita fish consumption stood at 20.21kg and 24.6kg respectively per person a year. Significantly, this figure exceeds the FAO estimate of 9-10 kg in sub-Saharan Africa, demonstrating the importance of fish for food and nutrition security in Ghana (Fisheries Commission, 2021). The fisheries sector also supports Government efforts to achieve national food and nutrition security with fish constituting about 60% of the animal protein intake of Ghanaians and also contributes to ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture (SDG Goal 2).

The aquaculture subsector is dominated by non-commercial systems (i.e. extensive, small scale and subsistence), often using earthen ponds. However, there has been an increase in the use of other aquaculture holding facilities like cages, tanks, dams, dugouts and reservoirs. Tilapia continues to dominate cultured species in Ghana, with cage culture contributing the highest in terms of quantity of fish production. In recent times, catfish production has seen significant improvement, recording a high production of 20,660.95mt in 2021 as against 16,321.96 (2020) and 13,063.41 (2019). The increase in catfish production has been attributed to a number of factors including their hardiness, fast growth and high survival rates under adverse environmental conditions which have influenced fish farmers to shift to catfish farming.

Policies geared towards improving the fisheries and aquaculture sector has been implemented over the years, including National Fisheries and Aquaculture Policy (2008 & 2022), Ghana National Aquatic Animal Health Policy, Fisheries Co-Management Policy (2020), Marine Fisheries Management Plan (2015-2019 & 2022-2026), Fisheries and Aquaculture Sector Development Plan (2011-2016) and Ghana National Aquaculture Development Plan (2012-2016 & 2022-2026). Some of the thematic scope of the above policy documents include: availability of and access to inputs for aquaculture operations; complementary roles of public and private sectors in aquaculture; education and training; extension and outreach; research and innovation; partnerships; and production system; environment & climate change, aquatic animal health; post-harvest management & trade of fish and fish products.

This brief seeks the patterns and correlates in aquaculture holdings as well as institutions engaged in aquaculture.

2.0 DEFINITION OF CONCEPTS AND DATA SOURCES

2.1 Definition of Concepts

Agricultural activity: Agricultural activities include the cultivation of arable crops, tree crops, forest trees and the rearing of livestock, aquaculture and capture fisheries.

Agricultural household: A household with at least one of its members engaged in an agricultural activity.

Agricultural land: This is defined as the sum of arable land, land under permanent crops and land under permanent pastures.

Agricultural institution: An institution engaged in an agricultural activity.

Aquaculture institution: An institution engaged in an aquaculture activity.

Agriculture: The production of plants and animals, including fresh water and marine species, for food, fuel, fibre or medicine.

Agro-ecological zones: Geographical areas exhibiting similar soil and climatic conditions that support rain-fed agriculture.

Aquaculture: The farming of fish. The farming refers to some intervention in the rearing process to enhance production, such as regular stocking, feeding and protection from predators.

Capture fisheries: Fishing in the wild, from marine and inland waters.

Enumeration area (EA): A small geographic area that one census officer is expected to cover in data collection within the specified period allotted for the census exercise.

Field: A piece of land in a parcel separated from the rest of the parcels by easily recognisable demarcation lines, such as paths, cadastral boundaries and/or hedges. A field may consist of one or more plots.

Freehold: This is a type of tenure which involves the holding of registered land in perpetuity or for a period less than perpetuity which may be fixed by a condition, that is owning a piece of land for a period of time that is not limited.

Grow-out: The production unit in which fish fingerlings are raised to adult size for sale.

Hatchery: The production unit in which fish eggs are hatched and raised to fingerlings.

Head of household: A member of the household who takes general responsibility for the up-keep, wellbeing and security of the household and is recognised and acknowledged by the other household members as such.

Holder: Agricultural holder (Farm owner) is a person who takes the major decisions regarding resource use and exercises management control over the holding.

Household: A person or group of persons who normally live together and are catered for as one unit. Members of the household may or may not be related.

Inheritance: It is the practice of passing property, title, debt, right and obligation of the death of an individual land received by members of collective holding for individual use

Institution: A non-household entity engaged in commercial or non-commercial agricultural activities.

Integrated system of production: An aquaculture production system that uses livestock droppings as feed for the fingerlings.

Land tenure: The relationship, whether legally or customarily defined, among individuals or groups that define how access is granted to rights to use, control, and transfer land, as well as associated responsibilities and restraints (FAO).

Leasehold: A piece of land that can be used for a limited period of time according to the arrangement in the lease.

Literacy: Ability to read and write in any language with understanding.

Locality: A distinct population cluster (also designated as inhabited place, populated centre, settlement) which has a NAME or LOCALLY RECOGNISED STATUS. It includes fishing hamlets, mining camps, ranches, farms, market towns, villages, towns, cities and many other types of population clusters, which meet the above criteria.

Mass media: Communication that is to a large group or groups of people in a short time, for example, newspapers, magazines, radio, advertisement, social media, TV, internet and films.

Mono-culture: An aquaculture production system in which one type of fish is reared at a time in a production facility.

Parcel of land: A piece of land under one land tenure arrangements, entirely surrounded by features such as other land (not under the same land tenure arrangement), water, road, or forest. A parcel may consist of one or more fields or plots adjacent to each other.

Plot: The section of a parcel or field used for cultivating a specific crop or a mix of crops.

Polyculture: An aquaculture production system in which more than one type of fish are reared together at a time in a facility.

Premix fuel: Special fuel for outboard motor engines, usually containing a mixture of Engine oil and Petrol.

Relationship to head: Persons are related either by blood, marriage or by legal means. Examples of blood relations are son/daughters, Parents, Sisters/Brothers, etc.

Respondent: This is the person from whom information is being obtained, e.g., head of the household or any adult member (15 years or older) of the household.

Semi-industrial vessel: Small and medium sized fishing vessels fitted out with mechanised method of operating the fishing gear without refrigeration.

Squatting: The practice where a holder is using a parcel of private or public land without any clear ownership and/or permission of the owner.

Structure: A separate and independent building or an enclosure, either completed or uncompleted with a roof and walls and may be permanent or movable. It can be constructed with different materials such as concrete, brick, mud, metal, plastic, cardboard, wood, glass, grass, straw and bamboo. Some examples of a structure are house, factory, school, church, mosque, office, hotel, store, supper-market, kiosk, container, etc.

Trusteeship: A situation in which someone's land or property is managed by another person or organisation on behalf of the owner.

2.2 Data Sources

The statistics presented in this report are generated from the 2017/18 Ghana Census of Agriculture (GCA) Regional thematic Tables on Aquaculture.

3.0 JUSTIFICATION FOR THE SELECTION OF CORRELATES OF AQUACULTURE

3.1 Sex

Aquaculture is a male-dominated venture. A study in the EU showed that the sector is dominated by male employees covering 77% (Nicheva *et al.*, 2022). In general, aquaculture is labour intensive and demands physical and organizational skills to harvest a profitable output. Men perform tasks requiring tools that are owned by men and which are perceived to be physically hard such as digging the pond and harvesting. Women are involved in all sections of the aquaculture value chain but their opportunities are not in stride with its growth.

Sex-disaggregated statistics that could track women in aquaculture are scarce, and therefore women's presence, influence and interests are invisible. There is therefore the need to embrace the targets of Sustainable Development Goals 5 (gender equality and empowerment of all women and girls) and 8 (decent work and economic growth).

3.2 Age

Aquaculture is capital intensive and requires huge financial outlay at the beginning of the business. This makes it nearly impossible for the young to venture into. They therefore migrate to the cities to engage in other employment opportunities to be able to fend for themselves. A study by Adhikary *et al.*, (2018) found that the highest proportions (36%) of fish farmer were middle aged (31-40 years), with those above 50 years being the lowest (14%). According to Nicheva *et al.*, (2022), in EU aquaculture sector the age class 40–64 dominates and is also the largest in terms of employees, covering 45% of the people employed with every third employee in aquaculture being younger than 40 years (35%). They youth may later engage in aquaculture production after they have made enough money from other employment.

3.3 Locality of Residence

Generally, locality of aquaculture holdings/holders have great influence on farming operations in Ghana. It is dominated by holders in rural localities. A good source of water is the foundation for any aquaculture operation. The water source should be consistent, reliable, and as close to the desired parameters as possible (Tyson and Simone 2014). Traditionally aquaculture operations rely on reservoirs, rivers, or

groundwater, which are mostly found in rural areas. However, urban aquaculture can shorten the path between farm and the final consumer, generate income, use less resources, and, in some cases, serve as a tool in community building (RUIAF 2018).

3.4 Educational Attainment

Education is very important in the use of technology in aquaculture. Educational attainment provides opportunity to learn, understand and adopt modern technologies to improve yields, land use and sound environmental practices for the purposes of environmental conservation. According to Ponnusamy and Pillai (2014), highly educated farmers could seek information from different sources, are better informed and better understand the technology to adopt. In aquaculture farming, adequate investment gets better returns. It requires higher education and skilled technical personnel to achieve the desired results.

There could be a positive or negative correlation between the level of educational attainment and aquaculture activity depending on the species farmed and kind of technology used.

3.5 Literacy Status

Literacy in aquaculture refers to holders' ability to read, write and be familiar with information concerning aquaculture and related environmental, economic, and social topics. Enhanced literacy of aquaculture holders enables them to confidently participate in discussions about aquaculture and easily transfer knowledge to existing and potential holders.

Illiteracy and lack of fish farming skills will require significant investments in time and resources to provide appropriate training. Aquaculture holders' ability to read, write, analyse, evaluate information will facilitate farmer's ability to adopt best practices, drive their success in farming, and ultimately their motivation to keep farming and draw in others.

3.6 Disability Status

Persons with some form of disabilities usually face the challenges of discrimination, stigmatisation and even exclusion from livelihood sustaining opportunities in society, a situation which may render them vulnerable.

Little is known about the extent to which persons with disabilities rely on aquaculture for livelihood support. If any at all, there is the need-to-know opportunities persons with disabilities have to participate in aquaculture.

3.7 Scale of Production

Productive capacity of aquaculture establishments can differ from small, medium to large scale depending on the size of the aquaculture holding. Before one engages in production, s/he is required to make an initial capital investment in the form of land, labour and machinery. Large scale production requires a large capital investment, use of hired skilled labour and some level of sophisticated technology which are often identified as major limiting factors for investment in many parts of this country. Small-scale holders, on the other hand, typically use low-input farming methods and a large percentage of farm labour is provided by household members.

3.8 Land and Tenure Arrangement

The type of tenure arrangement through which one gains access to land may inform the decision on what the land is used for and the investment made on the land. For aquaculture, the type of tenure arrangement informs the type of holding facilities a holder may mount on the land. For instance, it may be deemed riskier to use land accessed through trusteeship, renting and squatting for excavated ponds and concrete tanks, compared to freehold, inheritance and others.

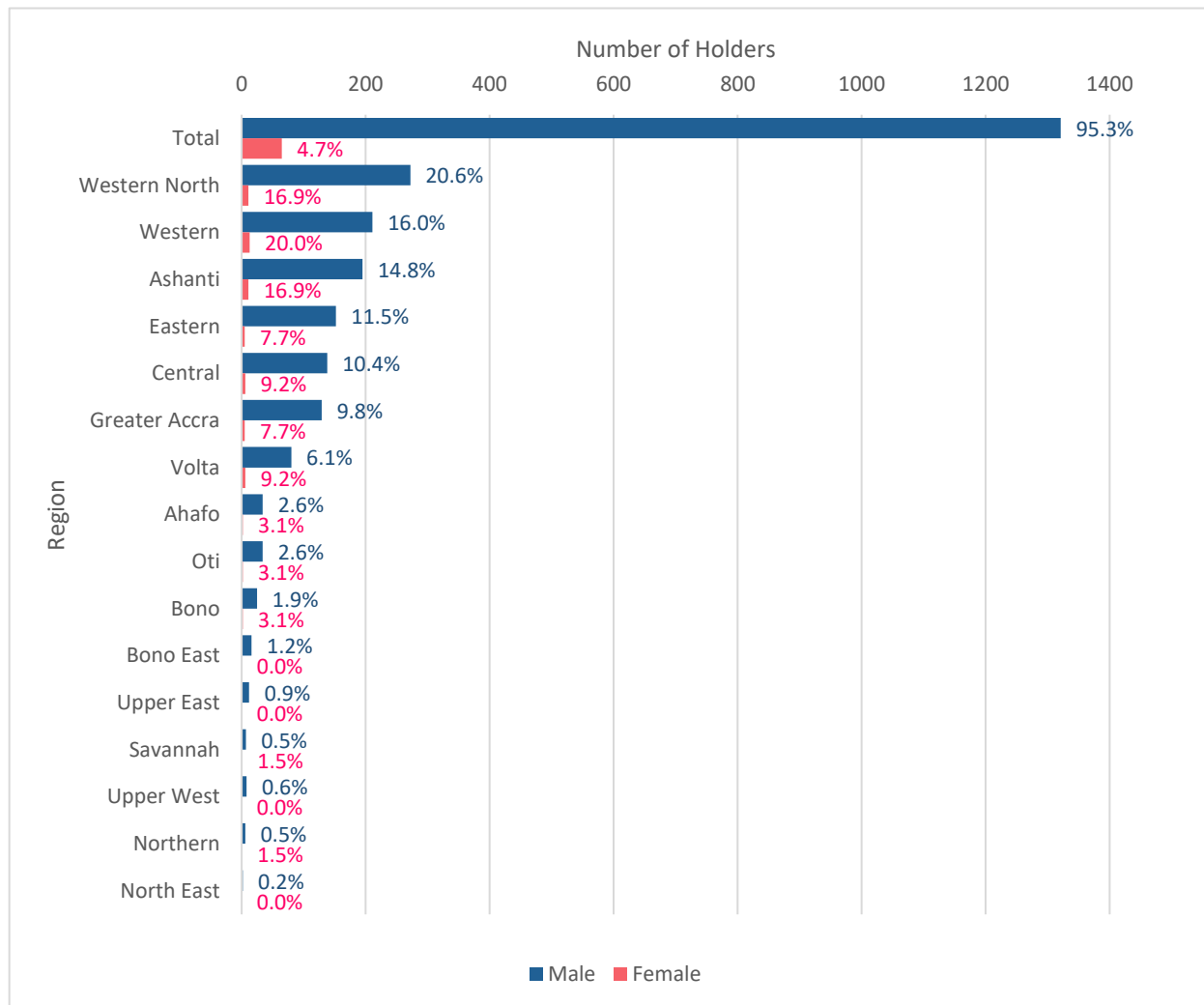
4.0 KEY FINDINGS

4.1 Patterns

4.1.1 Sex of Holders

Female participation in aquaculture is very low as only 5 percent of the 1,386 holders are females. Western region constitutes one-fifth (20%) of the female aquaculture holders. There are no female aquaculture holders in Bono East, North East, Upper East and Upper West regions.

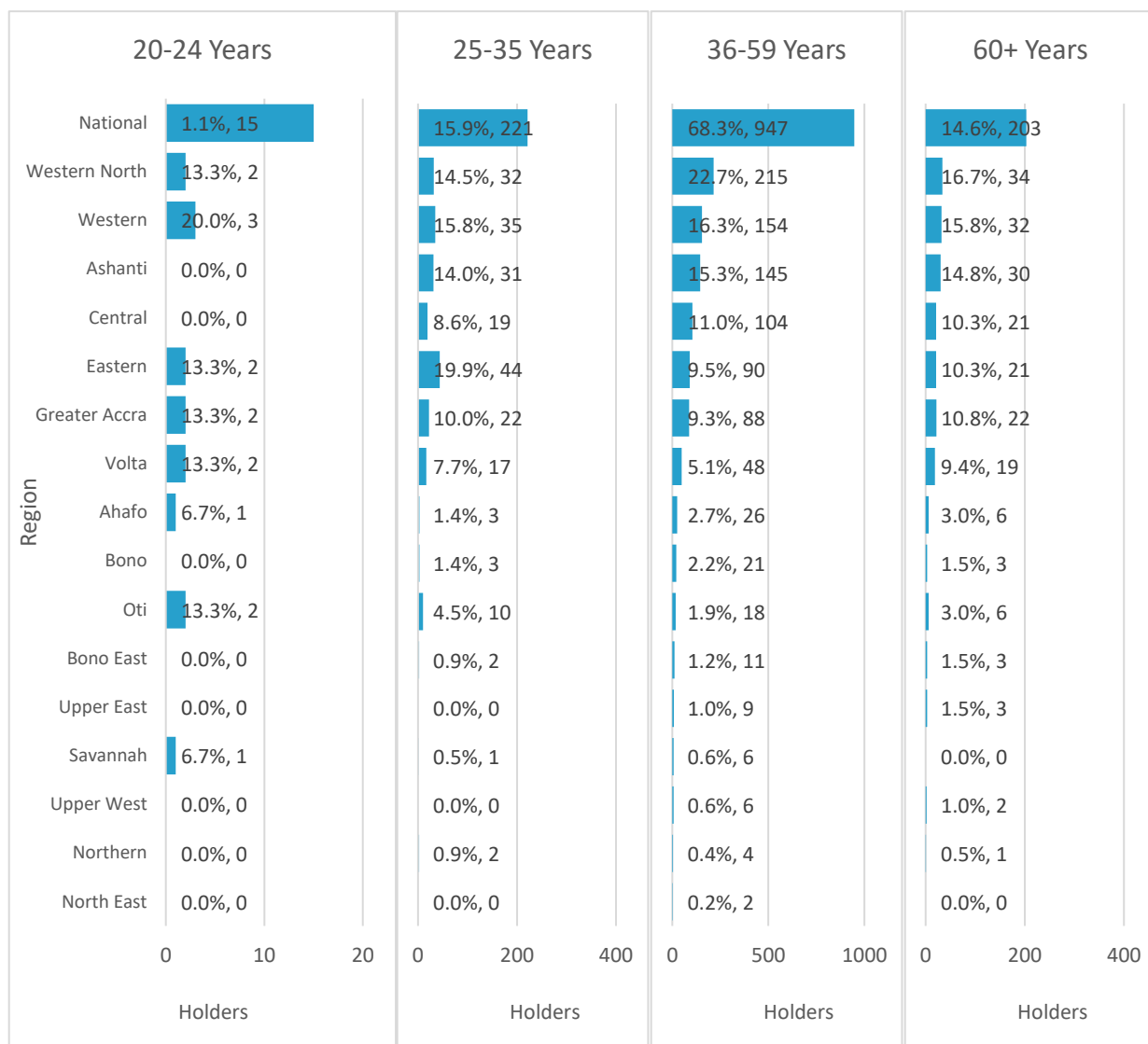
FIGURE 4. 1: SEX OF AQUACULTURE HOLDERS BY REGION



4.1.2 Age of Holders

All aquaculture holders are 20 years and older. But most (82.9%) of them are 36 years and older. About seven in ten (68.3%) of aquaculture holders are aged 36 to 59 years old. Western North region constitutes more than one-fifth (22.7%) of holders aged 36-59 years old.

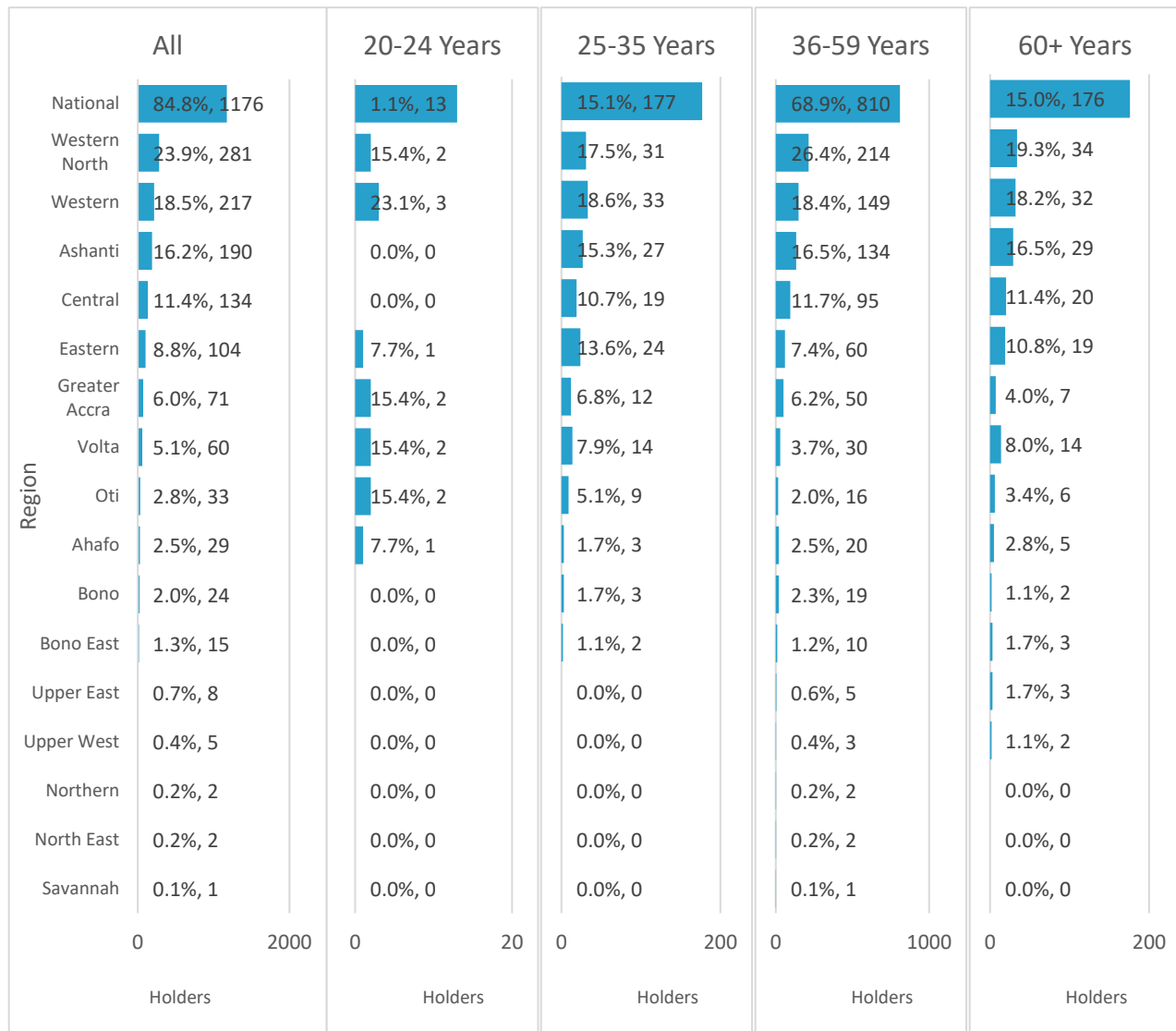
FIGURE 4. 2: AQUACULTURE HOLDERS BY AGE AND REGION



Age of Holders by Production Facility

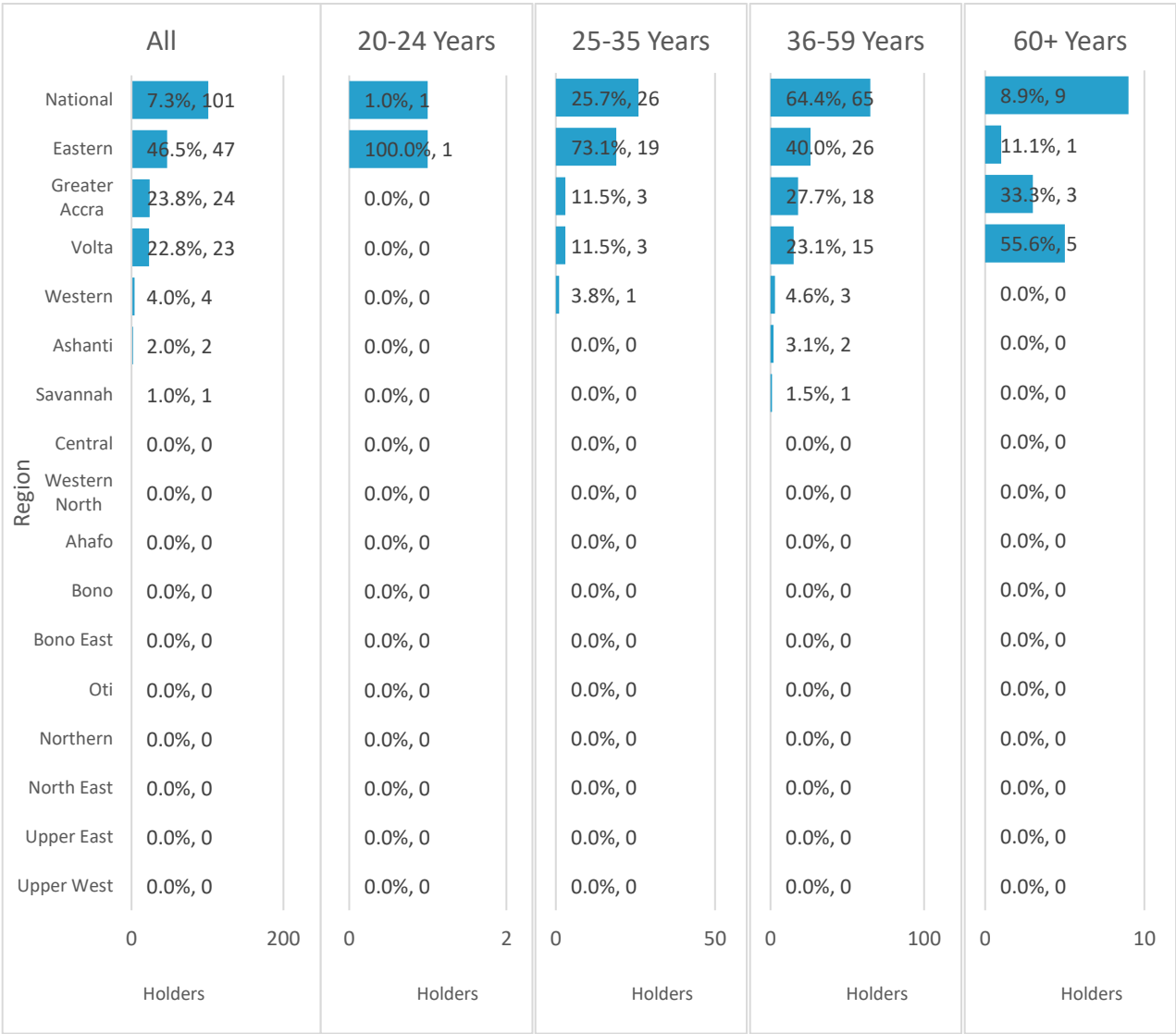
Ponds are the major production facilities as 1,176 (84.8%) out of a total of 1,386 aquaculture holders use pond in the production of fish. Aquaculture holders using ponds in Western North (23.9%), Western (18.5%), Ashanti (16.2%) and Central (11.4%) regions constitute about 70 percent. About seven in ten of pond aquaculture holders are aged 36 to 59 years old.

FIGURE 4. 3: AQUACULTURE POND HOLDERS 15 YEARS OR OLDER BY AGE AND REGION



Holders who use cage for production of fish are 101 out of 1,386, representing 7.3 percent. Eastern region dominates with 46.5 percent, followed by Greater Accra (23.8%) and Volta (22.8%) regions. All other regions accounted for 6.9 percent. Over six in ten (64.4%) of aquaculture cage holders are aged 36 to 59 years, out of which 90.8 percent are located in Eastern (40%), Greater Accra (27.7%) and Volta (23.1% regions).

FIGURE 4. 4: AQUACULTURE CAGE HOLDERS 15 YEARS OR OLDER BY AGE AND REGION

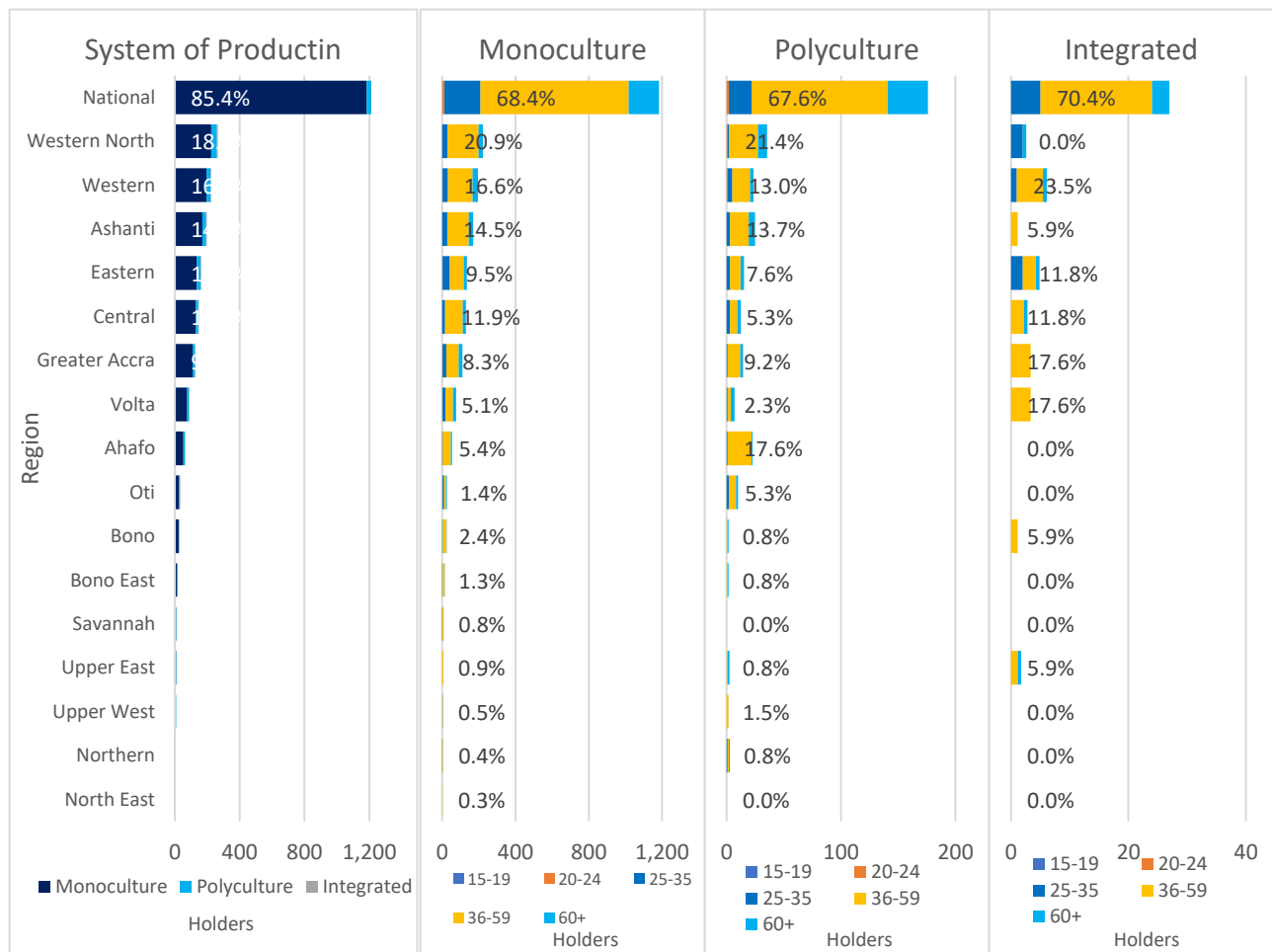


Age of Holders by System of Production

Monoculture is the predominant system of aquaculture production, with 85.4 percent of 1,386 holders using this system. Western North (18.9%), Western (16.5%), Ashanti (14.4%), Eastern (11.4%) and Central (10.9%) regions contribute more than seven out of ten (73.6%) of holders using monoculture.

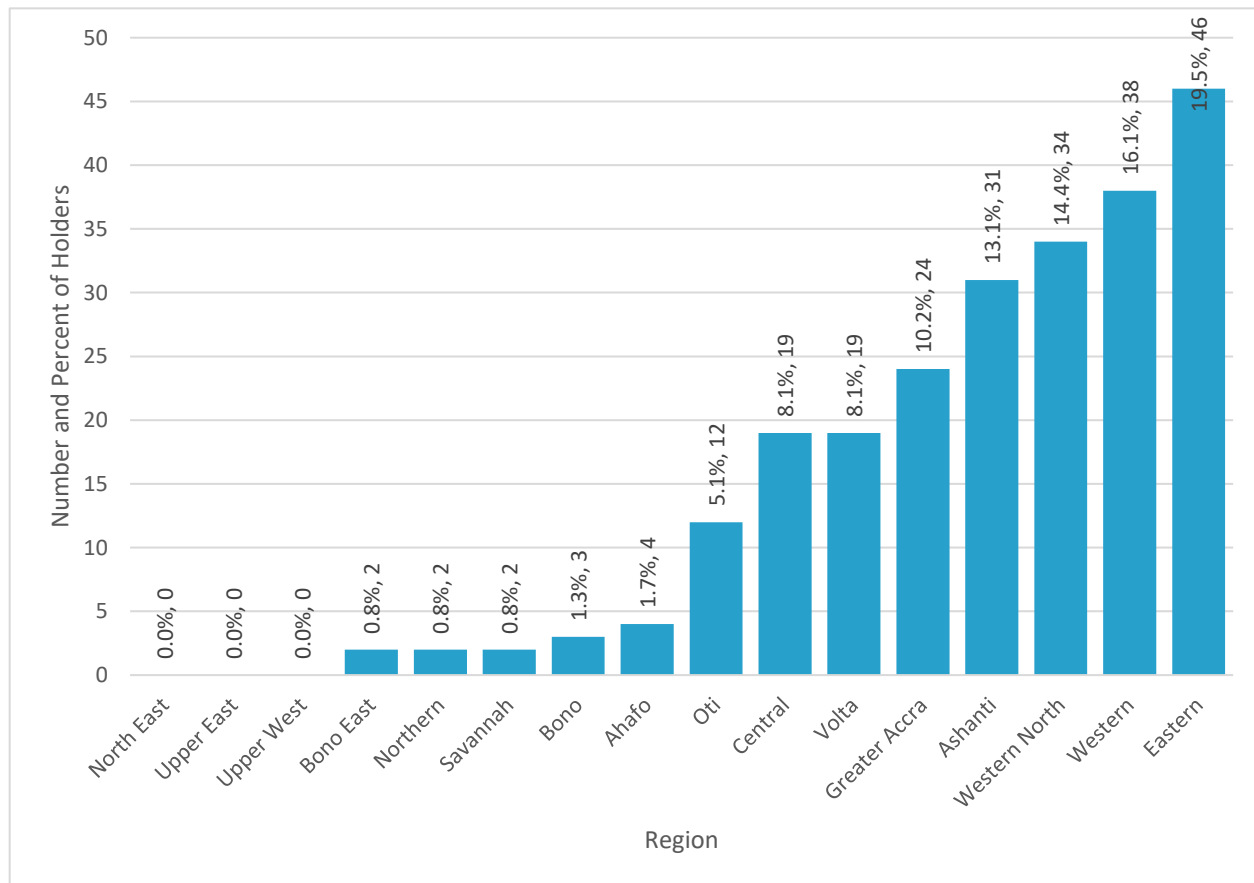
The integrated system of production is not common. Only 27 out of the 1,386 holders use the integrated system with a higher proportion (70.4%) of them being adults aged 36 years or older. Among the holders who use the integrated system, Western region has almost a quarter (23.5%) of those who are aged 36 to 59 years.

FIGURE 4. 5: AQUACULTURE HOLDERS 15 YEARS OR OLDER BY AGE, TYPE OF PRODUCTION SYSTEM AND REGION



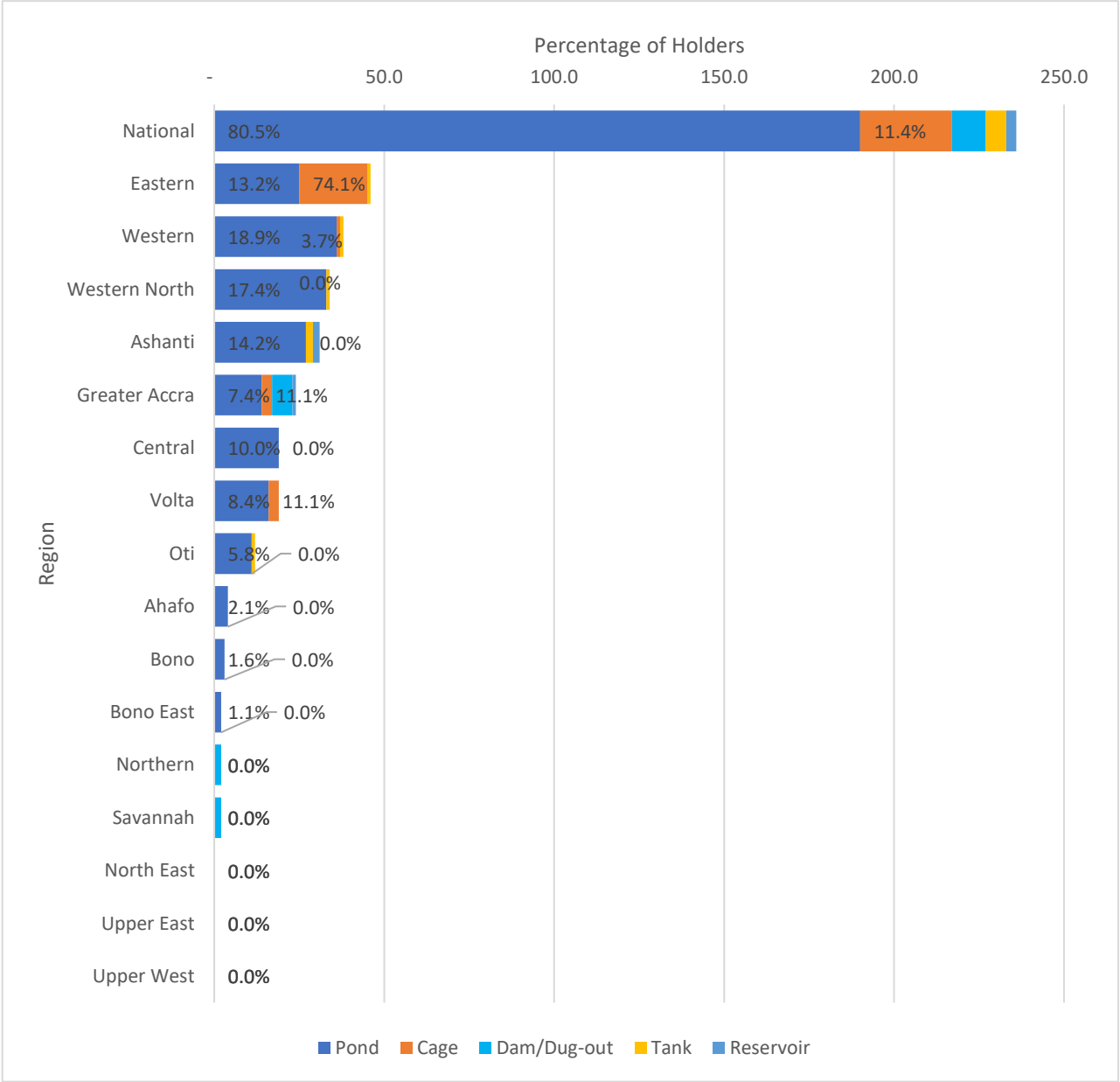
The youth population of holders who are into aquaculture is 236, with Eastern (19.5%), Western (16.1%), Western North (14.4%), Ashanti (13.1%), and Greater Accra (10.2%) regions contributing more than seven in ten (73.3%).

FIGURE 4. 6: DISTRIBUTION OF YOUTH (15-35YEARS) HOLDERS IN AQUACULTURE



Ponds and cages are the most (91.9%) common production facilities used by the youth, with the highest proportions in Eastern (19.1%), Western (15.7%), Western North (14.0%) and Ashanti (11.4%) regions.

FIGURE 4. 7: DISTRIBUTION OF AQUACULTURE YOUTH (15-35YEARS) HOLDERS BY PRODUCTION FACILITY

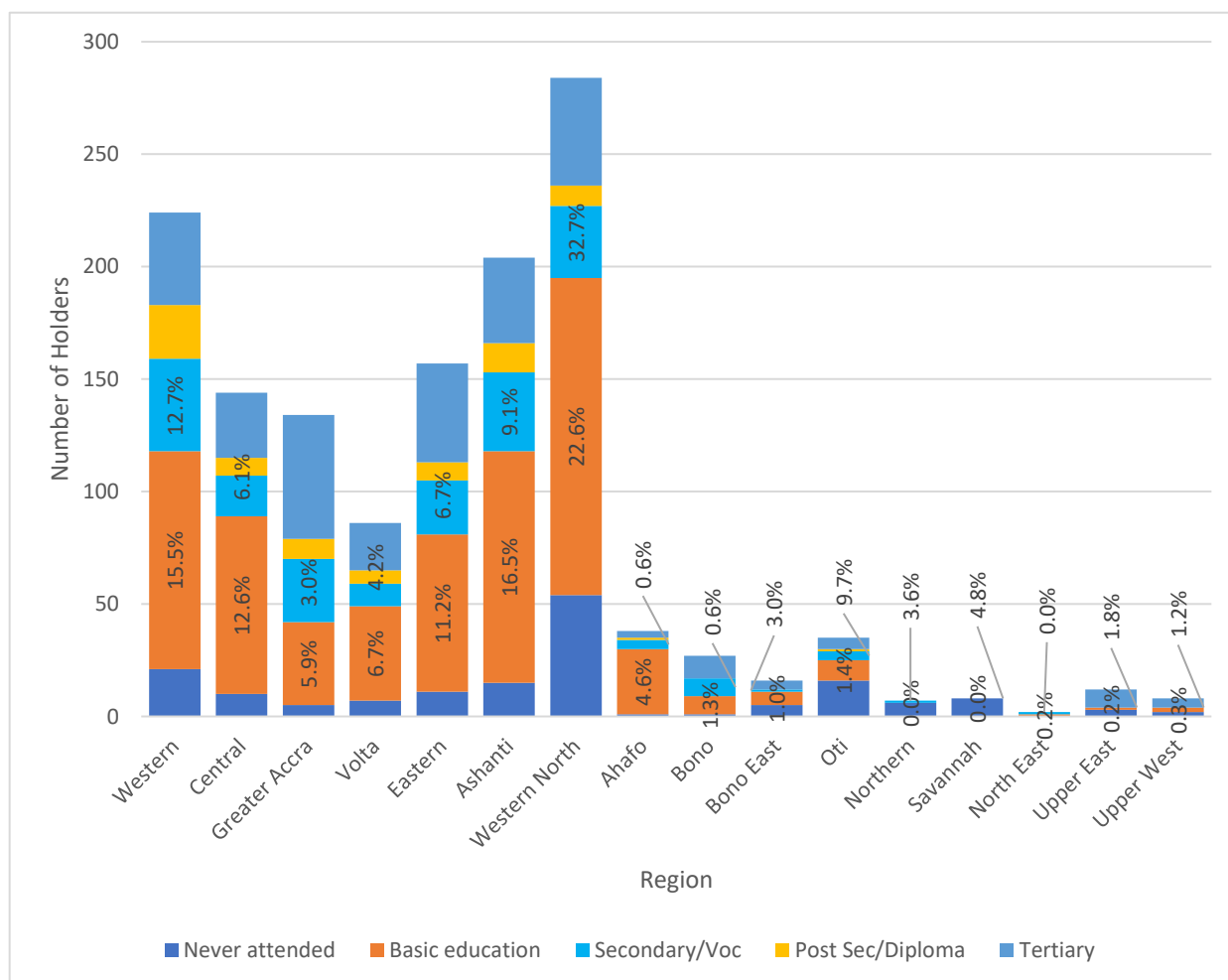


4.1.3 Educational Attainment of Holders

Educational Attainment of Holders by Production Facility

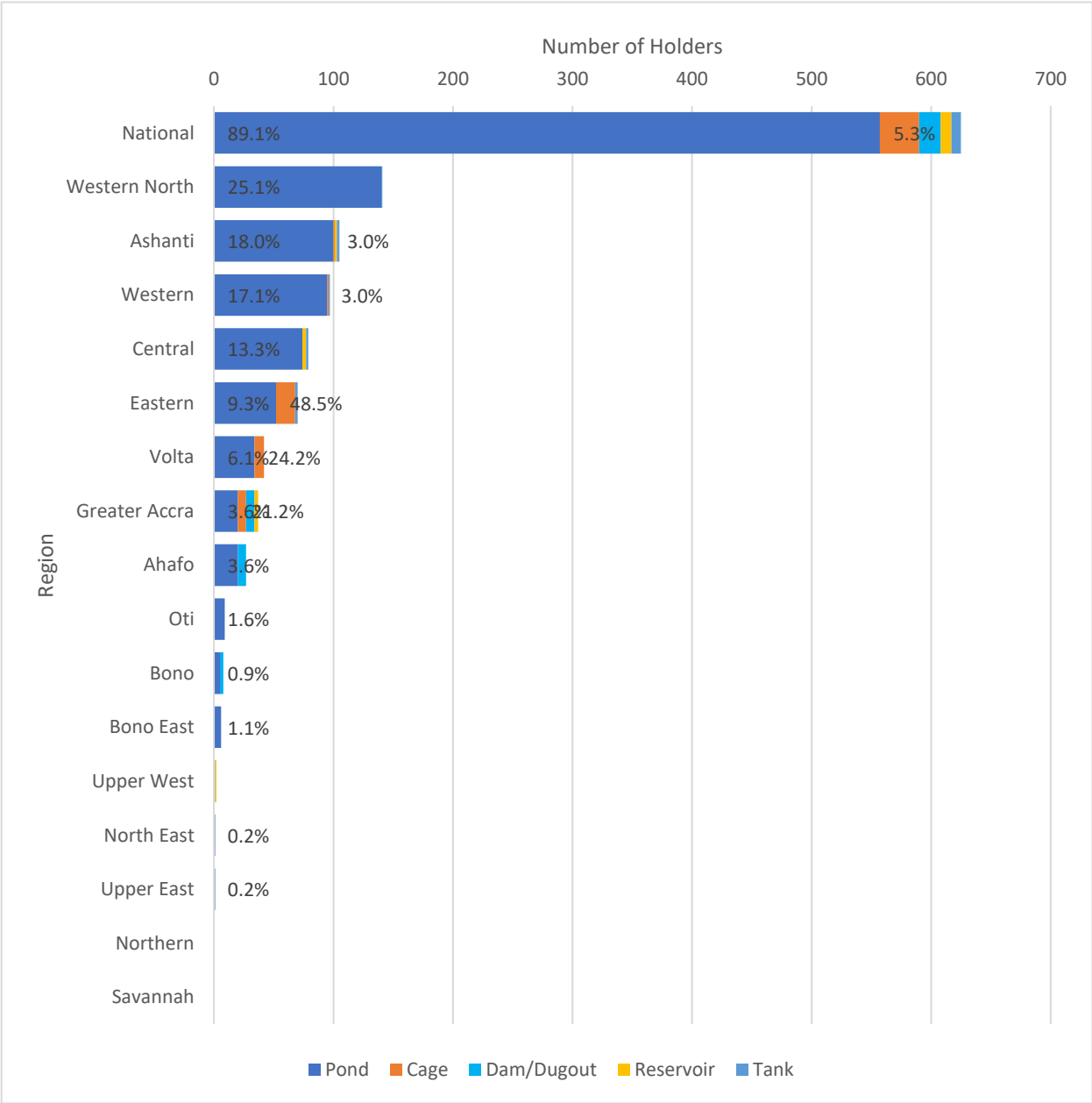
A little over one-tenth (11.9%) of holders have never attended school, with the majority of them in Western North (32.7%) and Western (12.7%) regions. The highest educational level attained by most holders is basic education (45.1%), of which majority are in Western North (22.6%), Ashanti (16.8%), Western (15.5%), Central (12.6%), and Eastern (11.2%) regions, together accounting for 78.7%.

FIGURE 4. 8: AQUACULTURE HOLDERS 15 YEARS OR OLDER BY EDUCATIONAL ATTAINMENT AND REGION



About nine in ten (89.1%) of holders who have attained basic education use ponds for aquaculture production and the highest proportion of them are from the Western North (25.1%), Ashanti (18.0%), Western (17.1%) and Central (13.3%) regions, which altogether contribute 73.4 percent.

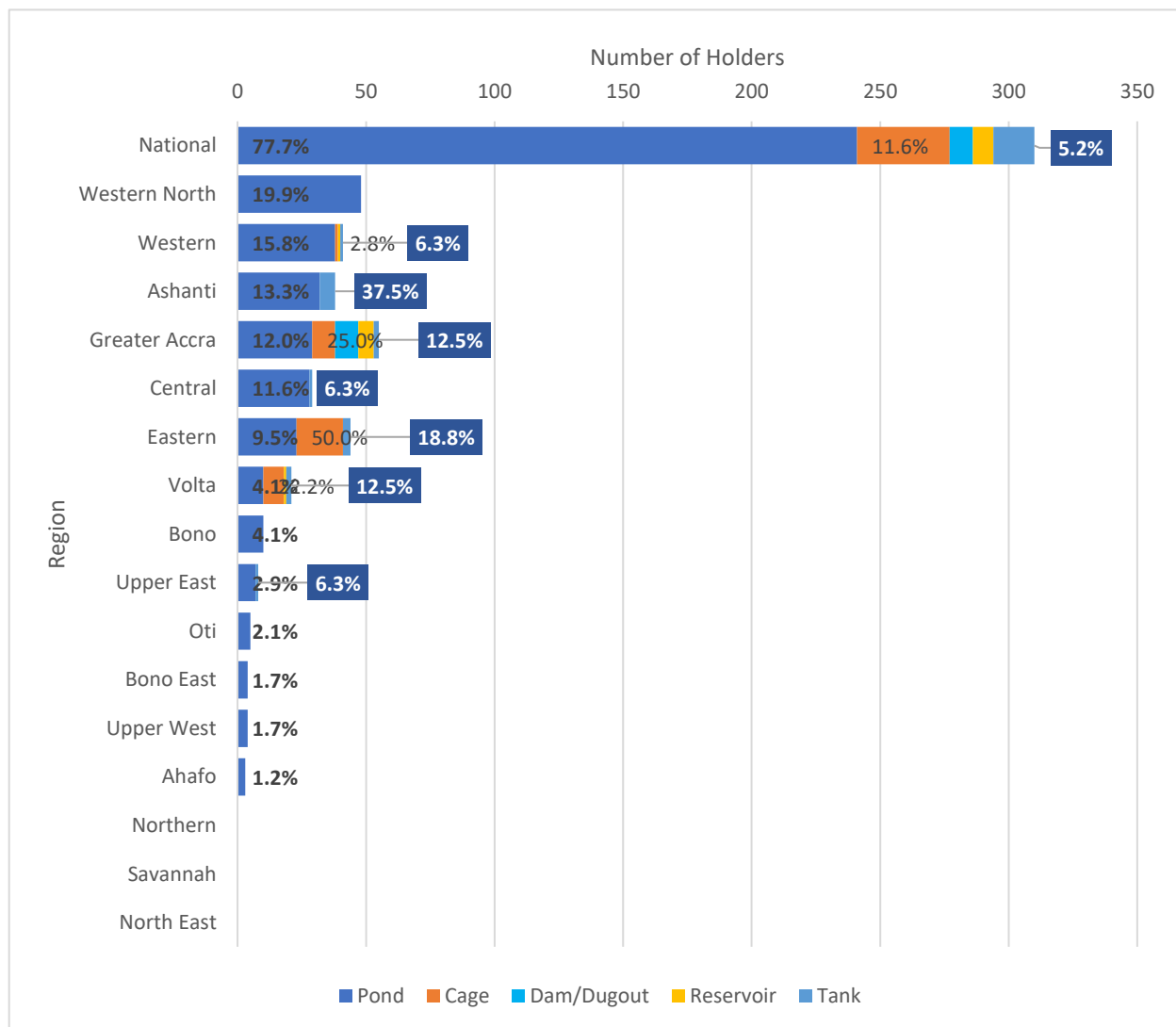
FIGURE 4. 9: AQUACULTURE HOLDERS 15 YEARS OR OLDER WITH BASIC EDUCATION BY TYPE OF HOLDING FACILITY AND REGION



About eight in ten (89.1%) of holders who have attained tertiary education use ponds for aquaculture production and the highest proportion of them are from the Western North (19.9%), Western (15.8%), Ashanti (13.3%) and Greater Accra (12%) regions, which altogether contribute 61 percent.

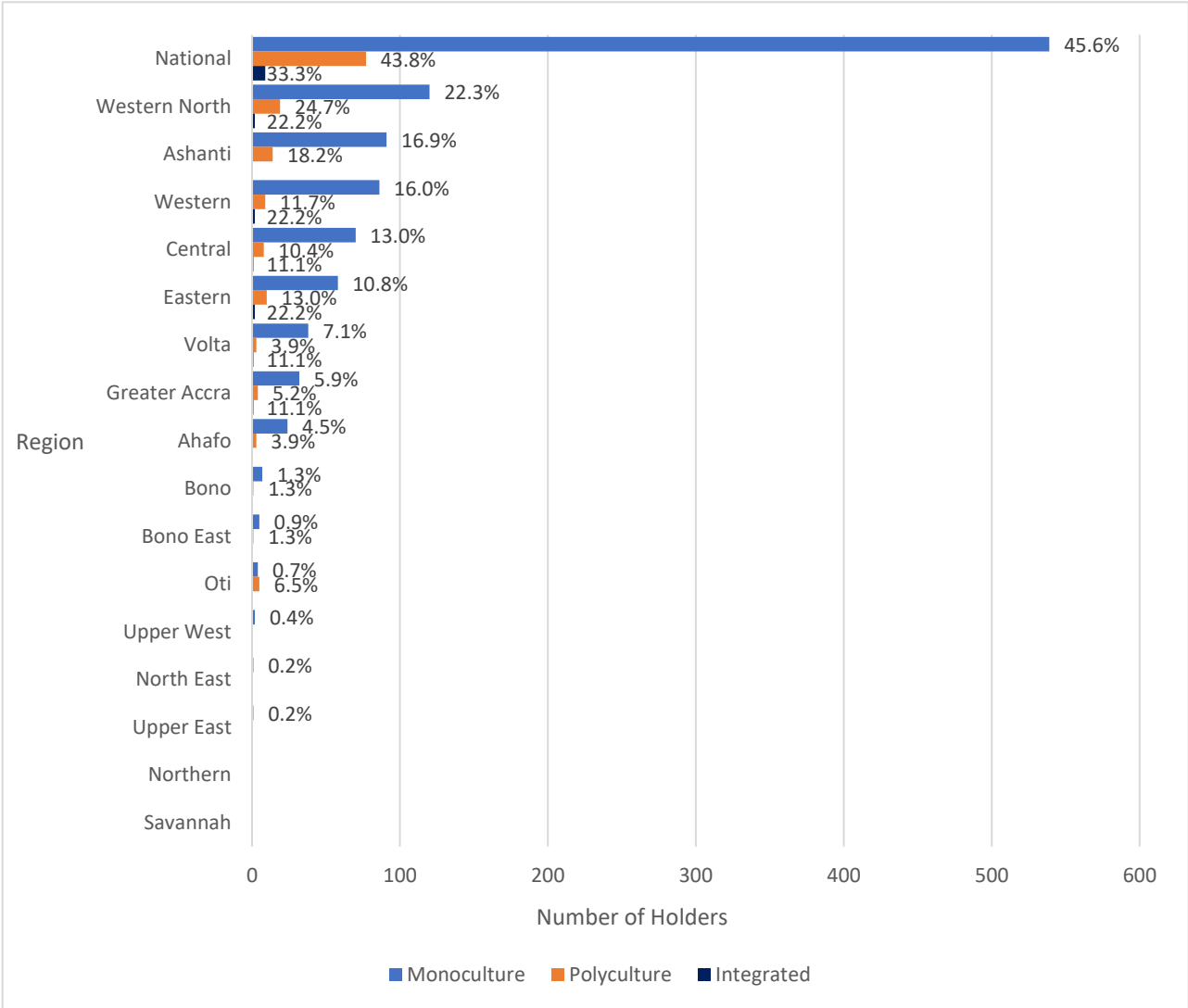
About one in twenty aquaculture holders who have attained tertiary education use tanks for fish production. Ashanti (37.5%) and Eastern (18.8%) account for 56.3 percent.

FIGURE 4. 10: AQUACULTURE HOLDERS 15 YEARS OR OLDER WITH TERTIARY EDUCATION BY TYPE OF HOLDING FACILITY AND REGION



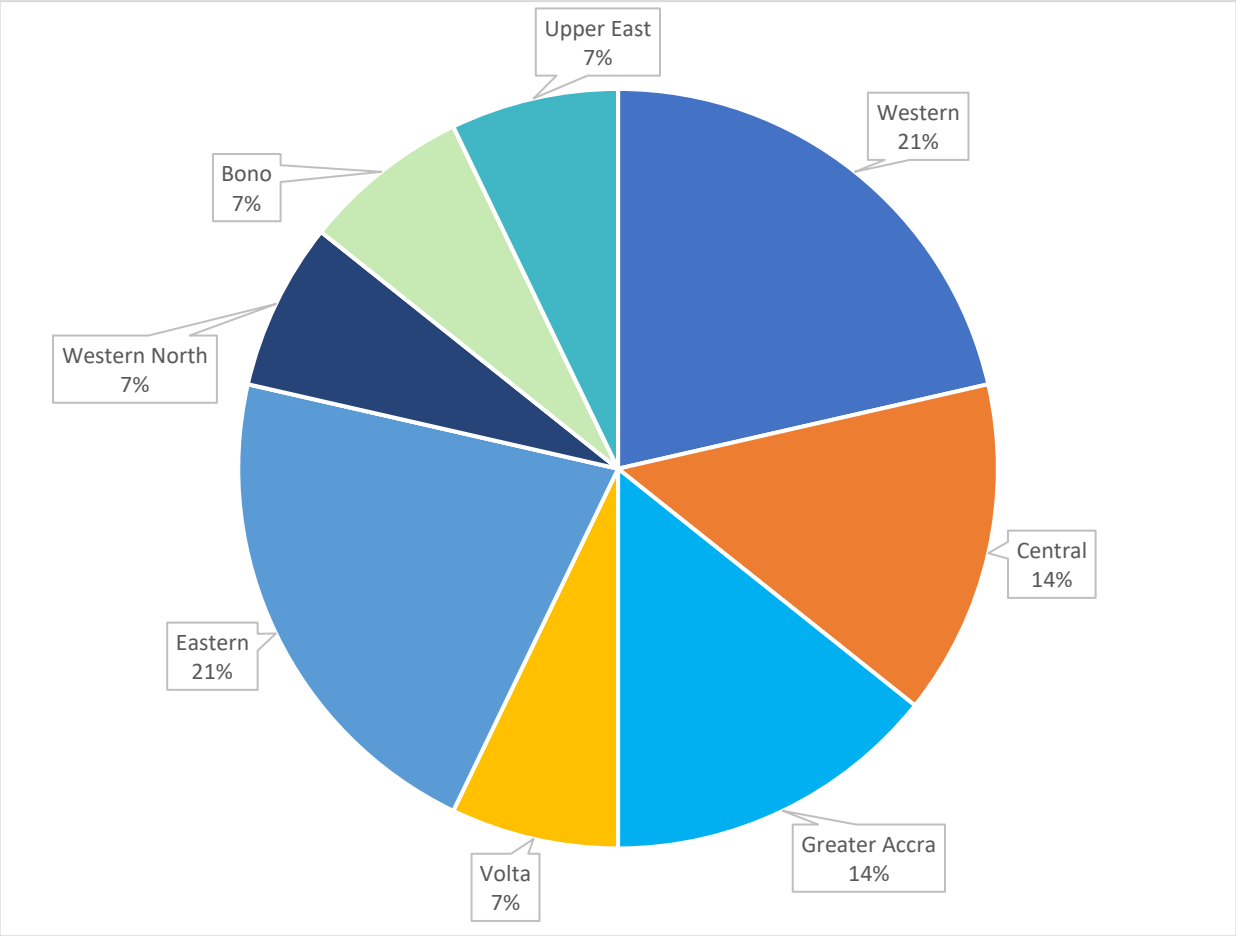
Basic education has been attained predominantly by holders engaged in monoculture (45.6%) and poly-culture (43.8%). Five regions; Western North (22.3%, 24.7%), Ashanti (16.9%, 18.2%), Western (16%, 11.7%), Central (13%, 10.4%) and Eastern (10.8%, 13%) contributed almost eight in ten of holders engaged in monoculture (78.8%) and polyculture (77.9%) respectively and have attained basic education.

FIGURE 4. 11: AQUACULTURE HOLDERS 15 YEARS OR OLDER WITH BASIC EDUCATION BY TYPE OF PRODUCTION SYSTEM AND REGION



Most holders using the integrated system of production have at least secondary education (51.8%) with the highest proportion (71.4%) of them residing in Western (21.4%), Eastern (21.4%), Greater Accra (14.3%) and Central (14.3%) regions.

FIGURE 4. 12: INTEGRATED SYSTEM AQUACULTURE HOLDERS 15 YEARS OR OLDER WITH SECONDARY EDUCATION AND ABOVE



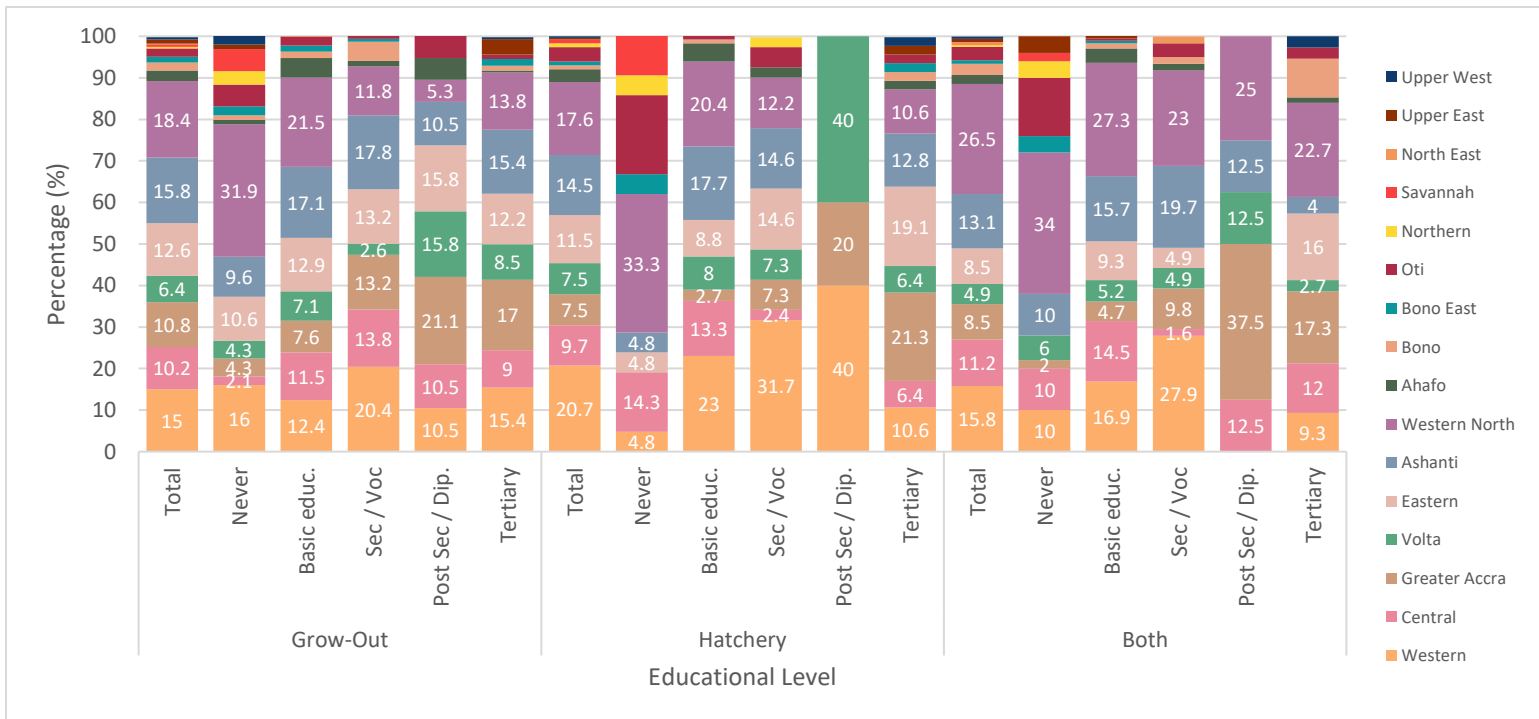
Educational Attainment of Holders by Aquaculture Establishment

Holders with basic education constitute the highest proportion of holders for all the types of aquaculture establishments, with Hatchery and Grow-out recording 49.8% and 42.9% respectively. Hatchery operators with basic education in four regions, Western (23.0%), Western North (20.4%), Ashanti (17.7%) and Central (13.3%) contributed more than seven in ten (74.3%).

Correspondingly, grow-out fish farmers in Western North (21.5%), Ashanti (17.1%), Eastern (12.9%), Western (12.4%) and Central (11.5%) regions contributed more than seven in ten (75.3%).

Basic education also dominates (47.0%) among holders who operate both hatchery and grow-out establishments, with the highest proportion being in Western North (27.3%), Western (16.9%), Ashanti (15.7%) and Central (14.5%) regions.

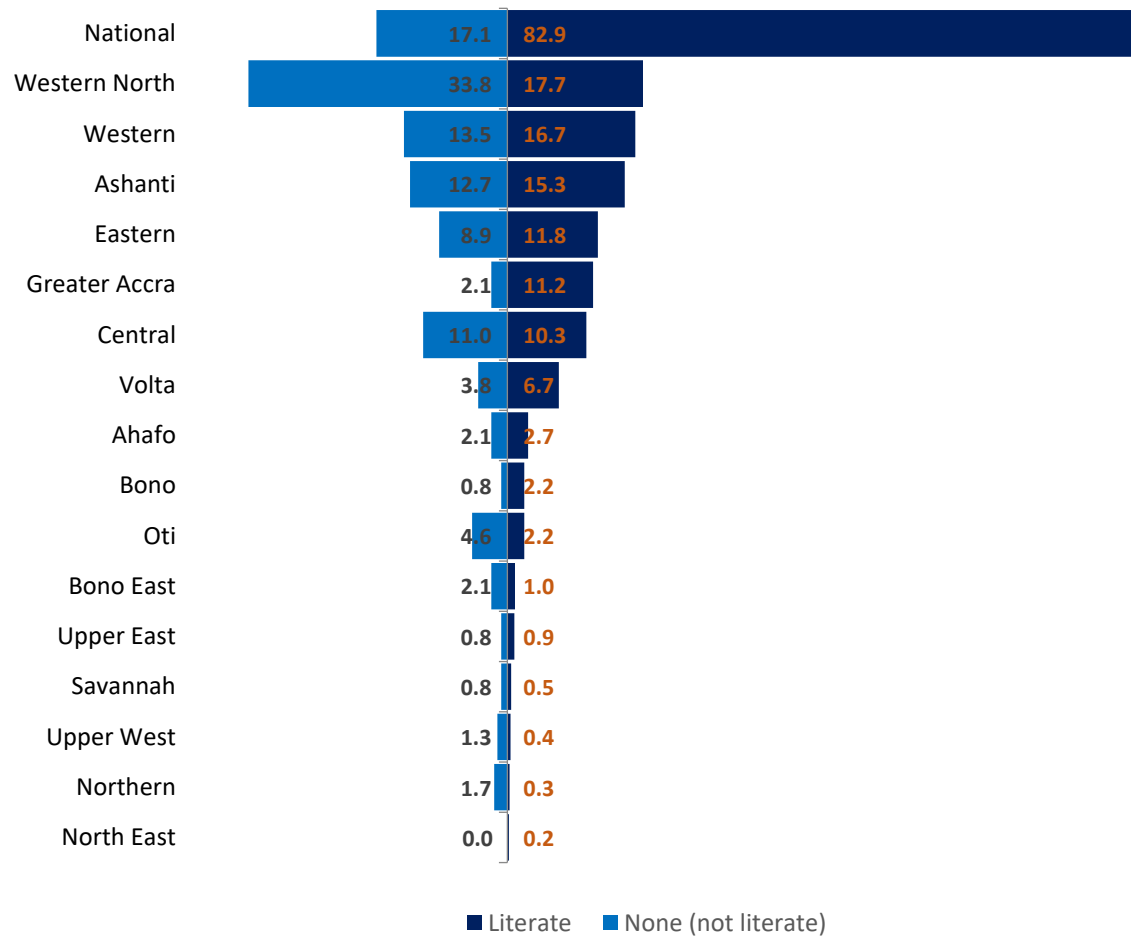
FIGURE 4. 13: EDUCATIONAL ATTAINMENT OF AQUACULTURE HOLDERS 15 YEARS OR OLDER BY TYPE OF PRODUCTION ESTABLISHMENT



4.1.4 Literacy Status of Holders

More than eight out of ten holders in aquaculture (82.9%) can read and write in at least one language with understanding. Six (6) regions, Western North (17.1%), Western (16.7%), Ashanti (15.3%), Eastern (11.8%), Greater Accra (11.2%) and Central (10.3%) constitute about 83.0% of aquaculture holders who are literate.

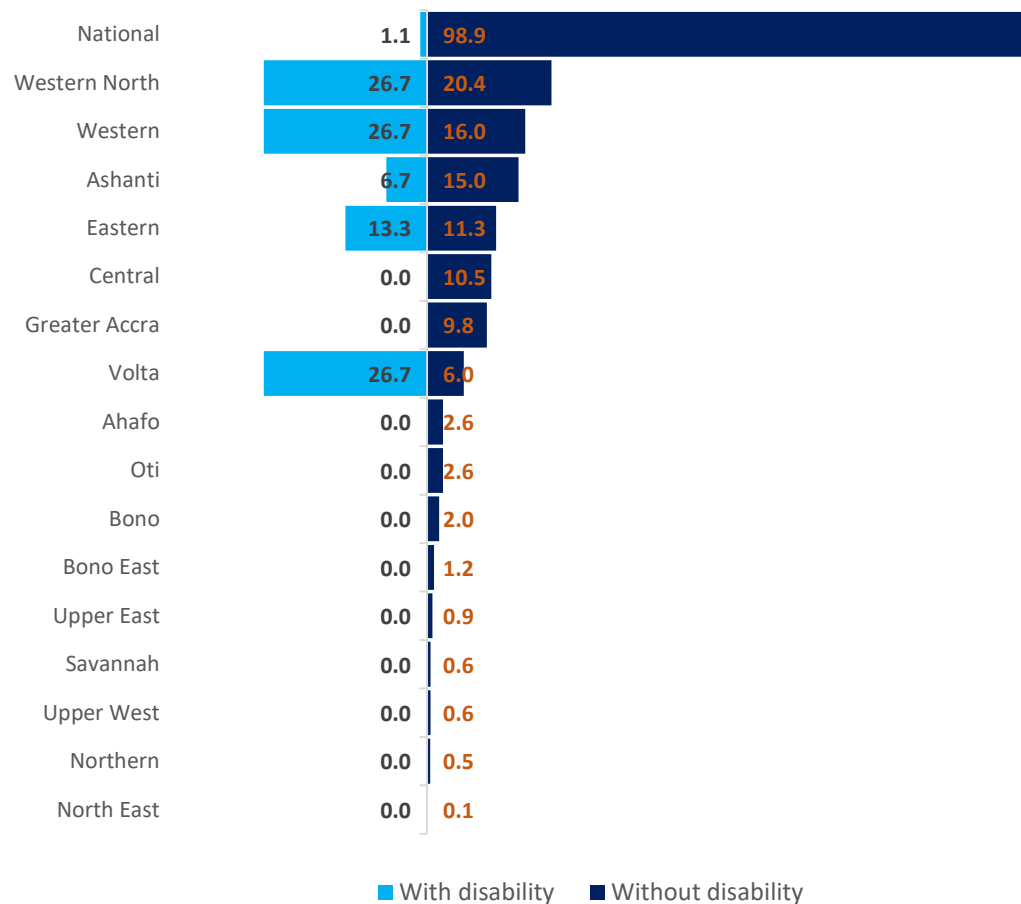
FIGURE 4. 14: LITERACY STATUS OF AQUACULTURE HOLDERS 15 YEARS OR OLDER BY REGION



4.1.5 Disability Status of Aquaculture Holders

The proportion of holders with disability who are into aquaculture is 1.1 percent and are mainly distributed across five regions; Western (26.7%), Volta (26.7%), Eastern (13.3%), Ashanti (6.7%) and Western North (26.7%).

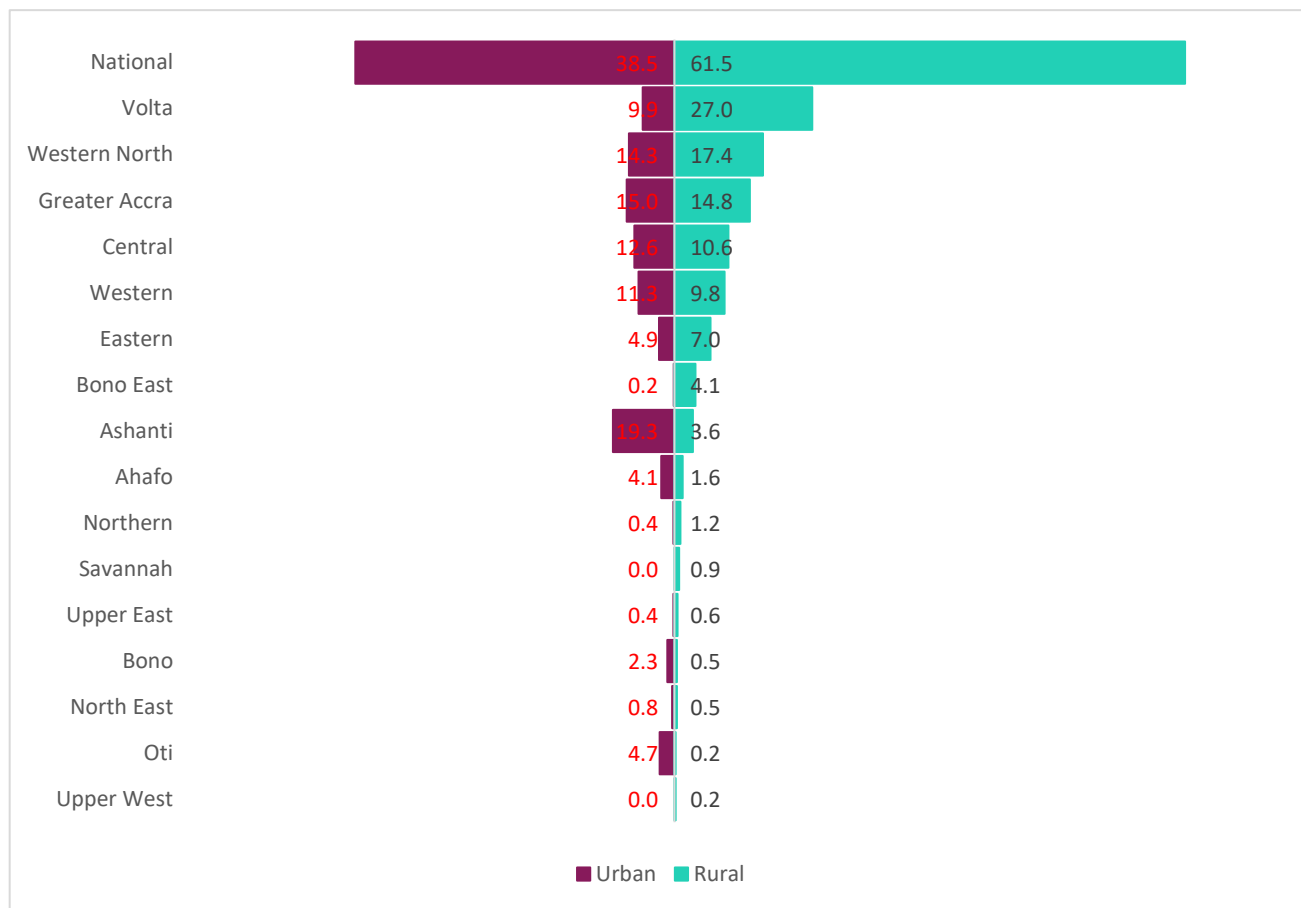
FIGURE 4. 15: DISABILITY STATUS OF AQUACULTURE HOLDERS 15 YEARS OR OLDER



4.1.6 Locality of Aquaculture Holders

There are more aquaculture holders in the rural (62%) than in the urban areas (38%). This pattern is observed for most of the regions except Greater Accra, Bono, Ahafo and Bono East where the reverse occurs. Western North (27%), Western (17%) and Ashanti (15%) regions constitute about 60% of aquaculture holders in rural areas.

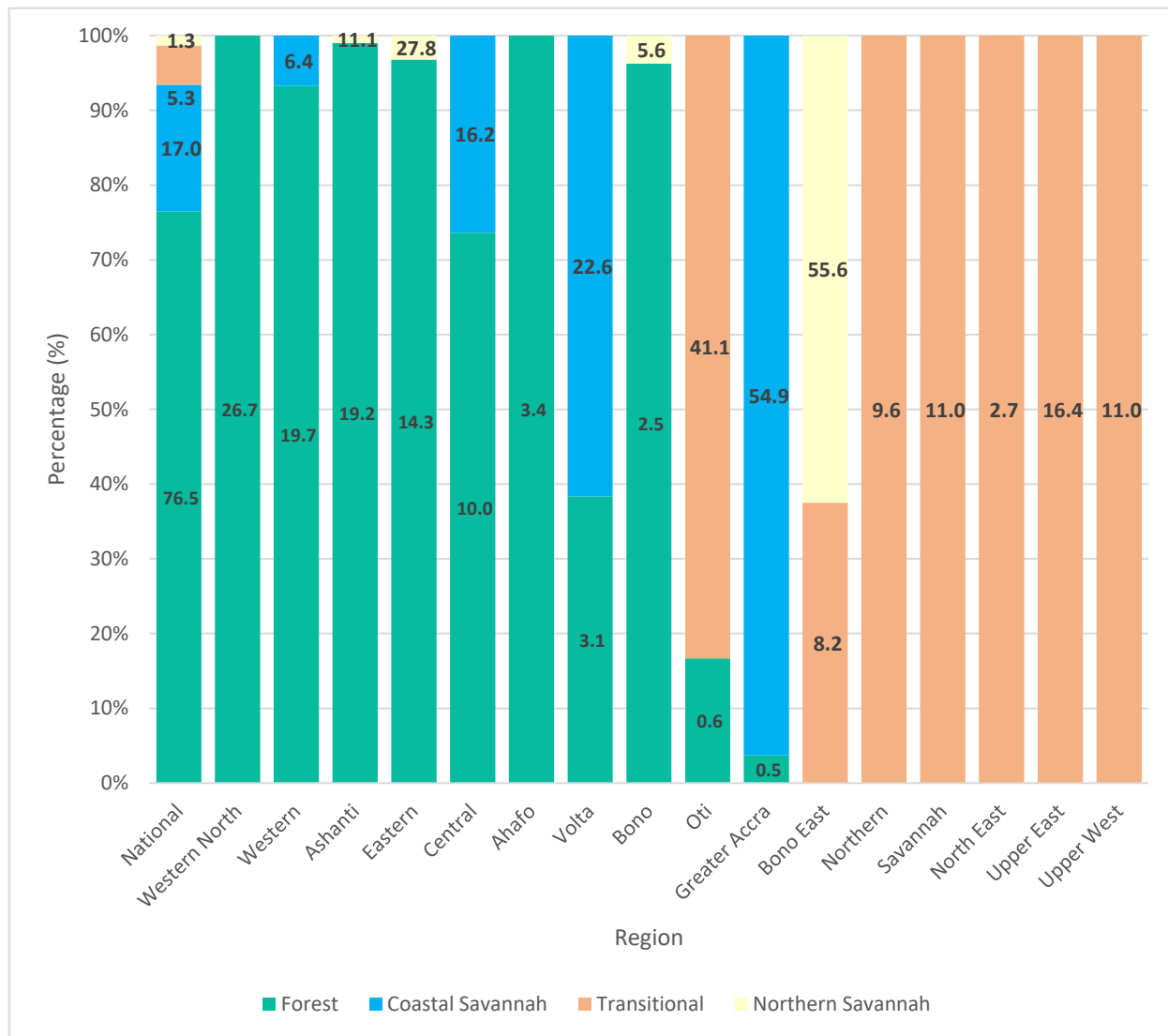
FIGURE 4. 16: LOCALITY OF AQUACULTURE HOLDERS



4.1.7 Holders in Agro-Ecological Zones

Aquaculture holders are mostly in the forest zone (76.5%) cultivating mainly tilapia with the highest proportion being in Western North (26.7%).

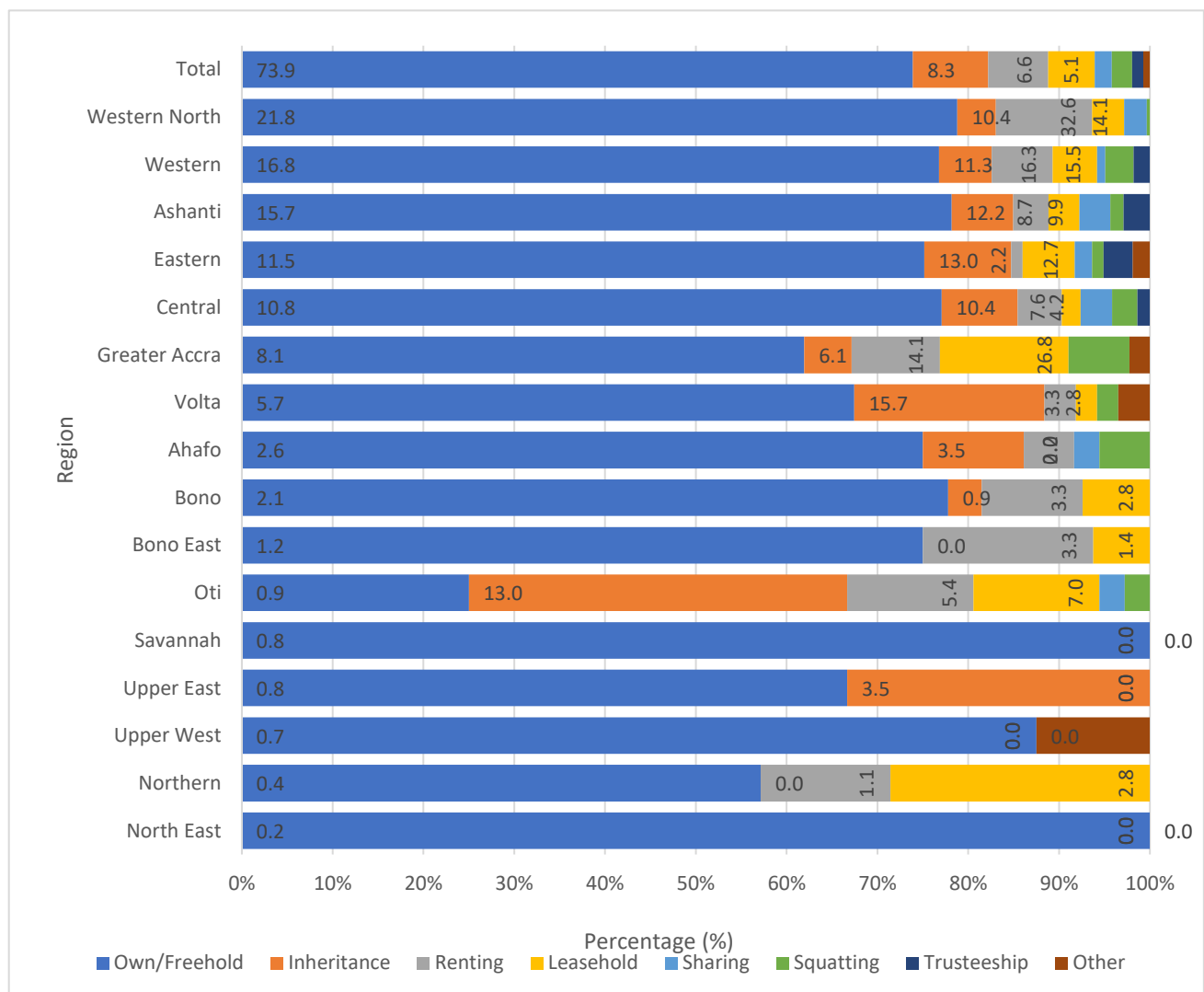
FIGURE 4. 17: AQUACULTURE HOLDERS 15 YEARS OR OLDER BY AGRO-ECOLOGICAL ZONE AND REGION



4.1.8 Land Tenure Arrangement

Majority of aquaculture holders own (73.9%) or have inherited (8.3%) the holding. The other tenure arrangements are renting (7%) and leasehold (5%). Renting is common in Western North (32.6%) region while leasehold is practised by about a quarter (26.6%) of holders located in Greater Accra region.

FIGURE 4. 18: AQUACULTURE HOLDERS 15 YEARS OR OLDER BY TYPE OF LAND TENURE AGREEMENT AND BY REGION



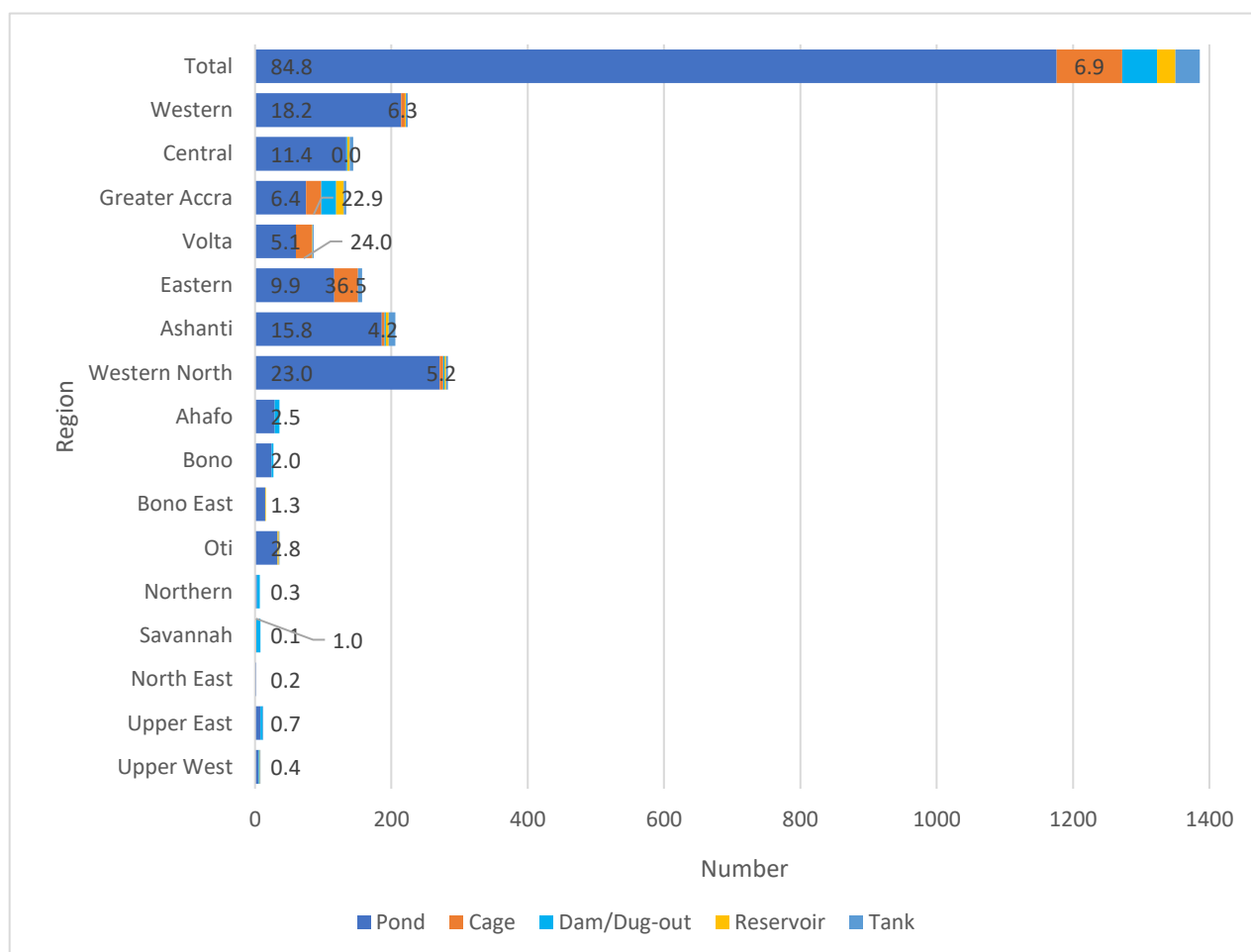
4.2 CORRELATES

4.2.1 Aquaculture Holders by Production Facility, System of Production, Sex and by Region

The use of pond by holders is predominant in aquaculture production as 84.8% use it as production facility. About 60% of pond aquaculture holders are in Western North (23%), Western (18.2%) and Ashanti (15.8%) regions.

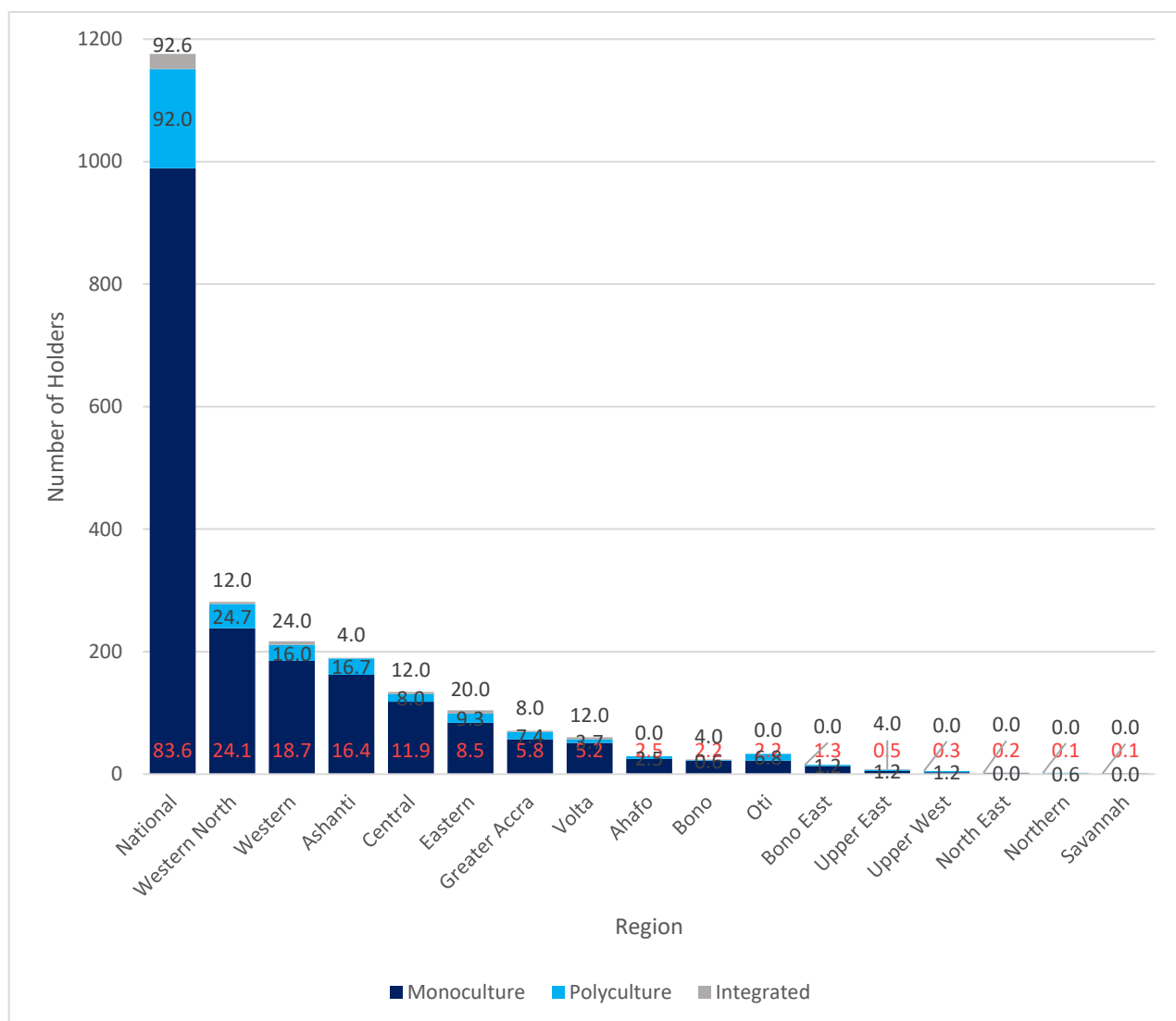
Use of cage (6.9%) is predominant in Eastern (36.5%), Greater Accra (22.9%), and Volta (24%).

FIGURE 4. 19: AQUACULTURE HOLDERS 15 YEARS OR OLDER BY PRODUCTION FACILITY AND BY REGION



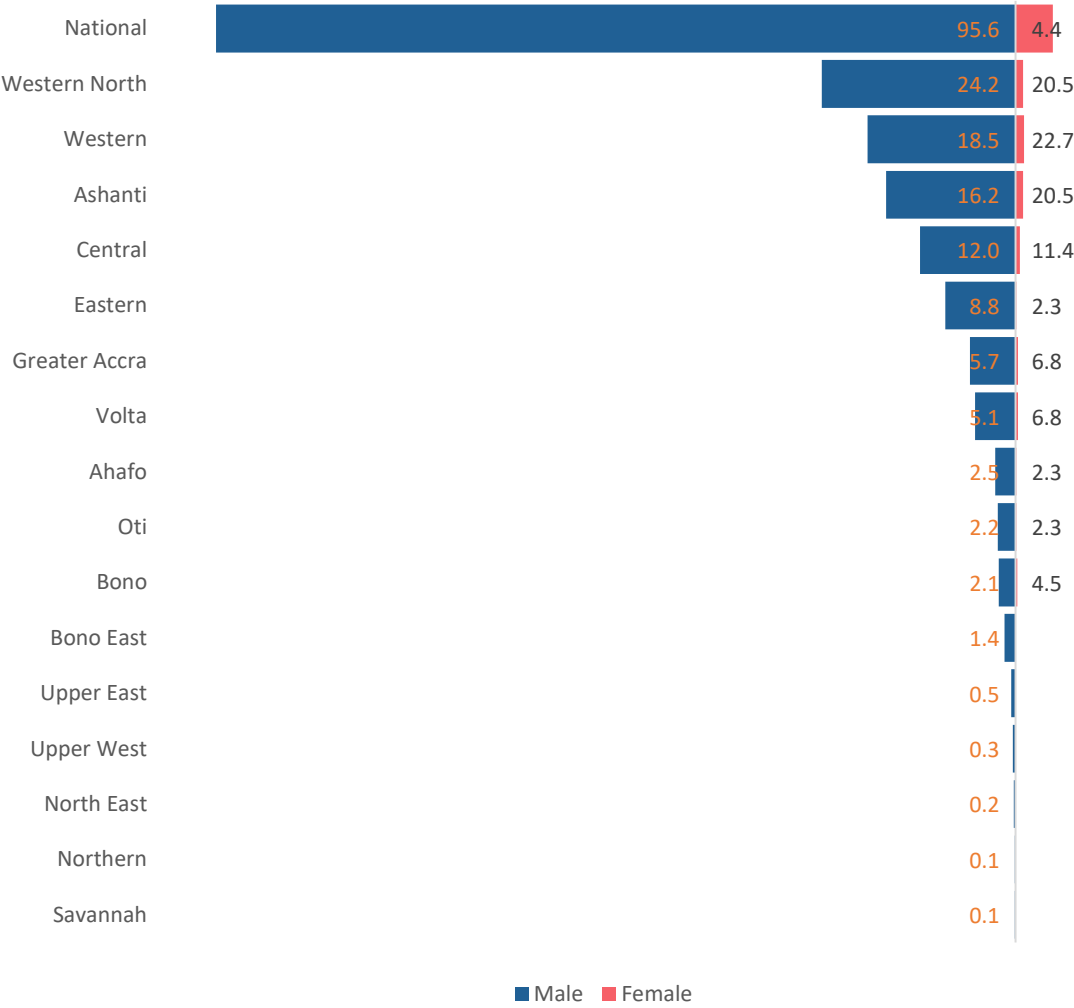
The use of pond is popular among the three production systems of monoculture (83.6%), polyculture (92%) and integrated (92.6%). Three regions, Western (18.7%, 16.0%, 24.0%), Ashanti (16.4%, 16.7%, 4.0%) and Western North (24.1%, 24.7%, 12.0%) have contributed significantly to the pond monoculture, polyculture and integrated systems respectively.

FIGURE 4. 20: POND AQUACULTURE HOLDERS BY SYSTEM OF PRODUCTION BY AND REGION



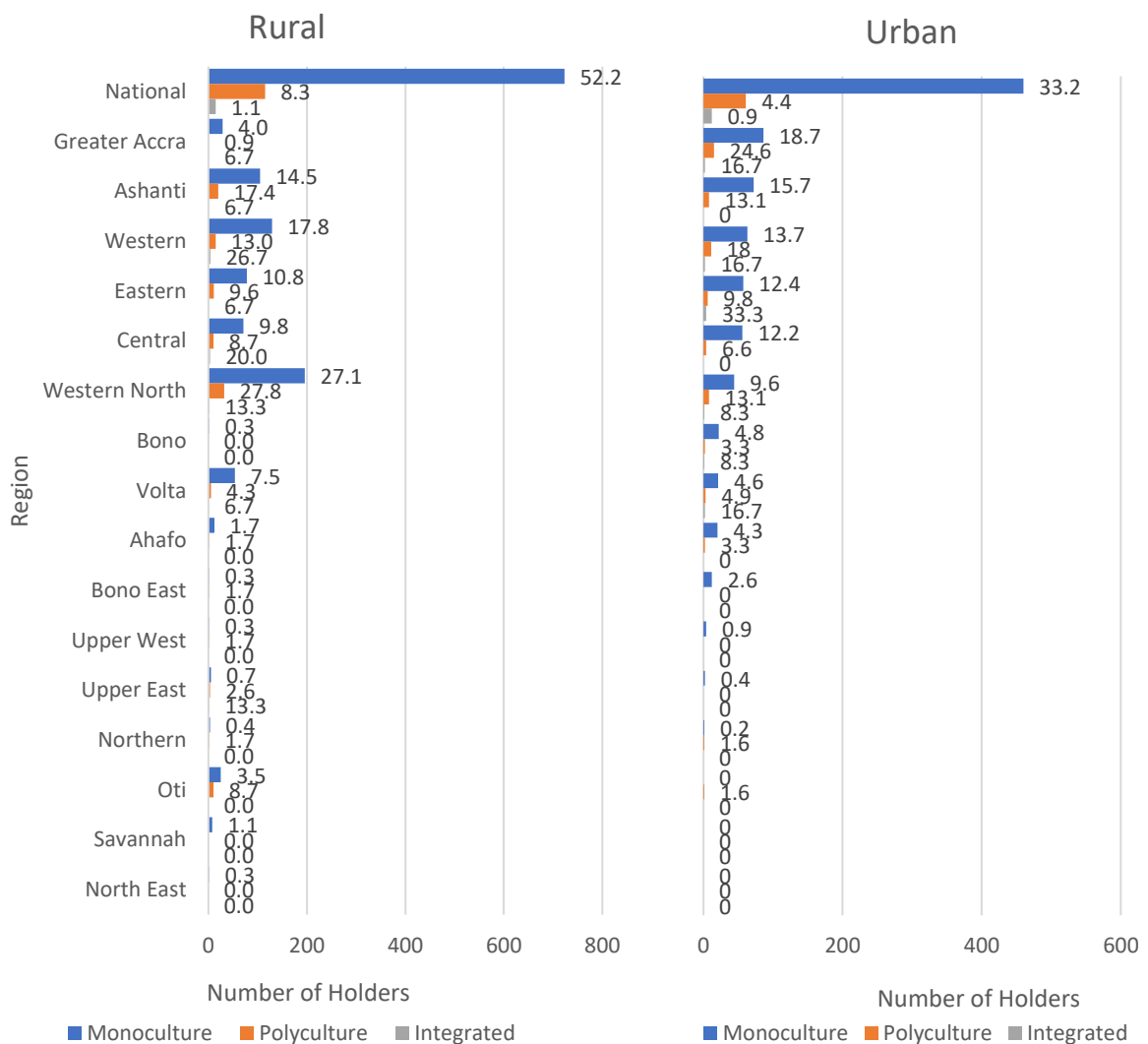
More than nine in ten (95.6%) of aquaculture holders who use ponds for fish production are males. Western North (24.2%), Western (18.5%), Ashanti (16.2%) regions contribute about 60 percent (58.9%) to the male monoculture pond holders. Females of the same regions contribute 20.5%, 22.7% and 20.5% respectively to the monoculture pond holders.

FIGURE 4. 21: DISTRIBUTION OF POND MONOCULTURE HOLDERS AGED 15 YEARS OR OLDER BY SEX AND REGION



Majority of aquaculture holders who practice monoculture (85.4%) are in rural areas (52.2%), while 33.2 percent are in the urban areas. Western North region has the highest number of aquaculture holders who engage in monoculture (27.1%) and polyculture (27.8%) in rural areas while Western region has the highest number of holders who engage in integrated (26.7%) fish farming in rural areas.

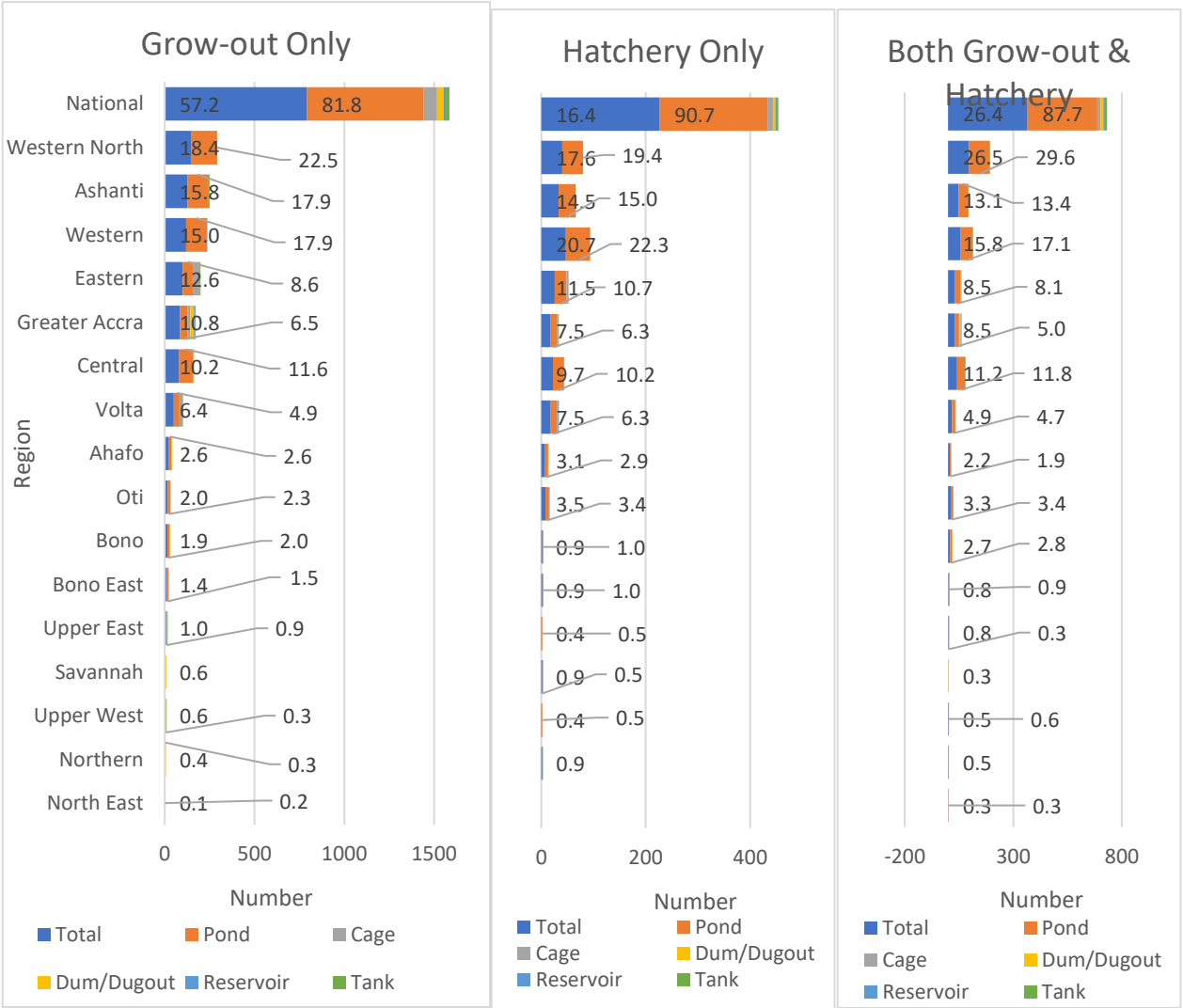
FIGURE 4. 22: AQUACULTURE HOLDERS 15 YEARS OR OLDER LOCALITY, BY SYSTEM OF PRODUCTION AND BY REGION



About six in ten (57.2%) out of 1,386 aquaculture holders engage in grow-out production only. Western North (18.4%), Ashanti (15.8%) and Western (15.0%) regions together contribute almost half (49.2%) of aquaculture holders who engage in grow-out only.

More hatchery operators (90.7%) use ponds compared to grow-out holders (81.8%).

FIGURE 4. 23: AQUACULTURE HOLDERS 15 YEARS OR OLDER BY TYPE OF PRODUCTION FACILITY, PRODUCTION ESTABLISHMENT AND BY REGION

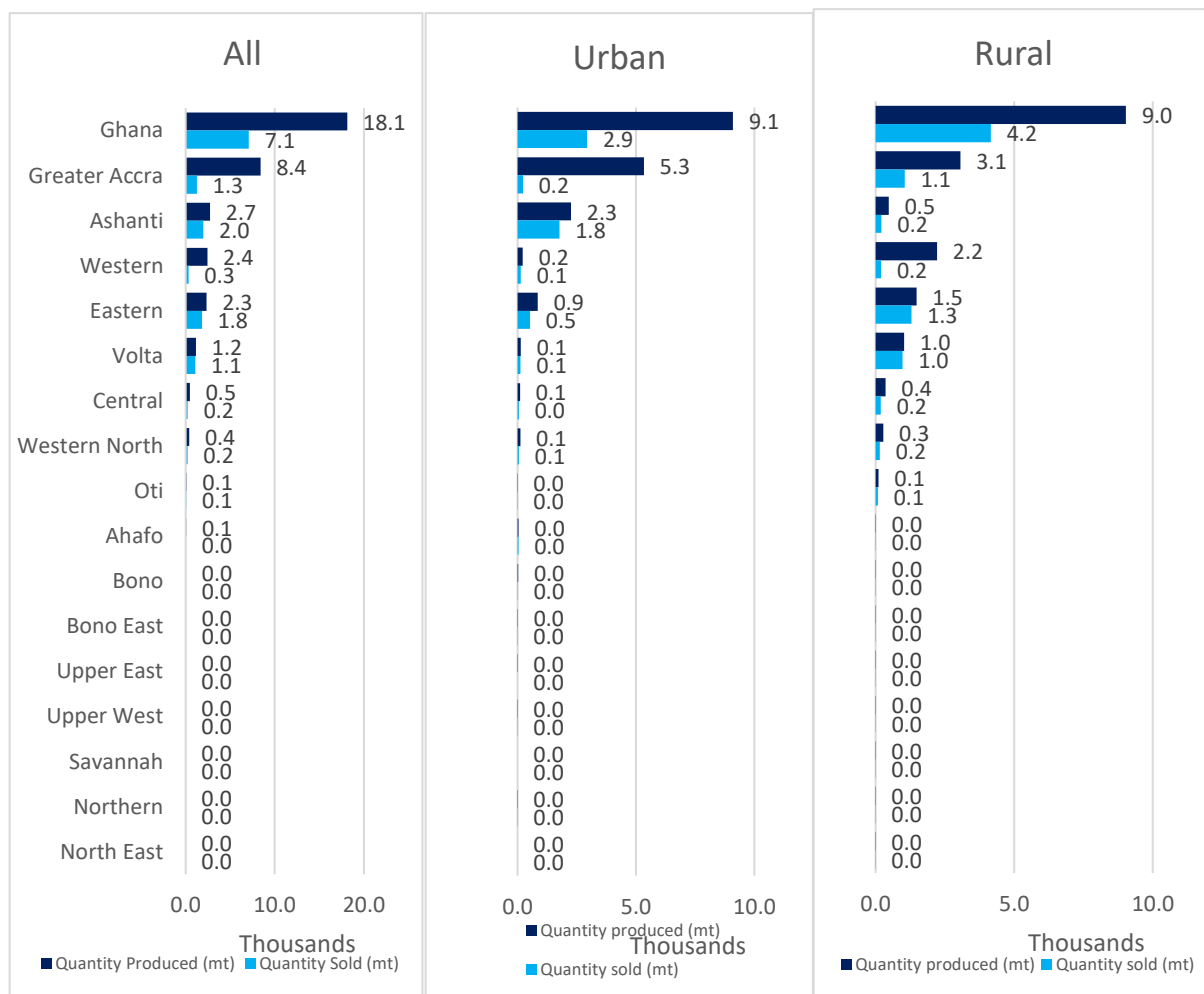


4.2.2 Fish Production and Sales by Type of Locality and Region

Out of the total of 18,134,477 metric tons of fish produced, Greater Accra alone accounts for almost half (46.3%). Production from both urban (50.2%) and rural (49.8%) areas are almost the same.

About 40% of the total production was sold. Ashanti (38.0%), Eastern (25.6%), Volta (15.4%) and Greater Accra (18.0) regions had the highest proportions. Holders in rural areas sold more of their produce (58.6%) than their urban counterparts (41.4%). Eastern (31.1%), Volta (23.3%), and Greater Accra (25.3%) regions dominate the proportions of fish sold in the rural areas.

FIGURE 4. 24: FISH PRODUCTION AND SALES BY TYPE OF LOCALITY AND REGION

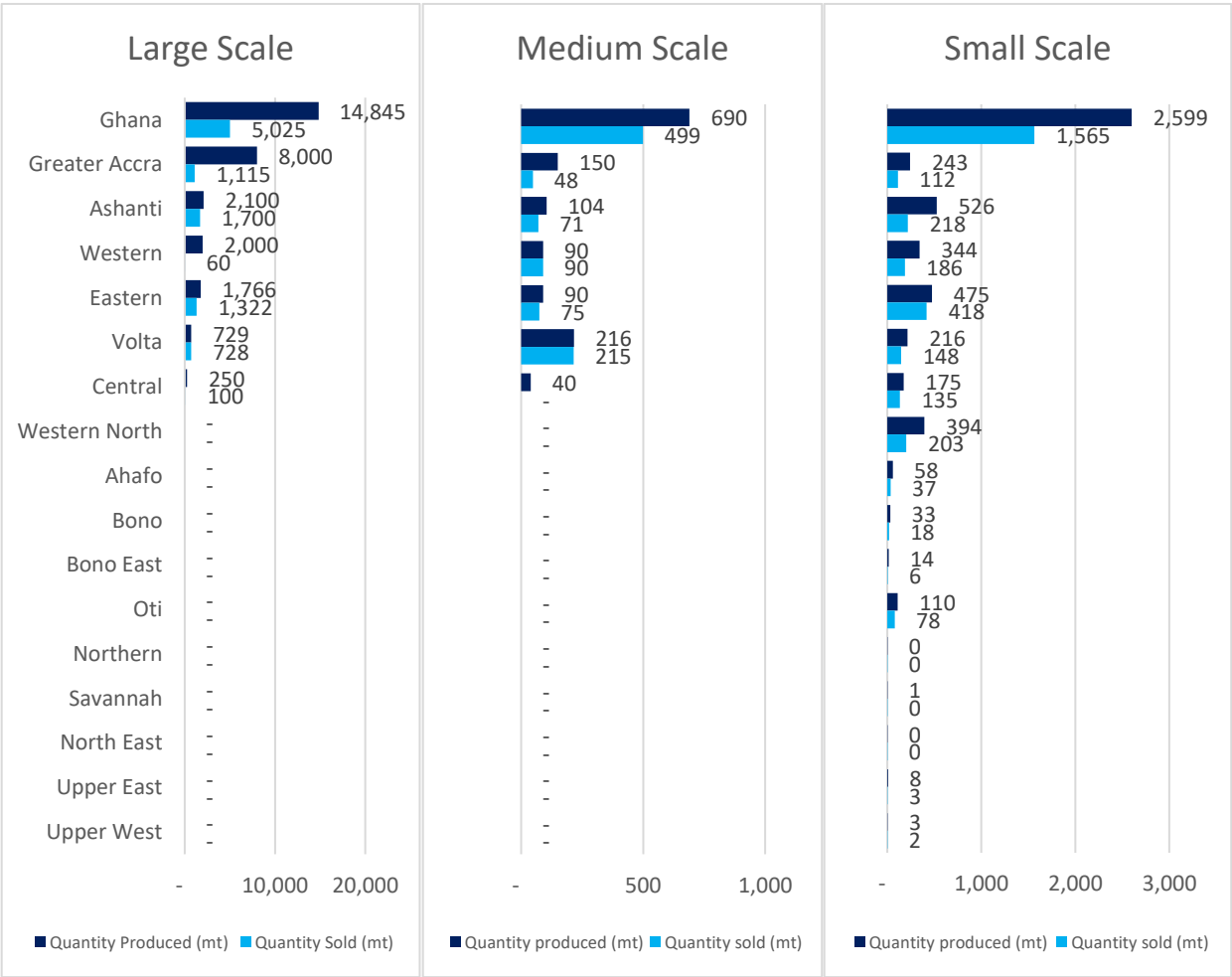


Small-scale holders produced 14.3% of the total production. Medium and large-scale holders produced only tilapia species and produced 3.8% and 81.9% of the total production respectively.

Medium and small-scale holders sold much higher proportions (72.2% and 60.2% respectively) of their produce compared to large-scale holders (33.9%).

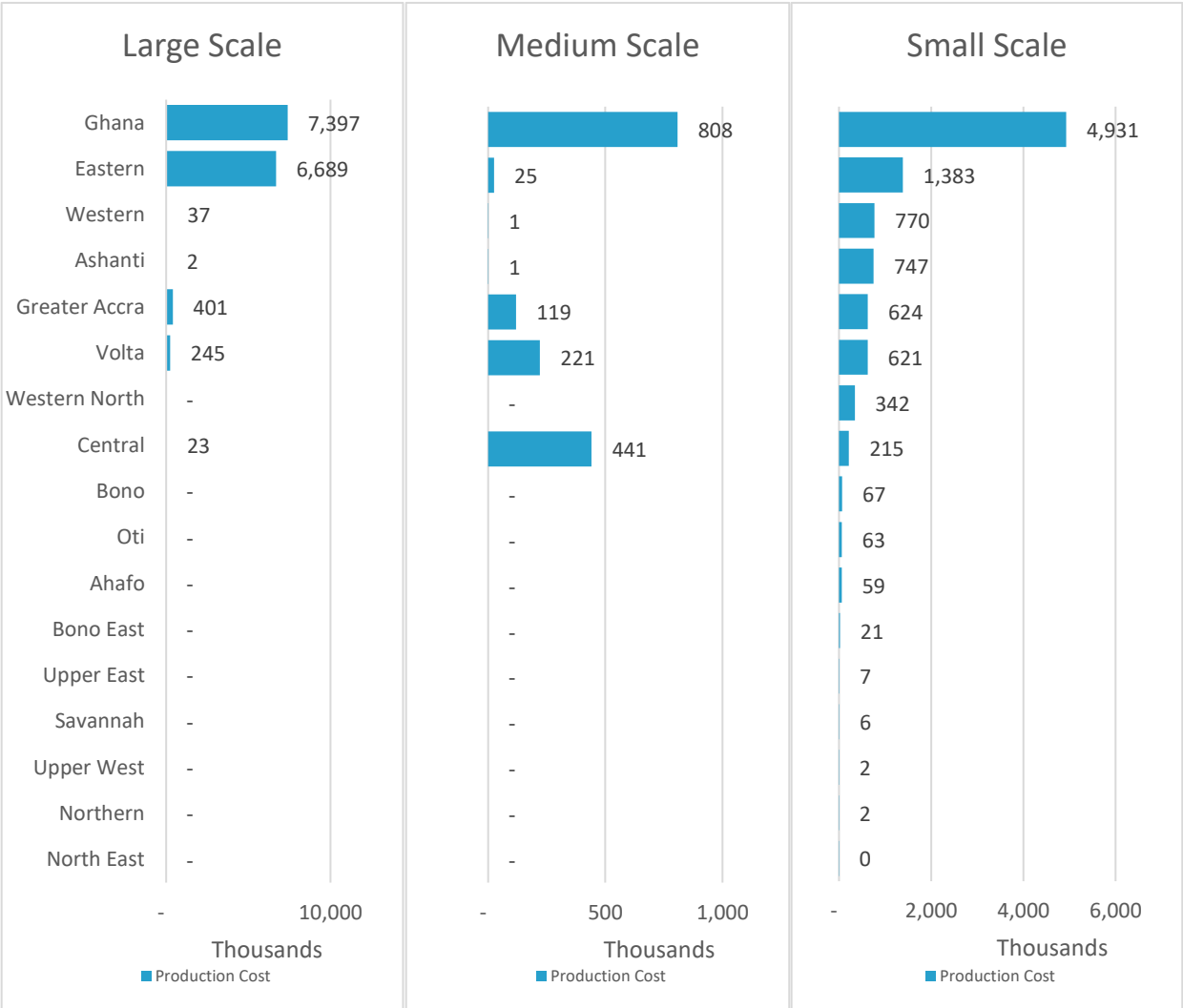
For small-scale, Ashanti contributed to 20.2 % and 13.9% of the total quantity produced and sold respectively. For medium-scale, Volta contributed 31.3% (production) and 43.1% (sold). For large-scale, Greater Accra's contribution to production and sales was 53.9% and 22.2% respectively.

FIGURE 4. 25: FISH PRODUCTION AND SALES BY SCALE OF PRODUCTION AND REGION



The total operational cost of production was about GH¢13.1 million of which 56.3 percent was incurred by large-scale holders. More than one-third (37.5%) of the total cost was borne by small-scale holders while only 6.2 percent was incurred by medium-scale holders. With 56.3% cost incurred by large-scale holders, Eastern incurred 90.4%, Greater Accra (5.4%), and Volta (3.3%). For small-scale holders, Eastern (28.1%), Western (15.6%), Ashanti (15.2%) regions incurred most of the cost. Also, for medium-scale holders, Central (54.6%), Volta (27.4%) Greater Accra (14.7%) regions incurred most of the cost.

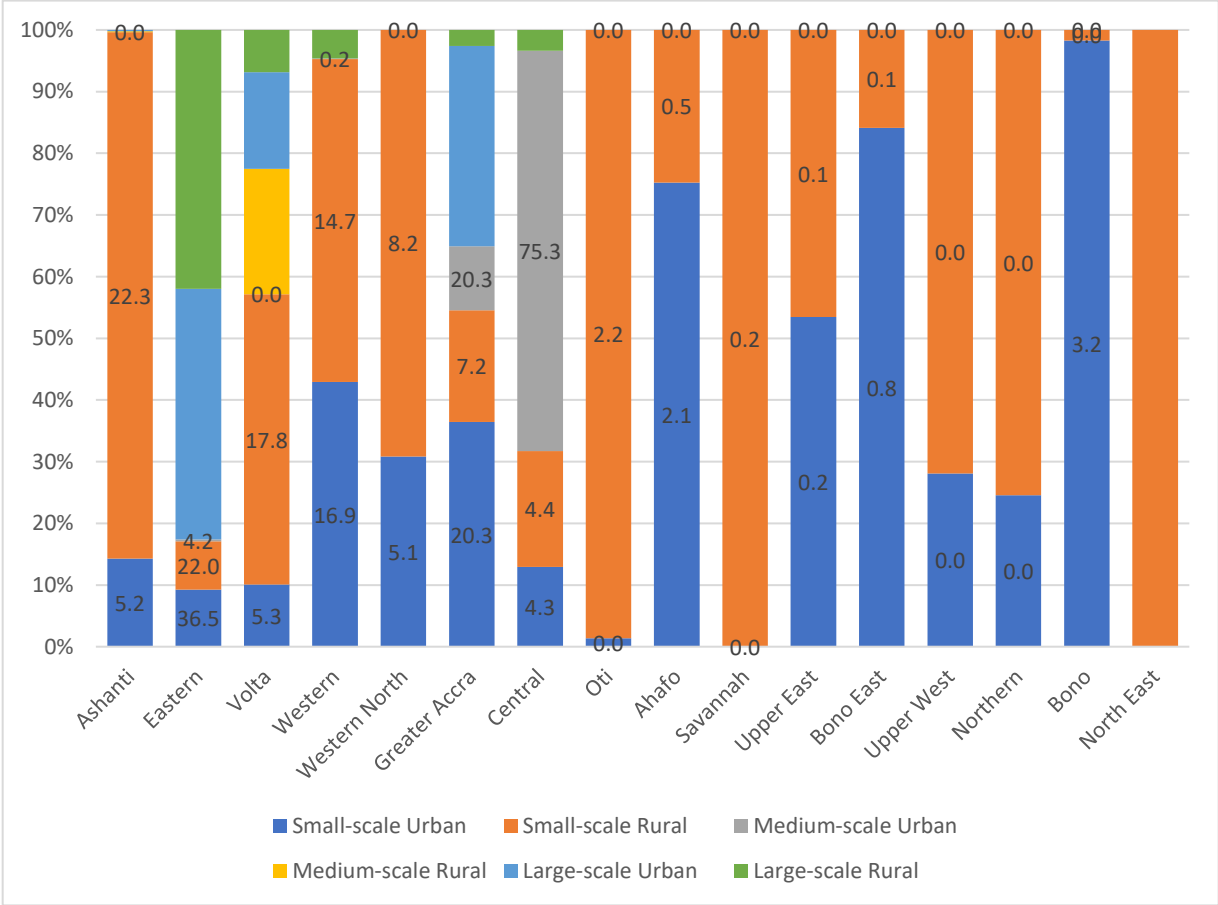
FIGURE 4. 26: FISH PRODUCTION COST BY SCALE OF PRODUCTION AND REGION



The cost incurred by urban holders is higher than that of rural holders for medium and large-scale holders. For urban medium-scale holders, Central (75.3%), and Greater Accra (20.3%) regions dominated and for those in large-scale holding, Eastern (85.8%) and Greater Accra (9.7%) regions recorded the highest. For rural medium scale holders, Volta was dominant with (99.6%) whereas for large scale, Eastern was dominant with (95.4%).

For small-scale holders, costs incurred by rural holders are more than urban holders. For urban holders, Eastern (36.5%), Greater Accra (20.3%) and Western (16.9%) regions incurred higher cost whereas for rural holders, Ashanti (22.3%), Eastern (22.0%) and Volta region were dominant.

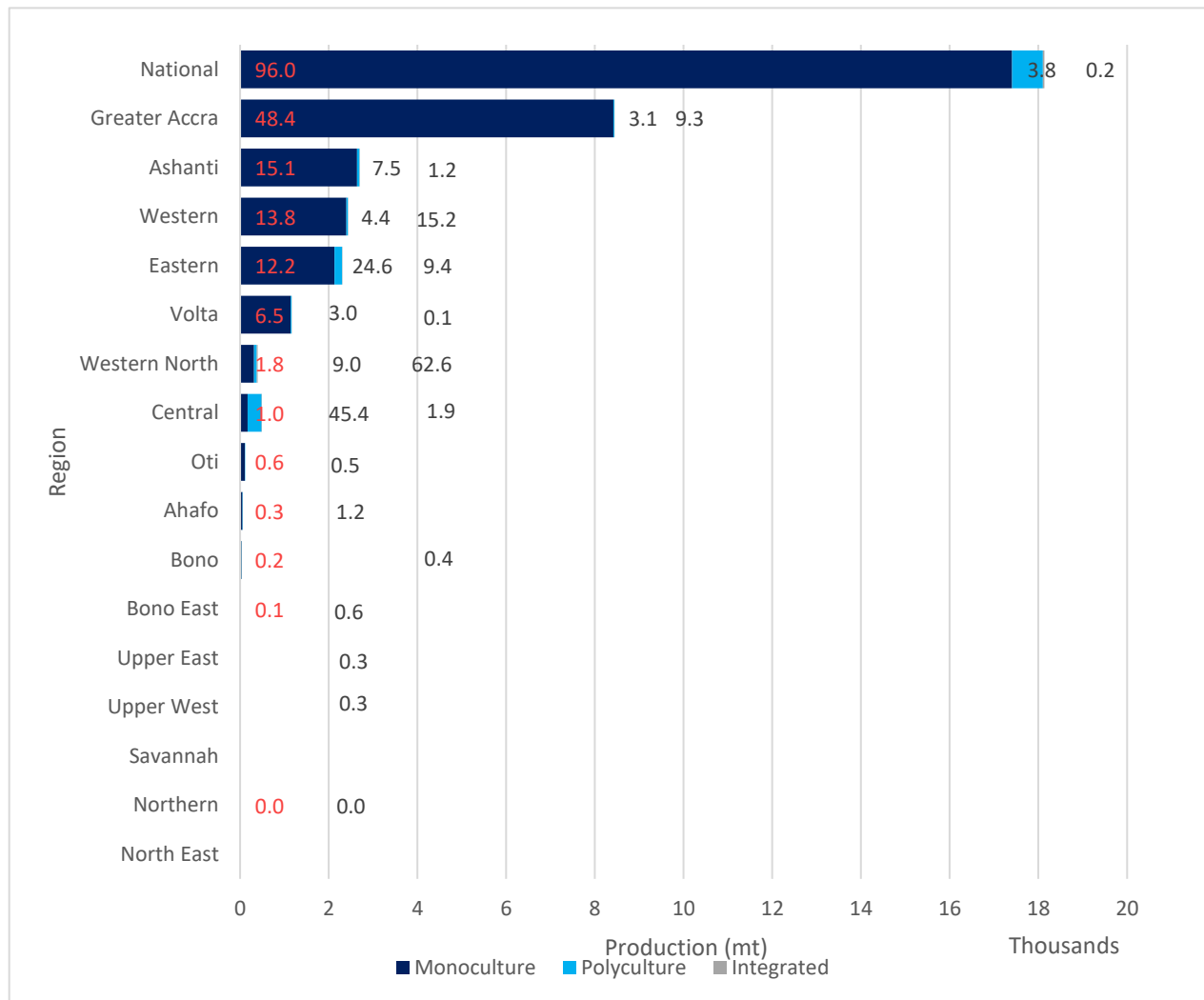
FIGURE 4. 27: FISH PRODUCTION COST BY SIZE OF PRODUCTION, LOCALITY AND REGION



4.2.3 Quantity Produced by System of Production, Type of Establishment and Species Cultures

Out of the three production systems, monoculture is the most popular, constituting 96 percent. Greater Accra holders alone constitute almost half (48.4%) of the total production.

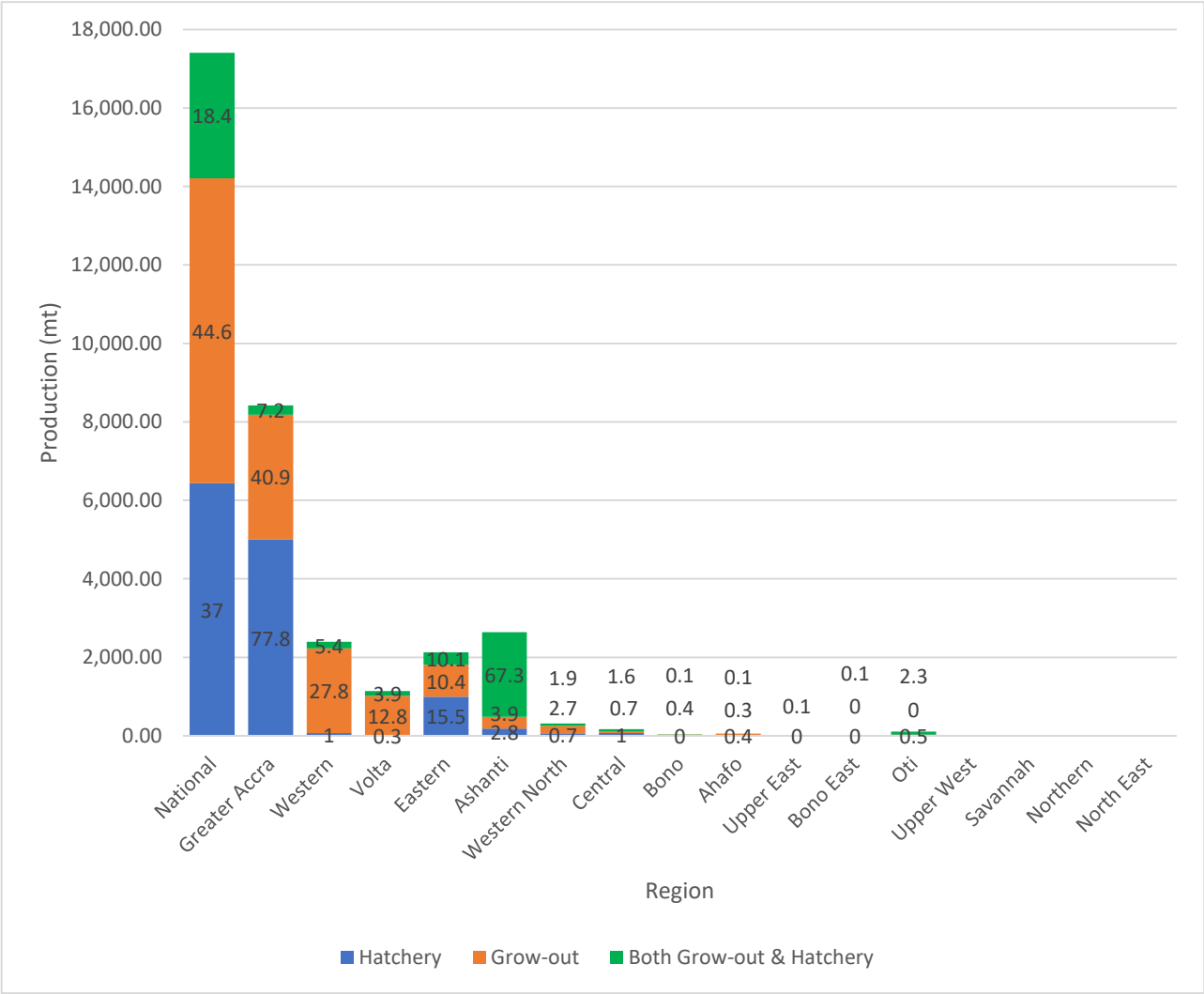
FIGURE 4. 28: QUANTITY OF FISH PRODUCED BY SYSTEM OF PRODUCTION AND REGION



Under the monoculture system, grow-out constitutes 44.6 percent. Two regions, Greater Accra (40.9%) and Western (27.8%) constitute more than two-thirds (68.7%) of the grow-out production establishment under the monoculture system.

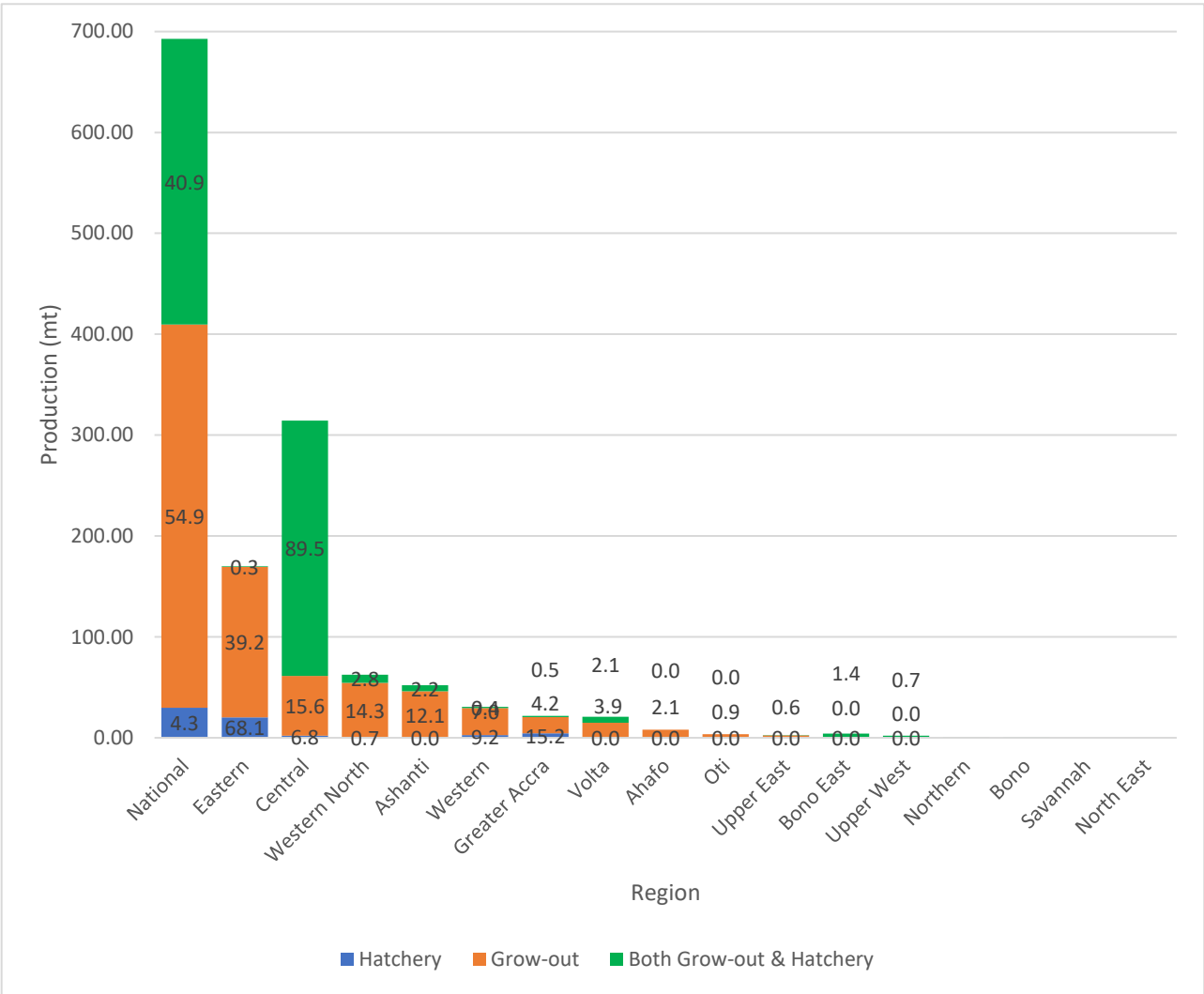
Greater Accra (77.8%) and Eastern (15.5%) regions dominated the production of fingerlings (hatchery) under the monoculture system (37.0%).

FIGURE 4. 29: QUANTITY OF FISH PRODUCED UNDER MONOCULTURE BY TYPE OF PRODUCTION ESTABLISHMENT AND BY REGION



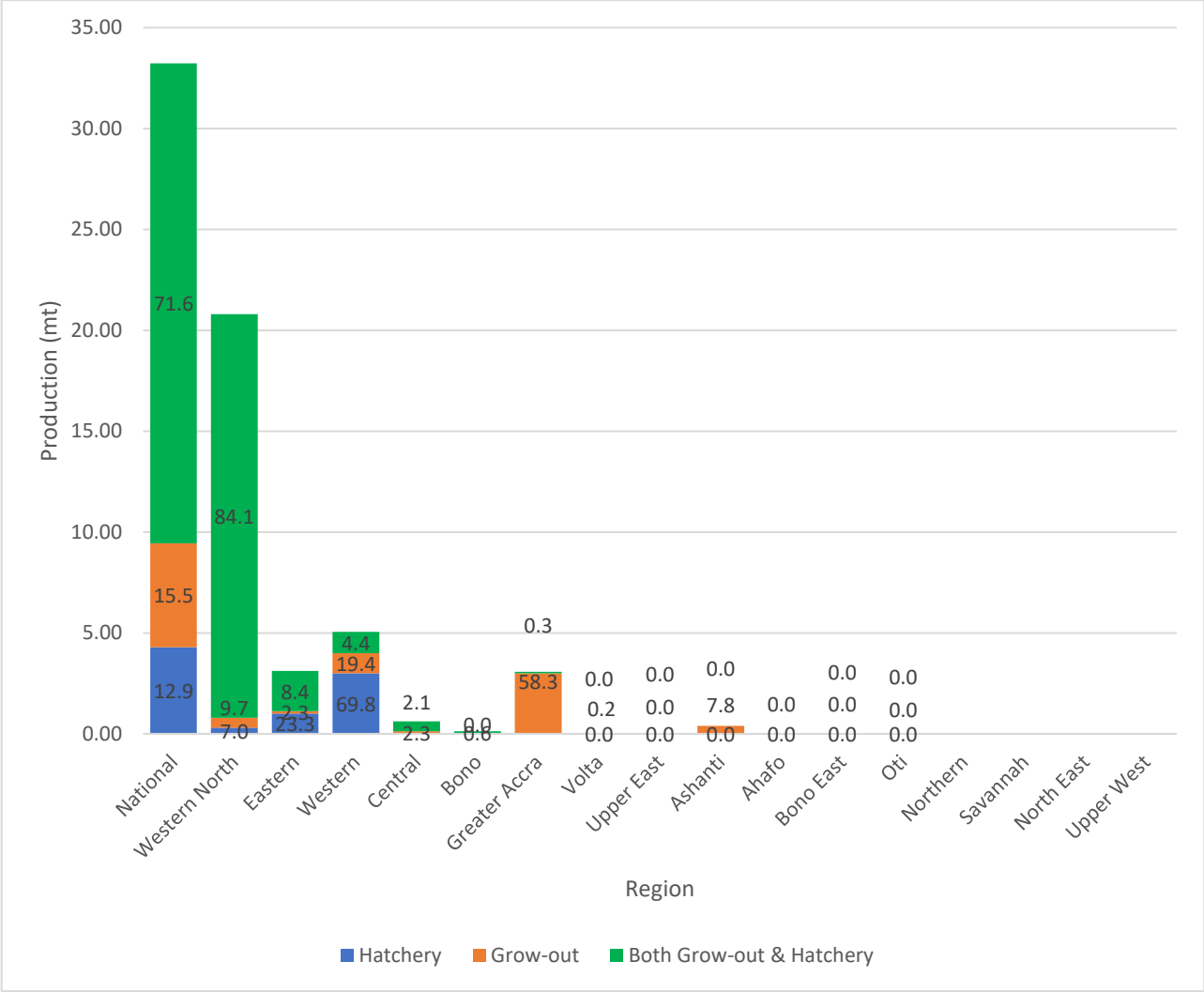
Grow-out is the most common production establishment under poly-culture, contributing 54.9 percent. Eastern (39.2%), Central (15.6%) and Western North (14.3%) regions contribute 69.1 percent of the grow-out production establishment under this system.

FIGURE 4. 30: QUANTITY OF FISH PRODUCED UNDER POLY-CULTURE BY TYPE OF PRODUCTION ESTABLISHMENT AND BY REGION



The production output of both hatchery and grow-out systems under integrated system of production is 24 metric tonnes. This quantity constitutes a little more than two thirds (71.6%) of all production establishments under the integrated production system of 33 metric tonnes. Out of the total output of both hatchery and grow-out system, Western North region alone contributes about eight in ten (84.1%) of the total fish produced.

FIGURE 4. 31: QUANTITY OF FISH PRODUCED UNDER INTEGRATED SYSTEM BY TYPE OF PRODUCTION ESTABLISHMENT AND BY REGION



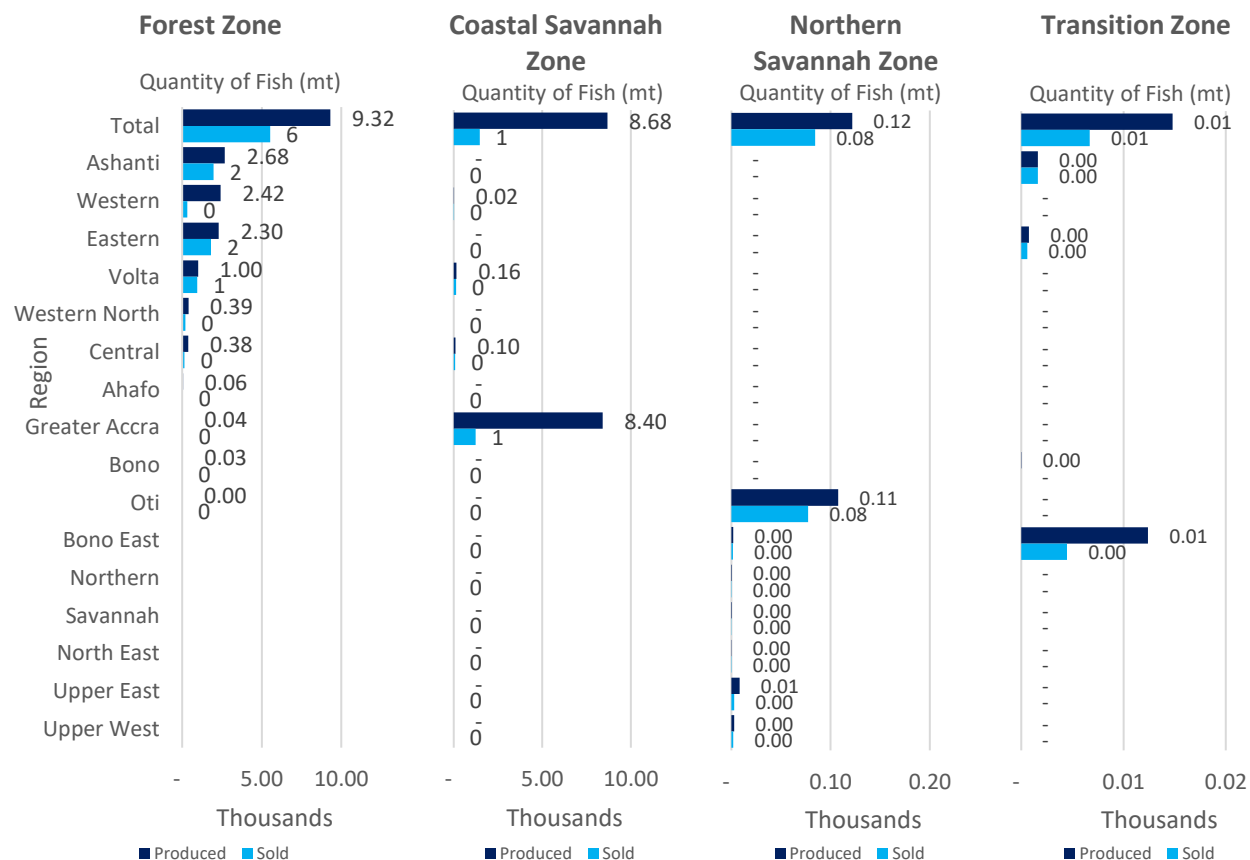
4.2.4 Aquaculture Production and Sales by Agro-Ecological Zones

Forest zone contributed more than half (9,321.6 mt, 51.4%) of the total quantity of fish produced. Ashanti (28.8%), Western (26.0%) and Eastern (24.7%) regions were the most dominant regions. Coastal savannah also contributes to 47.8% of the total quantity produced and has Greater Accra as the most dominant producer (96.8%).

Production of fish in the Northern savannah was 122mt (0.7%) with Oti region leading production (88.5%). Production in the transitional zone was 15mt (0.1%) with Bono-East being the highest region (83.7%) in fish production.

Only 16.9 percent (1,466.2 mts) of the quantity produced in the coastal savannah zone was sold. Of this, Greater Accra sold the most (1,243.5mt, 84.5%).

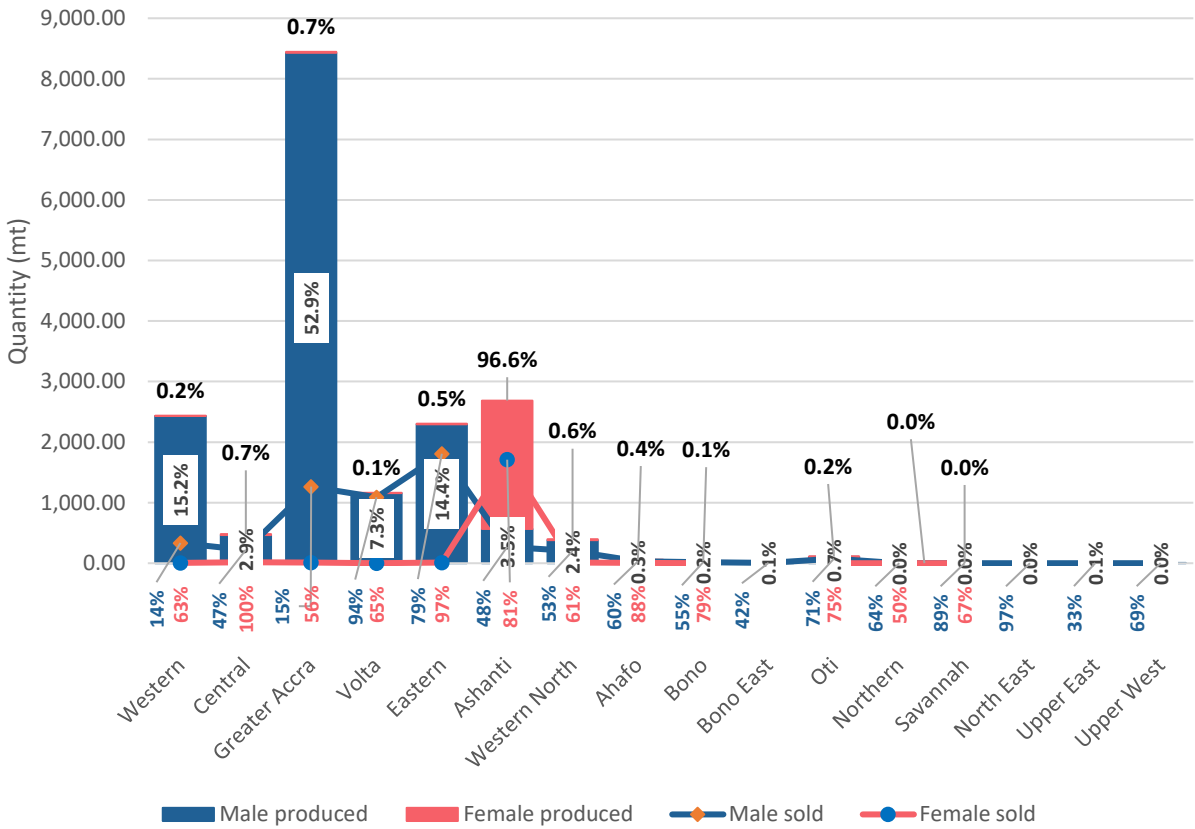
FIGURE 4. 32: FISH PRODUCTION AND SALES BY AGRO-ECOLOGICAL ZONES AND BY REGION



The quantity of fish produced by male aquaculture holders is about seven times more than those produced by female holders, with a difference of 13,740 metric tonnes. Greater Accra (52.9%), western (15.2%) and Eastern (14.4%) regions have the highest quantity of fish produced by males. For female producers, Ashanti (96.6%) is the most dominant.

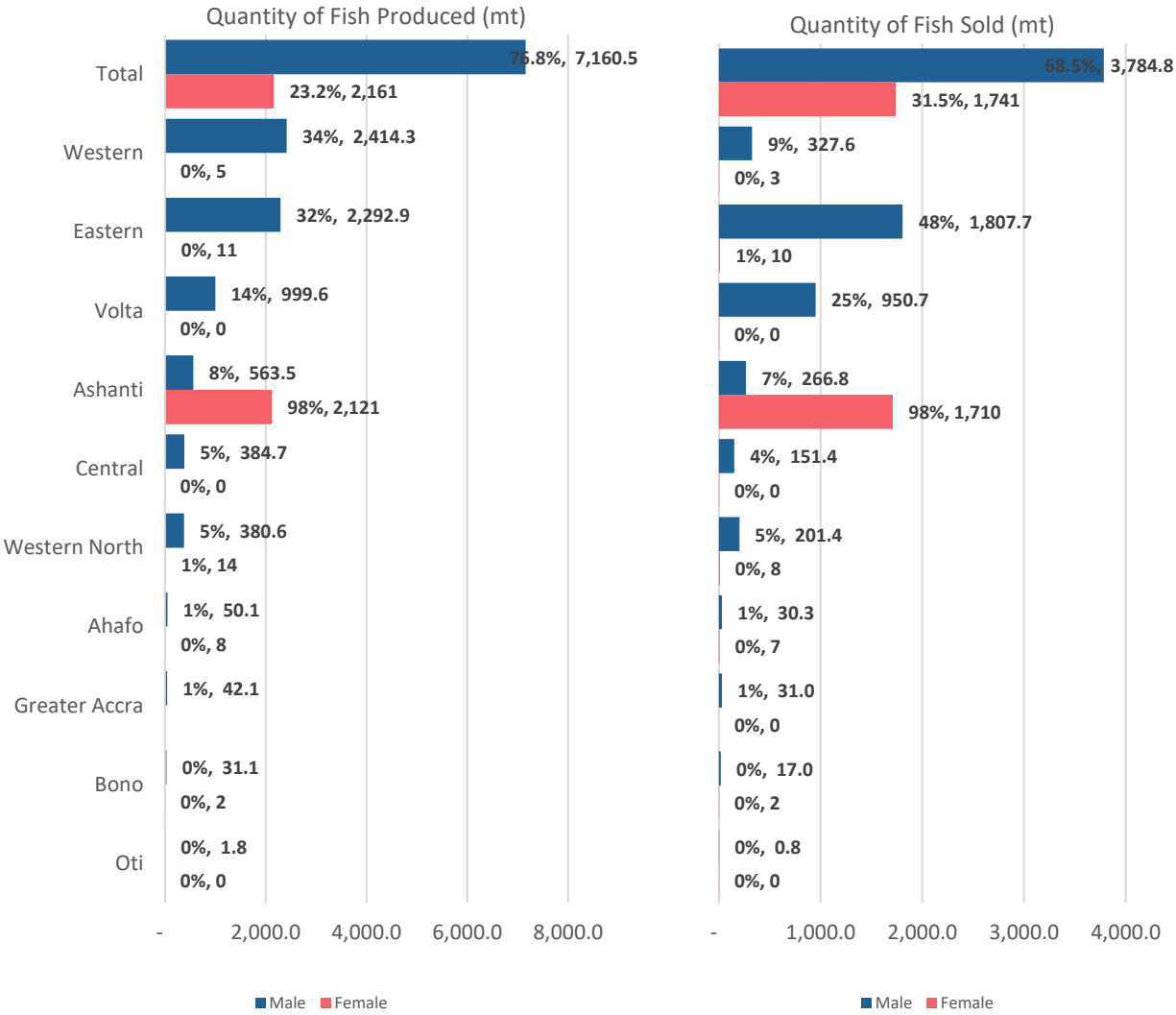
In all the ecological zones, the proportions of quantities produced and sold were higher for female aquaculture holders (80.5%) as compared to males (33.4%). Most males in the North East (97%), Volta (94%) and Savannah (89%) regions sold the highest proportions of their production. Females in Central (100%), and Eastern (97%) regions sold the highest proportions of their production.

FIGURE 4. 33: QUANTITY OF FISH PRODUCED AND SOLD IN ALL ECOLOGICAL ZONES BY SEX AND REGION



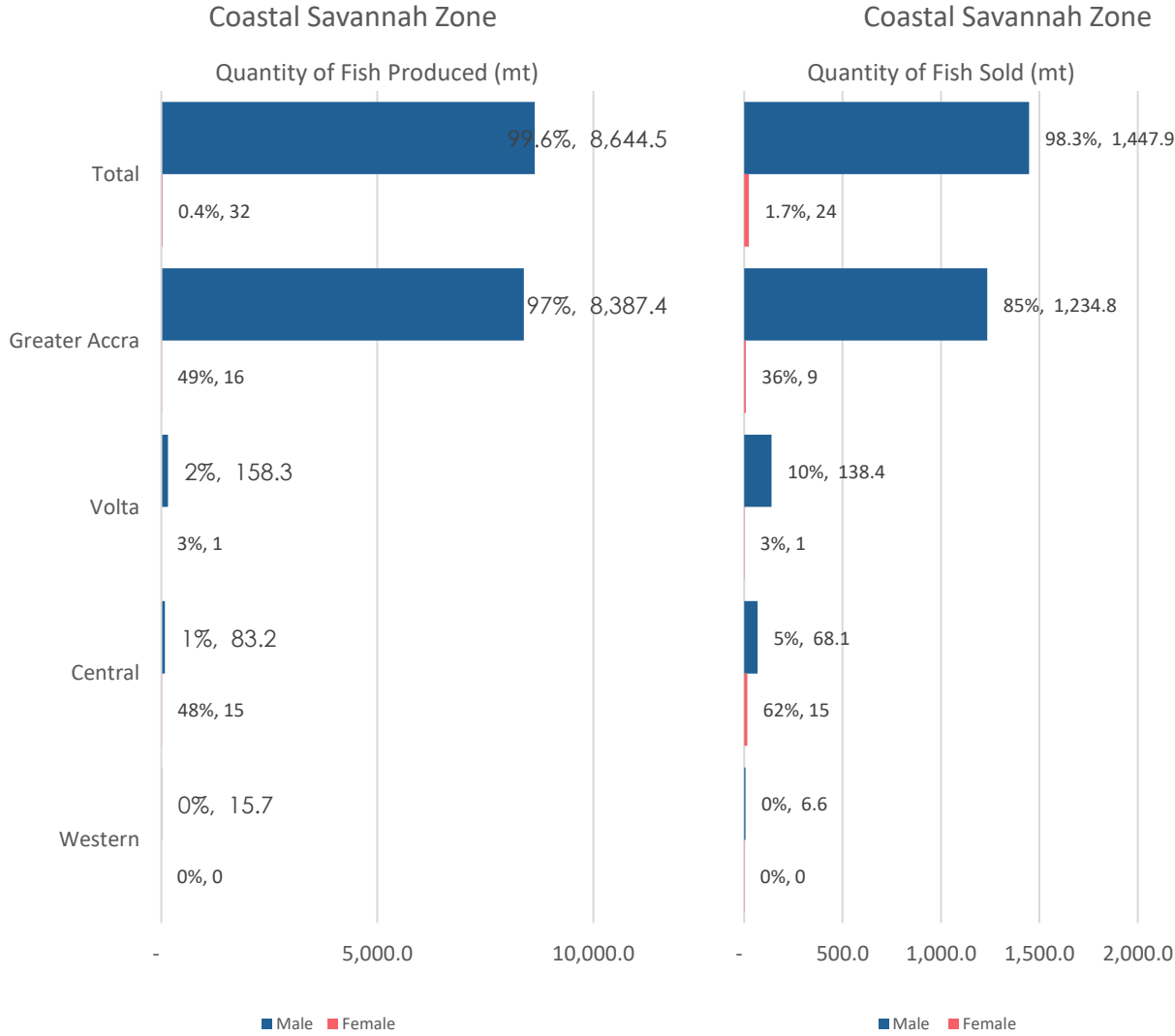
Male holders in the forest zone produced 3 times (7,161 mt) as much as female holders (2,161 mt) and sold twice as much (3,785 mt and 1,741 mt respectively). Western (34%) and Eastern (32%) regions dominated in the production by male holders whereas for female holders, Ashanti (98%) was dominant. Male holders dominated in the proportion of fish sold in Eastern (47.8%) and Volta (25.1%) regions, which contributed the highest, whereas for female holders, Ashanti (98.2%) region dominated.

FIGURE 4. 34: QUANTITY OF FISH PRODUCED AND SOLD IN THE FOREST ZONE BY SEX AND REGION



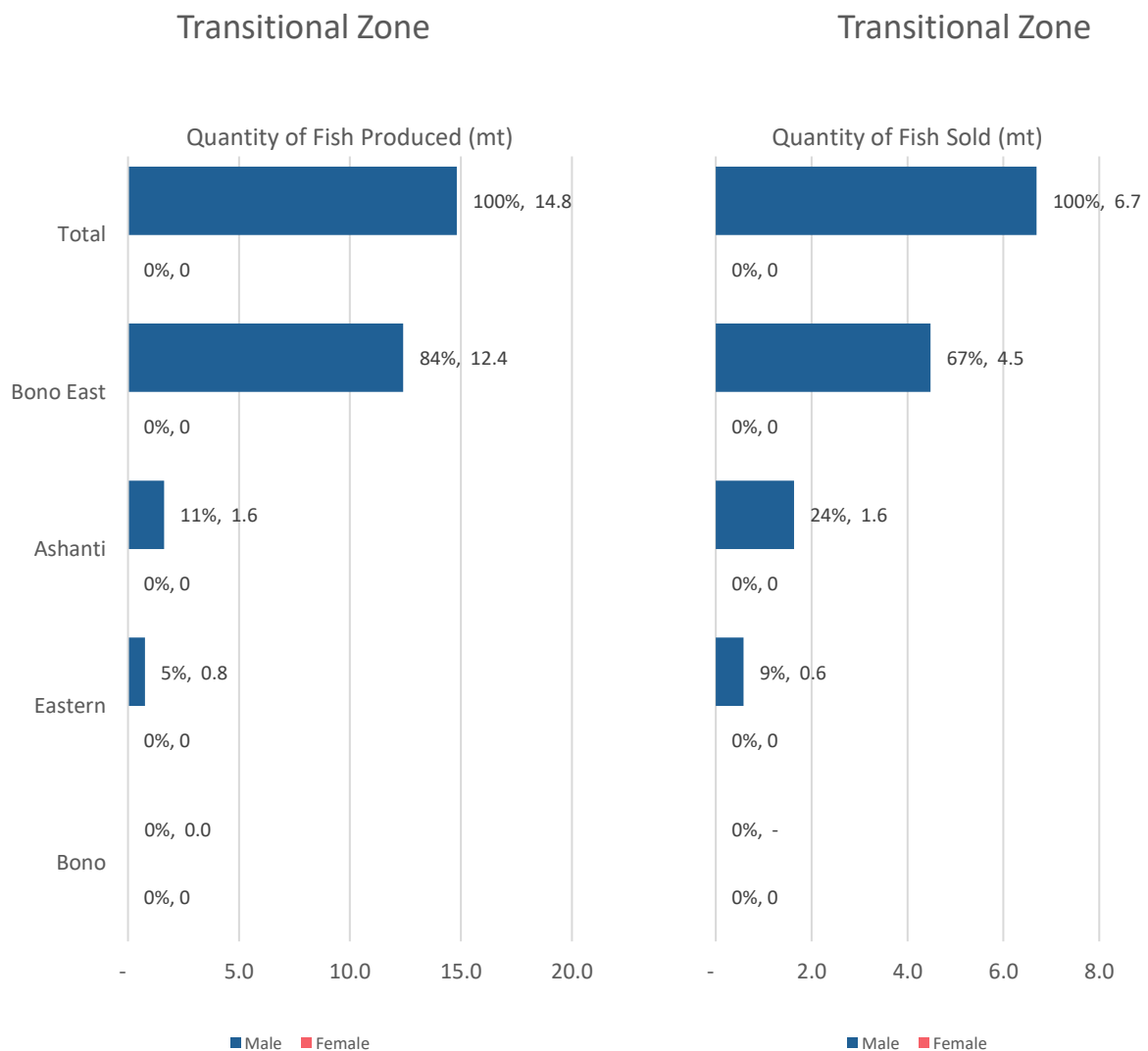
Aquaculture in the coastal zone is largely a male (99.6%) dominated activity. Male holders produced 273 times (8,644.5 mt) and sold 59 times (1,448 mt) as much as female holders in the coastal savannah zone. Most of the fish produced (97%) and sold (85%) by male holders was from Greater Accra region. For female holders, Central and Greater Accra regions contributed the highest in both quantities produced (48% and 49% respectively) and sold (62% and 36% respectively).

FIGURE 4. 35: QUANTITY OF FISH PRODUCED AND SOLD IN COASTAL SAVANNAH ZONE BY SEX AND REGION



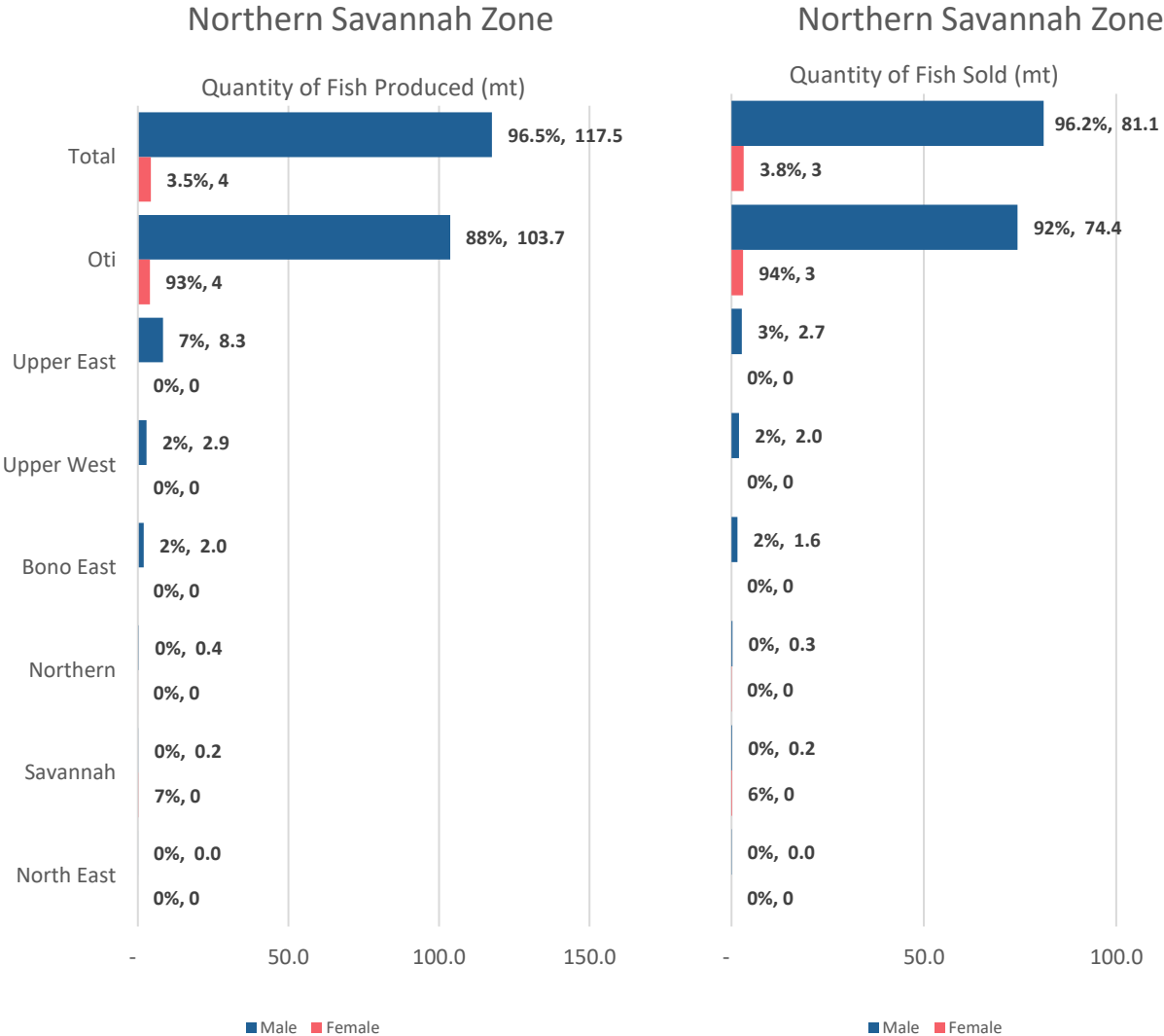
In the transitional zone, there were only male holders. Bono East region dominated in both quantities of fish produced (84%) and proportion sold (67%).

FIGURE 4. 36: QUANTITY OF FISH PRODUCED AND SOLD IN TRANSITIONAL ZONE BY SEX AND REGION



Aquaculture in the northern savannah zone is largely a male (99.5%) dominated activity. Male holders produced 27 times (117.5 mt) and sold 25 times (81.1 mt) as much as female holders in the northern savannah zone. Most of the fish produced (88%) and sold (92%) by male holders was from Oti region. For female holders, Oti region dominated again in both quantities produced (93%) and sold (94%) respectively.

FIGURE 4. 37: QUANTITY OF FISH PRODUCED AND SOLD IN THE NORTHERN SAVANNAH ZONE BY SEX AND REGION



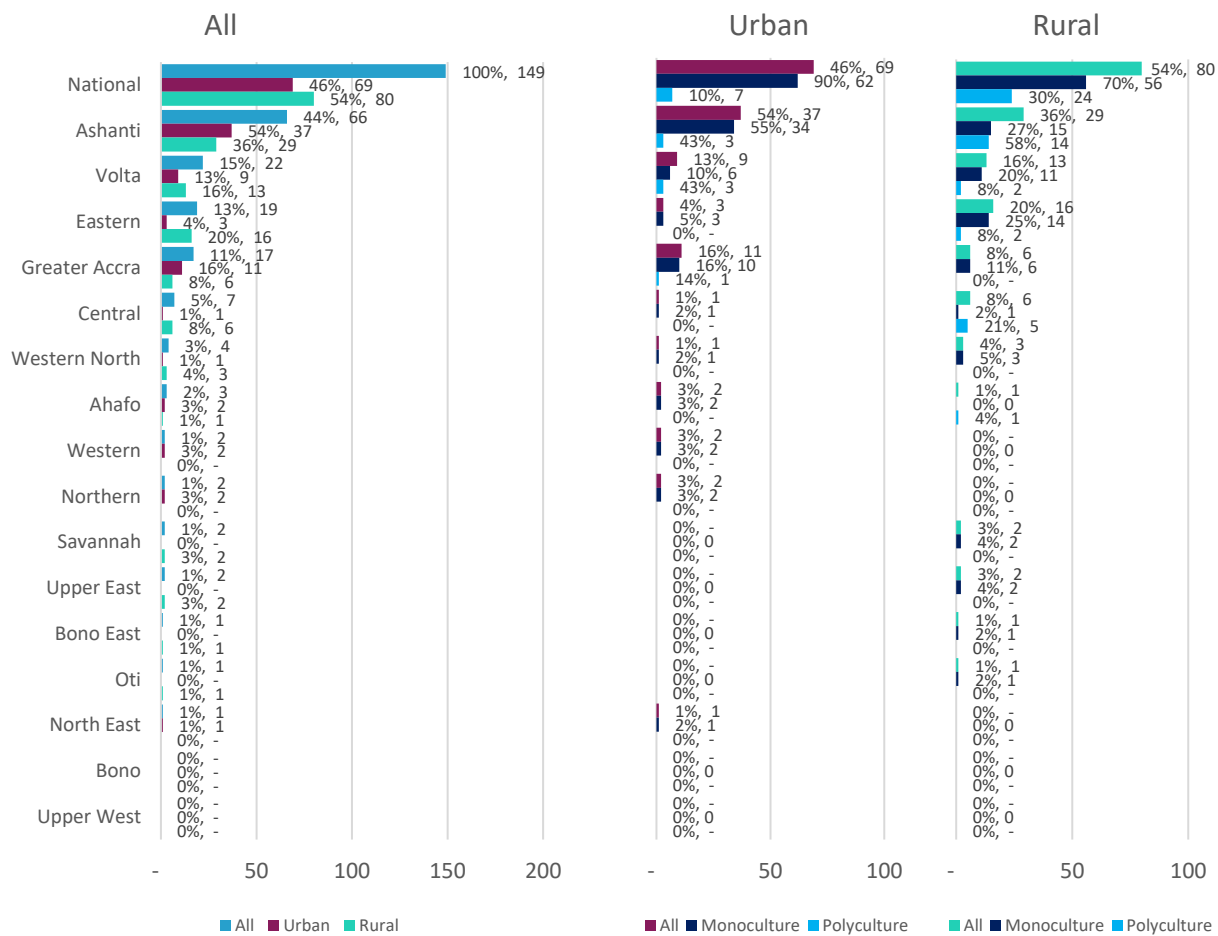
4.3 Aquaculture Institutions

4.3.1 Institutions in Aquaculture by Type of Production System and Facility

There are 149 institutions engaged in aquaculture of which 80 (54%) are in rural areas. Four in ten (44%) of aquaculture institutions are located in the Ashanti region. Out of 80 rural institutions engaged in aquaculture, Ashanti region dominated with 36.3%, followed by Eastern (20%) and Volta (16%).

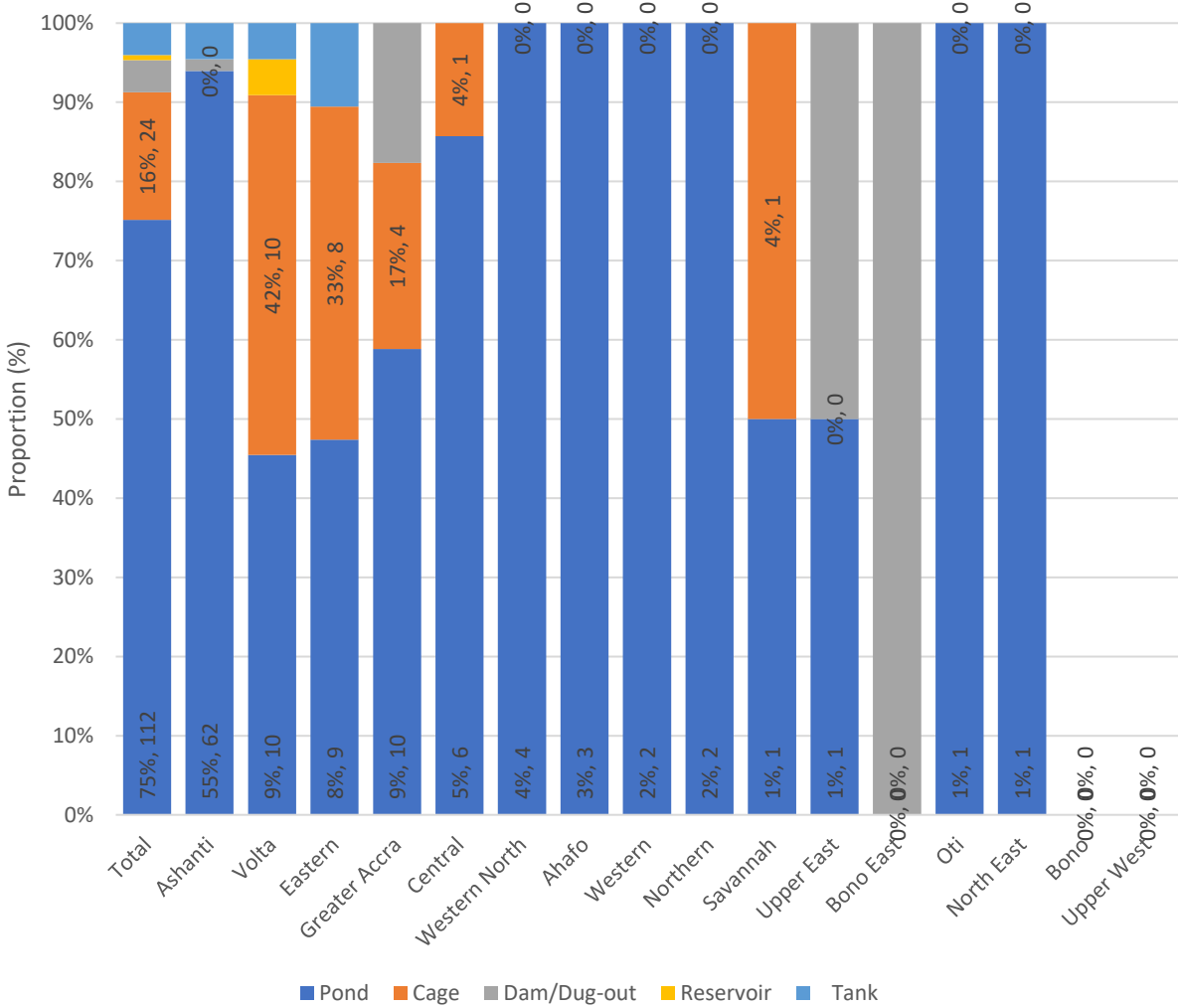
Majority (79%) of aquaculture institutions practise monoculture in both urban (90%) and rural (70%) areas. Ashanti region dominates with 55% and 27% in both urban and rural aquaculture institutions that practice monoculture respectively.

FIGURE 4. 38: AQUACULTURE INSTITUTIONS BY LOCALITY AND TYPE OF PRODUCTION SYSTEM AND BY REGION



Ponds (75%) and cages (16%) are the most common types of holding facilities used by institutions, which accounts for 91%. Ashanti region (55%) contributed more than half the number of institutions using ponds. Volta (42%) and Eastern (33%) regions contributed 75% of the number of institutions using cages.

FIGURE 4. 39: AQUACULTURE INSTITUTIONS BY TYPE OF HOLDING FACILITY AND BY REGIONS

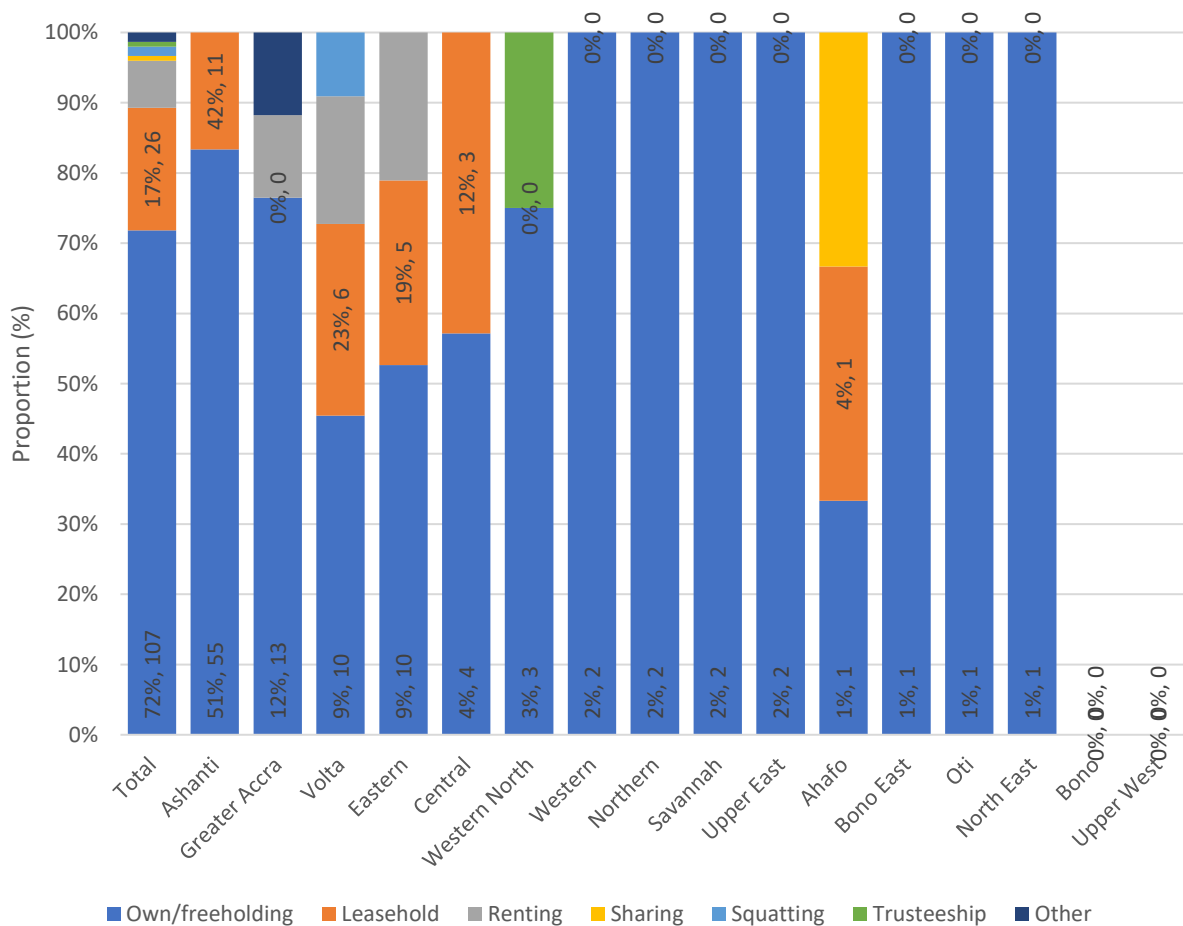


4.3.2 Institutions in Aquaculture by Type of Land Tenure Arrangements

A total of 107 (72%) out of the 149 aquaculture institutions own the holding facility used for aquaculture. Among those who own the facility, 51 percent are located in Ashanti region, followed distantly by Greater Accra (12%), Volta (9%) and eastern (9%).

It was observed 17 percent of aquaculture institutions acquired the holding facility through lease. Ashanti (42%), Volta (23%), Eastern (19%) and Central (12%) regions account for 96 percent.

FIGURE 4. 40: AQUACULTURE INSTITUTIONS BY TYPE OF TENURE SYSTEM AND BY REGIONS

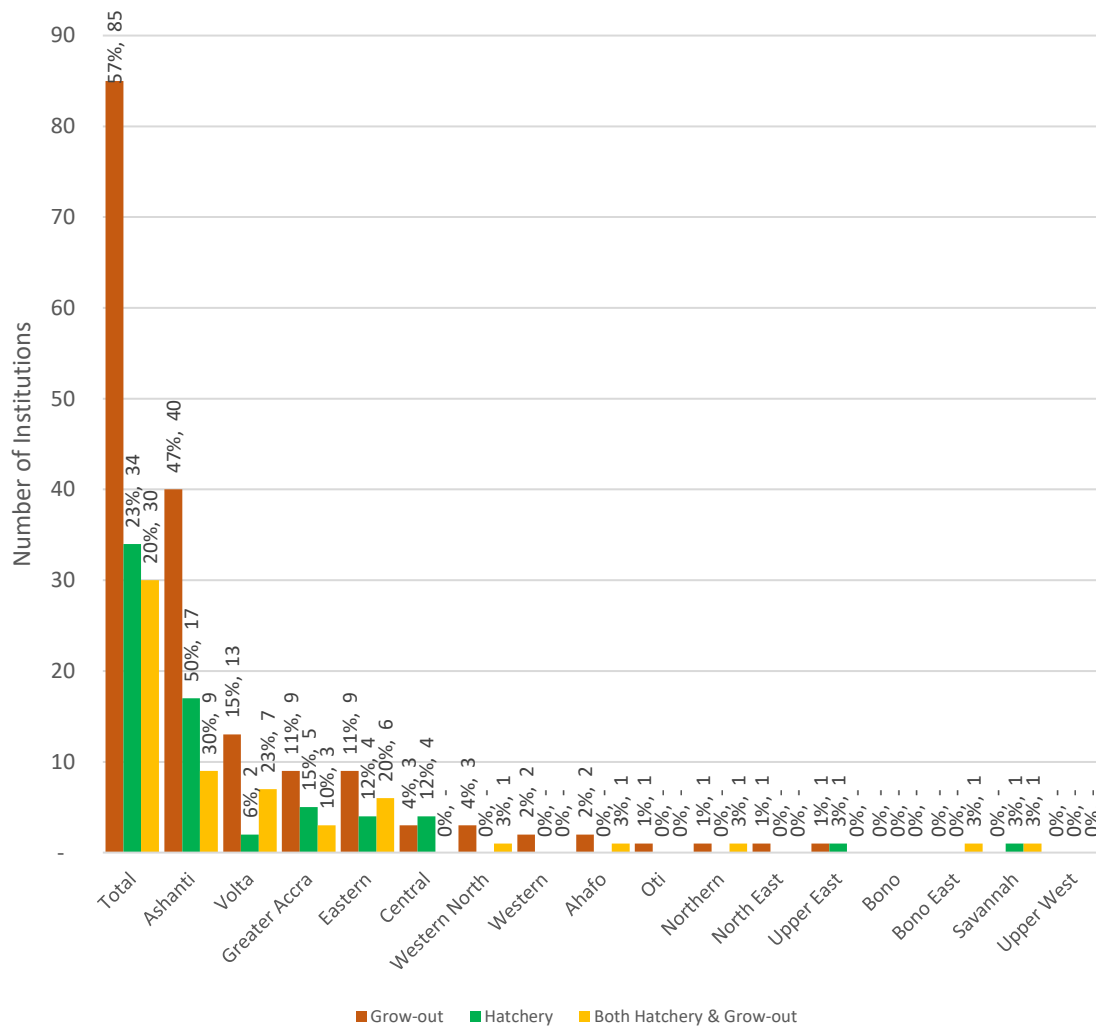


4.3.3 Institutions in Aquaculture by Type of Production Establishment

A total of 85 (57%) out of the 149 agricultural institutions engaged in aquaculture are involved in grow-out. Ashanti (47%) and Volta (15) regions accounts for 62.4% of the number of institutions who engage in grow-out production.

Almost a quarter (23%) of aquaculture institutions engage in hatchery production only while 20 percent carry out both hrow-out and hatchery production. A total of 9 out of 16 regions do not have institutions specialized in hatchery establishment only.

FIGURE 4. 41: AQUACULTURE INSTITUTION BY TYPE OF PRODUCTION ESTABLISHMENT AND REGION



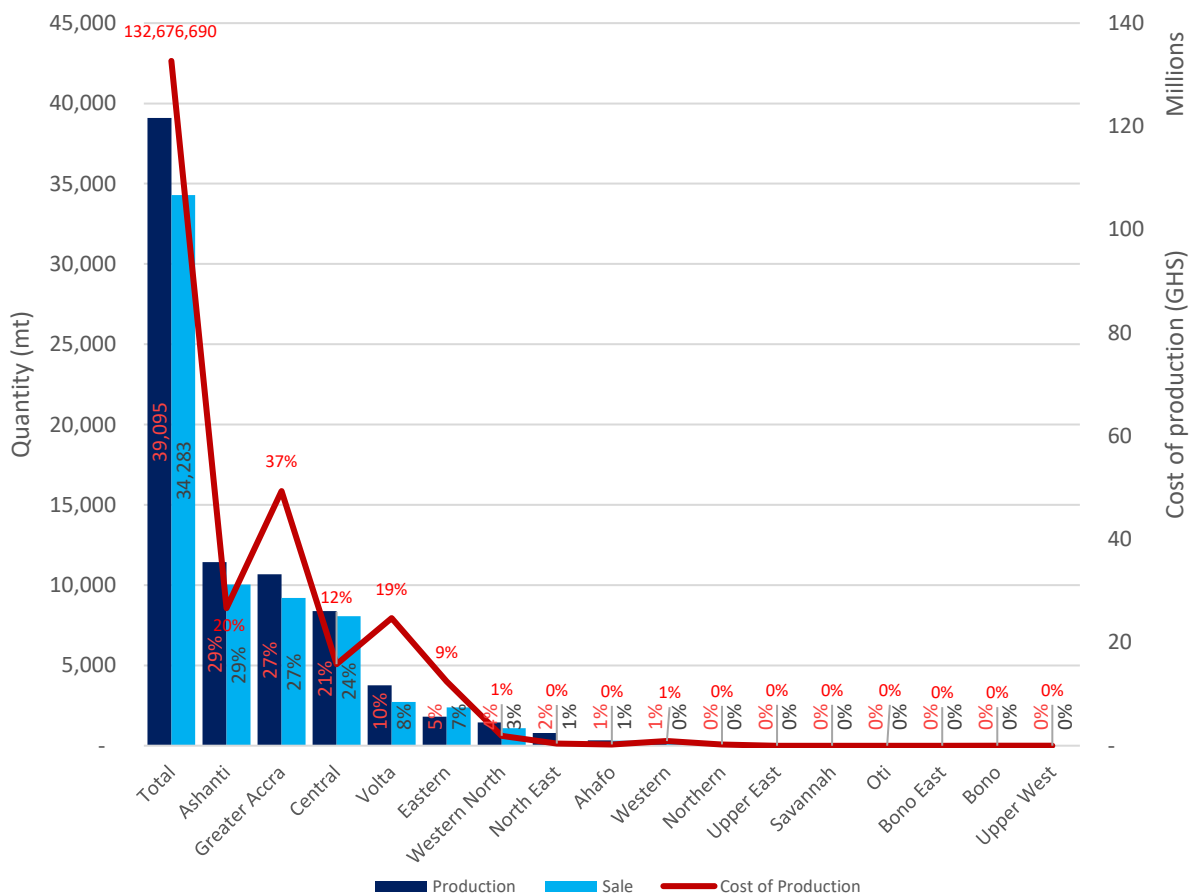
4.3.4 Aquaculture Production, Sale and Cost of Production

A total of 39,095 mts of fish were produced in the reference year. Out of the total fish produced, Ashanti (29%), Greater Accra (27%) and Central (21%) region accounted for 78 percent.

About 88 percent (34,283 mt) of the total production was sold. Ashanti (29%), Greater Accra (27%) and Central (24%) regions, together had a share of 81 percent.

Total operational cost of production for the reference year was GH132,676,690, of which Greater Accra (37%) incurred the highest cost.

FIGURE 4. 42: AQUACULTURE PRODUCTION, SALE AND COST OF PRODUCTION BY REGION



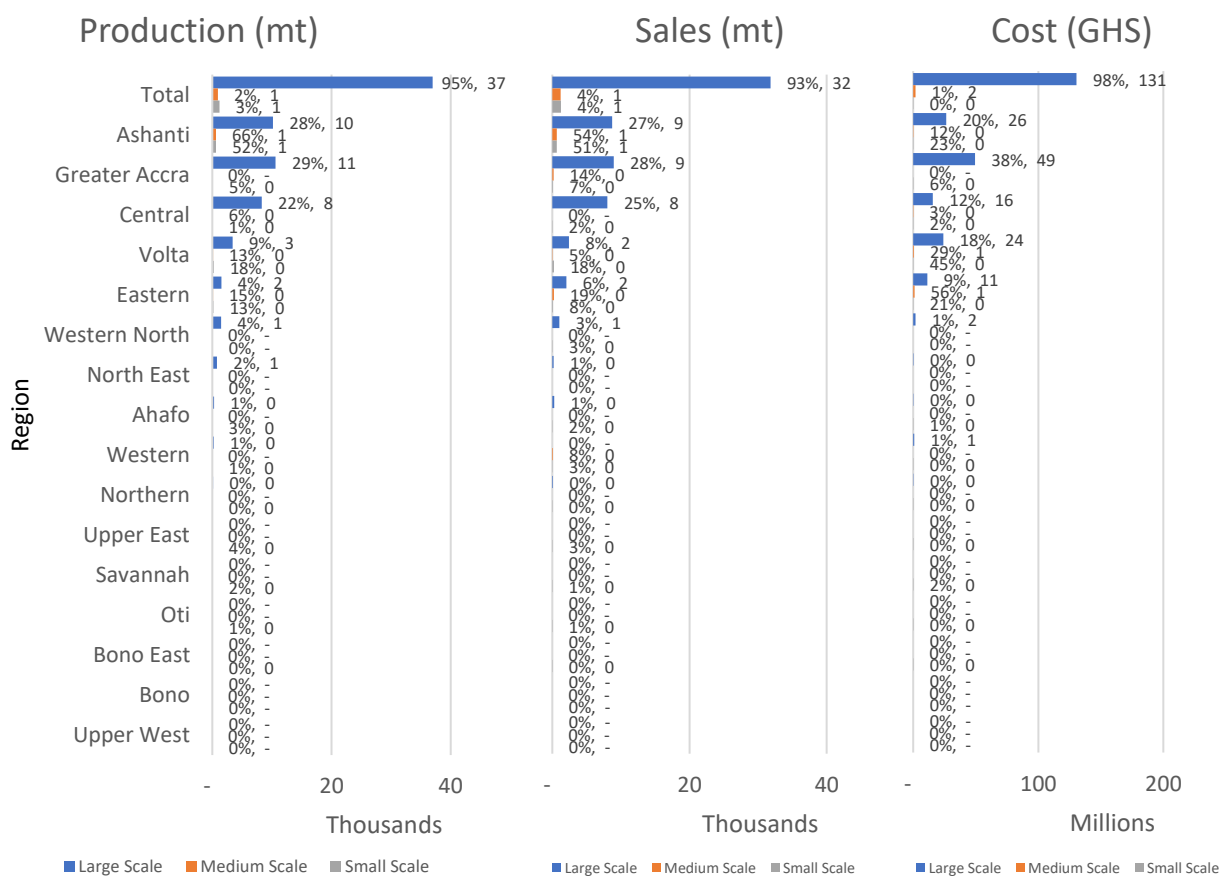
4.3.5 Fish Production, Sales and Cost by Scale of Production and Region

Large scale aquaculture holders contributed more than 90 percent (95%) of the total produced. For the large scale holders, about 80 percent of their production was by Greater Accra (29%), Ashanti (28%) and Central (22%) region. Ashanti region alone contributed more than half (66%) and small (52%) scale holders.

About 93% of total fish produced was sold by the large scale holders. Greater Accra (28%), Ashanti (27%) and Central (25%) together contributed 81 percent.

Most (98%) of the total cost of production was incurred by the large scale holders, of which Greater Accra (38%), Ashanti (20%) and Volta (18%) regions contributed the highest proportions. More than half (56%) of the cost incurred by medium scale holders was in the Eastern region while that of the small scale was in Volta (45%).

FIGURE 4. 43: FISH PRODUCTION, SALES AND COST BY SCALE OF PRODUCTION AND REGION



Small-scale farmers (produces between less than 50,000kg); Medium-scale farmers (produces between more than 50,000kg but less than 100,000kg); Large-scale farmers (produces between more than 100,000kg)

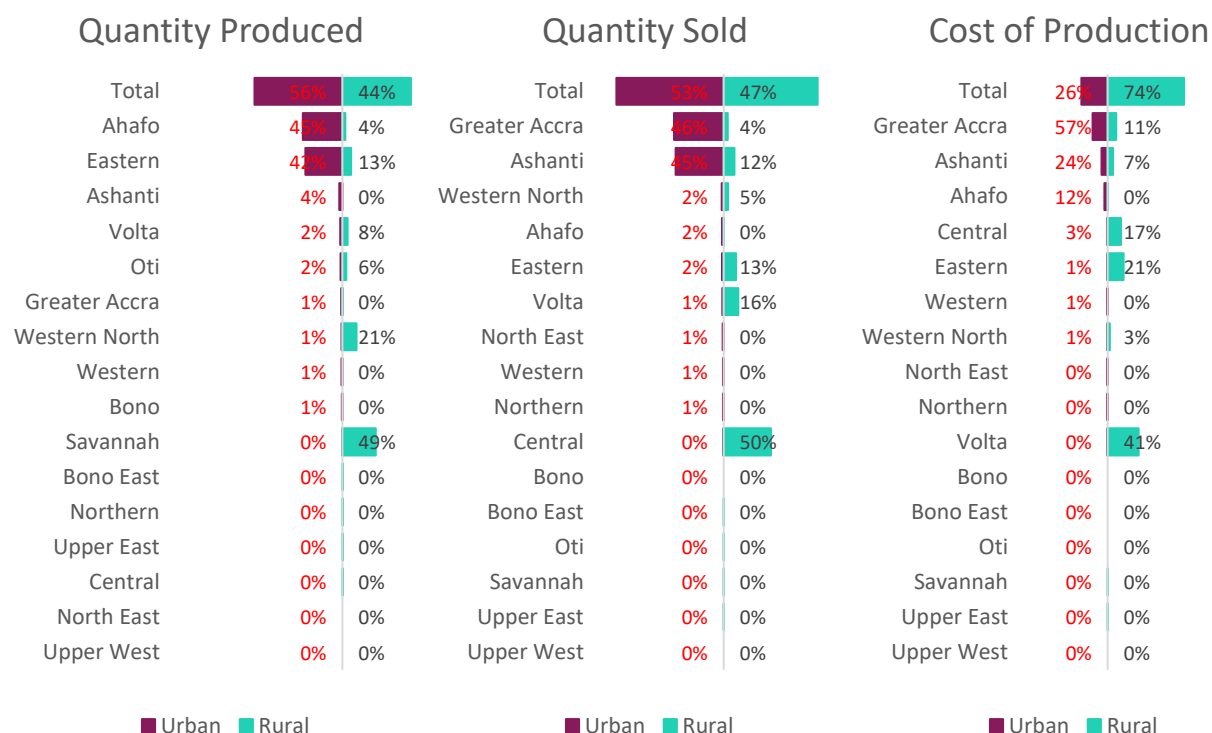
4.3.6 Fish Production, Sales and Cost by Locality and by Region

More fish was produced in urban areas (56%) as compared to rural areas (44%). Ahafo (45%) and Eastern (42%) regions constitute 87% of fish produced by urban agricultural institutions. Savannah region constitutes almost half (49%) of the fish produced by rural aquaculture institutions.

More urban aquaculture institutions sold fish (53%) compared to those in rural areas (47%). Greater Accra (46%) and Ashanti (45%) regions constitute 91% of fish sold by urban institutions. Central region sold exactly 50 percent of fish produced by rural aquaculture institutions.

More operational cost was incurred in rural areas (74%) as compared to urban areas (26%). Volta region accounts for 41 percent of the total cost incurred by rural aquaculture institutions.

FIGURE 4. 44: FISH PRODUCTION, SALES AND COST BY LOCALITY AND BY REGION



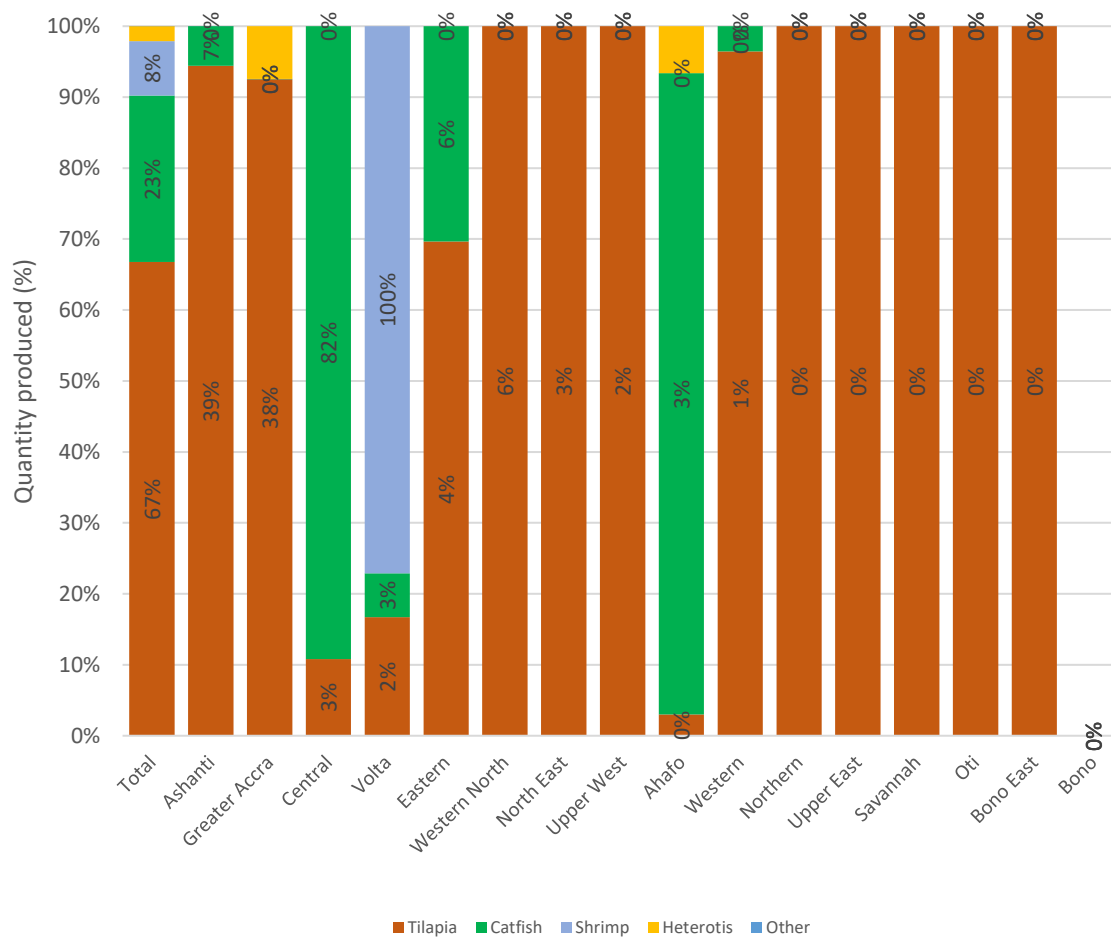
4.3.7 Fish Production by Species and by Region

Tilapia constituted 67 percent of total fish produced by aquaculture institutions. Ashanti and Greater Accra regions together accounted for 77% of the quantity of tilapia produced by institutions.

More than one-fifth (23%) of fish produced was catfish, out of which Central region accounted for 82 percent.

Shrimps account for 8 percent of total fish produced. Volta is the only region which produced shrimps by agricultural institutions.

FIGURE 4. 45: QUANTITY OF FISH PRODUCED SPECIE AND BY REGION



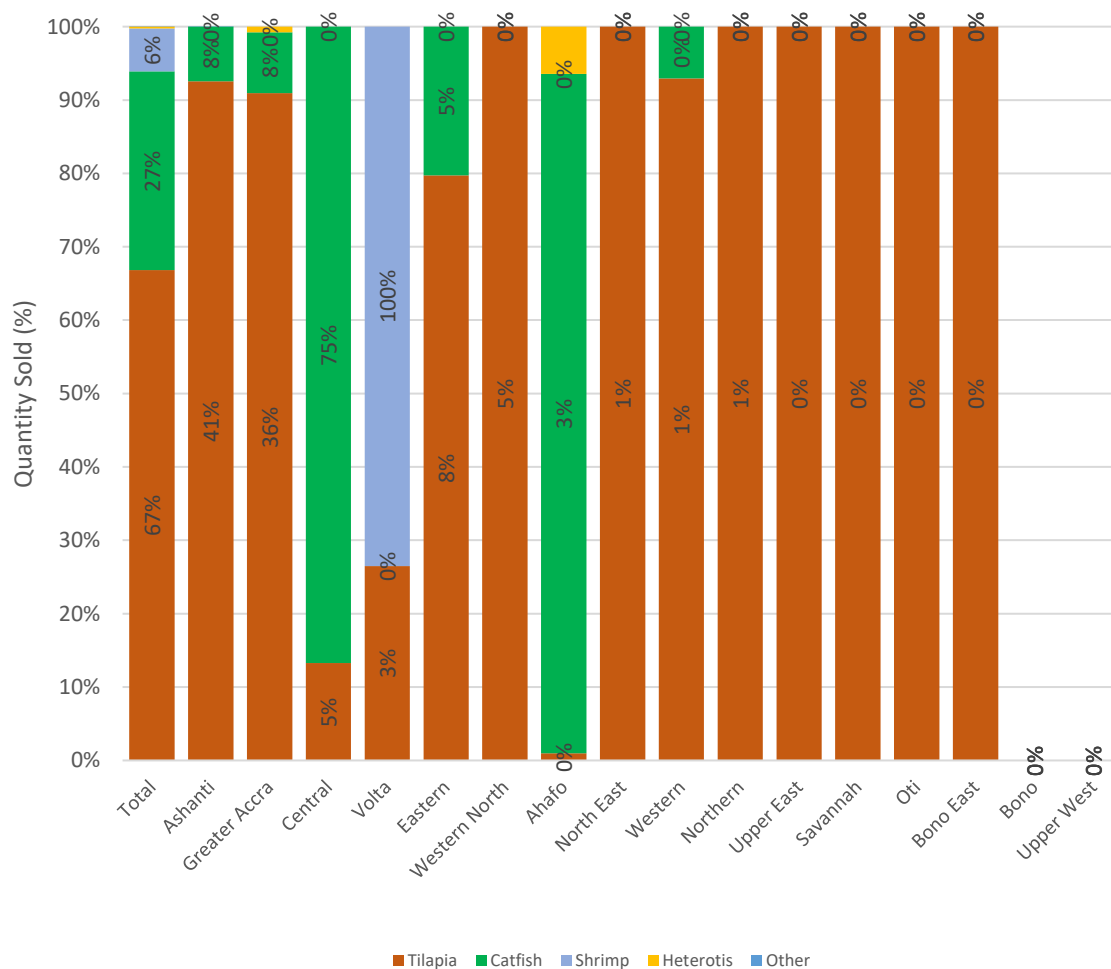
4.3.8 Quantity of Fish Sold by Species and by Region

About 67 percent of fish sold by aquaculture institutions was tilapia. Ashanti and Greater Accra constitutes 77% of the quantity of tilapia sold by institutions.

Catfish contributes about 27 percent of the quantity of fish sold. Central region accounts for 75% of the quantity of catfish produced by institutions.

About 6% of the fish sold was shrimp, of which Volta is the only region which produced and sold.

FIGURE 4. 46: QUANTITY OF FISH SOLD BY SPECIE AND BY REGION



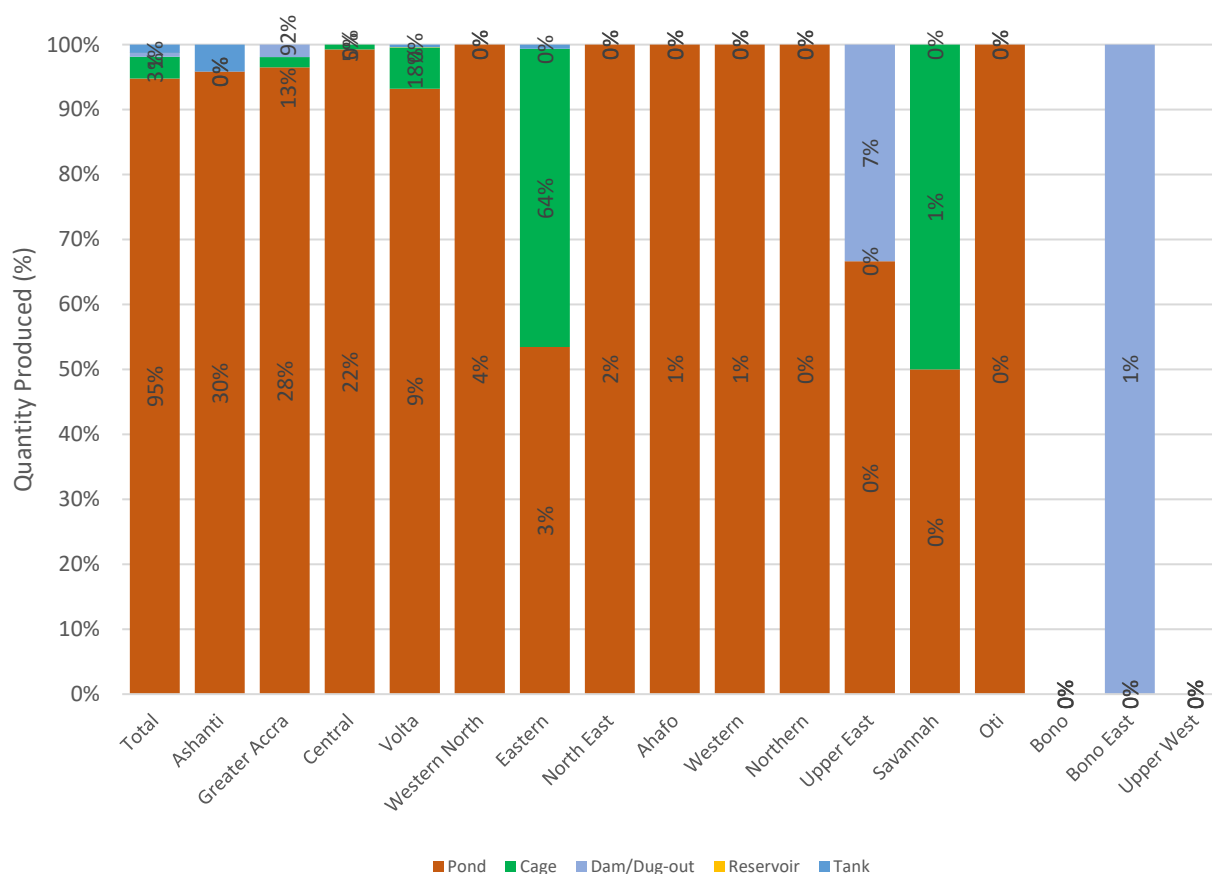
4.3.9 Quantity of Fish Produced by Production Facility and by Region

About 95 percent of the total quantity of fish was produced in ponds by agricultural institutions and the others were produced in cages (3.4%), tanks (1.3%) and dams/dugout (0.6%).

Ashanti (30%), Greater Accra (28%) and Central (22%) regions account for 80 percent of fish produced in ponds by agricultural institutions.

Eastern (64%), Volta (18%) and Greater Accra (13%) regions together constitute 95% of fishes produced in cages by institutions.

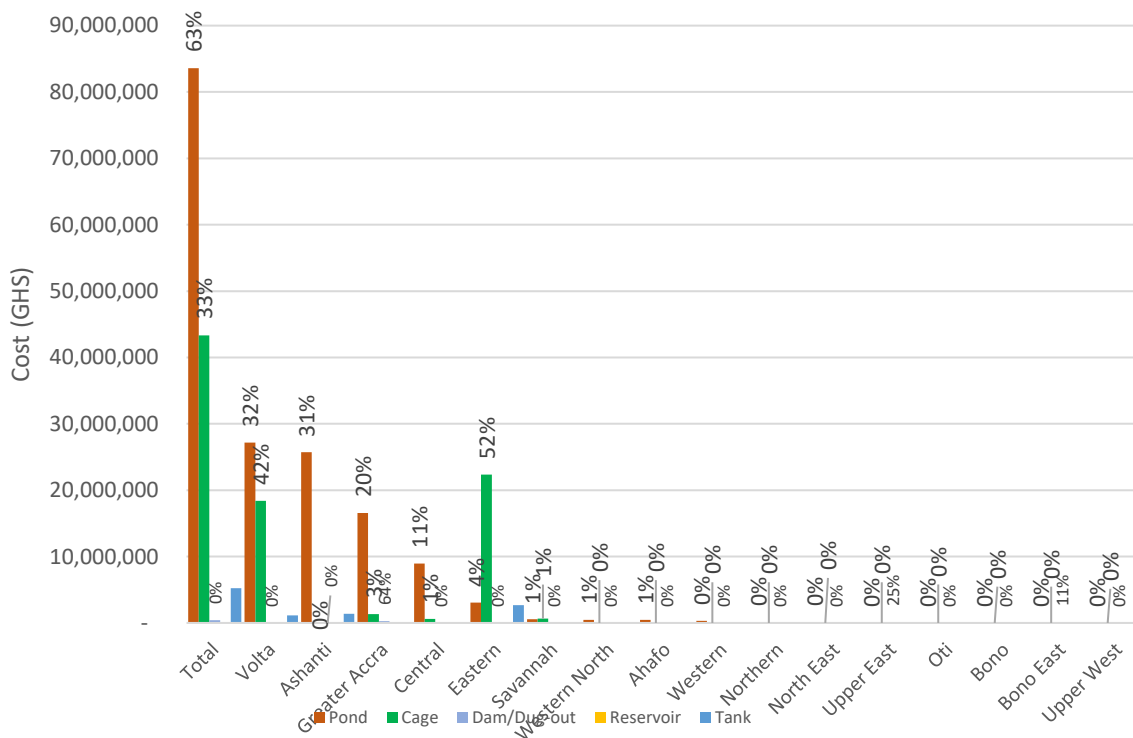
FIGURE 4. 47: QUANTITY OF FISH PRODUCED BY HOLDING FACILITY AND BY REGION



4.3.10 Cost of Fish Produced by Production Facility and by Region

Institutions that produce in ponds incur 63 percent of the cost of production. Ashanti (31%) and Greater Accra (20%) region contributed 83 percent of the cost of producing fish in ponds by aquaculture institutions. However, Eastern region incurs more than half (52.%) of the cost of fishes produced in cages.

FIGURE 4. 48: COST OF FISH PRODUCED BY HOLDING FACILITY AND BY REGION



5. CONCLUSIONS

Aquaculture activities in the country are mainly undertaken by Ghanaians and household holders are mostly males. The proportion of persons with some form of disability engaged in aquaculture is very low and are mostly concentrated in Western, Volta and Western North regions. Most of the aquaculture holders are literate.

In a typical aquaculture household, those engaged are aging (36 years and above) and majority of the youth (15-35 years) do not seem to consider aquaculture activities as a viable source of employment as insignificant few are engaged in the aquaculture. Youth population engaged in aquaculture are located in Eastern, Western, Western North, Ashanti and Greater Accra regions.

Aquaculture holders mostly use ponds in the production of fish. Monoculture is the predominant system of aquaculture production. Tilapia is the most cultured fish species, but a large proportion of the harvest is not sold. More holders in Ashanti, Eastern, Volta and Greater Accra regions sold their produce compared to the other regions. Holders in rural areas sold more of their produce than holders in urban areas.

The main type of land tenure arrangement made by both household holders and institutions for production of aquaculture is ownership either by freehold or inheritance.

Predominantly, aquaculture institutions are engaged in large-scale production of tilapia using ponds and cages. Use of ponds for fish production is concentrated in the Ashanti region while institution using cages are mostly located in Volta and Eastern regions, which is probably due to location of the Volta Lake.

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REFERENCES

- Adhikary, R. K., Kar, S., Faruk, A., Hossain, M. A., Bhuiyan, M. N. M., & Asif, A. A. (2018). Contribution of aquaculture on livelihood development of fish farmer at Noakhali, Bangladesh. *Asian-Australasian Journal of Bioscience and Biotechnology*, 3(2), 106-121.
- Atta-Mills, J., Alder, J., & Rashid Sumaila, U. (2004, February). The decline of a regional fishing nation: the case of Ghana and West Africa. In *Natural Resources Forum* (Vol. 28, No. 1, pp. 13-21). Oxford, UK: Blackwell Publishing Ltd.
- Fisheries Commission. (2022). *2021 Annual Performance Report*.
- Food and Agriculture Organisation (2022). The state of world fisheries and aquaculture. *Towards blue transformation. Food and Agriculture Organization of the United Nations*.
- Hanh, L. M., Phan, V. T., Nghia, N. H., & Jepsen, M. R. (2017). Dependency on aquaculture in northern Vietnam. *Aquaculture international*, 25(2), 881-891.
- Nicheva, S., Waldo, S., Nielsen, R., Lasner, T., Guillen, J., Jackson, E., ... & Llorente, I. (2022). Collecting demographic data for the EU aquaculture sector: What can we learn?. *Aquaculture*, 559, 738382.
- Ponnusamy, K., & Pillai, S. M. (2014). Evaluation of factors contributing to adoption of management practices productivity and net income in shrimp farming in Gujarat, India. *Indian J. Fish*, 61(4), 79-83.
- The RUAF Foundation. (2018). *Urban Agriculture: What and Why?*. www.ruaf.org/urban-agriculture-what-and-why. (September 2018).
- Tyson, R. V., & Simonne, E. H. (2014). A practical guide for aquaponics as an alternative enterprise. *University of Florida Horticultural Science Department, UF/IFAS Extension document HS1252*.

