REPUBLIC OF BOTSWANA

DEVELOPMENT OF AQUACULTURE IN BOTSWANA

AQUACULTURE BACKGROUND

Fisheries used to be a unit under the Division of Animal Production in the Department of Animal Health and Production. The unit was transferred fully with its functions and staff to Ministry of Environment, Wildlife and Tourism (MEWT) as a standalone division in 2003. While at Ministry of Environment, Wildlife and Tourism (MEWT) there was a proposal in 2013 for the function of Aquaculture to be moved back to Ministry of Agriculture as a result of restructuring.

In 11th October 2017 Aquaculture function and some former fisheries staff were transferred to Ministry Of Agricultural Development And Food Security as a standalone division called Aquaculture Division. Capture fishery remained in Wildlife Department.

Aquaculture is a broad term used to describe farming of aquatic organisms in a controlled environment including both plants and animals but highlighted that the division will mainly focus on fish farming only.

AQUACULTURE FUNCTIONS

1. Aquaculture Development in Botswana

The overall objective of the Division of Aquaculture is to promote the development of a viable and sustainable aquaculture industry as a way of economic diversification in Botswana. The aquaculture industry will directly contribute to the upliftment of the livelihoods of Batswana and ultimately to food and nutrition security and poverty eradication.

2. Fingerling Production

As a way of promoting aquaculture production the Division produces fingerlings for supply to aspiring fish farmers. The fingerlings are currently produced in Mmadinare Fish Hatchery Facility. This hatchery facility has a capacity to produce 500, 000 mixed Tilapia and Catfish fingerlings per annum. The facility provides a complete fish production system (Hatchery, Nursery and Grow-out). The facility also acts as fish demonstration/educational centre.

3. Research

The Aquaculture Division conducts research in the following areas;

Fish Stock Assessment in Dams

Dams in Botswana consists of lager dams that are owned by Water Utilities Corporation whose main purpose is potable water supply to main cities and major villages. The country is also endowed with numerous dams that were constructed for livestock watering by then Ministry of Agriculture. There is therefore a need for assessment of fish stocks in these dams in order to determine their potential for fish utilization in terms of fishing and recreational fishing.

Fish Disease Surveillances

The advent of fish diseases (eg. Epizootic Ulcerative Syndrome (EUS)) in our river systems has of recent become a cause for concern. The Division therefore conducts regular fish disease surveillances in dams so as to establish the extent of the spread of EUS or if there are any new outbreaks.

Research on Candidate aquaculture Species

For a fish species to become a good candidate aquaculture species it has to be researched upon extensively and it has to be also genetically improved over time. The current indigenous species in Botswana have not yet been improved hence they cannot be good performers in aquaculture hence the need for more research.

4. Extension Service

In order to transfer the technology and information to fish farming community the Division embarks upon the following;Aquaculture Training Courses

Training courses on various aspects of aquaculture are provided to aspiring fish farmers.

Technical Assistance/advize to Farmers

Fish farmers are advised in the field on the running and management of their projects.

Site Assessment

Site assessment for aquaculture projects is conducted and reports with recommendations are produced.

AQUACULTURE

•The farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants with some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators.

Differences between aquaculture and capture fisheries

•In capture fisheries one reaps without having to sow whereas in aquaculture one has to sow, rear, nurse, nurture, care and harvest. Examples of capture fisheries are rivers, lakes and lagoons. Aquaculture is carried out in small water bodies, manipulated and prepared for stocking. The manipulations include fertilization before or after stocking or during stocking. Fish are fed from external sources. Examples of aquaculture systems are ponds, cages, pen culture etc.

Examples of aquatic animals cultured

Tilapia
(Orechromis andersonii)

Lobster
(Macrobrachium rosenbergii)

Catfish
(Clarias gariepinus)

Oyster
(Crassostrea gigas)

Chinese river crab
(Eriocheir sinensis)

Shrimp
(Palaemon serratus)

Diversity of aquaculture

•Many varieties of species cultured.

• Over 150 species of aquatic animals and plants cultured.

•Many forms of practical interventions man can make.

•Variety of times in the life cycle of the species where man can intervene.

AQUACULTURE PRODUCTION SYSTEMS

•Aquaculture is much more diverse and varied.

•Many different species cultured have different ecological requirements.

•Have different feeding and breeding requirements as well as water quality.

•Aquaculture production is done at different intensifications.

•Production systems developed to meet economic needs and requirements of species cultured.

The systems can be classified by:
•The type of holding unit used.

•The level of management employed.

•The number of species cultured in one holding unit.

•Integration with other economic activities.

The choice of the production level depend on:
•The market infrastructure.

•Existing competitors.

•Potential prices of fish.

•Availability of essential inputs e.g.
feeds, power, skilled labour, professional expertise etc.

THE TYPES OF HOLDING UNIT

Pond culture

•A fishpond is a water impoundment for fish culture.

•Earthen ponds are most commonly used.

•Options of using still water earthen or flow through

•Most of tilapine and catfish are cultured in still water earthen ponds.

•Pond culture needs relatively large area of land.

Raceway culture

•Raceways are long and narrow ponds

•Could be made of: concrete, PVC, fiberglass etc.

•They are constructed so as to avoid dead ends

•Water flows in and out continuously.

•Allow higher stocking densities.

•Are expensive to construct

•Requires good supply of good quality water

•Complete feeding with properly formulated feeds

•Less land is required to produce fish.

Race ways

Tank culture

•Tanks are normally circular or polygonal ponds

•Made of concrete, PVC or fiberglass

•Have a central outlet at the tapering bottom.

•The circular shape and the central drain allow for self-cleaning

•Requires complete diets and continuous water flow

•Allow for high stocking densities

Cage culture

•The cages can be cuboids or cylindrical.

•Sizes and materials used vary.

•Placed either in water reservoirs, large ponds, lakes, rivers or ocean.

•The construction material must be strong enough to hold the weight of fish and withstand the destructive nature of water.

•The mesh sizes must be right for the fish under culture.

Types of cages

Two types

•*Hard:* made of metal or hard plastic

•*Soft:* made of polypropylene or nylon netting.

•Allow little or no control over the

environmental parameters

Cages

•Are placed in a way to allow free water flow through them

Advantages

•Water bodies which would otherwise remain unused can be utilized

•The water can still be used for other purposes like irrigation

•Feeding, sampling and harvesting are simple

Disadvantages

•Localized poor water quality

•Increased sedimentation

•Causes fouling in public water bodies

•Hinder navigation

•Prone to destruction by water waves

Pen culture

This involves sectioning off a part of a water body by fencing it off in a way that will confine the species that is being cultured.

MANAGEMENT LEVELS

Extensive systems

•The lowest management levels

•Fish are stocked in floating cages, earthen ponds etc. and let to fend for themselves.

•Low inputs; fertilizer, low stocking densities, 1 – 2 fish/m2

•Highly dependent on natural productivity

•Characterized by low stocking densities and low yields per given area.

•Production in these systems ranges between 500 and 1500 Kg/Ha/year.

•Little control of water quality.

Semi-intensive systems

•Earthen ponds and floating cages are used

•Ponds are fertilized using both chemical and organic fertilizers

•Exogenous feeding using cereals brans and other locally available feeds to supplement pond productivity.

•Adoption of middle level of technology

•There is partial dependence on natural productivity

•Stock manipulation

•Medium level inputs

•Medium volume of production

•Stocking densities 3 – 5 fish/m2

•Production ranges between 2000 and 20,000 Kg/Ha/year

Intensive systems

•Practiced by private companies or cooperatives

•Use of nutritionally complete diets

•Cost of production is high

•Full measure of stock manipulation

•Disease control

•High level inputs

•Scientific pond design

•Scientific harvesting

•Stocking densities above 7 – 10 fish/m2

•Indoor facilities, cages, raceways and tanks used.

•Controlled feeding, aeration, bio-filtration & temperature .

Intensive culture

Characteristics of intensive systems

•Very high stocking densities

•Removal or treatment of growth inhibitors

•Complete feeding by use of high quality feeds rich in protein and energy

•Mechanical aeration or use of pure oxygen

•High level control of production process

•Use of high technology e.g. automatic feeders, water parameter sensors etc.

Intensive systems can be divided into:

Flow through systems

•Water flows through the production units supplying oxygen while removing wastes.

•The water is then released back into the environment

•Production in such farms range from 5 to 50Kg/m2/year depending on the management level employed.

Recycled through reservoir

•Water flows through raceways and tanks into a reservoir before being pumped back.

•The reservoir acts as regular pond where fish are stocked and as a purification station.

•Harmful compounds like ammonia and nitrites are converted to harmless substances by bacterial action.

•The reservoirs may be aerated to enhance decomposition.

•Production average about 70Kg/m2/year.

Recycled through bio-filter

•Water from the production units is passed through a screen filter to sieve suspended solids.

•Then through a bio-filter where bacterial actions convert harmful compounds to harmless substances

•The water is then oxygenated and pumped back to the production units.

•Production ranges from 70 – 100 Kg/m2/year in such systems

Note: This system is in use at Mmadinare fish hatchery

Characteristics of recycled systems

•Water requirements are low

•High risk factors especially in terms of diseases and water quality.

•They require round the clock monitoring.

•Minor fluctuations in operational inputs or outputs and the price of fish have a major effect on the net cash flows and profitability of these systems.

•Economic sensitivity of these systems requires tight control over all expenses.

•Profitability depends on farmers' ability to avoid unnecessary expenses and maintain the high productivity of these systems.

Based On Number Of Species Raised In One Holding Unit

Monoculture

•Culture of only one species in one holding unit at a time.

•Can be done as mono-sex monoculture or mixed-sex monoculture.

Polyculture

•Culture of more than one species in one holding unit at the same time

•Species are selected such that they have different ecological requirements to reduce competition

•Species should not have negative effects on each other

•They should have complementary effects on one another in such a way that they improve growth conditions for each other

•Intention is to maximize productivity by maximizing use of available resources

•An example is culture of Clarias and Tilapia.

Integrated Systems

•This refers to an economic enterprise where fish are cultured among other farming activities.

• The objective is to optimize profits by recycling nutrients generated by various production units

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