

Integrated Agriculture and Aquaculture (IAA) Systems for Food Security

Ahmed Nasr-Allah PhD
WorldFish
Country Director - Egypt

CIMMYT
International Maize and Wheat
Improvement Center

 **CGIAR** | RESEARCH PROGRAM ON Fish


WorldFish

Integration Advantages

- Efficient use of resources.
- Increase income & job creation in rural areas.
- Afford animal protein food for local society.
- Protect the environment

Integrated agriculture-aquaculture

FAO 407

- Integrated Farming Systems
- Animal-Fish Systems
- Rice-Fish Systems
- Fish Feeding and Management

Driver for system development

Population by region



Note: Regions follow United Nations definitions and may differ from other Pew Research Center reports.

Source: United Nations, Department of Economic and Social Affairs, Population Division, "World Population Prospects 2019."

PEW RESEARCH CENTER

[World Population GIF](#)

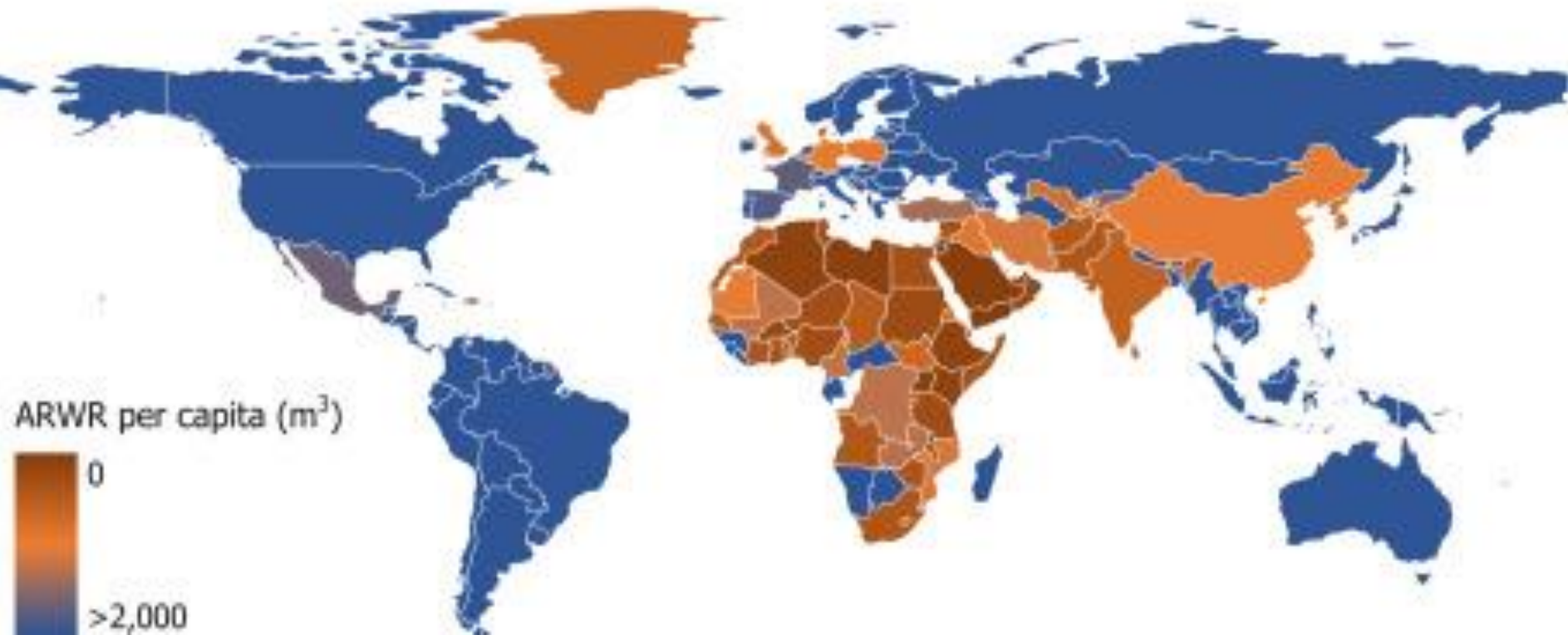
Source: Pew Research <https://www.pewresearch.org/>



Freshwater availability

Guilherme, et al., (2021).

Projected water availability in 2050



water availability

planet is becoming increasingly water stressed – 10% increase in demand 2000-2010

e.g. Egypt

agriculture uses 86% available freshwater

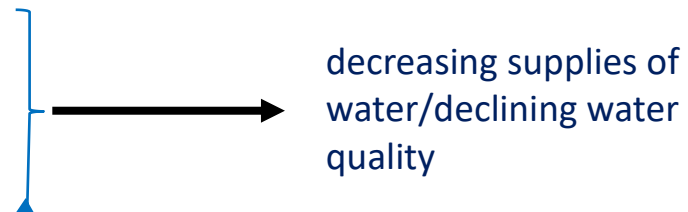
population growth 2% p a

increasing wealth (GDP 7% pa)

increasing upstream intervention

increasing pollution

climate change



how to best use water for human well-being without unacceptable adverse impacts on the environment?

Integration in Old Land

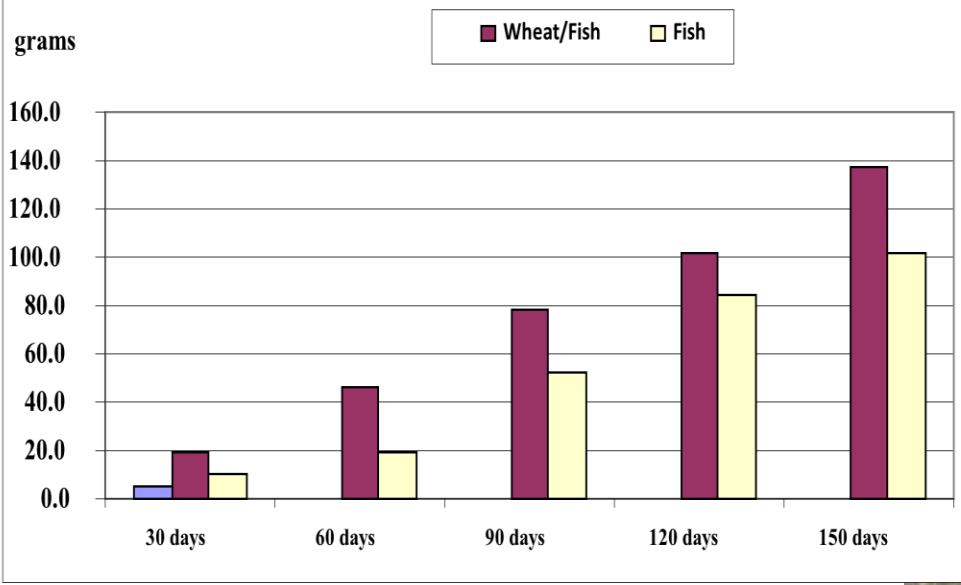
Fish&wheat systems, Nile Delta



Fish and Wheat Rotation



Growth of Nile tilapia in 3 different systems



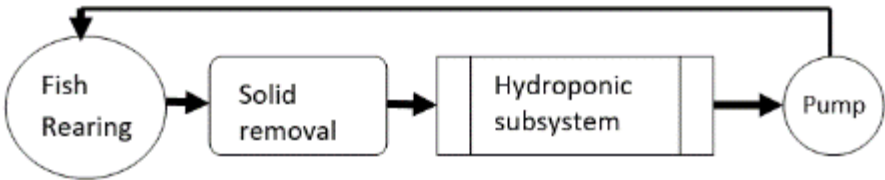
	<i>Fish</i>	<i>wheat\Fish</i>
Tilapia	1238.5	2331.5
Other fish spp.	455.6	365.2
Fingerlings	396	113
Total	2090.1	2809.7



• *Animal Fish System*



Indoor Integration Aquaponic



- Integrated Farming Systems

Outdoor Integration

Use of fish farm effluent in Irrigating crops

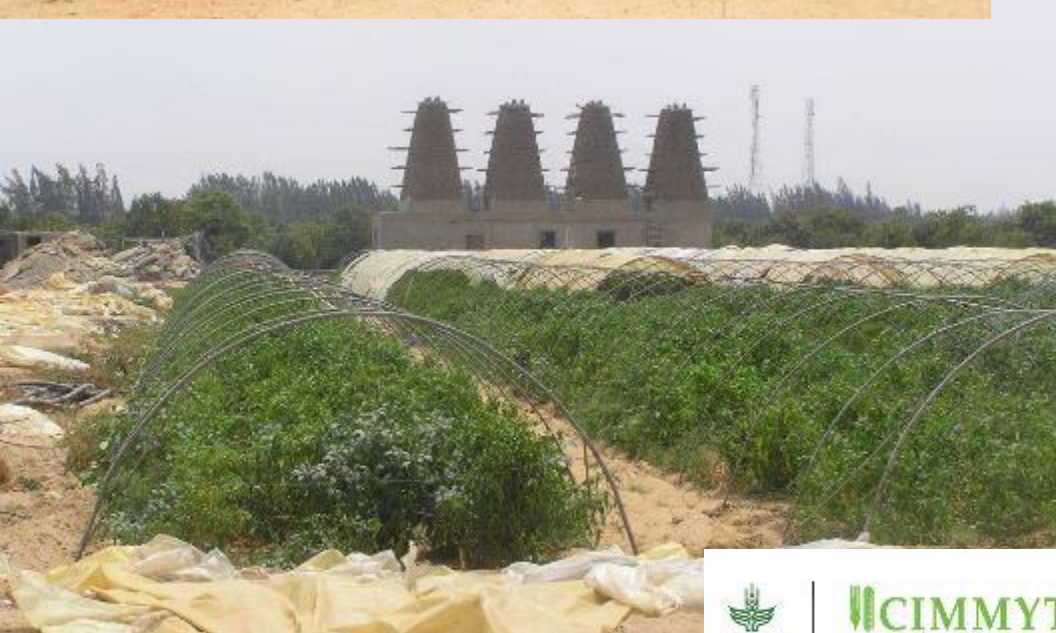
- For the production of Kg (marketable size) Salmon and Trout, that added 10-23 gm phosphorus, 60-100 g Nitrogen and 750 g organic carbon.
- 2-3% of the feed converted to ammonia, while FCR in intensive farms is 2:1, then quantity of Nitrogen released for the production of each ton (Tilapia) is
- 40-60 kg (Mean 50 kg).

Water source

- الري من الابار الجوفية
(ground water)

- الري بماء النيل (خزانات المياه)
(water reservoir)

- الري بمياه الابار ومياه النيل
(Mixed water)

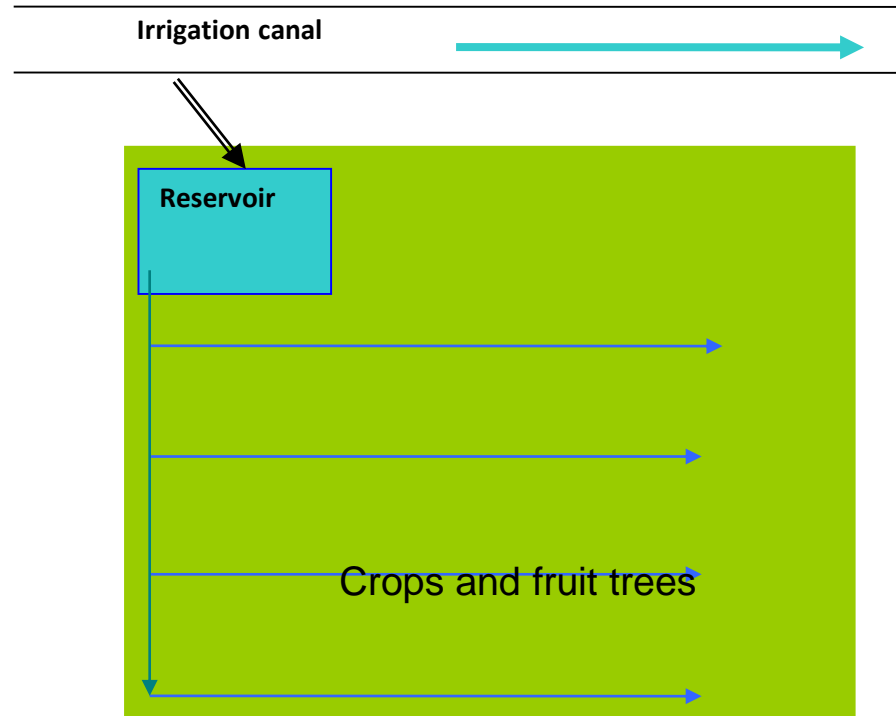
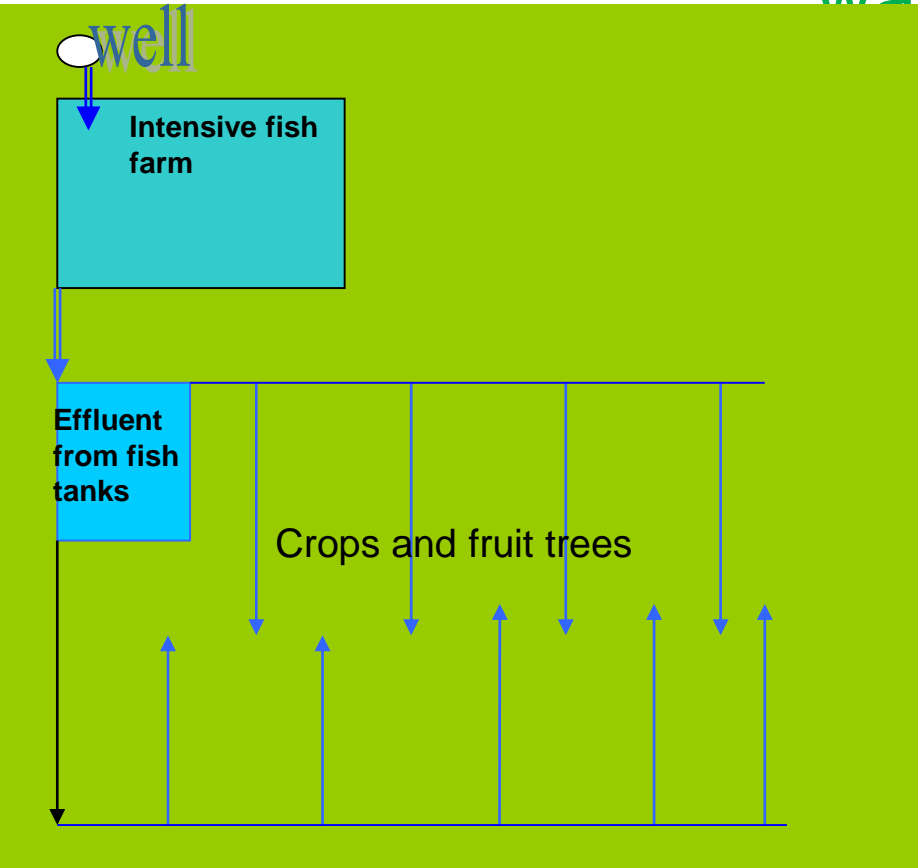


Water use Chart

Ground water farms

Surface

water



Integration in Old lands



Integration in Old lands



Small to Medium size Integration Desert Farming



Integrated farm in Menyaia



Integration in Medium and large size farm



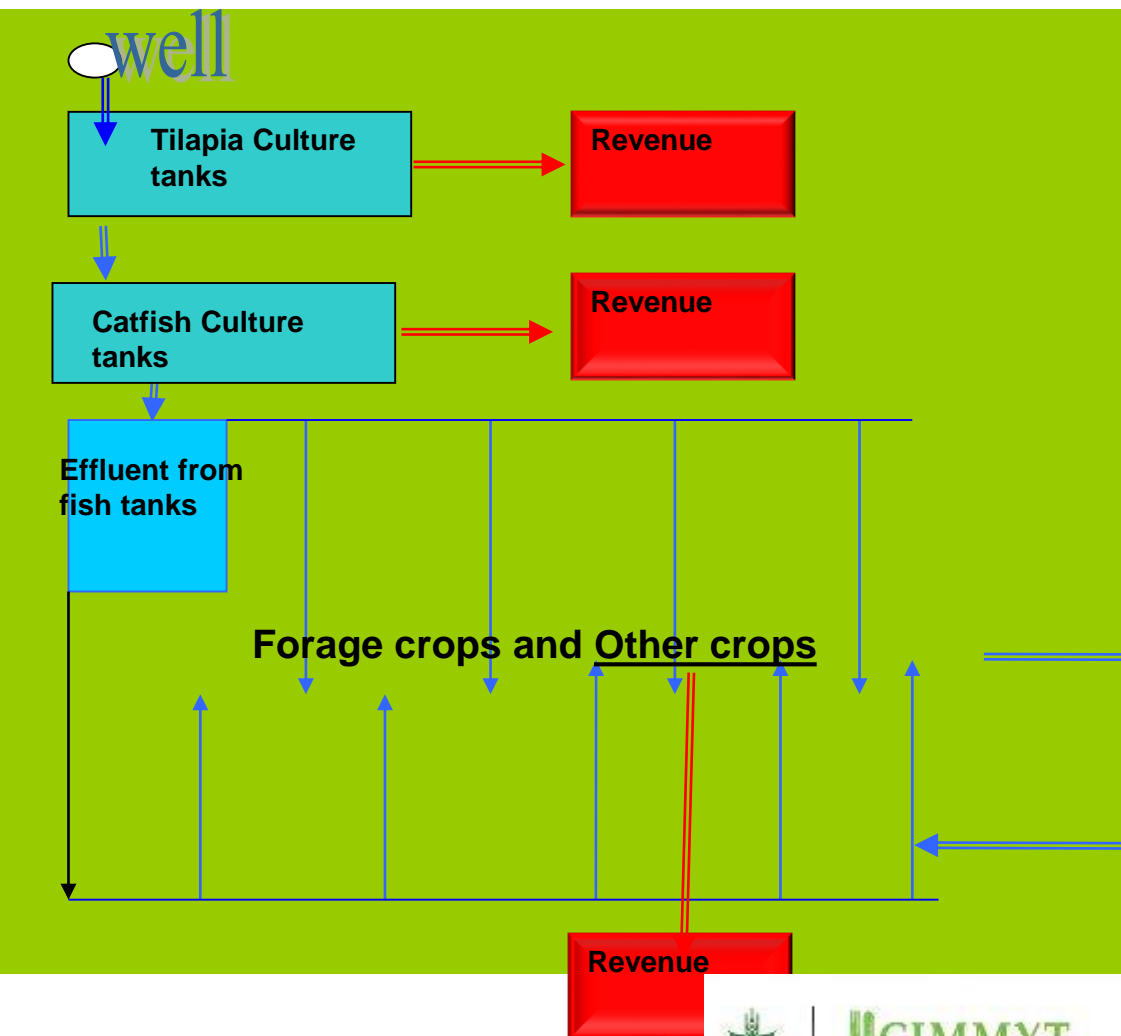
Evaluation of efficient use of fresh water - application of integrated aquaculture agriculture practices (2010 study)

Farm Number	1	2	3	4
Water source for fish farm	Ground water 25oC, fresh, 70 m deep well	Ground water 25°C, fresh, 80-m deep well	Canal	Canal
Water source for crops	Fish pond effluent plus canal	Fish Farm effluent	Fish Culture Reservoir	Fish Culture Reservoir
Crops			R 1	
1	Mango	Mango	Mango	Banana
2	Banana	Alfa Alfa	Orange	Iychees (Bashmela)
3	Vegatable (peper, curcumber) & flowers		R 4	Mandarin (Kaka)
4	Orange		Mango	Orange
5			Orange	Under preparatio
6			Grapes	
7			Vegatables	

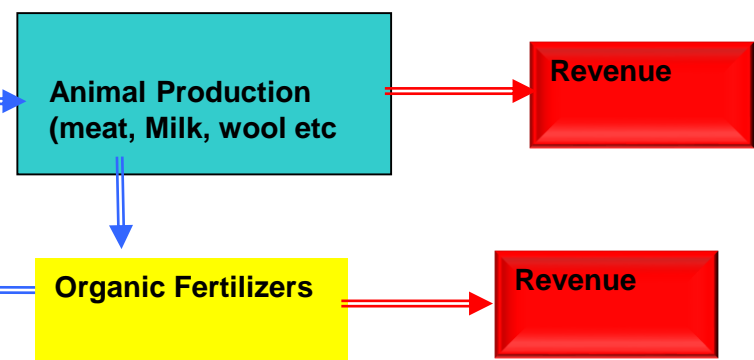
Quantify Changes in Water Nutrients

	Farm 1			Farm 2			Farm 3			Farm 4		
	TN	Av P	K	TN	Av P	K	TN	Av P	K	TN	Av P	K
Source average, mg/l	0.5	0.128	7	2.52	0.07	6.5	2.77	0.09	8.03	0.9		9.87
Drain Average, mg/l	2.48	0.08	8.77	4.43	0.123	8.9	2.75	0.056	6.3	1.6		17.4
difference	1.98	-0.005	1.77	2.11	0.05	2.4	-0.02	-0.04	-1.7	0.7		7.53
Volum m3 / day	1070			320			5104			7390		
Fertilizer /Day (kg)	2.12	-0.01	1.89	0.68	0.02	0.77	-0.10	-0.20	-8.68	5.17		55.65

Integrated A-A Output



sequential linkages between two or more human activity systems (one or more of which is aquaculture),



Partial Budget for small scale unit (2015)

Item	Partial Budget			
	Unit	Quant	Value (EGP)	Total
Fish sales	Kg	2,240	14	31,360
Fertilizers saving	???			
Gross revenue				31,360
Production input				
Fry	1000	8	90	720
feed	t	3	5,000	15,000
Other feed	t	0.5	4000	2000
Harvest day	Man/day	10	100	1,000
Fuel cost for additional pump	Sum	1	1,000	1,000
Total operational input				19,720
Net revenue				11,640

Integration in Old lands

Sustainable use of resources



	Parameters				
Source	Temp	pH	DO (mg/l)	NH4 (mg/l)	No3 (mg/l)
Site 1					
Inlet	24.9	8.24	5.83	0.12	0.28
Pond	26.6	8.17	5.46	0.42	0.21
Outlet	24.7	7.81	4.43	0.16	0.21
Site 2					
Inlet	28.7	7.6	6.0	0.11	-
Pond	28.6	7.7	6.2	0.12	-
Outlet	28.8	7.5	3.6	0.15	-

Practices and resource use efficiency of Egyptian farms applying aquaculture-agriculture integration.

WAS 2018. France.

Conclusion and Recommendation

- **IAA enable maximize water use efficiency and contributes for food security and increase farm income**
- **Research and Development area** for successful Integrated A-A systems
 1. **Nutrient flow from fish system to crop system, & Nutrient required for crop.**
 2. **Standardise water exchange in fish system and requirements for crop systems.**
 3. **Efficiency of water filtration system to avoid clogging of drip irrigation system.**
 4. **Lake of knowledge of BMP for IAA.**

شکرا



Thank You

