



# Aquaponics as an example of long term sustainable food production

Jan Mráz



# World megatrends

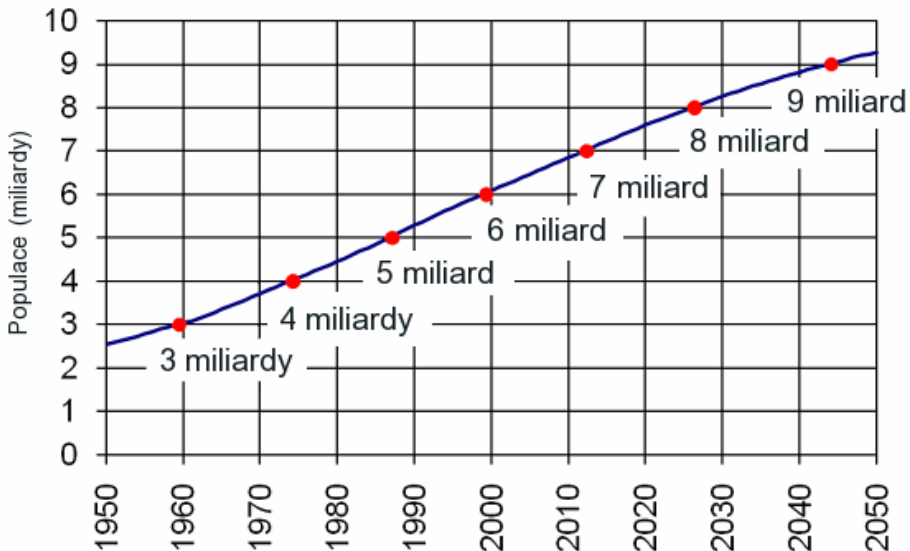


7.364 bilions



Světová populace

(vývoj v letech 1950 až 2010 + projekce do roku 2050)

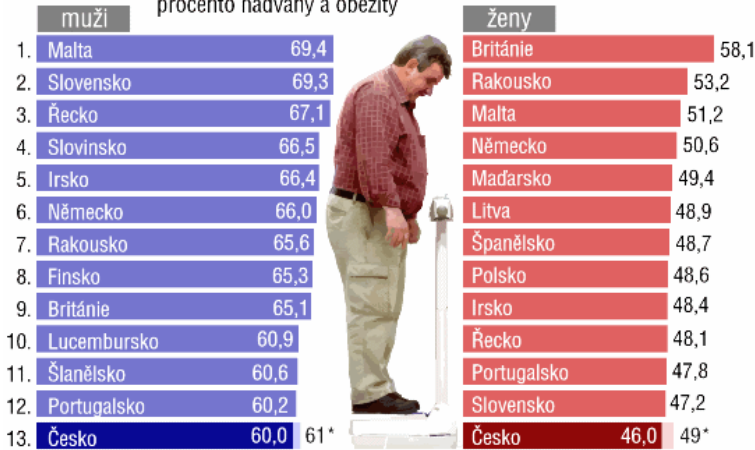


Zdroj: U.S. Census Bureau

# World megatrends

## NADVÁHA A OBEZITA V EVROPĚ

procento nadváhy a obezity

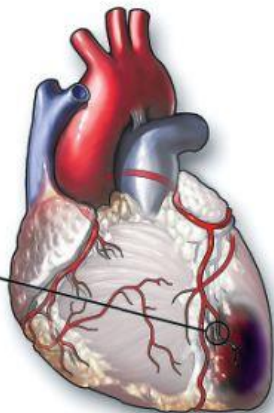


\* - výzkum 2010

zdroj: Světová zdravotnická organizace ČTK

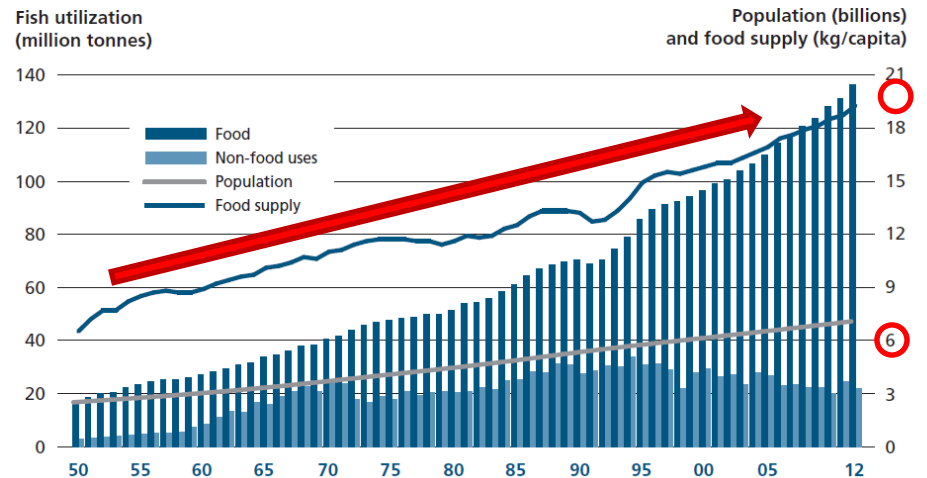


Blocked Lumen in Branch of Left Coronary Artery



Anterior infarct

## World fish utilization and supply

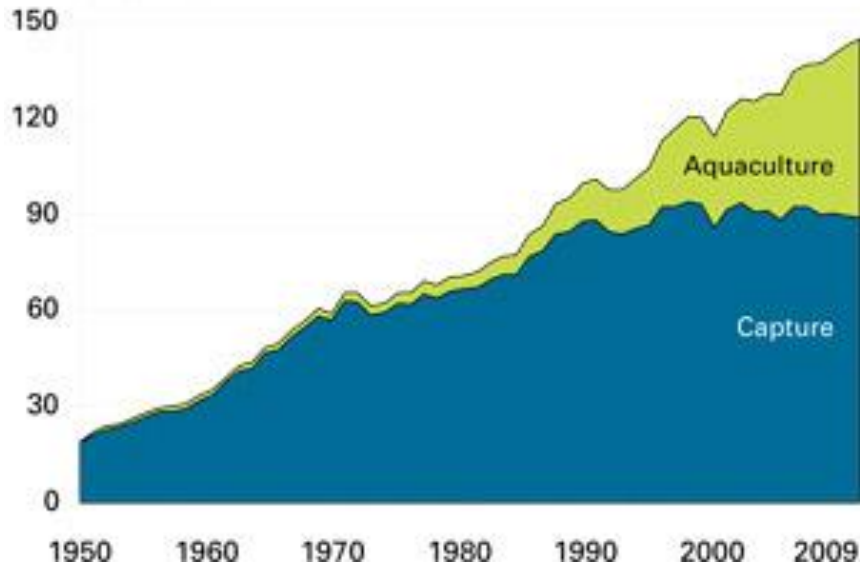


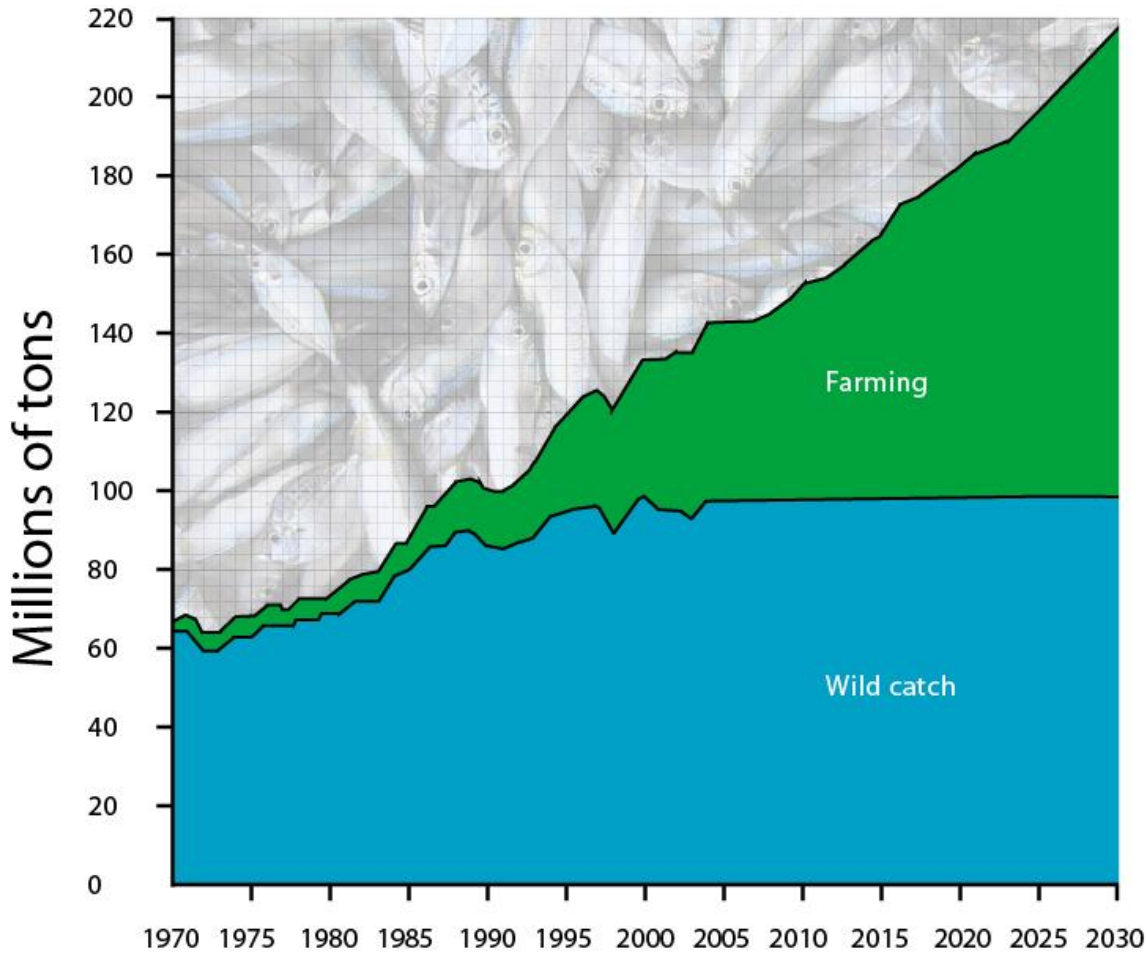


# Introduction:

## World fishery production

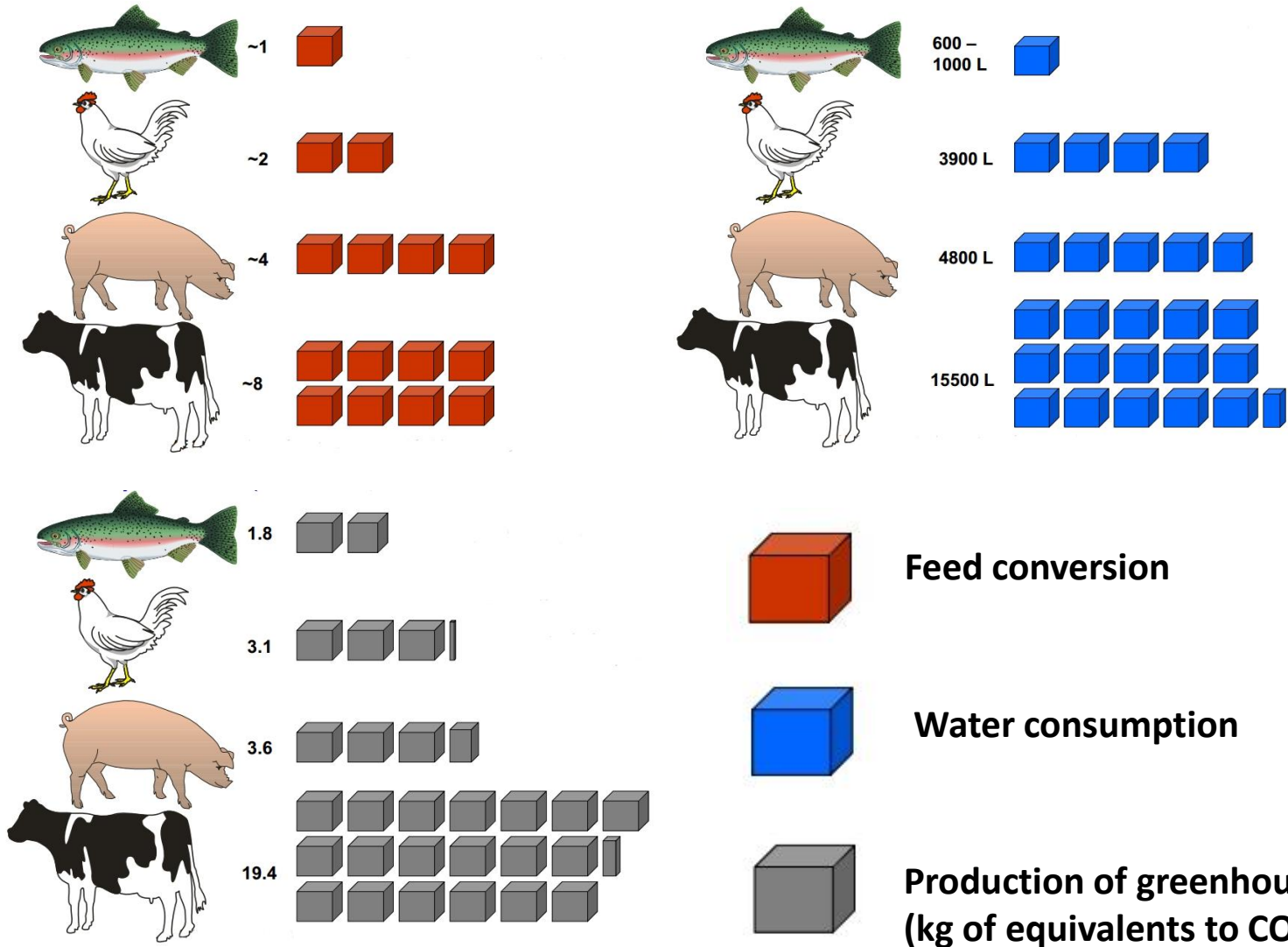
million tonnes



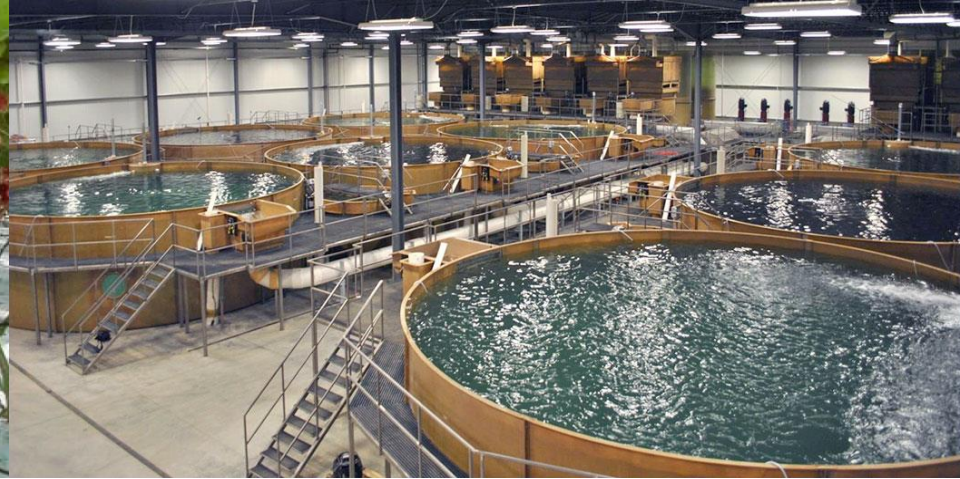


[www.futuretimeline.net](http://www.futuretimeline.net)





(Kloas et al., 2011)

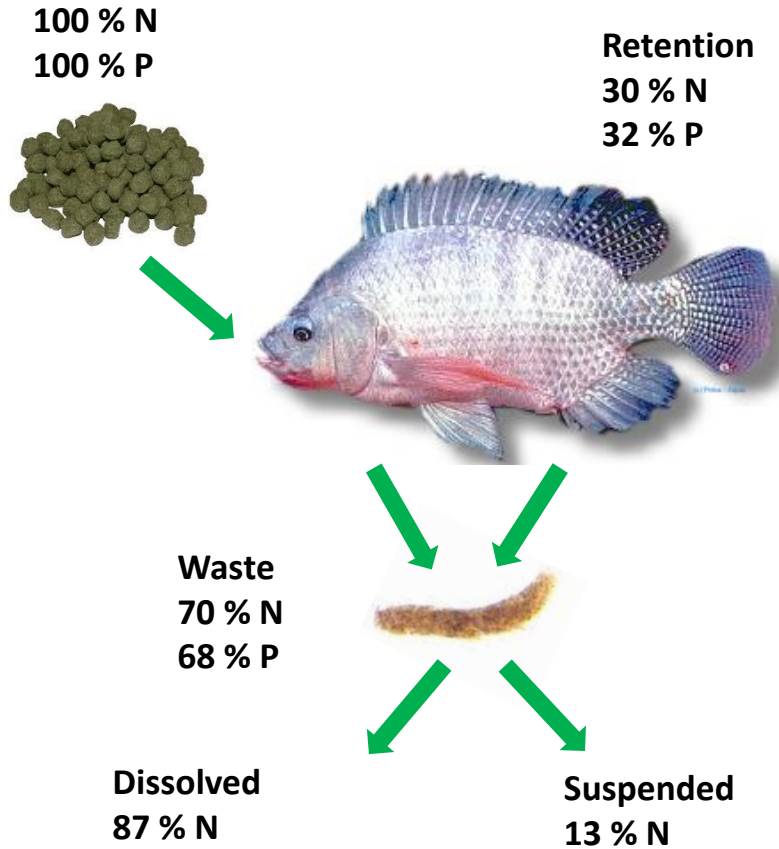


- Hydroponics

- low need of water
- soilless
- no weeds and diseases
- close to consumption
- optimal conditions
- fast growth
- even quality

- Aquaculture

- low need of water
- no need of ponds, streams or seas
- close to consumption
- optimal conditions
- fast growth
- even quality





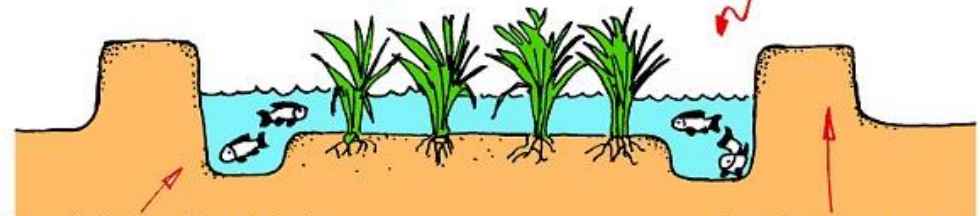


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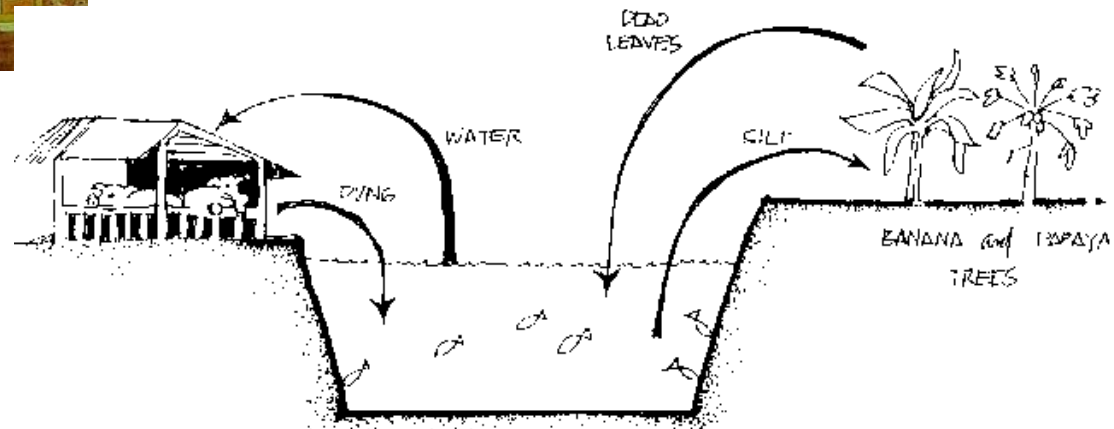
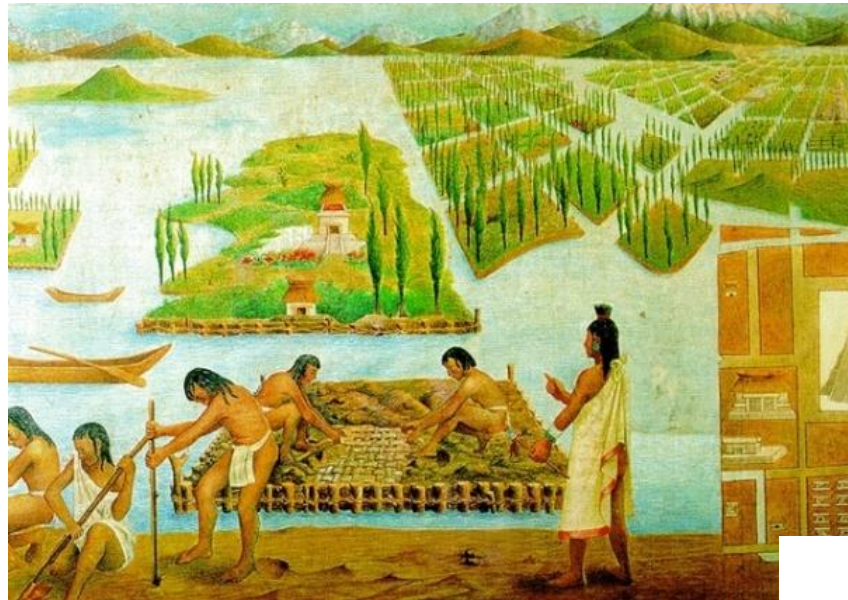
the fish help the rice thrive by providing organic fertilizer, eating insects and circulating oxygen throughout the plants...

...which means the farmer has to buy less fertilizer and pesticide



this small ditch provides the fish with a habitat during the dry season

the dyke helps ensure an adequate water level





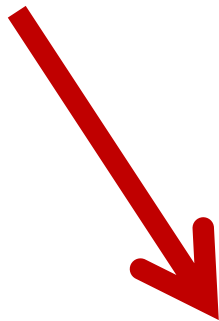
O<sub>2</sub>



CO<sub>2</sub>



**Rich in nutrients**



CO<sub>2</sub>



**Rich  
in nutrients**

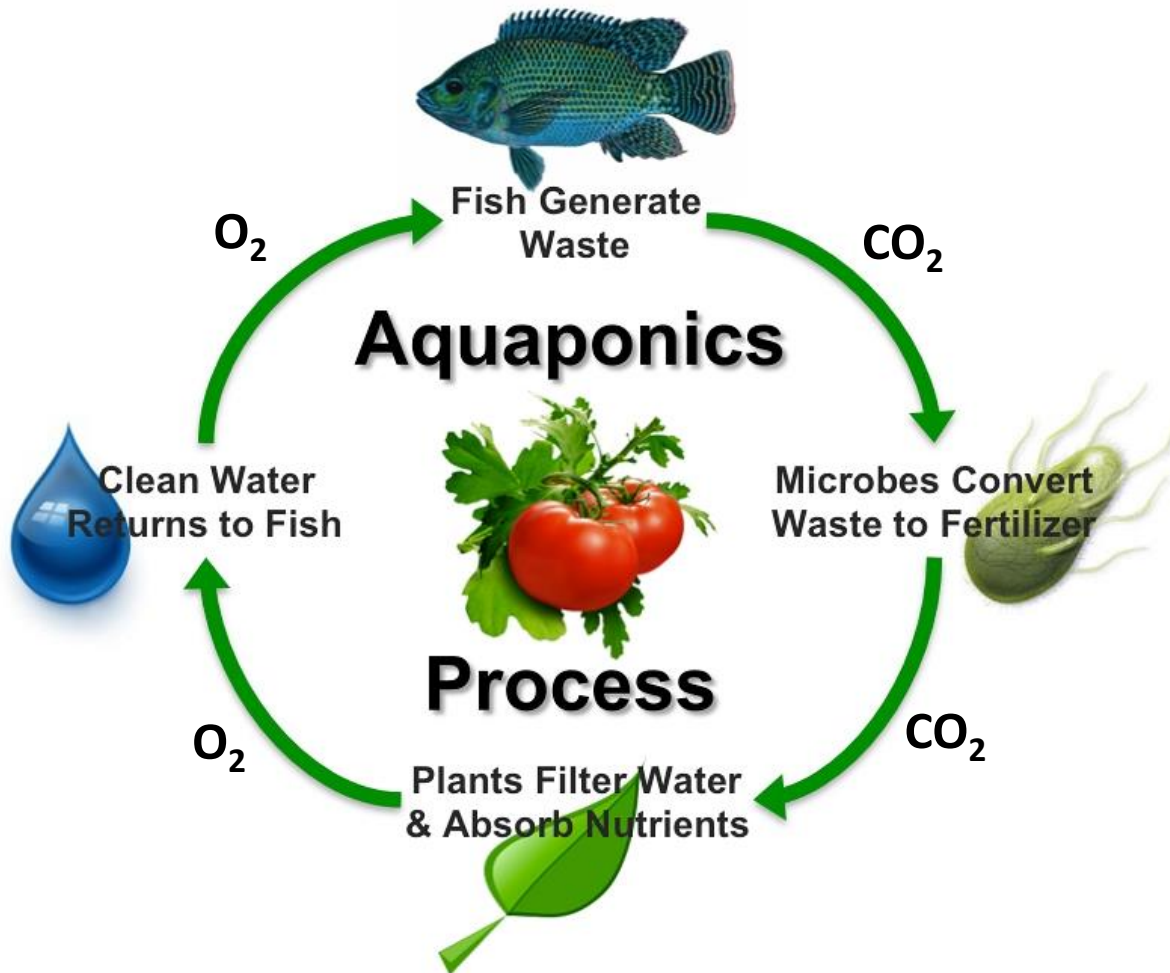


O<sub>2</sub>





# ***Aquaculture + Hydroponics = Aquaponics***





1.5 kg



1 kg



2 kg





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## 2 THE GLOBE - AQUAPONIC SYSTEM

AQUAPONIC FARMING IS A TECHNIQUE THAT COMBINES THE CULTIVATION OF FISH WITH THE GROWING OF VEGETABLES. THE FISH PROVIDE RICH FERTILIZER FOR THE PLANTS AND IN RETURN, THE PLANTS CLEAN THE WATER FOR THE FISH. THE FISH AND THE PLANTS CO-EXIST IN A SYMBIOTIC RELATIONSHIP.

COLD SEASON HARVEST



CARROTS PEAS



LETTUCE



CABBAGE



BROCCOLI



SWISS CHARD



SPINACH



GREY FISH

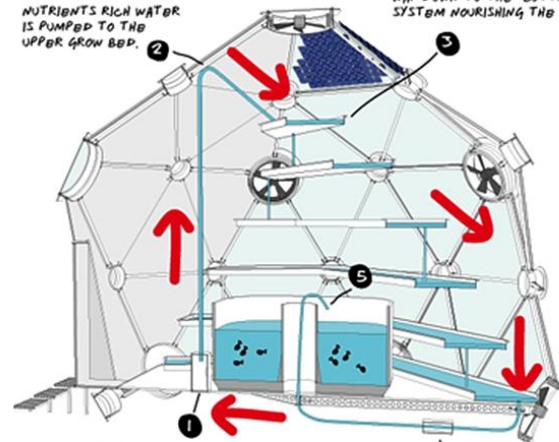
NUTRIENTS RICH WATER IS PUMPED TO THE UPPER GROW BED.

2

THE WATER IS PUMPED THROUGH THE BIO FILTER TO COLLECT FISH FECS WHICH ARE TRANSFORMED INTO NUTRIENTS BY NITRIFYING BACTERIA.

1

FOLLOWING GRAVITY THE WATER RUNS INTO THE GROW BEDS ALL THE WAY DOWN TO THE BOTTOM OF THE SYSTEM NOURISHING THE PLANTS



THE FRESHLY CLEANED WATER IS PUMPED BACK INTO THE FISH TANK.

4

HOT SEASON HARVEST



TOMATOES



MELONS



CUCUMBERS



GREEN PEPPERS



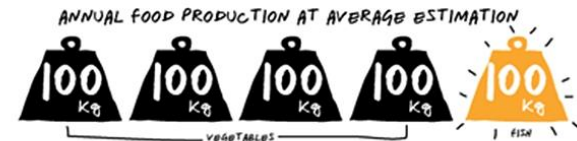
AUBERGINES



GREEN BEANS



SQUASH



OPTIMAL FISH SPECIES FOR AQUAPONIC FARMING



CARP



TROUT



TILAPIA

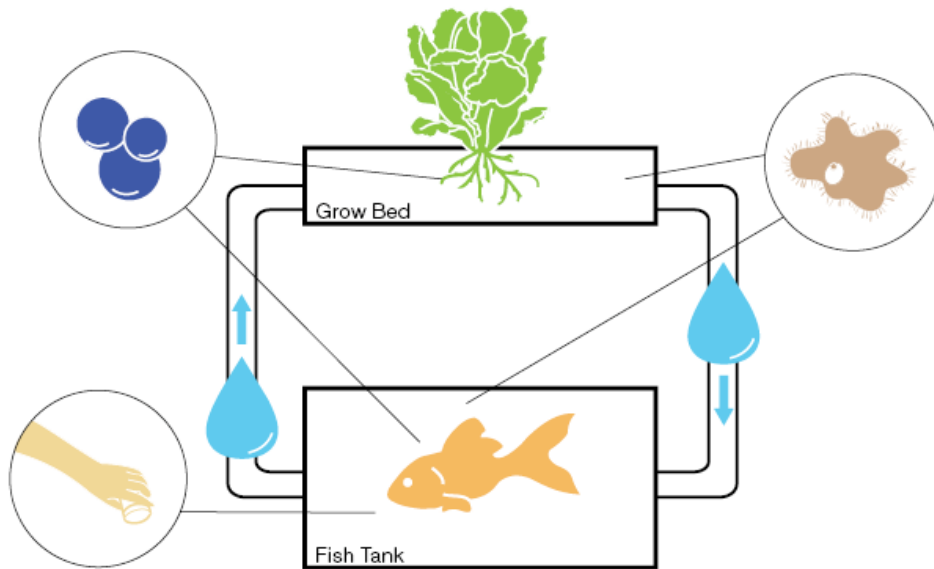


SALMON

[https://www.youtube.com/watch?v=OvHVLHZiXHk&feature=player\\_embedded](https://www.youtube.com/watch?v=OvHVLHZiXHk&feature=player_embedded)



# Aquaponics – how it works



- Fish produce waste, ammonia (toxic)



- Microbes convert ammonia to nitrites and nitrates



- Plants use nitrates and other nutrients from water



- Water is cleaned and oxygenated through growbeds



- Clean and oxygen rich water goes back to fish tank



# Aquaponics - plants

- They don't invest energy in root growth
- Continual excess of nutrients
- Excess of  $\text{CO}_2$ ,  $\text{NO}_3^-$
- Warm water
- No weeds





# Aquaponics – design

- Media-Based Growbed
- Growing Power System
- Raft System
- NFT  
(Nutrient Film Technique)
- Towers
- VertiGro





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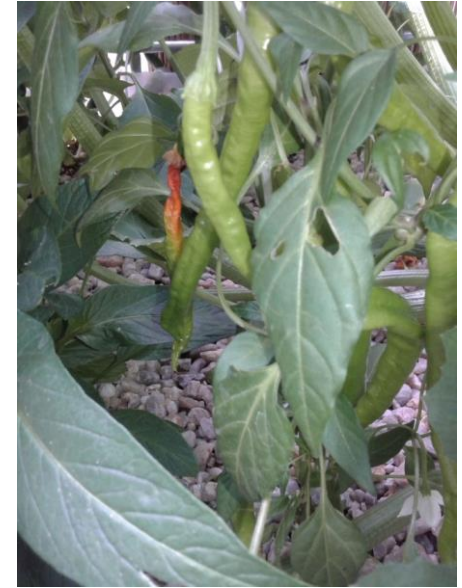


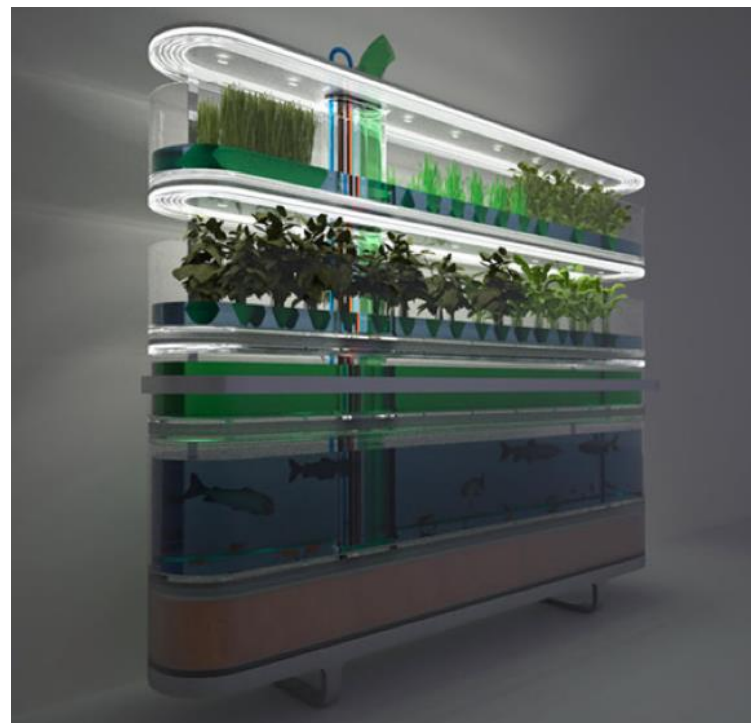




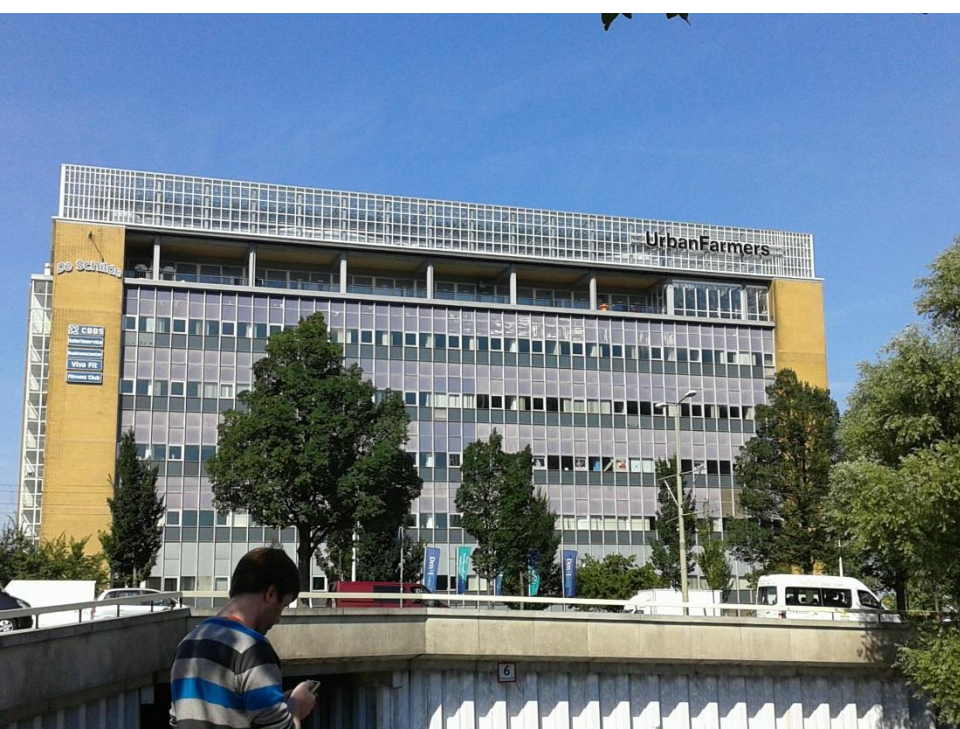
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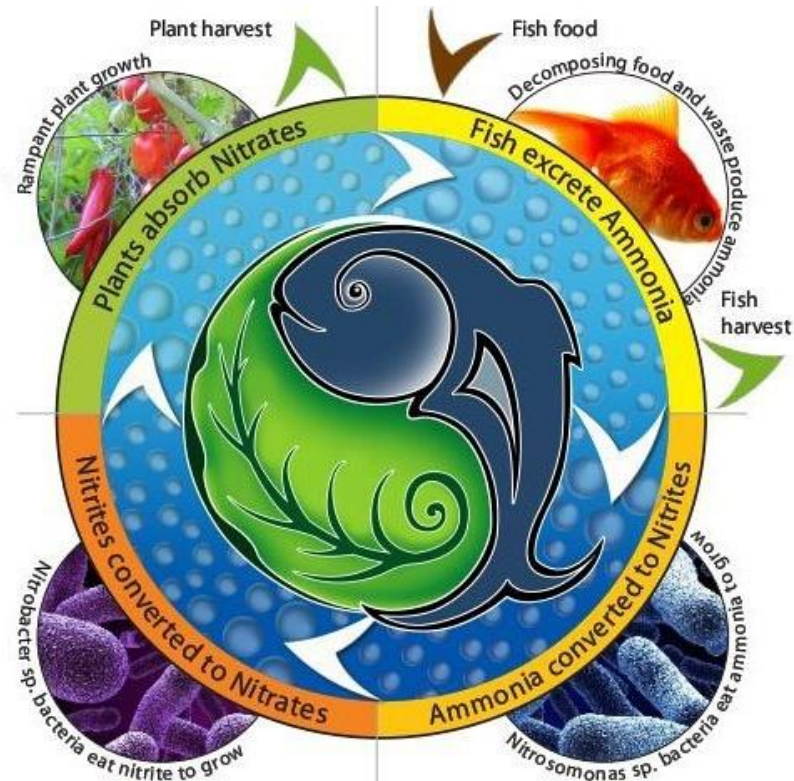












*Thank you for your attention*