Aquaculture in Michigan – Future Directions and Challenges

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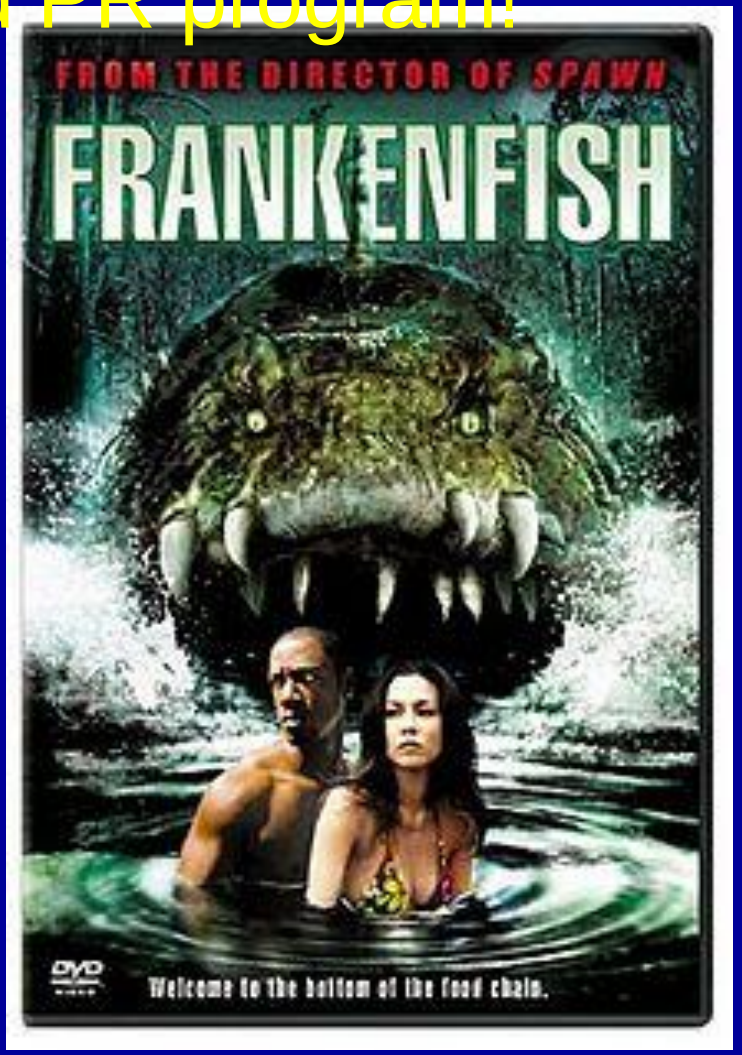
Aquaculture

- Controlled growing of an aquatic crop
- Humans currently consume more seafood from aquaculture than from wild fisheries
- This imbalance will be more extreme in the future, because aquaculture is the fastest growing method of food production today
- Efficiency is high compared to other protein production systems, in terms of energy use, space, water use, and conversion efficiency
- Relatively new technology with lots of change in recent years and potential to change in the future

Public view of aquaculture

Aquaculture needs a good PR program!



Public view of aquaculture

In reality, agriculture adds far more nutrients to receiving waters that aquaculture will ever do.

Agriculture

Aquaculture wallpaper?

Some basic ideas in the Michigan Aquaculture Association strategic plan

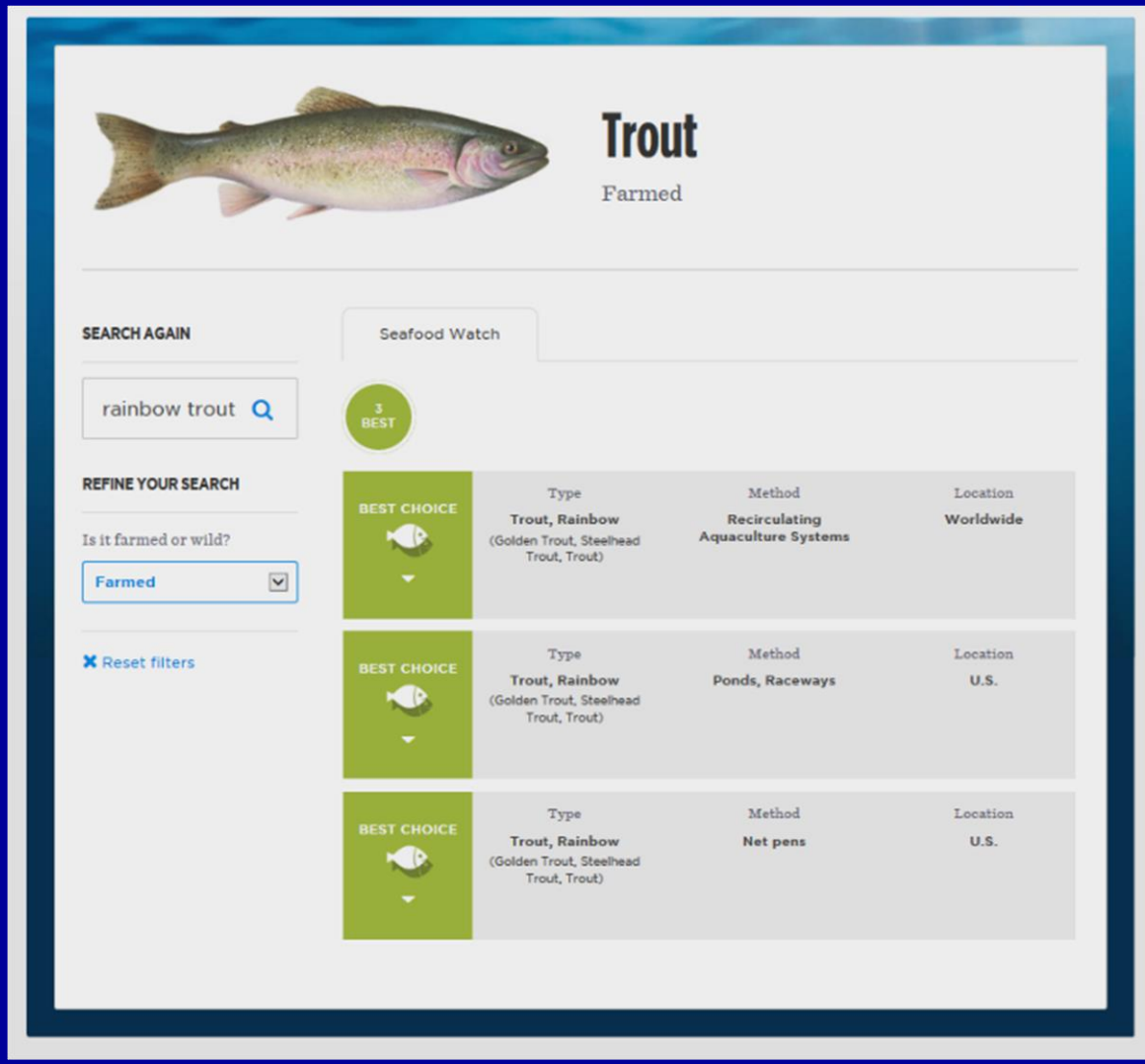
- Michigan needs to step up in aquaculture because:
  - 90% of our seafood is imported
  - We have reasons to question its quality
  - Population growth is causing new demand
  - We have the water, expertise, and fishing history to make it work
- However, Michigan needs to use caution to develop systems that will be productive yet not cause undue harm to the environment
  - Somewhat an issue because ALL interventions cause some harm – need to limit it

Basic concepts in strategic plan

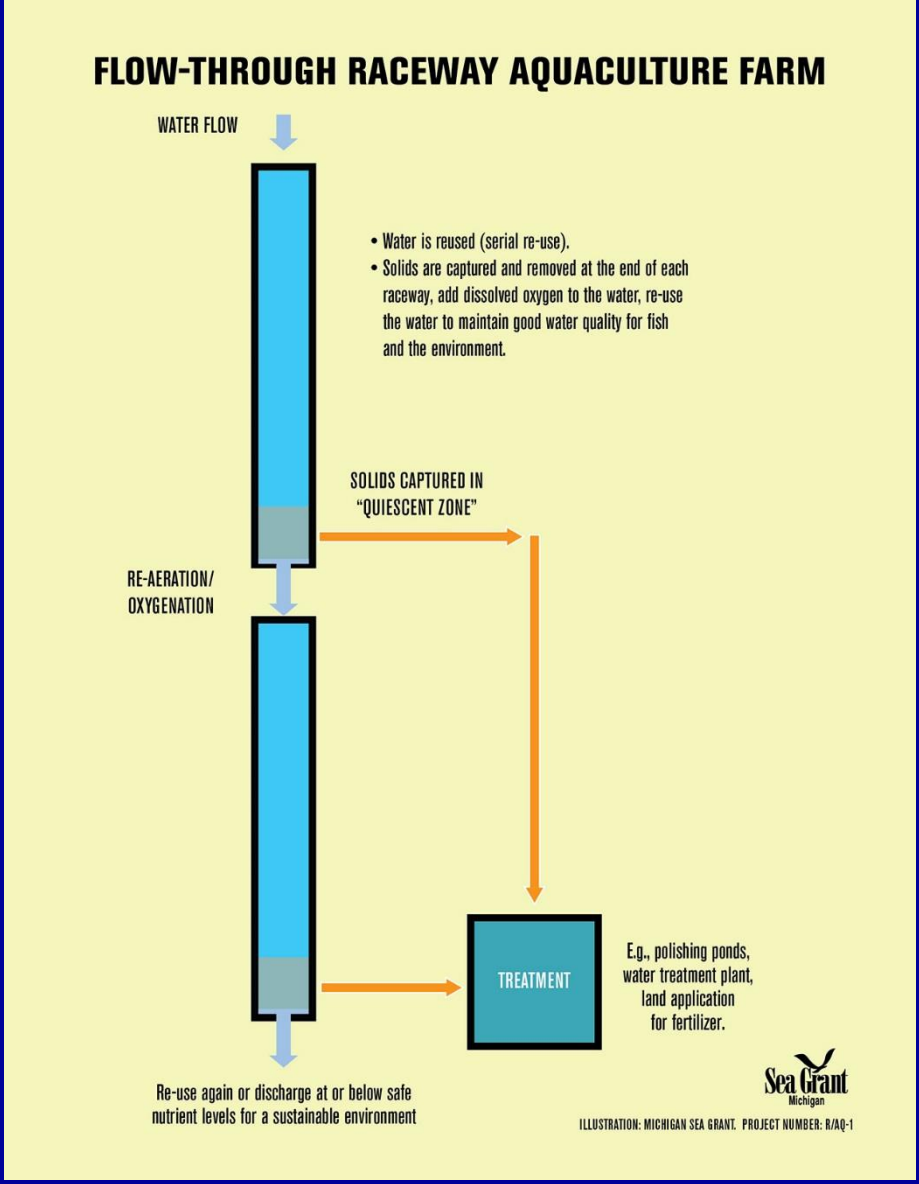
- Expand aquaculture to $1 billion industry by 2025
- Do so using 3 main systems – raceways, recirculating, and cage culture
- Start by expanding existing systems, but then develop demonstration farms and business plans that will support financing for new systems
- Develop whole industry, not just production facilities - fry production, feed production, food fish production, processing, and marketing

Raceways

- Most common system in Michigan today – includes state salmon and trout hatcheries
- Ranked as a “Best Choice” for sustainable seafood from the Seafood Watch program.



Schematic of a raceway farm



Raceway culture

- Potential impacts
  - Nutrients and solid waste released in receiving waters
  - Fish can escape and interbreed or compete with natives
  - Diseases or parasites can be established because of high-density culture

Raceway treatments

- Efficient feeding and density can control dissolved nutrients
- Use of settling areas can reduce solid waste
- Use of disease-free fry can reduce disease frequency
- Use of species, hybrids, triploids can reduce genetic impacts
- Smart management can reduce escapes

Raceway systems in Michigan

Dan Vogler
Harrietta Hills Trout Farm

Owen Ballow
Indian Brook Trout Farm

Indian Brook – hybrid system

- Raceways and round tanks

Indian Brook – hybrid system

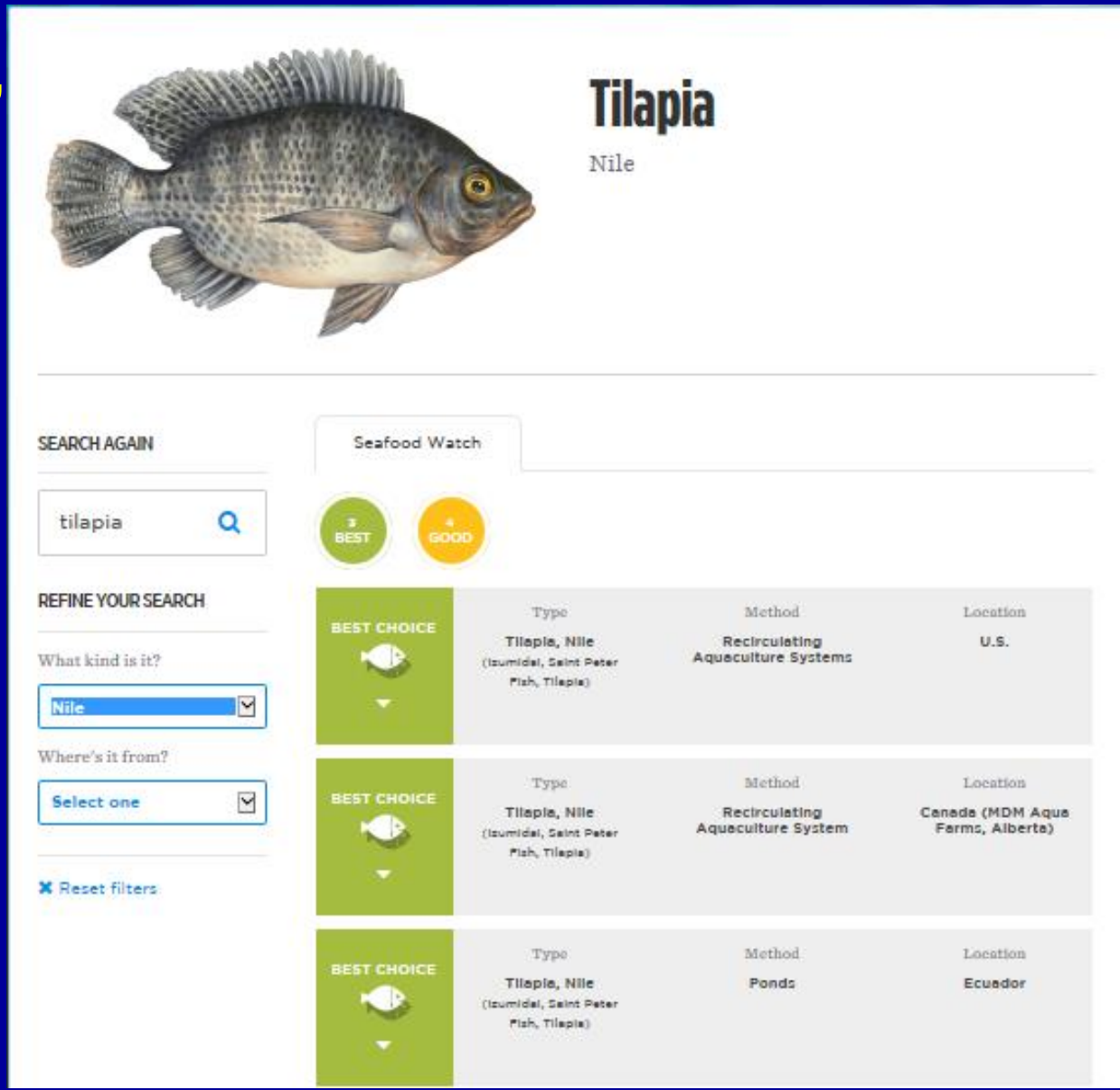
- Raceways and round tanks
- Water source from artesian wells
  - No pumping or circulation cost
  - Always at 55 F

Indian Brook – hybrid system

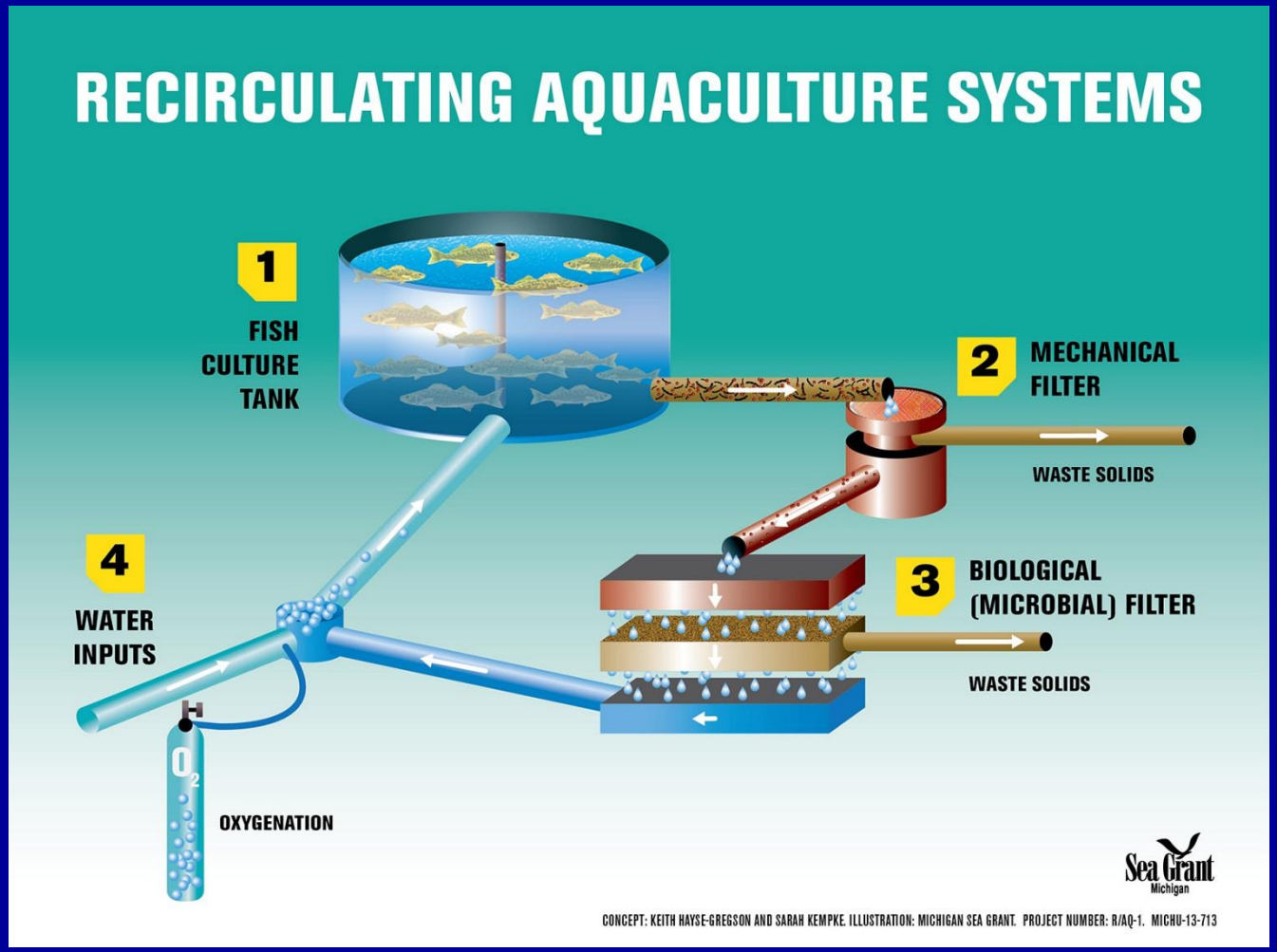
- Raceways and round tanks
- Water source from artesian wells
- Water treatment from wetland absorption

Recirculating aquaculture

- Developing in US, more common in Europe
- Again rated as “Best Choice” by Seafood Watch



Schematic of a recirculating farm



Recirculating aquaculture

- Potential impacts
  - Limited escapement
  - Nutrients controlled on site
  - Water use usually limited, but still needs water exchange
  - May use more chemicals and other treatments
  - High cost of electricity or energy to run system
- Is it economically sustainable?

Recirculating systems in Michigan

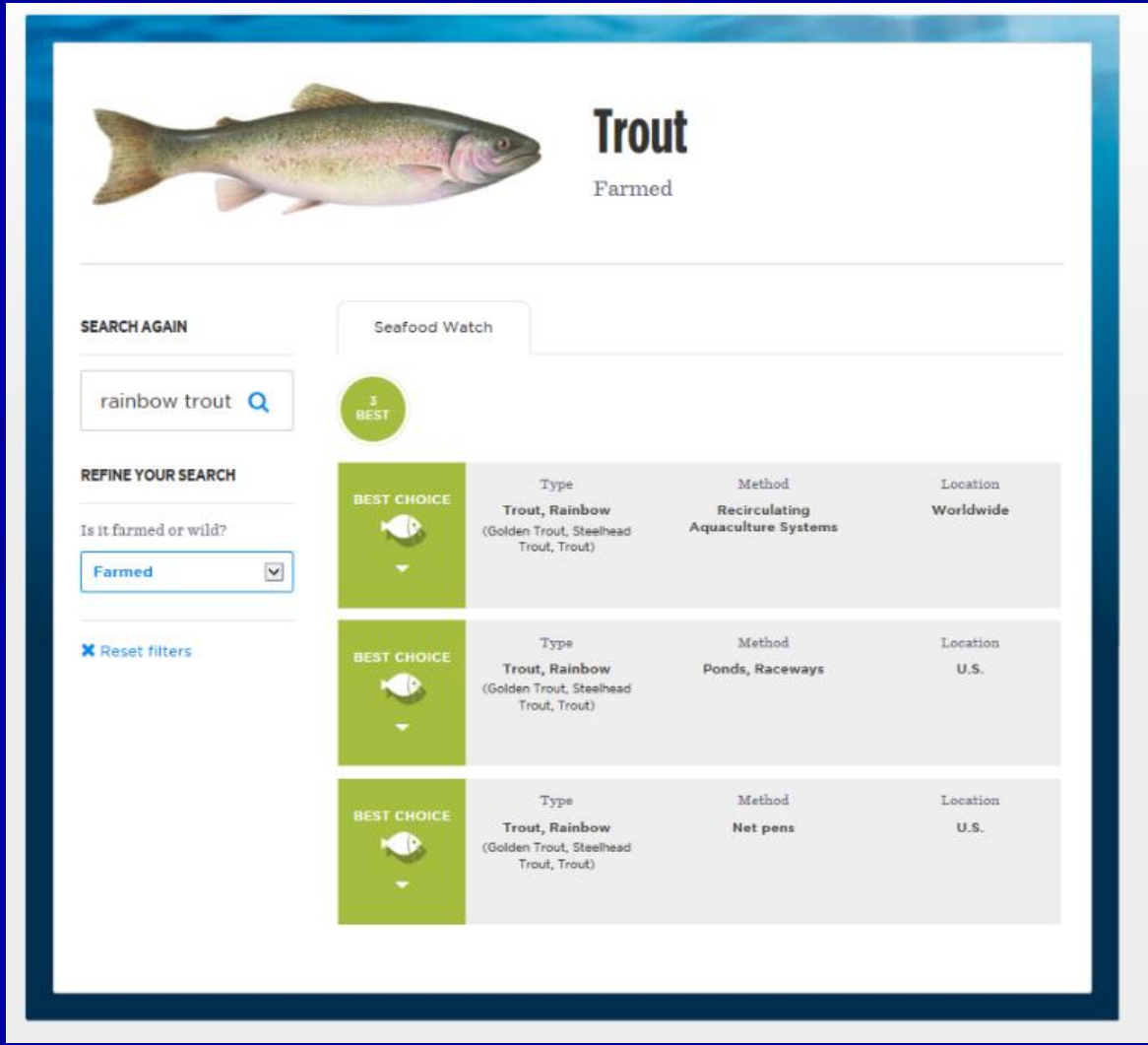
- Russ Allen and shrimp in Okemos
- Aqua Growers and tilapia aquaponics in Livonia

Recirculating systems in Michigan

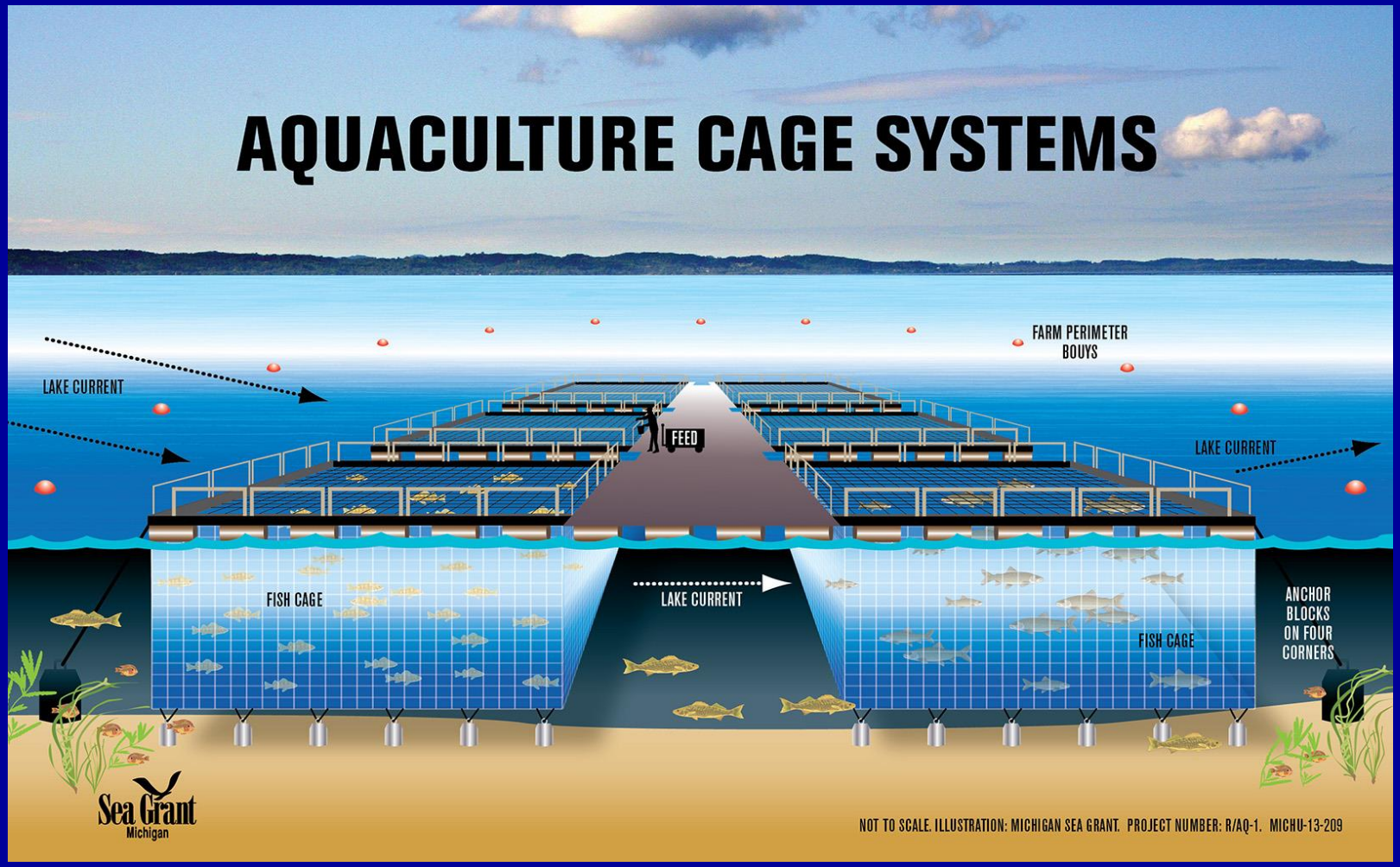
- Russ Allen and shrimp in Okemos
- Aqua Growers and tilapia aquaponics in Livonia
- Barramundi culture in Manistee
- Recovery Park in Detroit

Net-pen culture in Great Lakes

- Systems in place in Ontario, also common on both coasts and the Columbia River
- Rainbow trout system also rated as “Best Choice”



Schematic of a net-pen farm



Net-pen culture

- Potential impacts
  - Nutrients and solid waste released in receiving waters
  - Fish can escape and interbreed or compete with natives
  - Diseases or parasites can be established because of high-density culture
  - Solid waste can smother sediments near cages

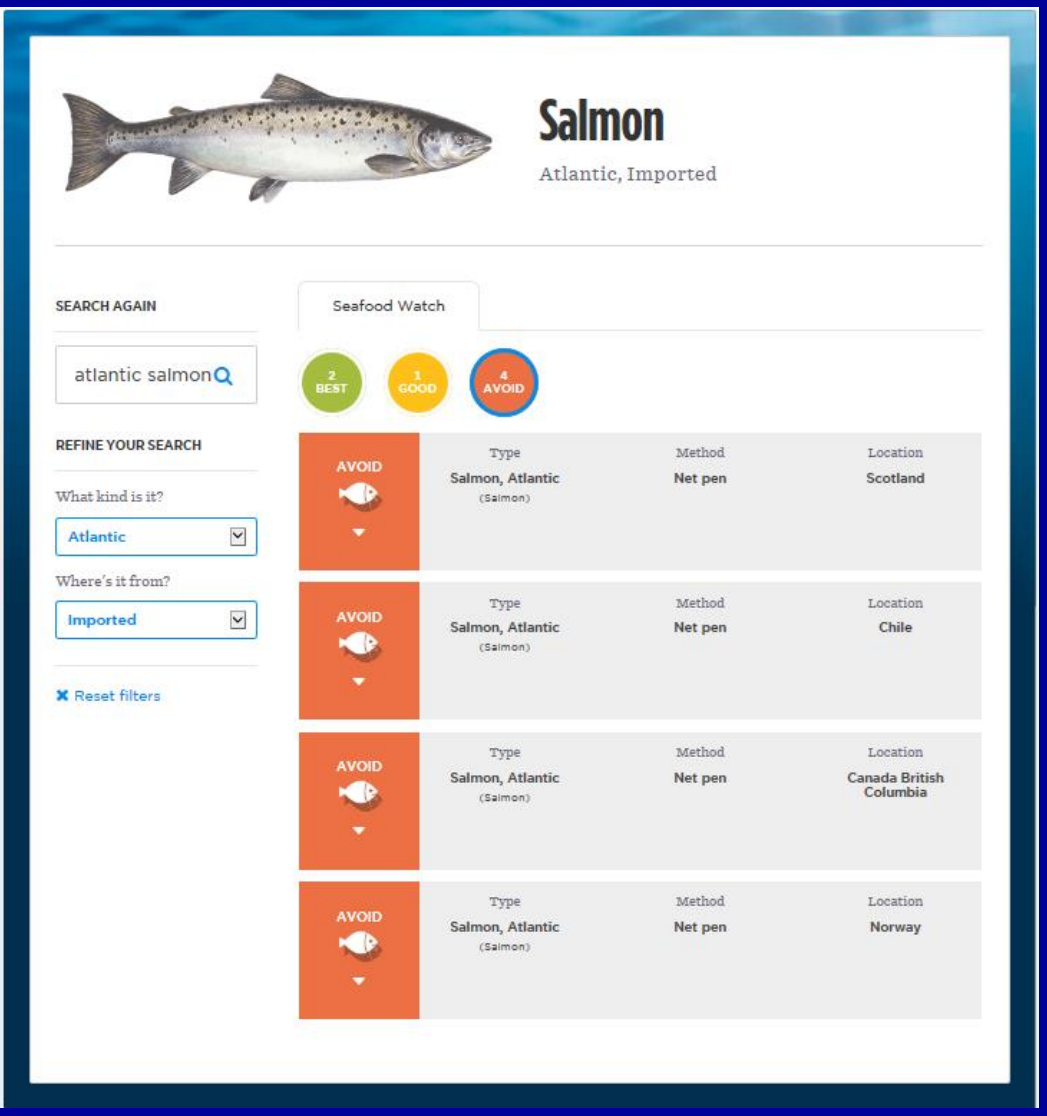
Benefits of net-pen culture

- Could become major economic driver
  - Norway produced 1.7 million tons and $6.5 billion in Atlantic salmon in 2013
  - Especially focused in rural areas of special need
- Provide safe, high-quality seafood
- Add to other forms of aquaculture operating in the state

Improvements for net-pen culture

- Integrated multi-trophic aquaculture
  - Nutrients absorbed by plants
  - Solid waste eaten by animals
  - This idea is still quite experimental and only done in marine waters
- Impacts really a matter of cage and fish density
- Escapees still more common

Concerns about Net Pens



- Problems with Atlantic salmon culture well known
- Rated as “Avoid” by Seafood Watch

AVOID	Type	Method	Location
	Salmon, Atlantic (Salmon)	Net pen	Norway

Overall Score: 3.60

Data	Effluent	Habitat	Chemicals	Feed	Escapes	Disease	Source	Predator Mortalities	Escapes (Other Species)
6.70	4.00	6.00	1.00	5.20	2.00	0.00	10.00	-6.00	0.00

What does each criteria mean?

Summary

Open net pen farmed Atlantic salmon from Norway receive an "Avoid" due to high concerns regarding the use of chemicals, the impacts of escapes on wild salmon and sea trout, and the transfer of parasites to wild populations.

The majority of salmon farmed today (and all salmon farmed in Norway) are Atlantic salmon. A small quantity of Pacific salmon - Chinook and coho - is also farmed. Salmon is known as sake when prepared for sushi.Salmon farmed in open net pens are vulnerable to infection from diseases and parasites, and are treated with antibiotics and pesticides. Pesticide use in Norway to control parasitic sea lice is high. Although antibiotic use has declined in Norway, the majority used there are critically important for treating human diseases, and there are no regulatory limits on total use should a disease outbreak occur.

The salmon farming industry in Norway is located in important areas for wild salmon and sea trout populations. The impacts of escaping farmed salmon on wild salmon populations are a high concern, as are the impacts of parasitic sea lice on wild salmon and particularly sea trout.

Consumers interested in purchasing salmon are encouraged to look for either wild-caught salmon, U.S.-farmed freshwater coho salmon that is clearly labeled, or Verlasso® salmon, and "Avoid" most farmed Atlantic salmon.

Michigan's experience with net pens

- Received 2 pre-permit applications
- Decided to convene expert panel to give recommendations to QOL group
- Panel reported in October 2015, along with a cursory market evaluation
  - http://www.michigan.gov/dnr/0,4570,7-153--368780--rss,00.html
- State to decide on next steps within the month

Panel recommendations

- Asked not to propose a decision, but recommend what to consider in decision
  - Use adaptive management
  - Monitor carefully (BACI)
  - Start slowly and develop best practices
  - Consider siting as the most important issue
  - Require decommissioning bonds or insurance
  - Pay particular attention to effects of ice and plans to manage for them

Specific concerns

- Nutrient addition to the lakes
- Sediment accumulation below cages
- Disease transmission to wild fish
- Breeding impacts on wild fish

Conclusions

- Aquaculture is here to stay
- Many projects and businesses are improving the environmental footprint of aquaculture
- Rural and urban areas in Michigan could benefit greatly from jobs created by expanding aquaculture
- Michigan needs to regulate aquaculture businesses appropriately, as an agribusiness and comparable to other agribusinesses
- We need some successes to drive more financial investment