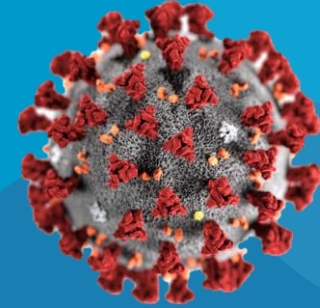


RAS ECONOMICS

Carole R. Engle, Ph.D.

ENGLE-STONE
Aquatic\$ LLC

2020 has been an exciting
year.....



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year.....

And I'm not talking about the
pandemic.....

**Executive Order on Promoting American
Seafood Competitiveness and Economic
Growth; signed 5/7/2020 by President
Trump.**

2020 has been an exciting year.....

Also for the continued announcements of new RAS investments in the U.S. and around the world.



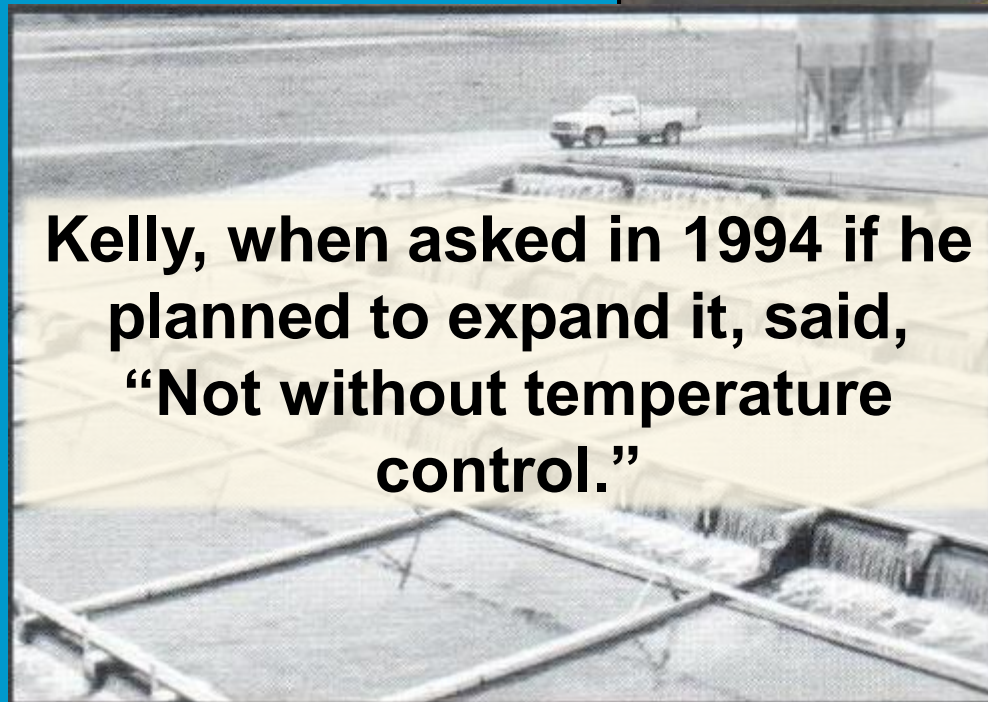
Visionaries of US aquaculture have long dreamed of major RAS farms.

Edgar “Chip” Farmer, early catfish pioneer’s son, Kelly, built an 80-acre outdoor RAS.



Visionaries of US aquaculture have long dreamed of major RAS farms.

Edgar “Chip” Farmer, early catfish pioneer’s son, Kelly, built an 80-acre outdoor RAS.



Kelly, when asked in 1994 if he planned to expand it, said, “Not without temperature control.”

In Kelly's day, the challenge was to
produce fish reliably in indoor
RAS.

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RAS have become part of the supply chain of commercial aquaculture.

In Kelly's day, the challenge was to produce fish reliably in indoor RAS.

Today, the challenge has become to make it economically viable.



RAS have become part of the supply chain of commercial aquaculture.

So, what is the business case for RAS aquaculture?

Business feasibility & profitability: come down to combined effect of 100's of decisions made.

So, what is the business case for RAS aquaculture?

Business feasibility & profitability: come down to combined effect of 100's of decisions made.



There are some well-established, profitable RAS farms in the US



Blue Ridge Aquaculture

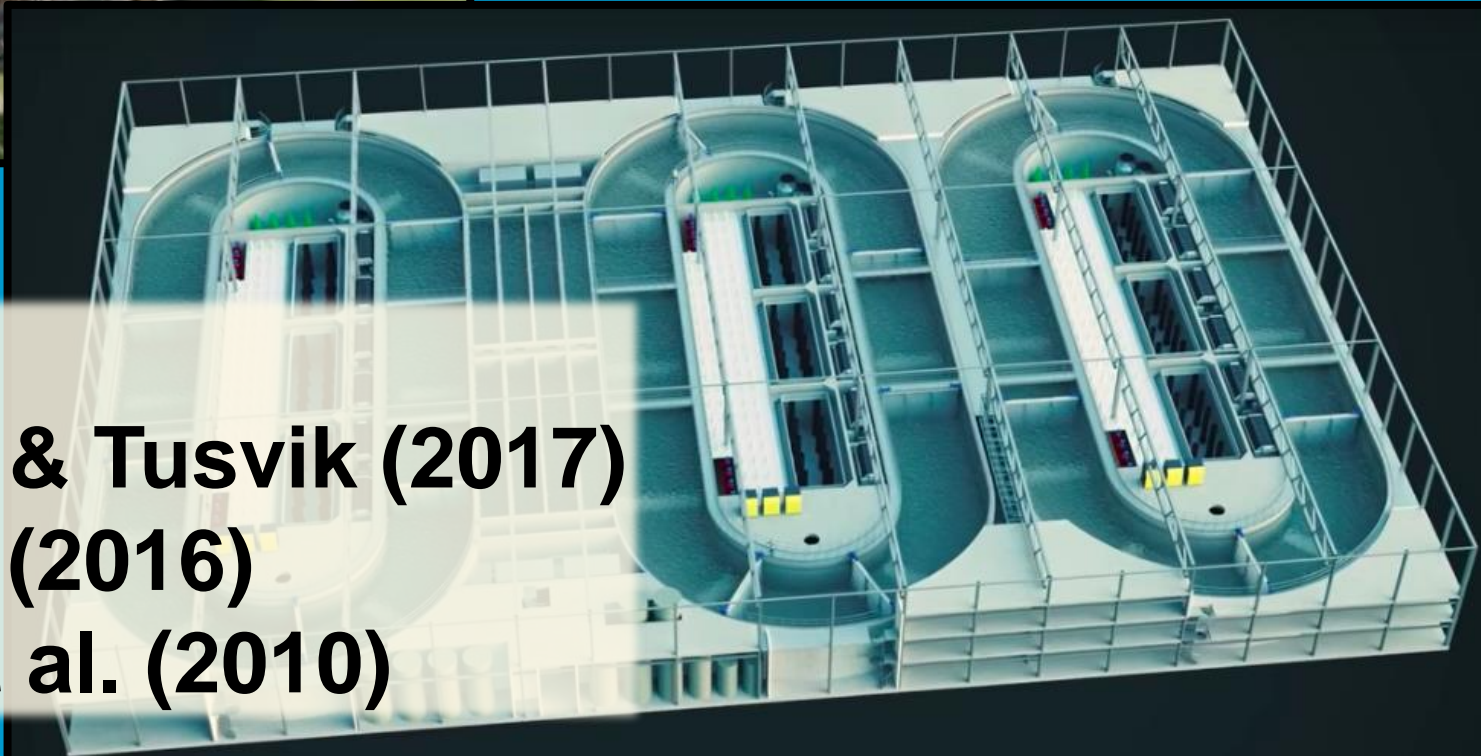




What do we know about RAS ?

Studies:

- Bjorndal & Tusvik (2017)
- Liu et al. (2016)
- Boulet et al. (2010)



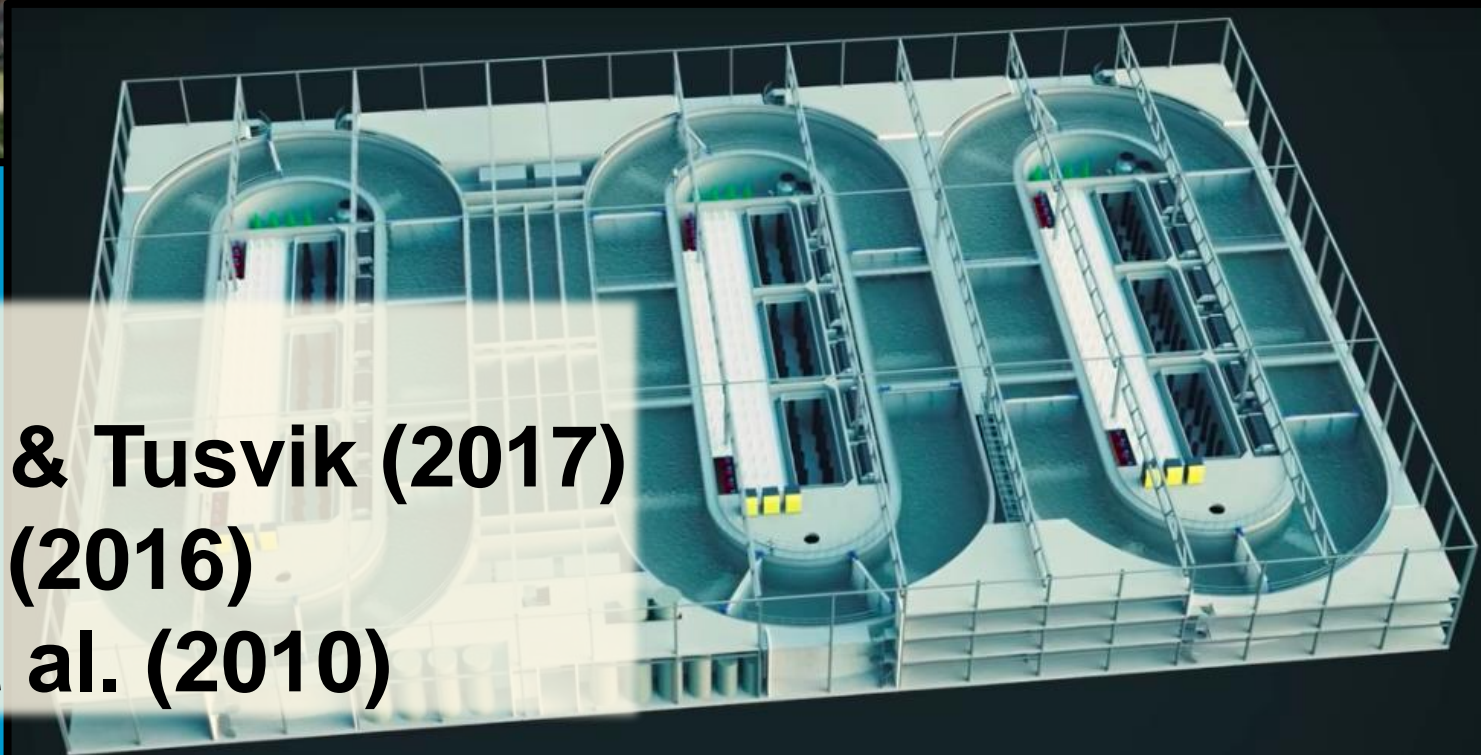


Major costs are:

- 1. Capital**
- 2. Feed**
- 3. Labor/energy**

Studies:

- Bjorndal & Tusvik (2017)**
- Liu et al. (2016)**
- Boulet et al. (2010)**



There may be lessons from other successful sectors of US aquaculture.

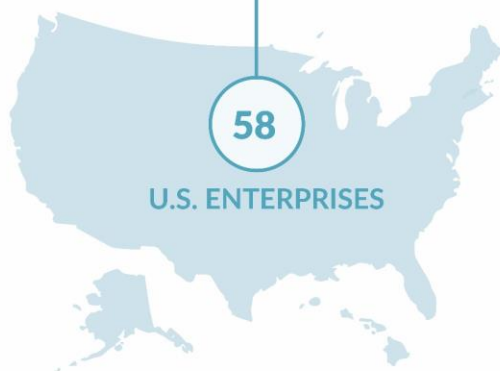
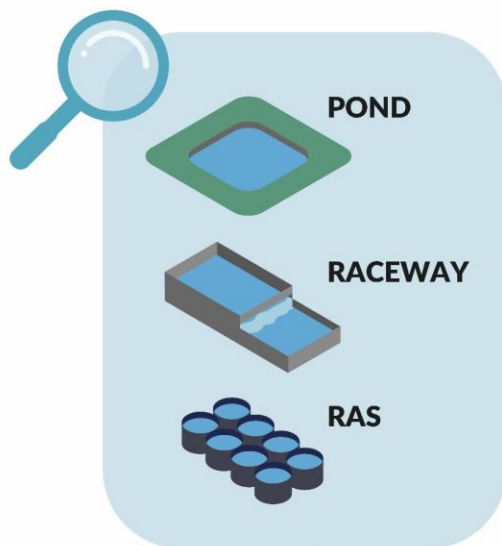
Engle, C.R., G. Kumar, and J. van Senten, 2020. Cost drivers and profitability of U.S. pond, raceway, and RAS aquaculture. Journal of the World Aquaculture Society. Article DOI: 10.1002/JWAS.12706.

**Farm
data**

Production systems	Species
Ponds	
Traditional	Catfish, sportfish, minnows, bass
Split ponds	Catfish
Intensively aerated	Catfish
Raceways	Trout
RAS	Salmon, trout, tilapia
Various scales of production	

COST DRIVERS AND PROFITABILITY OF U.S. POND, RACEWAY, AND RAS AQUACULTURE

JWAS 51(4): 847-873

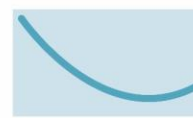


58
U.S. ENTERPRISES



PROFITABILITY

- ☒ POND
- ☒ RACEWAY
- ☒ RAS



ECONOMIES OF SCALE

- ☒ YES!

for all species/ systems and scales analyzed



KEY COST DRIVERS

Capital, feed, labor, management, energy, and fingerlings



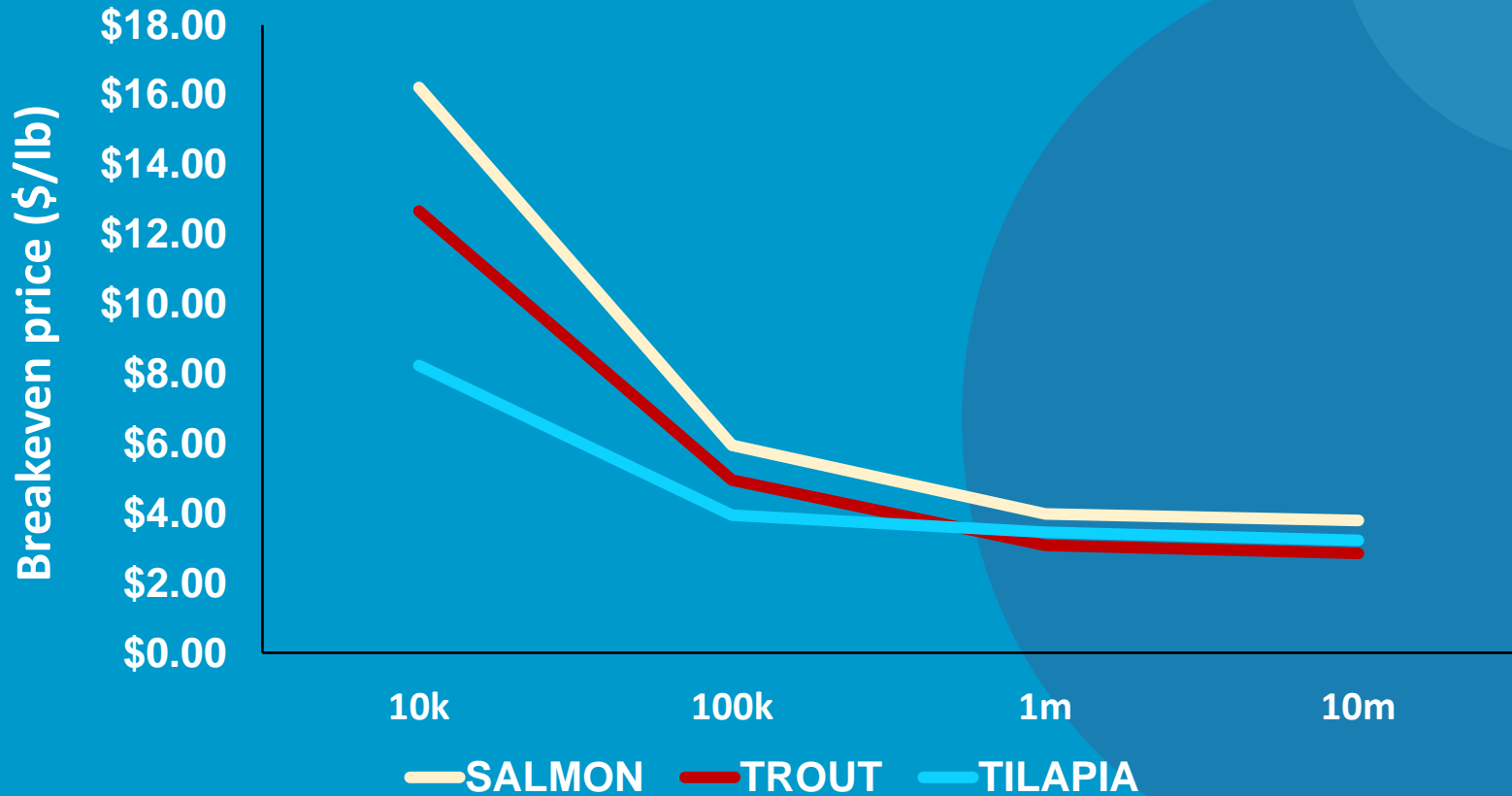
ENHANCE PROFITABILITY

Improve input productivity of capital, labor, and feed for cost efficiencies.

Capital

Do high capital costs equate to economies of scale?

Economies of scale - RAS

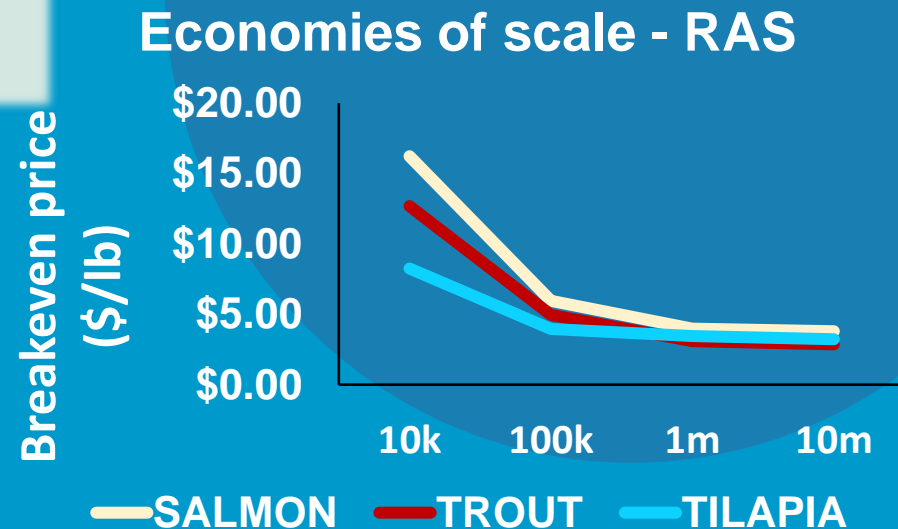


Capital

Do high capital costs equate to economies of scale?

There are economies of scale in RAS, but....

There are profitable RAS that produce only a couple of hundred thousand lb a year; there may be other factors of equal importance.



It's important to remember that there are also *diseconomies of scale*.

Cost (\$/kg)

Bigger is NOT always better.

Long-run Average Cost Curve (LRAC)

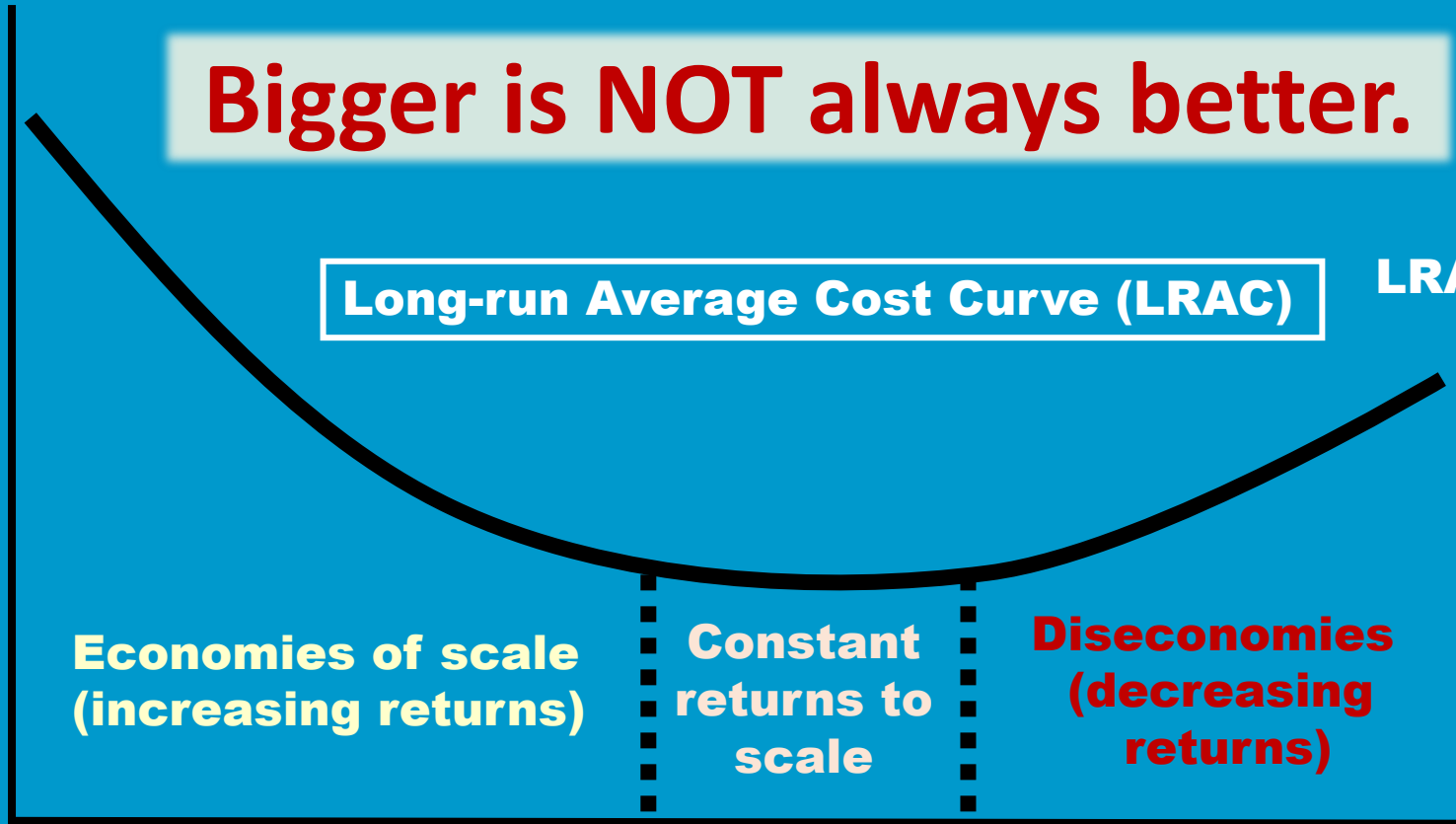
LRAC

**Economies of scale
(increasing returns)**

**Constant
returns to
scale**

**Diseconomies
(decreasing
returns)**

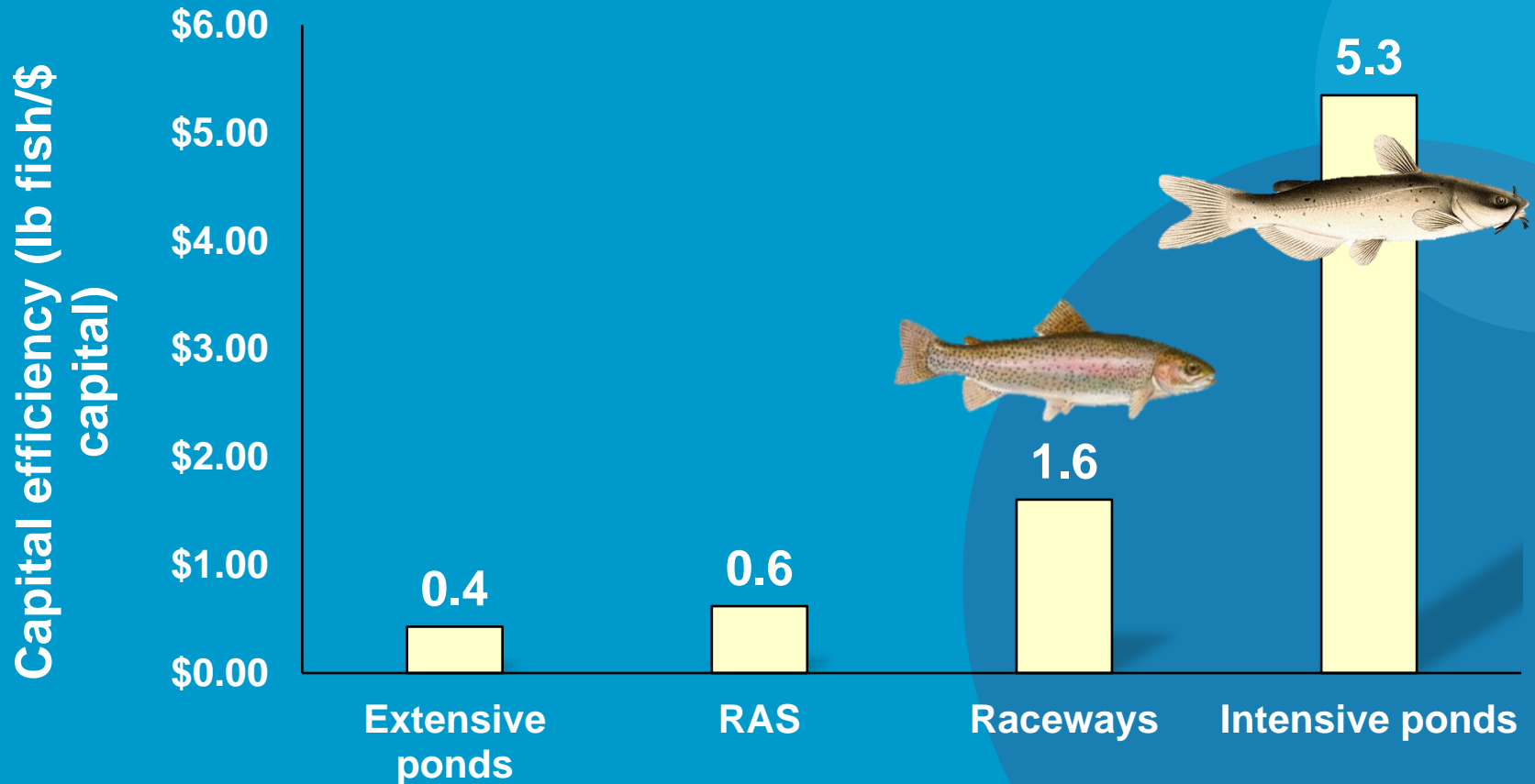
Quantity of output



Capital efficiency



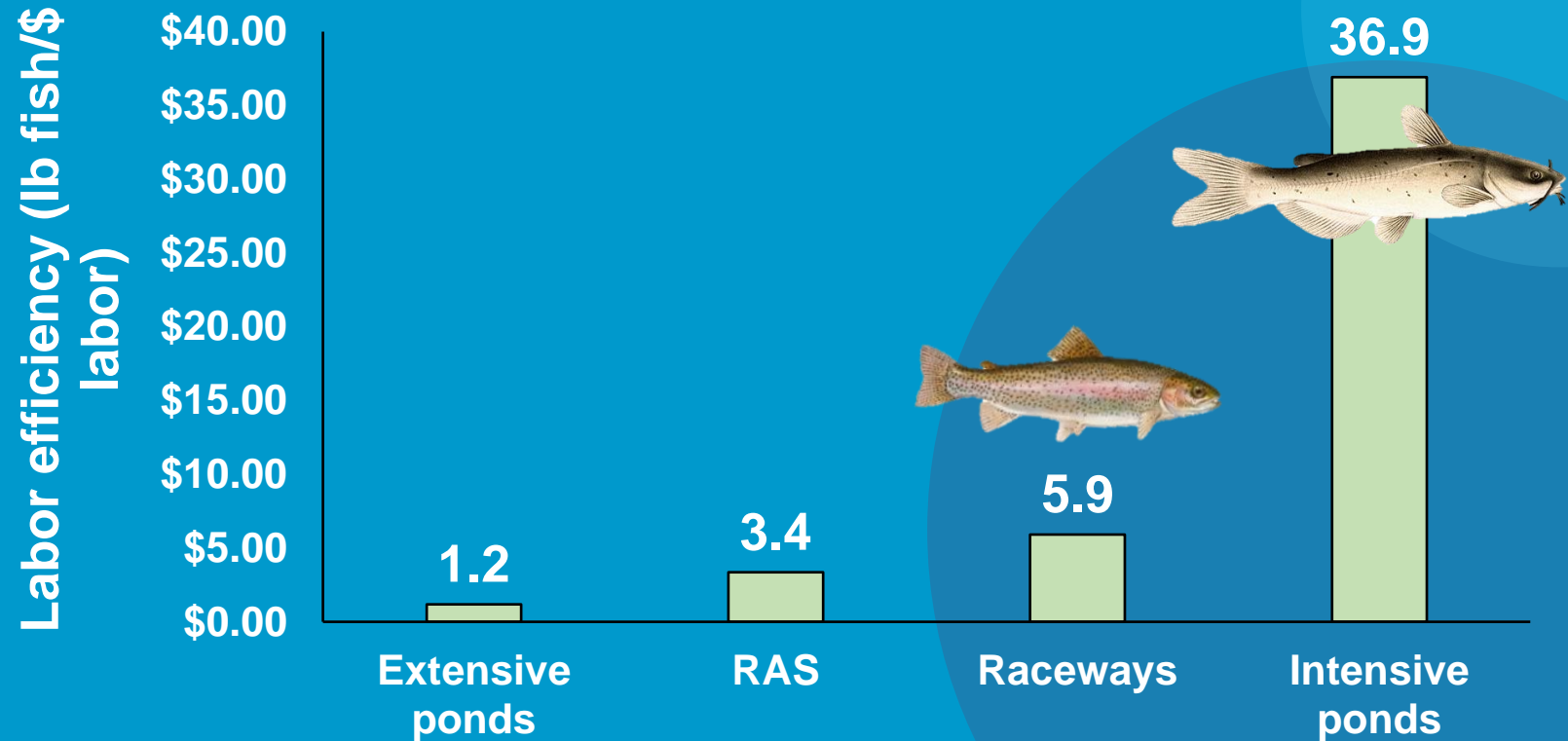
Capital efficiency



Labor efficiency



Labor efficiency



Markets & Marketing



Premium price

Farmed vs wild

RAS vs net pen

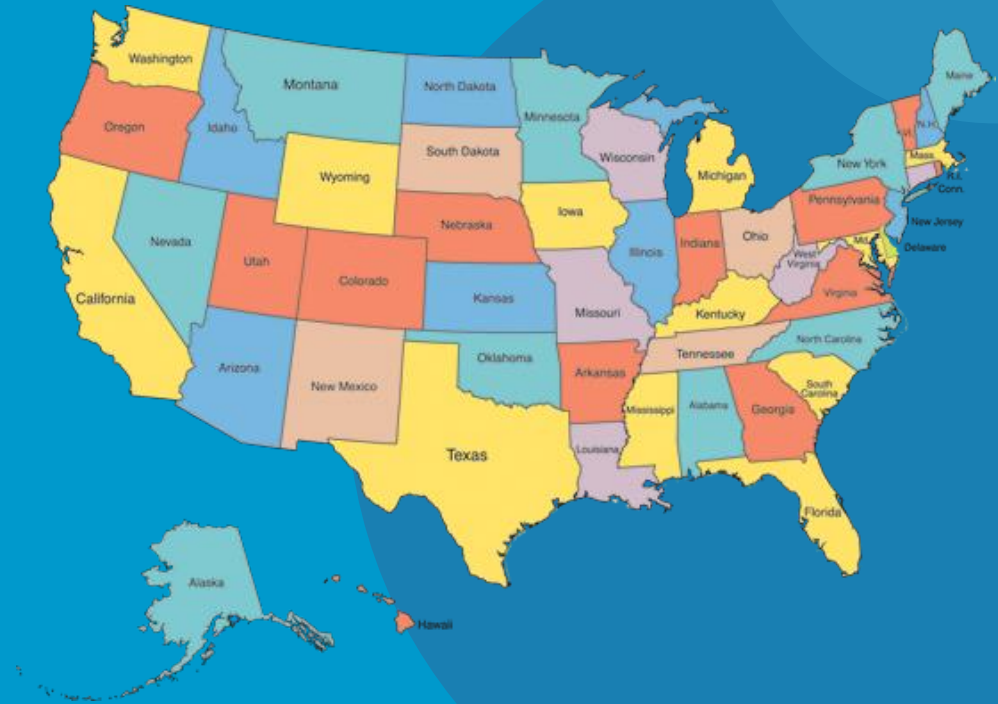
Environmentally sustainable

What can you offer your customers
that no one else can?

Markets & Marketing: What do we know?



#1. U.S. is one of the largest seafood markets in the world.

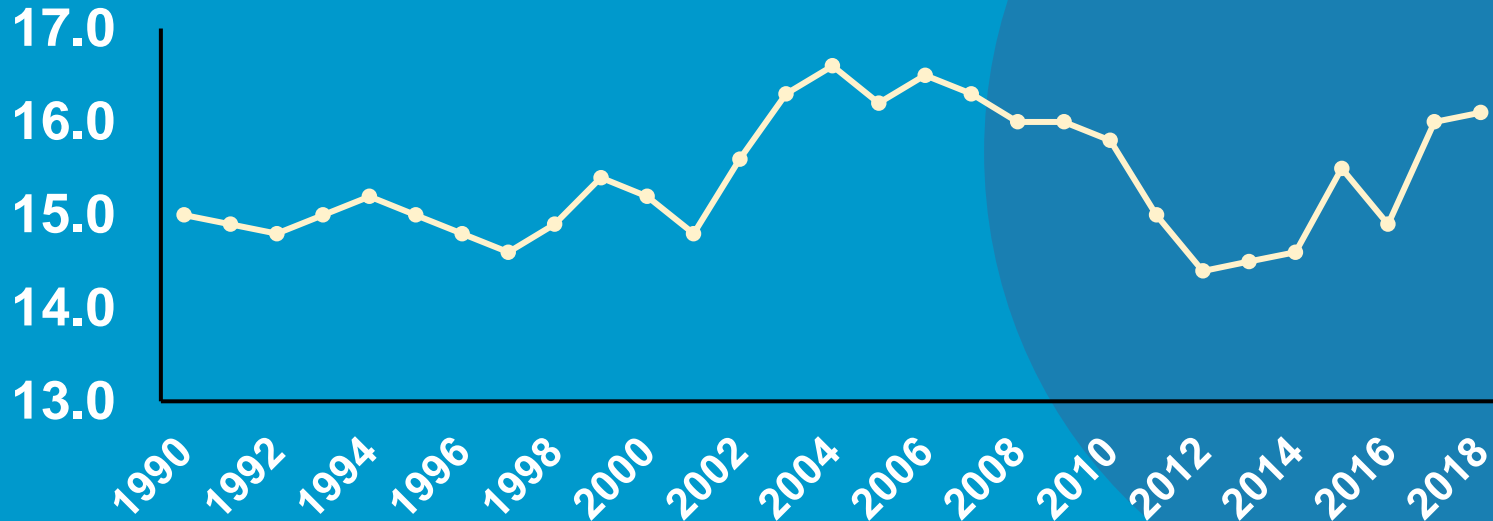


Markets & Marketing: What do we know?



**#2. U.S. consumers, however,
are NOT big seafood consumers.**

Per capita consumption of seafood in U.S.

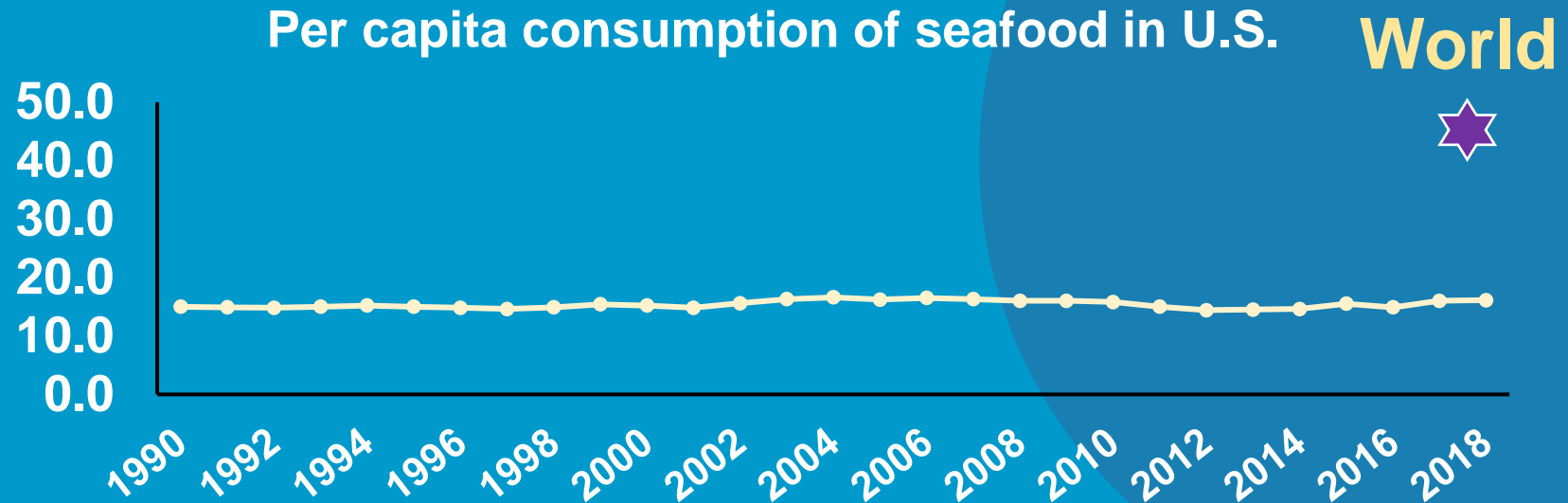


SOURCE: Fisheries of the United States 2018, NOAA

Markets & Marketing: What do we know?



#2. In fact, per capita consumption is essentially flat.

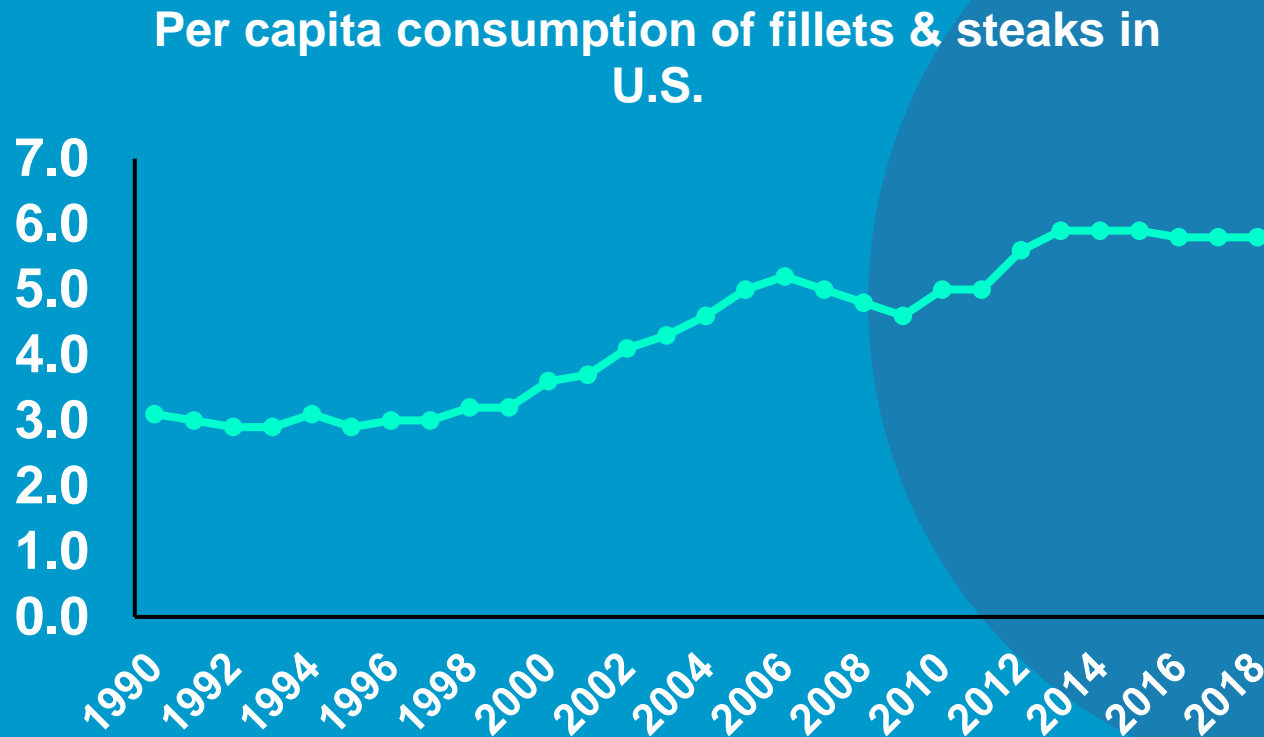


SOURCE: Fisheries of the United States 2018, NOAA

Markets & Marketing: What do we know?



#2. U.S. consumption of fillets & steaks has increased.



SOURCE: Fisheries of the United States 2018, NOAA

Markets & Marketing: What questions need to be answered?



Q1. Where will the new supply of RAS salmon go?

Answer: Increased US consumption of salmon?

- New US RAS salmon projected at 310,000 MT (Rabobank 2019).
- = 683,550,000 lb increased supply
- Divided by 331,000,000 people in US
- = 2.065 *additional* lb/capita to be consumed.
- ❖ Per capita salmon consumption needs to increase by *> 80%*.

Markets & Marketing: What questions need to be answered?



Q1. Where will the new supply of RAS salmon go?

- Current consumption of salmon in U.S. = 2.55 lb/capita (NFI)
- Thus, salmon is not an important part of our diet in the U.S.
- We eat 58 lb/capita beef a year (USDA)
- 52 lb/capita pork a year (USDA)
- 96 lb/capita chicken a year (USDA)

Answer: Displace beef, pork, or chicken?

Markets & Marketing: What questions need to be answered?



Q1. Where will the new supply of RAS salmon go?

Answer: Displace imported salmon?

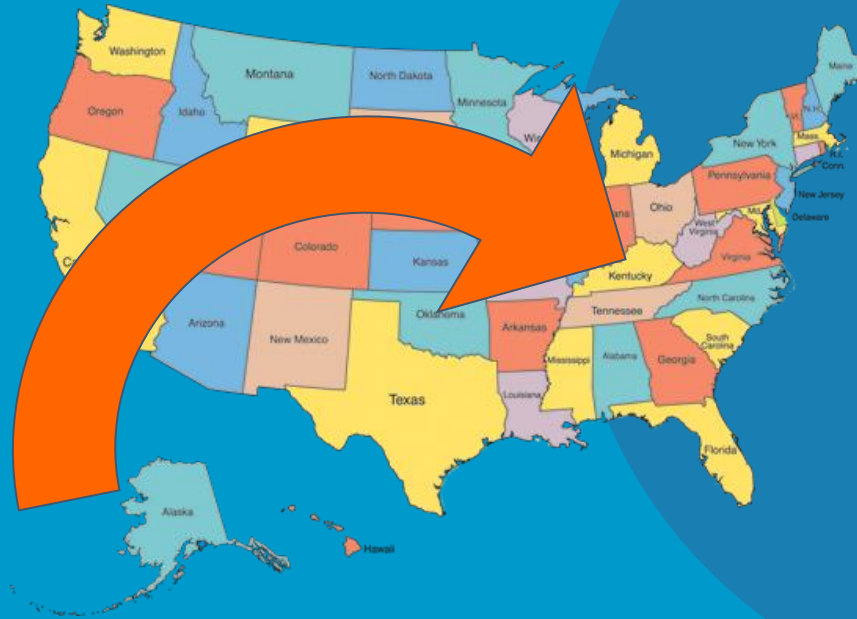


Markets & Marketing: What questions need to be answered?



Q1. Where will the new supply of RAS salmon go?

Answer: Displace wild-caught Alaskan salmon?



Markets & Marketing: What questions need to be answered?



Q1. Where will the new supply of RAS salmon go?

Answer: Displace another type of finfish?



Markets & Marketing: What questions need to be answered?



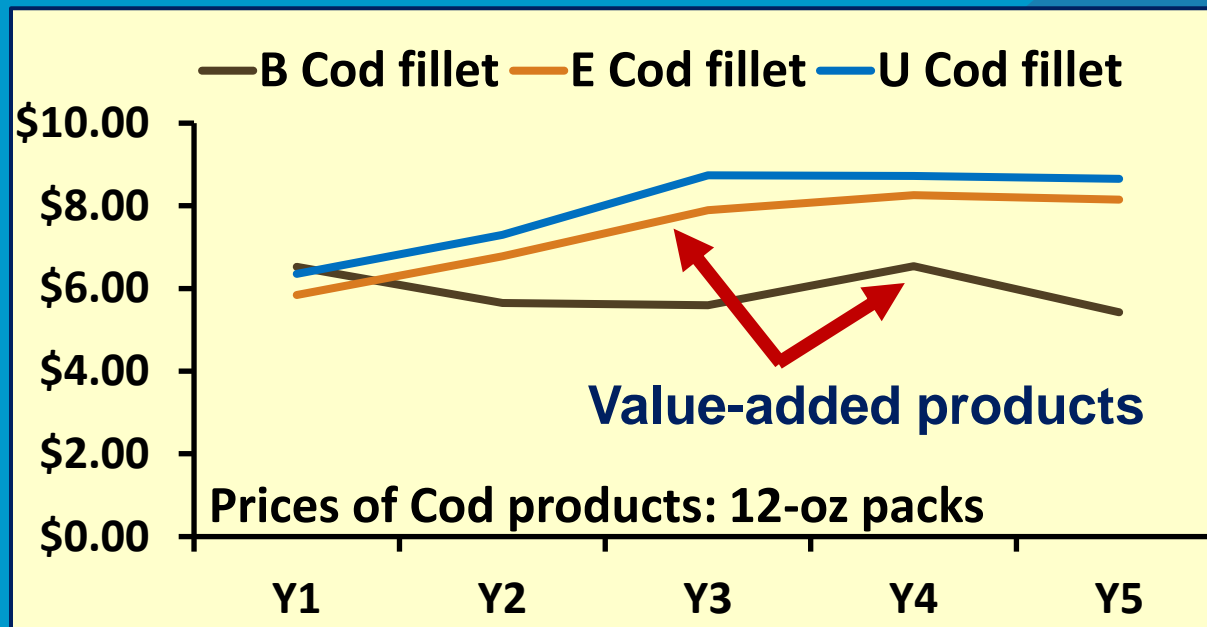
Q2. How will marketing goals be achieved?

Option	Who, how, where, based on what?
Displace beef or pork	What cities, demographics, lifestyle groups likeliest to be convinced? For what reasons?
Displace imported salmon	Fighting over low overall per capita seafood consumption; price likely a factor for larger segments.
Displace wild-caught salmon	Fighting over even smaller sub-segment of salmon consumers; have to overcome ideological & erroneous beliefs of this group that farmed is bad.

Markets & Marketing: What about value added?

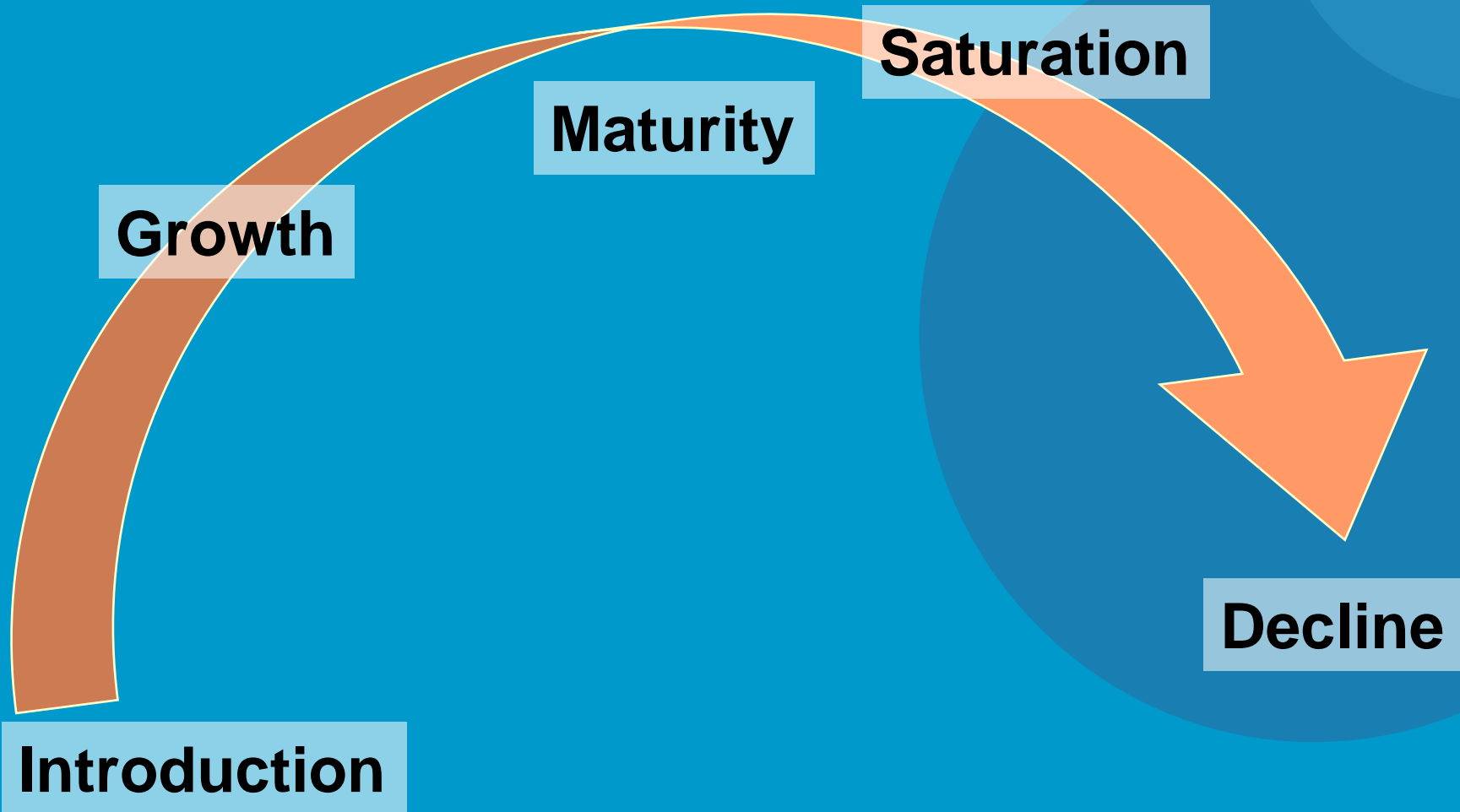


What's wrong with this picture?



Adding value also increases costs.

When the main product sold into a market is reaching maturity, time to either find a **new market** or develop a **new product** for the old market.



Markets & Marketing: Final thoughts



Q2. How will marketing goals be achieved?

- There have been many consumer preference surveys on seafood consumers. Key points are:
 - TASTE
 - Safety
 - Freshness
 - Price
 - Source/origin
 - Local
 - Overall quality

Markets & Marketing: Final thoughts



Q2. How will marketing goals be achieved?

- But, there also are groups who want to eat more seafood but do not know how to choose safe, good-tasting, quality seafood.
 - How can these groups be identified?
 - Where do you find pescatarians?
 - Likelier to be millennials
 - Likelier to have higher incomes
 - In the millennial “foodie” sub-group
 - Do most of their purchasing via apps

Final comments

- Challenges for RAS not that different from those of other US aquaculture businesses.
- Aquaculture is riskier than other agricultural crops, both in production & marketing.
- Producers assume the risk for developing production methods/markets.
- Little safety net for US aquaculture farms.
- Regulations an issue for ALL aquaculture.

Summary

- **Aquaculture is capital intensive, with economies of scale, but smaller-scale RAS can be profitable –**
- **Management intensive.**
- **Many aquaculture business owners have created markets, developed supply chains, built customer bases & receive adequate prices, & found a way to compete with wild-caught supply.**
- **Profitability requires strict cost controls & efficiencies.**



NATIONAL Aquaculture ASSOCIATION



There are more similarities than differences among types of aquaculture in the U.S.

RAS businesses will benefit from joining w/other US aquaculture producers to speak with one voice.

***Thank you for your
attention.***

Questions?

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