

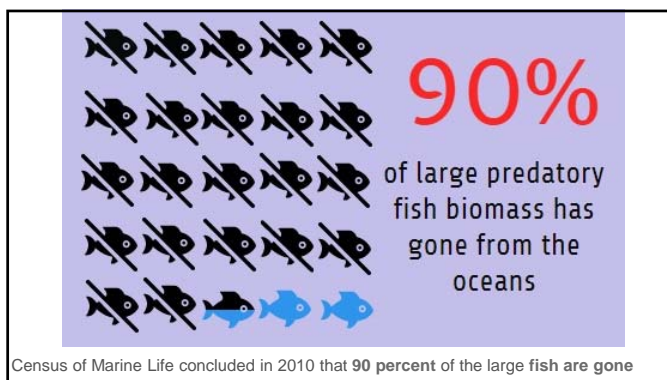
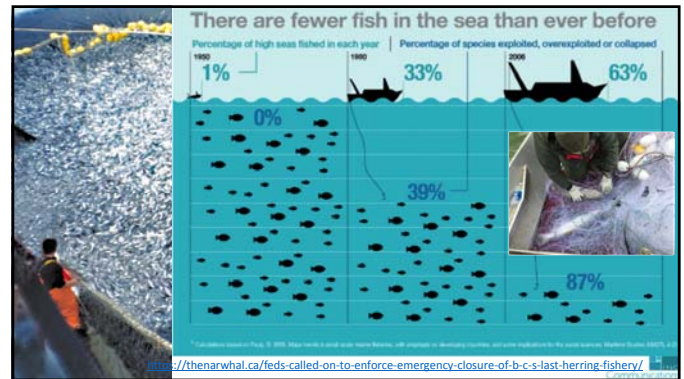
# SAVING THE OCEAN FISH

## Growing Fish Meat in a Lab

**Lucy Lee, PhD**  
Dean, Faculty of Science

Nov. 5, 2019

UNIVERSITY OF THE FRASER VALLEY

Dr. Lenore Newman, CRC  
University of the Fraser Valley

**The Narwhal**

<https://thenarwhal.ca/aquacalypse-now-end-fish/>

OPINION

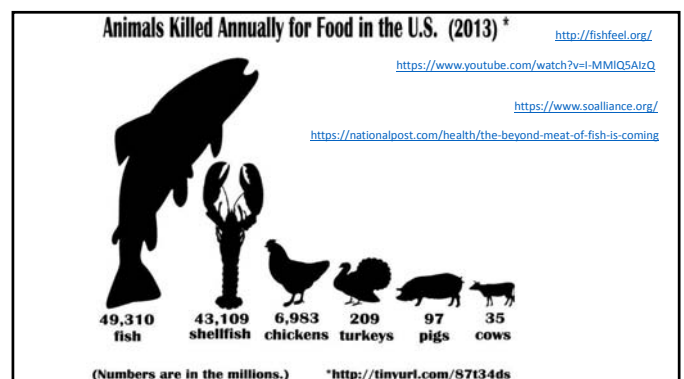
## Aquacalypse now: the end of fish

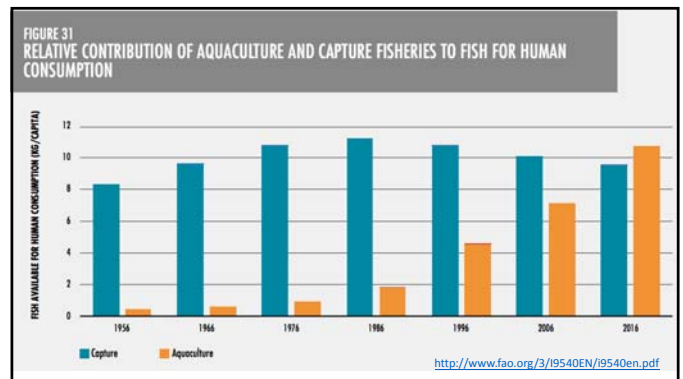
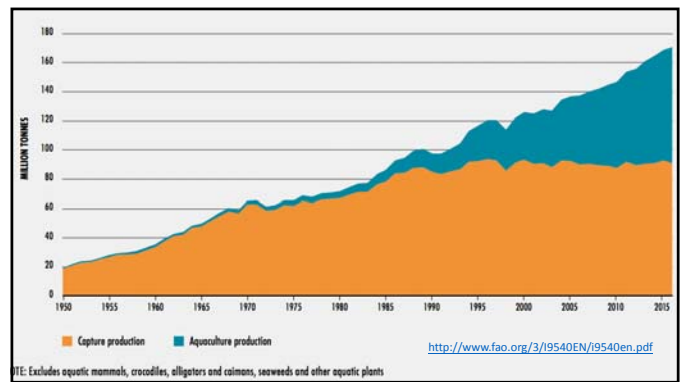
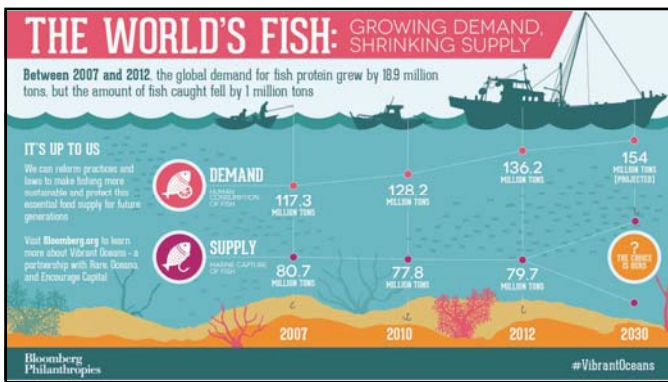
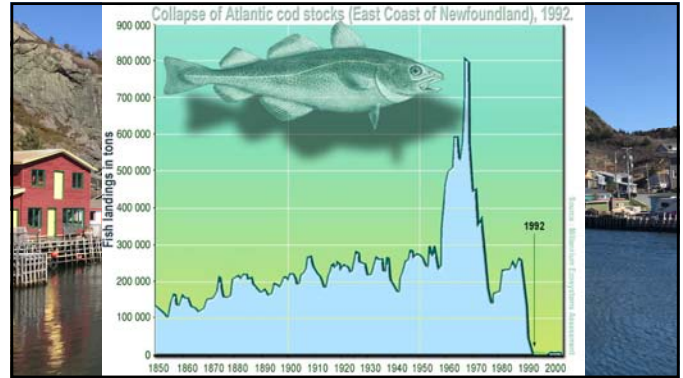
From renowned marine biologist Daniel Pauly, a fascinating analysis of our collapsed global fisheries and a revolutionary vision for their future

Daniel Pauly • Aug 4, 2019 • 17 min read

<http://www.seaaroundus.org/>

This is an excerpt adapted with permission of the publisher from the book *Vanishing Fish* by Daniel Pauly, published May 28, 2019 by Greystone Books.







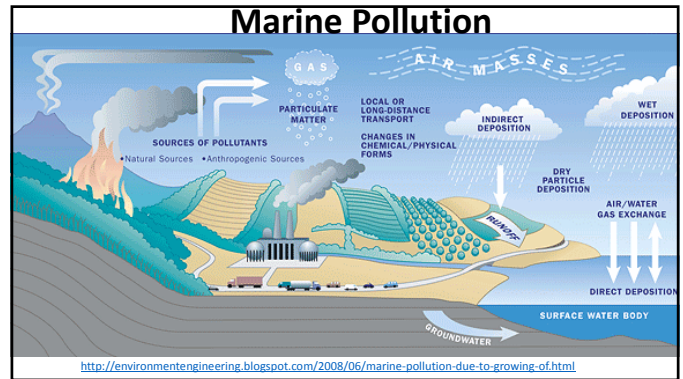
Environmental Risks of Marine Aquaculture

patagonia

# ARTIFISHAL

Now streaming on YouTube

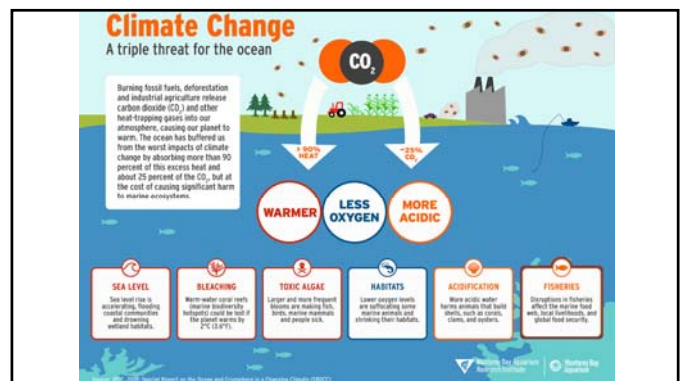
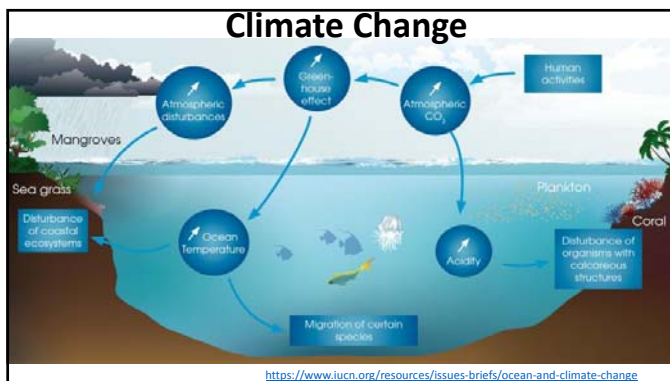
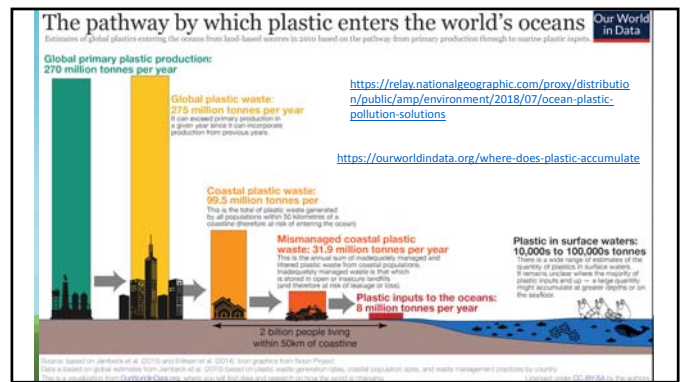
<https://www.youtube.com/watch?v=I-MM1Q5AizQ>  
<https://www.highsnobiety.com/p/patagonia-artifishal-film/>




## DROWNING IN PLASTIC

Some researchers estimate there will be **more plastic than fish** in our oceans by the year 2050

<http://americaonline.com/2013/04/12/this-world-is-going-to-drown-in-plastic/>






**The Solution:  
Finless Foods**  
We make the healthy fish you deserve

<https://www.finlessfoods.com>

<https://www.cnn.com/video/2017/09/02/indiebio-tour-lab-spawned-memphis-meats-funded-by-gates-branson.html>

<https://www.youtube.com/watch?v=8auHmGMuIQ> CNBC "will lab grown fish save the oceans?"

- For over 100 years, scientists have been able to culture cells outside an organisms' body.
- Scientific advancements for last 60 years have made it feasible to grow generations of cells *in vitro* (in labs), as cell lines.



## What are cell lines?

**Cell cultures that have been maintained outside an organism for several generations**

- Continuous** – permanent, eg. **HeLa** (since 1951)
  - Available from 'Repositories' eg. ATCC or scientific colleagues
  - Relatively uniform cellular composition
  - Relatively easy to maintain
  - Highly replicable
- Finite** – limited life span – limited use
  - Many available from commercial sources or prepared 'in-house'



## Fish Cell Lines: >500 Continuous fish cell lines (since 1962)

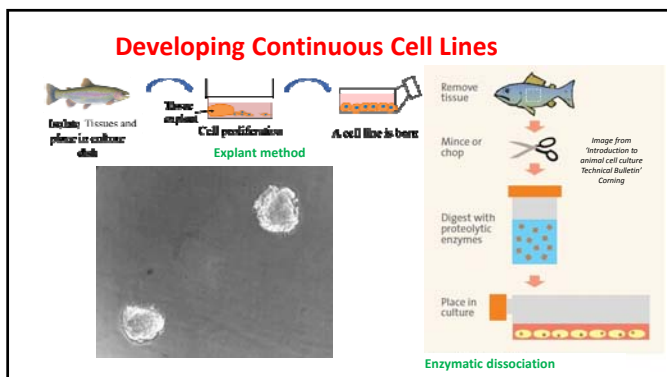
- Few continuous fish muscle cell lines reported to date
- My lab has developed many fish cell lines including first myogenic (muscle) fish cell line:



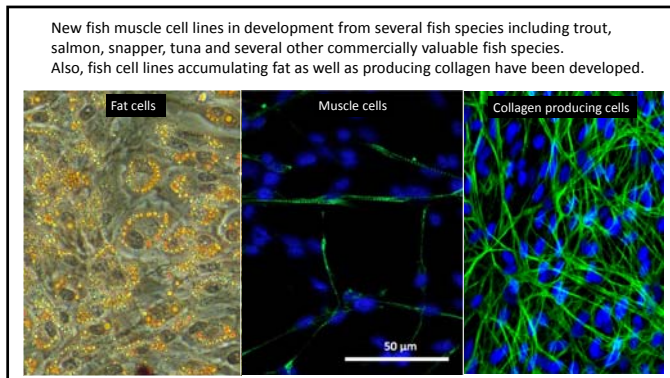
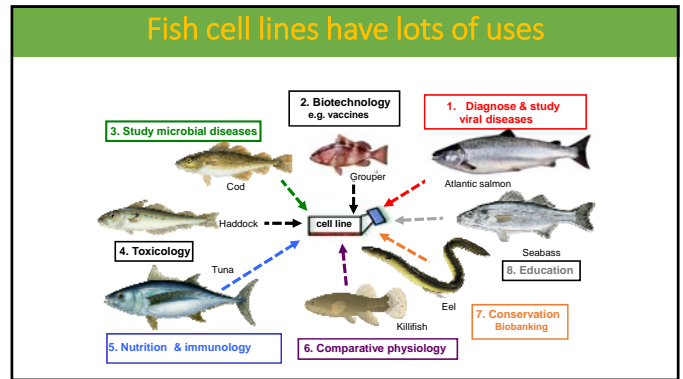
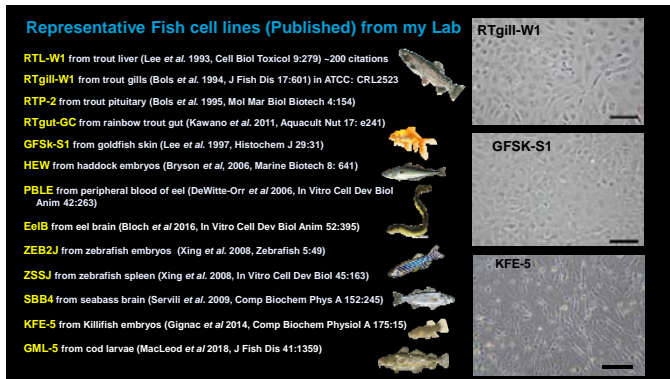
Derivation of a continuous myogenic cell culture from an embryo of common killifish, *Fundulus heteroclitus*

Sarah J. Gignac<sup>AB</sup>, Nguyen T.K. Vo<sup>BC</sup>, Michael S. Mikhael<sup>B</sup>, J. Andrew N. Alexander<sup>D</sup>, Deborah L. MacLachy<sup>B</sup>, Patricia M. Schulte<sup>A</sup>, Lucy E.J. Lee<sup>ABD</sup>

<sup>A</sup> Department of Zoology, University of British Columbia, Vancouver, BC, Canada  
<sup>B</sup> Department of Biology, Wilfrid Laurier University, Waterloo, ON, Canada  
<sup>C</sup> Department of Biology, University of Waterloo, Waterloo, ON, Canada  
<sup>D</sup> Department of Biology, University of the Fraser Valley, Abbotsford, BC, Canada







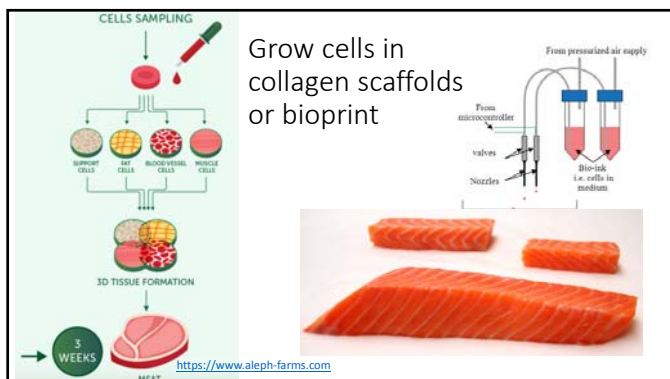
**Companies producing cellular agriculture/aquaculture products**

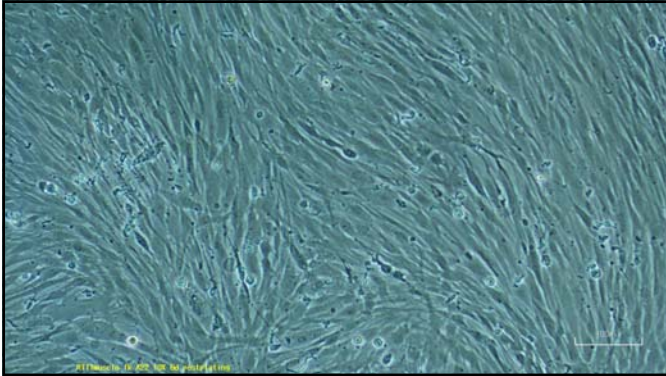
**Cellular Agriculture**

- Beef
  - Aleph-farms <https://www.aleph-farms.com>
  - Higher Steaks <https://www.highersteaks.com>
  - Meatable <https://www.meatable.com>
  - Memphis Meats <https://www.memphismeats.com>
  - Mission Barns <https://www.missionbarns.com>
  - Mosa Meat <https://www.mosameat.com>
- Chicken, avian products
  - Just <https://justforall.com/en-us/stories/clean-meat>
  - SuperMeat <https://www.supermeat.com>
  - Integriculture <http://integriculture.jp/?lang=en> foie gras
- Pork
  - New Age Meats <https://www.newagemeat.com>
  - Kiran Meats <https://www.kiranmeats.com>

**Cellular Aquaculture**

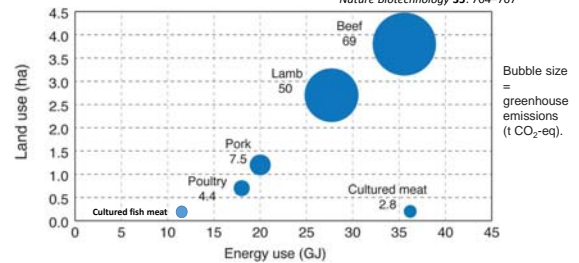
- Fish:
  - BlueNalu <https://www.bluenalu.com>
  - Clean Research (2019) <https://www.cleanresearch.io/>
  - Finless Foods <https://finlessfoods.com> (bluefin tuna) Sushi, Sashimi, Surimi
  - Seafuture <http://seafuturebio.com>
  - Shiok Meats <https://shiokmeats.com>
  - WildType <https://www.thewildtype.com> (salmon)





### Estimated environmental impacts of producing 1000 kg of cultured meat vs conventional meats

From Dance (2017) Engineering the animal out of animal products. *Nature Biotechnology* 35: 704–707



Land use and green house gas emissions drastically reduced with cultured meat, but Energy use for producing cultured meat still high as terrestrial animals need to be maintained at warmer temperatures in laboratory incubators.



### Advantages of cultured meat:

- Reduction of energy to produce 1 unit of output by 35-60%.
- Increased output with reduced waste output (no offal, no feces)
- Reduction of the area of production by 98%.
- No space constraints.
- Reduction of harmful emissions by 90%.
- Saving of fresh water used in production by 70%.
- No need of antibiotics.
- Reduced level of contaminants, e.g. mercury.
- Humanity towards animals. No ethical dilemmas.

### Disadvantages:

- Still costly
- Industrial production will require cellular growth factors. Unknown how these factors could affect humans.
- Need to develop technologies for industrial production.
- Cultured meat may not look like the natural meat.
- Resistance from the existing industry.
- Resistance from consumers.
- Legislative hurdles.



### Striped bass were once extinct in the St. Lawrence. Now they're back



Recovery of popular trophy fish could boost economy while proving damaged ecosystems can be repaired

Isaac Olson - CBC News · Posted: Nov 02, 2019 8:05 AM ET | Last Updated: November 2  
<https://www.cbc.ca/news/canada/montreal/striped-bass-fishing-st-lawrence-river-1.5339129>

