# “Bioprospecting for active ingredients from marine biota”


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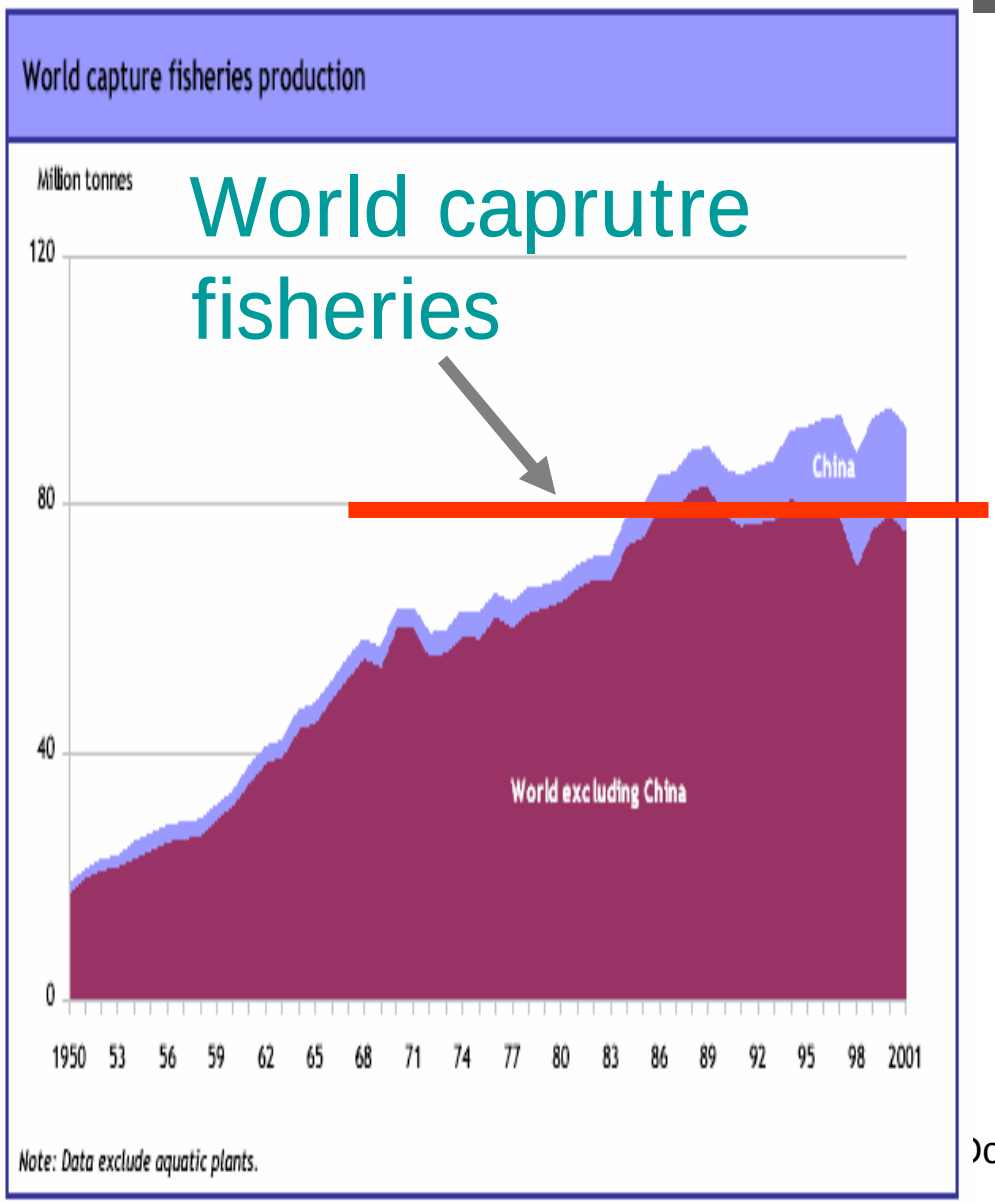
# Outline

- Background
- Laboratory of Applied Microbiology and Biotechnology at UNAK
- **Market** driven projects – Active ingredients
  - Antibacterial
  - Antioxidants
  - Algal extracts for growth and “sensation”
  - Functional Fish Protein Hydrolysats
  - Ingredients from plankton (e.g. oils)
- Conclusions




# World caprutre fisheries

**Is this,**

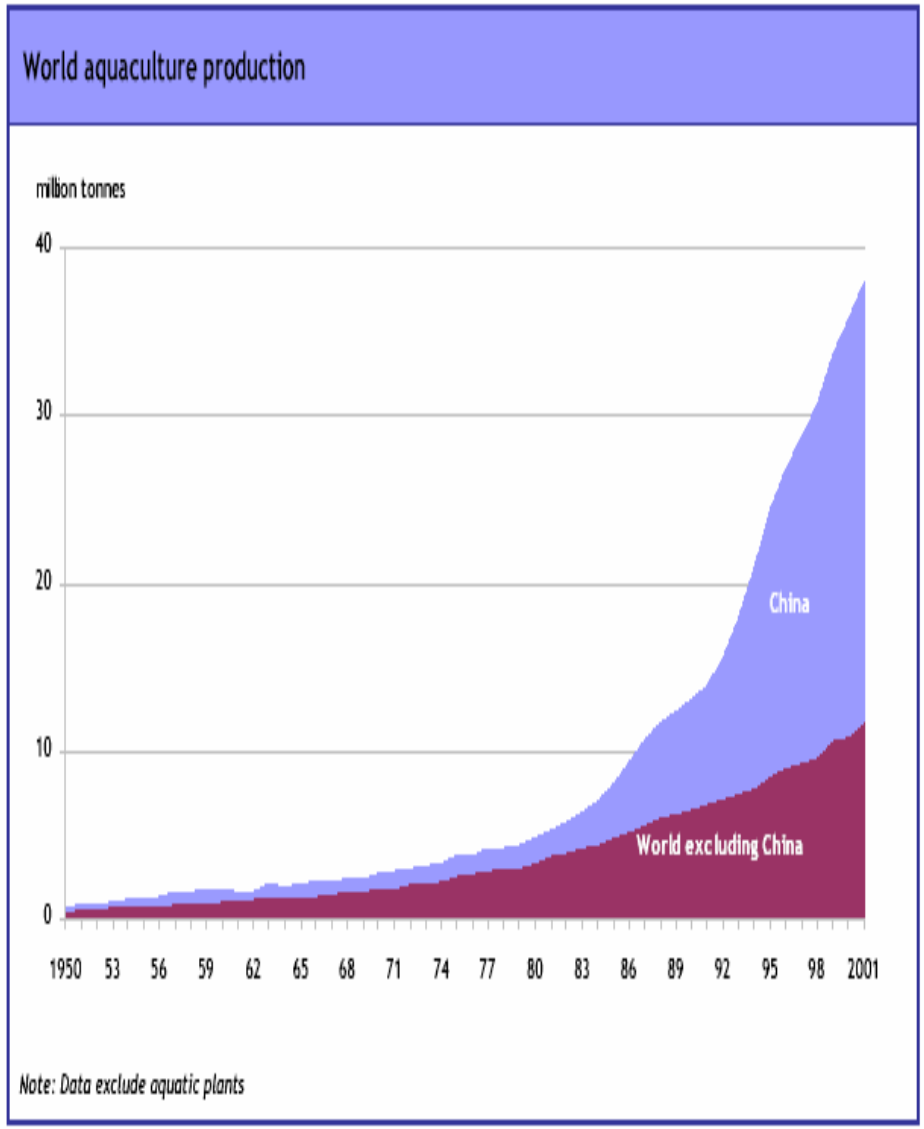
**“The end” ?**



FAO: ftp://ftp.fao.org/fi/document/trends/overview/2001/commodit/2001fisheryoverview.pdf

Not quite,

We have aquaculture and ...



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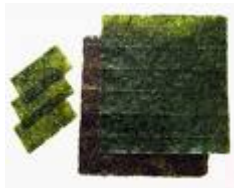


# Background (cont.)

- ….the fact that only a portion of the biodiversity is utilized (then as food, feed and polimers for industry)
- Fish, shellfish and algae
-

Photos from WWW

# Background (cont.)

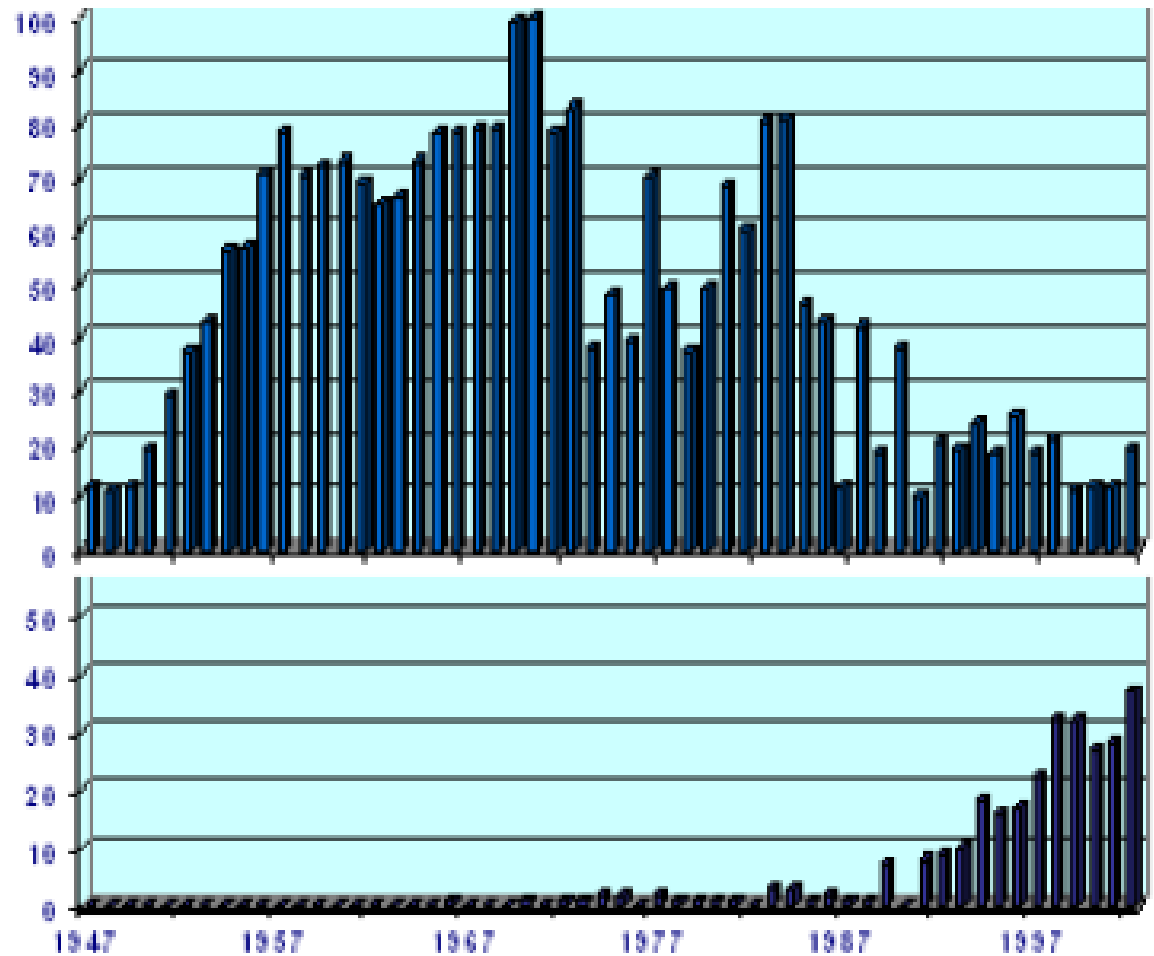
- ”underutilised”
  - Many invertebrates
  - Sea plants (algae)
  - Plankton
  - **Bacteria**
  - Viruses

Photos from: bibba

# Background - bacteria

- ~ < 1% marine micro organisms have been cultured and identified.
- of 27 bacterial phyla, all have a representatives in the marine environment, 17 on land.
- they have been fighting a “chemical war” for 2 to 3 mrd years.
- Many live in extreme environment
- the growth in novel natural product discovery is from marine sources.

# Novel Compounds Discovery

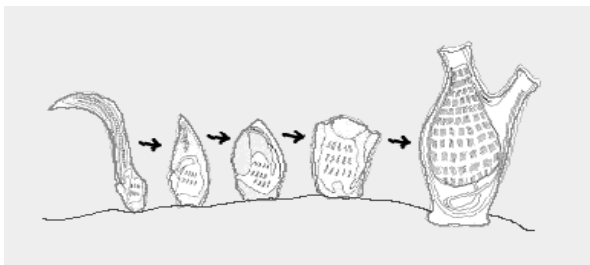



Novel Compounds Reported from Terrestrial Microorganisms (SIM News Jan/Feb 2003 Vol. 53, No. 1 pp 4-9)

Novel Compounds Reported from Marine Microorganisms

# Tunicate

- Didemnin B
  - Anti-viral,
  - cytotoxic,
  - immunosuppressive



Photos from WWW

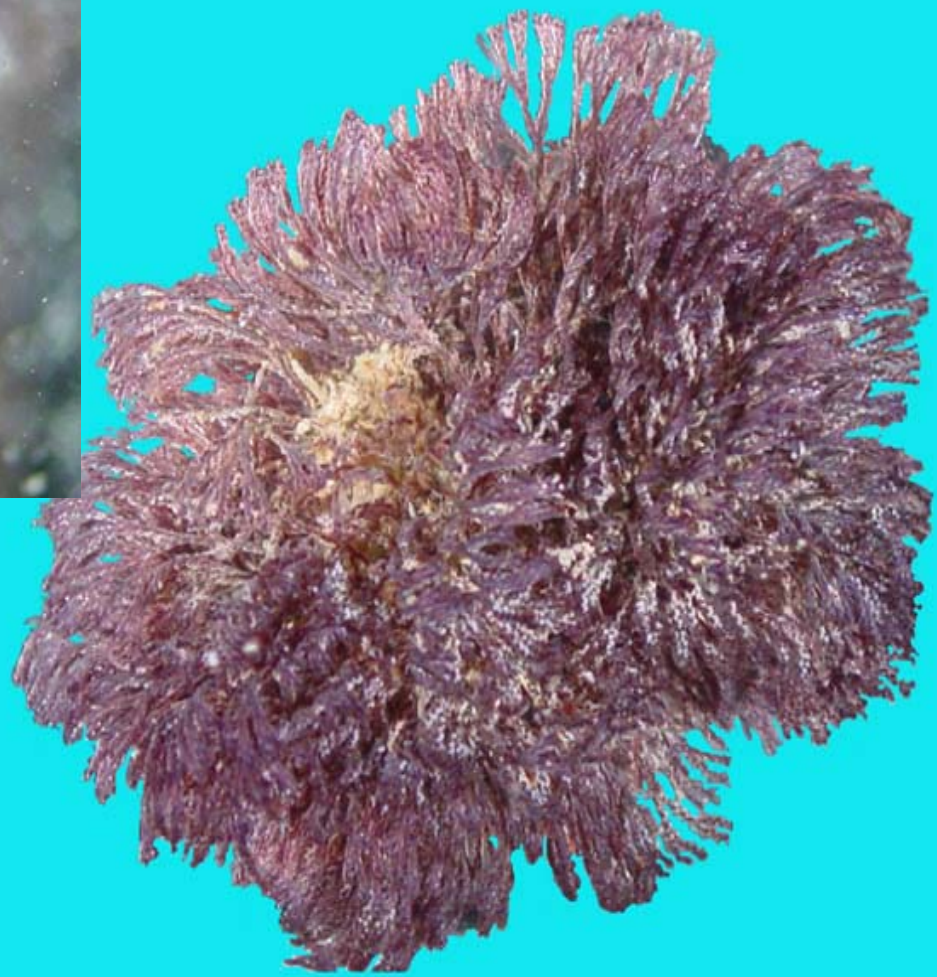
# Sea anemones

- Actinoporins (cell inhibitor)

Photos from WWW

# Bugula neritina

http://www.calacademy.org/research/izg/SFBay2K/bugula.htm



Bryostatin1 (anti cancer)

Bryozoa- *Bugula neritina*

Photos from WWW

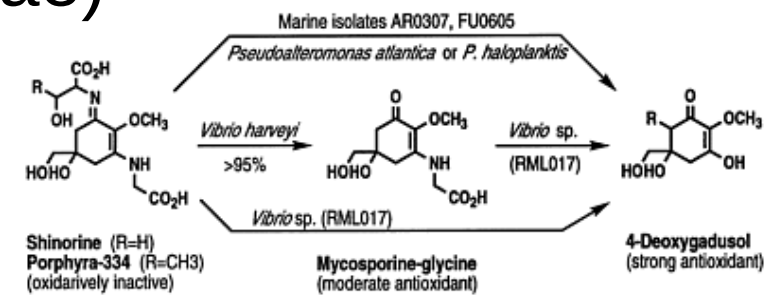
Value Creation and Innovation

# Antibacterial compounds

- Basic peptide – oft 30-40 a.s. (protamines from milt and mucous membranes)
- Plicatamide (oligo-peptide from a tunicate *Styela plicata)*
- Enzymes - lysosyme -chlamysin
- Furanon (*Delisea pulchra* algae)
- Chitosan

# Antioxidants

- **Astaxanthin** from (*Haematococcus*, *Pandalus*)
- Beta-Carotene (*Dunaliella salina*)
- Poly-phenols
- Coenzyme Q10 (micro algae)
- Antioxidants from algae
  - (converted)




http://www.aims.gov.au/pages/research/projects/sunscreens/pages/mb-sp07-01.html

# Background – Strategic documents

- Three strategic documents for development of Marine Biotechnology Programme in Iceland were written by UNAK staff for the Ministry of Industry
- Resulted in “Biotech-net”
  - Bioprospecting
  - Energy and
  - Aquaculture

# Laboratory of Applied Microbiology

## Quality and Safety

- Bacterial growth models / Shelf-life predictions
- Process microbiology / hygiene
- HACCP
- Natural preservatives

## Biotechnology

- Active ingredients
  - Bio prospecting
    - Antibacterial
    - Antioxidants
    - Marine oils
  - Hydrolysis
    - Algae
    - Fish Proteins

# Laboratory of Applied Microbiology

- Active ingredients
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    - Antibacterial
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# Screening (Bioprospecting) for antibacterial compounds (see next presentation)

- Source
  - Hot cones in Eyjafjörður
- Direct
  - Culturable bacteria
  - Production of active compounds in “laboratory media”
- Applications
  - Food
  - Cosmetics
  - “Topical” applications

# Hot cones in Eyjafjördur

Photos from Erlendur Bogason

# Screening for antibacterial and antioxidative compounds from algae (MSc project)

- Source
  - Brown algae ( and other)
- Method
  - Extraction and enzyme hydrolysis
  - Antibacterials as previously mentioned
  - Antioxidants ($O_2$ uptake, Peroxide value, TBARS and GC)
- Applications
  - Protection of Cosmetics and Food
  - Antioxidants as dietary supplement

# Screening for marine oil producers

- Source
  - Eyjafjord(ur)
- Method
  - Isolation of Thraustochytrids using pine pollen bait
  - First samples are being processed
- Applications
  - No specific yet

# Active ingredients from algae

- **<u>Organic</u> liquid seaweed hydrolysate (enzyme)**
  - **Plant hormones (cytokinin)**
  - **Nutrients**
  - **Minerals**
  - **(soil improvement)**
- **Waiting for process approval and shelf life evaluation**
- **Enzyme screening – new enzymes needed**

# Active ingredients from algae

- Organic seaweed flavour concentrate
- For a specific US customer
- Waiting for process approval

- seaweed flavour (Non organic)
- For a big European flavour house
- In product trial – Fish soup

# Active ingredients from fish

- Fish Protein hydrolysate (enzyme)
  - For injection
  - Yield increase
    - Weight increase ( 5-18%)

  - Setja inn myndir / töflur / koma með súpu

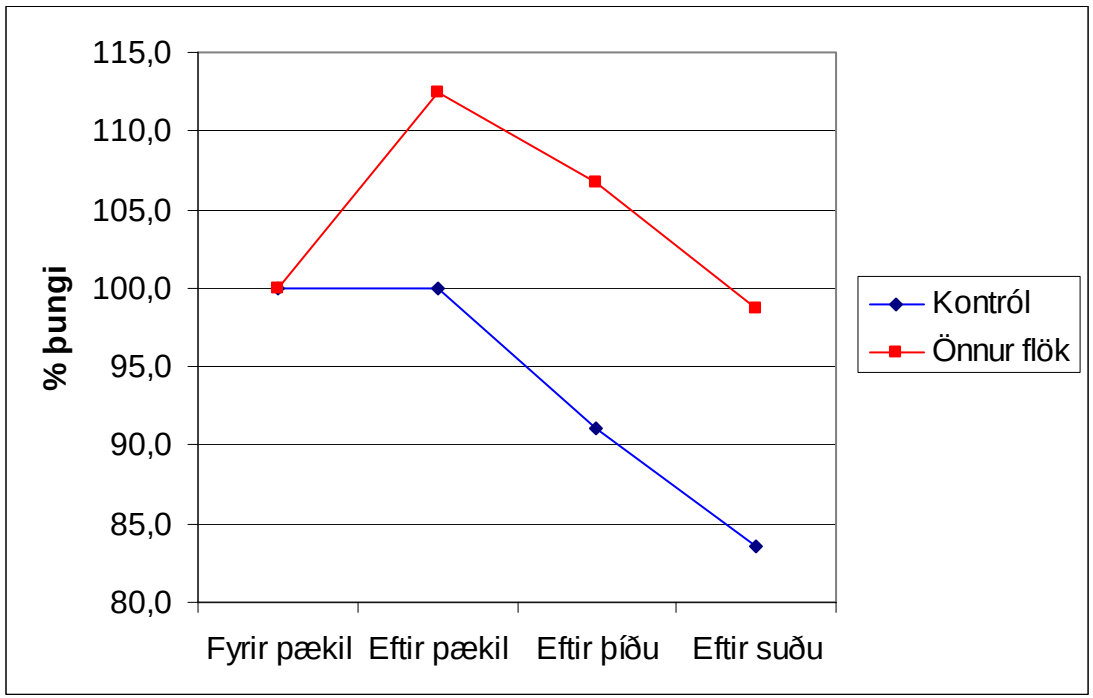
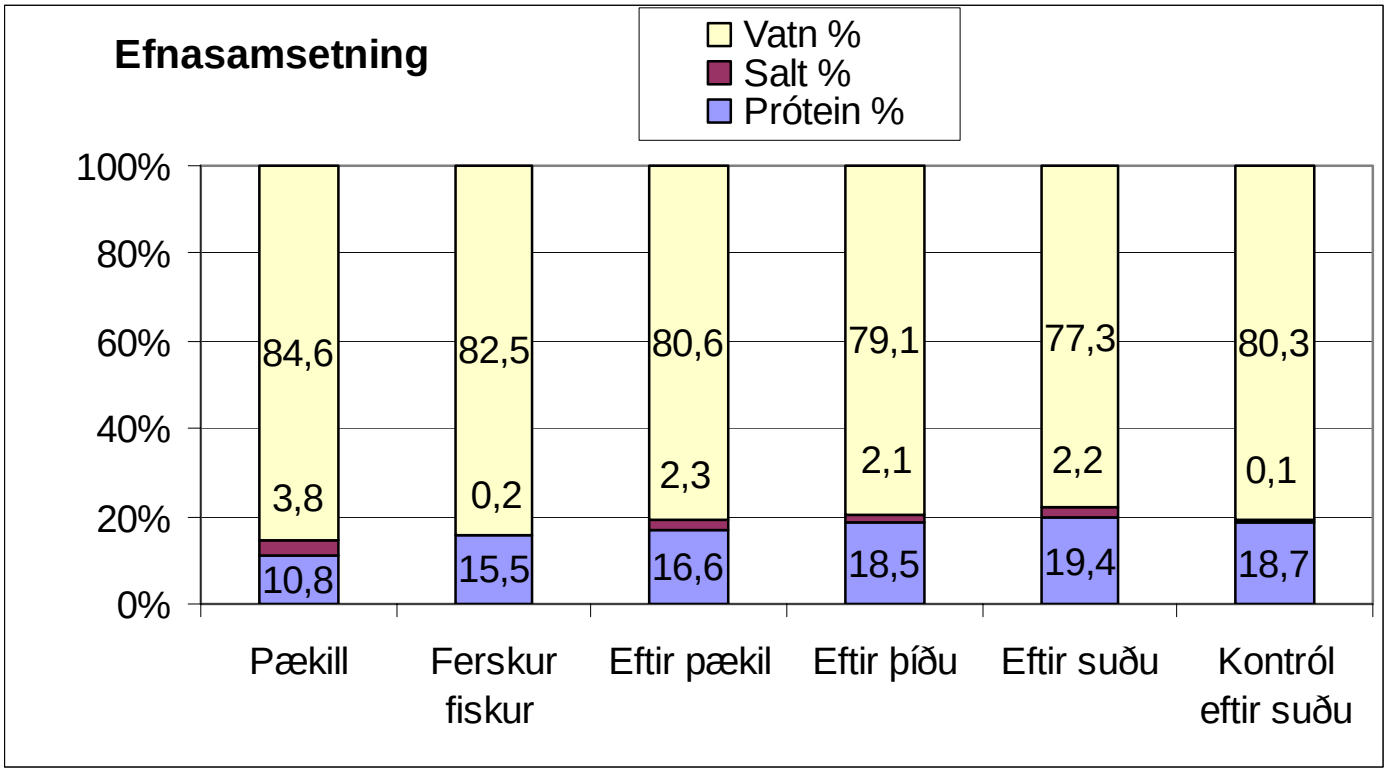



*Fig 1: Weight changes in cod fillets before, during marinating, freezing and cooking (Marinated in red, control in blue).*




- *Fig 2: Composition of marinated cod fillets, frozen, thawed and cooked*

# New companies

- MarinAgra
- BioPol (biopol.is)

# The blue shelf

- Cancer cell inhibitors
- Antimicrobials
- Antioxidants (e.g. SOD)
- Anti inflammatory
- Immune stimulants
- Probiotics / prebiotics
- Proteins and peptides
- Oligosaccharide
- Marine oils
- Vitamin and hormones
- Protein and fats for fed
- Si and Ca
- Aroma, colours, flavours

- Plant stimulants
- Plant inhibitors
- Pesticides
- Enzymes
- Anti freeze
- Glue
- Optical fibers
- bio-ceramic for nanotechnology
- bio-film inhibition
- „bio-sensors“
- Hydrogen, methane and other energy rich compounds
- Etc....

# Conclusion

- Value creation and innovation is not limited to traditional fisheries and processing
- We have just scratched the surface
- The blue revolution has just started