



“Bioprospecting for active ingredients from marine biota”

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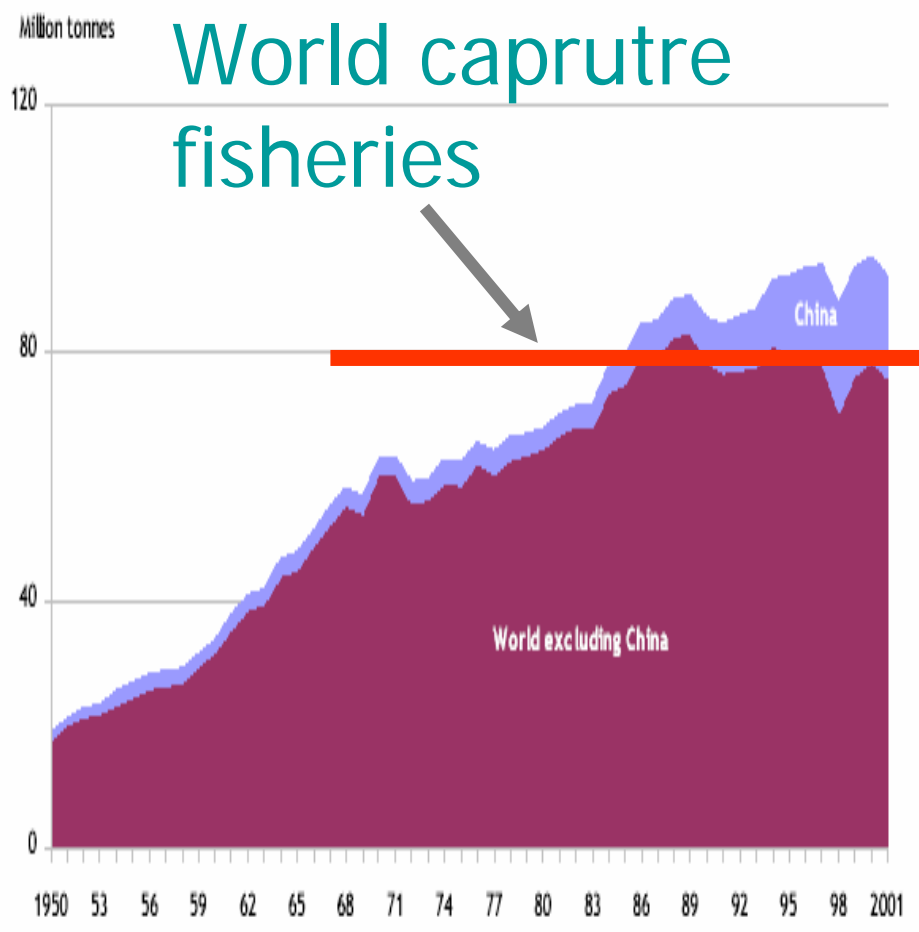


Outline

- 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 capture fisheries production



Is this, "The end" ?

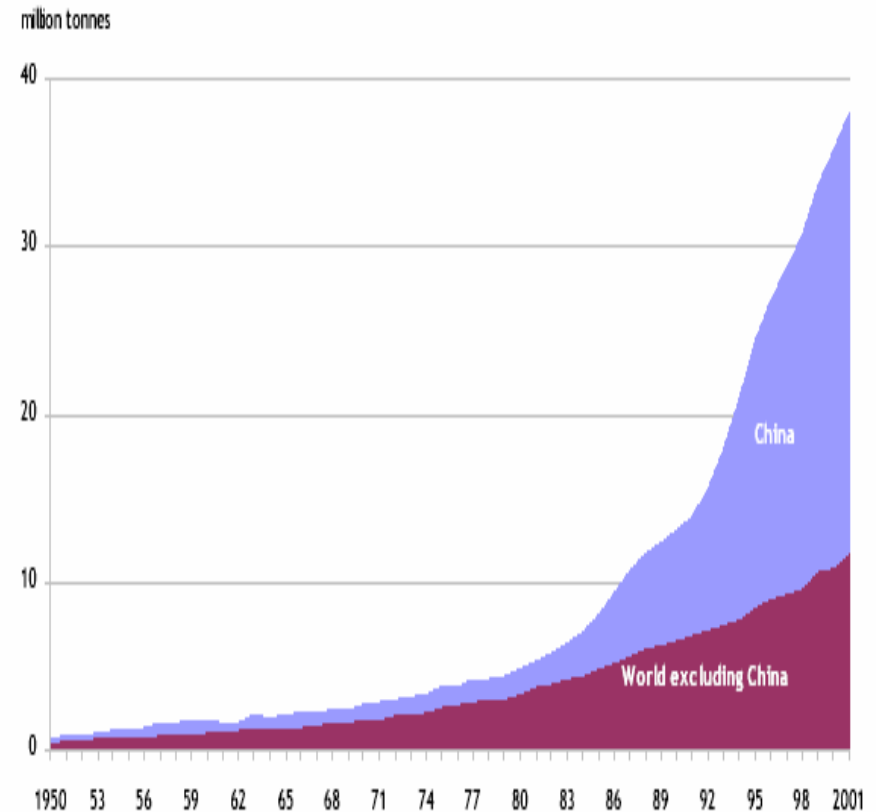
Note: Data exclude aquatic plants.



Not quite,

We have
aquaculture and ...

World aquaculture production



Note: Data exclude aquatic plants



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

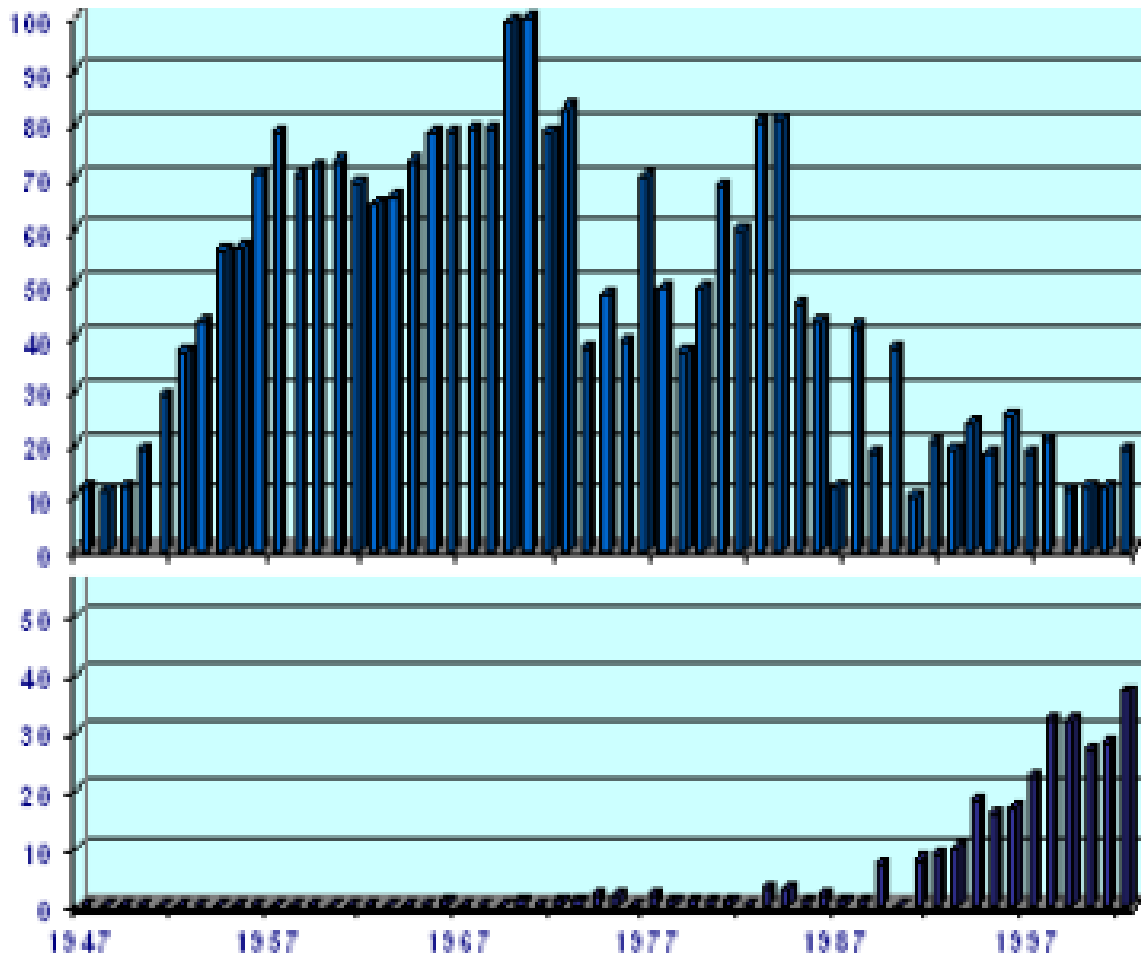


Background - bacteria

- ~ < 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



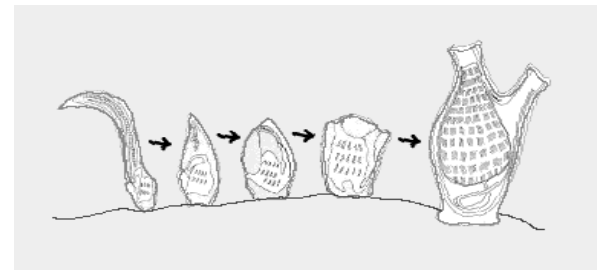
Novel Compounds Reported from Terrestrial Microorganisms (SIM News Jan/Feb 2003 Vol. 53, No. 1 pp 4-9)

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/izq/SFBay2K/bugula.htm>



Bryostatin1 (anti cancer)

Bryozoa- *Bugula neritina*

Photos from WWW

Value Creation and Innovation



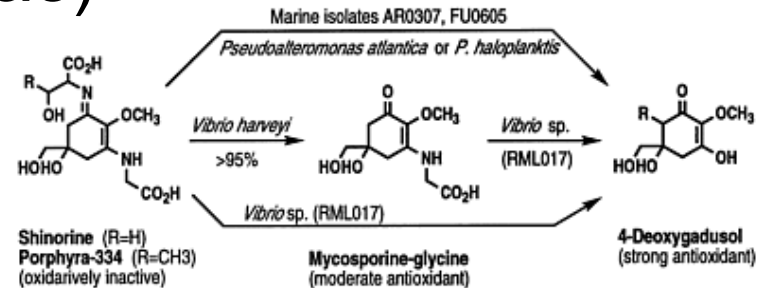
Antibacterial compounds

- 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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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 Eyjafjörður



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

- **Organic 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

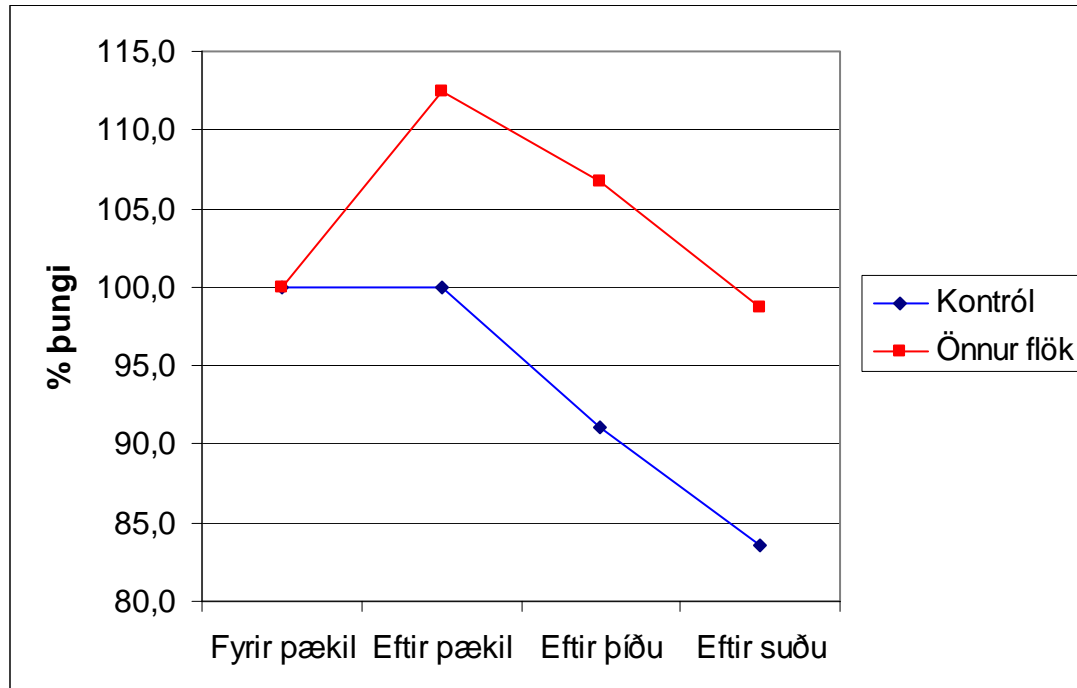
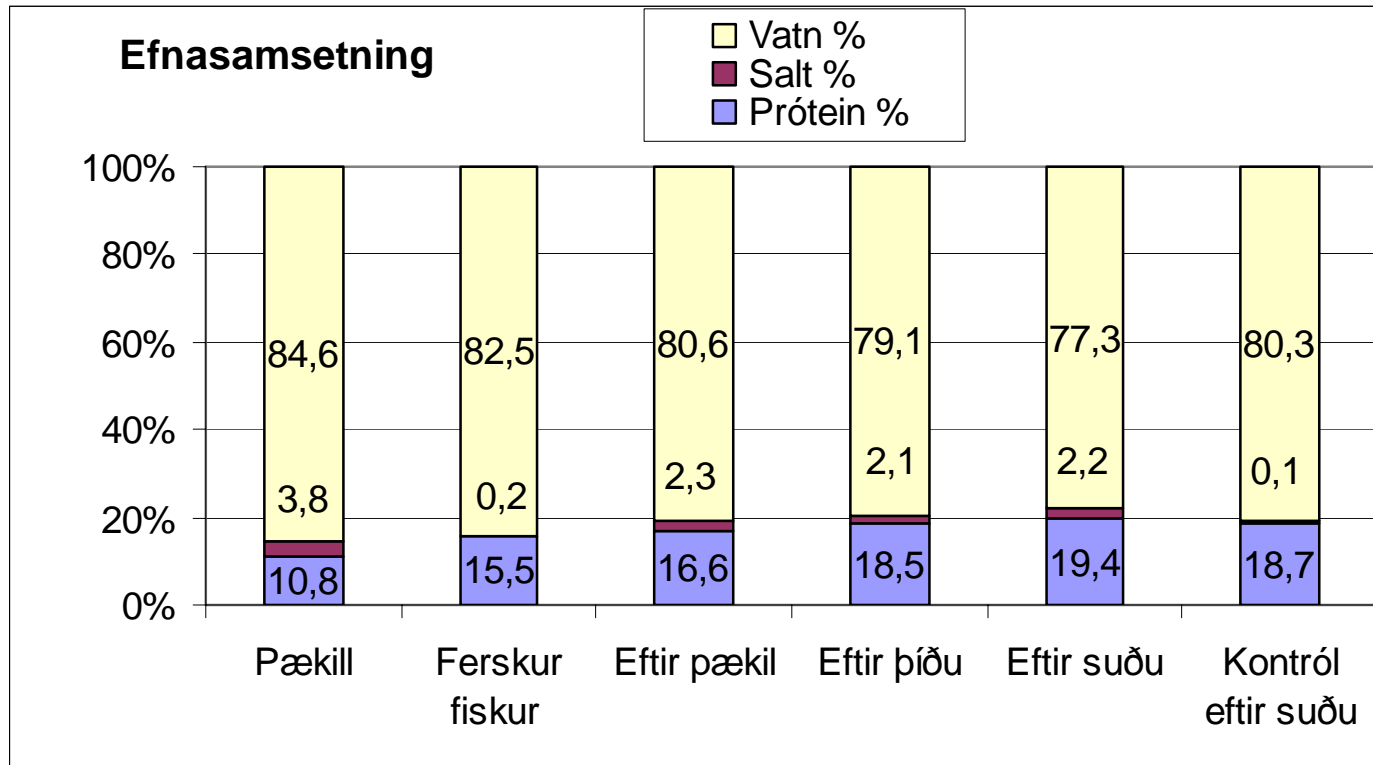


Fig 1: Weight changes in cod fillets before, during marinating, freezing and cooking (*Marinated in red, control in blue*).



- *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 feed
- 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