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Are we using too many, or too few, fish in research?

National platform for alternatives
www.oslovet.veths.no/fish

Adrian Smith & Renate Johansen
adrian.smith@veths.no

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Fish in Research

- How many research fish do we use?
- Why do we use so many research fish?
- How can the number of research fish be reduced?

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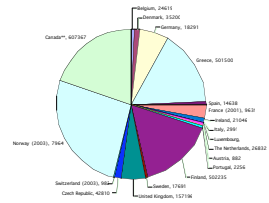
How many fish are we using?

Problems with definitions & reporting



Sweden (2005): 183,000 (EU/CoE definition)
+ 6.3 million (fishing trials)

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The situation in Norway as an example

- Annual production of 500,000 tons farmed fish
- About 500 million farmed salmon
- The mortality rate for farmed salmon in seawater is estimated to be 7% a year
  - About 50,000 fish die each day

+ 945,000 'research fish' (2005)

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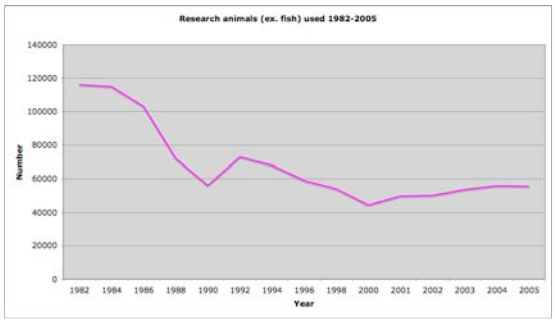

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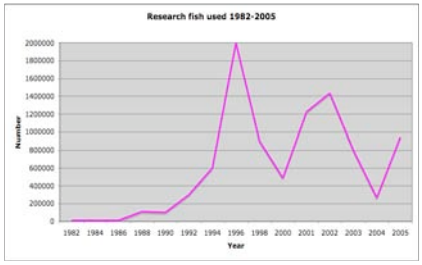

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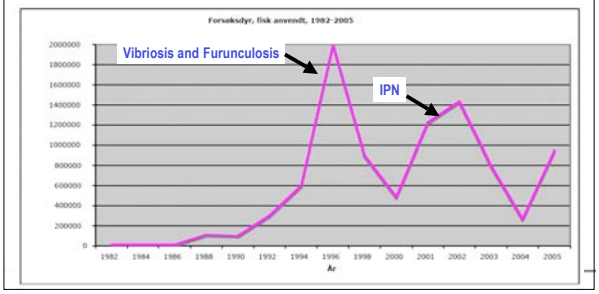
The large variation in the number of research fish is due to the health situation and economy of the fish farming industry



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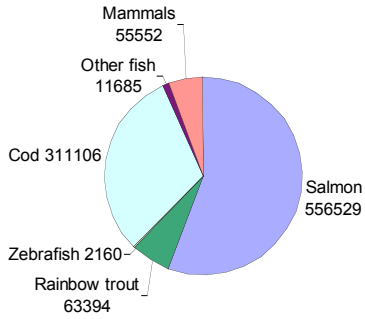

Research animals, Norway 2005

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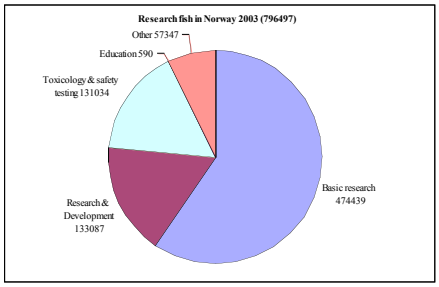
Why do we use research fish?

Official statistics



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Research fish 944.874 + "Fish used in research that are not defined as research fish" 1.659.051 = Total number of fish used for research 2.6 million

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"Fish used for research that are not defined as research fish"

Fish used for research that are not defined as research fish, 2004	
Simple marking of animals, withdrawal of blood samples and collection of natural secretions or excretions only casing slight pain or discomfort of a highly temporary nature	61665
Experiments having to do with breeding/rearing, feeding and environment without producing a non-physiological state in the fish	1205366
Fish killed before the start of the experiment	14179
Fish killed for educational purposes etc.	820
Fish at research stations not used	377000
Total	1659051

Observational studies, slaughterhouse data etc. on farmed fish are not counted in the statistics.

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Lack of international harmonisation of how a "research fish" is defined leads to problems when statistical data from different countries are compared.

Lack of international harmonisation on ethical norms for the use of fish in research could lead to movement of research from one country to another.

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Reporting: A survey of 160 papers in 8 major journals in 2004

Percentages of articles not mentioning the parameter:

Parameter	Fish	Lab animals
Total no. of animals used	55	25
Source	40	30
No. of animals per cage/tank	51	40
Sex	92	8
Genetic makeup	87	52
Age/weight	38	43
Temperature in room/water	15	74
Quarantine/acclimation period	61	73
Microbiological status	84	48
Water source	49	52
Reference to guidelines/code of conduct	98	10

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"Comparative medicine"

Farmed salmon

Farmed salmon

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"Comparative medicine"

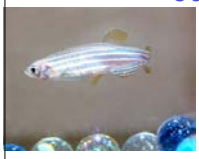

Photo: Peter Alestrøm lab

Photo: ESA

Photo: ESA

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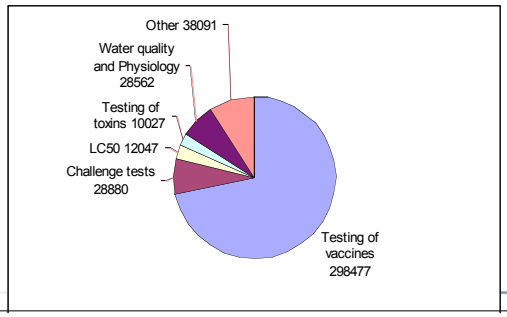
Over 50% of the research fish in Norway are used for testing of fish vaccines



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Why are so many fish used for testing of fish vaccines?

1. There is a continuous need for new and better vaccines
2. The European pharmacopoeia
   - States how vaccines have to be tested
   - Few possibilities to use alternatives
     - No alternatives methods available

Most fish are used for potency-testing

100 vaccinated fish and 100 unvaccinated fish per antigen (normally 6x = 1200 fish per vaccine)

↓

Challenge study:
i.p. injection to satisfy the law
bath to satisfy the customer

↓

Mortality of the unvaccinated fish has to reach 60%

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How can we reduce the number of research fish?

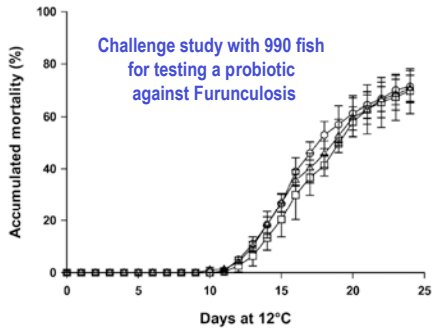

Fig. 4. Accumulated mortality of Atlantic salmon (*Salmo salar* L.) infected with *Aeromonas salmonicida* with and without (△) treatment with *Pseudomonas fluorescens* strain AH2 at two levels: $0–10^5$ (□) and $10^3–10^5$ (○) cfu/ml, respectively. Fish of 15–20 gram sizes were kept at in fresh water at 12°C with a flow of 0.8 l/kg fish per minute. Infection was done by 10% cohabitants and all treatments were carried out in triplicates. Errorbars are 95% confidence limits.


3x 100 fish

Low concentration of Probiotics


3x 100 fish

High concentration of Probiotics


3x 100 fish

Control groups

↓

10 fish infected with Furunculosis are added to each tank

↓

Mortality rates are compared

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How can we reduce the number of research fish?

- *In vitro* studies
- Pilot studies
- Standardise the fish used
  - Age, size, health
  - Genes
- Standardise the conditions
  - Water quality and tank facilities
  - Care and handling
    - Methods for blood sampling, anaesthesia etc.
    - Feeding systems, tagging etc.

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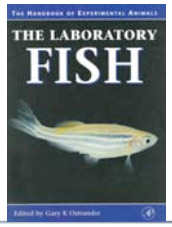
Alternatives

The 3 R's

- Reduce the number of fish used
- Replace live fish with *in vitro* methods
- Refine methods to reduce the number of fish and/or the amount of suffering



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Alternatives

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The lack of standardisation of research methods
leads to the fact that
all parameters have to be tested on the
same fish group at the
same time under the
same conditions.

This leads to LARGE experimental studies and
the results from one study
are difficult to compare with other studies.

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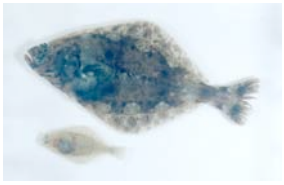
Challenges using fish in research



\+ Mortality rates
Pain perception
Anaesthetics
Husbandry, groups
Procedures etc. etc.

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**How do we define suffering
in research fish when we are still discussing
whether fish have the ability to suffer or not?**

- In Norway only a few studies such as surgical insertion of radio transmitters into the abdomen of fish are reported as painful experiments.
- Studies where fish are killed with high doses of bacteria or virus to show the effect of vaccines are not reported as painful experiments.

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Winter Ulcer Disease

Photo: Brit Tørud

Several million fish suffer from this disease each year

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Bambi factor

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Conclusion:

There is great potential for optimising
research methods leading to
more and better research results per fish
used in research

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Do we need more or fewer research fish?

Yes, we need **more** research fish to solve the major problems in the fish farming industry as new species are introduced,and in comparative functional genomics research

Yes, we should use **fewer** research fish to comply with the three R's of Russell & Burch

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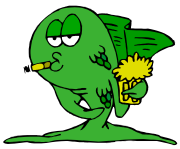
Health monitoring of fish used in research

What's the point?
We use only healthy fish in our research, don't we?



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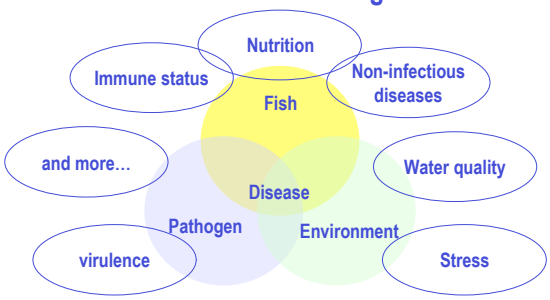
Health monitoring



Guidelines for health and welfare monitoring of fish used in research
Johansen R et al., Laboratory Animals, October 2006

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"Normal" hearts from "healthy" farmed salmonids

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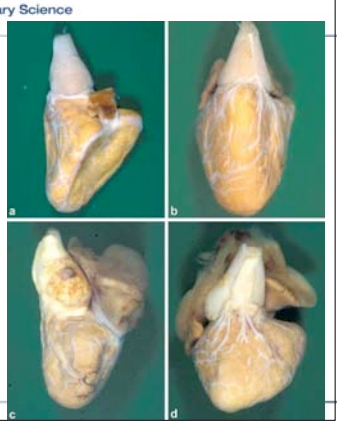
Wild rainbow trout

Farmed rainbow trout



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Conclusions on how to reduce the number of research fish

- The statistical data of the number of fish used in research need to be based on better definitions
- Laws and regulations should allow alternatives
- There is a great need for more research to develop *in vitro* methods and refine experimental methods
- Standardisation of research models
  - Including health and genetic status of the fish

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Report available on our website

www.oslovet.veths.no/fish

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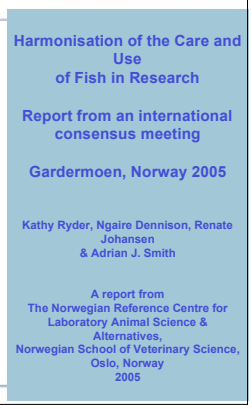

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Thanks to Gunvor Knudsen for the statistical data.

Thank you for your attention!

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adrian.smith@veths.no