



# Where are we, where do we go?

Concluding remarks of the 3<sup>rd</sup> ICFT

Eva B. Thorstad



13 -17 JULY 2015 | HALIFAX, NOVA SCOTIA | CANADA





# Fantastic week

- Presentations





# Fantastic week

## • Posters

**Post-reproductive migration behaviour and physiology of Atlantic salmon in a unique hydrological context, the Bras d'Or Lakes, Nova Scotia**  
X. Bordeleau<sup>1</sup>, S. Denny<sup>2</sup>, F. G. Whoriskey<sup>3</sup>, B. G. Hatcher<sup>4</sup>, M. Orr<sup>4</sup>, J. Sheng<sup>4</sup> and G. T. Crossin<sup>1</sup>

<sup>1</sup> DALHOUSIE UNIVERSITY <sup>2</sup> UPEI <sup>3</sup> OCEAN TECHNOLOGIES <sup>4</sup> CAPE BRETON UNIVERSITY

**Background**

- The Atlantic salmon is an iteroparous species and individuals have the capacity to survive a first spawning episode and recondition for subsequent attempts.
- Salmon originating from the Bras d'Or Lakes (BdL) watershed in Cape Breton NS, are thought to spend extended periods of their life cycle in the lakes rather than at sea, but little is known about the behaviour of these endangered salmon in this unique in-land sea ecosystem.
- To fill this knowledge gap, we use a combination of acoustic telemetry and physiological sampling techniques to investigate the post-spawning migrations, winter residency patterns, and survival of salmon in this system.

**Objectives**

Life history and habitat use

- Documenting freshwater to saltwater migration timing, survival, and characterize habitat utilization patterns in the BdL.
- Identifying physiological correlates of migration timing, habitat use patterns, and survival.

Anthropogenic impact and conservation efforts

- Assessing potential consequences of captivity and artificial spawning for adult salmon captured as part of the NS brood stock collection program.

**Methodology**

Between November 2014 and January 2015, a total of 21 post-spawned Atlantic salmon (from two river systems) were surgically implanted with acoustic transmitters (V16-4H) and bio-sampled for indicators of their physiology (nutritional state and stress level) before being released in the Bras d'Or Lakes system (OTN receiver array, map above).

Those 21 fish can be divided in 3 groups based on their origin and spawning conditions:

- 6 naturally spawned Middle River kelts (tagged between mid-Dec and mid-Jan)
- 7 hatchery spawned Middle River kelts (held in captivity - for 1 1/2 month - and artificially spawned before being released in mid-Nov)
- 8 hatchery spawned Baddeck River kelts (same Middle River hatchery spawned kelts)

**Early findings**

Tracking is presently underway, but preliminary results indicate condition driven river exit timing as well as elevated stress levels in hatchery spawned kelts.

Life history and habitat use

- Migration timing and detection:
  - 71% of tagged fish left their natal river
  - 48% subsequently detected leaving the Bay
  - Early and late migrants in both populations

Physiological correlates of seaward migration

- Parameters assessed include: body condition, hematocrit, plasma glucose, lactate, cortisol and testosterone.
- Parameters related to nutritional state showed significant relationships, as assessed from these regressions.
- Security for those how can afford to leave water is still.

**Anthropogenic impact and conservation efforts**

- Physiological and behavioural consequences of captivity and artificial spawning:
  - Captivity as a chronic stressor (vs angling impact) (see next slide)

Subsequent impact on migratory behaviour? Only 60% of hatchery spawned kelts were detected leaving the river (vs 100% for wild spawned kelts). However, many challenges arise when trying to infer natural mortality.

**International collaborations through OTN**

As an OTN H2P, opportunities for international collaborations are shaping what's becoming my PhD thesis. In addition to my work in Cape Breton, I am addressing similar questions with other salmonid species in different environmental contexts. Through collaborations between OTN Canada, Dr. Jan G. Davidson (NTNU, Norway) and Dr. Philippe Gauthier (UAA, France), I am also studying:

- Post-spawning migration behaviour and physiology of anadromous Brown trout and Arctic char in Trondheim, Norway.
- Physiological and environmental correlates of migration strategies in adult Brown trout on the colonization front at Les Kerkueles, French Southern and Antarctic Lands.





# Fantastic week

- Workshops





# Fantastic week

- Exhibitors







# Fantastic week

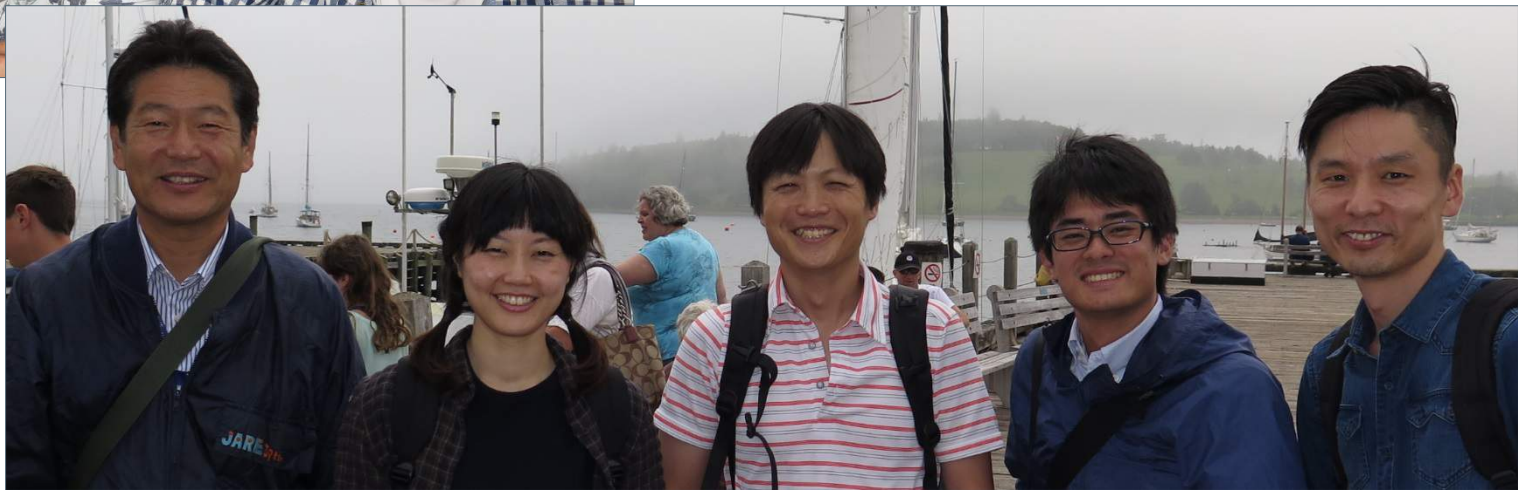
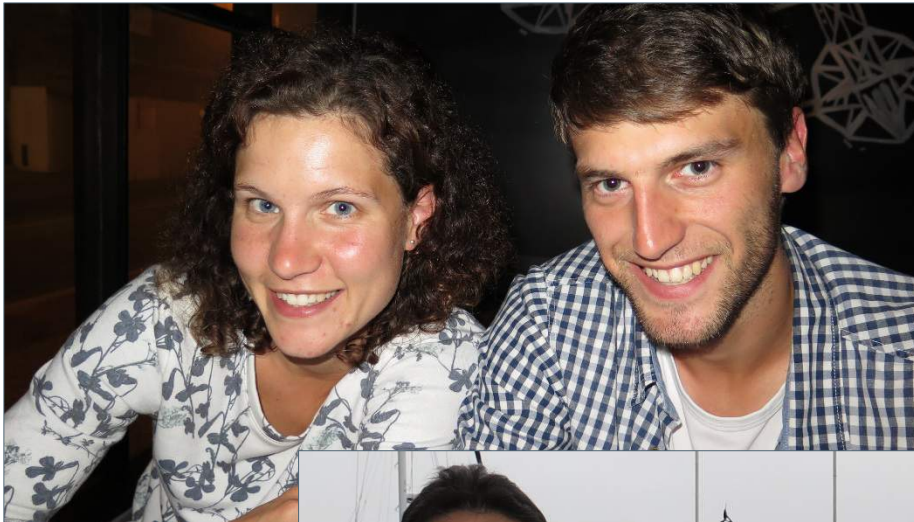
- Old and new friends





# Fantastic week

- Old and new friends

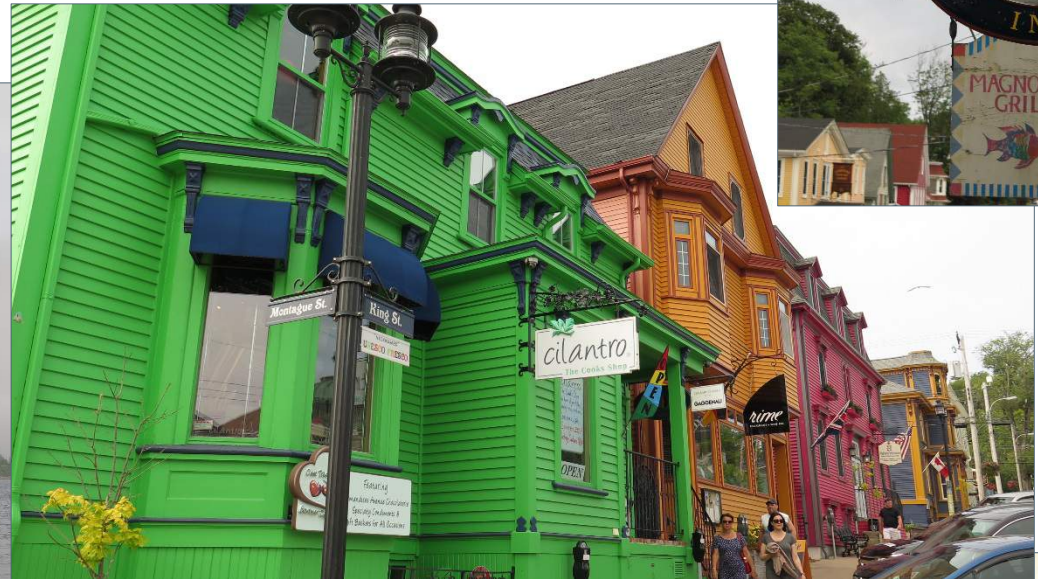






# Fantastic week

- Field trip







# Fantastic week

- Jr.-Sr. networking







# Fantastic week

- Gala dinner







# Fantastic week

- Gala dinner





11 conferences since 1995

20  
YEARS



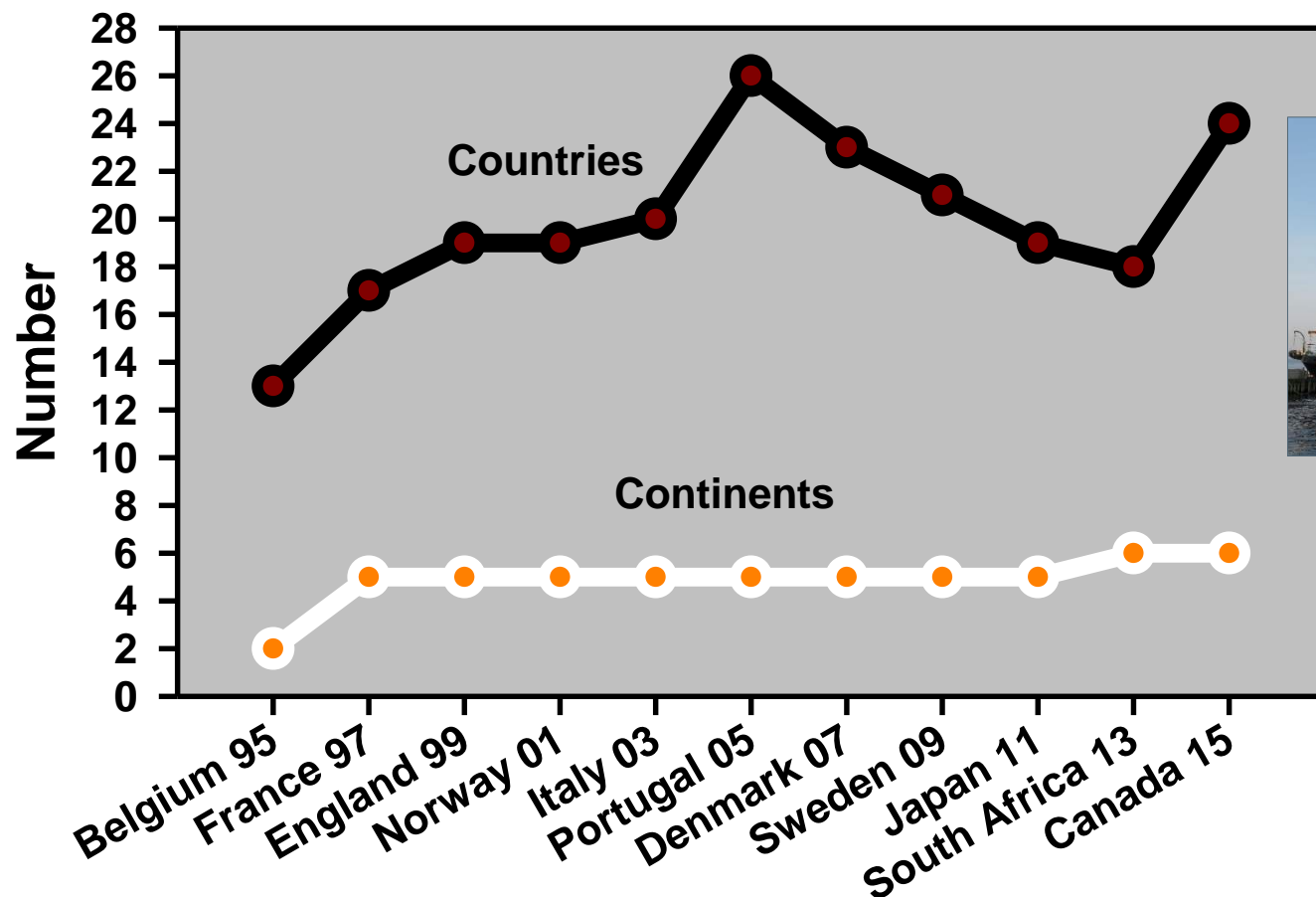


# How you become after listening to 900 presentations at 20 years of telemetry conferences ...



Kim  
Aarestrup  
DENMARK

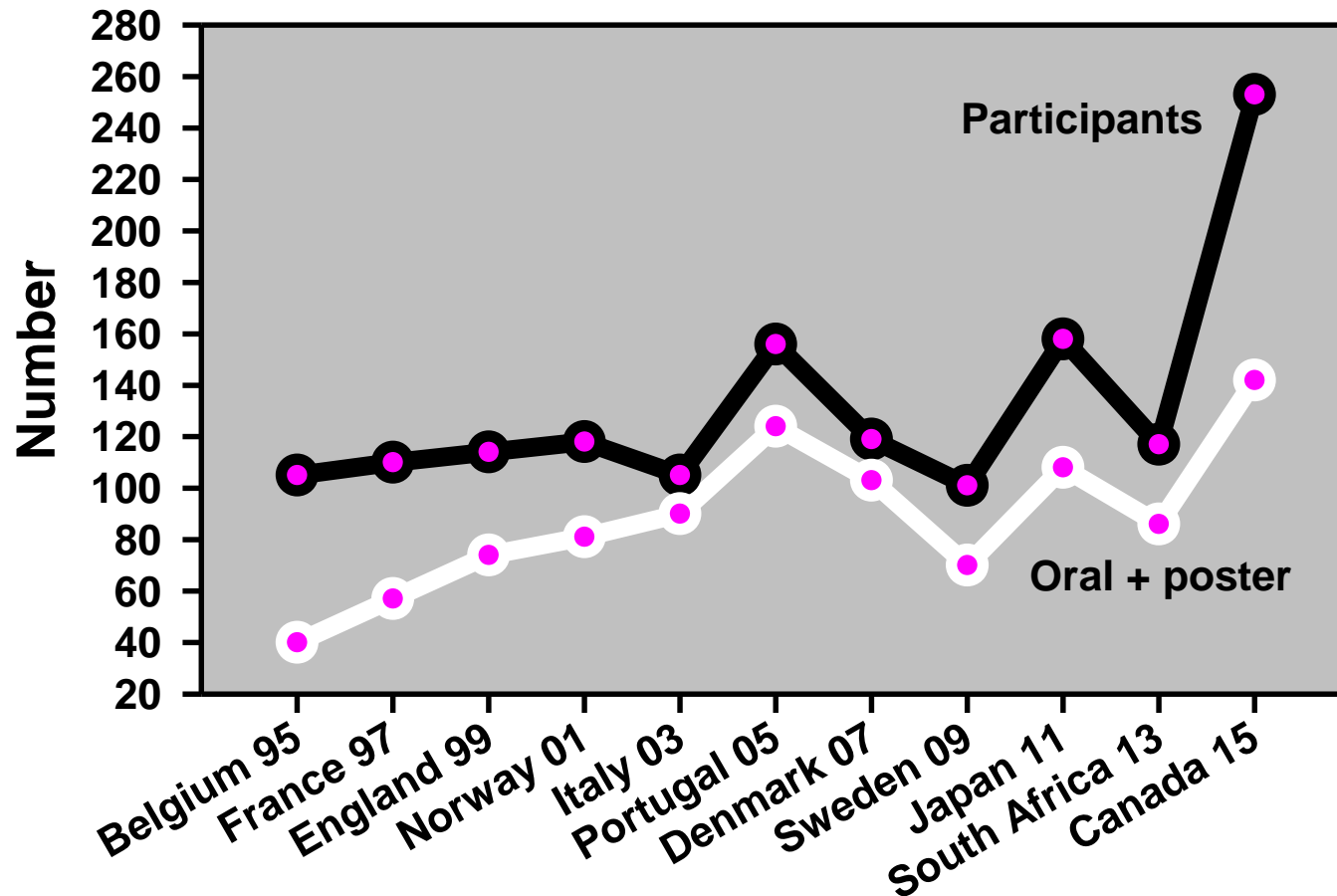
# 3rd ICFT: participants from 24 countries and 6 continents



We still lack  
Antarctica!

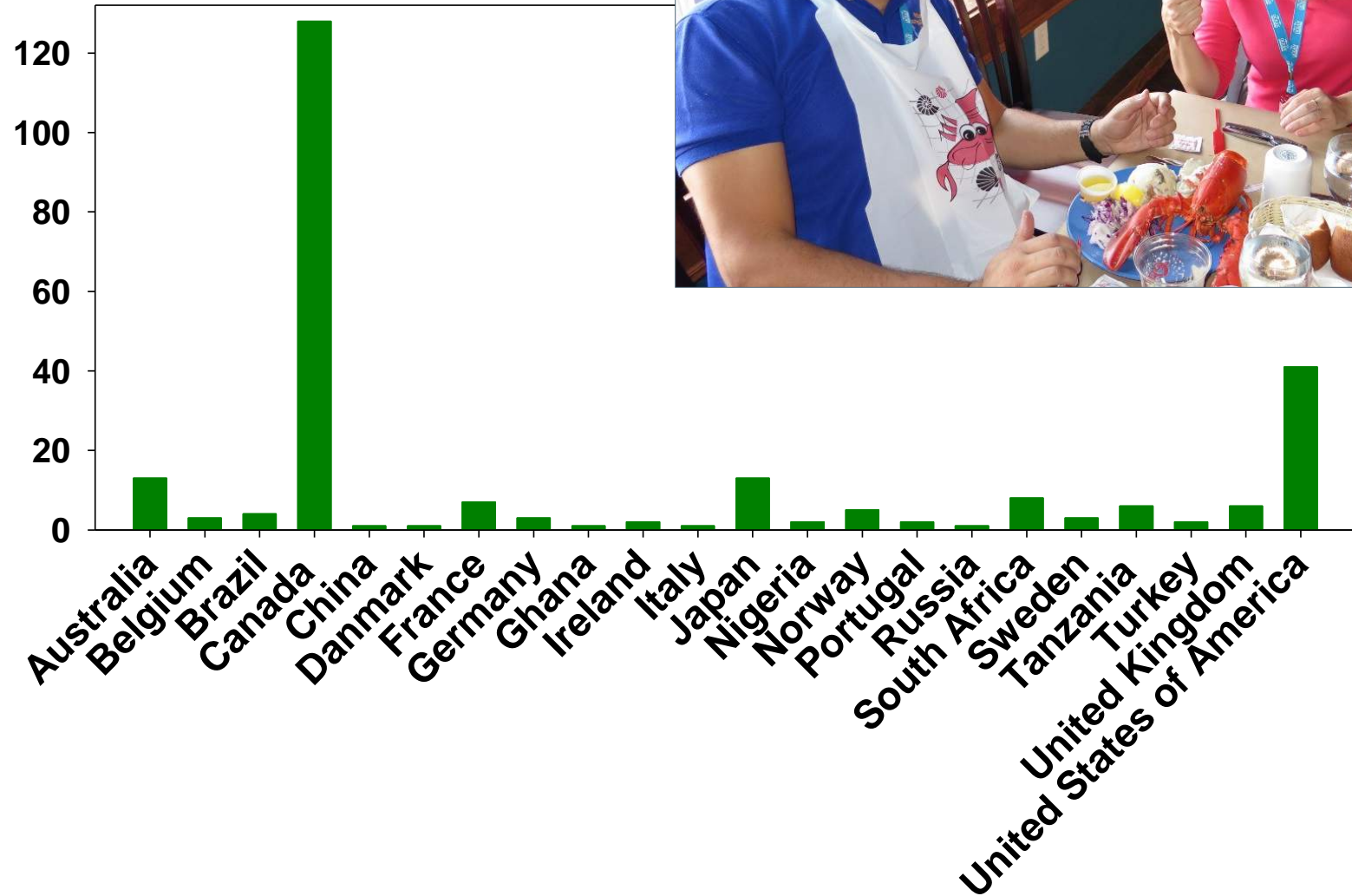


All-time high:  
253 participants, 142 oral + poster presentations



# Participants by country

Number of participants





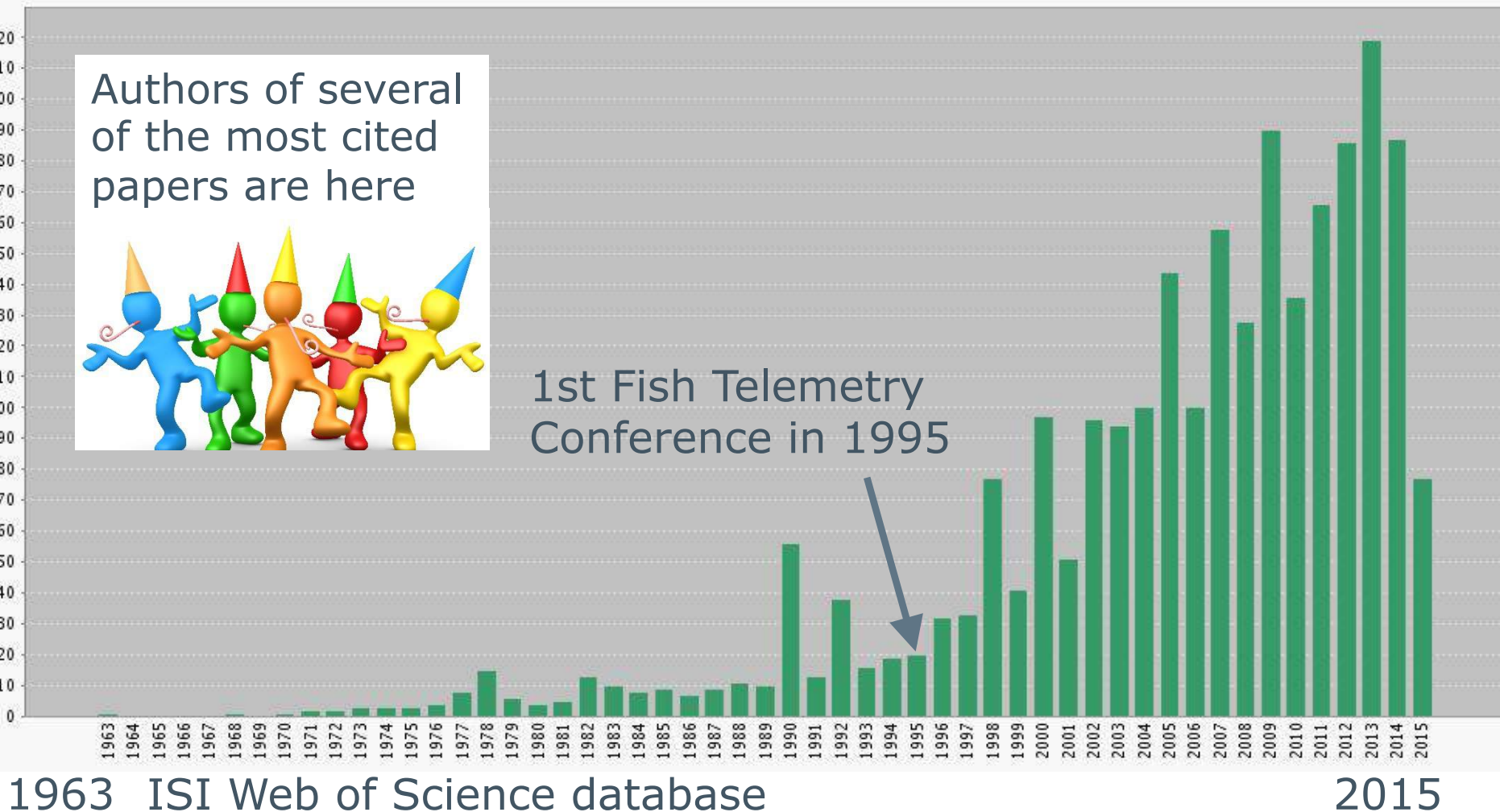
# Fish + telemetry: >2600 publications cited > 42 000 times



Authors of several  
of the most cited  
papers are here



1st Fish Telemetry  
Conference in 1995



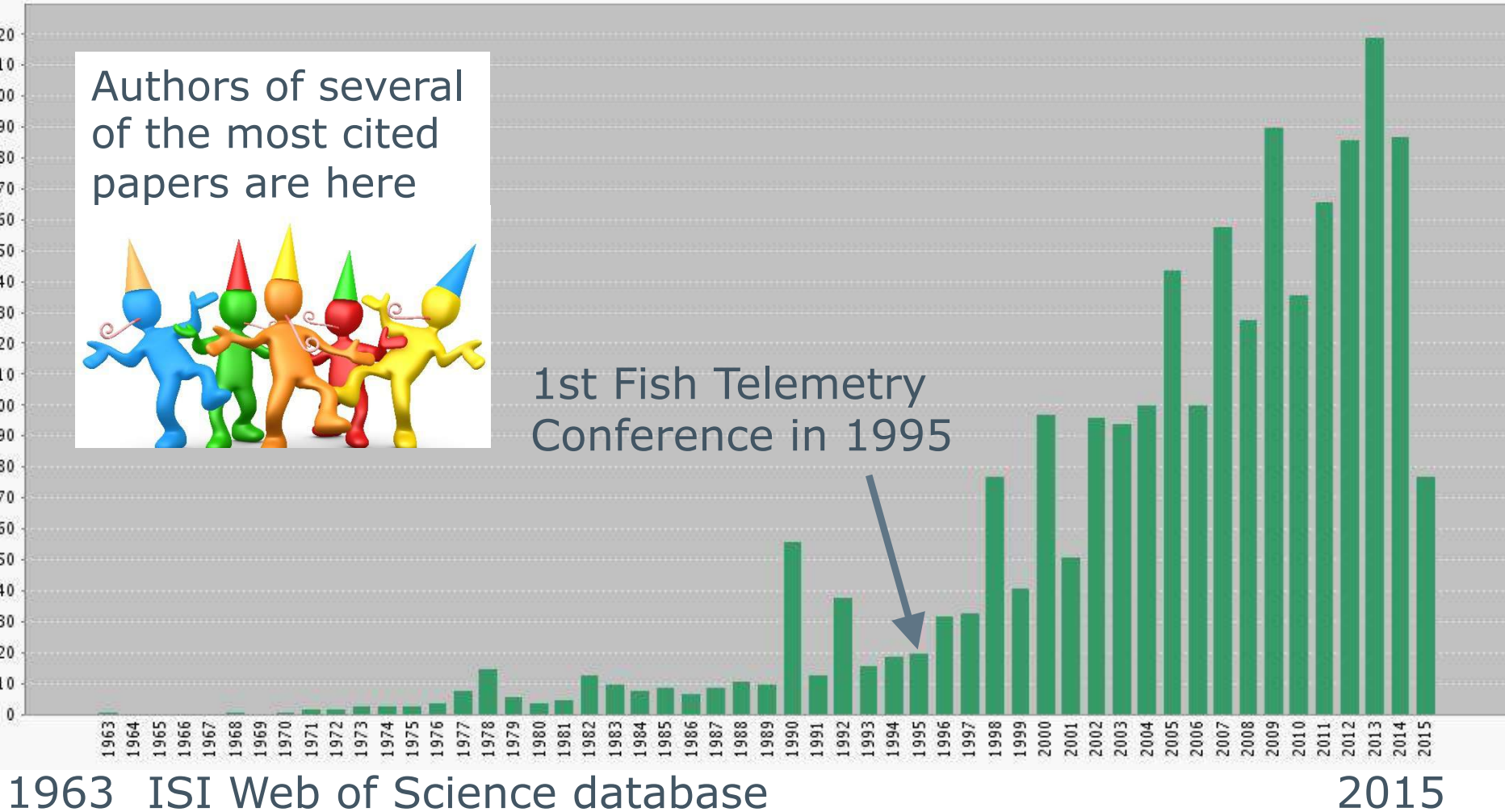
**No doubt** an important method for scientific advances and improved management



Authors of several of the most cited papers are here



1st Fish Telemetry Conference in 1995





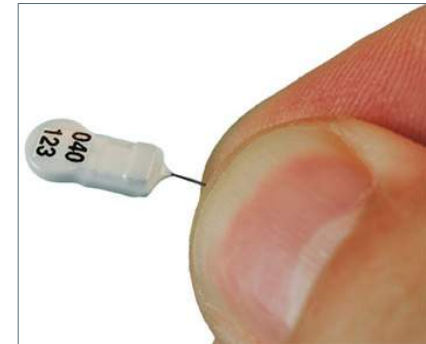
# Fish telemetry since 1995

- Increased use of acoustic, pop-up satellite and dst tags
- More marine studies, more off shore



# Fish telemetry since 1995

- Smaller radio, acoustic, pop up satellite and dst tags
- More data storage capacity, longer life
- Developments – but less use of sensor tags than expected

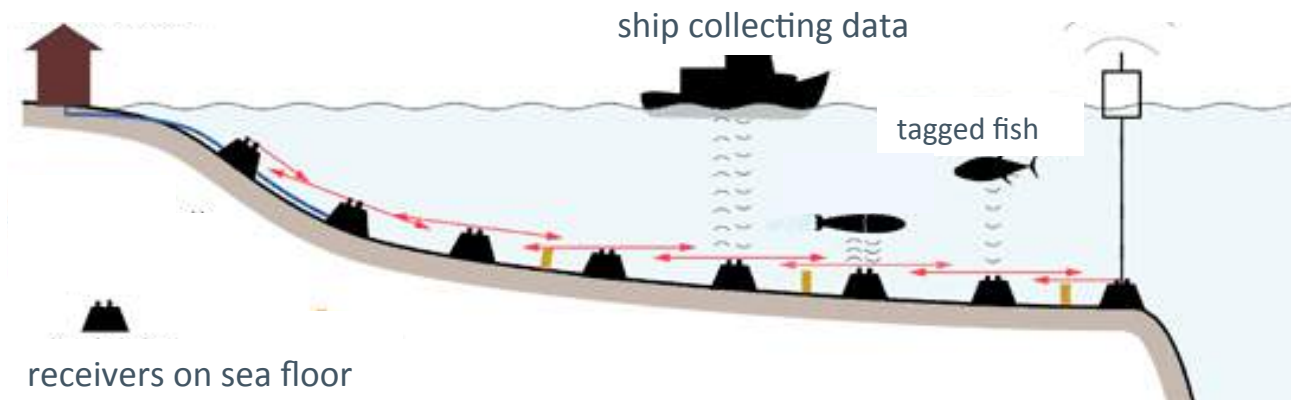




# Fish telemetry since 1995

- Large shared receiver arrays - collaborations across institutions and countries
- Improved statistical skills and analyses

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left( a_n \cos \frac{n\pi x}{L} + b_n \sin \frac{n\pi x}{L} \right)$$



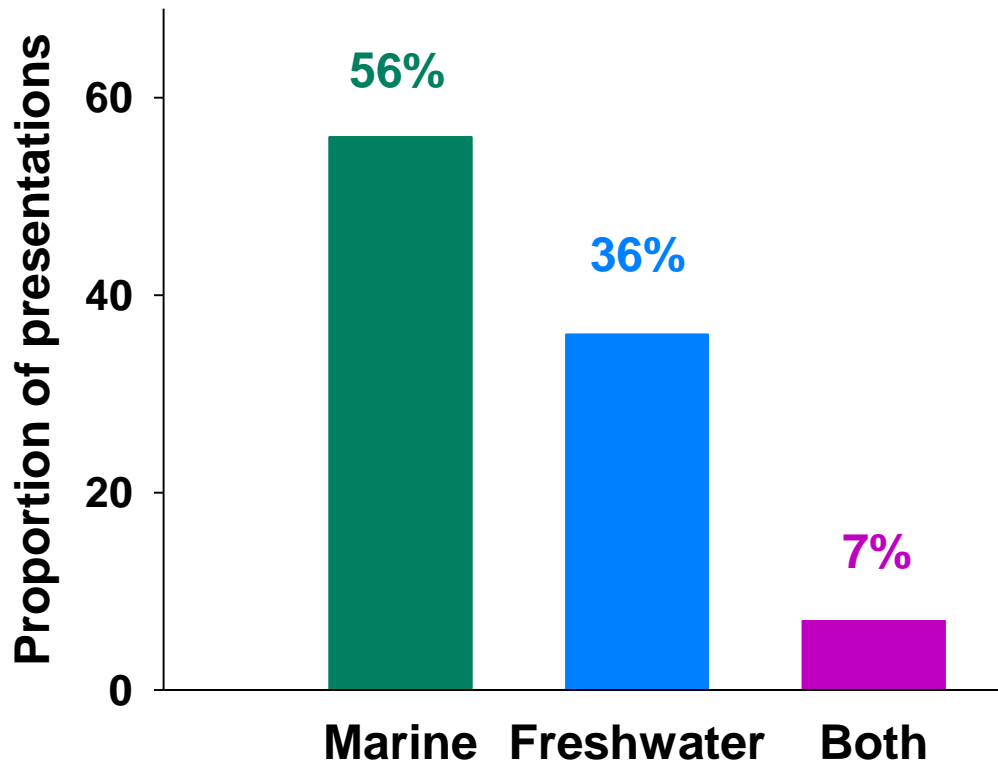
# Fish telemetry since 1995

- More widely accepted
- Less criticism that tagged fish are not representative for untagged fish
- Well known method among managers and the public





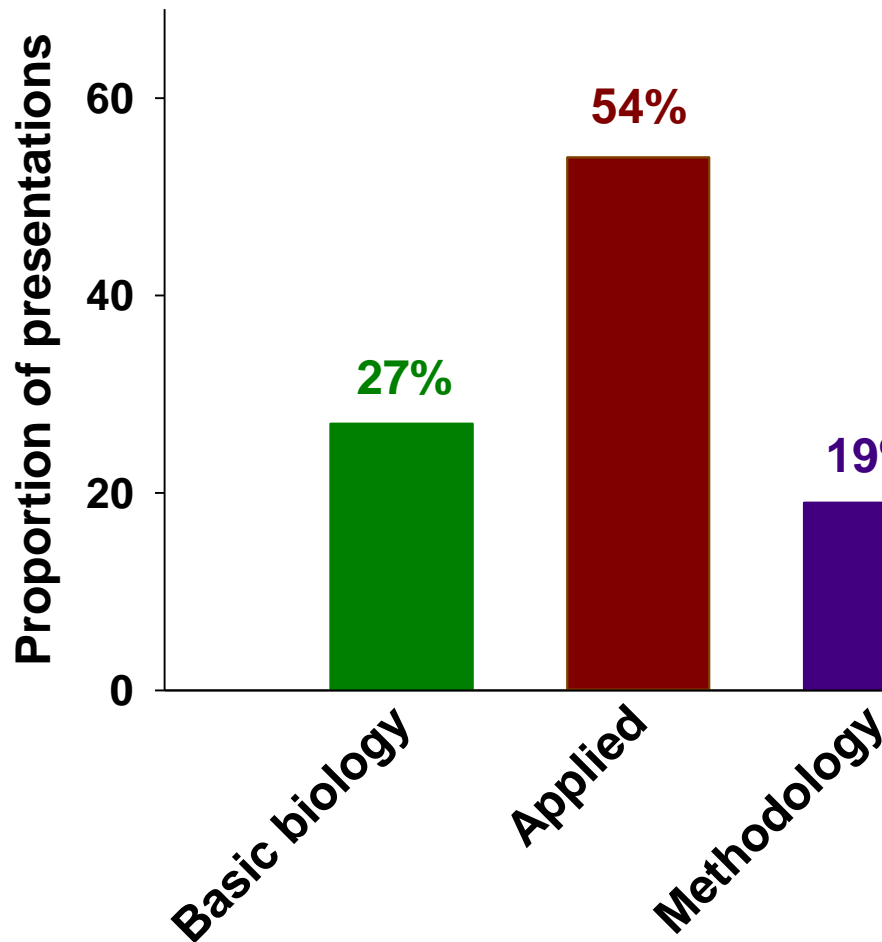
# This conference



- Telemetry used in a wide range of habitats and species
- More marine than freshwater



# This conference



- Strong focus on applied research questions

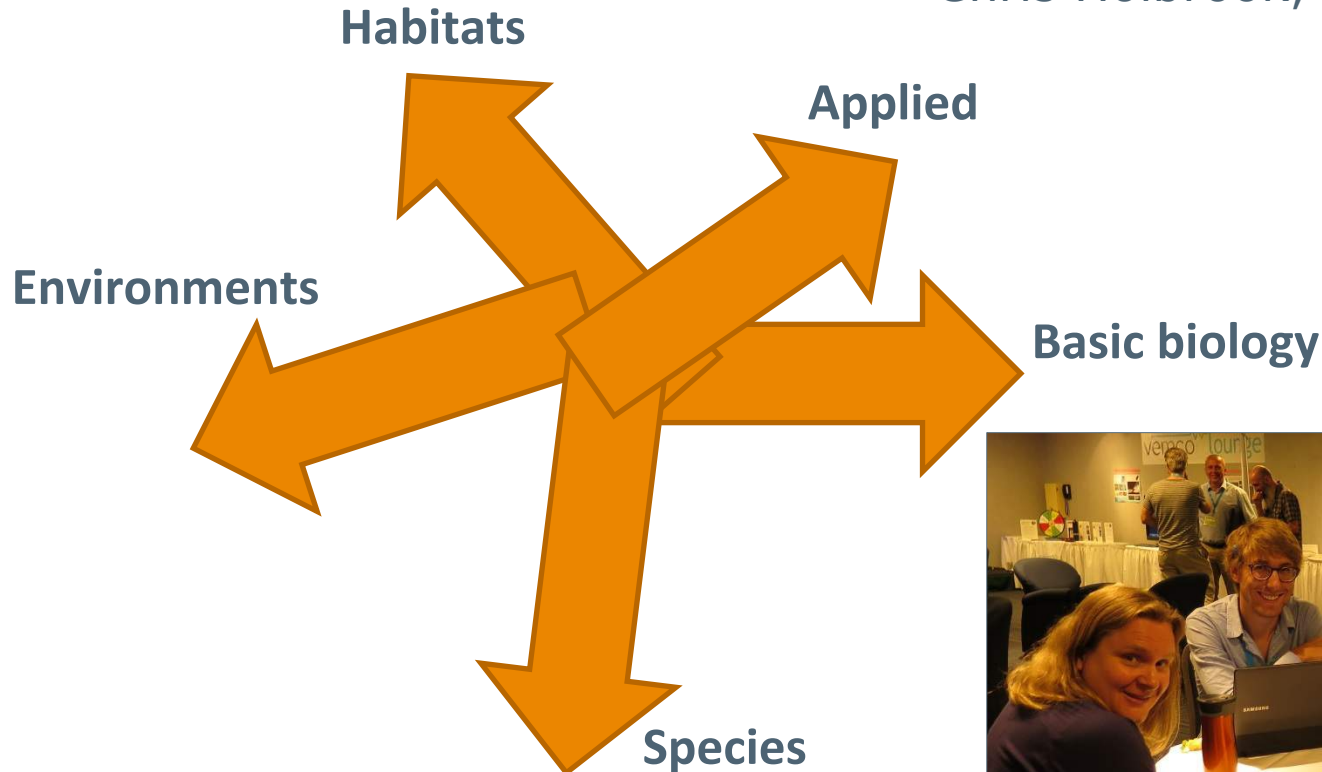




# FUTURE

**«There has not been more exciting times working with fish telemetry»**

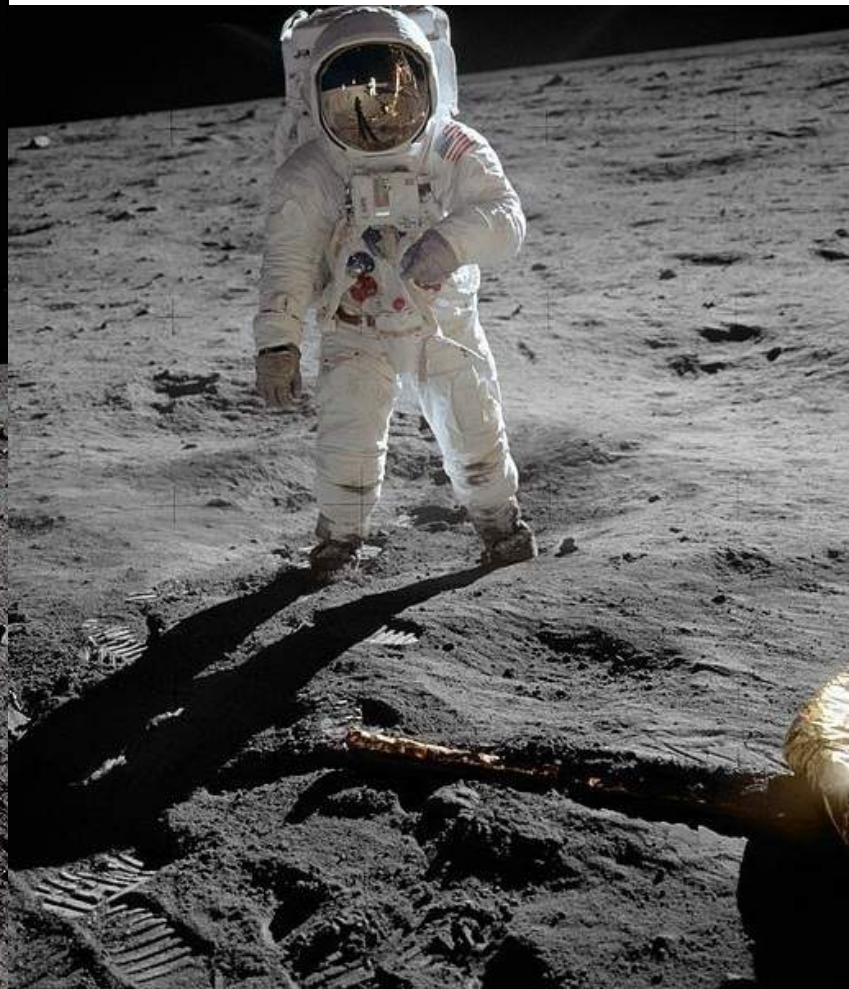
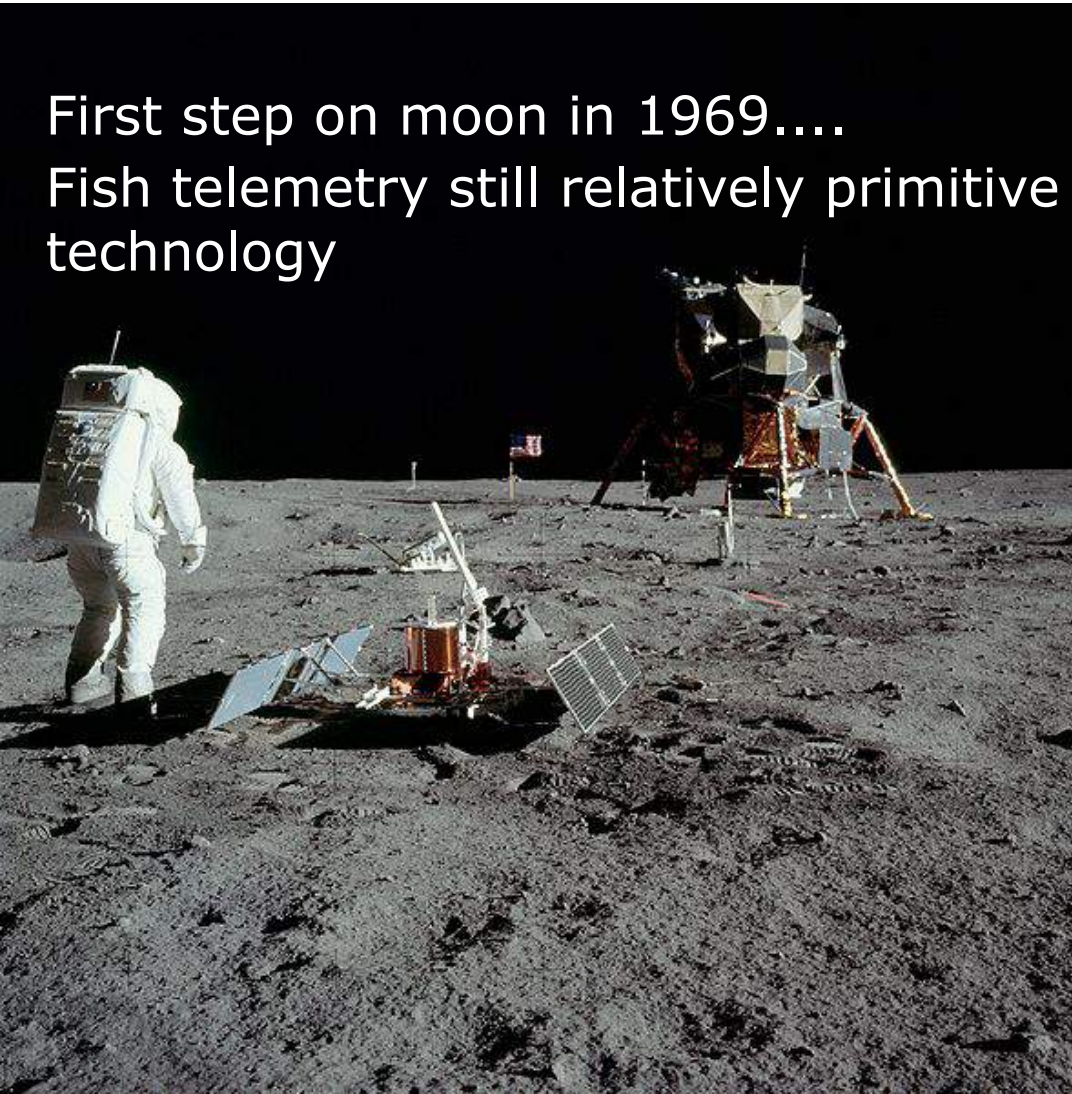
Chris Holbrook, Tuesday 08:36



# FUTURE

Developments of technologies and equipment will continue to open new research possibilities

First step on moon in 1969....  
Fish telemetry still relatively primitive technology





# FUTURE

Developments of technologies and equipment will continue to open new research possibilities

- Benefits from developments in portable consumer electronics driven by large markets



# FUTURE

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- Continued collaboration between companies producing equipment and scientists – we depend on each other
- Different companies have products with different strengths and weaknesses
- In complex research programs and complex habitats, we depend on equipment from different companies to solve our research questions
- Increased compatibility among products would increase our abilities to solve such research questions





# FUTURE

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- Methods must be openly described to meet scientific requirements for verification and reproducibility:
  - a limit to how undisclosed position calculations, sensor codes etc. can be before we do not meet scientific standards for re-examination of our methods and results



# FUTURE

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- Keep focus on telemetry system performance
- Especially important to separate between
  - noise and tag recordings
  - tagged fish and predators
- How do our capture methods influence which fish we capture for tagging – and thereby the results we obtain?
- More knowledge on anaesthetics

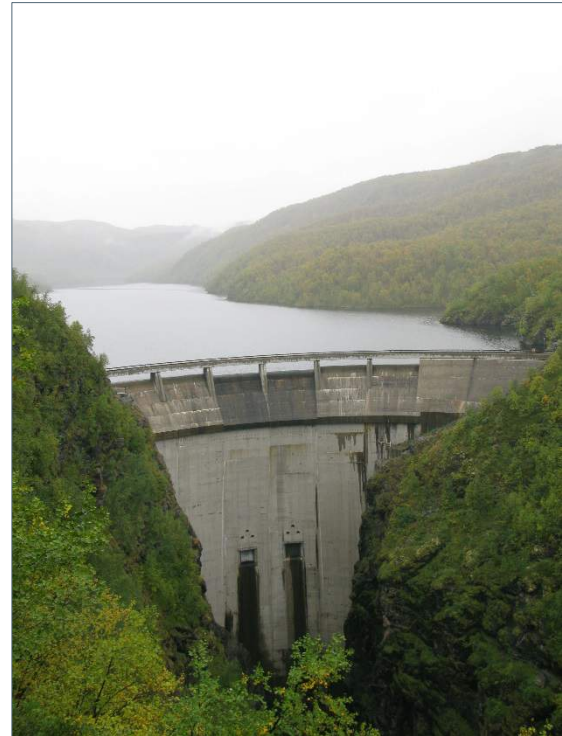




# FUTURE

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- Continued (increased) focus on applied science



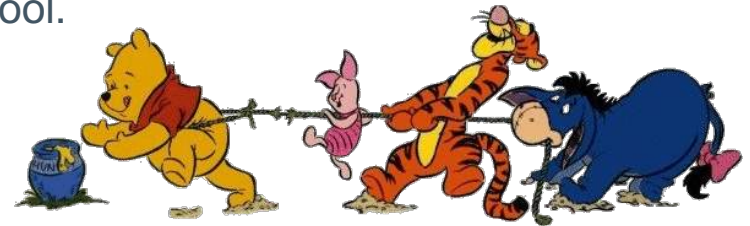
# Recent fish migration review

*“**Traditionally** fish migration studies has been observational, e.g., description of the specific migration patterns of a particular fish species”*

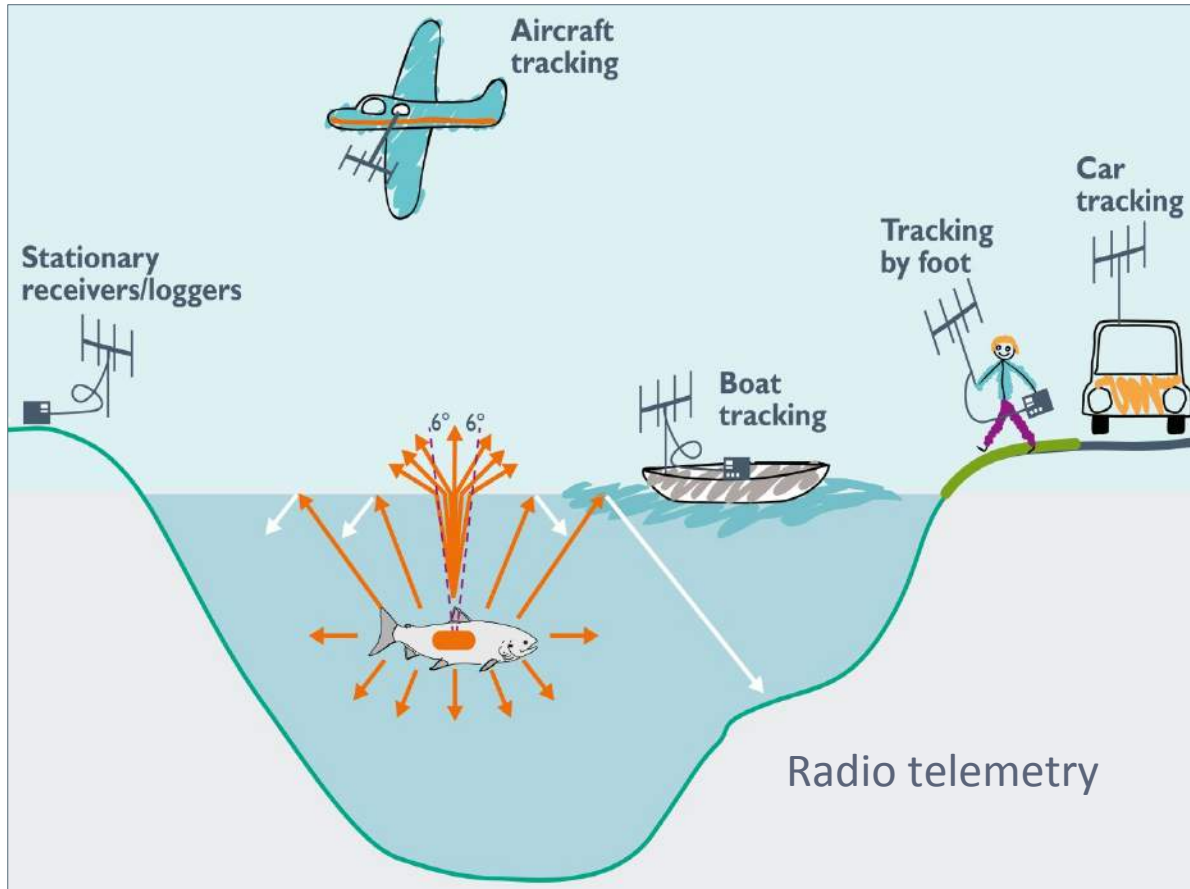
*“Clearly, we need to **move from** such descriptive and correlational studies **to** more hypothesis-driven research where specific predictions derived from theory are tested using manipulative experiments.”*

Brönmark et al. 2014 Can. J. Zool.

**My opinion: We still need both**



# How can we manage populations and species when we do not know where they are when?





# Need to combine with genetic studies

- Must we manage on species or population level?
- Are there populations that need concern to conserve genetic diversity and local adaptations?



# Clearly, descriptive studies can be improved

- Combinations of methods
- More data from the fish and environment we study (physiology, morphology, genetics, otolith chemistry....)
- Increased sample sizes
- Improved analyses



# Need to study also the smaller fishes

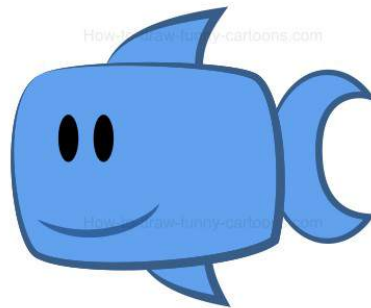
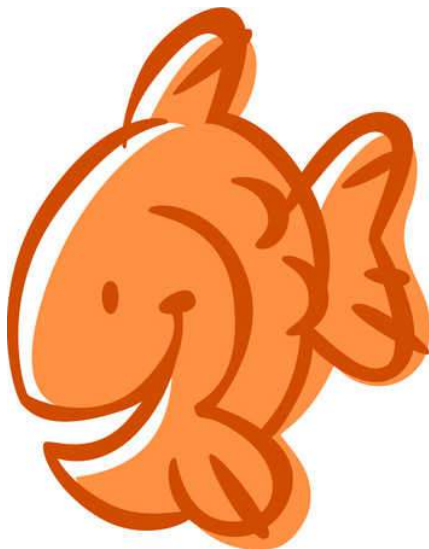
- Main focus on large fishes so far
- Leads to too much top-down food chain focus?
- Most fishes are small.....





# Increased focus on fish personalities

- Which ecological, fitness and management consequences do consistent differences in behavioural types have?
- Telemetry: ideal method



How-to-draw-funny-cartoons.com



# Combination of lab and field experiments

- Observe or exposure fish in lab - tag and release in field
  - compare behaviour and mortality among groups

- Ecotoxicology
- Fish personalities
- Etc.



# Telemetry has become a standard and common method....

...integrated in research programs and multi-disciplinary studies together with other methods

Less WOWWW, we can tag fish  
More emphasis on research questions





# ICFT 2017

**Michelle  
Heupel**

**Colin Simpfendorfer**





# ICFT 2017



# Come and enjoy what Cairns has to offer

- International airport to make travel easy
- Tourism based community including:
  - Reef diving/fishing trips
  - Rainforest trips
  - Native animal parks
- Aussie humour and beer!





# We hope to see you there!

## Organisers:

Michelle Heupel

Colin Simpfendorfer

Jayson Semmens

Watch for email updates and  
[2017icft.org](http://2017icft.org) coming soon

Email Michelle  
([m.heupel@aims.gov.au](mailto:m.heupel@aims.gov.au)) with  
suggestions, questions or  
sponsorship options





# THANK YOU for all contributions







# Organisers, **THANK YOU!!**







# See you in 2017!

