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## **SNIFFER with ICE: a taster of barrier assessment issues**

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# SNIFFER with ICE:

a taster of barrier assessment issues

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# Inland Fisheries Ireland



Inland Fisheries Ireland is the statutory agency responsible for inland fisheries in Ireland.

Mission Statement: "To ensure that the valuable natural resources of inland fisheries and sea angling are conserved, managed, developed and promoted in their own right to generate positive return for the community and the environment."



# *Barriers & Fish*

A physical, permanent structure that hinders or prevents fish migration up- or downstream

- Habitat fragmentation
- Habitat degradation



# DRIVERS for change – European Directives

- Habitats Directive (Species protection in SAC)
  - Salmon (smolts, adults)
  - Shad (Twaite & Allis)
  - Lamprey (River, Sea, Brook)



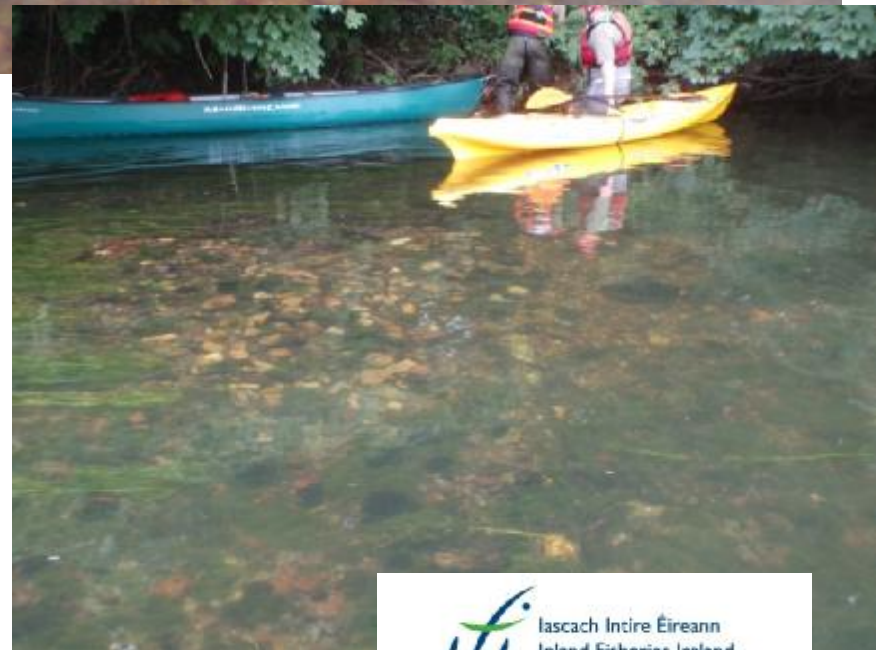
- Water Framework Directive - River connectivity a central theme
- EU Eel Regulations - Eel (glass eel, yellow eel, silver eel)



# Atlantic salmon



# Sea lamprey



# Irish Barriers: the usual man-made collection.....





# Bridge Floors & Aprons



# Weirs



# Culverts





# Fords



# Hydroschemes.....

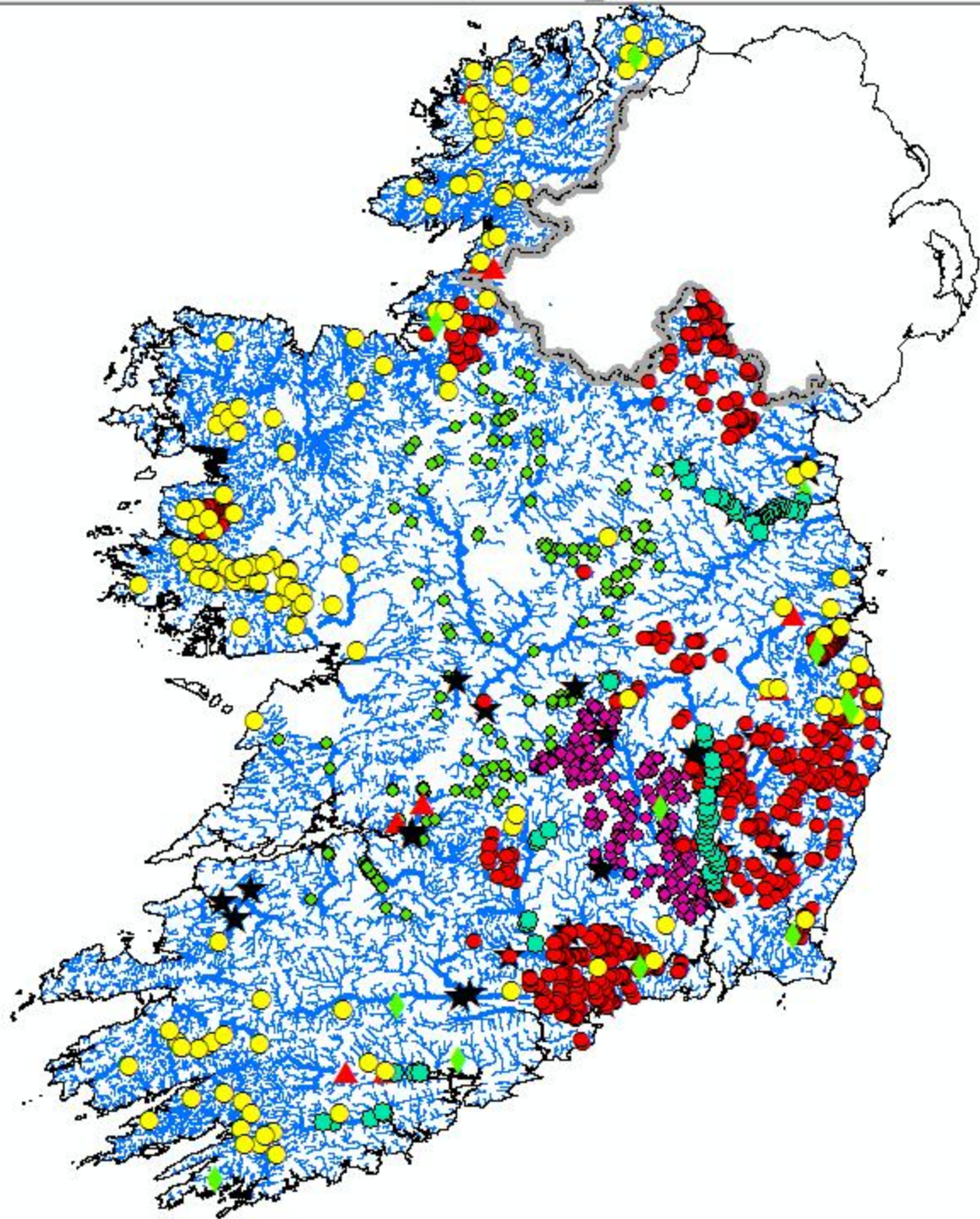


# Sluices



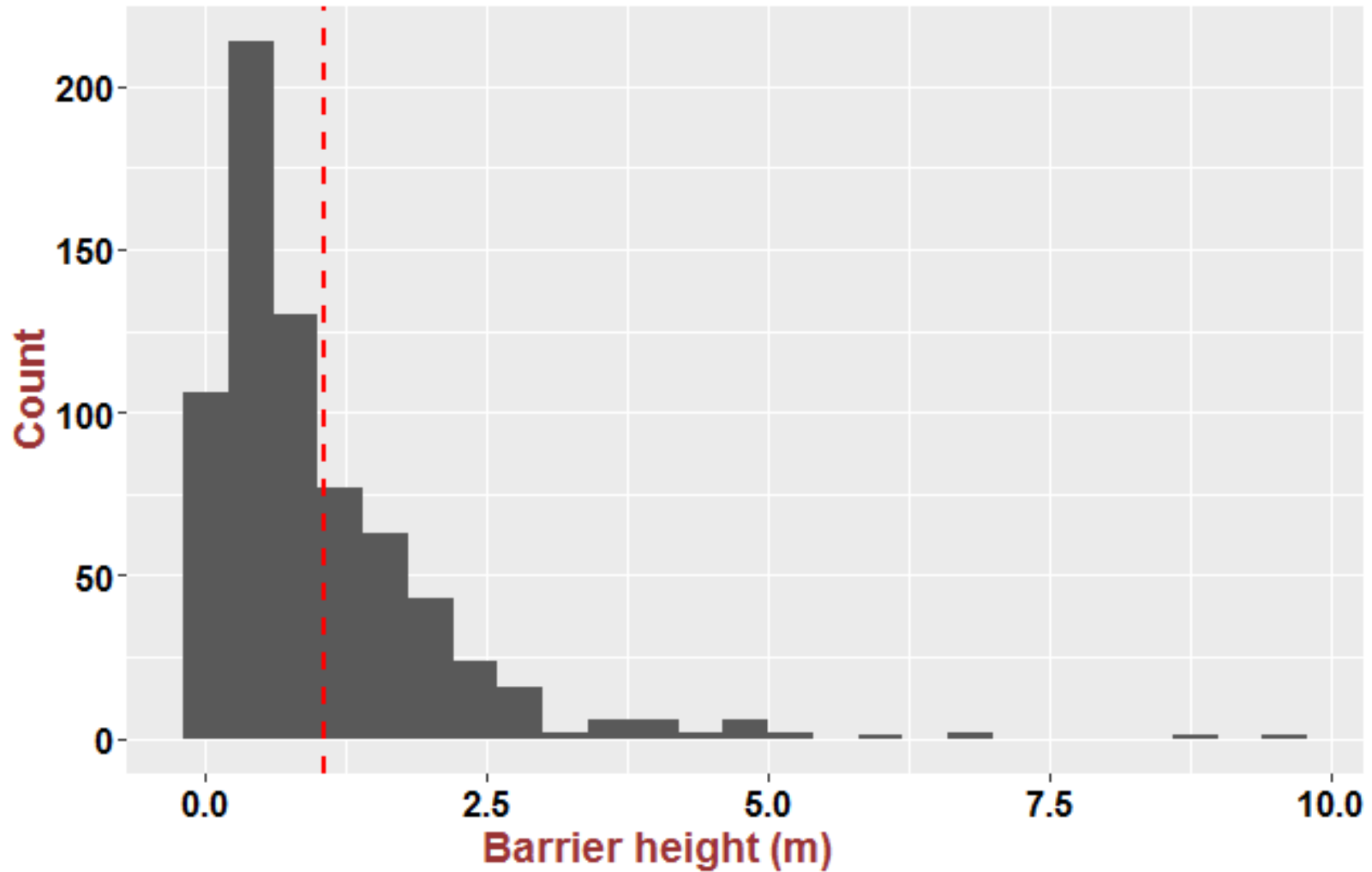
**Irish Barriers:  
The extent of the problem  
-contributing to European  
Atlas of Barriers in AMBER  
project**







## Irish Barriers



Mean barrier height **1.05m** (n=703, \*\*barriers <10metres)

(Excluded: 9 structures >10m)



# IFI 2-stage barriers strategy

- Level 1 surveys – putting spots on maps (desk and field protocol to generate GIS layer of barriers in Irish rivers
- Level 2 surveys – use SNIFFER at barriers where modifications are proposed – enables comparison of pre- and post-works passability

# IFI Barrier recording Level 1: IFI Tablet

- On-site Data collection *via* ruggedized laptops loaded with Geofield™ software.
- GPS recording
- Built-in camera
- Drop-down menus for data capture

The screenshot displays the 'Barriers Assessment' software interface. It features a tabbed menu at the top with options: General, Staff, Properties & Conditions (1), Properties & Conditions (2), Fish Passage, Barrier Risk, Photos, and Sketches. The main content area is divided into three sections:

- Nature of Obstruction:** Includes 'Artificial' options (Bridge Apron, Weir, Culvert, Ford, Hydro Scheme, Bridge Floor, Sluice, Other, None) and 'Natural' options (Rock/Bedrock, Ford, Other, None). A 'Comment:' text box is located below these options.
- Material Type:** Includes options (Mass Concrete, Rock/Bedrock, Masonry, Timber, Natural Bed Material, Corrugated Steel, Smooth Steel, Other). A 'Comment:' text box is located below these options.
- Artificial Structure:** Includes 'Maintained' and 'Abandoned' buttons.
- River Conditions During Survey:** Includes 'Flow (Visual):' options (Low, Medium, High, Flood).

At the bottom right of the interface, there are 'Submit' and 'Cancel' buttons.

**Barriers Assessment**

General | Staff | Properties & Conditions (1) | **Properties & Conditions (2)** | Fish Passage | Barrier Risk | Photos | Sketches

**Roughness of structure**

Smooth | Rough | Very Rough

**Slope through structure**

Vertical | Steep ~45+° | Moderate ~30° | Gentle ~15°

**Size information (Bridge or culvert)**

Width (m) - C/BW:

Length (m) - C/BL:

U/S Apron Length (m)(if present) - UAL:

D/S Apron Length (m)(if present) - DAL:

Drop Height (m) - DH:

D/S Depth (m) - DD:

Plunge Pool Depth (m) - PPD:

Depth (m)(water through structure) - D:

Channel Width (m):

**Size information (Weirs, waterfalls etc.)**

Barrier Length (m) - BL:

Barrier Depth (m) - BD:

D/S Apron Length (m)(if present) - DAL:

Drop Height (m) - DH:

D/S Depth (m) - DD:

Plunge Pool Depth (m) - PPD:

Sill Length (m)(measured on the horizontal) - SL:

Channel Width (m):

**OBJECTIVE**

Submit | Cancel

# Barriers Assessment

General

Staff

Properties & Conditions (1)

Properties & Conditions (2)

Fish Passage

Barrier Risk

Photos

Sketches

## Risk Posed By Structure To Particular Fish Species

Salmon (adult):

Impassable

High

Moderate

Low

None

Salmon (smolt-downstream):

Impassable

High

Moderate

Low

None

Eel (adult downstream):

Impassable

High

Moderate

Low

None

Eel (elver):

Impassable

High

Moderate

Low

None

Shad:

Impassable

High

Moderate

Low

None

Sea Lamprey:

Impassable

High

Moderate

Low

None

River Lamprey:

Impassable

High

Moderate

Low

None

Brown Trout:

Impassable

High

Moderate

Low

None

Pike:

Impassable

High

Moderate

Low

None

Cyprinids:

Impassable

High

Moderate

Low

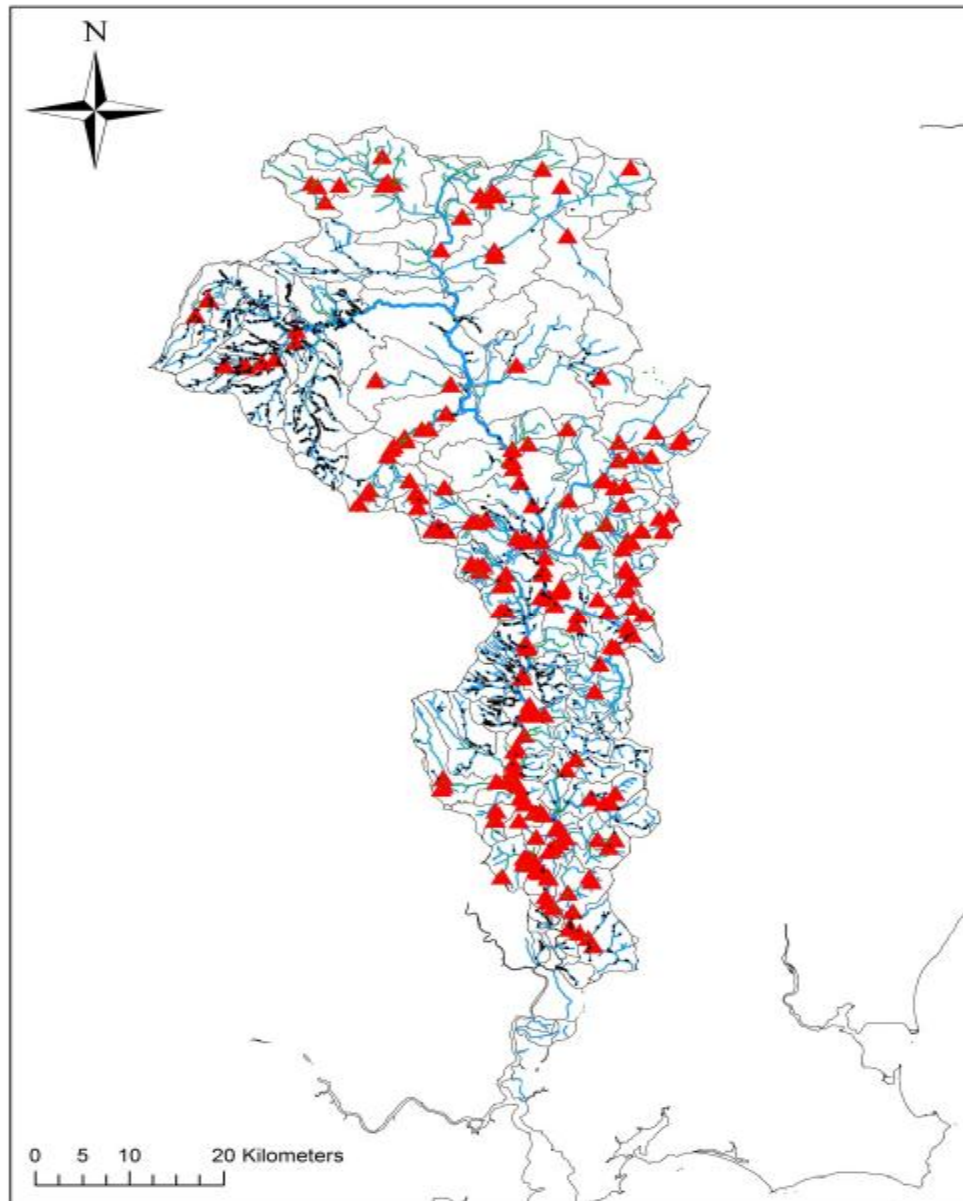
None

**SUBJECTIVE**

Submit

Cancel

# IFI Case study: Barrow catchment (3,100 km<sup>2</sup>)



Barriers recorded to date

N=233

- 126 bridges
- 42 weirs
- 22 locks
- 21 (sluice/mill/structure)
- 11 culverts
- 11 fords

# River Barrow Barriers....



# IFI Barrier surveys Level 2:- SNIFFER (UK)

## Field survey

- Examine each 'transversal' or possible crossing point
- Discrete set of measurements
- Detailed D and V measurements
- Qualitative observations

## Desk wrap-up

- Ø Reference to Tables
- Ø Final score





# Clondulane Weir: Hydraulic Head 2.6 m



# SNIFFER barrier passability survey September 2014

Complete Barrier



Partial Barrier High Impact



Partial Barrier High Impact



Complete Barrier



# IFI Barrier surveys Level 2: ICE (Fr)

## Field survey

- Examine each 'transversal'
- Discrete set of measurements
- Detailed D and V measurements....NON
- Qualitative observations...NON

## Desk wrap-up

- Ø Reference to Protocol
- Ø Final score



# *Barrier Scoring System (SNIFFER & ICE)*

Ø 0 = Total barrier 

Ø 0.3 = High impact partial barrier

Ø 0.6 = Medium impact partial barrier

Ø 1 = Low impact passable barrier



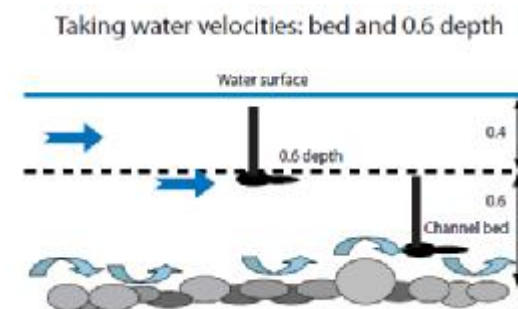
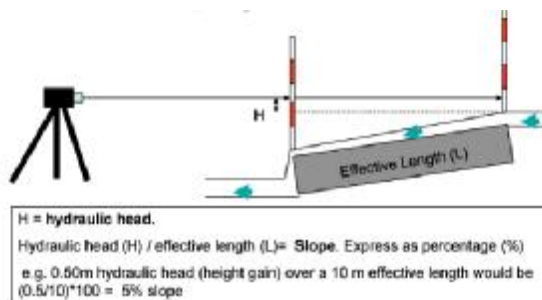


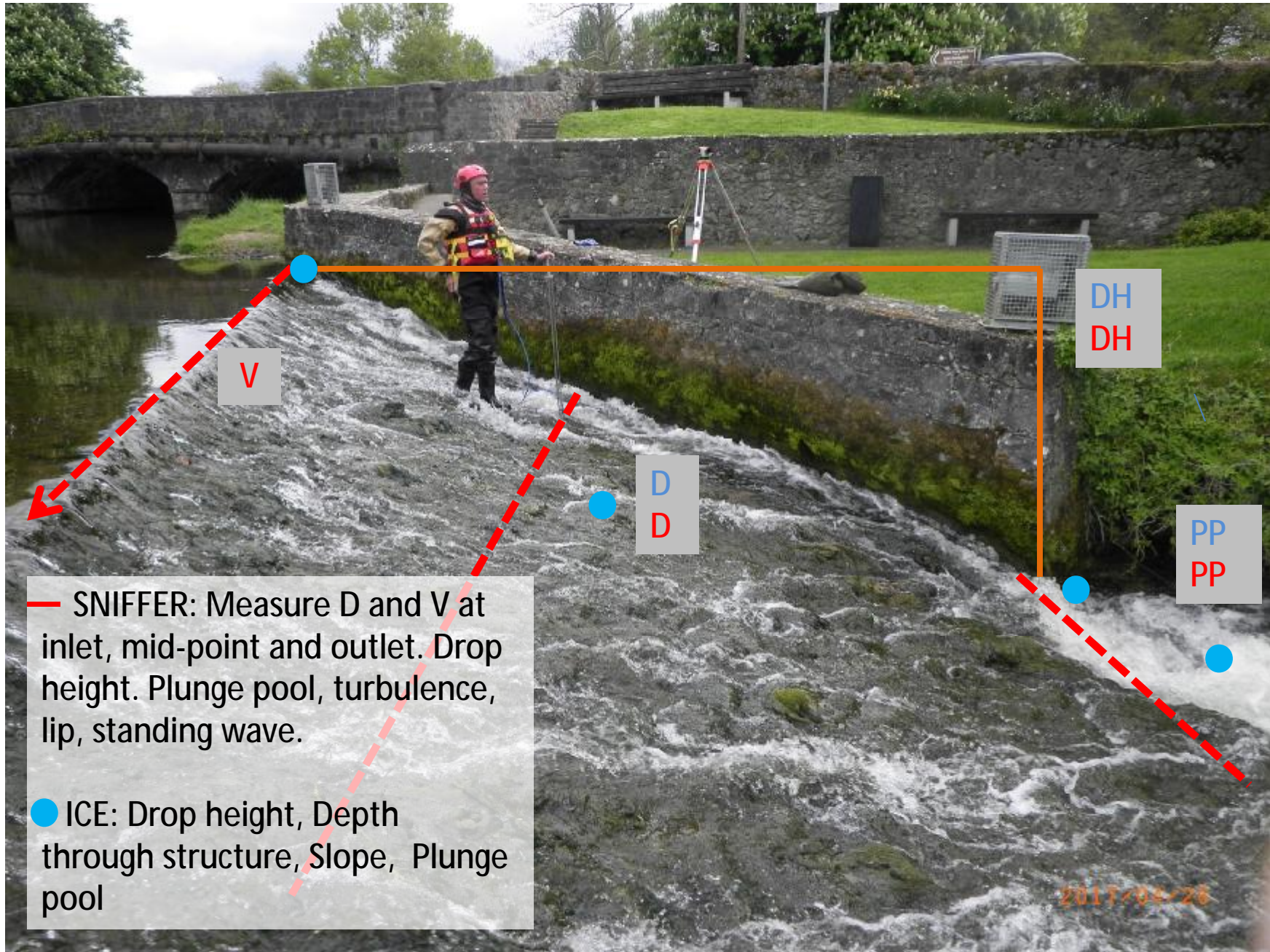
# SNIFFER V ICE

## Measurements required



Measurement	SNIFFER	ICE	IFI Level I
Drop height	ü	ü	X
Slope	ü	ü	X
Depth through structure	ü	ü	X
Plunge pool depth	ü	ü	X
Velocity	ü	û	
Turbulence (OPINION)	ü	û	
Standing wave (OPINION)	ü	û	





V

D  
D

DH  
DH

PP  
PP

— SNIFFER: Measure D and V at inlet, mid-point and outlet. Drop height. Plunge pool, turbulence, lip, standing wave.

● ICE: Drop height, Depth through structure, Slope, Plunge pool

2017/05/26

# *Intercalibration of SNIFFER and ICE: % Score Agreements between protocols*

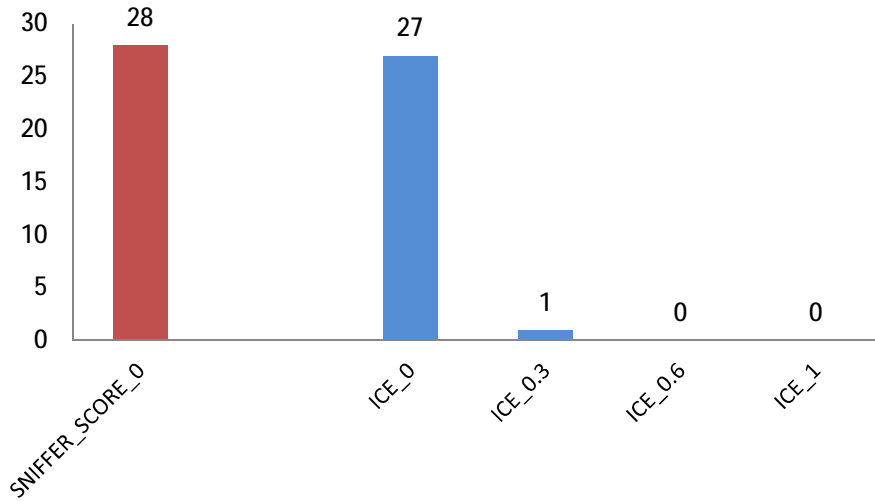
Species	Agree	Don't	Total Transversals
Adult salmon (55-100cm)	53.3	46.7	60
Adult Lamprey	60.3	39.7	58



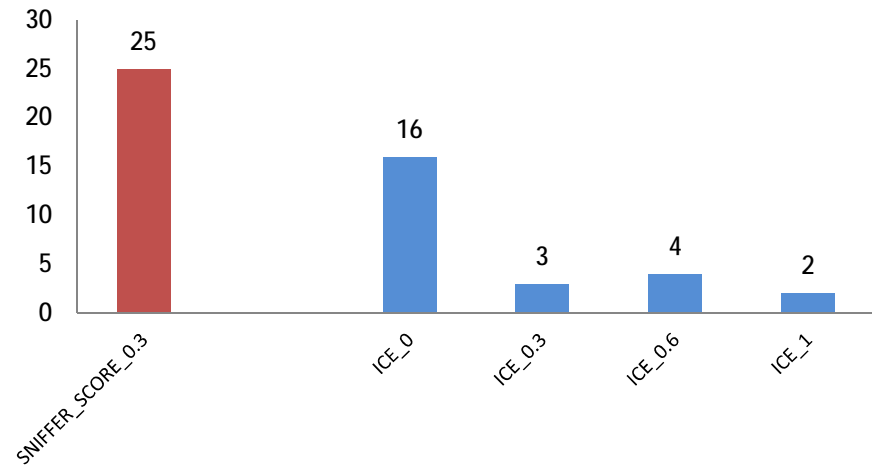
# Adult salmon score differences between protocols



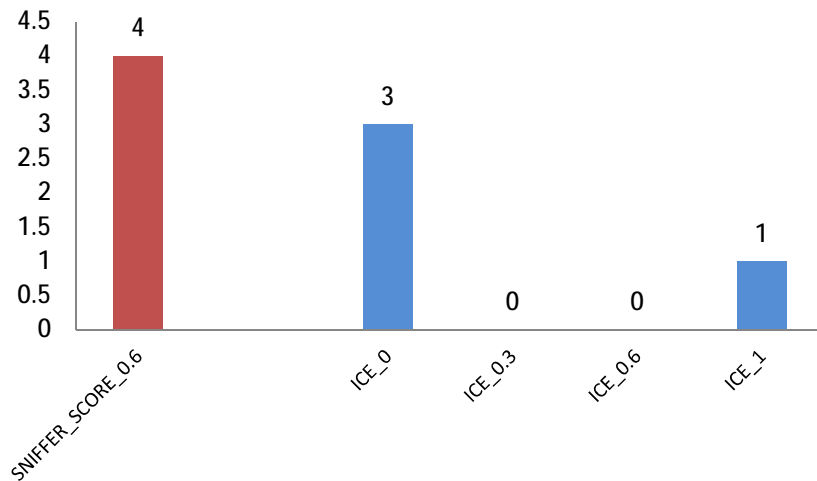
Salmon (SNIFFER 0)



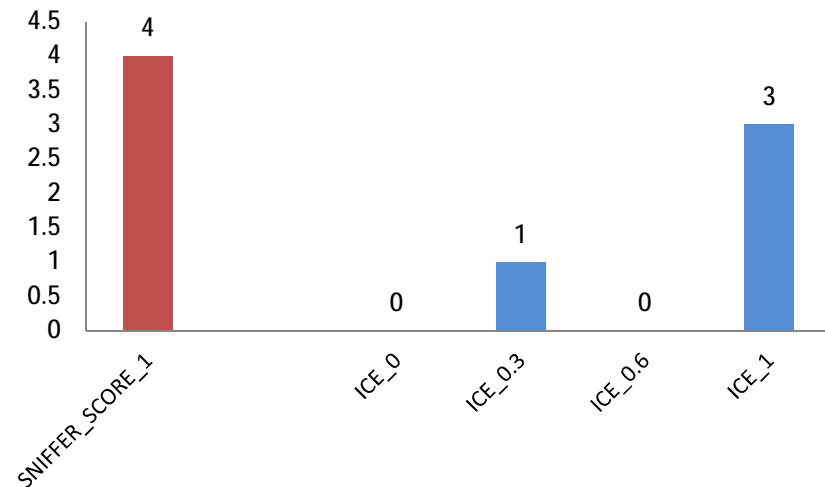
Salmon (SNIFFER 0.3)



Salmon (SNIFFER 0.6)



Salmon (SNIFFER 1)

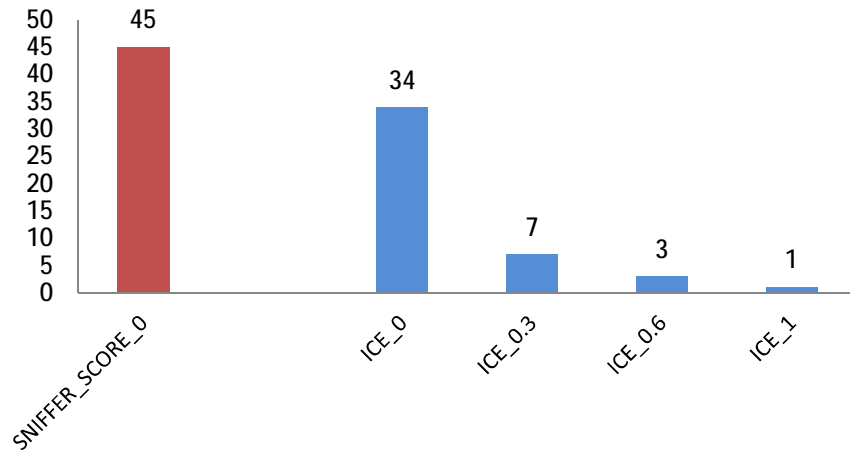




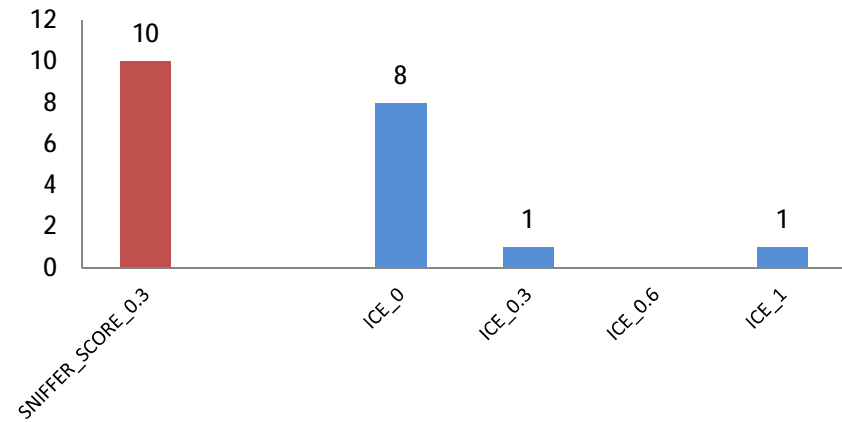
# Sea Lamprey score differences between protocols



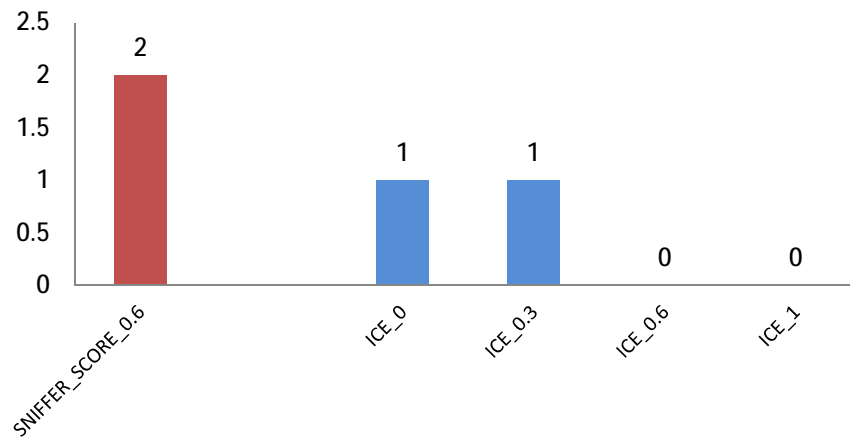
Sea Lamprey (SNIFFER 0)



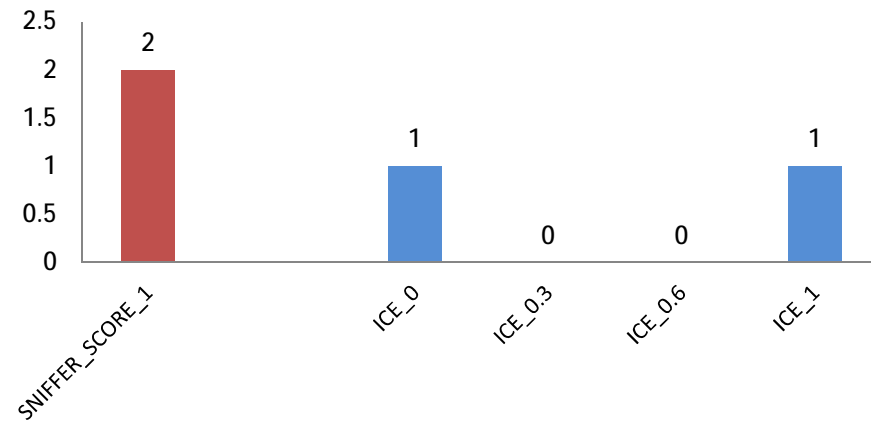
Sea Lamprey (SNIFFER 0.3)



Sea Lamprey (SNIFFER 0.6)



Sea Lamprey (SNIFFER 1)



Reasons for differences...

# Threshold depths for swimming

Species	ICE_min_depth m	SNIFFER_min_depth m
Adult Salmon (55-100cm)	0.2	$\leq 0.07$
Salmon Trout (25-55cm)	0.2	$\leq 0.05$
Juvenile salmonids (<25cm)	0.1	$\leq 0.03\text{m}$
Adult Lamprey	0.05	$\leq 0.03\text{m}$

Weir slope  
water depth  
0.10 m...

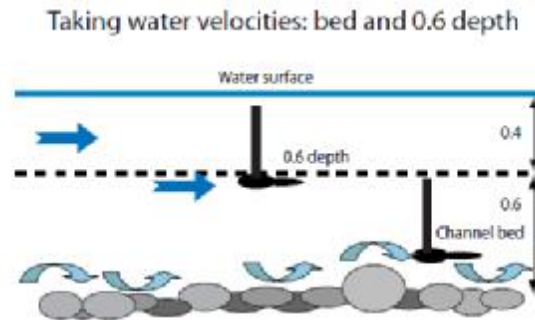


Adult salmon:  
SNIFFER= 0.3  
ICE = 0

Reasons for differences...

# Velocity

- SNIFFER assessment requires velocity readings



- ICE does not. Velocity outcome is based on modelled flow over slope in conjunction with swimming capabilities of fish
- Sometimes ICE can miss funnelling effect (velocities too high for fish to actively swim through)



Reasons for differences...

# SNIFFER: Subjective element can significantly affect passability scores

- Turbulence: entrained air and chaotic flows associated with high water velocities and plunging flows at riverine obstacles.
- Standing wave: Problems for fish passage by causing them to become disoriented and water velocities can exceed swimming capacity.



# So now.....added value

- Level 1 data – option to generate ICE scores  
.....leads to **OBJECTIVE** assessment of fish passage, complementing 'expert opinion'
- Linking with University of Southampton -  
AMBER project partner - on this one





Any Questions...

