

Leiðandi
vettvangur í tíu ár



Unlocking the full potential of industry-science collaboration: experiences in the Pelagic Freezer-trawler Association

Martin Pastoors

Chief Science Officer @ Pelagic Freezer-trawler Association



SJÁVARÚTVEGS
RÁÐSTEFNAN

ISI ICELAND
SEAFOOD



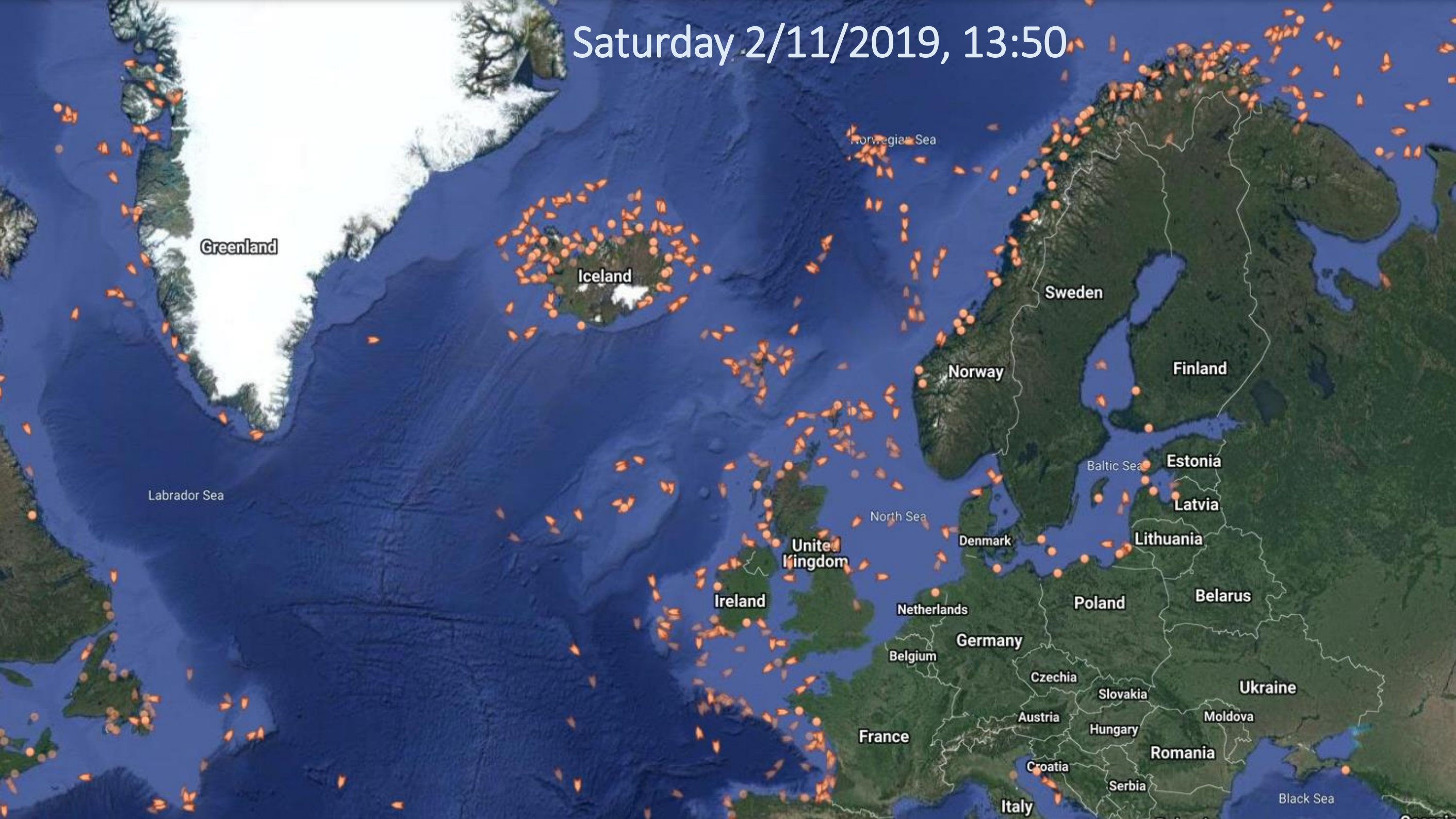
HAMPIÐJAN

Hvífa Óhásið



			RIVO / IMARES																						
1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Univ. Amsterdam												ICES ACFM			Centre for Marine Policy				Pelagic Freezer-trawler Association						

Saturday 2/11/2019, 13:50





UNCERTAINTY OVER 2019 MACKEREL ADVICE

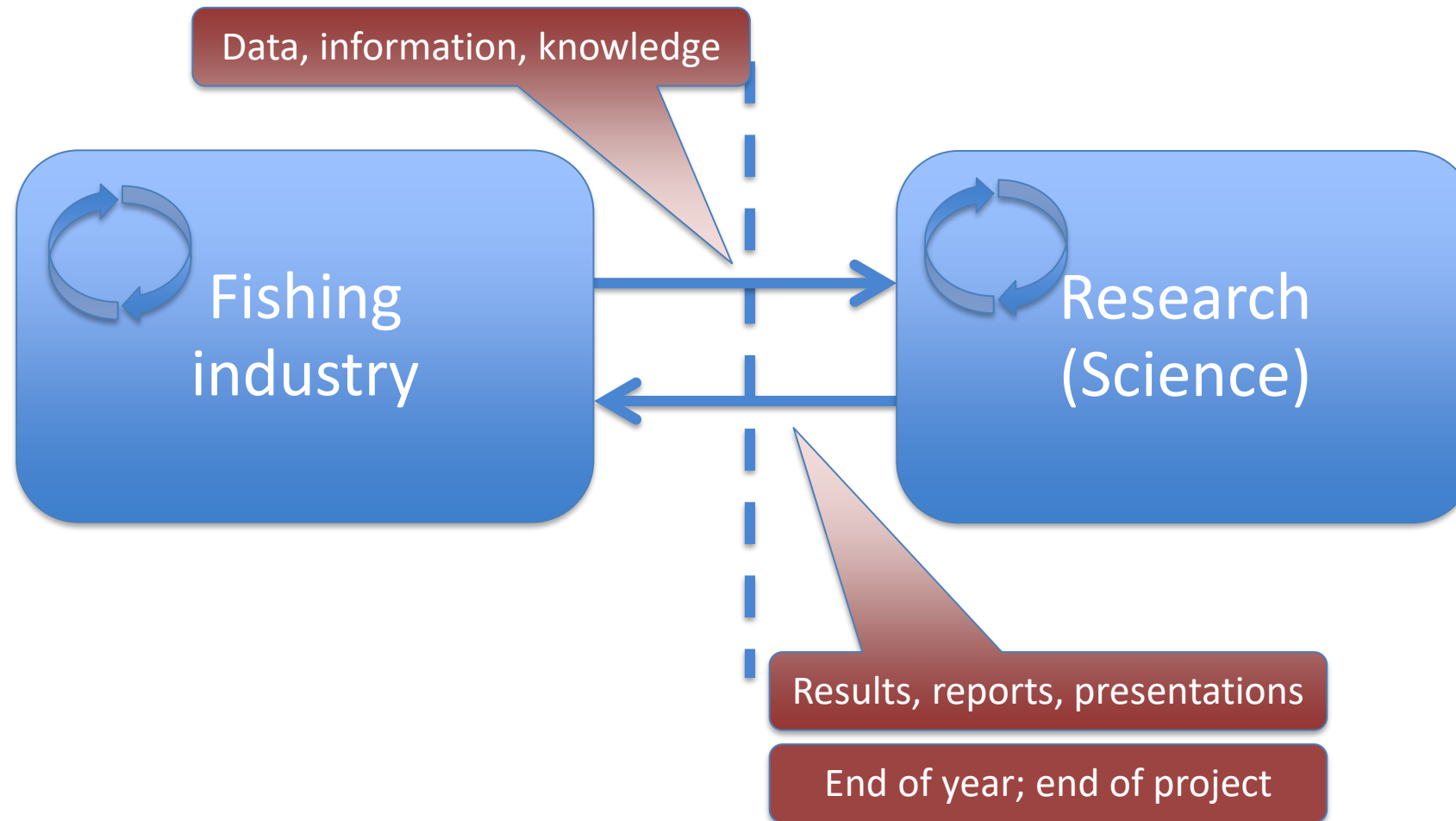
Many fishing vessels at sea

Large uncertainties on fish stocks +

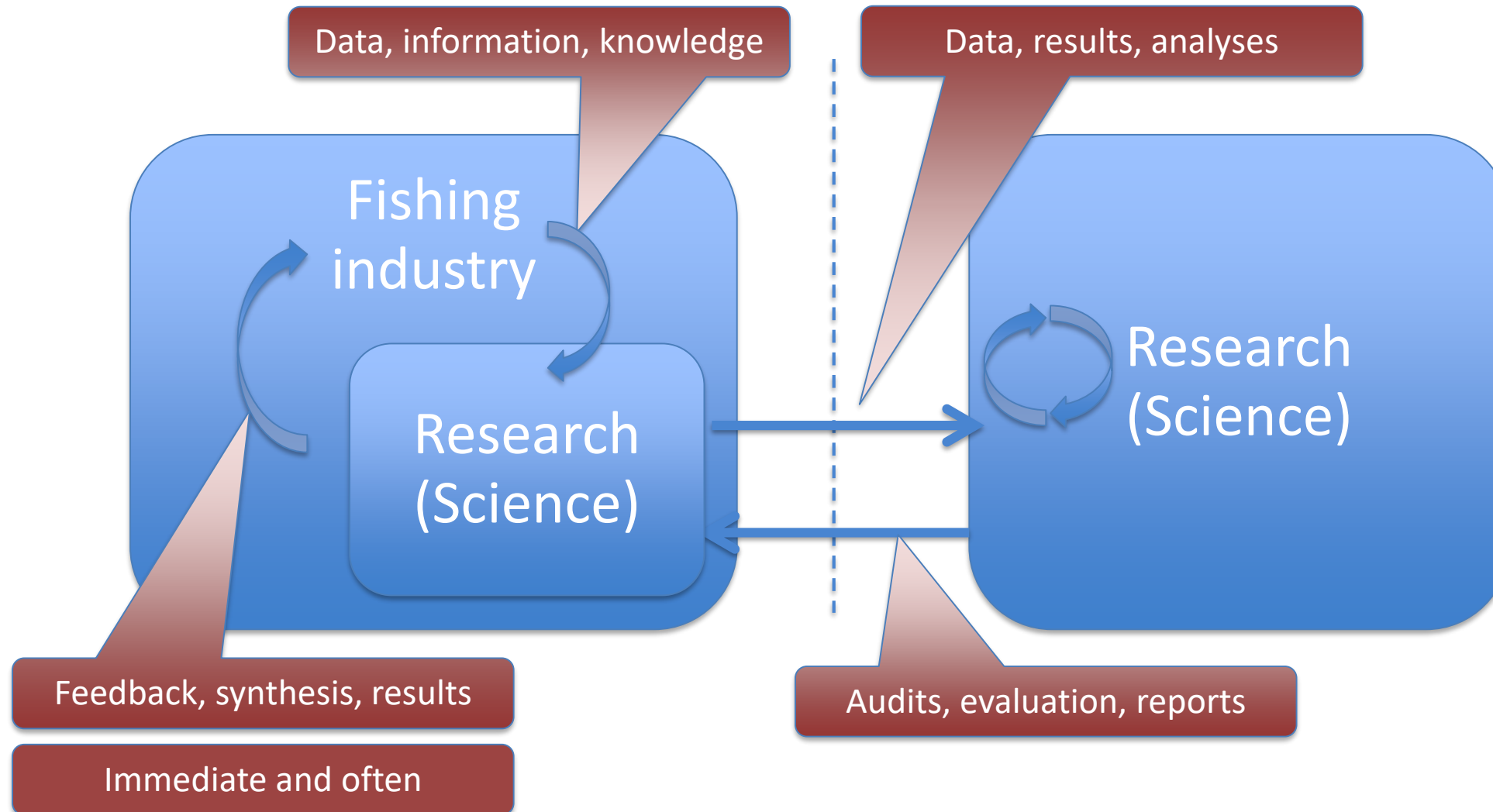
Large interest in 'getting it right' +

Let's make things better

The traditional Science-Industry collaboration



The new Fishing Industry Science



Social innovation: a new role for fisheries



Adapted from: <https://www.urbanmatters.ca/resurrecting-ordinary-civic-social-innovation/>

Research & Knowledge strategy 2015 - 2018



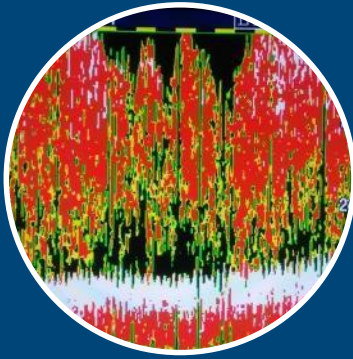
Ambition

PFA (*Pelagic Freezer-trawler Association*) is committed to initiate, develop, contribute and sustain knowledge development that is needed for sustainable management and exploitation of fish stocks in all areas where PFA members are active.

**Catching with care
for a better world.**



Self
sampling



Vessel
acoustics



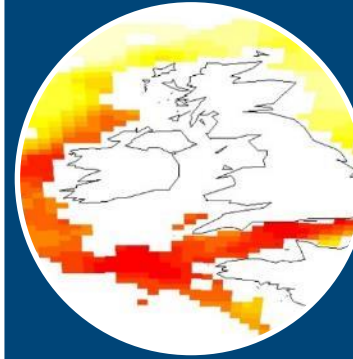
Improve
selectivity



Assess
impacts



Collaborate
with all



Contribute
to science



Communicate
results

PFA research & knowledge strategy



Self-sampling

Aim

- Get insight in fishing operations, environmental and fish conditions
- Discuss changes in ecosystems with fishers
- Improve knowledge base for science and management
- Real-time & accurate

Building on top of the existing monitoring efforts



Merk	Aantal cartons	Voorraad in (m/t)	Tijd in tank	Stukstallen per	Stuks per kg	Sorteerklasse	Kwaliteit	Sorteringskwalite	Voedsel	Textuur	Model	Buikvulling Hom/Kuit	Beschadigd andere vis
ARU010	5667	20	0 - 12uur	60/80	3 a 5	A	2	A	0	B	A	A	A/B
ARU011	2030	20	0 - 12uur	40/60	2 a 3	A	2	A	0 - 1	B	A/B	A/B	A/B
WHB012	1360	20	0 - 12uur	120/160	4 a 7	A/B	2/3	A/B	0	B	C	A	B/C
WHB013	1664	20	0 - 12uur	180/220	5 a 9	A/B	2/3	A/B	0	B	C	A	B/C
ARU014	2435	20	0 - 12uur	60/80	3 a 5	A	2	A	0	B	A	A	A/B
WHB015		30	0 - 12uur	300 +	13 a 16	A/B	2	A	0	B	C	A	B/C
WHB018		30	0 - 12uur	220/260	8 a 11	A/B	2	A/B	0	B	C	A	B/C
WHB019	5023	30	0 - 12uur	120/160	4 a 7	A/B	2	A/B	0	B	C	A	B/C
WHB021		30	0 - 12uur	180/220	6 a 10	A/B	2	A/B	0	B	C	A	B/C
WHB022	4992	30	0 - 12uur	260/300	10 a 13	A/B	2	A/B	0	B	C	A	B/C
ARU023	1543	20	0 - 12uur	40/60	2 a 3	A	2	A	0 - 1	B	A/B	A/B	A/B



Standardizing and expanding

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
	vessel	trip	haul	date	shoot time	haul time	shoot lat	shoot NS	shoot long	shoot EW	haul lat	haul NS	haul long	haul EW	surface temp	headline temp	Wind direction	Windforce (Bft)	headline depth	water depth	mesh size	vert opening	horz opening	netcode
1																								
2	ROS170	201709	1	10/08/2017	13:00	19:45	71°32'	N	003°18'	E	72°00'	N	003°02'	E	8.9	2.9	NE	3.0	410	1500				2560
3	ROS170	201709	2	11/08/2017	03:10	21:20	71°52'	N	002°48'	E	71°40'	N	003°10'	E	9.2	2.8	NE	4.0	410	1500				2560
4	ROS170	201709	3	12/08/2017	02:20	23:20	71°45'	N	004°30'	E	72°38'	N	006°29'	E	9.5	3.0	NE	5.0	410	1500				2560
5	ROS170	201709	4	13/08/2017	03:00	23:25	72°39'	N	005°31'	E	72°36'	N	005°29'	E	9.5	3.0	SE	4.0	420	1500				2560
6	ROS170	201709	5	14/08/2017	02:15	21:15	72°37'	N	005°29'	E	72°43'	N	005°35'	E	9.5	2.8	SE	3.0	420	1500				2560
7	ROS170	201709	6	15/08/2017	00:10	19:55	72°44'	N	005°42'	E	72°24'	N	003°07'	E	9.6	2.8	SW	4.0	420	1500				2560
8	ROS170	201709	7	15/08/2017	22:00	19:50	72°27'	N	005°33'	E	72°29'	N	005°20'	E	9.5	3.0	WSW	4.0	420	1500				2560
9	ROS170	201709	8	16/08/2017	23:40	21:10	72°10'	N	004°30'	E	72°06'	N	003°20'	E	9.6	3.8	SW	4.0	425	1500				2560
10	ROS170	201709	9	17/08/2017	23:45	20:30	72°14'	N	003°24'	E	72°10'	N	005°10'	E	9.5	3.7	SE	4.0	425	1500				2560
11	ROS170	201709	10	18/08/2017	22:40	21:00	72°11'	N	005°45'	E	72°10'	N	005°50'	E	9.6	2.8	E	5.0	415	1500				2560
12	ROS170	201709	11	19/08/2017	23:55	21:55	72°08'	N	005°51'	E	72°14'	N	006°30'	E	9.5	2.6	E	4.0	415	1500				2560
13	ROS170	201709	12	21/08/2017	00:20	20:40	72°13'	N	006°16'	E	72°13'	N	006°56'	E	9.5	2.7	NE	5.0	430	1500				2560
14	ROS170	201709	13	21/08/2017	22:45	21:15	72°14'	N	006°47'	E	72°18'	N	005°56'	E	9.5	3.3	NE	3.0	430	1500				2560
15	ROS170	201709	14	23/08/2017	00:00	22:15	72°19'	N	006°24'	E	72°14'	N	005°46'	E	9.2	3.0	VAR	2.0	430	1500				2560
16	ROS170	201709	15	24/08/2017	00:30	20:45	72°14'	N	005°40'	E	71°50'	N	003°22'	E	9.2	3.8	VAR	2.0	410	1500				2560
17	ROS170	201709	16	24/08/2017	23:30	21:15	71°42'	N	003°52'	E	70°48'	N	006°05'	E	9.2	3.7	VAR	2.0	410	1500				2560
18	ROS170	201709	17	26/08/2017	02:00	23:10	71°11'	N	006°47'	E	72°13'	N	007°10'	E	9.2	3.9	VAR	2.0	420	1500				2560
19	ROS170	201709	18	27/08/2017	01:30	19:10	72°20'	N	007°08'	E	72°22'	N	006°24'	E	9.5	3.0	VAR	2.0	420	1500				2560
20	ROS170	201709	19	28/08/2017	01:25	23:25	72°23'	N	006°33'	E	72°24'	N	007°04'	E	9.5	3.0	VAR	2.0	420	1500				2560
21	ROS170	201709	20	29/08/2017	04:15	21:15	72°50'	N	008°10'	E	73°08'	N	007°45'	E	9.5	2.9	VAR	2.0	420	1500				2560
22	ROS170	201709	21	30/08/2017	04:20	17:00	73°11'	N	007°38'	E	73°11'	N	007°36'	E	9.3	2.7	N	4.0	420	1500				2560
23	ROS170	201709	22	30/08/2017	20:00	13:15	73°16'	N	007°26'	E	72°53'	N	008°18'	E	9.3	3.0	NW	4.0	420	1500				2560
24	ROS170	201709	23	31/08/2017	15:40	07:45	72°55'	N	008°14'	E	73°03'	N	007°52'	E	9.1	3.0	VAR	2.0	420	1500				2560
25	ROS170	201709	24	01/09/2017	10:30	07:00	73°03'	N	007°57'	E	73°02'	N	007°38'	E	8.9	3.0	S	4.0	420	1500				2560
26	ROS170	201709	25	02/09/2017	11:00	03:30	73°30'	N	008°06'	E	72°52'	N	008°23'	E	8.9	2.9	SW	5.0	415	1500				2560
27	ROS170	201709	26	03/09/2017	06:30	04:15	72°48'	N	008°12'	E	72°52'	N	008°09'	E	8.9	2.8	SW	4.0	430	1500				2560
28	ROS170	201709	27	04/09/2017	07:15	04:45	72°48'	N	008°19'	E	73°10'	N	007°31'	E	9.2	3.0	SW	4.0	430	1500				2560
29	ROS170	201709	28	05/09/2017	06:45	04:30	73°11'	N	007°33'	E	72°19'	N	008°59'	E	9.2	2.9	S	3.0	430	1500				2560
30	ROS170	201709	29	06/09/2017	06:30	05:00	72°25'	N	009°01'	E	72°33'	N	008°40'	E	9.3	3.0	SE	3.0	410	1500				2560
31	ROS170	201709	30	07/09/2017	07:00	05:15	72°25'	N	008°16'	E	72°25'	N	008°18'	E	9.2	2.2	S	4.0	420	1500				2560

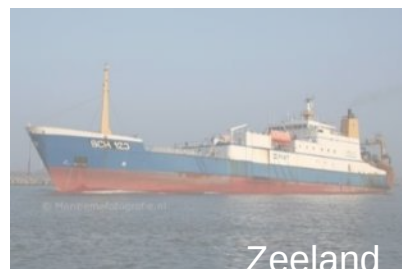
Collaborating and engaging



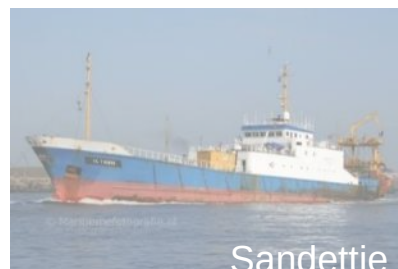
Starting slowly: PFA self-sampling fleet 2014



Afrika



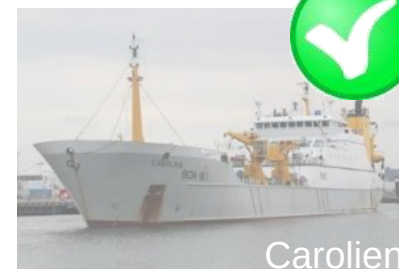
Zeeland



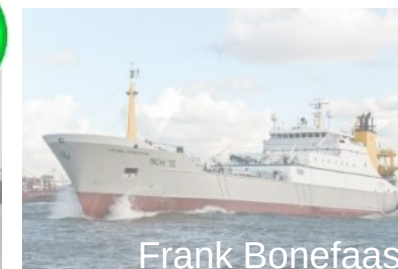
Sandettie



Wiron 5+6



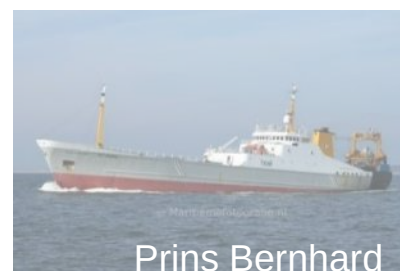
Carolien



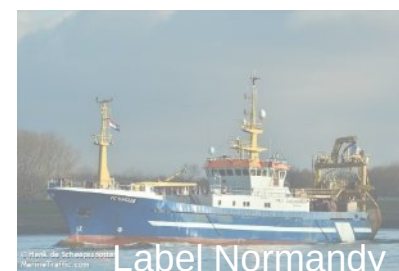
Frank Bonefaas



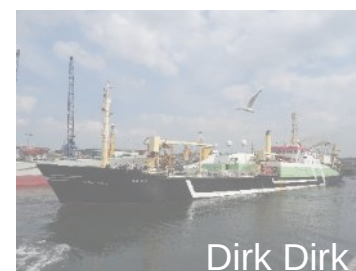
Cornelis Vrolijk



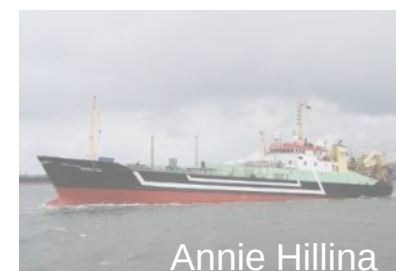
Prins Bernhard



Label Normandy



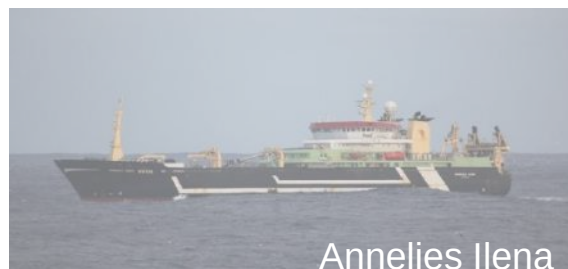
Dirk Dirk



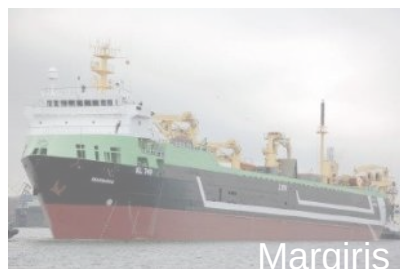
Annie Hillina



Willem van der Zwan



Annelies Ilena



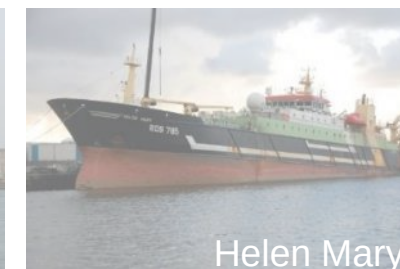
Margiris



Jan Maria



Maartje Theadora

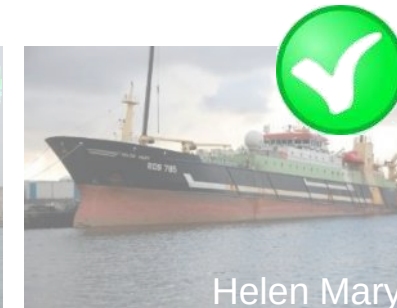
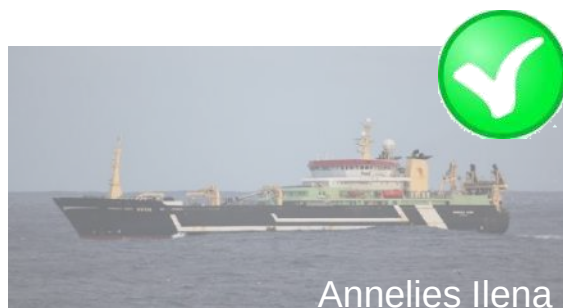
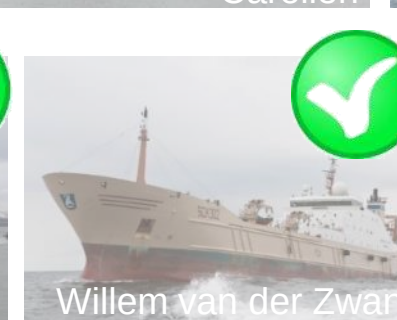
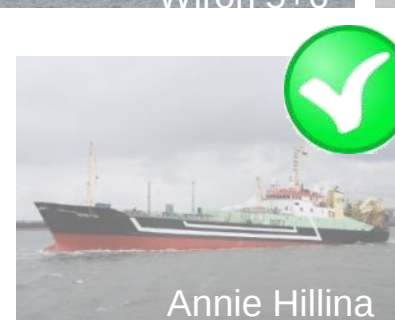
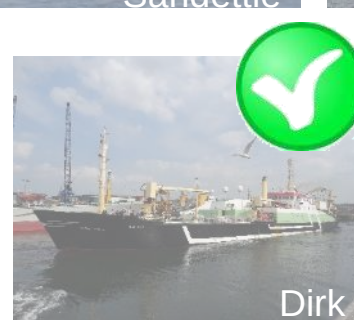
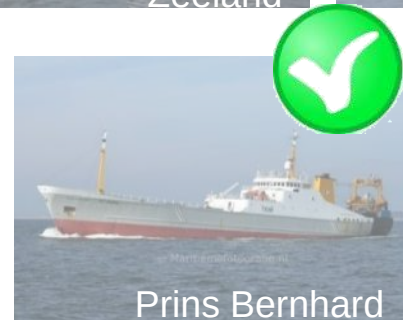


Helen Mary



Alida

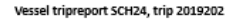
PFA self-sampling fleet 2019



Expansion in number of vessels, trips and measurements

year	nvessels	ntrips	ndays	nhauls	catch	nlength
2015	8	43	762	1,739	136,353	120,739
2016	11	98	1,539	4,067	302,860	154,010
2017	15	122	2,038	4,951	389,496	289,179
2018	16	162	2,556	6,081	474,086	339,767
2019	17	123	2,143	5,289	350,043	225,809
(all)		548	9,038	22,127	1,652,838	1,129,504

Key feature: immediate feedback to skipper and crew



Trip start: 2019-09-28, end: 2019-10-15

Report generated: 10/10/2019

[illegible]

Table 1: Summary of the trip

<i>species</i>	<i>english_name</i>	<i>D.L.A.</i>	<i>S</i>
nan	nannig	0.97	
nan	nannere	0.6	
nan	nninig	0	
nan	nannere	0	
nan	nannig parr	0	
nan	nann nannere	0	
(nan)	(nan)	0.08	

Table 2: Catfish composition per dielion fraction

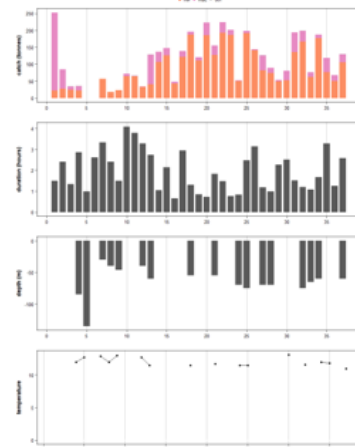


Figure 2: Total catch per species and haul (trawls), haul duration (hours), fishing depth (m) and water temperature at fishing depth (°C).

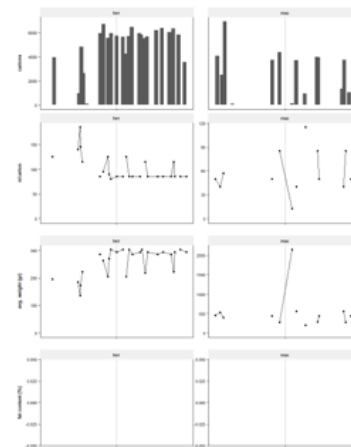


Figure 2: Number of cactons, number of fish per cacton, average weight and fat content (%) per day

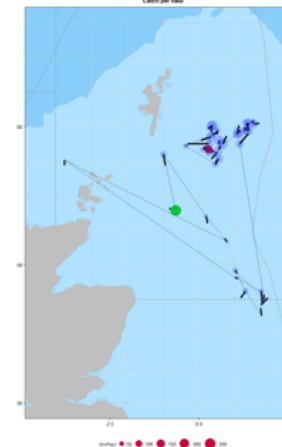


Figure 3: Total coral per haul (pieces/haul). Green is first haul position. Red is last haul position. The heavy black lines indicate the path between about and haul.

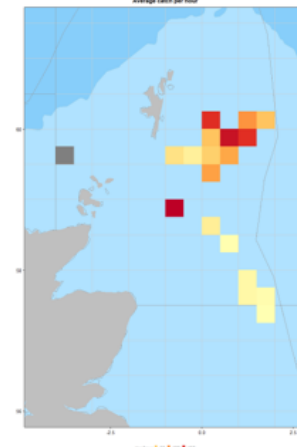


Figure 4: Average catch per hour per square (towers/hour)

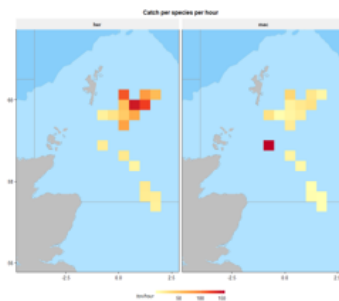


Figure 5: Average catch per hour (cones/hour) per species

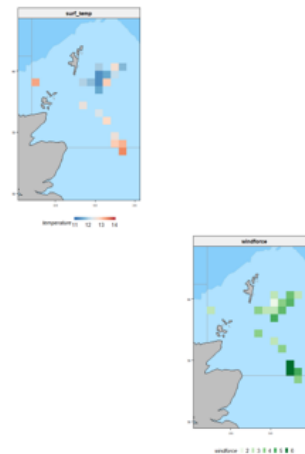


Figure 6: Average surface and bedline temperature ($^{\circ}\text{C}$), bedline depth (m) and wind force (beaufort). Grey blocks are shown if the information was not available

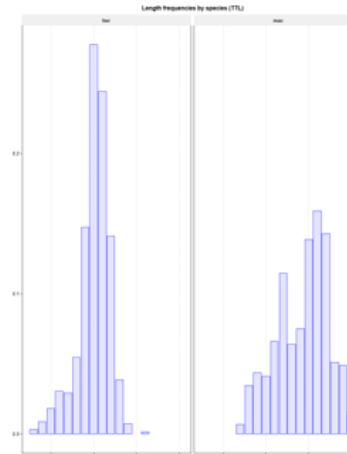


Figure 7. Relative length frequencies by species (only shown when more than 500,000 fish were caught).

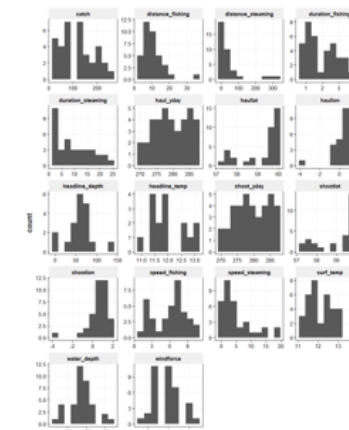
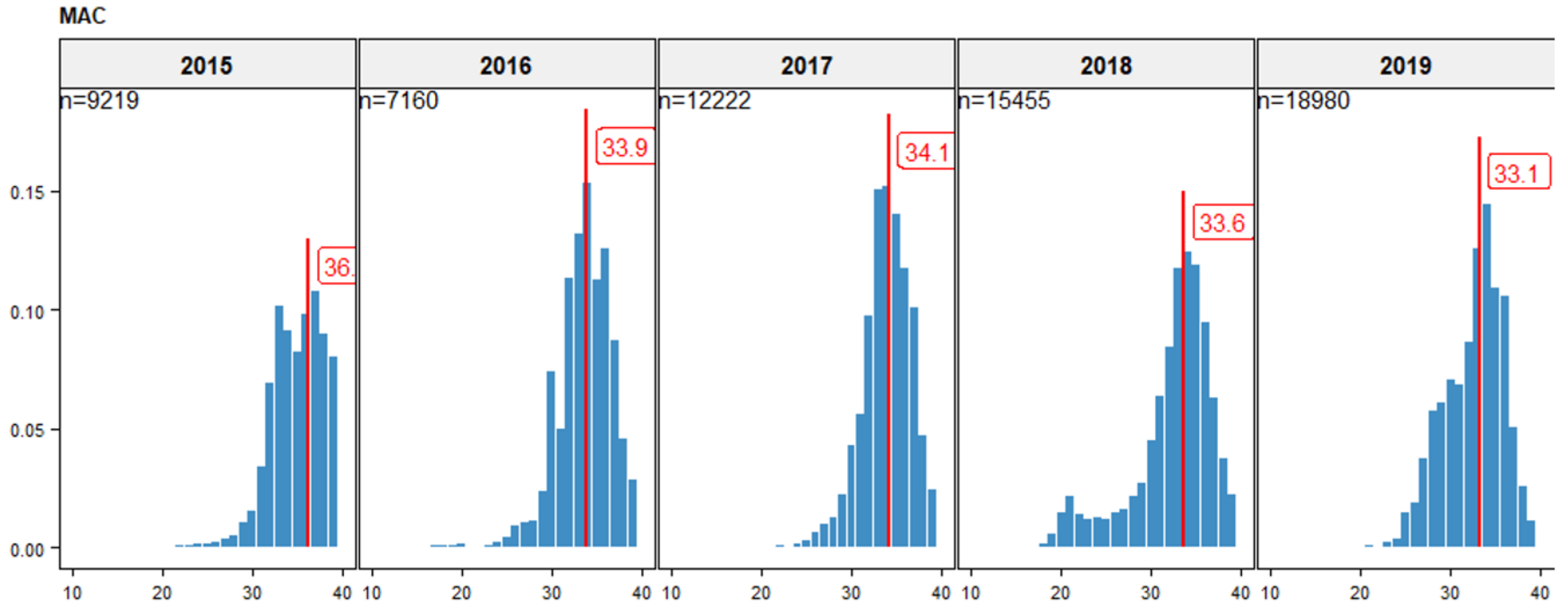


Figure 8: Ideal solidator overview

With self-sampling we know what is going on





REPORT

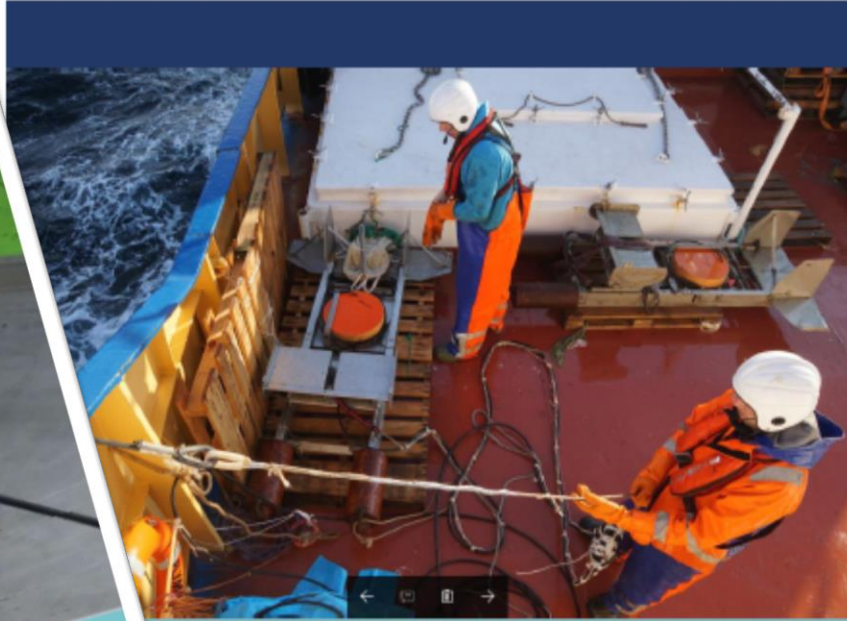
PFA Self-sampling report 2015-2016

M.A. Pastoors and F.J. Quirijns

PFA report 2017/02
2-6-2017



REPORT



Report on 2016 research projects

M.A. Pastoors

PFA report 2017/01
3-7-2017



PFA research Newsletter 12 13 May 2019



Hans van der Plas explaining mackerel fishing to ICES mackerel stock assessment experts, 6 March 2019



Self-sampling in fisheries: practical tool – new insights

NOVELTY



Real-time
information on
catch and sizes

EFFECTIVENESS



Crew are
measuring fish
just like scientists

PRACTICALITY



Build on the
vessels being on
the fishing
grounds

MEETS A SOCIAL NEED

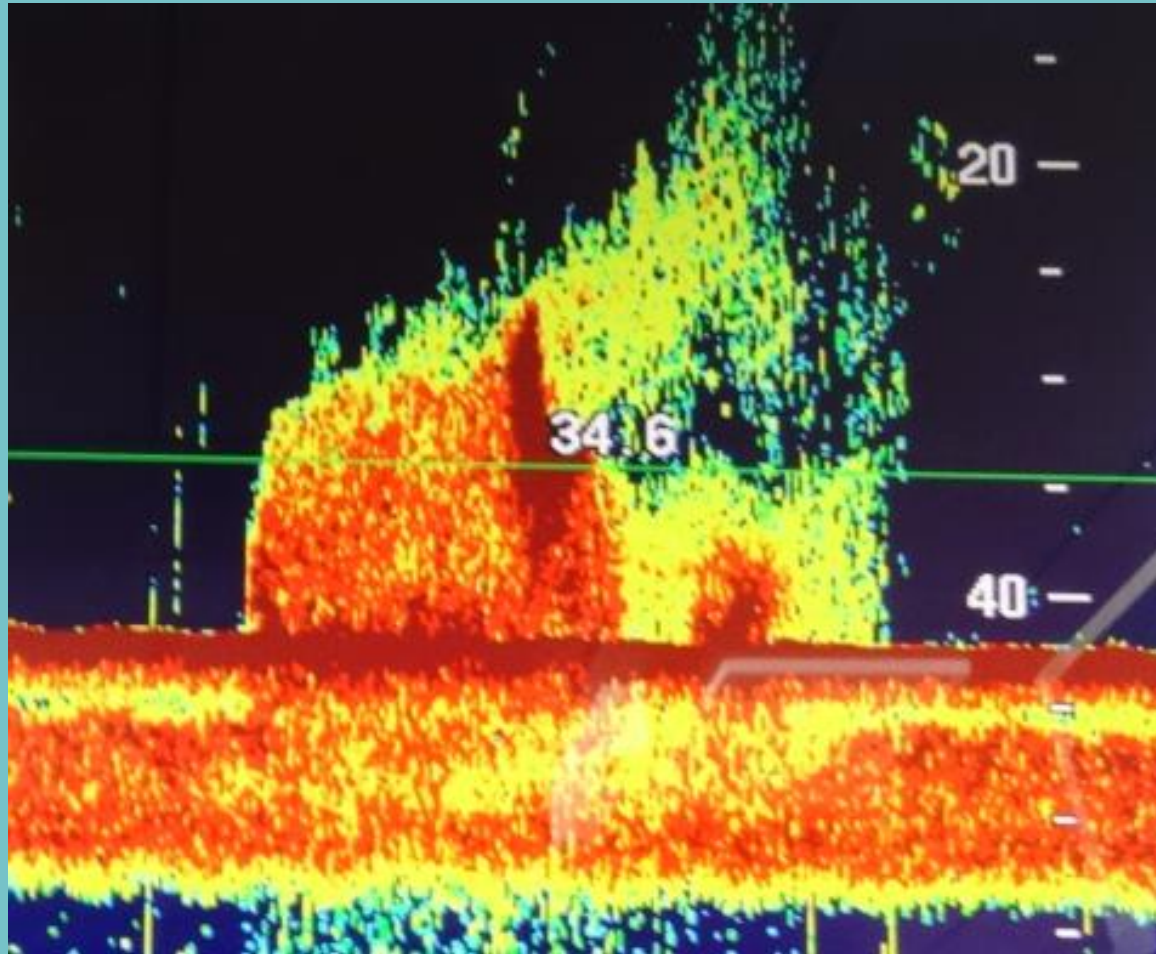


Training fishers in
understanding the
science (and vice
versa)

EMPOWERING

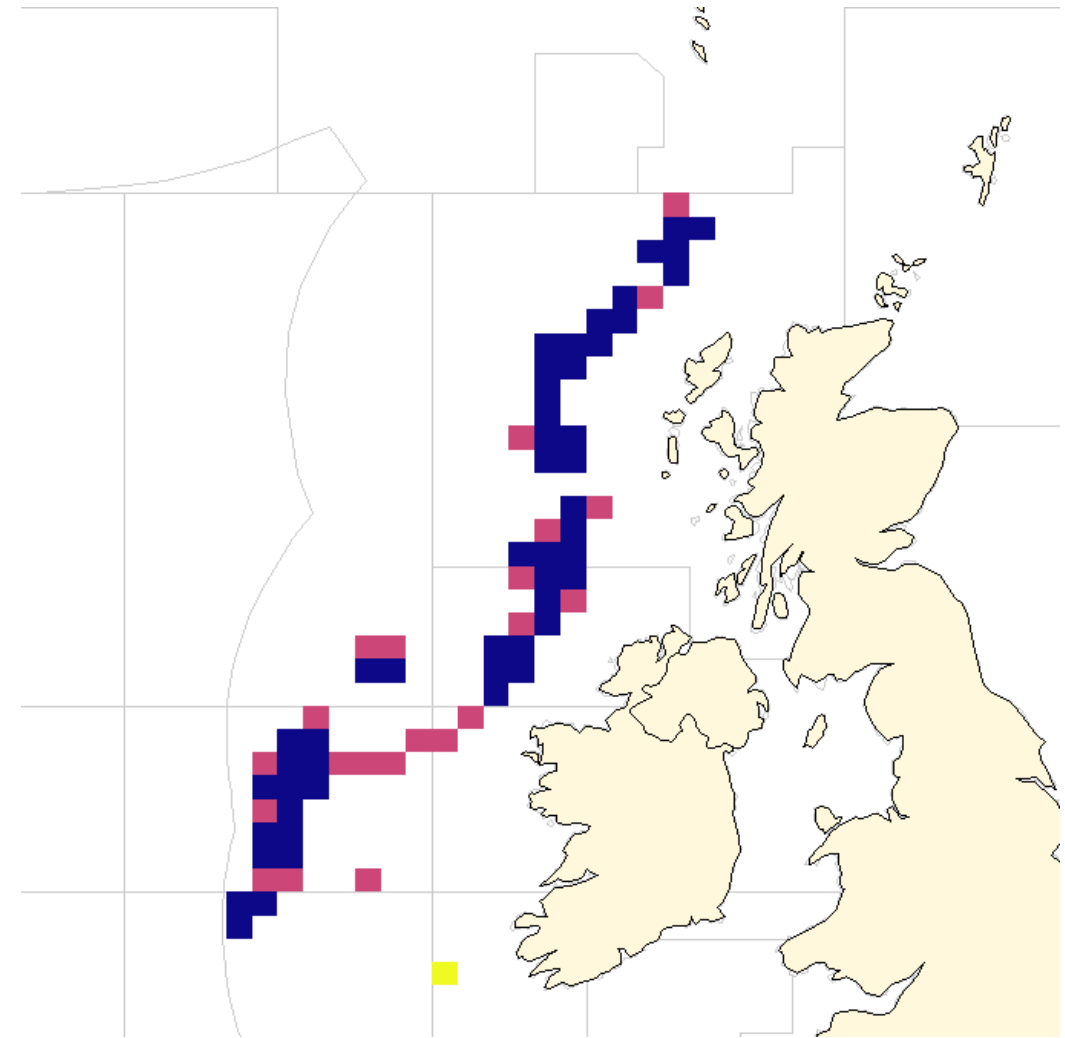
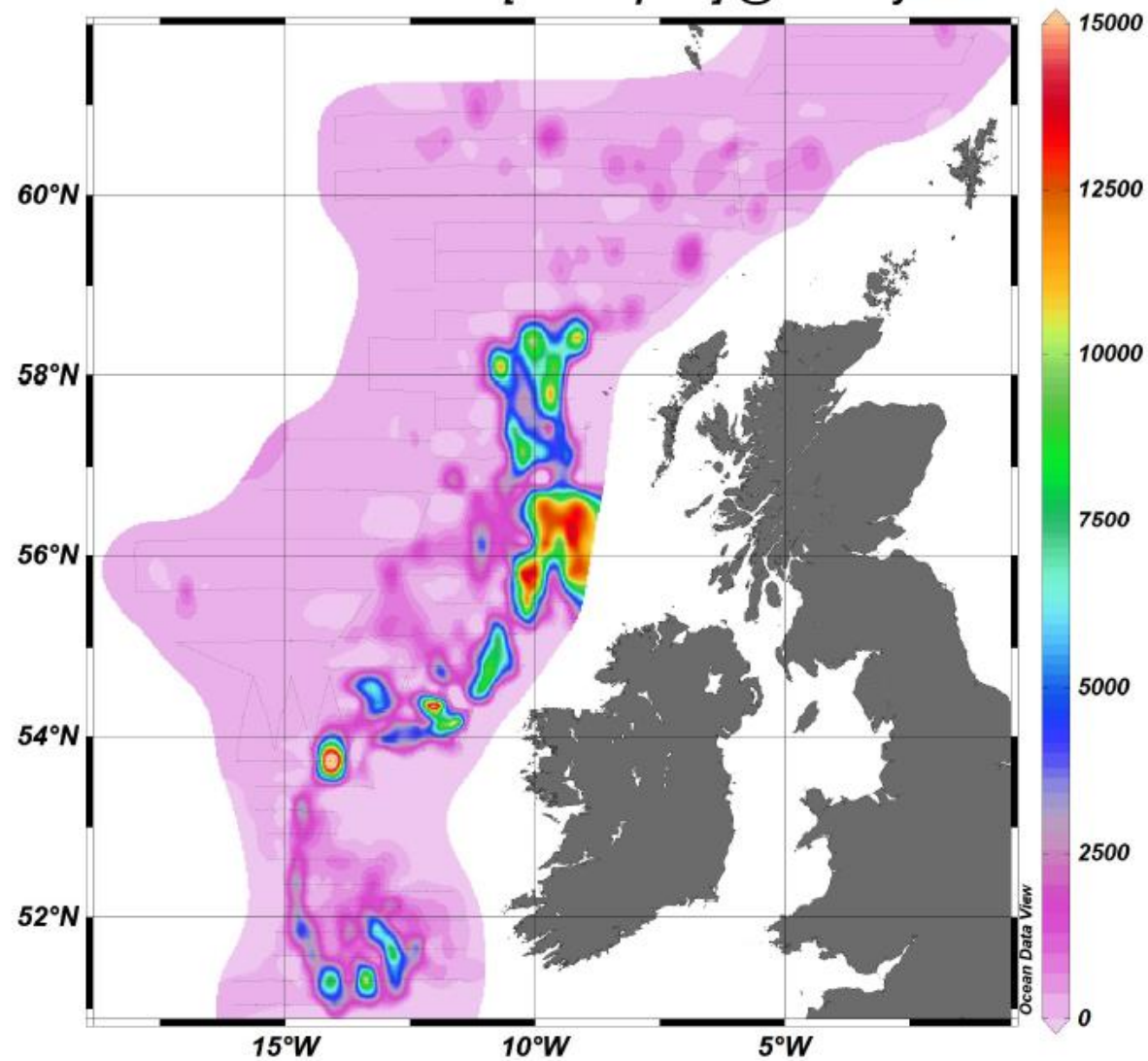


Fishers are
acknowledged
as experts



Vessel acoustics (Oceanbox)

Comparing 2019 blue whiting survey with PFA catch data



Aim

- **Improve and utilize capacity** of fishing vessels for monitoring
- Provide information on **abundance of species** from many vessels
- Provide information on **environmental variables** from many vessels
- Make data collection **routine and non-intrusive**
- **Process data** on board
- **Synchronize data** with shore-based systems

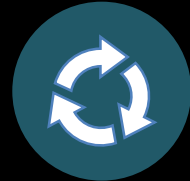
- Fisheries are exploring the environment continuously
- Every haul is a sampling event to a certain depth
 - Let's connect a sensor!

OceanBox: record, process, store and share



Autonomous recording

Acoustic data / GPS / Netsounder / Weather station /

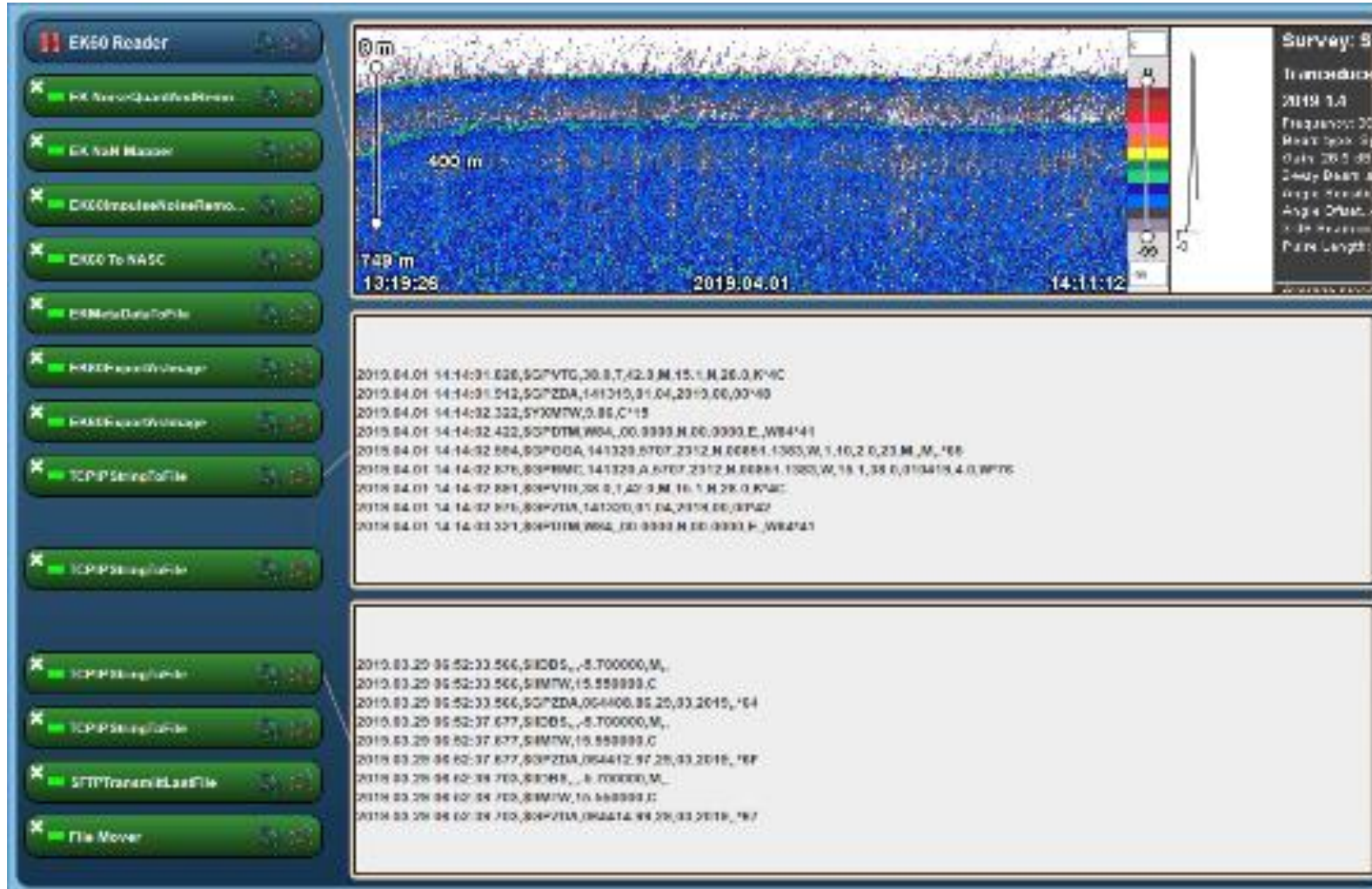


Onboard processing



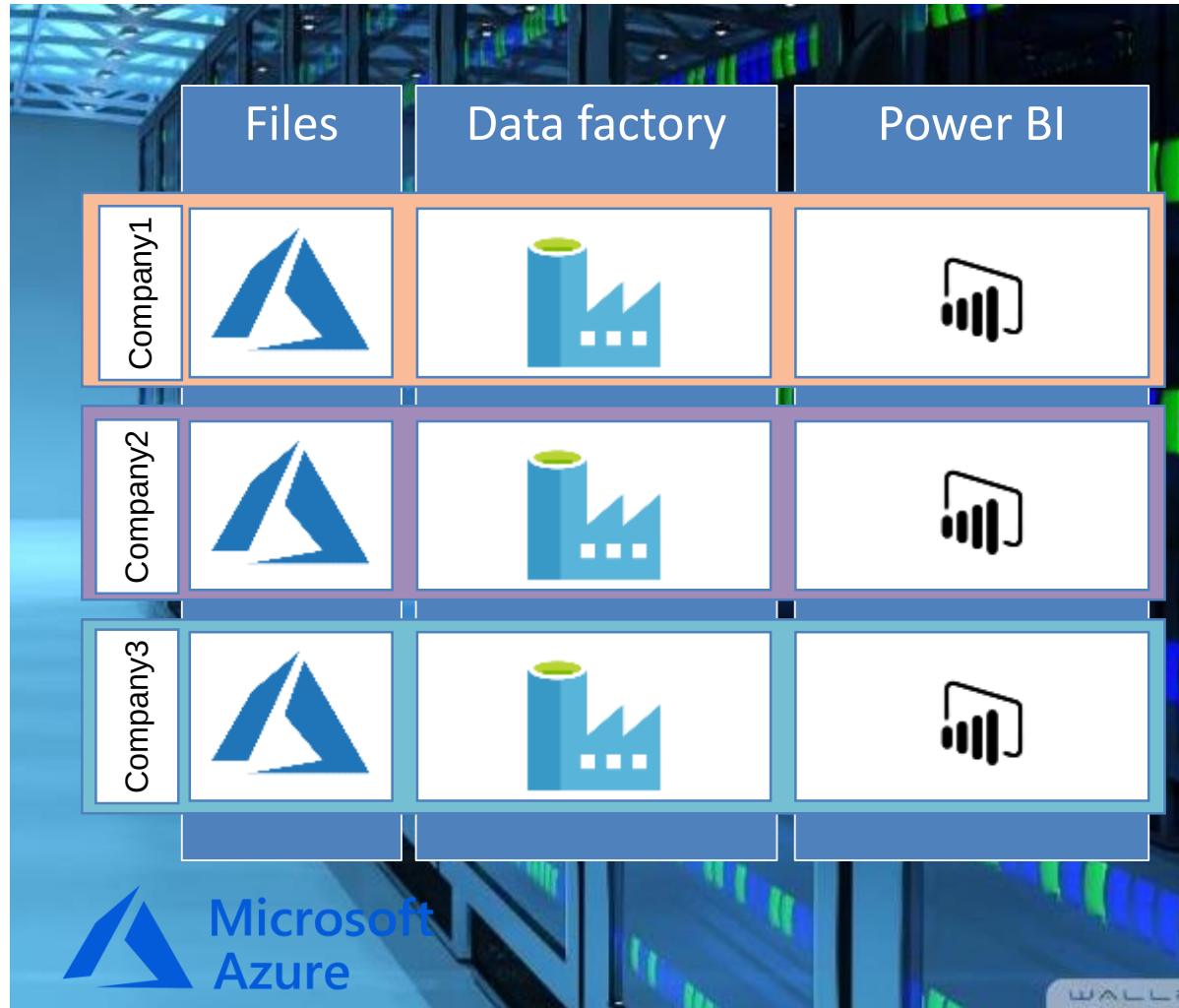
Live-link to shore data storage

Real-time data processing at sea



- Raw acoustic data
 - Noise removal
 - Spike removal
 - School detection
 - NASC calculation
 - Storage
 - Raw sensor data
 - Summarize
 - Storage
- Upload

Data processing on shore-based systems (“cloud”)



Data intake (vessel + satellite)

- Data selection
- Data connections
- Data science
- Reporting

Different reporting for different groups



Data quality dashboard



Skippers dashboard



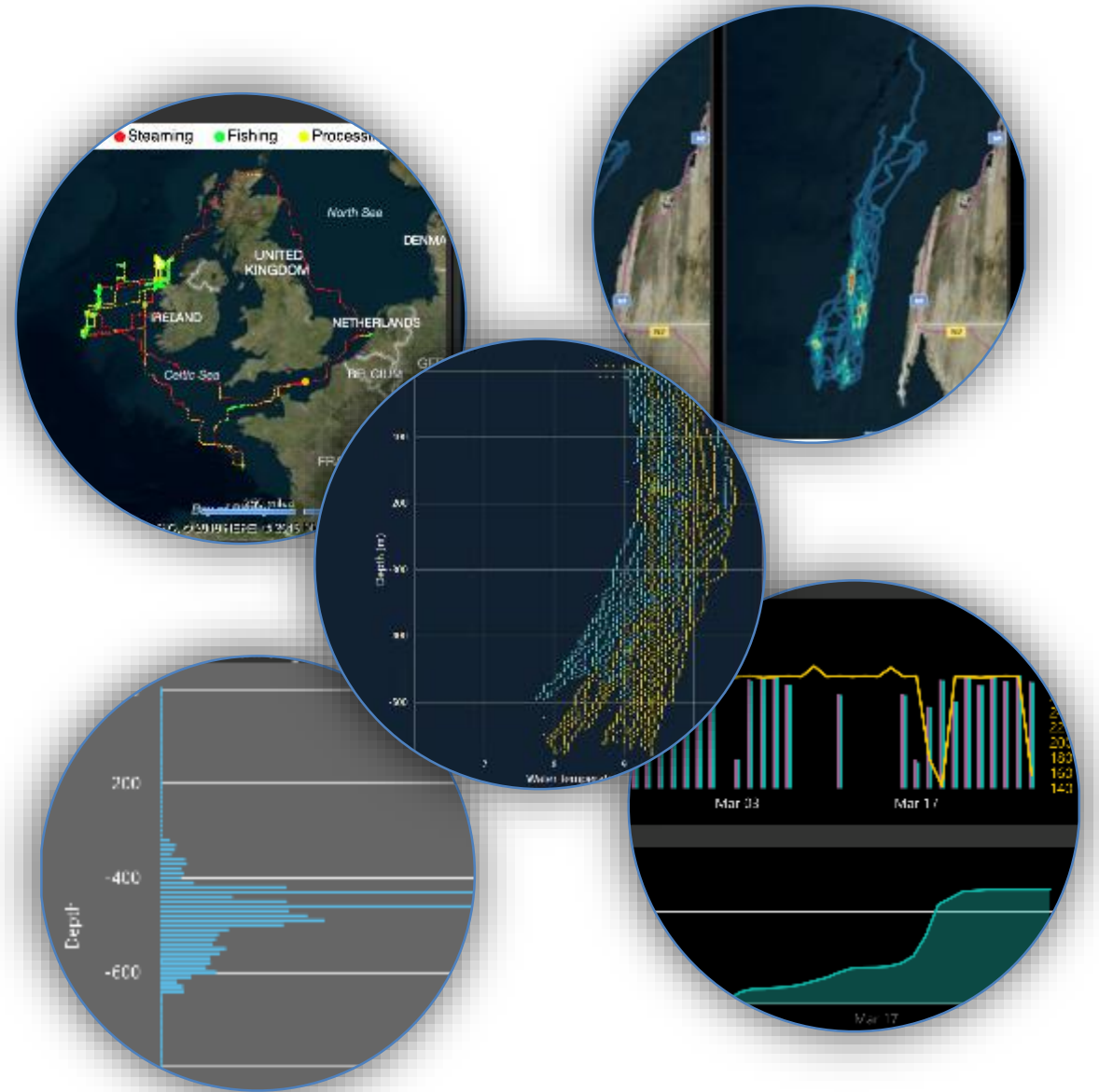
Fleet managers dashboard



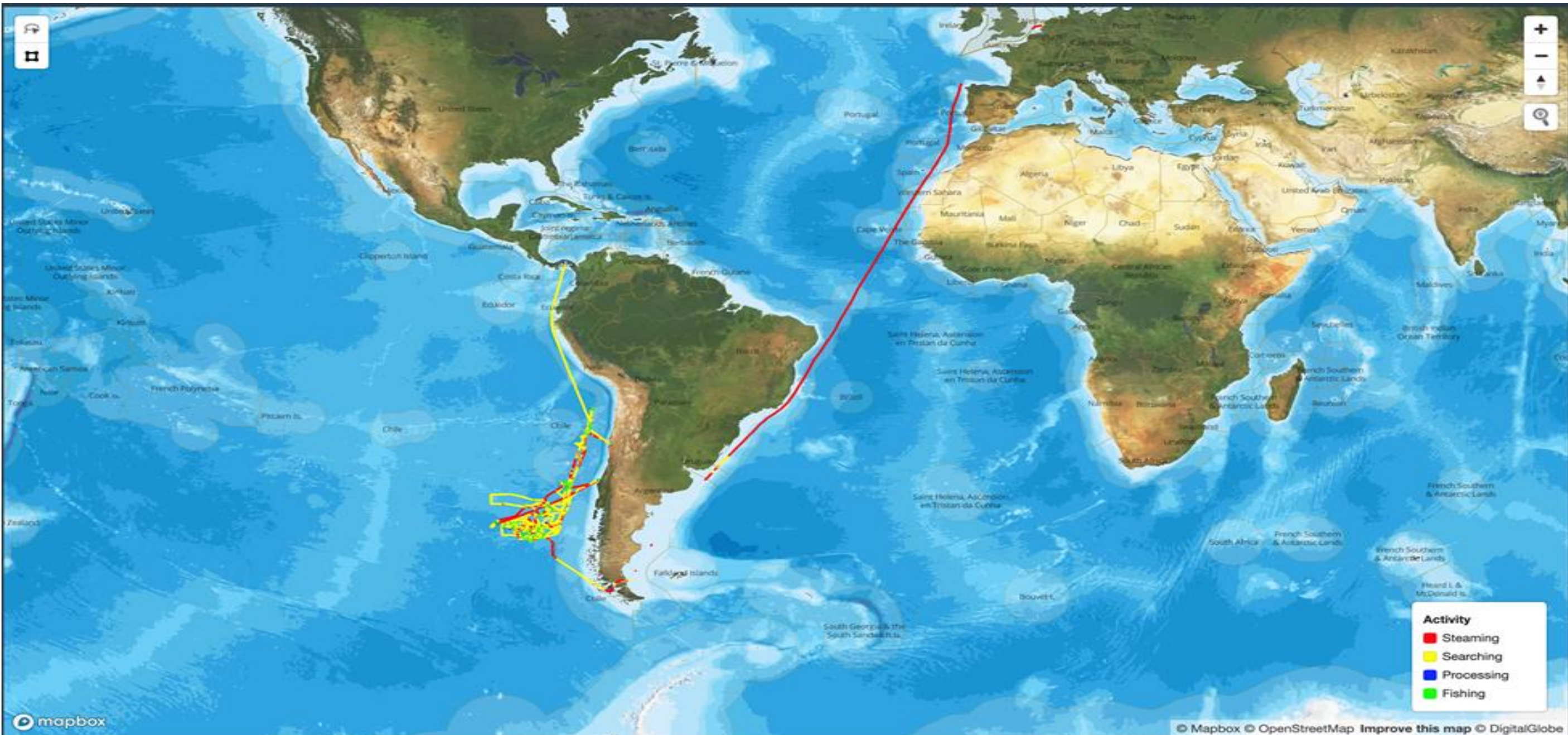
Fishing industry dashboard



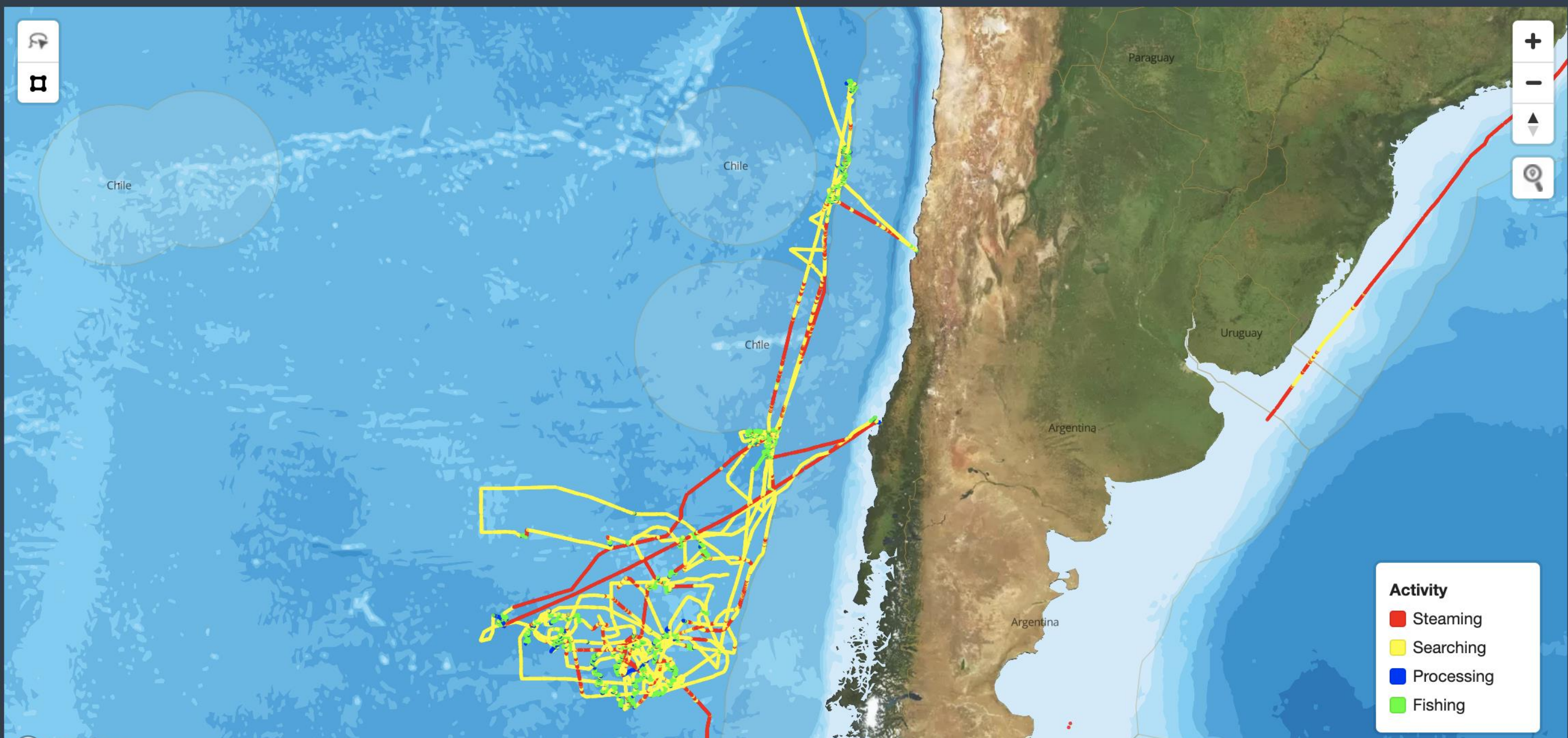
Science dashboard



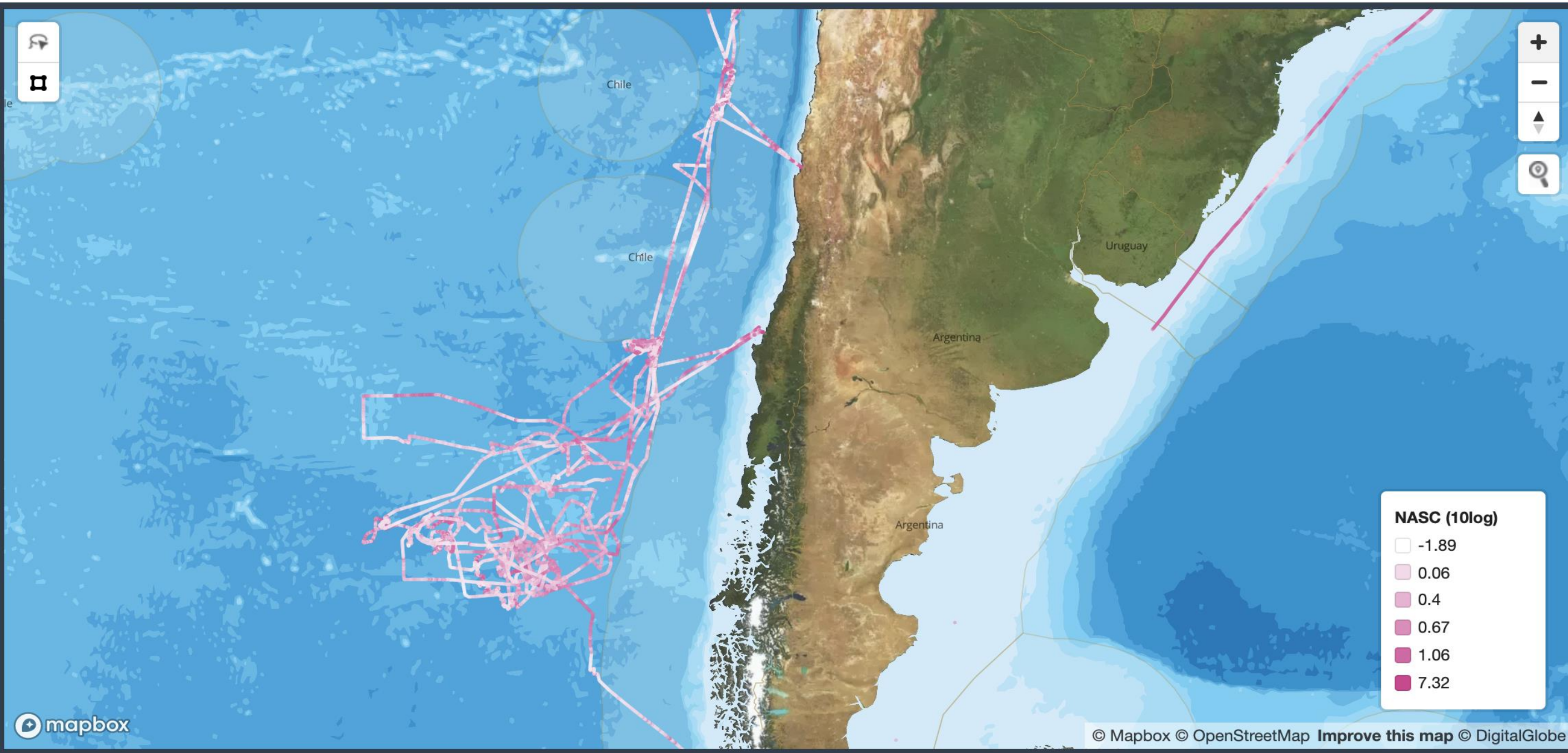
Trip overview



Steaming, searching, fishing



Acoustic detections



Current status: 5 Oceanboxes in operation



Afrika



Zeeland



Sandettie



Wiron 5+6



Carolien



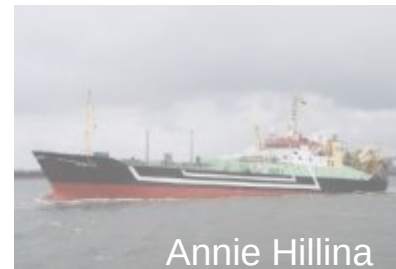
Frank Bonefaas



Prins Bernhard



Dirk Dirk



Annie Hillina



Willem van der Zwan



Annelies Ilena



Margiris



Maartje Theadora

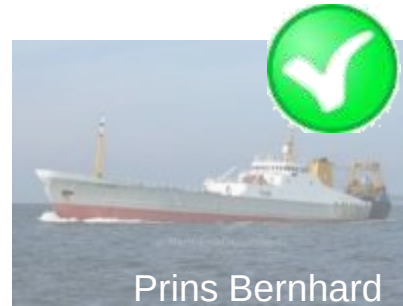


Helen Mary



Alida

PFA ambition (2020)



Just think about it !



Sensor recording in fisheries: real-time information

NOVELTY



Real-time information on environment & biomass

EFFECTIVENESS



Vessels are effectively sampling the environment

PRACTICALITY



Build on the vessels being on the fishing grounds

MEETS A SOCIAL NEED



Fishers become partners in research activities

EMPOWERING

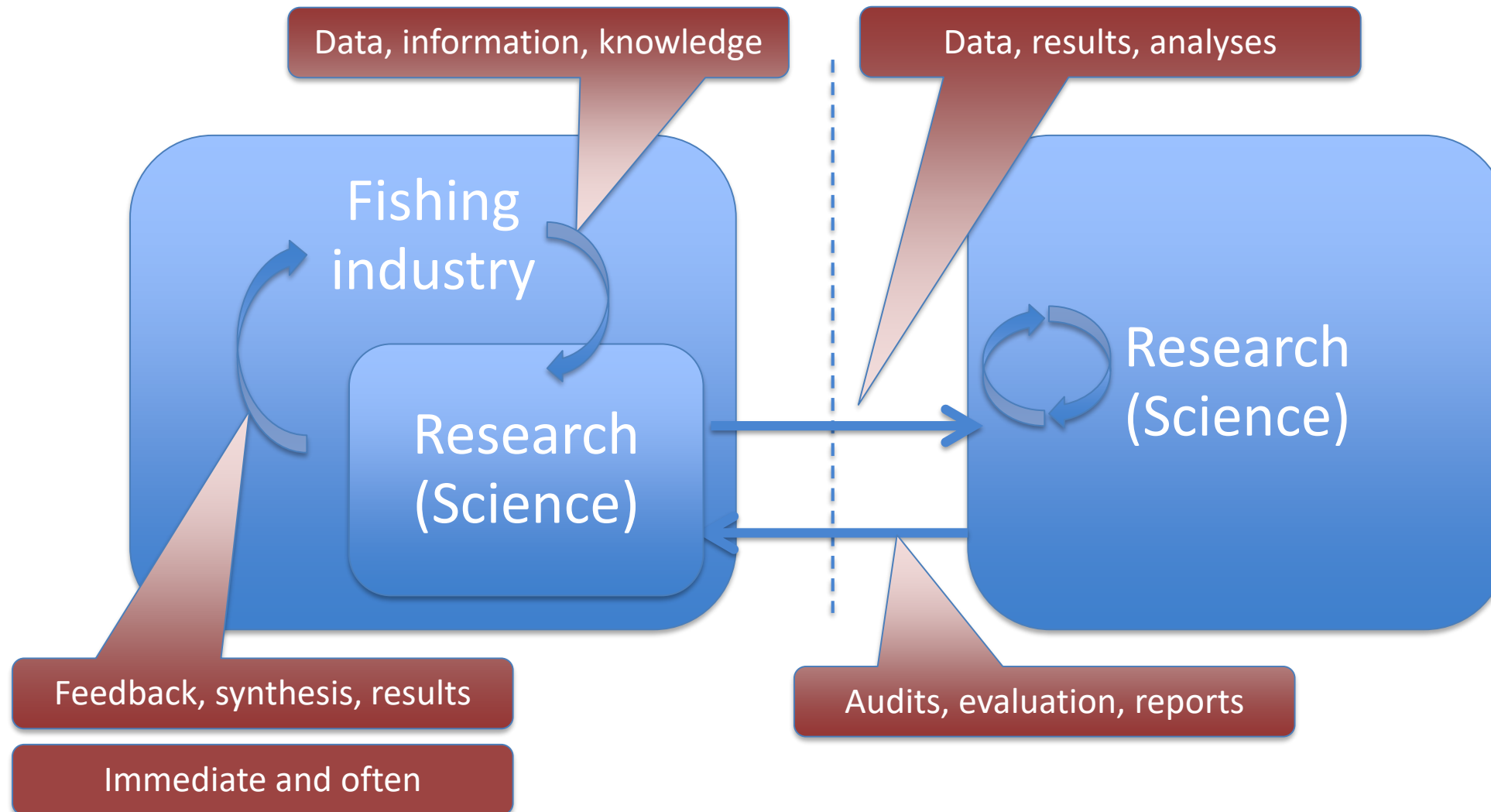


Fishers can use the data they collect themselves

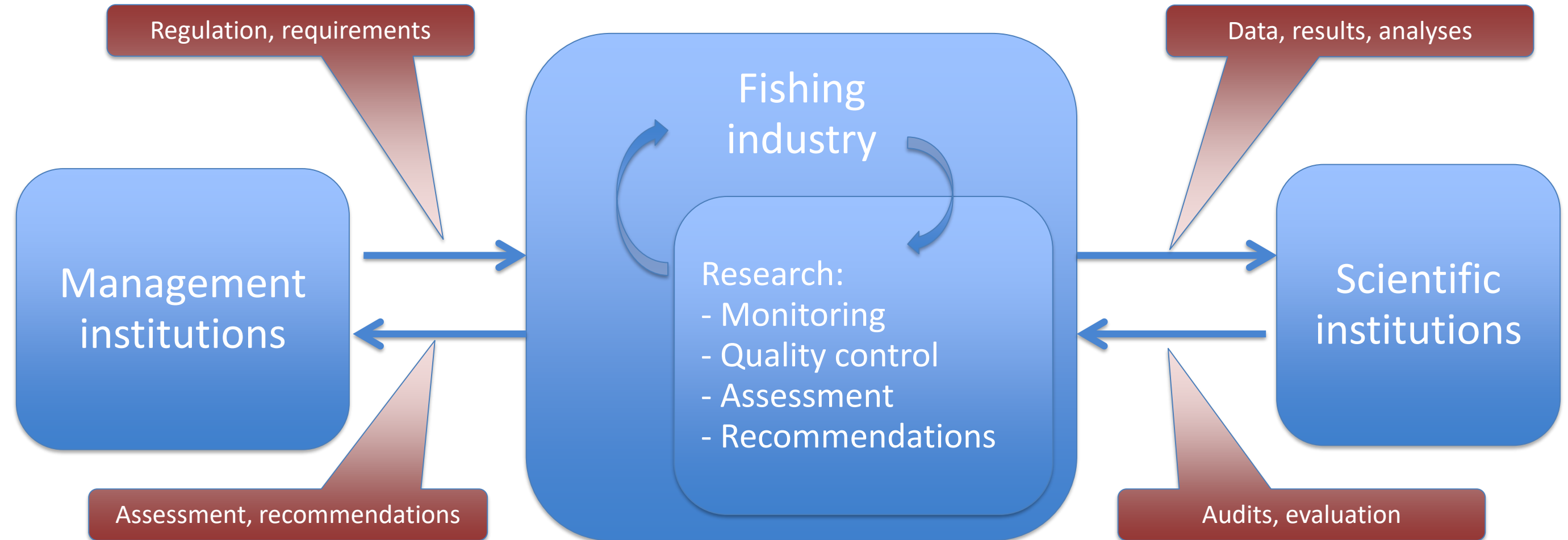
Fishing Industry Science

Could we go one step further?

Fishing Industry Science (1.0): improving capacity



Fishing Industry Science 2.0: taking responsibility

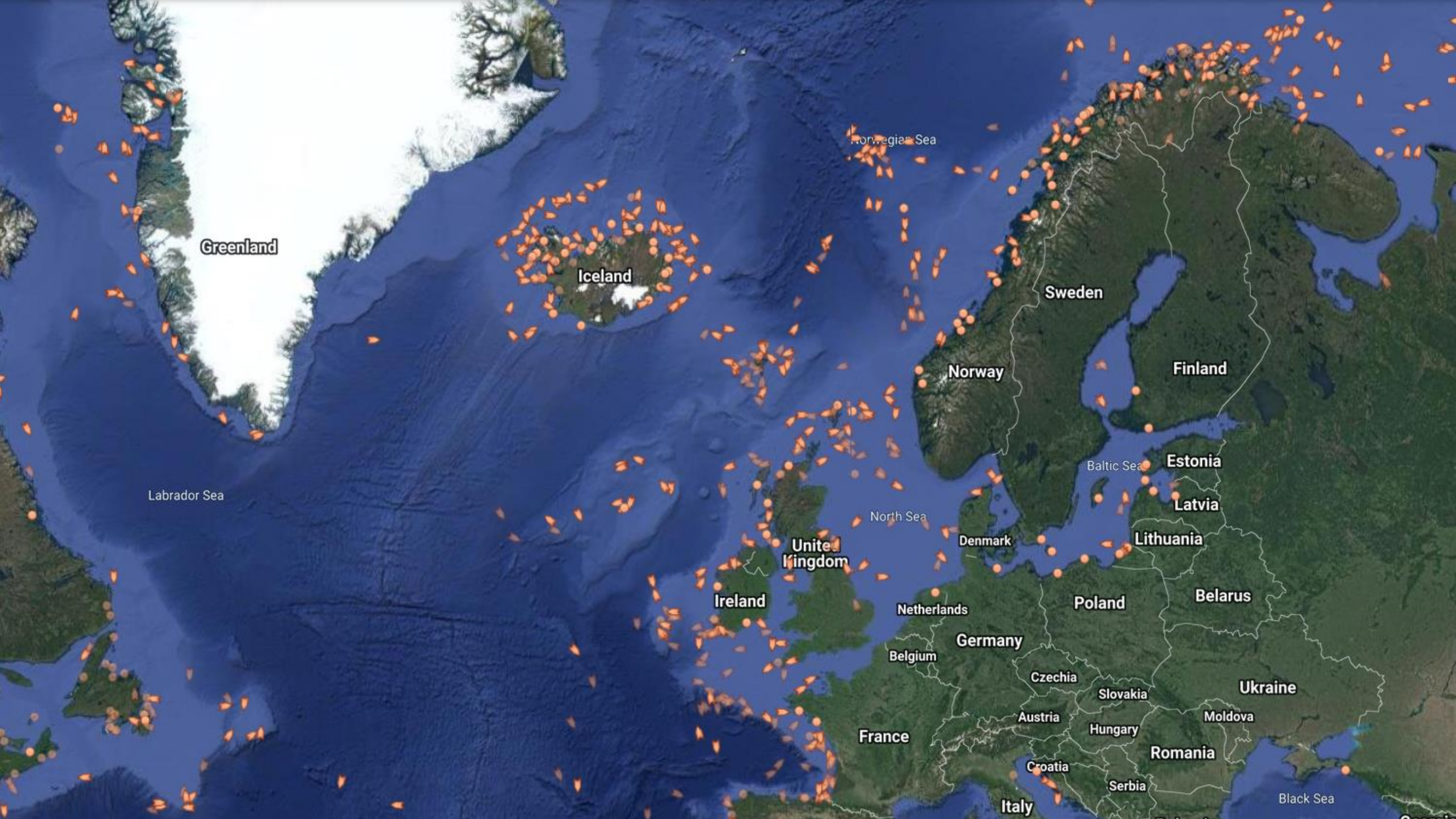


Many fishing vessels at sea

Large uncertainties on fish stocks +

Large interest in 'getting it right' +

Let's make things better





PELAGIC FREEZER-
TRAWLER ASSOCIATION

Fishing Industry Science: Let's do it !!



mpastoors@pelagicfish.eu