

Reproductive migration of Sea lamprey in the Rhine-Meuse catchment using **NEDAP-telemetry**

Sea lamprey webinar

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Max van de Ven / m.vandeven@at-kb.nl / (+31)0617116485



SEA LAMPREY IN THE NETHERLANDS

- Largest of three lamprey species in Dutch waters
- Anadromous “fish”
- Dutch rivers mainly used for migration (proof of spawning in the Roer)
- Common in Rhine-Meuse catchment until 1950's
- Strong decline after construction of the Deltawerken / Haringvlietdam (1970)





Europoort

Haringvlietdam

Brouwersdam

RESEARCH OBJECTIVE

General objective is to have a better understanding of the key characteristics of the **migration behaviour (in space and time)** of sea lamprey in the Rhine and Meuse.

The research should also provide insight in reproductive migration successes for different river sections and **identify possible bottlenecks**.

The results also serve as a reference to **evaluate the effect of the new sluice management** of the Haringvlietdam sluices (Kieren).



RESEARCH SET-UP

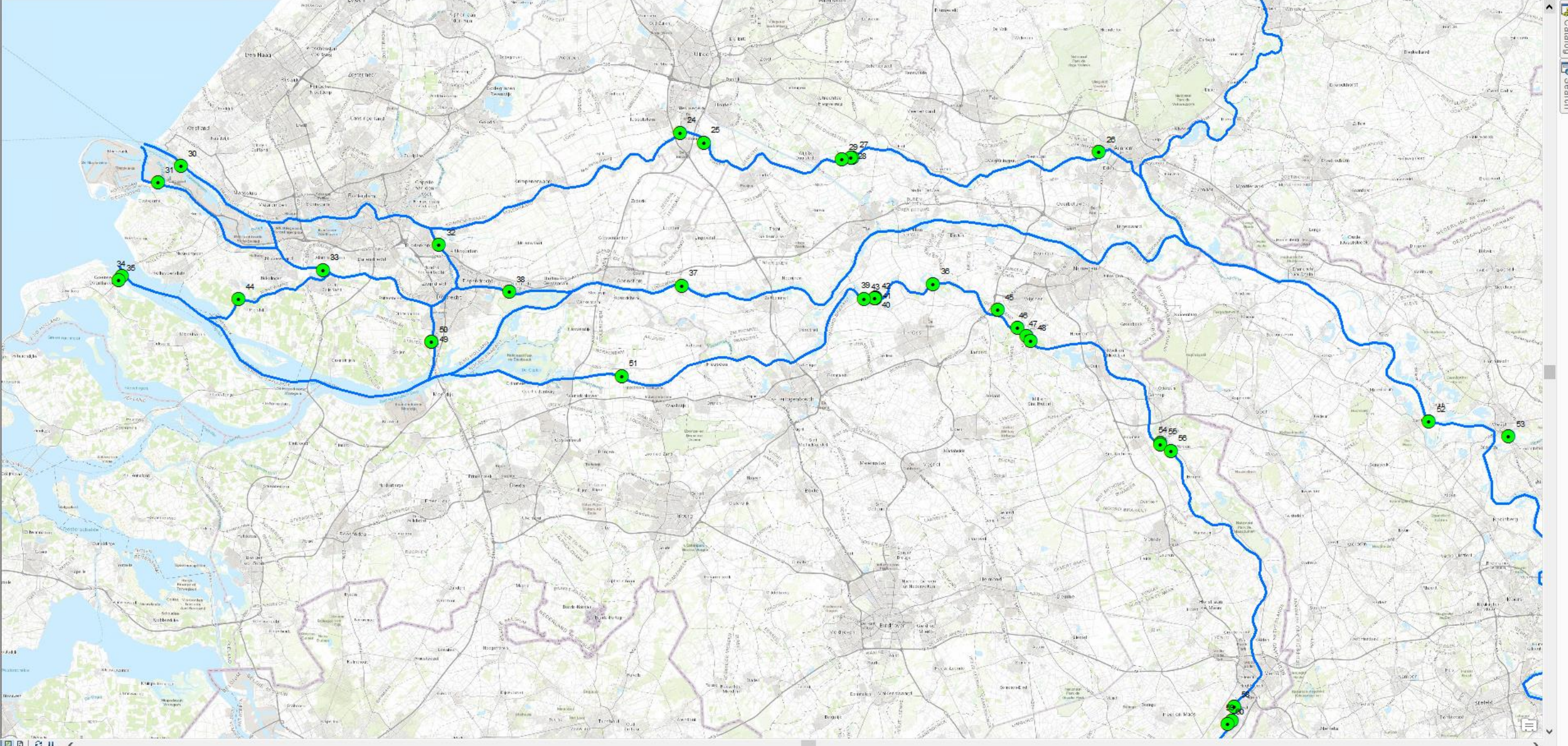
NEDAP Trail System®

Inductive coupling between **transponders** and **detection stations**.
Transmission at low frequency (33.25 kHz).

NEDAP Detection stations

- At strategic locations in Meuse-Rhine catchment
- Netherlands, Belgium, France and Germany (+/- 80 stations)
- Internal control/check every 12 hours
- Daily upload of data to central server
- Access to data through secure internet site





RESEARCH SET-UP

NEDAP Transponders

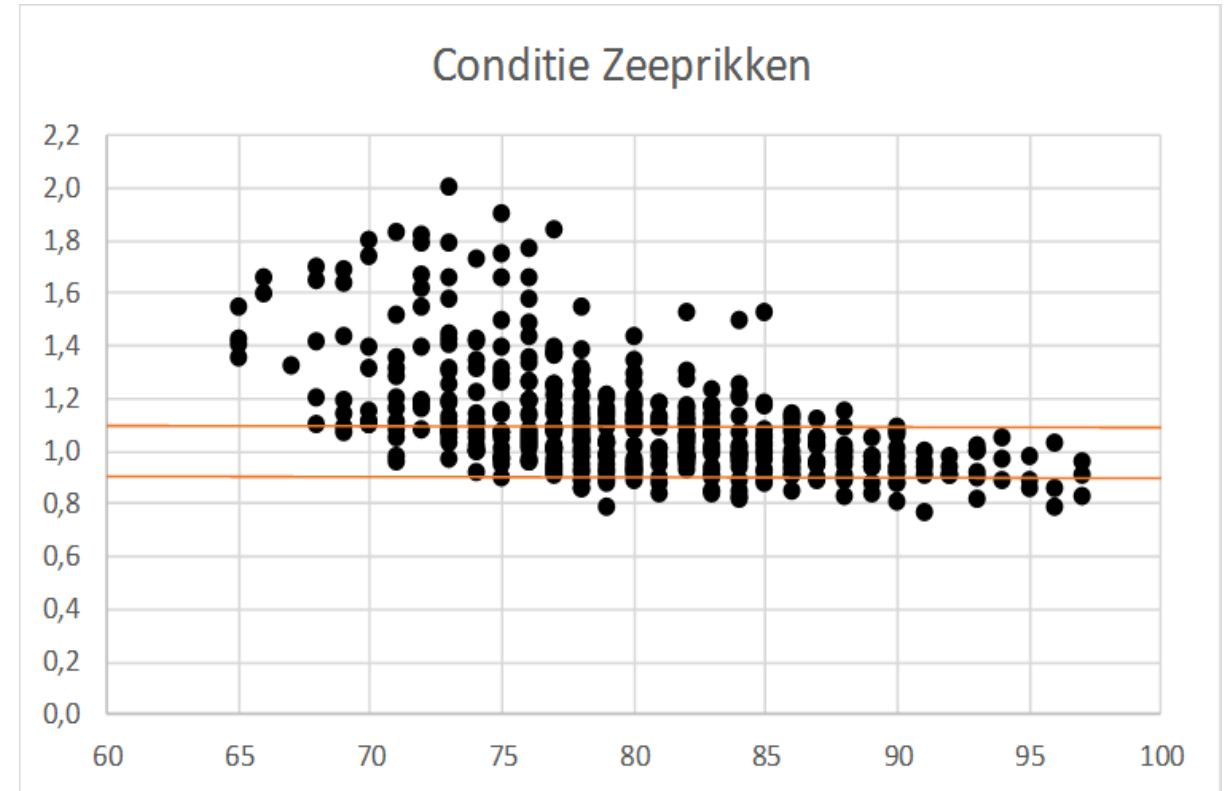
- Antenna and battery in HDPE casing
- 38 x 13 mm
- Useful life >6 months
- Unique ID number
- Reward and contact information

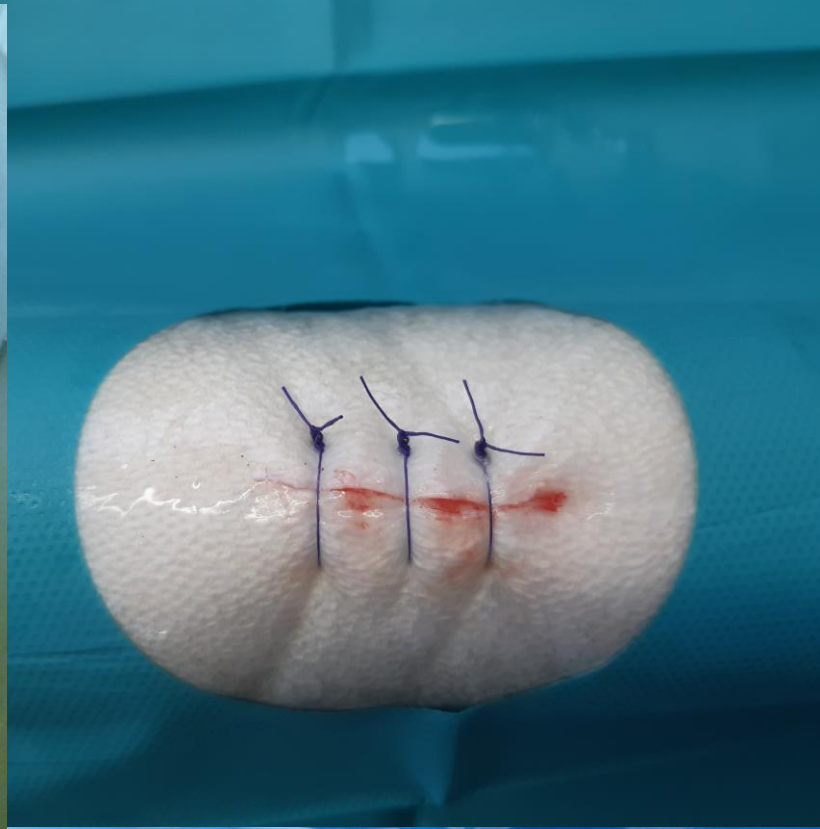
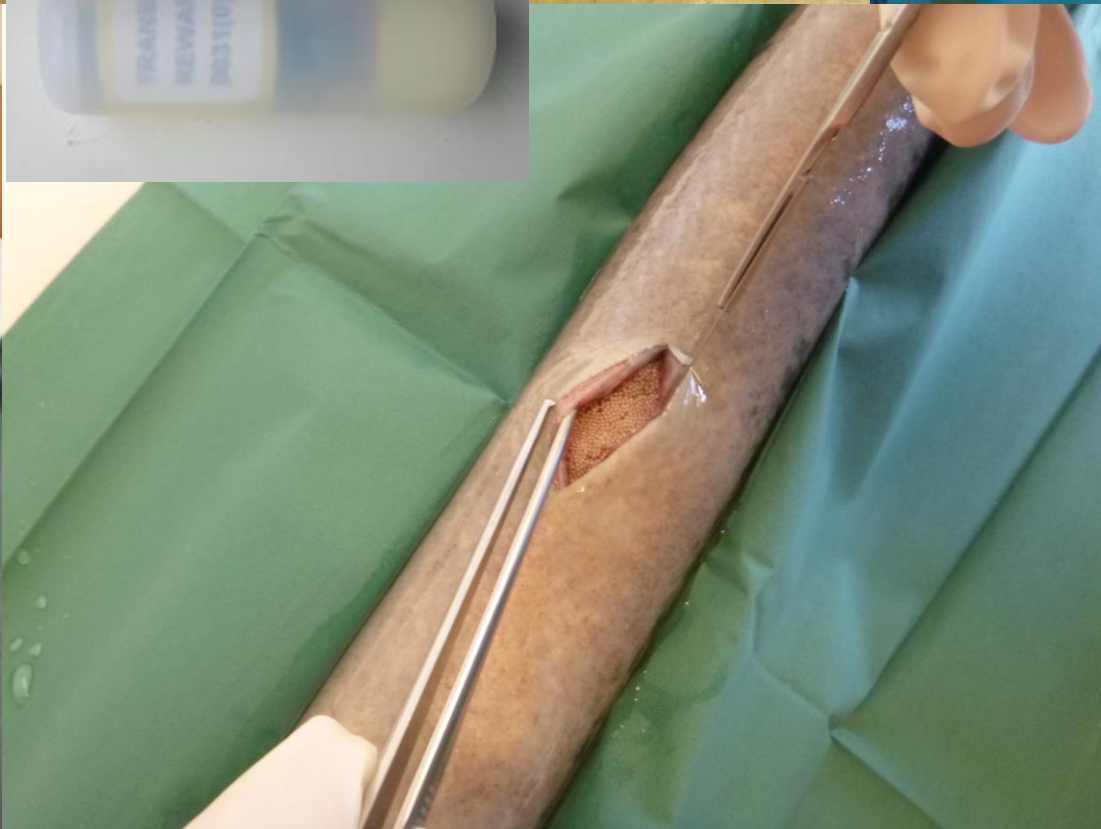
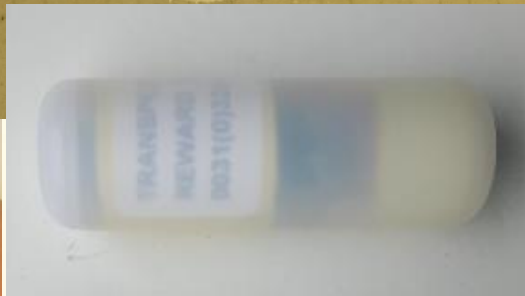


RESEARCH SETUP

Sea lampreys

- Period 2009 – 2018
- Total of 435 mature sea lamprey
- Caught with fyke in sea delta (migration route)
- TL: 65 – 97 cm / W: 700- 1.800 g



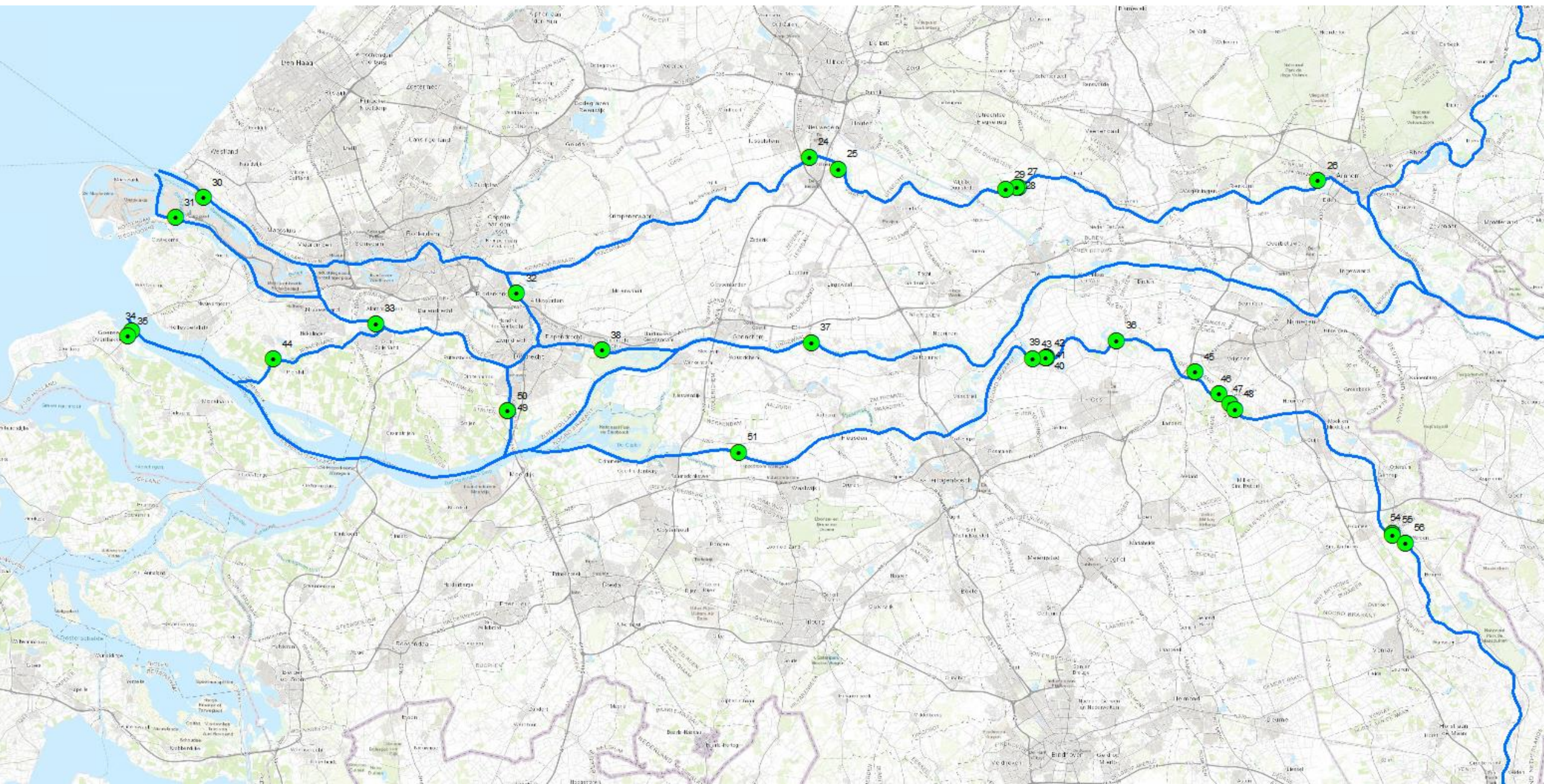


RESEARCH SET-UP

Study population:
numbers and release sites

Jaar	Kustwater				Binnenwater			Totaal
	Voordelta Haringvliet	Afsluitdijk Kornwerderzand	Lith benedenstr. stuw	Lith bovenstr. stuw	Lith vispassage	Roermond		
2009				62		3	65	
2010	48				21	45	114	
2011	36						36	
2012			54	49			103	
2015	56						56	
2016	52						52	
2018	3	6					9	
Totaal	195	6	54	132	45	3	435	





DATA-ANALYSIS

Coupling of tagging data x traildata through ID

Fish nr.	species	project	Tr. Nr.	Weight (g)	TL (cm)	Origin	Operat. location	Release date	Release tir	Group/ release location
433	ZP	20170225	16794	1160	83,0	Fuiken Stellendam buiten	Stellendam buitenhaven	29-6-2018	13:15	Voor de dam, met boot
434	ZP	20170225	16999	720	71,0	Fuiken Stellendam buiten	Stellendam buitenhaven	29-6-2018	13:15	Voor de dam, met boot
435	ZP	20170225	17014	705	65,0	Fuiken Stellendam buiten	Stellendam buitenhaven	29-6-2018	13:15	Voor de dam, met boot
319	ZP	20150240	14196	705	70,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
320	ZP	20150240	14198	880	78,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
321	ZP	20150240	14199	1105	82,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
322	ZP	20150240	14200	1095	85,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
323	ZP	20150240	14201	1330	87,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
324	ZP	20150240	14212	1145	81,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
325	ZP	20150240	14297	1520	90,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
326	ZP	20150240	14298	1240	90,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	15:40	buitenkant haven
327	ZP	20150240	14299	795	78,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	15:40	buitenkant haven
328	ZP	20150240	14300	1015	84,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
329	ZP	20150240	14301	1450	93,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	15:40	buitenkant haven
330	ZP	20150240	14302	1500	96,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
331	ZP	20150240	14303	1095	80,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
332	ZP	20150240	14305	1115	81,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
333	ZP	20150240	14307	1080	85,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	15:40	buitenkant haven
334	ZP	20150240	14308	935	80,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
335	ZP	20150240	14309	1425	87,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	15:40	buitenkant haven
336	ZP	20150240	14310	1170	83,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	15:40	buitenkant haven
337	ZP	20150240	14311	1120	84,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
338	ZP	20150240	14312	650	71,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	13:30	buitenkant haven
339	ZP	20150240	14313	1050	80,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	15:40	buitenkant haven
340	ZP	20150240	14314	930	76,0	Fuiken Stellendam buiten	Stellendam buitenhaven	24-4-2015	15:40	buitenkant haven

DATA-ANALYSIS

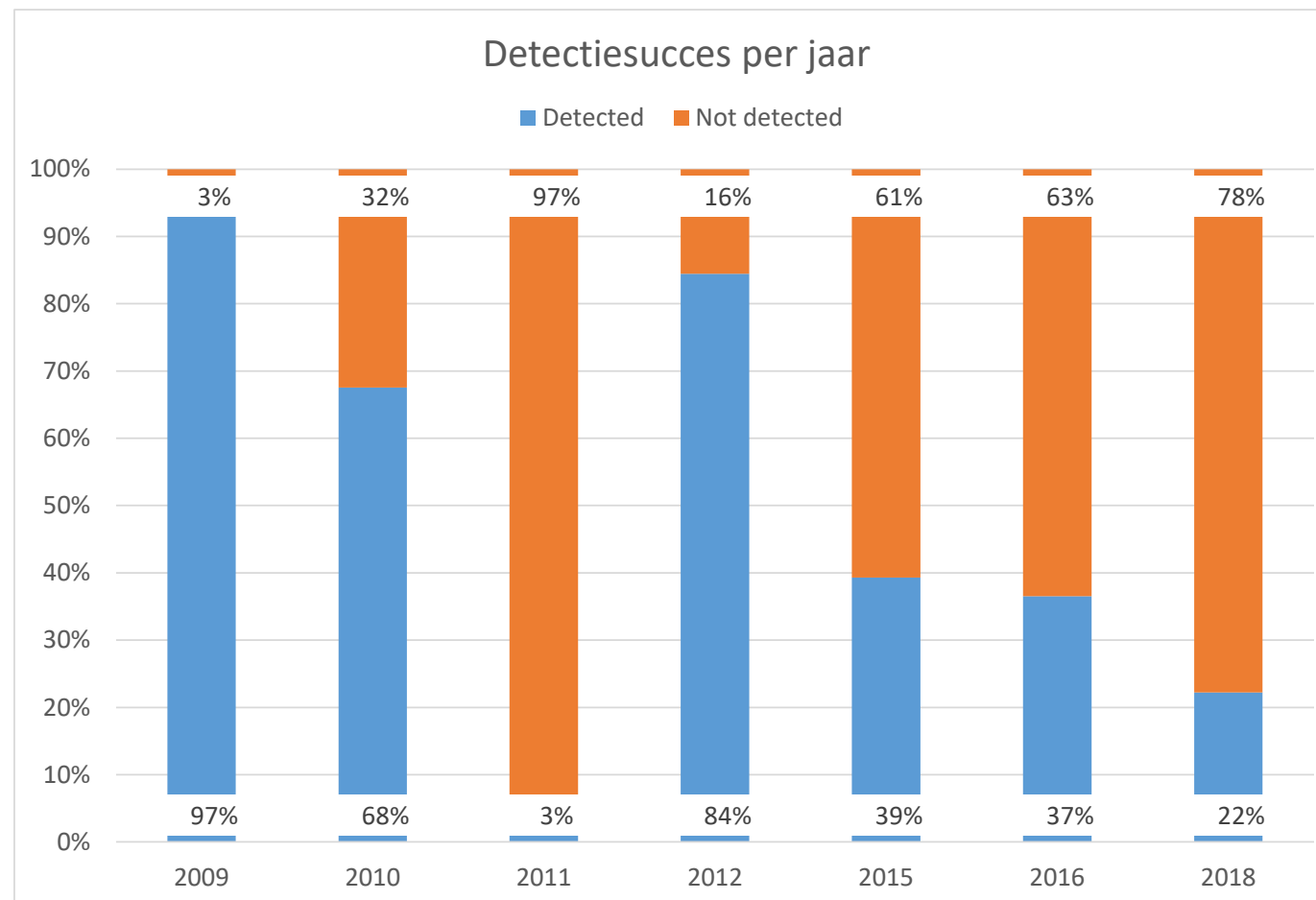
Coupling of tagging data x traildata through ID

Stationname	Recnr	Type	ID	Time	Date	Sig(SN)	SigAv	Noise	SWRF	SWRR	Alarm	NrID	SWR
HV_Stellendam_zuid	1459	DATA	7266	23:24	25-5-2010	138	120	90	255	10	0	8	1.1
HV_Stellendam_zuid	1475	DATA	7266	07:48	28-5-2010	119	100	88	255	8	0	2	1.1
HV_Stellendam_zuid	1476	DATA	7266	07:51	28-5-2010	130	108	88	255	8	0	8	1.1
DKil_sGravendeel	866	DATA	7266	06:09	29-5-2010	109	73	49	232	23	0	13	1.2
DKil_sGravendeel	868	DATA	7266	13:27	29-5-2010	106	69	47	235	24	0	2	1.2
BergscheMaas_CVeer	2010	DATA	7266	05:40	30-5-2010	135	106	69	255	10	0	40	1.1
Maas_Lith_dorp	535	DATA	7266	17:39	30-5-2010	179	128	87	240	44	0	34	1.4
Maas_Lith_stuw_ben	139	DATA	7266	18:05	30-5-2010	205	114	78	215	32	0	45	1.3
Maas_Lith_stuw_ben	144	DATA	7266	21:36	30-5-2010	209	108	71	222	34	0	46	1.4
Maas_Lith_stuw_ben	145	DATA	7266	21:44	30-5-2010	209	104	72	221	32	0	42	1.3
Maas_Alphen_wkc_ben	833	DATA	7266	22:00	30-5-2010	206	124	78	207	141	0	48	5.3
Maas_Alphen_wkc_ben	836	DATA	7266	22:02	30-5-2010	205	99	78	208	141	0	28	5.2
Maas_Alphen_wkc_ben	1177	DATA	7266	22:13	4-6-2010	208	97	61	190	125	0	31	4.8
Maas_Lith_stuw_ben	187	DATA	7266	22:17	4-6-2010	203	111	75	218	34	0	23	1.4
Maas_Lith_stuw_ben	189	DATA	7266	22:24	4-6-2010	208	123	76	219	34	0	44	1.4
Maas_Lith_stuw_ben	193	DATA	7266	22:45	4-6-2010	207	118	79	219	33	0	37	1.4
Maas_Alphen_wkc_ben	1204	DATA	7266	22:59	4-6-2010	207	113	63	193	128	0	44	4.9
Maas_Alphen_wkc_ben	1247	DATA	7266	00:52	5-6-2010	205	98	67	198	131	0	39	4.9
Maas_Alphen_wkc_ben	1249	DATA	7266	00:54	5-6-2010	204	100	68	199	132	0	41	4.9

RESULTS

Detection successes

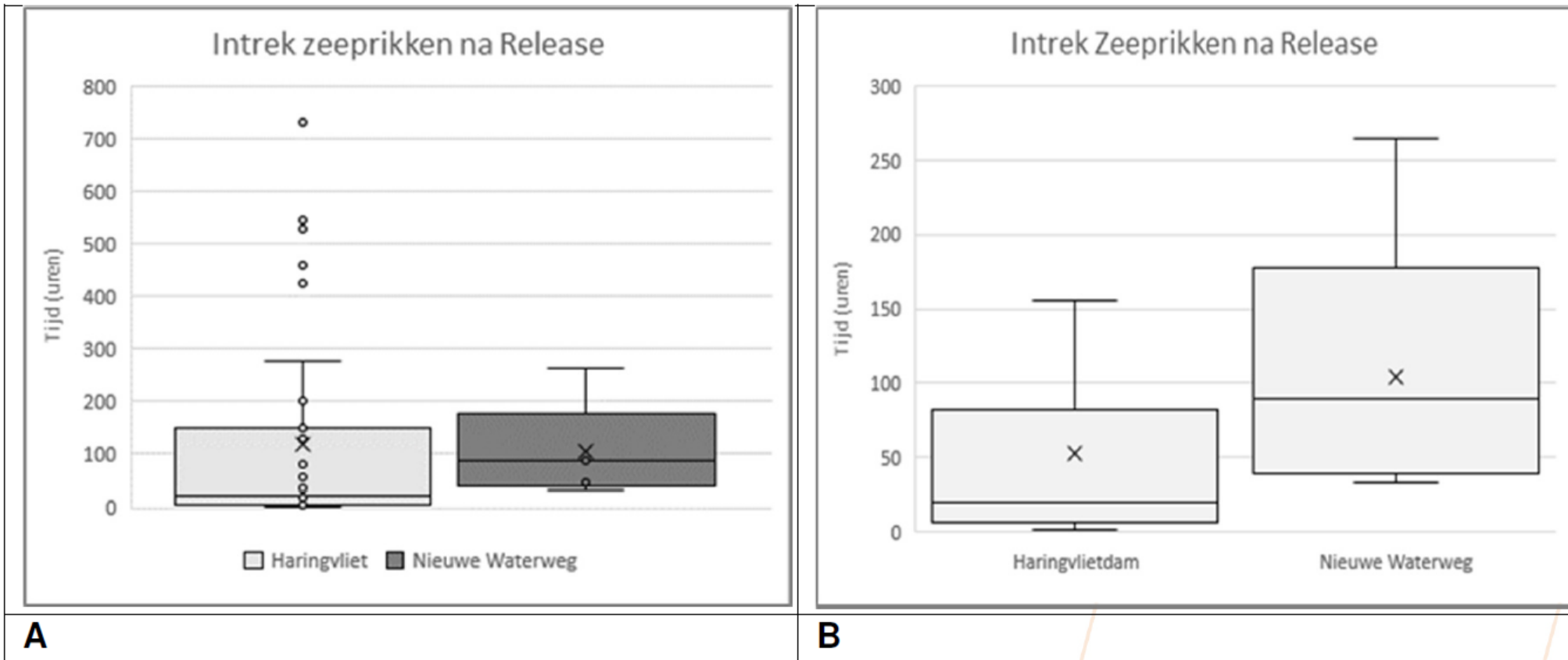
Jaar	Totaal		
	M	D	%D
2009	65	63	97%
2010	114	77	68%
2011	36	1	3%
2012	103	87	84%
2015	56	22	39%
2016	52	19	37%
2018	9	2	22%
Totaal	435	271	62%



- Returners
- Detection efficiency

RESULTS

Start of migration: majority within first week.



Migration via Haringvlietdam

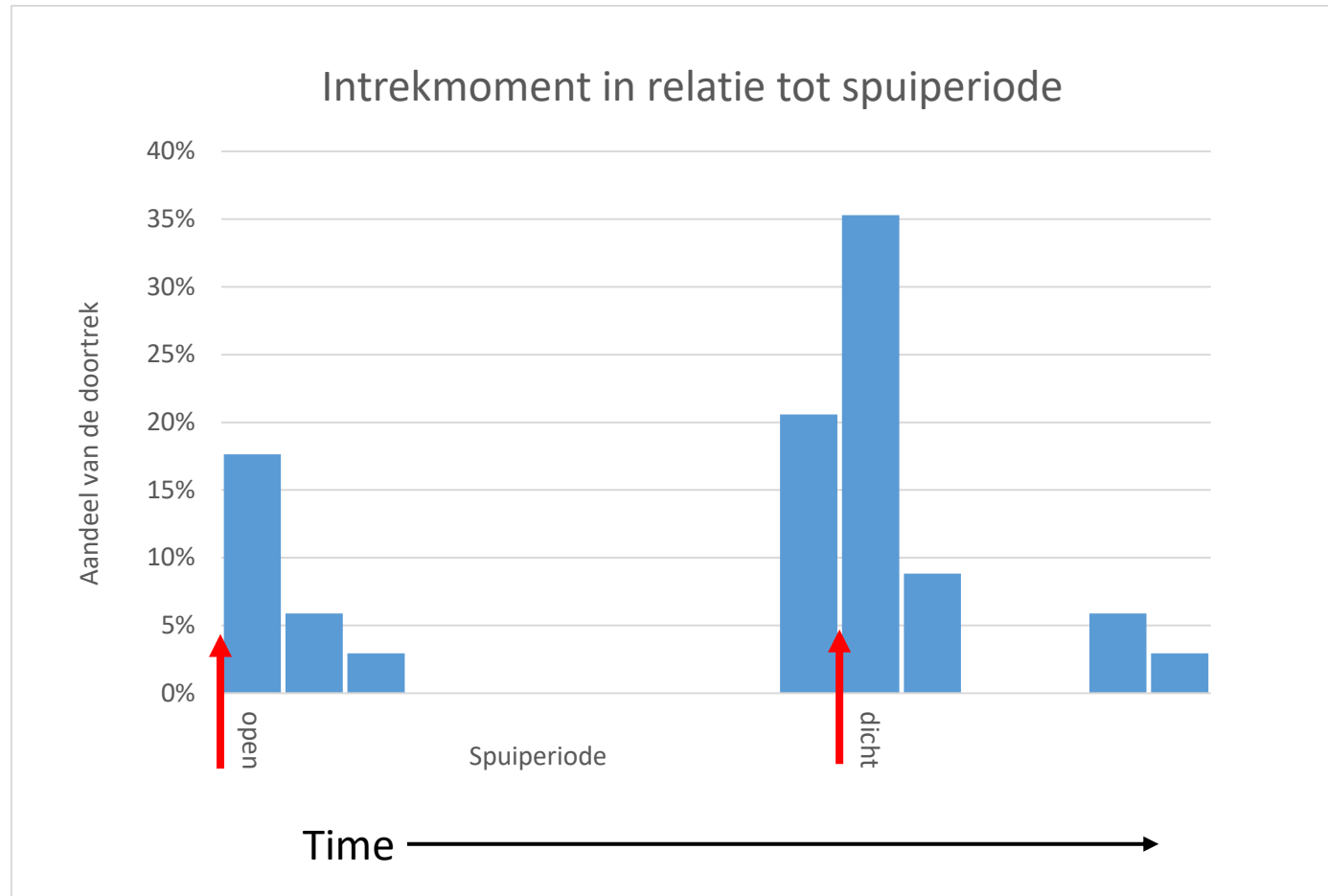
Situation until 2019: sluices open at low tide → water flows from Haringvliet into North Sea

New situation: one or more sluices remain open at high tide (kier) → salt water enters Haringvliet



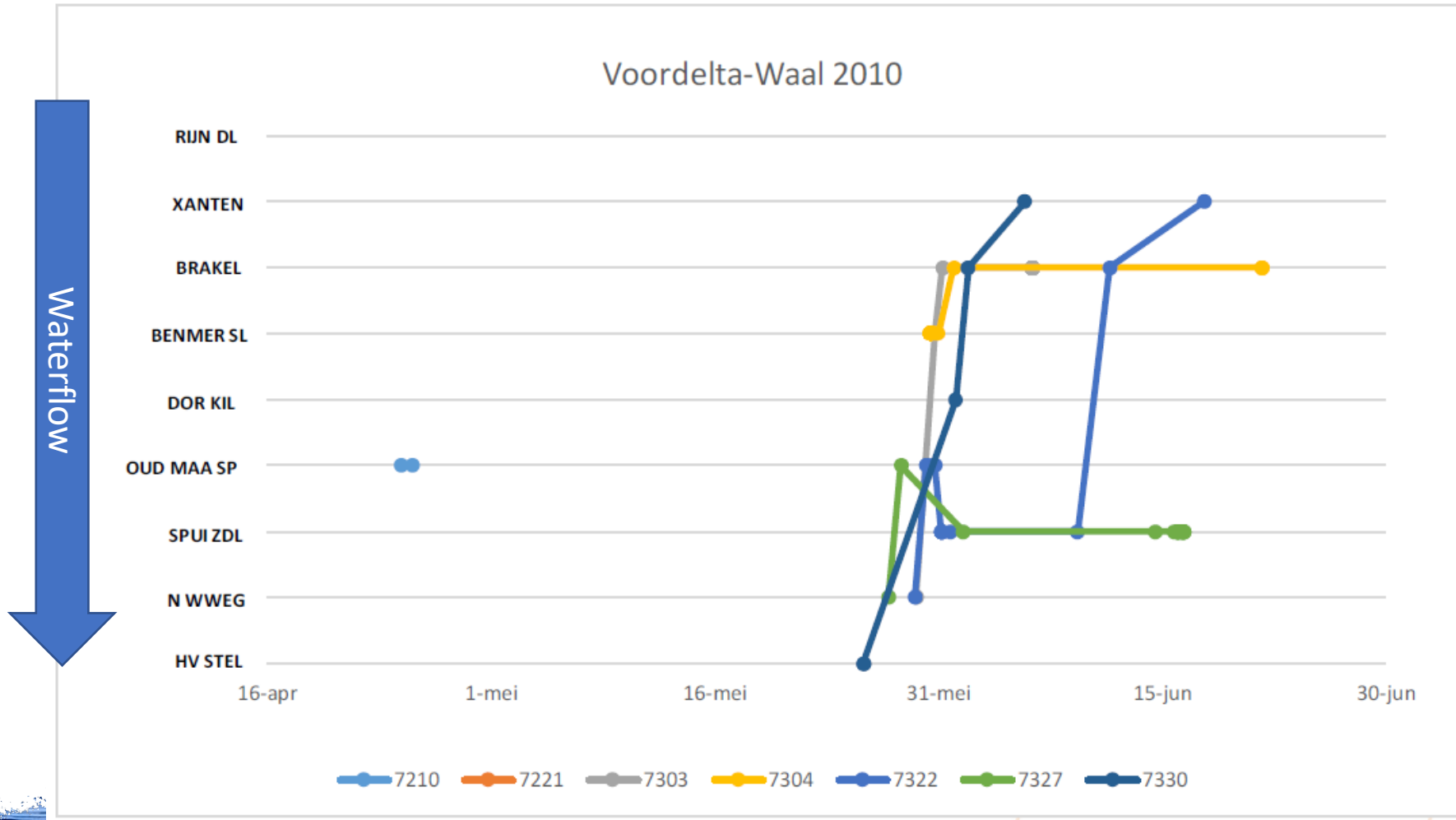
RESULTATEN

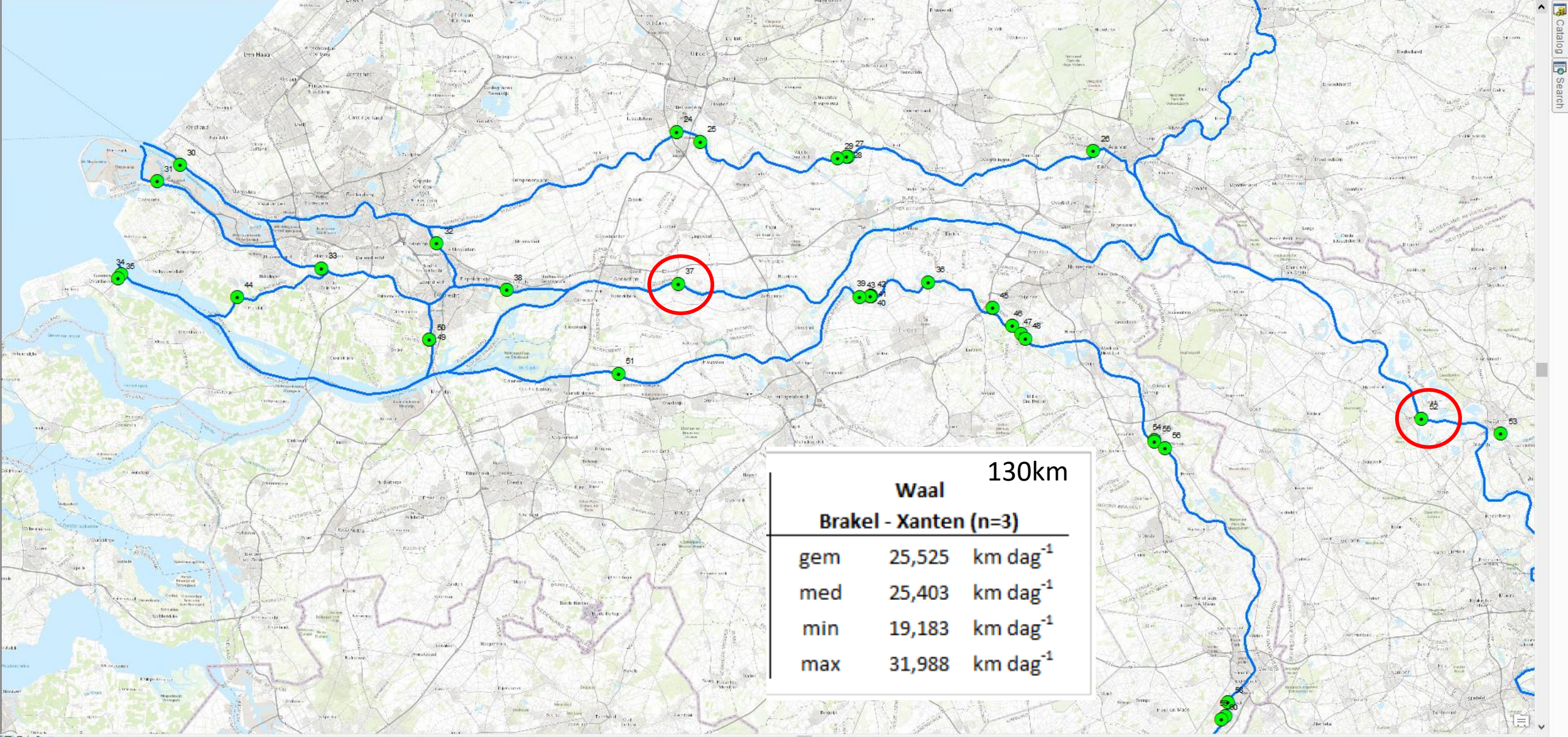
Passage of the Haringvlietdam sluices



RESULTS

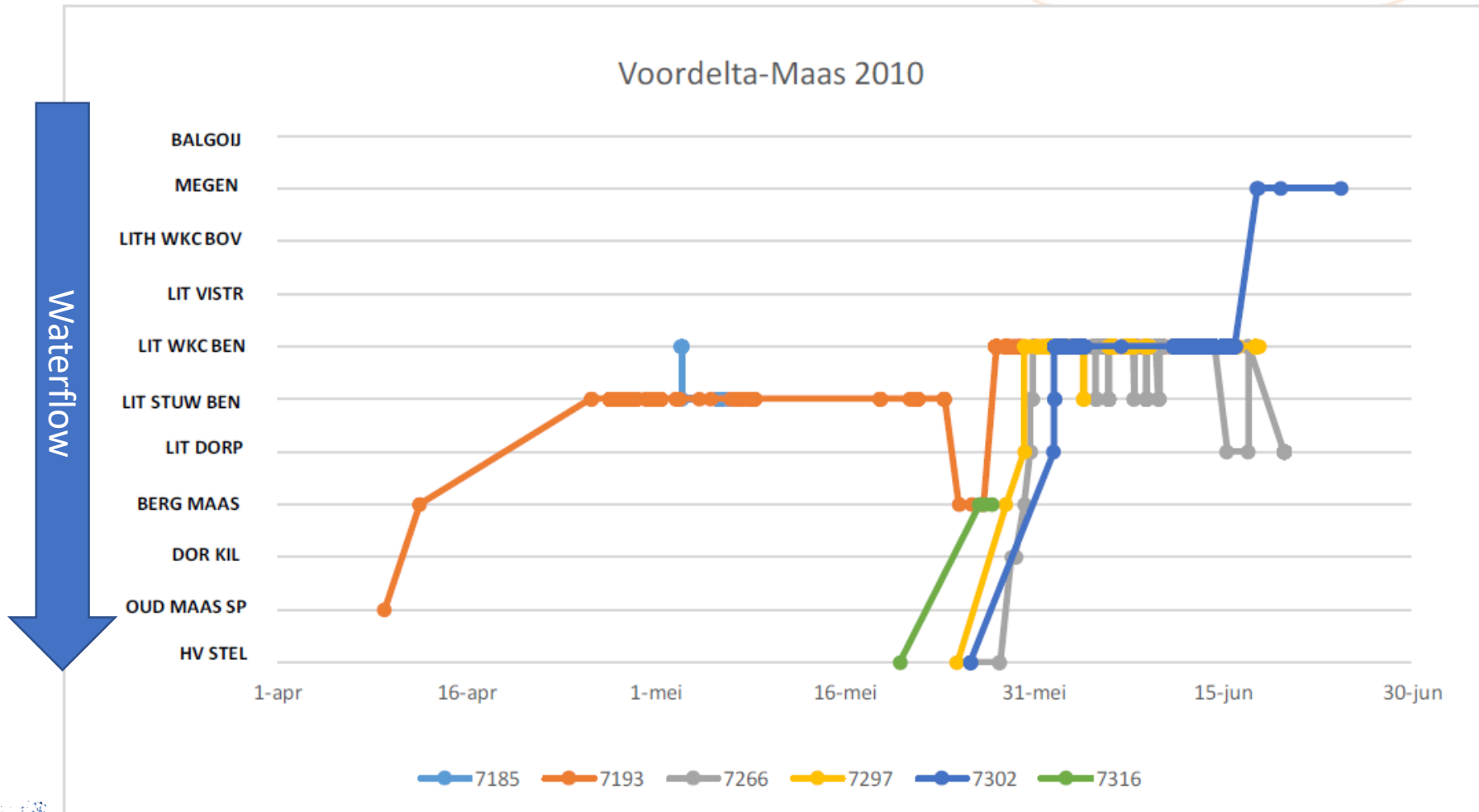
Individual migrations Waal

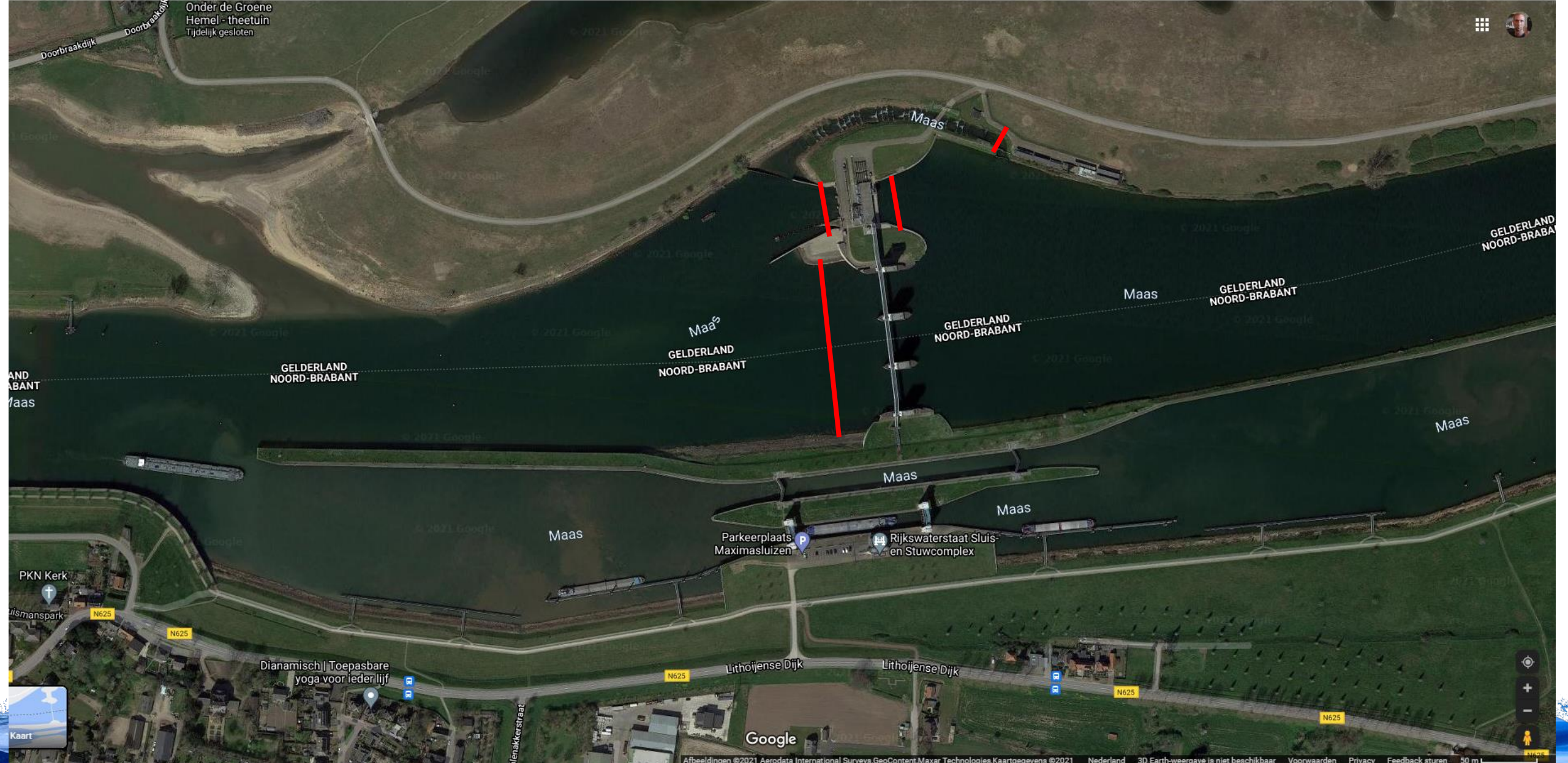




RESULTS

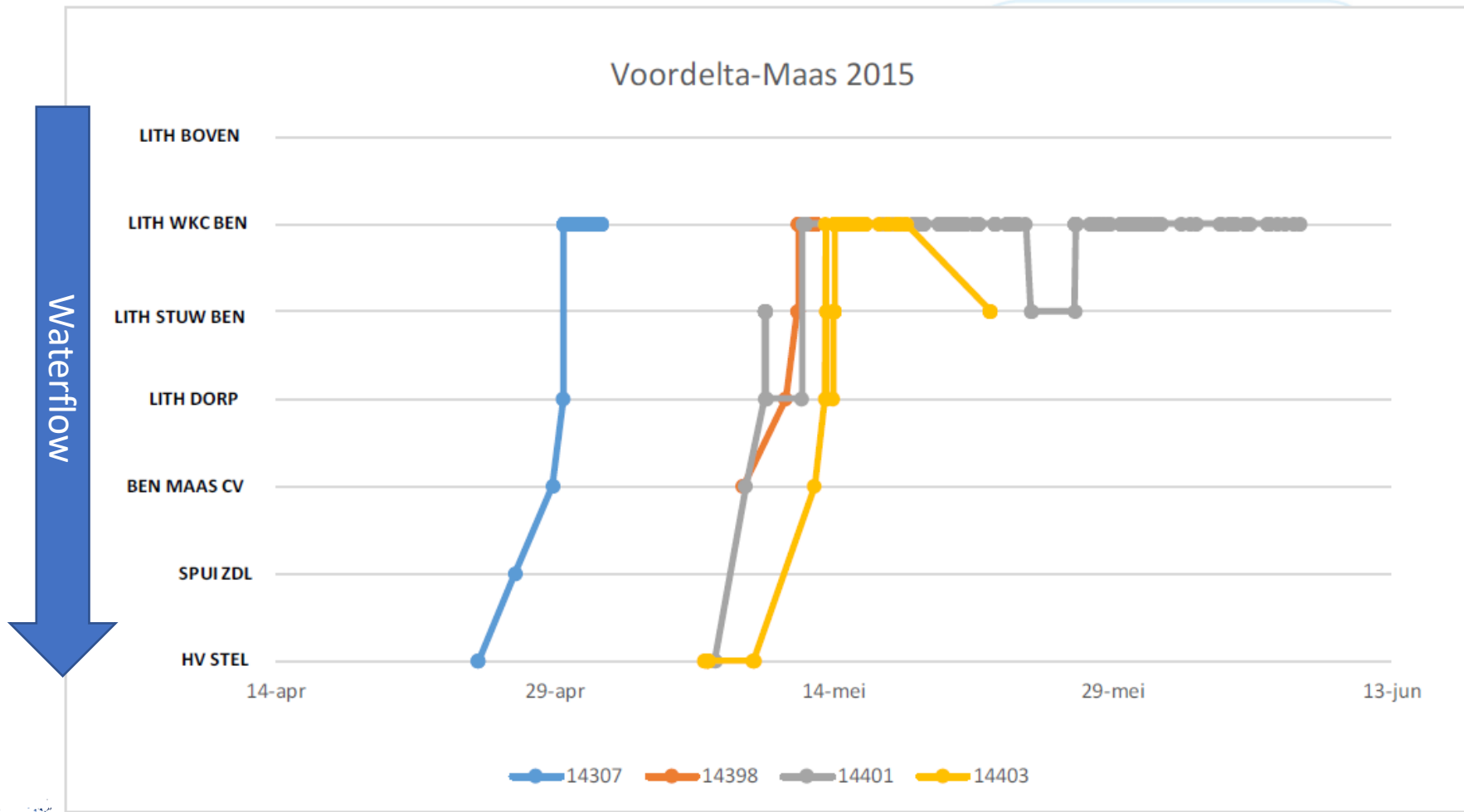
Individual migrations Meuse





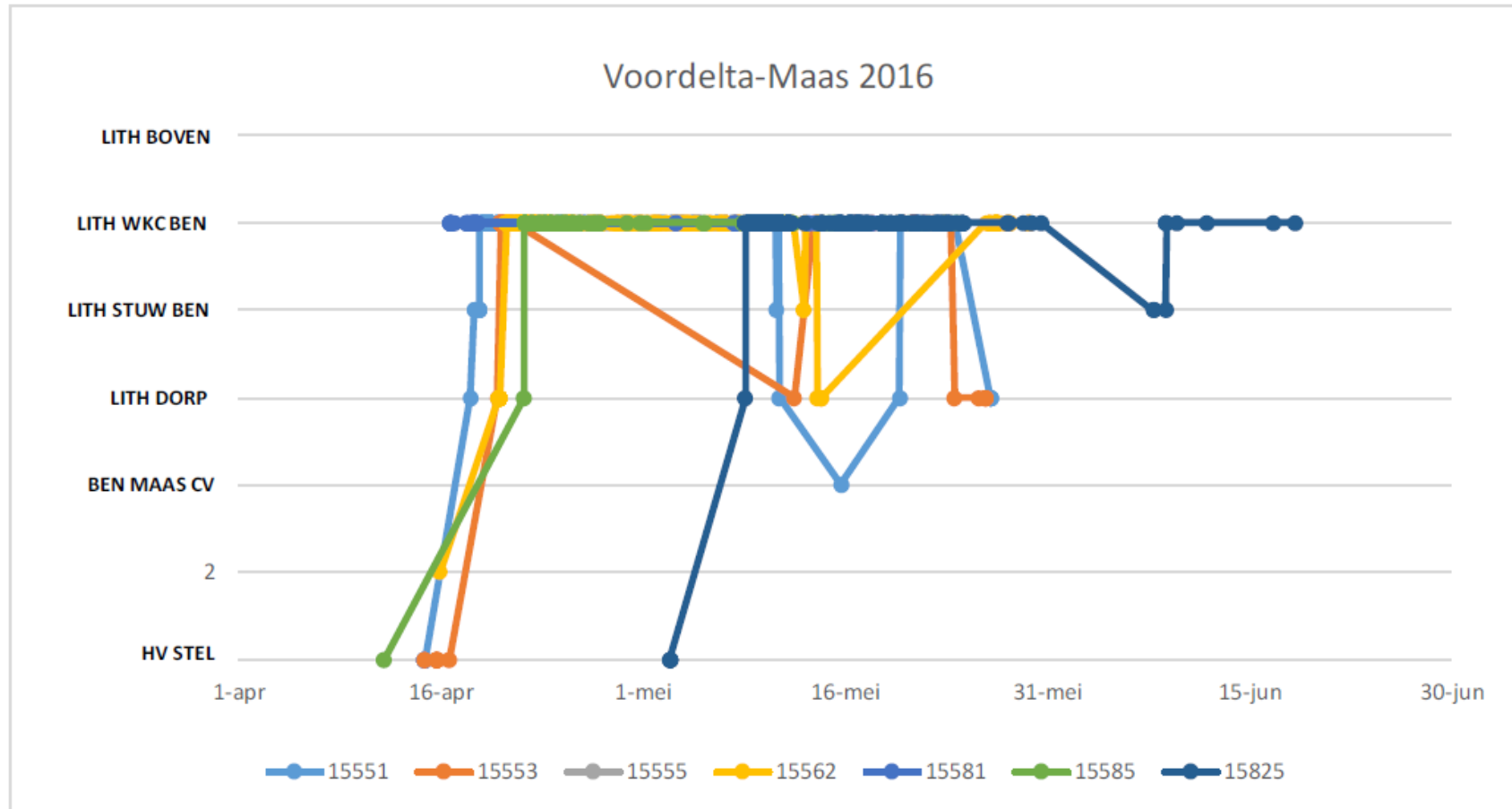
RESULTS

Individual migrations: Meuse

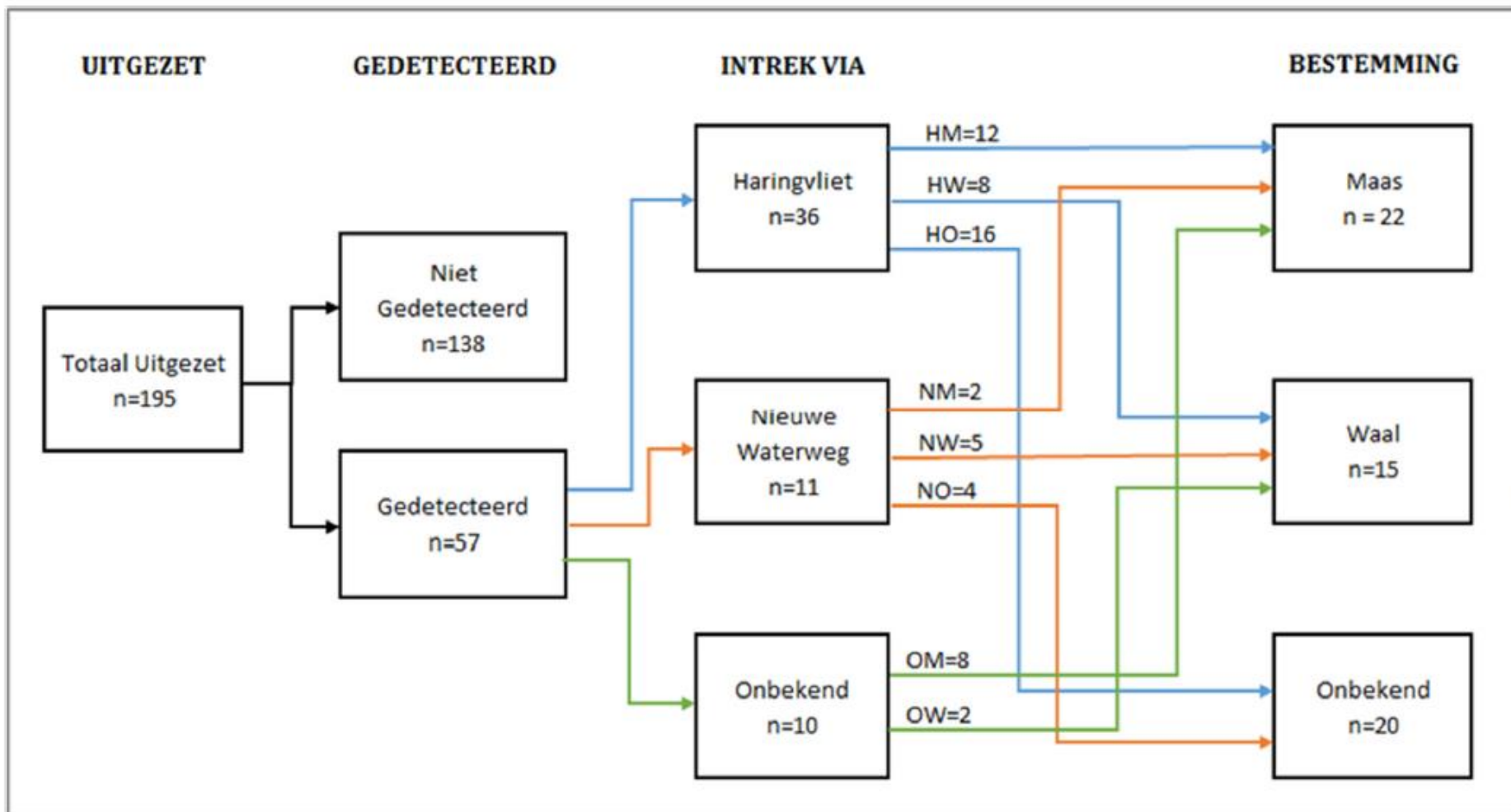


RESULTS

Individual migrations Meuse



RESULTS Overall migration diagram



Figuur 3.7. Intrek en bestemming van Zeeprikken uitgezet aan de zeezijde van de Haringvlietdam te Stellendam

Some conclusions

- The Haringvlietdam is an important entrance for sealampreys to reach spawning grounds further upstream (77%). A smaller part of the lamprey use the Nieuwe Waterweg (23%).
- Entrance mainly through the sluices in the Haringvlietdam. Use of the ship sluices is minimal.
- Discharge probably plays an important function in migration navigation. Sea lamprey seem to show less searching behaviour than salmonids.
- Passage through Haringvlietdam mainly at start and end of flushing, when water velocities are lowest. Sea lamprey probably profit from new sluice management (kieren).



Some conclusions

- Of the Sea lamprey that enter through the Haringvliet, 60% goes to the Maas and 40% to the Waal. Of the sea lamprey that enter through the NWW about 30% go to the Maas and 70% to the Waal.
- Only 20% of the sea lamprey that migrate via the Waal/Rhine are detected upstream of the German Dutch border near Xanten. None of the sea lamprey that migrate via the Meuse are detected upstream of Roermond.
- Sluice complexes in the river Meuse seem to be important migration obstacles.
- The results show that sea lamprey can migrate through the fish passages in Lith, Grave and Sambeek. However, especially the efficiency of the fish passage at Lith for sea lamprey seems to be low.



What is the fate of the sea lamprey that do not make it passed sluice complex Lith?

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THANK YOU FOR YOUR ATTENTION!

Max van de Ven (MSc) / m.vandeven@at-kb.nl / (+31)0617116485

