

**Downstream migration of salmon smolts in the river
Rhine: spring 2020**

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1 INTRODUCTION

1.1 Background

For many years the 'Landesamt für Natur, Umwelt und Verbraucherschutz NRW (LANUV)' has released salmon smolts (*Salmo salar*) in the tributaries of the German part of the river Rhine for the purpose of reintroducing this fish species in the Rhine. The smolts are introduced in the river shortly before their seaward migration starts. In this period these fish undergo a transformation, the so called 'smoltification process', in which they physically and physiologically adapt to their new life in the sea. During their stay in the rivers, the smolts are imprinted by the characteristics of these so called 'home waters' and will return as adult salmon after having spent one to three years at sea. The first results of these stocking operations show that the return rate of adult salmon in the Rhine is relatively low compared to other salmon rivers and reintroduction programmes over the world. It is possible that the return rate is eventually too low to establish a sustainable salmon population on the long term. Several causes for the low return rate of adult salmon to the rivers can be:

1. a loss of downstream migrating smolts before they enter the sea;
2. a high mortality during the marine phase of the salmon, i.e. due to (illegal) fishing activities on their feeding grounds;
3. a high mortality of returning adult salmon, caused by a high level of by-catches in commercial fisheries in the coastal area and in the Rhine delta.

In 2006 a pilot study on downstream migration salmon smolts was performed using the NEDAP Trail System® (Vriese & Breukelaar, 2006). This study was conducted to test the feasibility of a large scale study, planned the next year (Vriese & Breukelaar, 2007). Vriese & Breukelaar (2006) concluded that the NEDAP Trail System® is a viable tool for studying downstream migration of fish, including smolts, as 50% of the tagged smolts (N=10) were detected on the system. LANUV (Germany) and RWS Waterdienst, in cooperation with Sportvisserij Nederland (both the Netherlands), subsequently started a full scale project on the tagging of 78 salmon smolts in 2007. The tagged smolts were subsequently released in various branches of the Rhine system. A total of 62 smolts (79%) were detected somewhere along the Rhine (Vriese & Breukelaar, 2007). In subsequent years tagging of smolts was continued until now.

In the current study the objective was to tag and release a total of 200 salmon smolts. The study is conducted in cooperation with Rijkswaterstaat West-Nederland Zuid (the Netherlands) and LANUV NRW (Germany). Monitoring of the smolt migration is especially important with regard to the implementation of the 'Kier in the Haringvliet' (2018), which should improve the migration of fish.

1.2 Objectives

The objectives of the study are to:

1. gain insight in the migration behavior of smolts: migration pathways; the exact timing of the migration; the migration velocity, and the possible delays on their journey to the sea;
2. investigate factors that might influence the migration;
3. quantify the losses of smolts in the different river stretches of the lower Rhine system, and quantify the escapement of fish to sea.

In this report the tagging data and release of the salmon smolts are described. Also the fish data (length, weight and length-weight relation) are discussed.

1.3 Reader

After this introduction the material and methods are presented in Chapter 2. In Chapter 3 the smolt data are given. In Chapter 4 the references are shown.



2 MATERIALS AND METHODS

2.1 Telemetry: NEDAP Trail System®

In this project the NEDAP Trail System® was used. This system is based on the inductive coupling between an antenna loop and a ferrite rod antenna within transponders. The system consists of (1) a network of detection stations placed at strategically chosen locations along the river Rhine and Meuse and its tributaries, and (2) implantable transponders (figure 2.1). When a tagged fish passes a detection station its unique ID-number (among other information) is logged onto a data storage system. More information about this system can be found in Breukelaar *et al.* (1998) and Vriese *et al.* (2006). The transponder type used during this research has a size of 38 x 13 mm (length x width) and weighs 11,5 g (in air). The casing of the transponder is HDPE (High Density Poly Ethylene). The names of the stations that are important in this particular study are given in table 2.1 (the numbers correspond with those in figure 2.1).

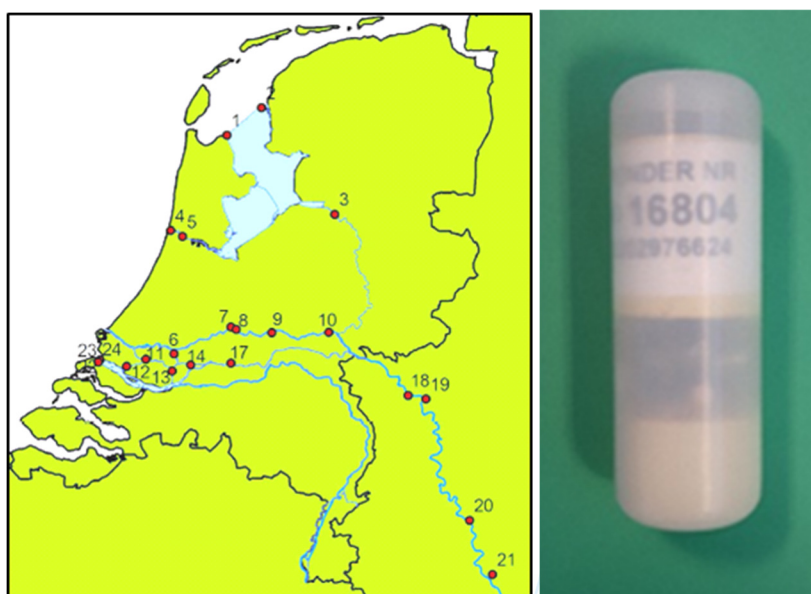


Figure 2.1. Network of detection stations of the NEDAP Trail system® in the Rhine system and lower river delta that are important for the current study and smolt transponder

Table 2.1. List of detections stations of the NEDAP Trail System® (Ben: downstream).

Nr.	Name	Nr.	Name
1	IJsselmeer_Den Oever	13	Dordtsche Kil_s'Gravendeel
2	IJsselmeer_Kornwerderzand	14	BenMerwede_Sliedrech
3	IJssel_Kampen	15	Beneden Merwede_Boven Hardinxveld
4	NZK_IJmuiden_gemaal	16	Waal_Vuren
5	NZK_Velsen	17	Waal_Brakel
6	De Noord_Kinderdijk	18	Rijn_Xanten
7	Lek_Nieuwegein	19	Lippe_Wesel
8	Nederrijn_Hagestein	20	Wupper_Burrig
9	Nederrijn_Maurik	21	Sieg_Menden
10	Nederrijn_Arnhem	22	Haringvliet_Stellendam_noord
11	Oude Maas_Spijkenisse	23	Haringvliet_Stellendam_zuid
12	Spui_Zuidland	24	HV_Stellendam_scheep

On November 19th 2009 and March 11th 2010 two new stations were added to the NEDAP Trail System® network, in the Hartelkanaal and the Nieuwe Waterweg, respectively. In 2015 the two former stations at the Haringvlietsluizen, Haringvliet_Stellendam_zuid and Haringvliet_Stellendam_noord (numbers 22 and 23 in figure 2.1), were replaced by one new detection station (one cable) which is situated approximately 50 m from the Haringvlietsluizen at the freshwater side. This station is called HV_Stellendam_Spuisluisen (number 25). Recently (2018) new stations were added at Den Oever and Kornwerderzand which will make it possible to discern between routes taken in and out of lake IJsselmeer (spill sluices or shipping sluices).

2.2 Salmon smolts

A number of 220 salmon smolts, divided into two groups of 110 fish, arrived at the tagging site (Rosandepolder Arnhem) on the 9th of March 2020. The fish were reared at the fish farm of *LANUV* in Kirchhundem-Albaum (Rückkehrer 2⁺) in Germany. All fish had smoltified at age two. A total number of 200 smolts were used for surgical implantation of the NEDAP transponders. Every fish met the desired minimum length of 25 cm and minimum weight of 150 grams. Current technical limitations (e.g. size of the antenna coil in the transponder) of the NEDAP system restrict a further reduction of transponder size, thus making it impossible to tag smolts of one year old or younger that are too small. Lacroix *et al.* (2004) stated that transponder length should not exceed 16% of the body length and transponder weight should be less than 8% of the body weight, which thus was respected in this study.

2.3 Surgical procedure

All fish were transported from Kirchhundem Albaum in Germany to the operation site of Rijkswaterstaat in the Netherlands (Rosandepolder, Arnhem), in order to be tagged. The transportation was performed on Monday March 9th 2020 by skilled employees of Alltech Coppens Aqua Centre B.V. (formerly Viskweekcentrum Valkenswaard). Fish were stored in two equal groups in two large fish tanks (approx. 1,800 liters each, water temperature: $\pm 8^{\circ}\text{C}$) before being operated the next days. During this period the smolts could recover from any possible stress experienced during the transportation. Water quality was maintained by a continuous flow of fresh river water (total volume change time approximately 15 minutes).

In total 200 fish were tagged: 67 fish on March 10th, 83 fish on March 11th and the remaining 50 on March 12th 2020. A skilled crew of three fish biologists from ATKb performed the surgery according to the procedure described by Vriese (1995). Feeding of smolts was ceased 48 hours before their operation. All fish were individually anaesthetized, using a 40 mg/l benzocaine solution to obtain a stage three level of anaesthesia (i.e. total loss of equilibrium and swimming motion, absence of reactivity and reflexes, and no opercular motion, figure 2.3A). Induction time was approximately 7-10 minutes. Total length and weight were recorded (figure 2.3B) after which the fish was placed dorso-ventrally (ventral side up) into a V-shaped operating trough, which is part of a live support system (figure 2.3C/D). One end of the V-shaped trough and the head of the fish were immersed in a small tank filled with a 20 mg/l aerated benzocaine solution. A small flexible tube, within a facial mask that covers the front end of the head, was induced in the mouth of the fish and the benzocaine solution was pumped through the gills to ensure proper aeration during the surgical procedure.

All surgical equipment and transponders were cold sterilized. Also sterile surgical gloves and drapes were used. A small mid-ventral incision was made (maximum of two cm), starting about one cm posterior to the pelvic. The disinfected transponder was positioned in the peritoneal cavity, directly under the incision, after which it was closed with three simple interrupted stitches that were tied with surgeons' knots, using Vicryl® 3/0 FS-1 Ethicon.

After surgery, fish were kept individually in a small well aerated recovery tank for observation. When the smolt was reacting normally, in terms of breathing, equilibrium and swimming motion, it was placed in one of the two larger holding tanks (water temperature: 8°C). For reasons unknown two smolts did not recover from the surgery. Transponders were recovered and reused.

On March 13th 2020 all smolts were transported from the operation in the Netherlands site to their respective release sites in Germany. Again the transportation was performed by employees of Alltech Coppens Aqua Centre B.V. The first batch of 100 tagged smolts (plus 9 not tagged smolts) was released in the river Sieg, Wahnachtalstrasse, 53721 Siegburg (figure 2.4), just after 16:30 hours. The second batch of 100 smolts (plus 9 not tagged smolts) was released into the river Wupper, Wupperhof 6 42659 Solingen (figure 2.5), around 17:00 hours.



Figure 2.3. Surgical procedure. A) Anaesthetised smolt; B) Smolt being weighed; C) Life support system, and D) V-shaped trough with smolt in it.

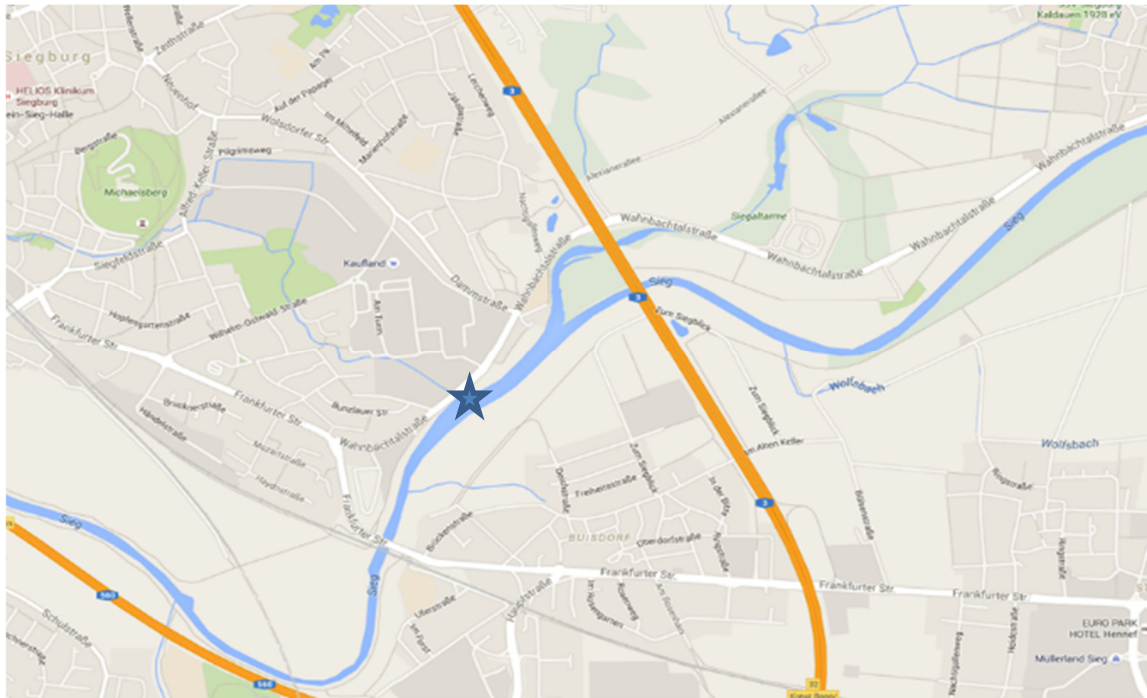


Figure 2.4. Release site on the River Sieg.

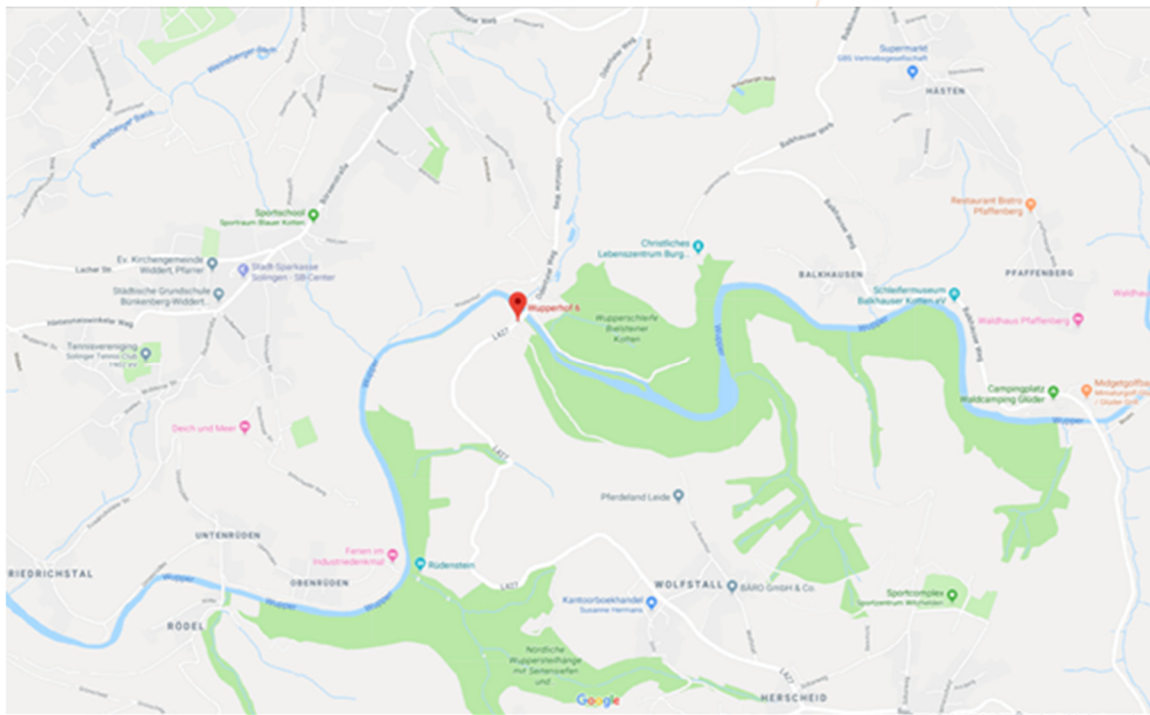


Figure 2.4. Release site on the River Wupper.

3 SMOLT DATA

In appendix I the information of the individual tagged salmon smolts is shown (data are sorted by river and transponder number). The total length (nearest cm) of the tagged salmon smolts was 28.0 ± 1.5 cm (mean $\pm$ STD), normally distributed (figure 3.1). The minimum length of the tagged fish was 25 cm and the maximum length was 32 cm. The weight was 215.1 ± 31.9 g (mean $\pm$ STD) (figure 3.2). The minimum weight was 153 g and the maximum weight was 317 g. Figure 3.3 shows the length-weight relation of all tagged smolts and can be described by the formula $y=19,798x - 338,59$. Everything went as planned and no problems were encountered.

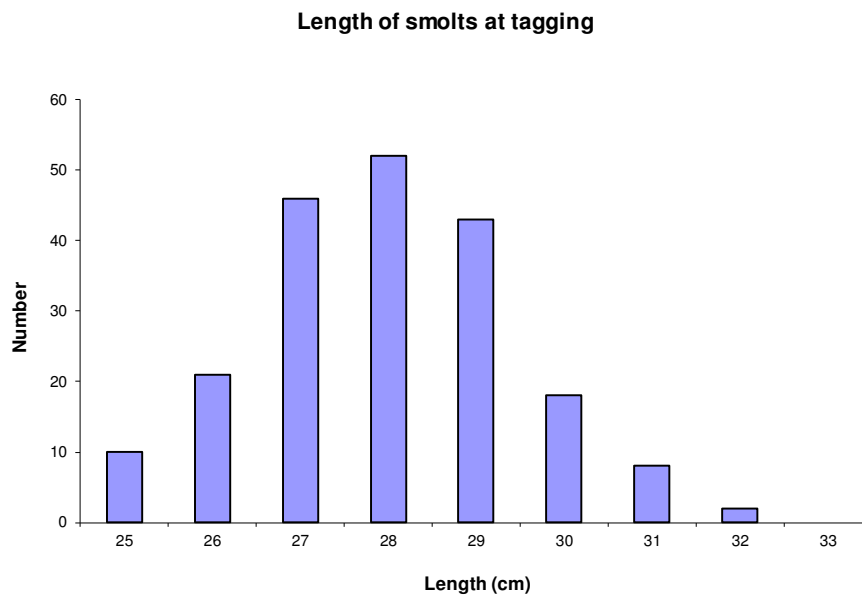


Figure 3.1. Length frequency distribution of the tagged smolts.

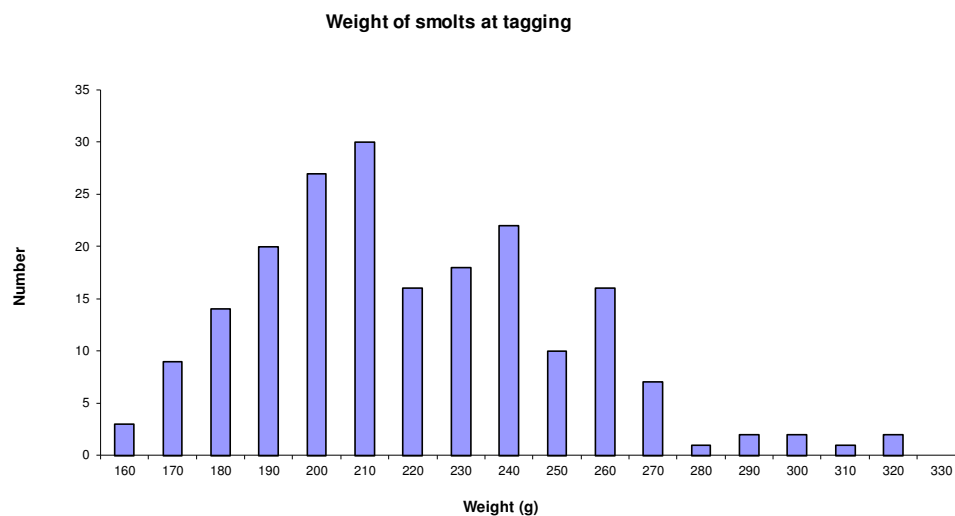


Figure 3.2. Weight distribution of the tagged smolts.

Length-weight relation smolts

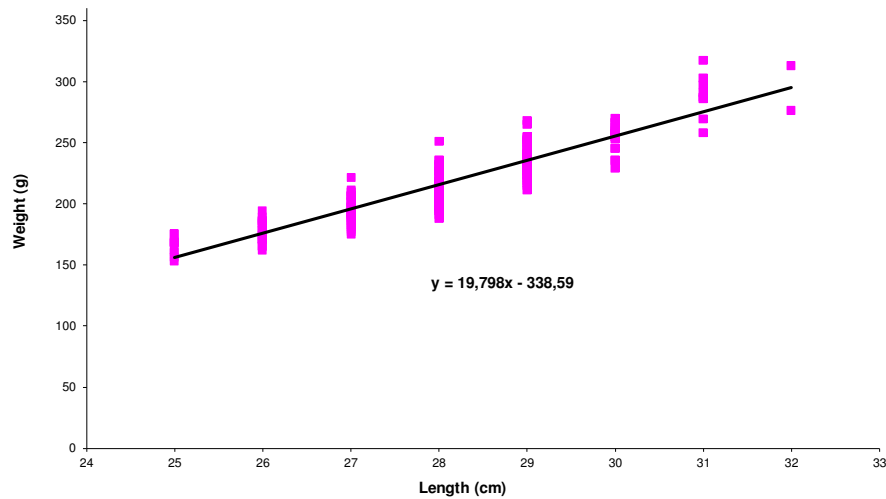


Figure 3.3. Length weight distribution of smolts (black: trend line).

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APPENDIX 1 SMOLT TAGGING DATA 2020

(data are sorted by river of release and transponder number, fish number is the actual sequence in which the fish were implanted)

Sieg 1

Number	Species	Origin	Transponder	G (g)	TL (cm)	Group	Surgeon	Date of tagging	Date of release	Time of release
15	SM	Albaum	18578	178,0	26,0	Sieg	MV	10-3-2020	13-3-2020	15:30
13	SM	Albaum	18579	188,0	27,0	Sieg	MV	10-3-2020	13-3-2020	15:30
66	SM	Albaum	18580	260,0	30,0	Sieg	KS	10-3-2020	13-3-2020	15:30
35	SM	Albaum	18581	250,0	29,0	Sieg	TV	10-3-2020	13-3-2020	15:30
24	SM	Albaum	18582	196,0	27,0	Sieg	TV	10-3-2020	13-3-2020	15:30
3	SM	Albaum	18583	169,0	26,0	Sieg	TV	10-3-2020	13-3-2020	15:30
22	SM	Albaum	18584	185,0	26,0	Sieg	TV	10-3-2020	13-3-2020	15:30
19	SM	Albaum	18585	313,0	32,0	Sieg	TV	10-3-2020	13-3-2020	15:30
10	SM	Albaum	18586	191,0	27,0	Sieg	MV	10-3-2020	13-3-2020	15:30
8	SM	Albaum	18587	249,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
6	SM	Albaum	18588	183,0	26,0	Sieg	MV	10-3-2020	13-3-2020	15:30
2	SM	Albaum	18589	231,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
32	SM	Albaum	18590	245,0	30,0	Sieg	MV	10-3-2020	13-3-2020	15:30
20	SM	Albaum	18591	210,0	28,0	Sieg	MV	10-3-2020	13-3-2020	15:30
17	SM	Albaum	18592	197,0	27,0	Sieg	MV	10-3-2020	13-3-2020	15:30
12	SM	Albaum	18593	209,0	27,0	Sieg	MV	10-3-2020	13-3-2020	15:30
18	SM	Albaum	18594	175,0	27,0	Sieg	TV	10-3-2020	13-3-2020	15:30
14	SM	Albaum	18595	286,0	31,0	Sieg	TV	10-3-2020	13-3-2020	15:30
16	SM	Albaum	18596	266,0	30,0	Sieg	TV	10-3-2020	13-3-2020	15:30
11	SM	Albaum	18597	175,0	25,0	Sieg	TV	10-3-2020	13-3-2020	15:30
9	SM	Albaum	18598	225,0	28,0	Sieg	TV	10-3-2020	13-3-2020	15:30
7	SM	Albaum	18599	231,0	28,0	Sieg	TV	10-3-2020	13-3-2020	15:30
5	SM	Albaum	18600	255,0	30,0	Sieg	TV	10-3-2020	13-3-2020	15:30
1	SM	Albaum	18601	197,0	27,0	Sieg	TV	10-3-2020	13-3-2020	15:30
4	SM	Albaum	18602	207,0	28,0	Sieg	MV	10-3-2020	13-3-2020	15:30
60	SM	Albaum	18603	192,0	27,0	Sieg	TV	10-3-2020	13-3-2020	15:30
37	SM	Albaum	18605	223,0	29,0	Sieg	TV	10-3-2020	13-3-2020	15:30
39	SM	Albaum	18606	219,0	28,0	Sieg	TV	10-3-2020	13-3-2020	15:30
41	SM	Albaum	18607	178,0	26,0	Sieg	TV	10-3-2020	13-3-2020	15:30
43	SM	Albaum	18608	171,0	26,0	Sieg	TV	10-3-2020	13-3-2020	15:30
45	SM	Albaum	18609	160,0	25,0	Sieg	TV	10-3-2020	13-3-2020	15:30
42	SM	Albaum	18610	229,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
44	SM	Albaum	18611	210,0	27,0	Sieg	MV	10-3-2020	13-3-2020	15:30
46	SM	Albaum	18612	317,0	31,0	Sieg	MV	10-3-2020	13-3-2020	15:30
49	SM	Albaum	18613	236,0	30,0	Sieg	MV	10-3-2020	13-3-2020	15:30
67	SM	Albaum	18614	245,0	29,0	Sieg	MV	11-3-2020	13-3-2020	15:30
47	SM	Albaum	18615	186,0	27,0	Sieg	TV	10-3-2020	13-3-2020	15:30
48	SM	Albaum	18616	214,0	28,0	Sieg	TV	10-3-2020	13-3-2020	15:30
50	SM	Albaum	18617	197,0	27,0	Sieg	TV	10-3-2020	13-3-2020	15:30
52	SM	Albaum	18618	199,0	28,0	Sieg	TV	10-3-2020	13-3-2020	15:30
54	SM	Albaum	18619	227,0	29,0	Sieg	TV	10-3-2020	13-3-2020	15:30
56	SM	Albaum	18620	233,0	29,0	Sieg	TV	10-3-2020	13-3-2020	15:30
51	SM	Albaum	18621	244,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
53	SM	Albaum	18622	202,0	28,0	Sieg	MV	10-3-2020	13-3-2020	15:30
55	SM	Albaum	18623	205,0	28,0	Sieg	MV	10-3-2020	13-3-2020	15:30
57	SM	Albaum	18624	231,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
58	SM	Albaum	18625	204,0	28,0	Sieg	TV	10-3-2020	13-3-2020	15:30
64	SM	Albaum	18626	232,0	28,0	Sieg	TV	10-3-2020	13-3-2020	15:30
62	SM	Albaum	18627	179,0	26,0	Sieg	TV	10-3-2020	13-3-2020	15:30
61	SM	Albaum	18628	174,0	26,0	Sieg	TV	10-3-2020	13-3-2020	15:30

Sieg 2

Number	Species	Origin	Transponder	G (g)	TL (cm)	Group	Surgeon	Date of tagging	Date of release	Time of release
21	SM	Albaum	18629	236,0	28,0	Sieg	MV	10-3-2020	13-3-2020	15:30
34	SM	Albaum	18630	240,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
36	SM	Albaum	18631	190,0	27,0	Sieg	MV	10-3-2020	13-3-2020	15:30
38	SM	Albaum	18632	239,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
40	SM	Albaum	18633	240,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
33	SM	Albaum	18635	215,0	28,0	Sieg	TV	10-3-2020	13-3-2020	15:30
31	SM	Albaum	18636	262,0	30,0	Sieg	TV	10-3-2020	13-3-2020	15:30
26	SM	Albaum	18637	234,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
23	SM	Albaum	18638	202,0	27,0	Sieg	MV	10-3-2020	13-3-2020	15:30
28	SM	Albaum	18639	252,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
30	SM	Albaum	18640	268,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
25	SM	Albaum	18641	169,0	25,0	Sieg	TV	10-3-2020	13-3-2020	15:30
27	SM	Albaum	18642	184,0	26,0	Sieg	TV	10-3-2020	13-3-2020	15:30
29	SM	Albaum	18643	207,0	27,0	Sieg	TV	10-3-2020	13-3-2020	15:30
84	SM	Albaum	18644	223,0	29,0	Sieg	JW	11-3-2020	13-3-2020	15:30
86	SM	Albaum	18645	233,0	29,0	Sieg	JW	11-3-2020	13-3-2020	15:30
88	SM	Albaum	18646	207,0	27,0	Sieg	JW	11-3-2020	13-3-2020	15:30
90	SM	Albaum	18647	201,0	27,0	Sieg	JW	11-3-2020	13-3-2020	15:30
92	SM	Albaum	18648	165,0	26,0	Sieg	JW	11-3-2020	13-3-2020	15:30
93	SM	Albaum	18650	219,0	28,0	Sieg	MV	11-3-2020	13-3-2020	15:30
95	SM	Albaum	18651	245,0	30,0	Sieg	MV	11-3-2020	13-3-2020	15:30
97	SM	Albaum	18652	254,0	29,0	Sieg	MV	11-3-2020	13-3-2020	15:30
99	SM	Albaum	18653	227,0	28,0	Sieg	MV	11-3-2020	13-3-2020	15:30
94	SM	Albaum	18657	199,0	27,0	Sieg	JW	11-3-2020	13-3-2020	15:30
96	SM	Albaum	18658	226,0	28,0	Sieg	JW	11-3-2020	13-3-2020	15:30
98	SM	Albaum	18659	215,0	28,0	Sieg	JW	11-3-2020	13-3-2020	15:30
100	SM	Albaum	18660	221,0	27,0	Sieg	JW	11-3-2020	13-3-2020	15:30
59	SM	Albaum	18729	186,0	27,0	Sieg	MV	10-3-2020	13-3-2020	15:30
71	SM	Albaum	18730	168,0	25,0	Sieg	MV	11-3-2020	13-3-2020	15:30
63	SM	Albaum	18731	233,0	29,0	Sieg	MV	10-3-2020	13-3-2020	15:30
65	SM	Albaum	18732	171,0	26,0	Sieg	MV	10-3-2020	13-3-2020	15:30
70	SM	Albaum	18733	211,0	29,0	Sieg	JW	11-3-2020	13-3-2020	15:30
68	SM	Albaum	18734	219,0	29,0	Sieg	JW	11-3-2020	13-3-2020	15:30
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76	SM	Albaum	18736	206,0	28,0	Sieg	JW	11-3-2020	13-3-2020	15:30
74	SM	Albaum	18737	194,0	26,0	Sieg	JW	11-3-2020	13-3-2020	15:30
75	SM	Albaum	18738	218,0	28,0	Sieg	MV	11-3-2020	13-3-2020	15:30
73	SM	Albaum	18739	198,0	28,0	Sieg	MV	11-3-2020	13-3-2020	15:30
69	SM	Albaum	18740	235,0	29,0	Sieg	MV	11-3-2020	13-3-2020	15:30
77	SM	Albaum	18741	241,0	29,0	Sieg	MV	11-3-2020	13-3-2020	15:30
79	SM	Albaum	18742	244,0	29,0	Sieg	MV	11-3-2020	13-3-2020	15:30
78	SM	Albaum	18743	218,0	28,0	Sieg	JW	11-3-2020	13-3-2020	15:30
82	SM	Albaum	18744	209,0	28,0	Sieg	JW	11-3-2020	13-3-2020	15:30
91	SM	Albaum	18747	212,0	28,0	Sieg	MV	11-3-2020	13-3-2020	15:30
89	SM	Albaum	18748	230,0	28,0	Sieg	MV	11-3-2020	13-3-2020	15:30
81	SM	Albaum	18749	224,0	29,0	Sieg	MV	11-3-2020	13-3-2020	15:30
80	SM	Albaum	18750	224,0	28,0	Sieg	JW	11-3-2020	13-3-2020	15:30
83	SM	Albaum	18751	229,0	29,0	Sieg	MV	11-3-2020	13-3-2020	15:30
85	SM	Albaum	18752	226,0	28,0	Sieg	MV	11-3-2020	13-3-2020	15:30
87	SM	Albaum	18753	206,0	27,0	Sieg	MV	11-3-2020	13-3-2020	15:30

Wupper 1

Number	Species	Origin	Transponder	G (g)	TL (cm)	Group	Surgeon	Date of tagging	Date of release	Time of release
116	SM	Albaum	18634	267,0	30,0	Wupper	MV	11-3-2020	13-3-2020	17:00
102	SM	Albaum	18655	194,0	28,0	Wupper	MV	11-3-2020	13-3-2020	17:00
104	SM	Albaum	18656	270,0	30,0	Wupper	MV	11-3-2020	13-3-2020	17:00
101	SM	Albaum	18661	259,0	30,0	Wupper	JW	11-3-2020	13-3-2020	17:00
114	SM	Albaum	18662	205,0	27,0	Wupper	MV	11-3-2020	13-3-2020	17:00
112	SM	Albaum	18663	258,0	31,0	Wupper	MV	11-3-2020	13-3-2020	17:00
110	SM	Albaum	18667	175,0	25,0	Wupper	MV	11-3-2020	13-3-2020	17:00
108	SM	Albaum	18668	156,0	25,0	Wupper	MV	11-3-2020	13-3-2020	17:00
106	SM	Albaum	18669	205,0	28,0	Wupper	MV	11-3-2020	13-3-2020	17:00
109	SM	Albaum	18670	171,0	26,0	Wupper	JW	11-3-2020	13-3-2020	17:00
107	SM	Albaum	18671	179,0	27,0	Wupper	JW	11-3-2020	13-3-2020	17:00
105	SM	Albaum	18672	198,0	27,0	Wupper	JW	11-3-2020	13-3-2020	17:00
113	SM	Albaum	18673	221,0	28,0	Wupper	TV	11-3-2020	13-3-2020	17:00
132	SM	Albaum	18674	189,0	27,0	Wupper	TV	11-3-2020	13-3-2020	17:00
134	SM	Albaum	18675	153,0	25,0	Wupper	TV	11-3-2020	13-3-2020	17:00
136	SM	Albaum	18676	192,0	27,0	Wupper	TV	11-3-2020	13-3-2020	17:00
137	SM	Albaum	18677	186,0	26,0	Wupper	TV	11-3-2020	13-3-2020	17:00
144	SM	Albaum	18679	291,0	31,0	Wupper	KS	11-3-2020	13-3-2020	17:00
143	SM	Albaum	18680	188,0	28,0	Wupper	TV	11-3-2020	13-3-2020	17:00
142	SM	Albaum	18681	231,0	29,0	Wupper	TV	11-3-2020	13-3-2020	17:00
145	SM	Albaum	18683	191,0	27,0	Wupper	TV	11-3-2020	13-3-2020	17:00
140	SM	Albaum	18684	226,0	29,0	Wupper	TV	11-3-2020	13-3-2020	17:00
199	SM	Albaum	18685	189,0	26,0	Wupper	MV	12-3-2020	13-3-2020	17:00
146	SM	Albaum	18686	235,0	28,0	Wupper	KS	11-3-2020	13-3-2020	17:00
148	SM	Albaum	18687	216,0	28,0	Wupper	KS	11-3-2020	13-3-2020	17:00
161	SM	Albaum	18688	196,0	27,0	Wupper	TV	12-3-2020	13-3-2020	17:00
152	SM	Albaum	18689	187,0	26,0	Wupper	TV	12-3-2020	13-3-2020	17:00
147	SM	Albaum	18690	217,0	28,0	Wupper	TV	11-3-2020	13-3-2020	17:00
153	SM	Albaum	18691	205,0	28,0	Wupper	MV	12-3-2020	13-3-2020	17:00
151	SM	Albaum	18692	297,0	31,0	Wupper	MV	12-3-2020	13-3-2020	17:00
155	SM	Albaum	18693	182,0	27,0	Wupper	MV	12-3-2020	13-3-2020	17:00
150	SM	Albaum	18694	201,0	27,0	Wupper	TV	12-3-2020	13-3-2020	17:00
193	SM	Albaum	18695	196,0	28,0	Wupper	MV	12-3-2020	13-3-2020	17:00
159	SM	Albaum	18696	162,0	26,0	Wupper	MV	12-3-2020	13-3-2020	17:00
163	SM	Albaum	18697	255,0	30,0	Wupper	MV	12-3-2020	13-3-2020	17:00
156	SM	Albaum	18698	252,0	29,0	Wupper	TV	12-3-2020	13-3-2020	17:00
158	SM	Albaum	18700	276,0	32,0	Wupper	TV	12-3-2020	13-3-2020	17:00
160	SM	Albaum	18701	211,0	27,0	Wupper	TV	12-3-2020	13-3-2020	17:00
176	SM	Albaum	18702	210,0	28,0	Wupper	TV	12-3-2020	13-3-2020	17:00
123	SM	Albaum	18703	198,0	28,0	Wupper	TV	11-3-2020	13-3-2020	17:00
117	SM	Albaum	18704	232,0	29,0	Wupper	TV	11-3-2020	13-3-2020	17:00
115	SM	Albaum	18705	194,0	27,0	Wupper	TV	11-3-2020	13-3-2020	17:00
157	SM	Albaum	18706	205,0	28,0	Wupper	MV	12-3-2020	13-3-2020	17:00
149	SM	Albaum	18707	235,0	30,0	Wupper	KS	11-3-2020	13-3-2020	17:00
124	SM	Albaum	18708	217,0	29,0	Wupper	MV	11-3-2020	13-3-2020	17:00
122	SM	Albaum	18709	195,0	28,0	Wupper	MV	11-3-2020	13-3-2020	17:00
120	SM	Albaum	18710	287,0	31,0	Wupper	MV	11-3-2020	13-3-2020	17:00
118	SM	Albaum	18711	191,0	28,0	Wupper	MV	11-3-2020	13-3-2020	17:00
121	SM	Albaum	18712	209,0	28,0	Wupper	TV	11-3-2020	13-3-2020	17:00
119	SM	Albaum	18714	177,0	27,0	Wupper	TV	11-3-2020	13-3-2020	17:00

Wupper 2

Number	Species	Origin	Transponder	G (g)	TL (cm)	Group	Surgeon	Date of tagging	Date of release	Time of release
130	SM	Albaum	18715	171,0	26,0	Wupper	TV	11-3-2020	13-3-2020	17:00
125	SM	Albaum	18716	242,0	29,0	Wupper	TV	11-3-2020	13-3-2020	17:00
126	SM	Albaum	18717	192,0	27,0	Wupper	MV	11-3-2020	13-3-2020	17:00
129	SM	Albaum	18718	232,0	29,0	Wupper	MV	11-3-2020	13-3-2020	17:00
131	SM	Albaum	18719	206,0	27,0	Wupper	MV	11-3-2020	13-3-2020	17:00
141	SM	Albaum	18721	198,0	28,0	Wupper	MV	11-3-2020	13-3-2020	17:00
127	SM	Albaum	18722	257,0	30,0	Wupper	TV	11-3-2020	13-3-2020	17:00
128	SM	Albaum	18723	233,0	29,0	Wupper	TV	11-3-2020	13-3-2020	17:00
138	SM	Albaum	18724	162,0	25,0	Wupper	TV	11-3-2020	13-3-2020	17:00
139	SM	Albaum	18725	233,0	29,0	Wupper	MV	11-3-2020	13-3-2020	17:00
135	SM	Albaum	18726	202,0	27,0	Wupper	MV	11-3-2020	13-3-2020	17:00
133	SM	Albaum	18727	241,0	29,0	Wupper	MV	11-3-2020	13-3-2020	17:00
154	SM	Albaum	18728	209,0	28,0	Wupper	TV	12-3-2020	13-3-2020	17:00
103	SM	Albaum	18745	229,0	30,0	Wupper	JW	11-3-2020	13-3-2020	17:00
111	SM	Albaum	18746	189,0	27,0	Wupper	TV	11-3-2020	13-3-2020	17:00
170	SM	Albaum	18754	256,0	30,0	Wupper	TV	12-3-2020	13-3-2020	17:00
168	SM	Albaum	18755	269,0	31,0	Wupper	TV	12-3-2020	13-3-2020	17:00
166	SM	Albaum	18756	260,0	30,0	Wupper	TV	12-3-2020	13-3-2020	17:00
162	SM	Albaum	18758	194,0	28,0	Wupper	TV	12-3-2020	13-3-2020	17:00
200	SM	Albaum	18759	207,0	27,0	Wupper	TV	12-3-2020	13-3-2020	17:00
164	SM	Albaum	18760	168,0	25,0	Wupper	TV	12-3-2020	13-3-2020	17:00
171	SM	Albaum	18761	215,0	29,0	Wupper	MV	12-3-2020	13-3-2020	17:00
169	SM	Albaum	18762	303,0	31,0	Wupper	MV	12-3-2020	13-3-2020	17:00
167	SM	Albaum	18763	199,0	28,0	Wupper	MV	12-3-2020	13-3-2020	17:00
165	SM	Albaum	18764	253,0	30,0	Wupper	MV	12-3-2020	13-3-2020	17:00
191	SM	Albaum	18765	208,0	28,0	Wupper	MV	12-3-2020	13-3-2020	17:00
175	SM	Albaum	18766	191,0	27,0	Wupper	MV	12-3-2020	13-3-2020	17:00
178	SM	Albaum	18767	198,0	27,0	Wupper	MV	12-3-2020	13-3-2020	17:00
173	SM	Albaum	18768	251,0	28,0	Wupper	MV	12-3-2020	13-3-2020	17:00
172	SM	Albaum	18769	183,0	27,0	Wupper	TV	12-3-2020	13-3-2020	17:00
174	SM	Albaum	18770	206,0	28,0	Wupper	TV	12-3-2020	13-3-2020	17:00
177	SM	Albaum	18771	251,0	29,0	Wupper	TV	12-3-2020	13-3-2020	17:00
179	SM	Albaum	18772	190,0	27,0	Wupper	TV	12-3-2020	13-3-2020	17:00
181	SM	Albaum	18773	186,0	26,0	Wupper	TV	12-3-2020	13-3-2020	17:00
180	SM	Albaum	18774	168,0	25,0	Wupper	MV	12-3-2020	13-3-2020	17:00
183	SM	Albaum	18775	204,0	28,0	Wupper	MV	12-3-2020	13-3-2020	17:00
194	SM	Albaum	18776	255,0	29,0	Wupper	TV	12-3-2020	13-3-2020	17:00
184	SM	Albaum	18777	221,0	29,0	Wupper	TV	12-3-2020	13-3-2020	17:00
182	SM	Albaum	18778	204,0	27,0	Wupper	TV	12-3-2020	13-3-2020	17:00
185	SM	Albaum	18779	165,0	26,0	Wupper	MV	12-3-2020	13-3-2020	17:00
196	SM	Albaum	18780	230,0	29,0	Wupper	TV	12-3-2020	13-3-2020	17:00
198	SM	Albaum	18781	265,0	29,0	Wupper	TV	12-3-2020	13-3-2020	17:00
197	SM	Albaum	18782	184,0	27,0	Wupper	MV	12-3-2020	13-3-2020	17:00
195	SM	Albaum	18783	176,0	26,0	Wupper	MV	12-3-2020	13-3-2020	17:00
190	SM	Albaum	18784	215,0	28,0	Wupper	TV	12-3-2020	13-3-2020	17:00
192	SM	Albaum	18785	232,0	28,0	Wupper	TV	12-3-2020	13-3-2020	17:00
188	SM	Albaum	18786	204,0	28,0	Wupper	TV	12-3-2020	13-3-2020	17:00
186	SM	Albaum	18787	181,0	27,0	Wupper	TV	12-3-2020	13-3-2020	17:00
189	SM	Albaum	18788	188,0	27,0	Wupper	MV	12-3-2020	13-3-2020	17:00
187	SM	Albaum	18789	257,0	30,0	Wupper	MV	12-3-2020	13-3-2020	17:00