

**TESTON THE FISH-FRIENDLINESS OF THE PUMPS**  
**OF PUMPING-STATION DE NIEUWE HORN**



Author: HenkJan van Essen

## General details regarding the test on fish-friendliness

### Project Information:

Project Name : Renovation pumping-station De Nieuwe Horn

Project and Test Location : Meerdijk 26 te Acquoy  
Pumps : Fish-friendly pumps , type VPF1-1400.200,vertical position with concrete volutes.

Specification : T001-4737931  
Our Reference : 4111397  
Test Date : 20-11-2013  
Report Date : 26-11-2013

### Client:

Waterschap Rivierenland  
De Blomboogerd1  
4003BX Tiel

Project-leader : Mr. R. Heida

### Test executed by:

FishFlow Innovations  
Dissel 4  
1671NG Medemblik

Contact-person : Mr. G. Manshanden

### On behalf of:

Nijhuis Pompen B.V.(Pentair Fairbanks Nijhuis)  
Parallelweg 4  
7102DE Winterswijk

Contact-person : Mr. H.J. van Essen

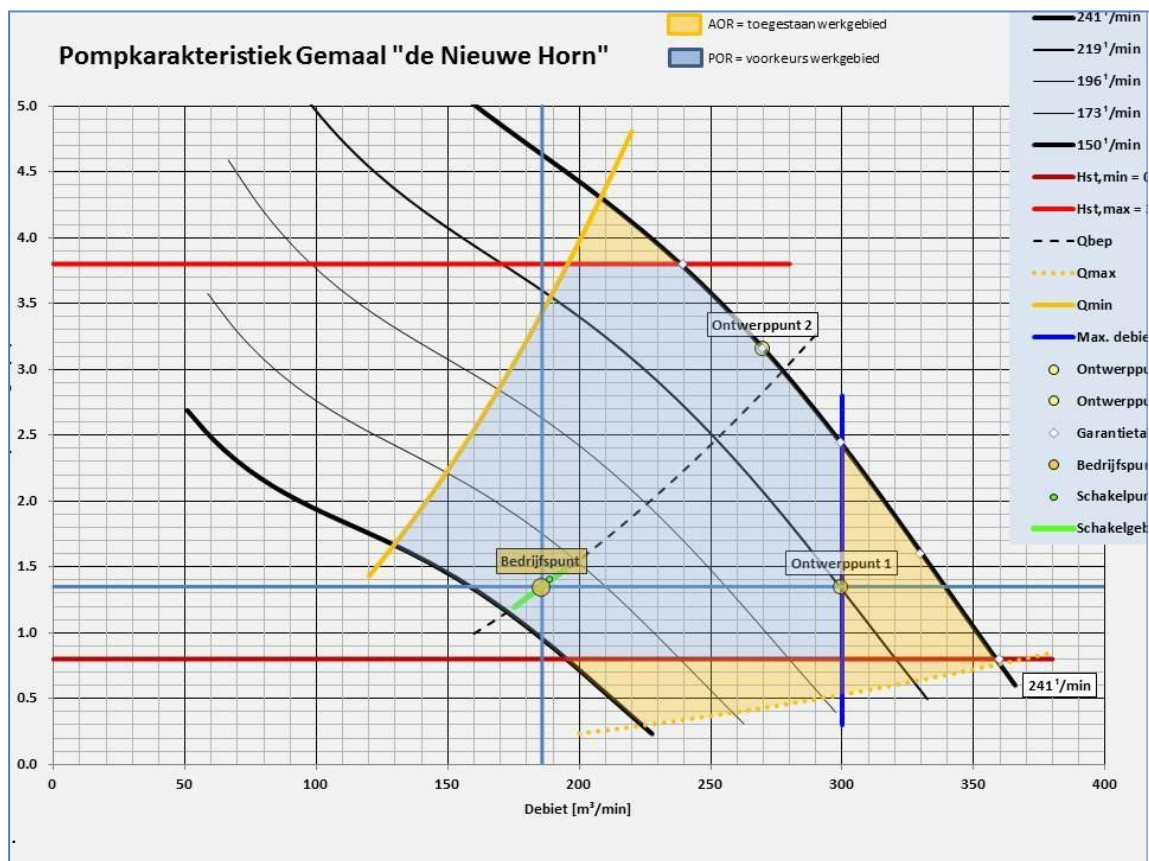
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## 1. Starting Points

For the purpose of renovation of pumping-station De Nieuwe Horn, Nijhuis Pumps BV has installed two new fish-friendly pumps provided with electric drive, according to the test chart as shown in Figure 1

Figure 1



In accordance with the tender requirement one of the pumps (pump 1) is tested for the extent of fish-friendliness.

The survival rate of passing fish(migratory course) was specified herein at a minimum of 85% at maximum speed and a minimum of 95% at minimum speed.

At the time of testing, the average static head was 1.5Mwc.

Note: In a previous study of STOWA an association between the speed of a lifting tool and the level of damage to fish was only evident. The static head herein is not decisive (Source: STOWA study "Gemalen of vermalen worden" - "Pumped or minced").

## 2 Attendees

### Executing parties:

Mr. G. Manshanden	: FishFlow Innovations
Mr. N. Manshanden	: FishFlow Innovations
Mr. A. Betting	: Nijhuis Pompen B.V.(as from test3)
Mr. W. Vermeulen	: Nijhuis Services B.V.(Zevenbergen)
Mr .H.J. van Essen	: Nijhuis Pompen B.V.

### Witnesses:

Mr. R. Heida	: H.B.C.Projectmanagement.Project-leader on behalf of Waterschap Rivierenland ((Internal Drainage Board))for pumping-station De Nieuwe Horn. Witnessed all tests.
Mr. P. van den Anker	: BAM Civils Southwest.Main Contractor for pumping-station Waterdunen; Waterschap Scheldestromen (Internal Drainage Board). Witnessed all tests.
Mr. M. Venbrux	: Waterschap Rivierenland (Internal Drainage Board) Superintendant Mechanical Engineer Witnessed as from 4
Mr. M. van Wingerden	: Waterschap Scheldestromen. (Internal Drainage Board) Policy Officer Aquatic Ecology and Fish Management Witnessed as from test 4
Mr.F.Bommeljé Project Manager	: WaterschapScheldestromen.(Internal Drainage Board) Witnessed as from test 4



### 3. Test set up

The pumps have been tested on the basis of a natural fish migration through the pumps. Therefore this was dependent on the fish supply.

At the end of the discharge pipe a frame was mounted with a net attached to the recesses of the frame (Figure 2). The net was provided with a fyke net where the fish ended up in a funnel at the end of which they were collected (Figure 3)



Figure 3.

## 4. Results

### Test 1

Pump on : 09.40 am  
 Pump off : 10.00 am  
 Speed : 155 revs/min.  
 Capacity : 160 m<sup>3</sup>/min.  
 Hstat. : 1.45 mwc

No fish passed the pumps at minimum speed

### Test 2

Pump on : 10.10 am  
 Pump off : 10.30 am  
 Speed : 261 revs/min.  
 Capacity : 372 m<sup>3</sup>/min.  
 Hstat. : 1.45 mwc

Fish Species	Length (cm)	No damage	Scale Damage		Total Quantity
			By Pump	By Net	
Bream	10-14	27			27
	15 - 19	1			1
	20 - 24	1			1
Perch	22	1			1
Total		30	0	0	30



Figure 4.

### Test 3

Pump on : 10.50 am  
 Pumpoff : 11.50 am  
 Speed : 219 revs/min.  
 Capacity : 295 m<sup>3</sup>/min.  
 Hstat. : 1.5 mwc

Fish Species	Length (cm)	No Damage	Scale Damage		Total Quantity	Comments
			By pump	Bynet		
Bream	10-14	2			2	Light scale damage by the net (figure 6).
	15 - 19	1		1	1	
Perch	27	1			1	
Roach	22	1			1	No damage visible, death by entrapment of the head in the net (figure 7).
Pike-Perch	15	1		1	1	
Total		6		2	6	

N.B.: The Bream, Roach and Pike-Perch were kept in an aerated storage tank for 48 hours after capture for observation of any delayed mortality.



Figure 5.



Figure 6.



Figure 7.



#### Test 4

Pump on : 12.10am.  
 Pump off : 13.26am  
 Speed : 221 revs/min.  
 Capacity : 300 m<sup>3</sup>/min.  
 Hstat. : 1.52 mwc

Fish Species	Length (cm)	No damage	Scale damage		Total Quantity
			By pump	By net	
Bream	10-14	7			7
Perch	10-14	2			2
Pikeperch	13	1			1
Total		10	0	0	10



Figure 8.



Figure 9.

From Test 5 the pumps were tested for Eels as well. These were added to the water. Because it was not a forced exposure for the Eels here, it was possible that an amount of Eels were not captured. Presumably these swam back, remained in the pipe, swam back from the pipe, or swam out of the discharge pipe when the net was raised.

Since there were no "pieces" of Eel or floating dead eel found in the water, it is assumed that the above-mentioned reasons are the cause of the Eels that went missing.

All Eels were checked for damage before the test. The results presented below are, therefore, on the basis of the difference of injury to the Eels before and after the test.

All captured Eels have survived the test of delayed mortality.

### Test 5

Pump on : 13.45 am  
 Pump off : 14.00 am  
 Speed : 200 revs/min.  
 Capacity : 260 m³/min.  
 Hstat. : 1.5 mwc

Fish Species	Length (cm)	No Damage	Scale Damage		Not captured	Total Quantity
			By pump	By net		
Eel	70	1			1	2
	73				1	1
	74				2	2
	76				1	1
Bream	10-14	2				2
Total		3	0	0	5	8

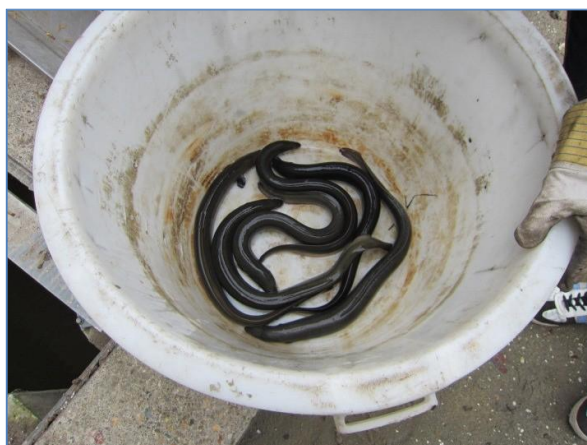


Figure 10 (Eels before being added to the water).



Figure 11 (captured after the test).

### Test 6

Pump on : 14.10 am (pump remains on until end of test 8)  
 Pump off : 15.15 am (end test 8).  
 Speed : 220 revs/min.  
 Capacity : 302 m<sup>3</sup>/min.  
 Hstat. : 1.5 mwc

Fish Species	Length (cm)	Number	Scale Damage		Not captured	Total Quantity
			By Pump	By net		
Eel	68	1			1	1
	74				1	1
	75					1
	77					1
	80				1	1
	81	1			1	1
Bream	10-14	2				2
Pikeperch	18	1				1
Total		5	0	0	4	9



Figure 12 (before the test).



Figure 13 (captured).

Test 7

Start test : 14.40 am (pump remains on until end of test 8)  
 Pump off : 15.15 am (endtest8).  
 Speed : 254 revs/min.  
 Capacity : 370 m³/min.  
 Hstat. : 1.5 mwc

Fish Species	Length (cm)	No damage	Scale Damage		Not Captured	Total Quantity
			By pump	By Net		
Eel	67	1				1
	68	1				1
	69	1				1
	70	1			1	2
	72	1				1
	76				2	2
Total		5	0	0	3	8

Test 8

Start test : 15.00am.  
 Pump off : 15.15am.  
 Speed : 254 revs/min.  
 Capacity : 370 m³/min.  
 Hstat. : 1.5 mwc

Fish Species	Length (cm)	No damage	Scale Damage		Not captured	Total Quantity
			By	By net		
Eel	58 - 62				3	3
	63 - 67				2	2
	68 - 72	1			6	7
	73 - 77	3			3	6
	78 - 82	1				1
Bream	14	1				1
Pikeperch	14	1				1
Total		7	0	0	14	21



## 5. Summary

Table 5.1 shows the total number of fish captured, the classification is based on natural features and Eels have been added in length groups.

One fish showed scale damage which was most likely caused by the net. Given that the fish were not checked before capture, it cannot be said with certainty whether the lesions were already present on the fish. The damage, however, looked 'fresh'. The fish did not show the kind of damage normally caused by pumps.

Another fish showed no injury but was dead. The fish had his head stuck in the net and tried to escape in vain, with resulted in death. This is shown as scale damage in the table.

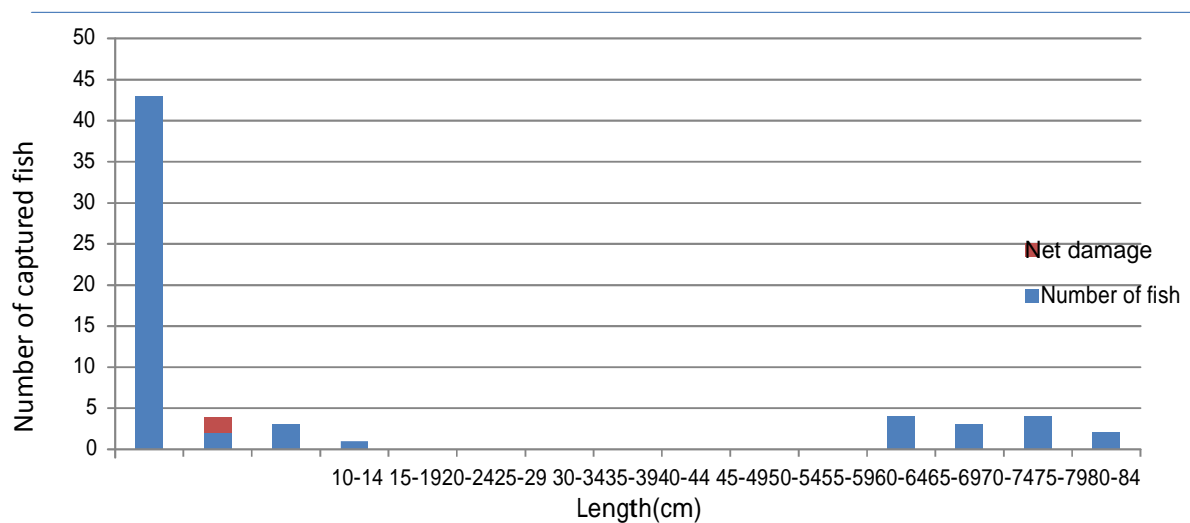


Table 5.1

### Delayed Mortality:

The Bream, Perch and Pike-perch from test 3 and all captured Eels have been kept for 48 hours in an aerated storage tank. This to observe whether any delayed mortality would take place. After 48 hours all fish were still alive.





## **6. Conclusion**

From the results mentioned above, we can conclude that the tests concerning the fish-friendliness of the Pentair Fairbanks Nijhuis pumps were successful.

The tests took place later in the autumn. It is therefore likely that the supply of fish was lower than normal compared to earlier in the autumn.

This could be the reason that at minimum speed no fish was captured in Test 1 .

When the rotational speed was increased, the difference was clearly visible. At maximum speed, test 2, 30 fish were captured .

Despite the lower quantity of fish present, 66 fish in total were still captured with the fish damaged by the net included, in only two fish signs of injury or mortality was observed.

We can therefore conclude that the pumps at pumping station De Nieuwe Horn have caused fish no harm or death and that a score of 100% is achieved on level of fish-friendliness !

These tests also included two Eels which were greater than 80 cm

## **7. Closing Remarks**

I would like to thank everybody that has contributed to the execution or witnessing of this test.

I would like to thank Mr. Paul van den Anker in particular for the photography and permission to publish these.

Please do not hesitate to contact me if you have any questions in relation to this report.

Met vriendelijke groeten,



HenkJan van Essen