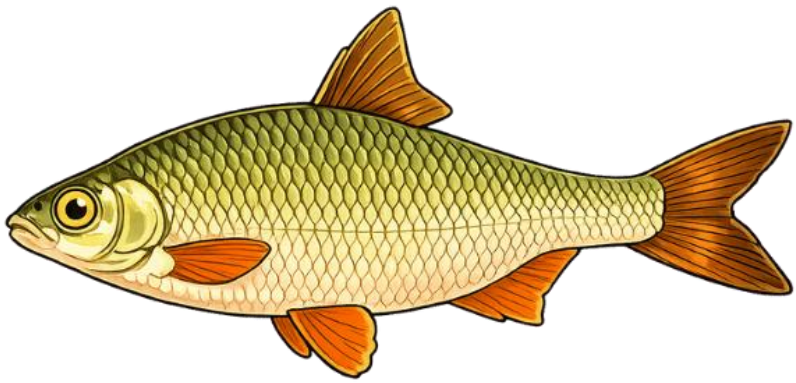
VALIDATION

Rutilis rutilis qPCR detection kit

SYL139

Document date: 13 November 2026



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1. *In silico* validation

Table 1. *In silico* validation of primers and probe

Parameter	Forward primer	Reverse primer	Probe*
Length (bp)	21	23	25
GC %	52	43	52
Stability	2.5	2.9	-
T_m (°C)	66	60	70
Target region	CytB (mtDNA)	CytB (mtDNA)	CytB (mtDNA)
Dimer formation	No	No	No
Nucleotide runs	No	No	No

*Probe labelled with FAM.

Table 2. *In silico* validation primers and probe combination

PCR product size (bp)	93
Combined dimer formation	No
***In silico* PCR on Genbank**	*Rutilis rutilis, Rutilus vegariticus, Rutilus heckelii*
Date of in silico PCR	May 2019

Conclusion:

The *in silico* analysis identified the target organism exclusively, with no predicted amplification of non-target taxa.

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2. Experimental validation

All validation experiments were conducted using the Sylphium qPCR mix and analyzed with the Applied biosystems 7300 qPCR instrument.

2.1. Analytical sensitivity, fluorescence output signal and efficiency

Standard solutions containing nominal target concentrations of 10^4, 10^3, 10^2, 10, 1 and 0 target copies per reaction were analyzed at the optimal primer and probe concentrations. Fluorescence output was compared with the background signal, with a minimum 100-fold increase in fluorescence considered acceptable. Reaction conditions were optimized when fluorescence signals were insufficiently distinguishable from background noise.

The amplification efficiency of the primer and probe set was calculated from the slope of the standard curve and was considered acceptable when between 90% and 110%.

Results

Positive amplification was observed down to the lowest tested nominal concentration of **1 target copy per reaction**, demonstrating single-copy detection capability under the tested conditions (**Figure 1; Table 3**). The fluorescence output of positive reactions exceeded the predefined criterion of a 100-fold increase relative to the background signal.

The amplification efficiency of the assay was **98%**, indicating that the primer and probe set performed within the predefined acceptable efficiency range of 90-110% (**Figure 2; Table 4**).

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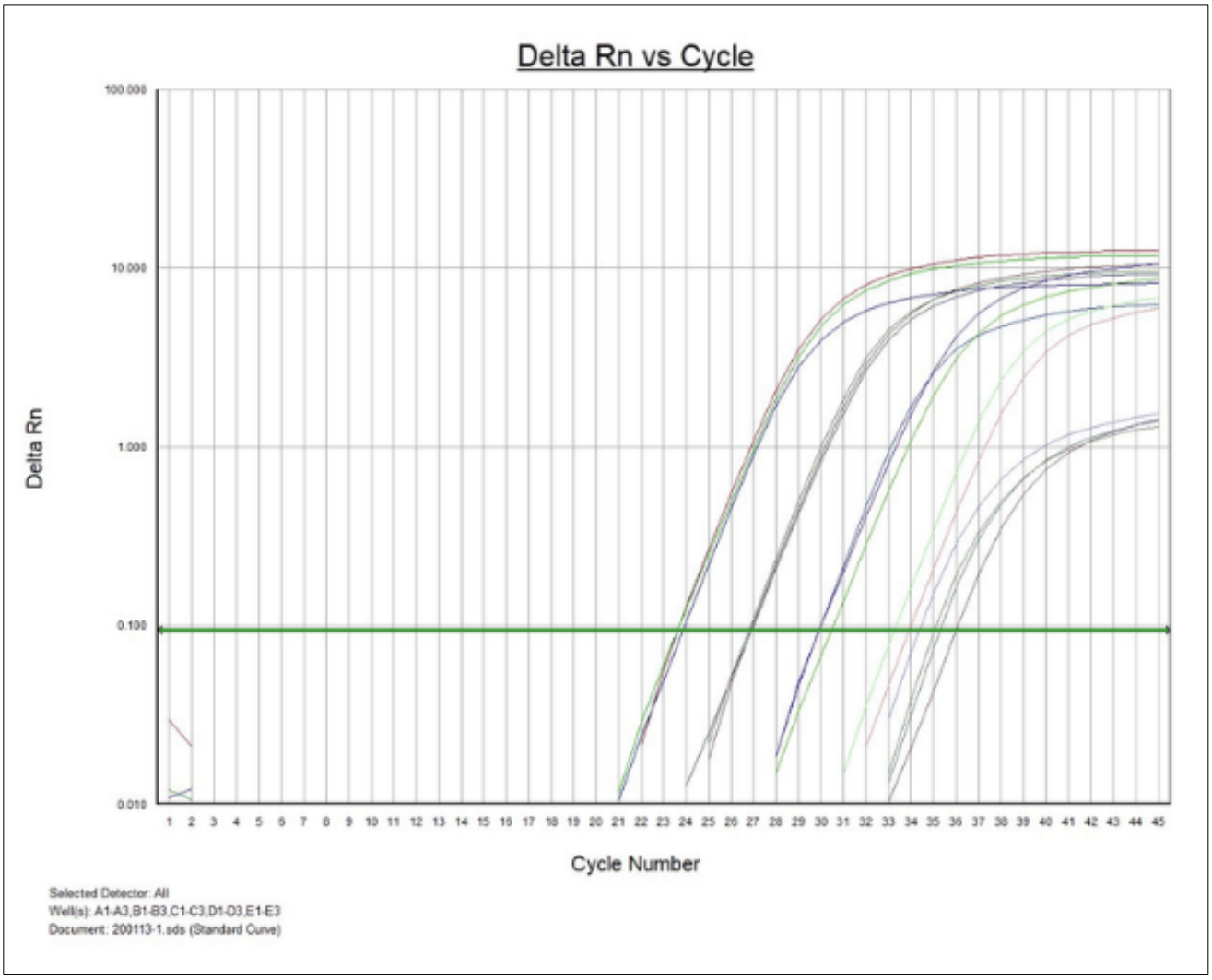


Figure 1. Amplification curves obtained at the optimal primer and probe concentrations and an annealing temperature of 58°C.

Table 3. Detection results and Cq values obtained at the optimal primer and probe concentrations and an annealing temperature of 58°C

Nominal target copies per reaction*	Target detected	Mean Cq	SD
0	No	-	-
1	Yes	35.4	0.5
10	Yes	33.8	0.5
10^2	Yes	30.0	0.3
10^3	Yes	26.8	0.1
10^4	Yes	23.6	0.2

***As estimated by gel electrophoresis.

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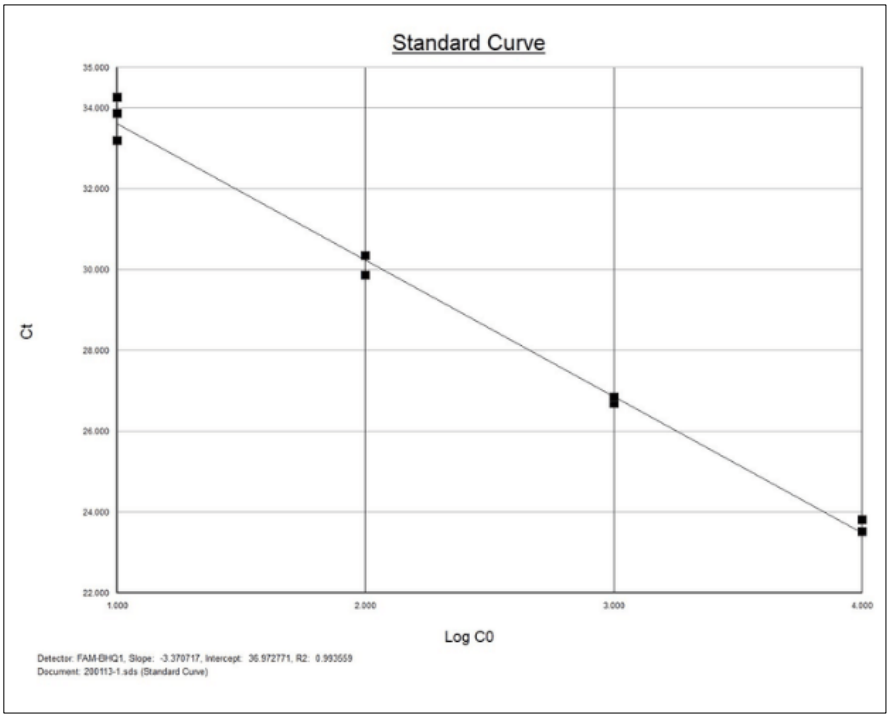


Figure 2. Standard curve generated from nominal target concentrations of 10, 10^2, 10^3, and 10^4 copies per reaction.

Table 4. Standard curve parameters obtained with the *Rutilis rutilis* qPCR detection kit

Parameter	Result
Slope	-3.37
Amplification efficiency (%)	98%
R^2	0.994

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2.3. Detection confirmation of *Rutilis rutilis* in environmental samples

The amount of eDNA released by a target organism into the environment depends on the target species, the environmental conditions, and season (CEN / TC230-water analysis, proposal documented in N 1229). Samples were collected with the **SYL009 Complete eDNA sampling set** and eDNA was isolated using the **SYL002 Environmental DNA isolation kit**.

Results:

The kit SYL139 - *Rutilis rutilis* detection kit successfully detected *Rutilis rutilis* DNA in environmental samples from different locations in Groningen, the Netherlands, when 100 mL water was filtrated.

PCR products obtained from positive environmental samples were analyzed by Sanger sequencing. The resulting sequences were identical, and BLAST analysis confirmed that the amplified products originated from *Rutilis rutilis*. No amplification was observed in the tested target-organism-free environmental samples.

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