

Table S1. Pearson correlation analyses among all variables assessed in the SML \*  $p \geq 0.05 \leq 0.1$  (marginally significant); \*\*  $p \leq 0.05$ ; \*\*\* $p \leq 0.005$ ; NS: no significant. For units see Tables 2 and 3

	UV	Wind	Sal	NO <sub>3</sub> <sup>-</sup>	NO <sub>2</sub> <sup>-</sup>	NH <sub>4</sub> <sup>+</sup>	SiO <sub>4</sub> <sup>4+</sup>	PO <sub>4</sub> <sup>3-</sup>	DOC	DMSP	PA	VA	V1	V2	V3	V4	HNF	HNF≤2	HNF2-5	HNF5-10	HNF10-20	PNF	PNF≤2	PNF2-5	PNF5-10	PNF10-20
UV	1	0.598***	NS	-0.543*	NS	NS	NS	-0.524**	NS	NS	0.449**	0.583***	0.421*	0.658***	0.727***	NS	-0.506**	-0.611**	-0.506**	NS	0.609**	NS	-0.586**	NS	NS	0.507*
Wind	0.598***	1	NS	NS	-0.492*	NS	NS	NS	NS	-0.401*	NS	0.453***	NS	0.619***	0.803***	-0.693***	-0.420*	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sal	NS	NS	1		NS	NS	NS	NS	NS	0.806***	NS	0.532*	0.471*	NS	0.465*	NS	NS	-0.614**	NS	0.524*	NS	0.580*	NS	NS	NS	0.467*
NO <sub>3</sub> <sup>-</sup>	-0.543*	NS	NS	1	0.831***	NS	NS	0.906***	0.716***	NS	NS	-0.652**	NS	NS	NS	NS	NS	NS	NS	NS	NS	-0.620**	NS	-0.630**	NS	NS
NO <sub>2</sub> <sup>-</sup>	NS	-0.492*	NS	0.831***	1	NS	NS	0.815***	0.535*	NS	NS	-0.685***	-0.672**	-0.657***	NS	0.718***	NS	NS	NS	NS	NS	-0.566*	NS	-0.572*	NS	NS
NH <sub>4</sub> <sup>+</sup>	NS	NS	NS	NS	NS	1	-0.652**	NS	0.623**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-0.577*	NS	-0.604**	NS	-0.592*	NS	-0.958***
SiO <sub>4</sub> <sup>4+</sup>	NS	NS	NS	NS	NS	-0.652**	1	NS	-0.592**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PO <sub>4</sub> <sup>3-</sup>	-0.524*	NS	NS	0.906***	0.815***	NS	NS	1	0.619**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-0.777***	NS	-0.774**	NS	NS
DOC	NS	NS	NS	0.716***	0.535*	0.623**	-0.592**	0.619**	1	NS	NS	NS	NS	NS	-0.641**	NS	NS	NS	NS	NS	-0.677*	NS	NS	NS	NS	-0.813**
DMSP	NS	-0.401*	0.806***	NS	NS	NS	NS	NS	NS	1	NS	0.585**	0.612**	NS	NS	0.688***	NS	NS	NS	0.582**	NS	0.785***	NS	0.694***	NS	NS
PA	0.449**	NS	NS	NS	NS	NS	NS	NS	NS	NS	1	NS	NS	NS	NS	0.545**	NS	NS	NS	NS	NS	-0.535**	NS	NS	NS	NS
VA	0.583***	0.453***	0.532*	-0.652**	-0.685***	NS	NS	NS	NS	0.585**	NS	1	0.961***	0.909***	0.747***	NS	NS	NS	NS	0.923**	NS	0.433*	NS	NS	NS	NS
V1	0.421*	NS	0.471*	NS	-0.672**	NS	NS	NS	NS	0.612**	NS	0.961***	1	0.835***	0.596***	-0.394*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
V2	0.658***	0.619***	NS	NS	-0.657**	NS	NS	NS	NS	NS	NS	0.909***	0.835***	1	0.836***	-0.566**	NS	NS	NS	NS	0.673**	NS	NS	NS	NS	NS
V3	0.727***	0.803***	0.465*	NS	NS	NS	NS	NS	-0.641**	NS	NS	0.747***	0.596***	0.836***	1	-0.438*	NS	-0.506*	NS	0.468*	0.617**	0.502**	NS	NS	NS	NS
V4	NS	-0.693***	NS	NS	0.718***	NS	NS	NS	NS	0.688***	0.545**	NS	-0.394*	-0.566**	-0.438*	1	NS	NS	NS	NS	NS	0.671***	NS	0.756***	NS	NS
HNF	-0.506**	-0.420*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1	0.737**	0.888***	NS	NS	NS	NS	NS	NS	NS
HNF<2	-0.611**	NS	-0.614**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-0.506*	NS	0.737**	1	0.660***	NS	NS	NS	NS	NS	-0.626**	-0.595*
HNF2-5	-0.506**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.888***	0.660***	1	NS	NS	NS	NS	NS	NS	NS
HNF5-10	NS	NS	0.524*	NS	NS	-0.577*	NS	NS	NS	0.582**	NS	NS	NS	NS	0.468*	NS	NS	NS	NS	1	NS	0.646***	NS	0.539**	NS	NS
HNF10-20	0.609**	NS	NS	NS	NS	NS	NS	NS	-0.677*	NS	NS	NS	NS	0.673**	0.617**	NS	NS	NS	NS	NS	1	NS	-0.681**	NS	NS	NS
PNF	NS	NS	0.580*	-0.620**	-0.566*	-0.604**	NS	-0.777***	NS	0.785***	NS	0.433*	NS	NS	0.502**	0.671***	NS	NS	NS	0.646***	NS	1	NS	0.946***	NS	NS
PNF≤2	-0.586**	NS	NS	NS	NS	NS	NS	NS	NS	NS	-0.535**	NS	NS	NS	NS	NS	NS	NS	NS	NS	-0.681**	NS	1	NS	NS	NS
PNF2-5	NS	NS	NS	-0.637**	-0.572*	-0.592*	NS	-0.774***	NS	0.694***	NS	NS	NS	NS	NS	0.756***	NS	NS	NS	0.539**	NS	0.946***	NS	1	NS	NS
PNF5-10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-0.626**	NS	NS	NS	NS	NS	NS	1	NS
PNF10-20	0.507*	NS	0.467*	NS	NS	-0.958***	NS	NS	-0.813**	NS	NS	NS	NS	NS	NS	NS	NS	-0.595*	NS	NS	NS	NS	NS	NS	NS	1

Table S2. Pearson correlation analyses among all variables assessed in the SSW \*  $p \geq 0.05 \leq 0.1$  (marginally significant); \*\*  $p \leq 0.05$ ; \*\*\*  $p \leq 0.005$ ; NS: no significant. For units see Tables 2 and 3

	UV	WIND	Temp	Sal	NO <sub>3</sub> <sup>-</sup>	NO <sub>2</sub> <sup>-</sup>	NH <sub>4</sub> <sup>+</sup>	SiO <sub>4</sub> <sup>4+</sup>	PO <sub>4</sub> <sup>3-</sup>	DOC	DMSP	PA	VA	V1	V2	V3	V4	HNF	HNF2	HNF2-5	HNF5-10	HNF10-20	PNF	PNF2	PNF2-5	PNF5-10	PNF10-20	
UV	1	0.599***	NS	0.434**	NS	-0.526**	NS	-0.408*	-0.470**	-0.451*	NS	0.543**	0.481**	NS	0.557**	0.634***	NS	0.618****	-0.596***	-0.634***	NS	NS	NS	NS	NS	NS	NS	
wind	0.599***	1	NS	0.463*	NS	NS	NS	NS	NS	-0.489**	NS	NS	0.400*	NS	0.570**	0.686***	-0.693***	NS	-0.419*	NS	NS	NS	NS	NS	NS	NS	NS	
Temp	NS	NS	1	NS	NS	NS	NS	NS	NS	NS	0.642**	0.413*	NS	0.417*	NS	NS	NS	NS	NS	NS	NS	NS	0.477*	NS	0.495*	NS	NS	
Sal	0.434*	0.463**	NS	1	NS	NS	NS	NS	NS	-0.490**	0.732***	NS	0.408*	NS	0.418*	0.620***	NS	NS	-0.453*	NS	0.717***	NS	0.705***	NS	0.546**	0.437*	0.651**	
NO <sub>3</sub> <sup>-</sup>	NS	NS	NS	NS	1	0.853***	NS	0.421*	0.940***	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.636***	NS	NS	NS	
NO <sub>2</sub> <sup>-</sup>	-0.526**	NS	NS	NS	NS	0.853***	1	NS	0.492**	0.836***	NS	NS	NS	NS	NS	-0.475**	-0.429*	NS	NS	NS	NS	NS	NS	0.439*	0.522**	0.441*	NS	NS
NH <sub>4</sub> <sup>+</sup>	NS	NS	NS	NS	NS	NS	1	0.476**	NS	0.597***	-0.679***	NS	NS	NS	NS	NS	NS	NS	0.470**	NS	-0.732***	NS	-0.674***	NS	-0.611***	NS	NS	
SiO <sub>4</sub> <sup>4+</sup>	-0.408*	NS	NS	NS	NS	0.421*	0.492**	0.476**	1	0.581**	0.495*	NS	-0.561**	NS	NS	NS	NS	NS	0.502*	0.582**	0.455*	NS	NS	NS	NS	NS	-0.452*	NS
PO <sub>4</sub> <sup>3-</sup>	-0.470**	NS	NS	NS	NS	0.940***	0.836***	NS	NS	1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.566**	NS	NS	NS	
DOC	-0.451*	-0.489**	NS	NS	NS	NS	0.597***	0.495*	NS	1	NS	NS	NS	NS	NS	-0.480**	NS	NS	0.669***	NS	-0.617***	NS	-0.472**	NS	-0.405*	NS	NS	
DMSP	NS	NS	NS	0.642**	0.732***	NS	NS	-0.679***	NS	NS	1	NS	0.601**	0.561**	NS	0.584**	0.636**	NS	NS	NS	NS	NS	NS	0.827***	NS	0.729***	NS	NS
PA	0.543**	NS	0.413*	NS	NS	NS	NS	-0.561**	NS	NS	NS	1	NS	NS	NS	NS	0.422*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
VA	0.481**	0.400*	NS	0.408*	NS	NS	NS	NS	NS	NS	0.601**	NS	1	0.968***	0.921***	0.803***	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
V1	NS	NS	0.417*	NS	NS	NS	NS	NS	NS	NS	0.561**	NS	0.968***	1	0.846***	0.678***	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
V2	0.557**	0.570**	NS	0.418*	NS	-0.475**	NS	NS	NS	NS	NS	NS	0.921***	0.846***	1	0.865***	-0.531**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
V3	0.634***	0.686***	NS	0.620***	NS	-0.429*	NS	NS	NS	-0.480**	0.584**	NS	0.803***	0.678***	0.865***	1	-0.551*	NS	-0.600**	NS	0.601*	NS	0.453*	NS	NS	NS	NS	
V4	NS	-0.693***	NS	NS	NS	NS	NS	NS	NS	NS	0.636**	0.422*	NS	NS	-0.531**	-0.551**	1	NS	NS	NS	NS	NS	0.473*	NS	0.477*	NS	NS	
HNF	-0.618***	NS	NS	NS	NS	NS	NS	0.502*	NS	NS	NS	NS	NS	NS	NS	NS	NS	1	0.667***	0.947***	NS	NS	NS	NS	NS	NS	NS	
HNF≤2	-0.596***	-0.419*	NS	-0.453*	NS	NS	0.470**	0.582**	NS	0.669***	NS	NS	NS	NS	NS	-0.600**	NS	0.667***	1	0.527**	NS	NS	NS	NS	NS	NS	NS	
HNF2-5	-0.634***	NS	NS	NS	NS	NS	NS	0.455*	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.947***	0.527**	1	NS	NS	NS	NS	NS	NS		
HNF5-10	NS	NS	NS	0.717***	NS	NS	-0.732***	NS	NS	-0.617***	NS	NS	NS	NS	NS	0.601*	NS	NS	NS	NS	1	NS	0.698***	NS	0.475*	0.478*	NS	
HNF10-20	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1	NS	NS	NS	0.782***	NS	
PNF	NS	NS	0.477*	0.705***	NS	0.439*	-0.674***	NS	NS	-0.472**	0.827***	NS	NS	NS	NS	0.453*	0.473*	NS	NS	NS	NS	NS	1	NS	0.963***	NS	NS	
PNF≤2	NS	NS	NS	NS	NS	0.636***	0.522**	NS	NS	0.566**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1	NS	NS	NS	
PNF2-5	NS	NS	0.495*	0.546**	NS	0.441*	-0.611***	NS	NS	-0.405*	0.729***	NS	NS	NS	NS	NS	0.477*	NS	NS	NS	NS	NS	NS	NS	1	NS	NS	
PNF5-10	NS	NS	NS	0.437*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.478*	0.782***	NS	NS	NS	1	NS	
PNF10-20	NS	NS	NS	0.651**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1	

**Table S3.** Pearson correlation analyses of variables between SML and SSW

Variables	r	p	n
Sal	0.793	<b>&lt;0.0001</b>	17
PO <sub>4</sub> <sup>3-</sup>	0.860	<b>0.0001</b>	17
SiO <sub>4</sub> <sup>4-</sup>	-0.152	>0.05	13
NO <sub>3</sub> <sup>-</sup>	0.732	<b>0.004</b>	13
NO <sub>2</sub> <sup>-</sup>	0.774	<b>0.002</b>	18
NH <sub>4</sub> <sup>+</sup>	0.587	<b>0.03</b>	19
DOC	0.602	<b>0.04</b>	12
DMSP	0.965	<b>&lt;0.0001</b>	16
VA	0.850	<b>&lt;0.0001</b>	19
VA1	0.789	<b>&lt;0.0001</b>	19
VA2	0.932	<b>&lt;0.0001</b>	19
VA3	0.943	<b>&lt;0.0001</b>	19
VA4	0.874	<b>&lt;0.0001</b>	19
PA	0.873	<b>&lt;0.0001</b>	20
HF	0.532	<b>0.028</b>	17
PF	0.960	<b>&lt;0.0001</b>	17
PF≤2μm	0.578	<b>0.02</b>	17
PF 2-5μm	0.904	<b>&lt;0.0001</b>	17
PF 5-10 μm	0.636	<b>0.026</b>	17
PF 10-20 μm	0.725	<b>0.02</b>	12

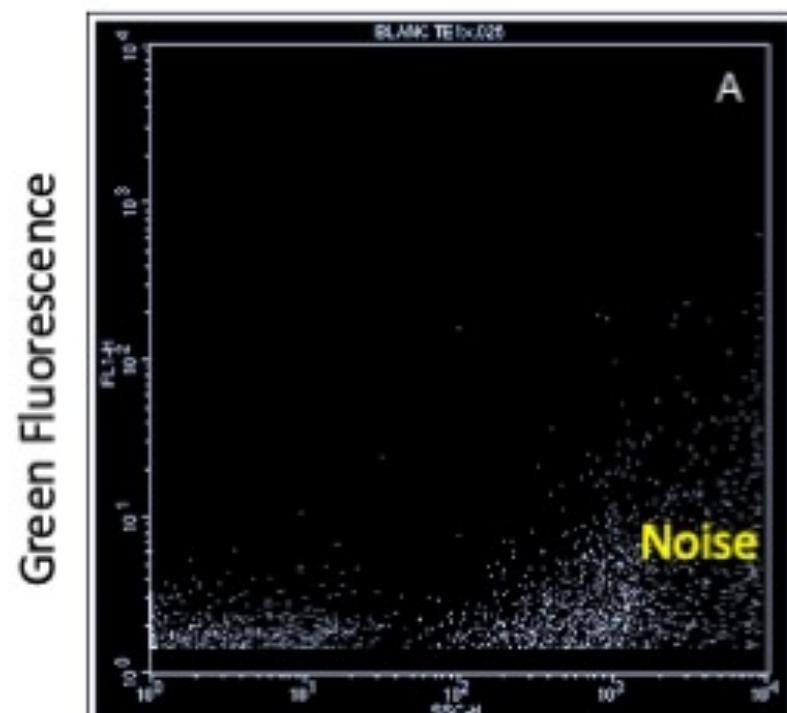
Table S4. ANOVA analyses of the corresponding variables to look at differences between layers (SML vs SSW) and regions. 1: Bellingshausen Sea; 2: Gerlache Passage and 3: Bransfield Strait. (+) indicated that the named region has significantly higher values. For units see Tables 2 and 3

Variable	SML-SSW	SML-SSW1	SML-SSW2	SML-SSW3	SML1-2	SML1-3	SML2-3	SSW1-2	SSW1-3	SSW2-3
Sal	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
DOC	-	-	-	-	-	-	-	ns	ns	ns
DMSP	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
PO <sub>4</sub> <sup>3-</sup>	ns	-	ns	ns	-	-	ns	0.002*(+2)	0.00048***(+3)	ns
SiO <sub>4</sub> <sup>4-</sup>	0.0002 (+SSW)	-	ns	0.0007 (+SSW)	-	-	0.05 (+2)	0.007 (+2)	0.02 (+3)	ns
NO <sub>3</sub> <sup>-</sup>	ns	-	ns	ns	-	-	0.005 (+3)	ns	0.003 (+3)	0.04 (+3)
NO <sub>2</sub> <sup>-</sup>	ns	-	ns	ns	-	-	0.01 (+3)	ns	0.001 (+3)	0.04 (+3)
NH <sub>4</sub> <sup>+</sup>	ns	-	ns	ns	-	-	ns	ns	ns	ns
PA	ns	ns	ns	ns	0.08 (+1)	ns	0.02 (+3)	ns	ns	ns
VA	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
VA1	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
VA2	ns	ns	ns	ns	ns	ns	0.05 (+2)	ns	ns	0.07 (+2)
VA3	ns	0.02_SML	ns	ns	ns	0.09 (+1)	0.02 (+2)	ns	ns	0.013 (+2)
VA4	ns	0.05_SSW	ns	ns	ns	ns	0.0007 (+3)	0.02 (+2)	ns	0.00041 (+3)
HNF	ns	ns	ns	ns	ns	0.04 (+3)	ns	ns	ns	ns
HNF≤2	ns	ns	ns	ns	ns	0.03 (+3)	ns	ns	0.06 (+3)	0.02 (+3)
HNF2-5	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
HNF5-10	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
HNF 10-20	ns	0.05 (+1)	-	ns	0.04 (+1)	0.007 (+1)	ns	-	ns	-
PNF	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
PNF 2	ns	ns	ns	ns	0.0004 (+2)	0.03 (+3)	ns	ns	ns	ns
PNF 2-5	ns	ns	ns	ns	ns	ns	ns	0.08 (+3)	ns	ns
PNF 5-10	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
PNF 10-20	ns	ns	ns	ns	ns	0.07 (+1)	ns	ns	ns	ns

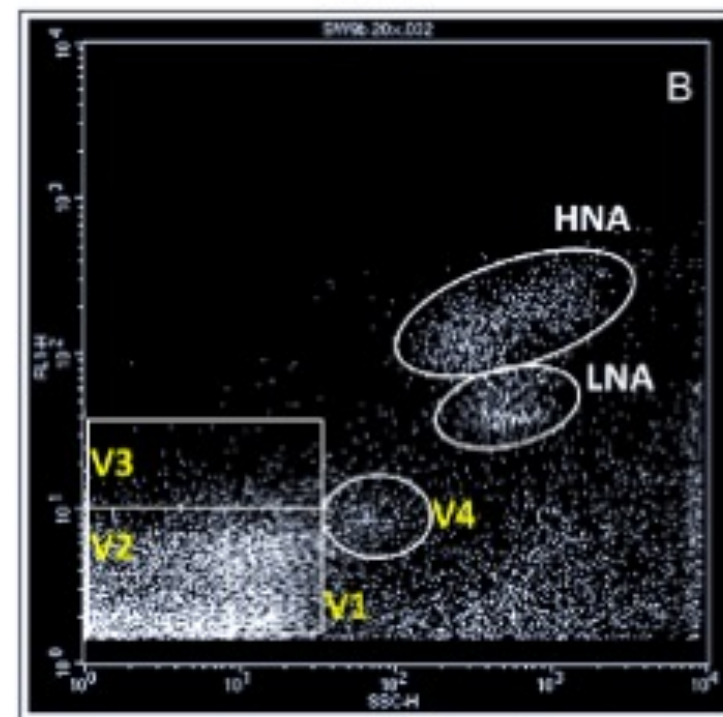


Figure S1

Blank



Sample



Side Scatter

Figure S2

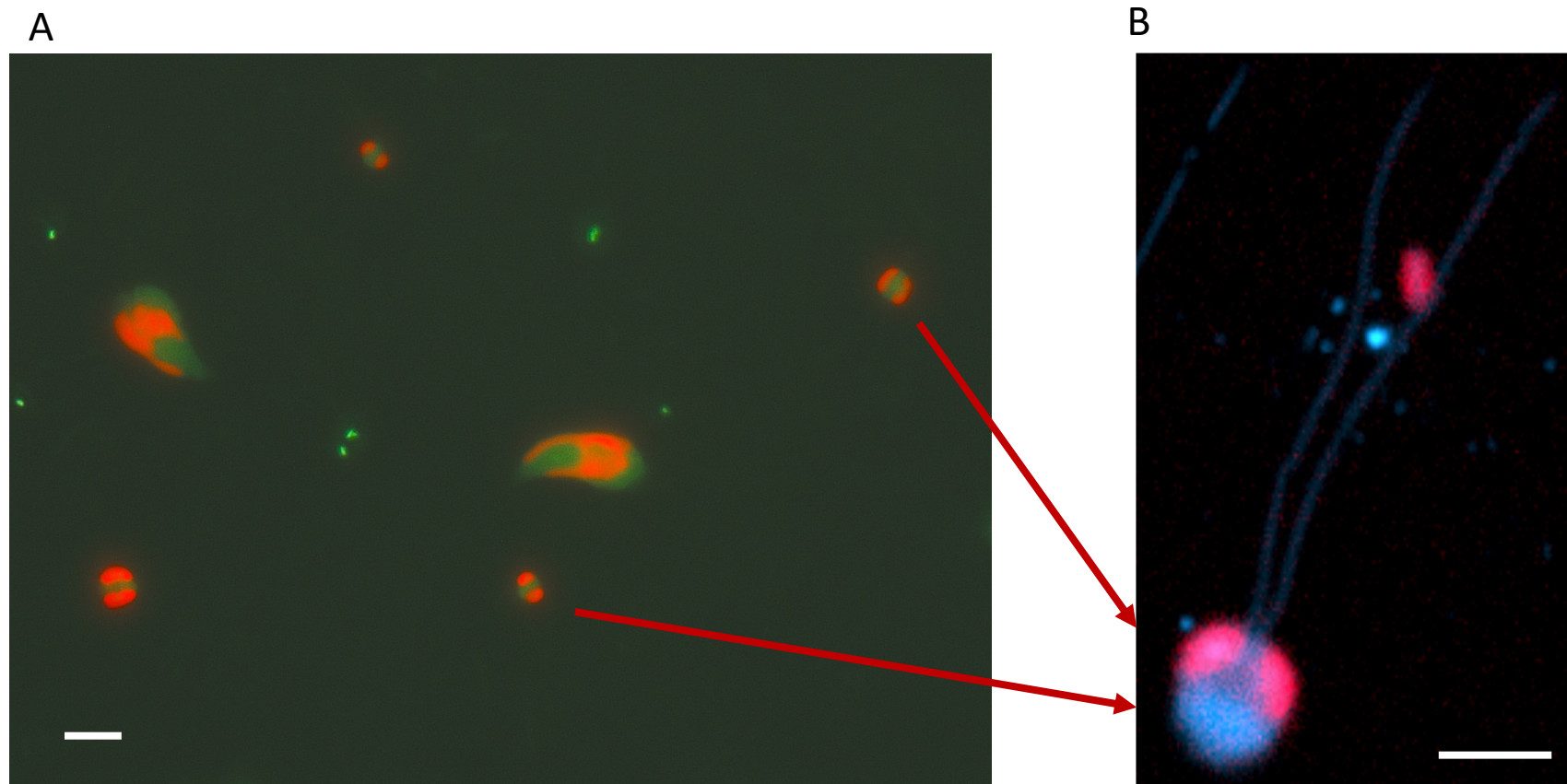


Figure S3.