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**Bjørøya Fiskeoppdrett AS**  
**Attn: Per Anton Løfsnes**  
**7770 Flatanger**

**11. mars 2014**

**Lokalitet: Nausttaren, Osen. Strømmålinger. Sprednings- og bunnstrøm.**

Som avtalt sender vi over strømmålingene fra området ved Nausttaren, i Osen kommune. Dette er en oppsummering for å få en oversikt over resultatene av strømmålingene og er bygd på forutsetningen om at du/dere studerer vedlagte data nøye selv. Rådataene finnes oppbevart hos Aqua Kompetanse AS i Flatanger.

**Firmanavn / Lokalitet. Type oppdrett:**

Firma : Bjørøya Fiskeoppdrett AS Adresse : 7770 Flatanger  
Lokalitet : Nausttaren  
Kommune : Osen Fylke : Sør-Trøndelag  
UTM-koordinater : 64°23.368N,10°30.719Ø  
Oppdrettstype : Generelle strømforhold - matfiskanlegg  
Hva er vurdert : Spredning (60 m) og bunnstrøm (102 m).

**Måleperioder / frekvenser.**

Målingene er utført med Sensordata SD6000 rotormåler nummer 8 og 10. Målerne registrerer kontinuerlig i 2 minutter, og beregner en snittverdi for dette tidsintervallet. Det gjøres 5 slike delmålinger, som oppsummeres (10 minutter totalt) og presenteres som en råverdi.

**Nærhet til anlegg.**

Strømmålerne har stått på en lokalitet hvor det i måleperioden ikke har stått anlegg, nøter og fisk i sjøen. Målingene ser ut til å være av god kvalitet. Rotor gikk fint ved opptak.

**Kort vurdering:**

I disse måleseriene er maksimal vannstrømhastighet 13,6 cm/sek på 60 meters dyp og 18,6 cm/sek på 102 meters dyp, mens gjennomsnittsstrømmen er 2,6 cm/sek på begge dyp. Vannstrømmen på 60 meters dyp har hovedkomponenter mot nordøst (45-75)°, med en returstrøm mot sørvest (210-225)°. På 102 meters dyp er hovedstrømsretningen i vannmassene mot sørvest (210-255)°, med en beskjeden returstrøm mot nord-nordøst (15-30)°. Det er registrert en del vannstrøm med lavere hastigheter enn 1 cm/sek i begge dyp.

Med hilsen:

Linda Hagen  
Trainee oseanografi, Aqua Kompetanse AS

Kvalitetssikret av:

Per Andersen  
Marin Seniorrådgiver i Nord-Trøndelag

## SPESIFIKASJONS- OG RESULTATOVERSIKT

**Firma:** Bjørøya Fiskeoppdrett AS

**Lokalitet:** Nausttaren, Osen kommune

### Generelle spesifikasjoner, periode, frekvens og resultater.

Tekst	Spredningsstrøm	Bunnstrøm
Tidsrom for registreringer	07.02.2014-07.03.2014	07.02.2014-07.03.2014
Dybde på målestedet. Ca.	104	104
Dybde for registreringer (meter). Ca.	60	102
Måler type - nummer	SD6000OPT - nr1226	SD6000 - nr1122
Type måling	Kontinuerlig	Kontinuerlig
Frekvens – varighet*4	2 min/10 min - 28 døgn	2 min/10 min - 28 døgn
Adresse	64°23.368N, 10°30.719Øs	64°23.368N, 10°30.719Øb
% strøm mindre enn 1 cm/sek.(ca)	42.3 %	53.9 %
Gjennomsnittsstrøm	2.6	2.6
Rest strøm	0.8	1.1
Neumanns parameter	0.316	0.432
De 4 hyppigst forekommende retningene strømmen beveger seg mot (grader) *1	45, 150, 60, 165	225, 210, 240, 255
De 4 hyppigst forekommende strømhastighetene (cm /sek) *1	0-1, 1-3, 3-4, 4-5	0-1, 1-3, 3-4, 4-5
Mest vannutskiftning / retning / 15 graders sektor.*2	11065m <sup>3</sup> ved 45-60 grader. 395m <sup>3</sup> /m <sup>2</sup> /døgn	20933m <sup>3</sup> ved 225-240 grader. 748m <sup>3</sup> /m <sup>2</sup> /døgn
Minst vannutskiftning / retning / 15 graders sektor.*2	149m <sup>3</sup> ved 285-300 grader. 5m <sup>3</sup> /m <sup>2</sup> /døgn	0m <sup>3</sup> ved 135-150 grader. 0m <sup>3</sup> /m <sup>2</sup> /døgn
Gjennomsnittelig total vannutskiftning pr.døgn. Alle retninger	2258m <sup>3</sup> /døgn	2276m <sup>3</sup> /døgn
Maksimum strøm – signifikant maksimum strøm (cm/sek) *3	13.6 - 5.2	18.6 - 5.8

\*1: gruppert i synkende rekkefølge

\*2: vann som passerer gjennom hver loddrett plassert kvadratmeter.

\*3: Signifikant maksimum strøm er gjennomsnittet av 1/3 målingene med høyest verdi.

# Spredningsstrøm - 60 meters dyp

## TEMPERATURE

File name: Nausttarenfebmars14sprednstrom.SD6

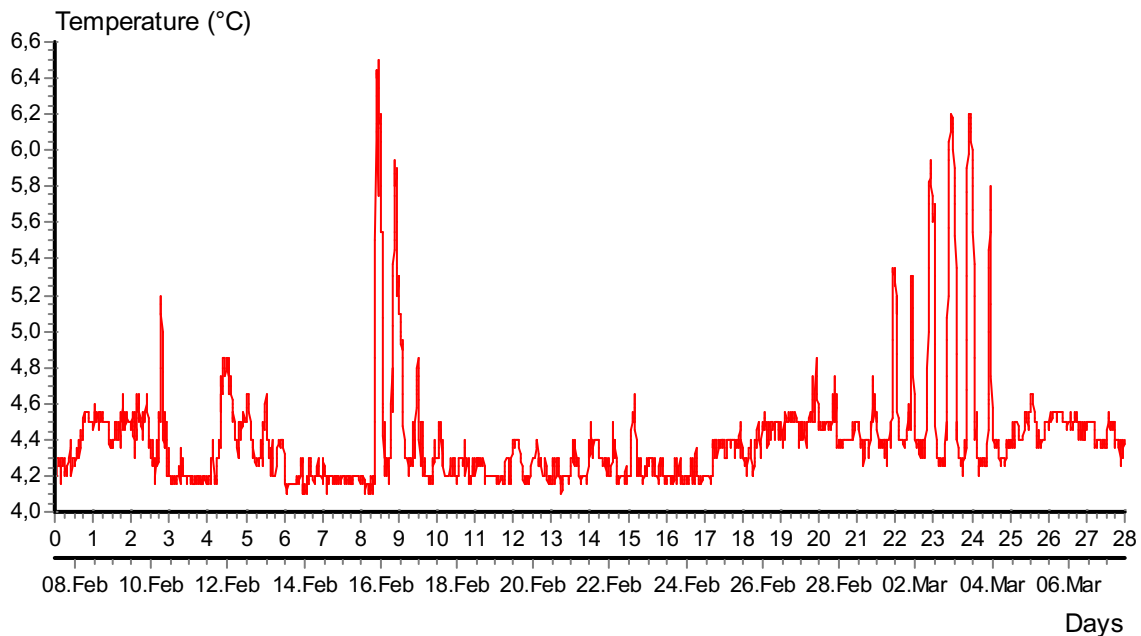
Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14



## CURRENT SPEED

File name: Nausttarenfebmars14sprednstrom.SD6

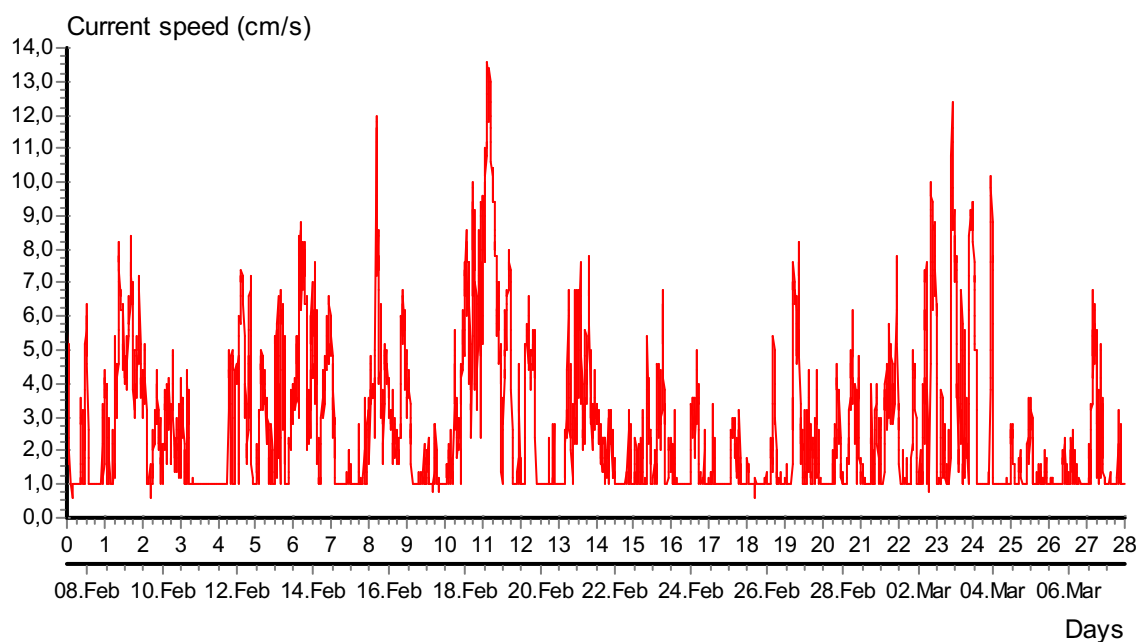
Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14



**OX SAT**

File name: Nausttarenfebmars14sprednstrom.SD6

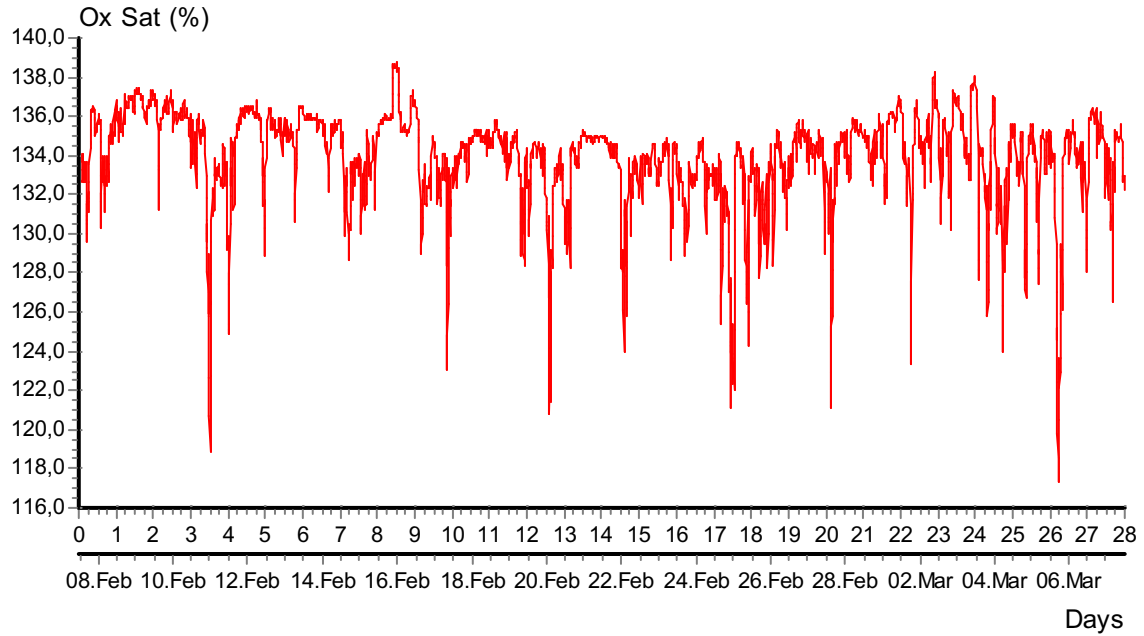
Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14



**OXYGEN mg/l**

File name: Nausttarenfebmars14sprednstrom.SD6

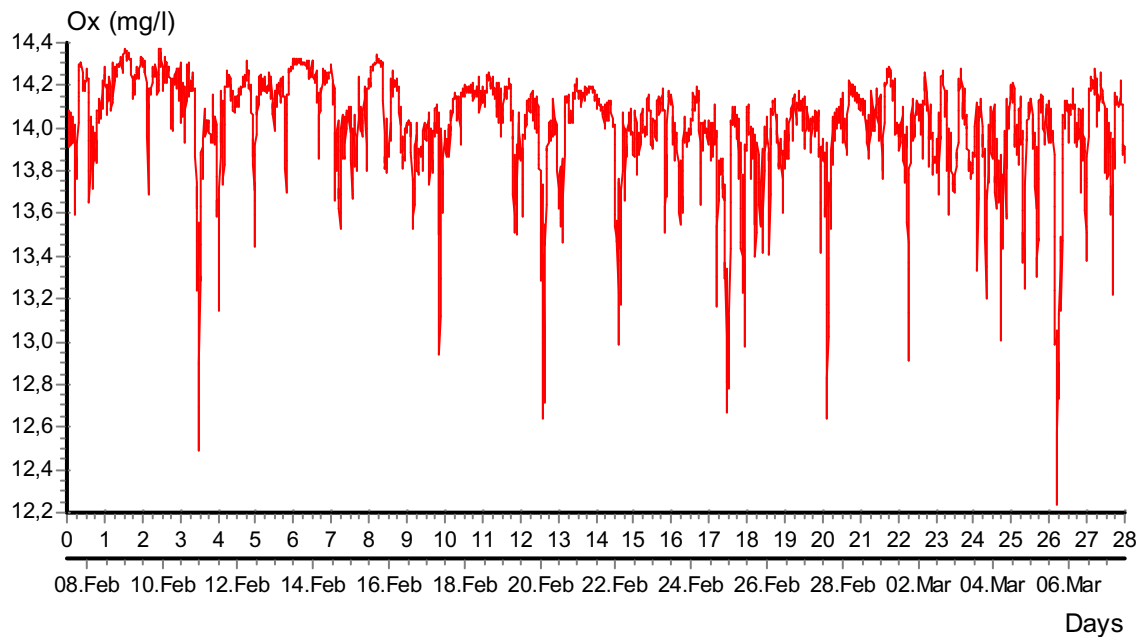
Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14



### OXYGEN FLUX

File name: Nausttarenfebmars14sprednstrom.SD6

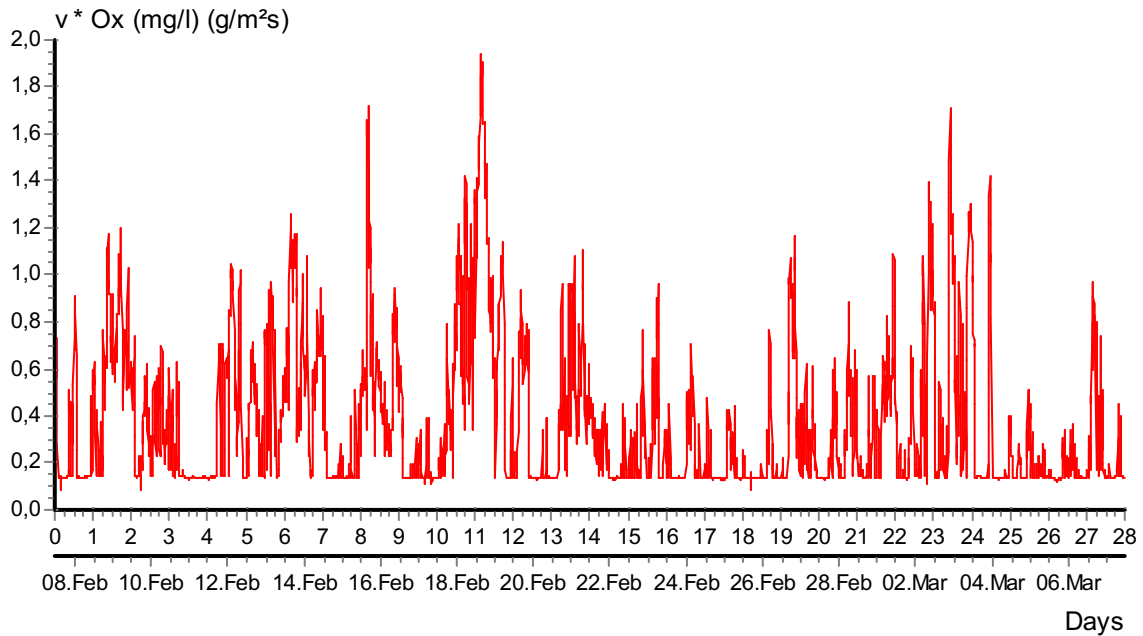
Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14



### CURRENT SPEED BAR CHART

File name: Nausttarenfebmars14sprednstrom.SD6

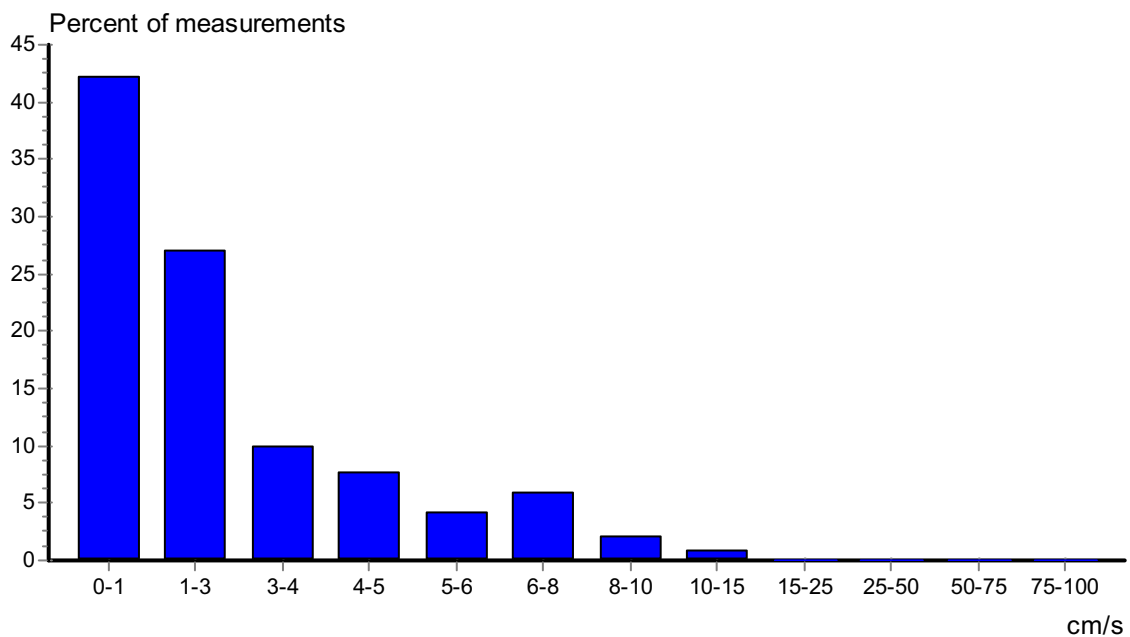
Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

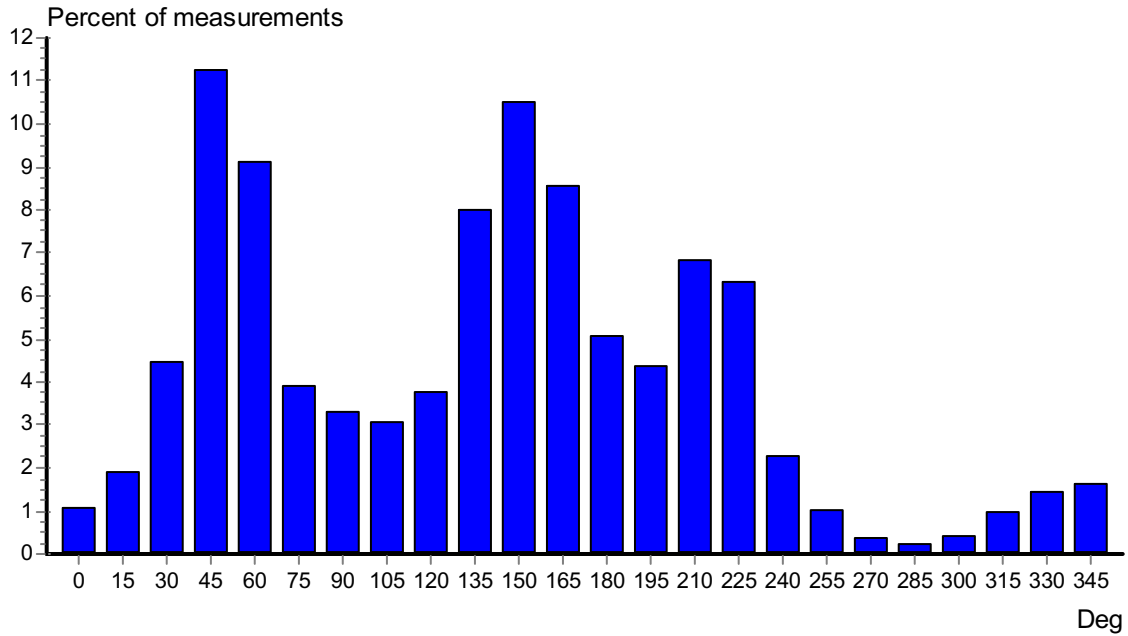
Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14



**CURRENT DIRECTION BAR CHART**

File name: Nausttarenfebmars14sprednstrom.SD6  
Series number: 1  
Number of measurements in data set: 4033  
Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14

Ref. number: 1226  
Interval time: 10 Minutes



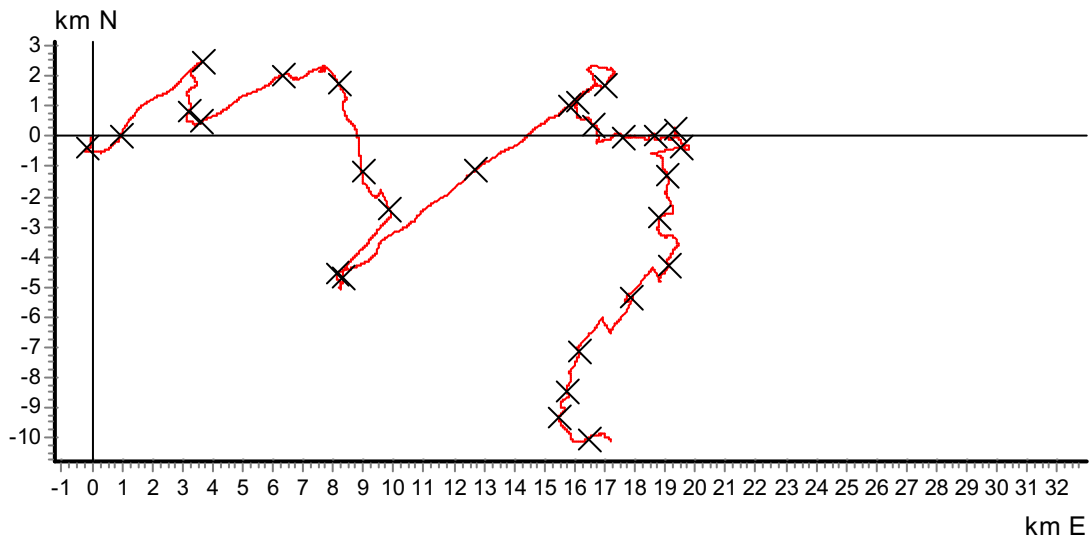
**PROGRESSIVE VECTOR**

File name: Nausttarenfebmars14sprednstrom.SD6  
Series number: 1  
Number of measurements in data set: 4033  
Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14

Ref. number: 1226  
Interval time: 10 Minutes

Neumann parameter: 0.316  
Average speed: 2.6 cm/s

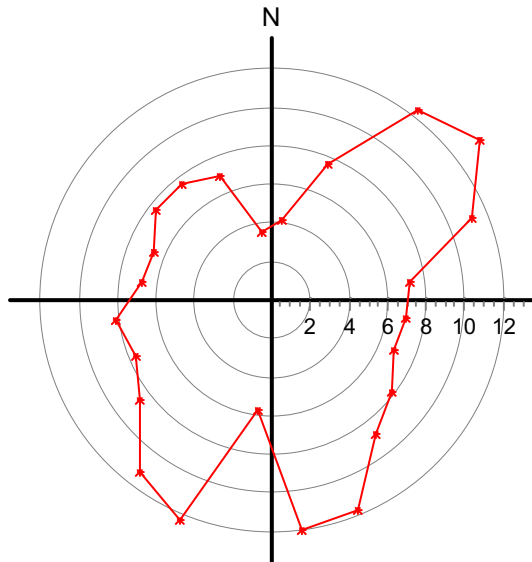
Rest speed: 0.8 cm/s  
Rest direction: 121 deg.



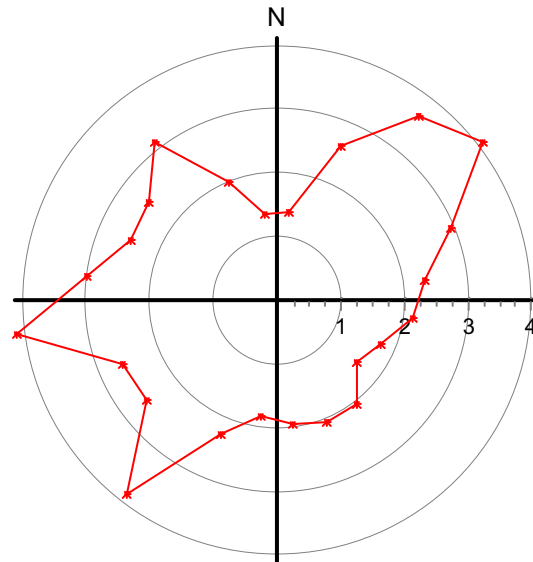
**CURRENT VELOCITY DISTRIBUTION DIAGRAM**

File name: Nausttarenfebmars14sprednstrom.SD6  
Series number: 1  
Number of measurements in data set: 4033  
Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14

Ref. number: 1226  
Interval time: 10 Minutes



Maximum velocity (cm/s)  
per 15 deg sector

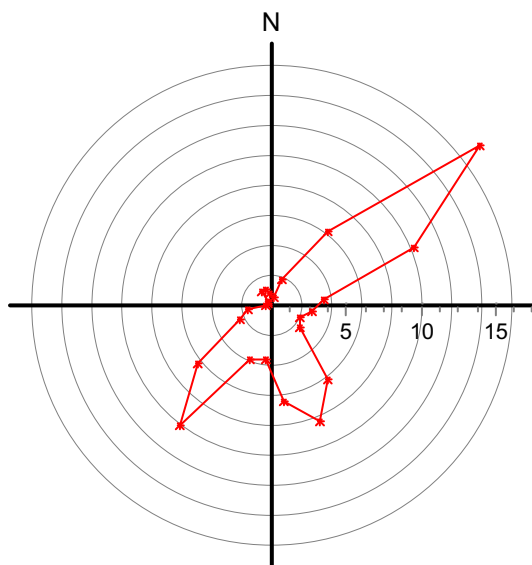


Mean velocity (cm/s)  
per 15 deg sector

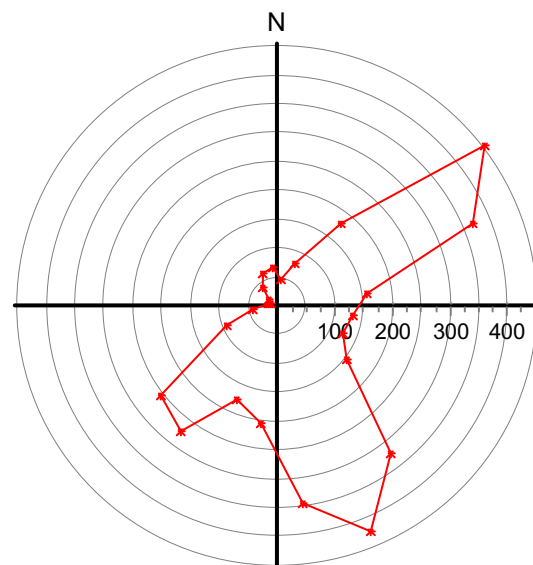
**CURRENT VELOCITY DISTRIBUTION DIAGRAM**

File name: Nausttarenfebmars14sprednstrom.SD6  
Series number: 1  
Number of measurements in data set: 4033  
Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14

Ref. number: 1226  
Interval time: 10 Minutes



Relative water flux (%)  
per 15 deg sector



Number of measurements  
per 15 deg sector

### OXYGEN FLUX DISTRIBUTION DIAGRAM

File name: Nausttarenfebmars14sprednstrom.SD6

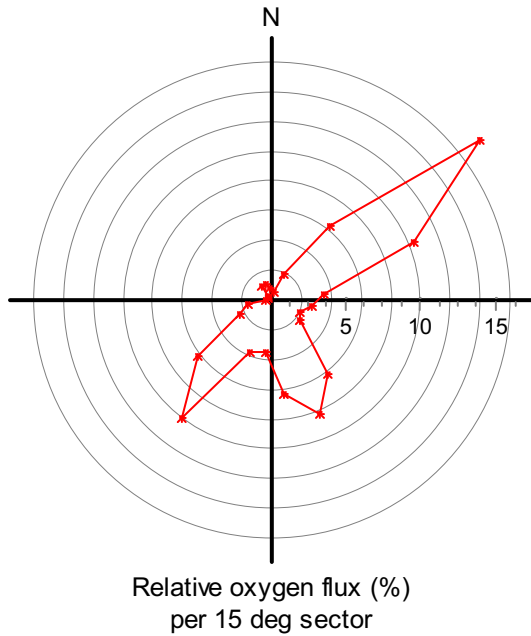
Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14



### STICK DIAGRAM

File name: Nausttarenfebmars14sprednstrom.SD6

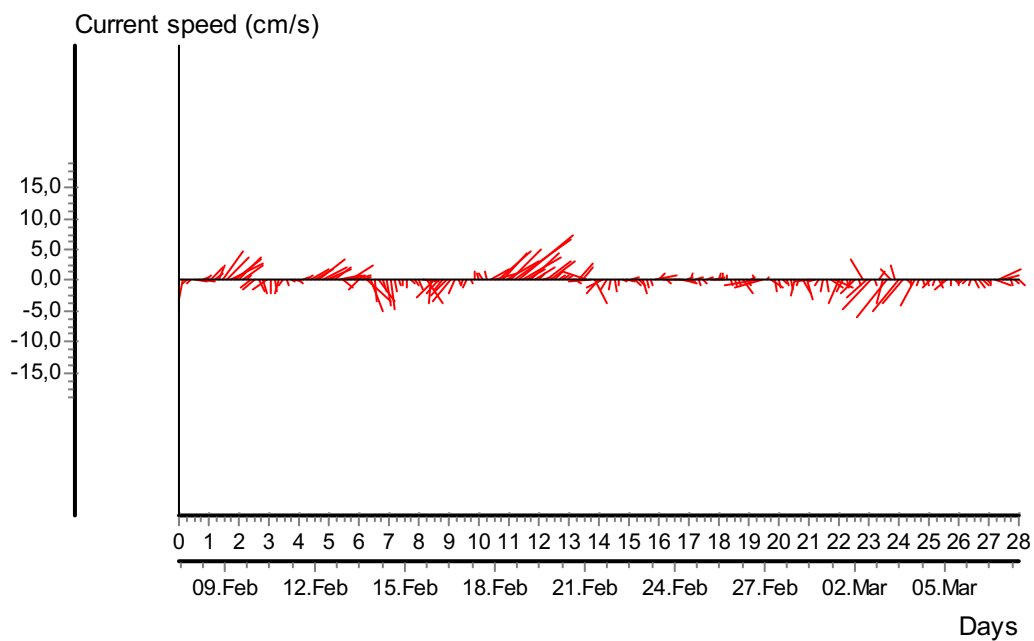
Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14





**CURRENT SPEED / DIRECTION MATRIX**

File name: Nausttarenfebmars14sprednstrom.SD6

Ref. number: 1226

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:28 - 07.Feb-14 To: 11:28 - 07.Mar-14

	Current speed groups														Total flow		Max curr	Tot. Ox. flux	
	1	3	4	5	6	8	10	15	25	50	75	100	Sum%	m <sup>3</sup> /m <sup>2</sup>	%	g/m <sup>2</sup>		%	
0	30	11	2	1	0	0	0	0	0	0	0	0	0	1.1	365	0.6	4.2	5107	0.6
15	28	19	12	9	4	5	0	0	0	0	0	0	0	1.9	1213	1.9	7.6	17195	1.9
30	41	45	18	27	16	26	6	1	0	0	0	0	0	4.5	3952	6.3	12.4	56056	6.3
45	142	60	45	68	36	55	23	25	0	0	0	0	0	11.3	11065	17.5	13.6	156706	17.6
60	138	72	48	46	29	30	2	3	0	0	0	0	0	9.1	6508	10.3	11.2	91948	10.3
75	66	47	16	14	11	4	0	0	0	0	0	0	0	3.9	2210	3.5	7.2	31160	3.5
90	69	31	16	5	10	3	0	0	0	0	0	0	0	3.3	1736	2.7	7.0	24479	2.7
105	62	42	14	4	0	1	0	0	0	0	0	0	0	3.0	1302	2.1	6.8	18295	2.1
120	83	59	7	1	1	1	0	0	0	0	0	0	0	3.8	1459	2.3	7.8	20503	2.3
135	166	93	28	12	7	11	5	0	0	0	0	0	0	8.0	3950	6.2	8.8	55798	6.3
150	247	99	21	17	10	21	6	3	0	0	0	0	0	10.5	5267	8.3	11.8	74224	8.3
165	179	100	26	26	9	5	0	1	0	0	0	0	0	8.6	4073	6.4	12.0	57277	6.4
180	105	68	14	10	8	0	0	0	0	0	0	0	0	5.1	2258	3.6	5.8	31682	3.6
195	78	62	19	3	1	6	4	4	0	0	0	0	0	4.4	2430	3.8	12.4	33952	3.8
210	65	73	35	28	9	29	35	1	0	0	0	0	0	6.8	6342	10.0	11.2	88390	9.9
225	58	124	42	13	8	8	2	0	0	0	0	0	0	6.3	3955	6.3	8.6	55689	6.3
240	34	27	15	6	2	8	0	0	0	0	0	0	0	2.3	1444	2.3	7.6	20375	2.3
255	5	8	8	7	1	11	1	0	0	0	0	0	0	1.0	1012	1.6	8.2	14280	1.6
270	4	5	2	1	2	1	0	0	0	0	0	0	0	0.4	270	0.4	6.8	3809	0.4
285	7	0	0	0	2	1	0	0	0	0	0	0	0	0.2	149	0.2	6.6	2102	0.2
300	12	0	1	0	1	3	0	0	0	0	0	0	0	0.4	257	0.4	7.6	3625	0.4
315	12	11	3	4	3	7	0	0	0	0	0	0	0	1.0	751	1.2	7.6	10612	1.2
330	29	16	7	5	1	1	0	0	0	0	0	0	0	1.5	709	1.1	7.0	9991	1.1
345	44	17	4	0	0	0	0	0	0	0	0	0	0	1.6	536	0.8	3.6	7504	0.8
Sum%	42.3	27.0	10.0	7.6	4.2	5.9	2.1	0.9	0.0	0.0	0.0	0.0	0.0	63214	13.6	13.6	890759		

**STATISTICAL SUMMARY**

	Total	East / west	North / south
Mean current speed (cm/s)	2,6	1,7	1,8
Variance (cm/s) <sup>2</sup>	4,833	3,055	2,668
Standard deviation (cm/s)	2,198	1,748	1,633
Mean standard deviation	0,842	1,033	0,932
Maximum current velocity	13,6		
Minimum current velocity	0,6		
Significant max velocity	5,2		
Significant min velocity	1,0		

# Bunnstrøm – 102 meters dyp

## TEMPERATURE

File name: Nausttarenfebmars14bunnstrom.SD6

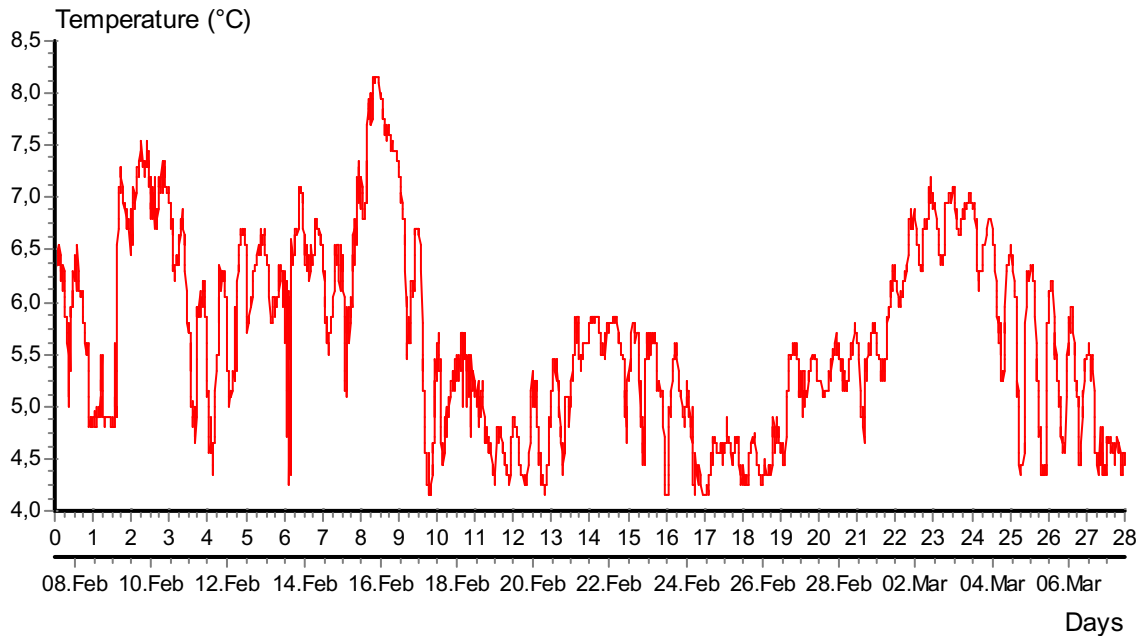
Ref. number: 1122

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14



## CURRENT SPEED

File name: Nausttarenfebmars14bunnstrom.SD6

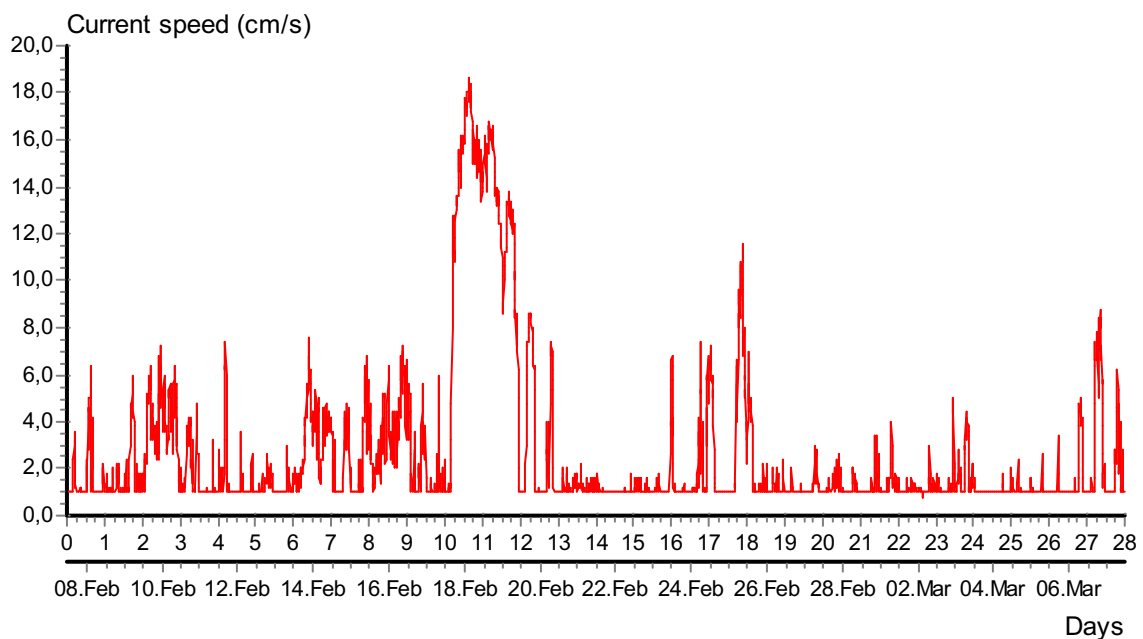
Ref. number: 1122

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14



### CURRENT SPEED BAR CHART

File name: Nausttarenfebmars14bunnstrom.SD6

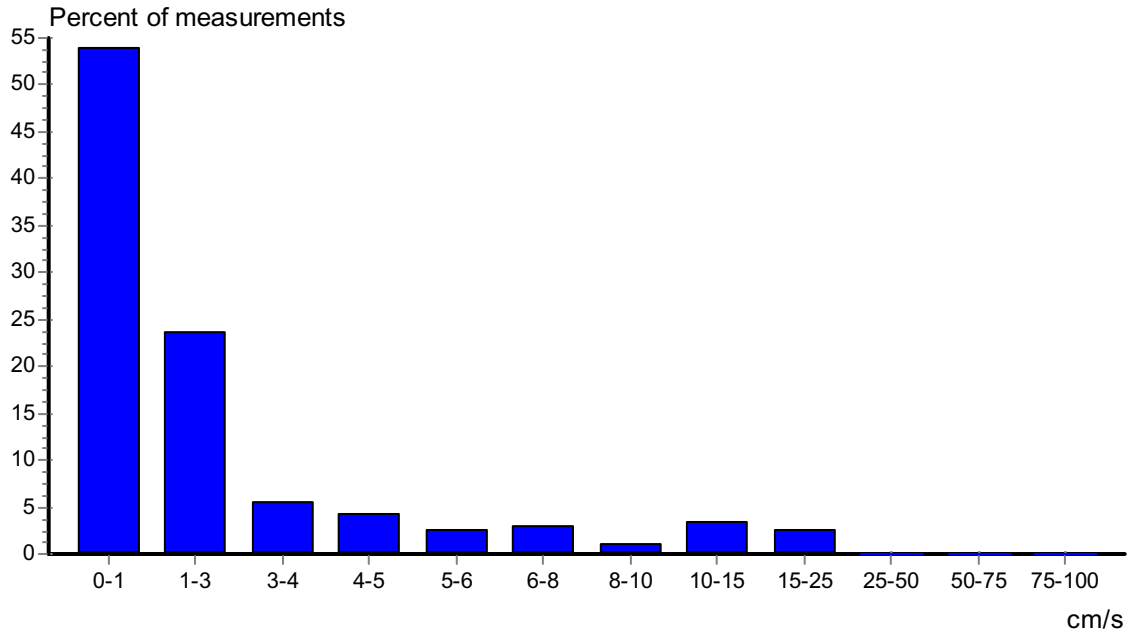
Ref. number: 1122

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14



### CURRENT DIRECTION BAR CHART

File name: Nausttarenfebmars14bunnstrom.SD6

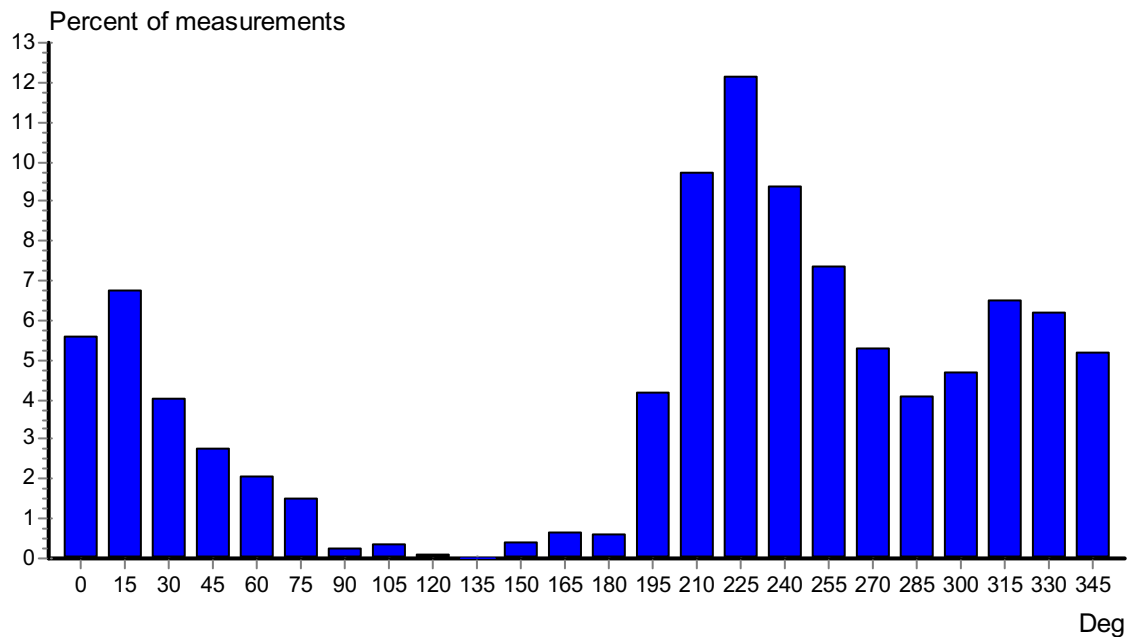
Ref. number: 1122

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14



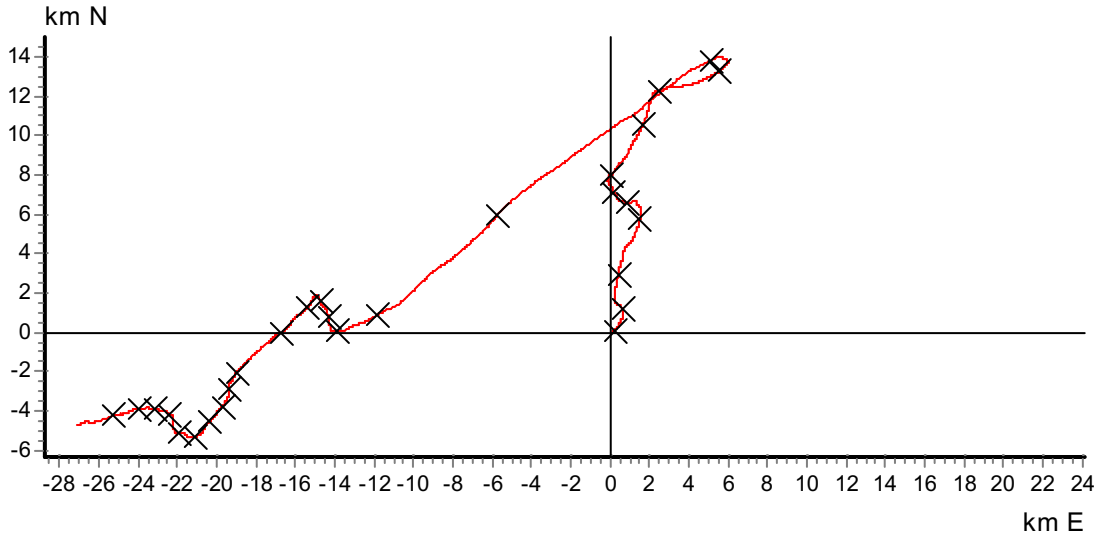
**PROGRESSIVE VECTOR**

File name: Nausttarenfebmars14bunnstrom.SD6  
Series number: 1  
Number of measurements in data set: 4033  
Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14

Ref. number: 1122  
Interval time: 10 Minutes

Neumann parameter: 0.432  
Average speed: 2.6 cm/s

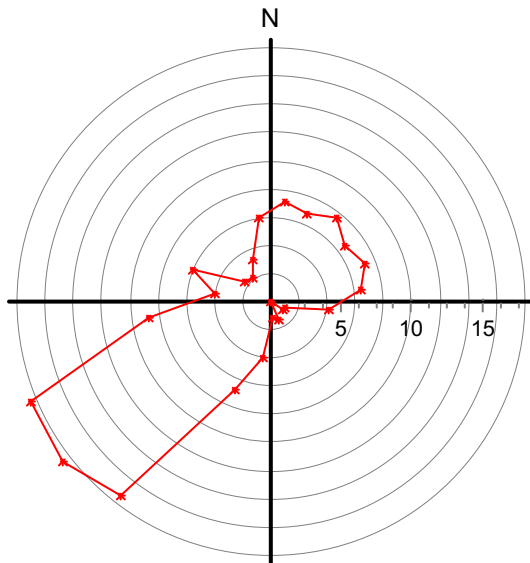
Rest speed: 1.1 cm/s  
Rest direction: 260 deg.



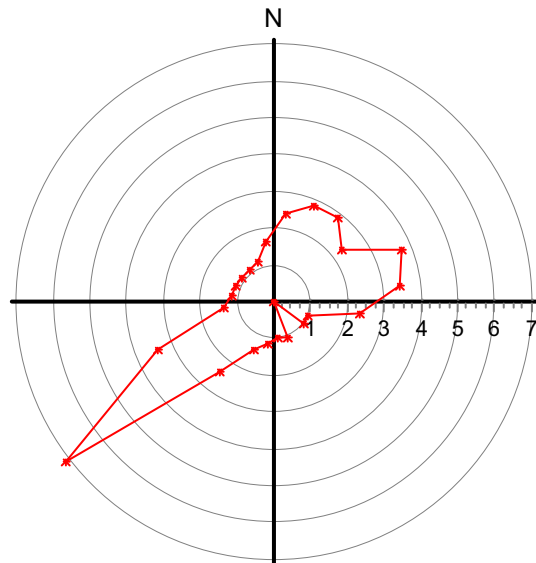
**CURRENT VELOCITY DISTRIBUTION DIAGRAM**

File name: Nausttarenfebmars14bunnstrom.SD6  
Series number: 1  
Number of measurements in data set: 4033  
Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14

Ref. number: 1122  
Interval time: 10 Minutes



Maximum velocity (cm/s)  
per 15 deg sector



Mean velocity (cm/s)  
per 15 deg sector

**CURRENT VELOCITY DISTRIBUTION DIAGRAM**

File name: Nausttarenfebmars14bunnstrom.SD6

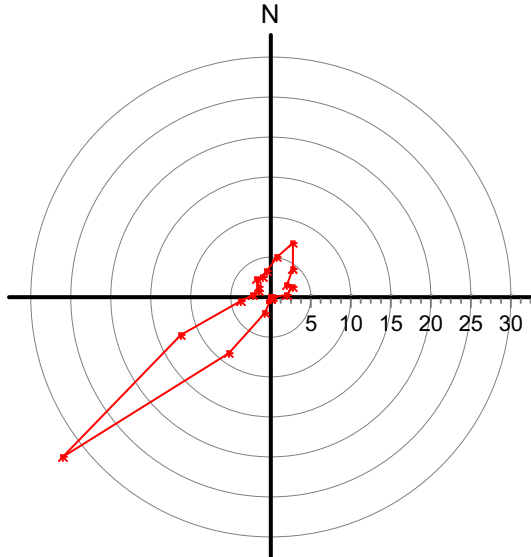
Ref. number: 1122

Series number: 1

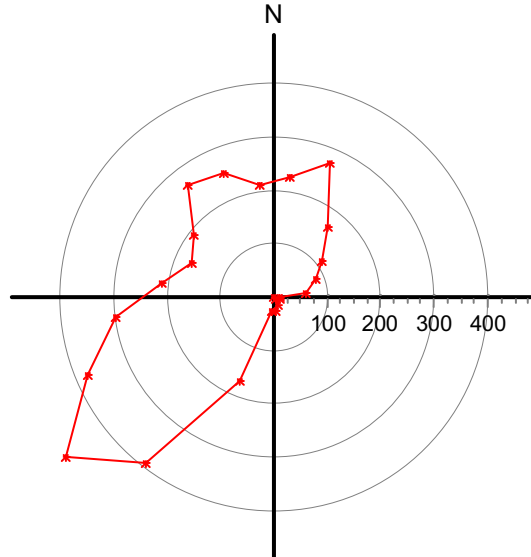
Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14



Relative water flux (%)  
per 15 deg sector



Number of measurements  
per 15 deg sector

**STICK DIAGRAM**

File name: Nausttarenfebmars14bunnstrom.SD6

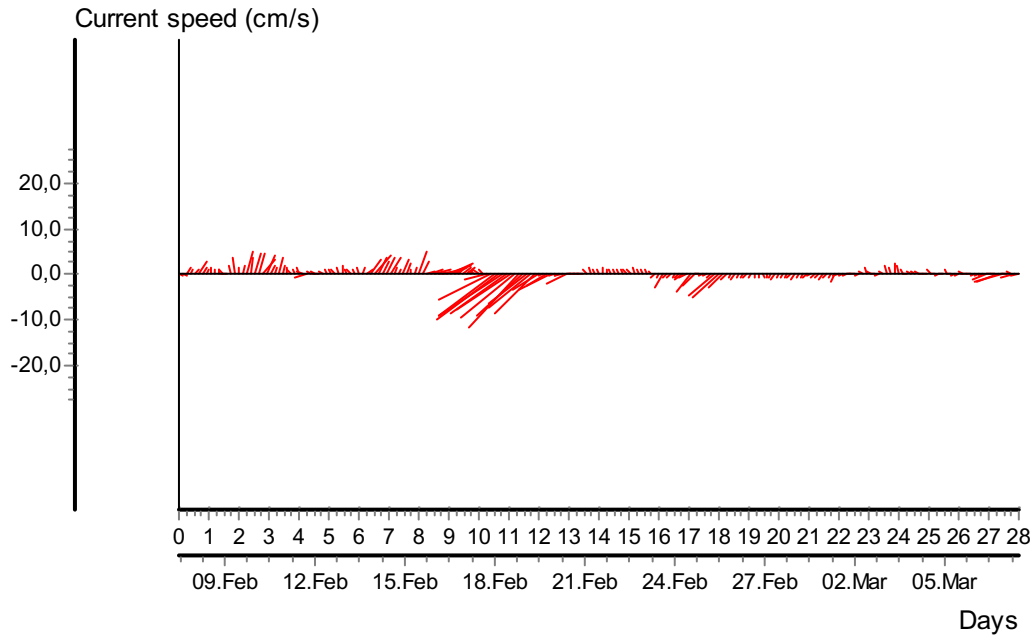
Ref. number: 1122

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14



**CURRENT SPEED / DIRECTION MATRIX**

File name: Nausttarenfebmars14bunnstrom.SD6

Ref. number: 1122

Series number: 1

Interval time: 10 Minutes

Number of measurements in data set: 4033

Data displayed from: 11:27 - 07.Feb-14 To: 11:27 - 07.Mar-14

	Current speed groups													Total flow		Max curr
	1	3	4	5	6	8	10	15	25	50	75	100	Sum%	m <sup>3</sup> /m <sup>2</sup>	%	
0	73	79	38	22	9	5	0	0	0	0	0	0	5.6	3235	5.1	7.2
15	88	65	45	41	25	9	0	0	0	0	0	0	6.8	4614	7.2	6.8
30	39	46	41	29	3	5	0	0	0	0	0	0	4.0	2821	4.4	7.6
45	47	31	16	4	11	3	0	0	0	0	0	0	2.8	1566	2.5	6.6
60	5	28	13	13	14	11	0	0	0	0	0	0	2.1	1883	3.0	7.2
75	0	24	21	9	6	1	0	0	0	0	0	0	1.5	1258	2.0	6.4
90	2	6	2	1	0	0	0	0	0	0	0	0	0.3	155	0.2	4.2
105	14	0	0	0	0	0	0	0	0	0	0	0	0.3	84	0.1	1.0
120	5	0	0	0	0	0	0	0	0	0	0	0	0.1	30	0.0	1.0
135	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0.0	0.0
150	15	2	0	0	0	0	0	0	0	0	0	0	0.4	107	0.2	1.4
165	26	1	0	0	0	0	0	0	0	0	0	0	0.7	163	0.3	1.2
180	23	1	1	0	0	0	0	0	0	0	0	0	0.6	174	0.3	4.0
195	119	39	5	0	2	4	0	0	0	0	0	0	4.2	1438	2.3	6.8
210	238	90	6	14	9	15	1	5	15	0	0	0	9.7	5627	8.8	17.4
225	167	62	11	9	7	23	21	111	79	0	0	0	12.1	20933	32.9	18.6
240	207	45	10	17	13	38	19	23	6	0	0	0	9.4	7774	12.2	18.4
255	219	62	6	3	2	4	1	0	0	0	0	0	7.4	2452	3.8	8.8
270	152	60	1	0	0	0	0	0	0	0	0	0	5.3	1493	2.3	4.0
285	127	36	0	0	1	0	0	0	0	0	0	0	4.1	1114	1.7	6.0
300	158	32	0	0	0	0	0	0	0	0	0	0	4.7	1212	1.9	2.4
315	205	57	0	0	0	0	0	0	0	0	0	0	6.5	1720	2.7	2.2
330	156	92	1	0	0	0	0	0	0	0	0	0	6.2	1781	2.8	3.2
345	90	100	6	9	5	0	0	0	0	0	0	0	5.2	2086	3.3	6.0
Sum%	53.9	23.8	5.5	4.2	2.7	2.9	1.0	3.4	2.5	0.0	0.0	0.0		63716		18.6

**STATISTICAL SUMMARY**

	Total	East / west	North / south
Mean current speed (cm/s)	2,6	1,8	1,7
Variance (cm/s) <sup>2</sup>	11,548	7,581	4,793
Standard deviation (cm/s)	3,398	2,753	2,189
Mean standard deviation	1,291	1,524	1,298
Maximum current velocity	18,6		
Minimum current velocity	0,8		
Significant max velocity	5,8		
Significant min velocity	1,0		