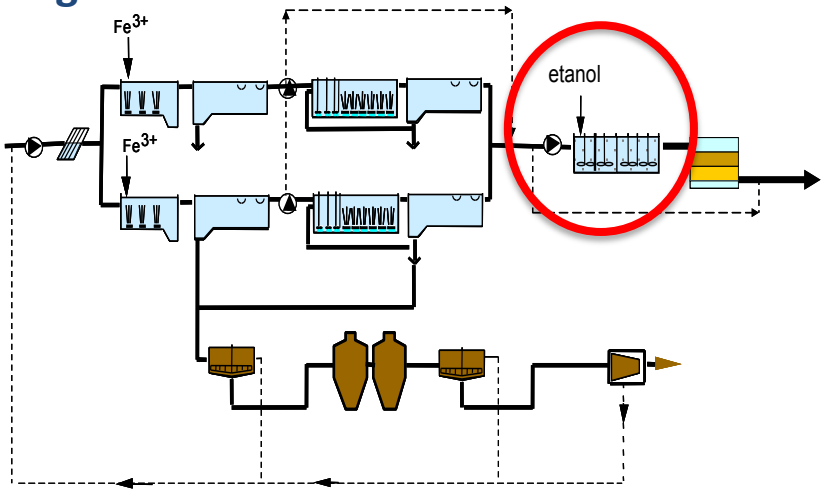
TVÅ DECENNIER AV MBBR DRIFT

Ivelina Dimitrova och Sara Ekström

Processingenjörer

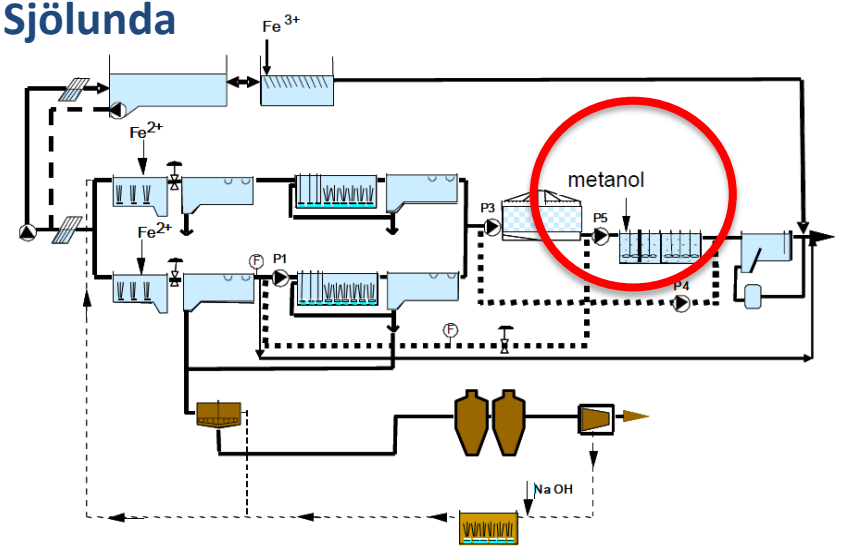
KORT OM VERKEN

Klagshamn



90 000 PE
(75 000 PE)

Sjölunda



550 000 PE
(350 000 PE)

Utsläppskrav	BOD 7, mg/l	Tot-N, mg/l	Tot-P, mg/l
Klagshamn	10	10 (70% red)	0,3
Sjölunda	12	10 (70% red)	0,3

MBBR DESIGN

Parameter	Klagshamn	Sjölunda
Total volym, m^3	1 100	6 300
Antal linjer/ reaktorer	2	6
Design temperatur, C	10	10
Specifik DN hastighet, g NOx-N/m^2*d	**1,7**	**1,2**
DN kapacitet, kg/d	360	2 000
Kolkälla	Etanol	Metanol
Max hydraulisk belastning, l/s	500	1 650
Fyllnadsgrad, %	36	50
Bärare	K1*	K1*
Partikelavskiljning	Sandfilter	DAF

**500 m^2/m^3*

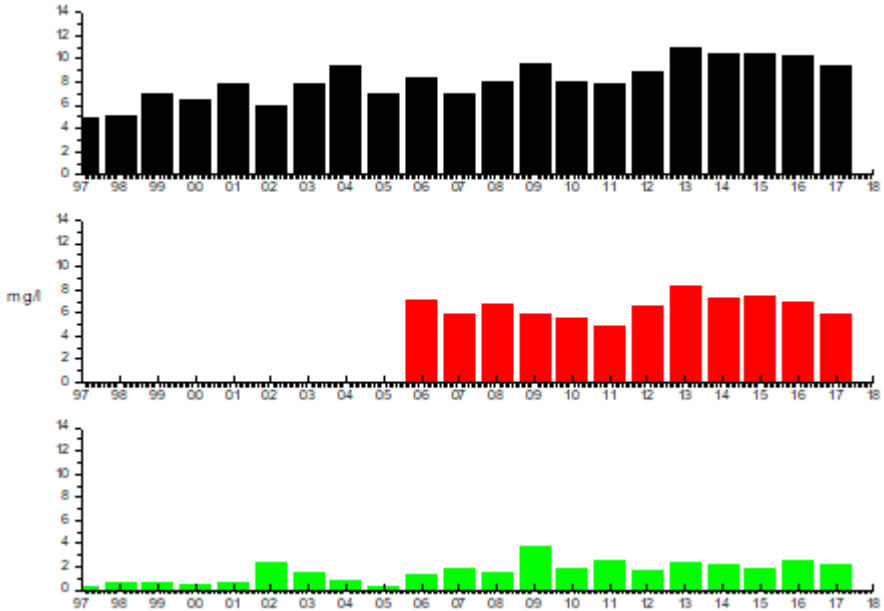
VASYD

UTGÅENDE KVÄVE

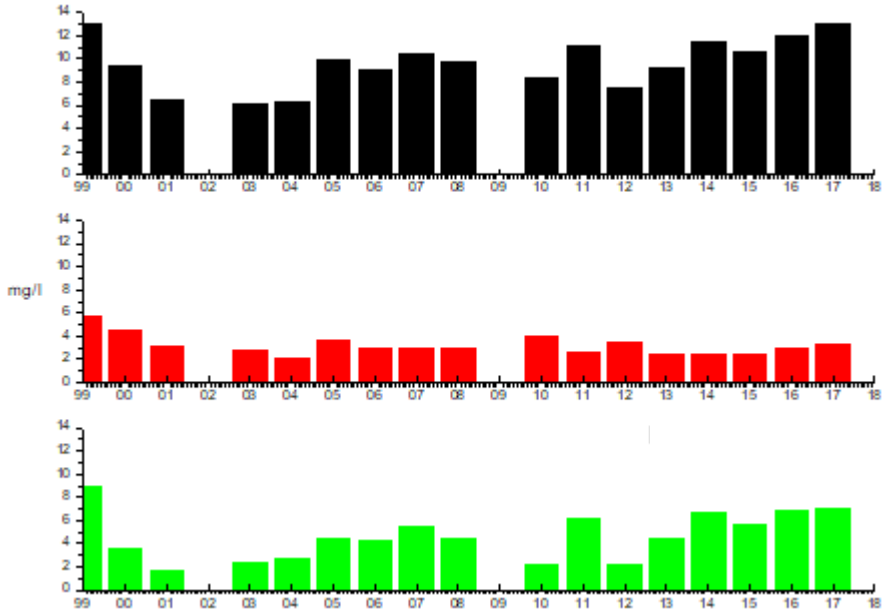
ett resultat av driftstrategi

N-tot ut verket
NOx-N ut verket
NH4-N ut verket

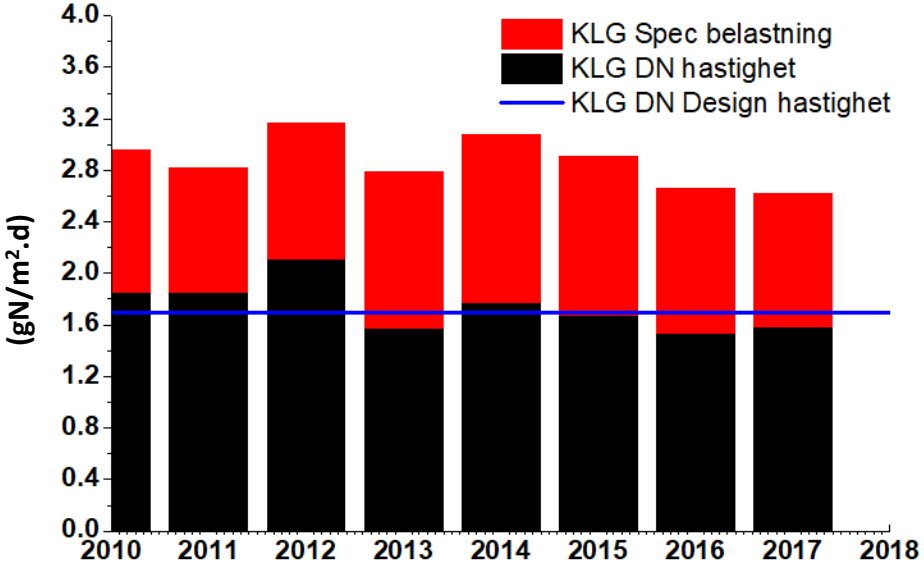
Klagshamn

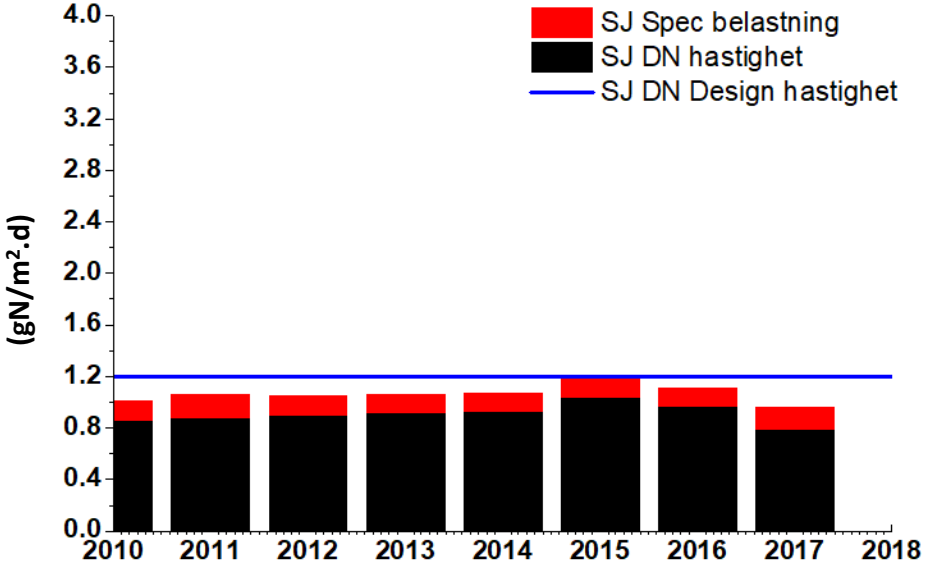


Sjölunda

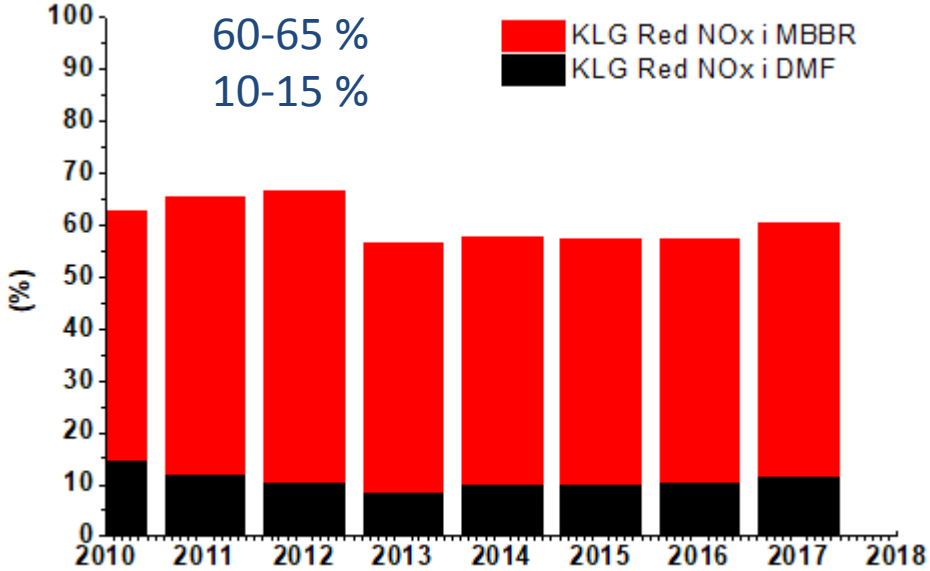


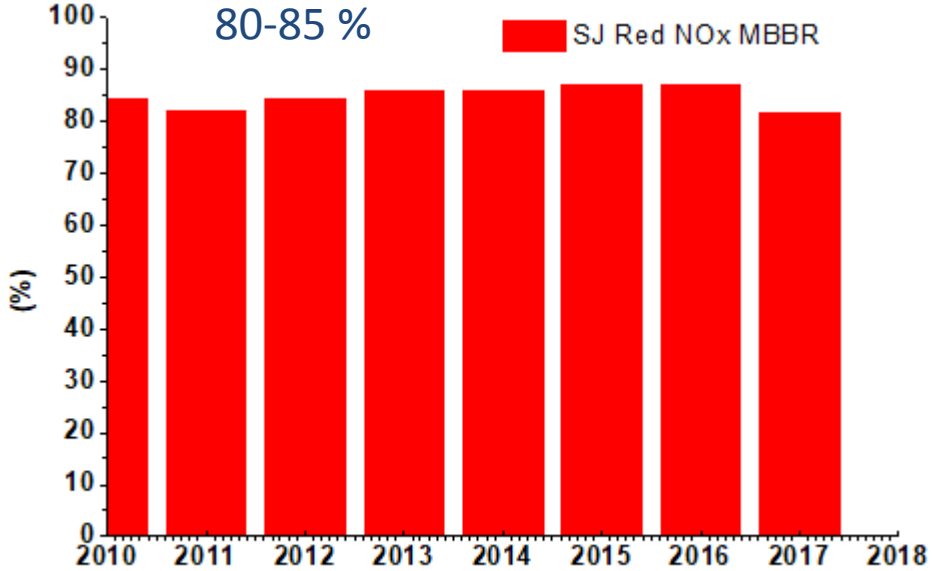
BELASTNING

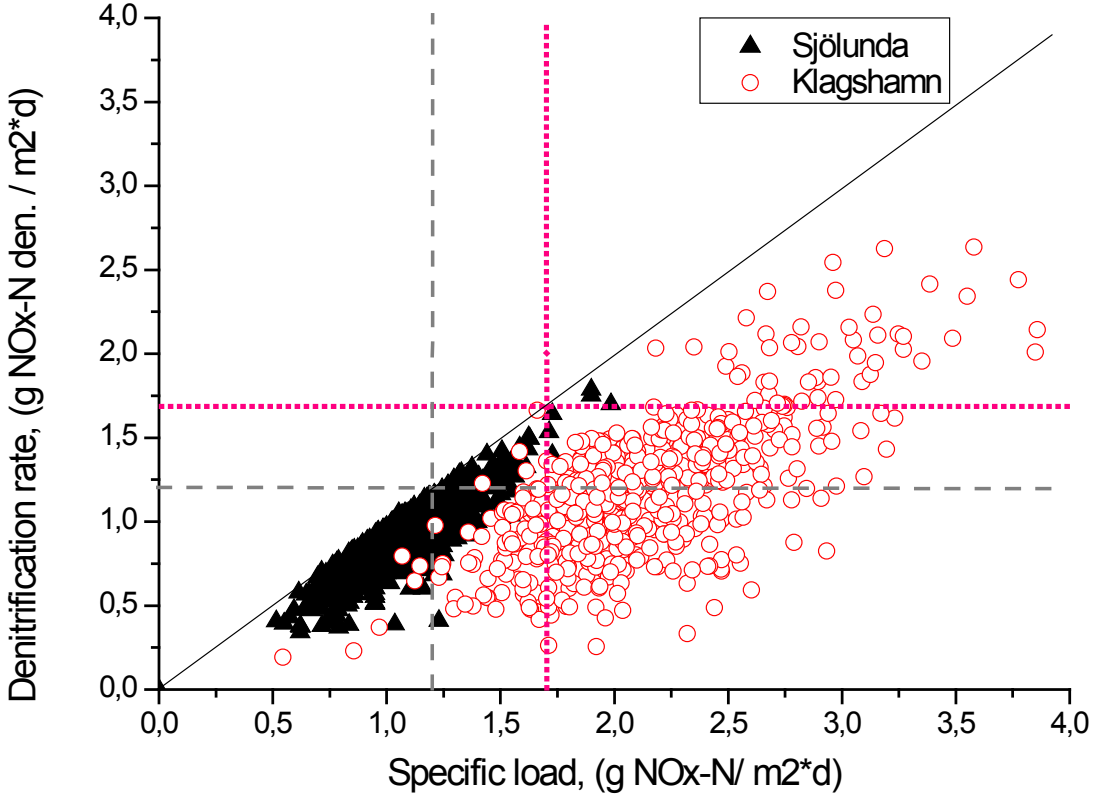

KLG Spec belastning
KLG DN hastighet
KLG DN Design hastighet
(gN/m².d)
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
2010
2011
2012
2013
2014
2015
2016
2017
2018


SJ Spec belastning
SJ DN hastighet
SJ DN Design hastighet
(gN/m².d)
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
2010
2011
2012
2013
2014
2015
2016
2017
2018

NO_X REDUKTION

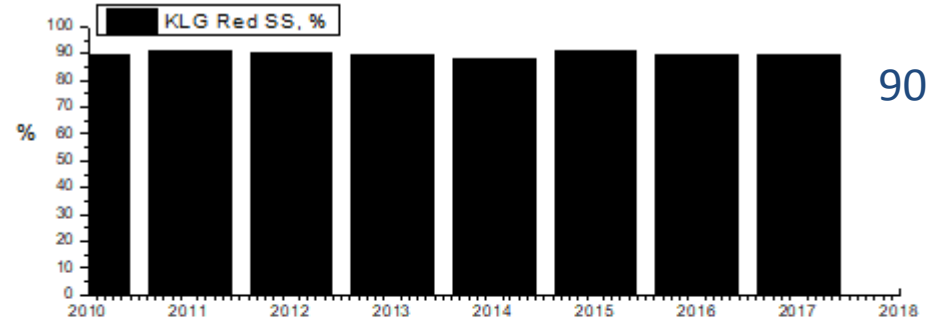




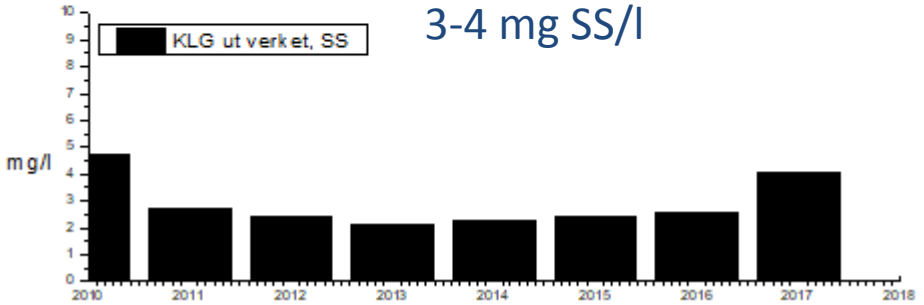

Sjölunda
Klagshamn
Denitrification rate, (g NOx-N den. / m2*d)
Specific load, (g NOx-N/ m2*d)
0,0
0,5
1,0
1,5
2,0
2,5
3,0
3,5
4,0

VASYD

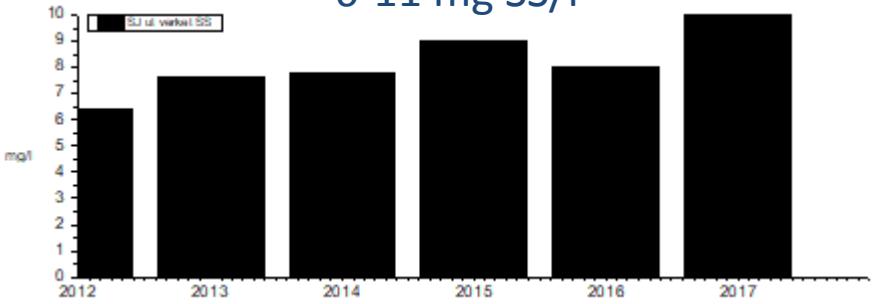
SEPARATIONSSTEG



90 %



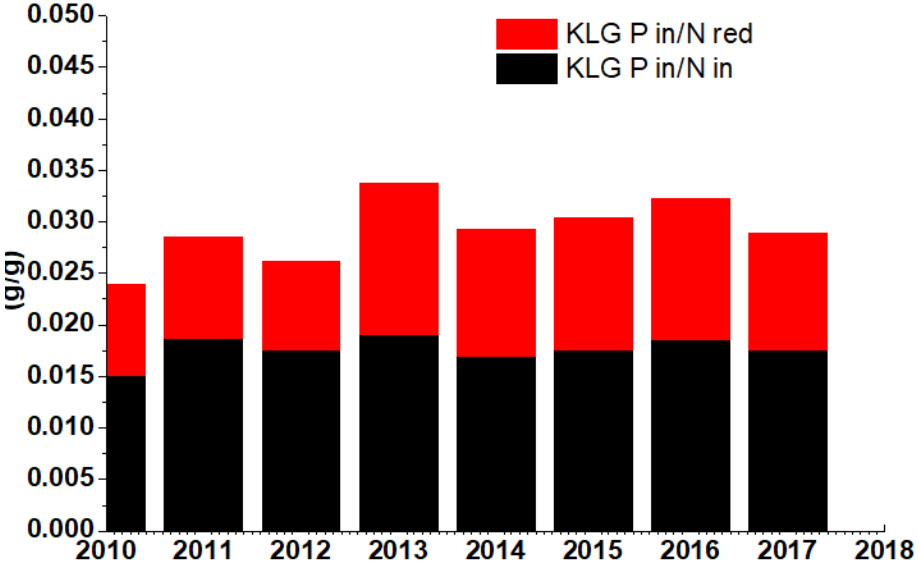
3-4 mg SS/l

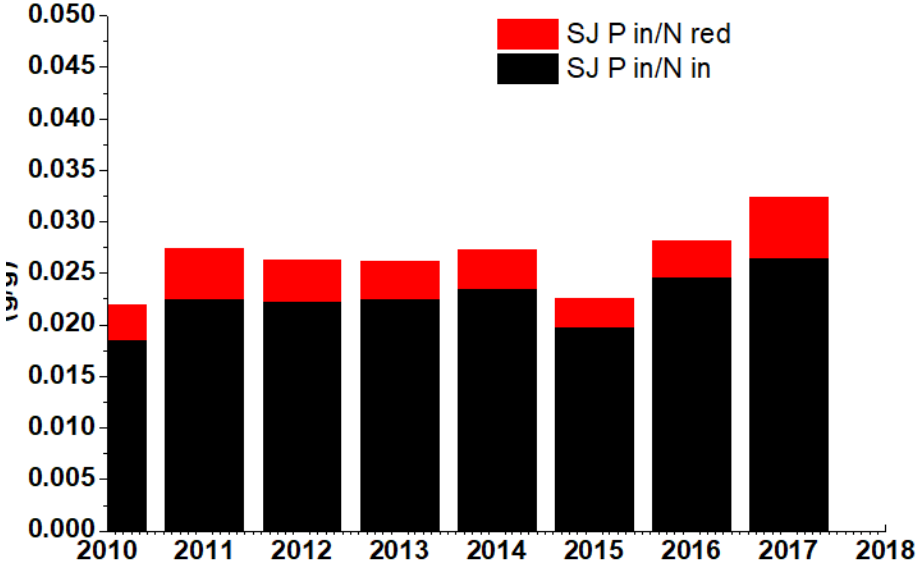


6-11 mg SS/l

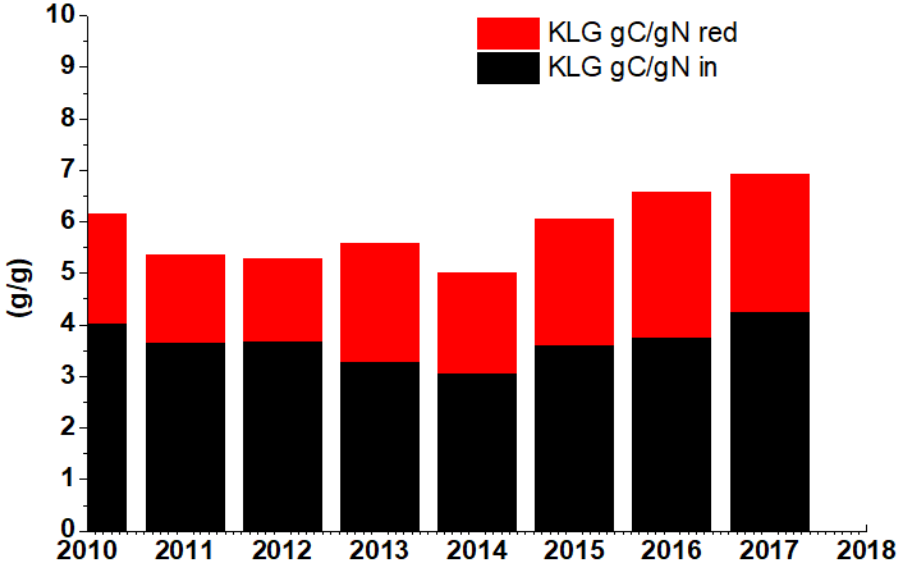
FOSFOR

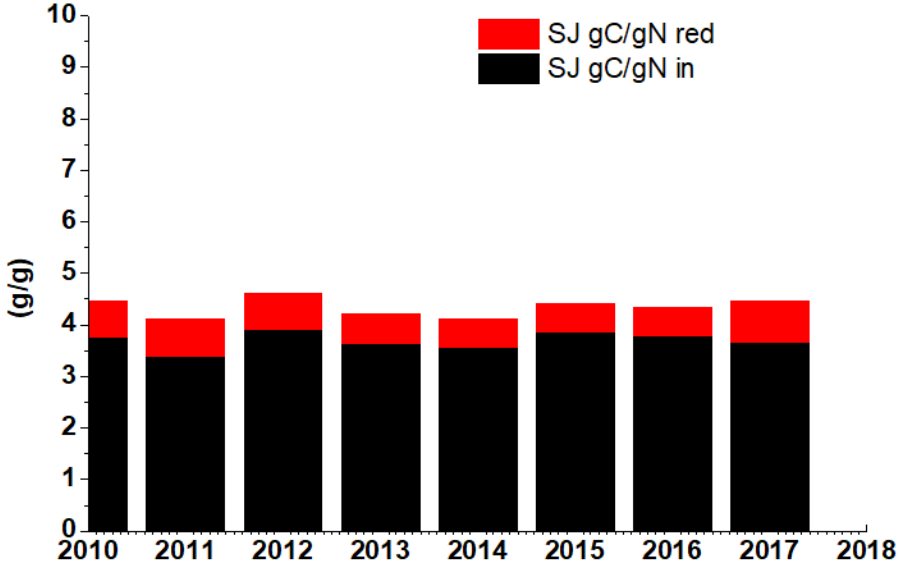
- Nordeidet et al. 1994
- Aspegren et al. 1998
- Hanner et al. 2003
- Täljemark et al. 2004
- Mases et al. 2010





KOLKÄLLA

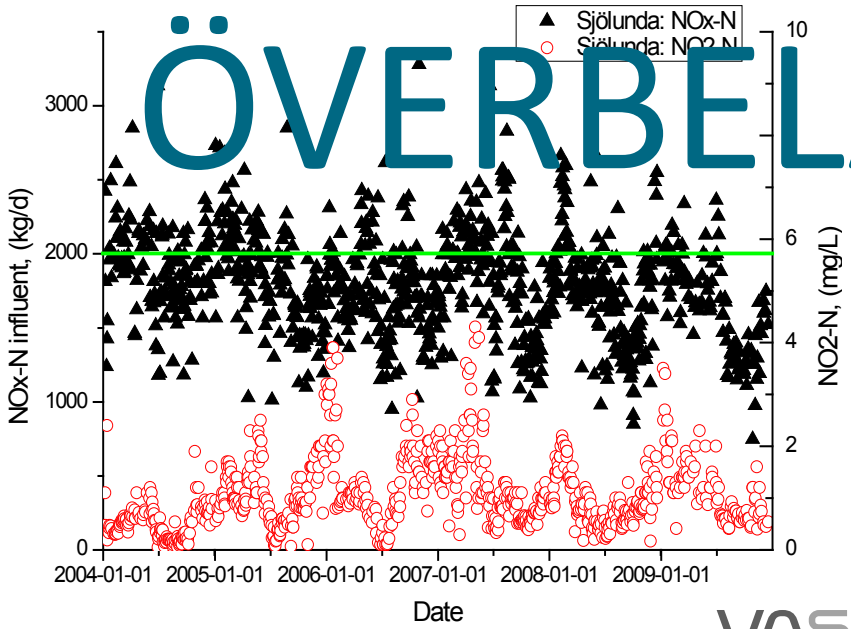

KLG gC/gN red
KLG gC/gN in
(g/g)
0
1
2
3
4
5
6
7
8
9
10
2010
2011
2012
2013
2014
2015
2016
2017
2018

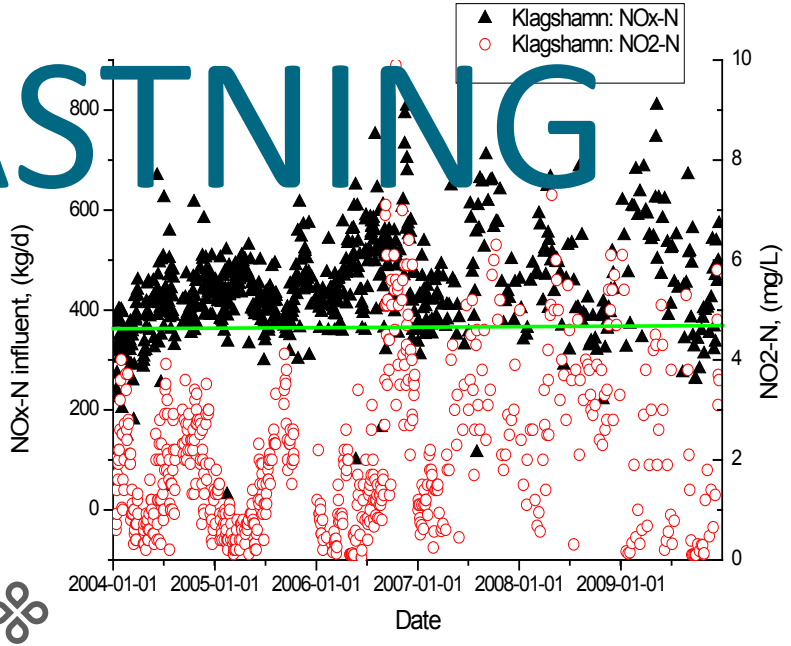

SJ gC/gN red
SJ gC/gN in
(g/g)
0
1
2
3
4
5
6
7
8
9
10
2010
2011
2012
2013
2014
2015
2016
2017
2018

NITRIT

	Normal (mg/L)	Peak conc. (mg/L)
Sjölunda	1	4
Klagshamn	0.5 - 4	10

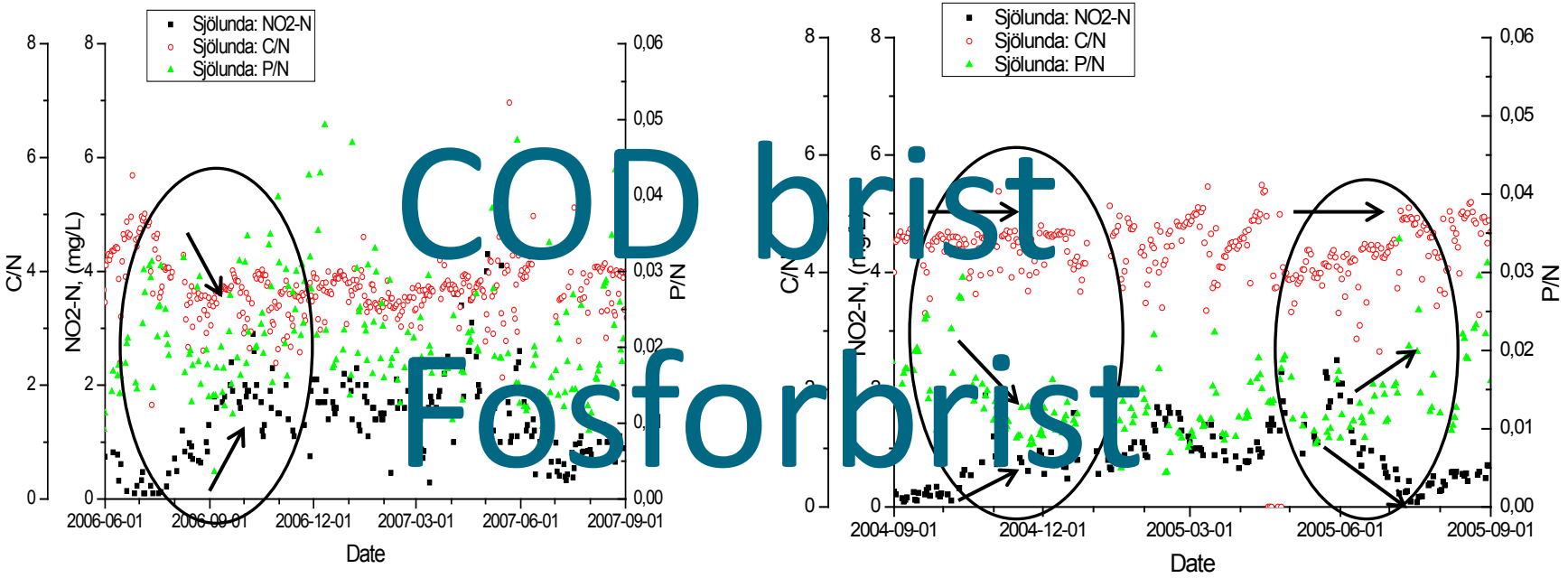
ÖVERBELASTNING





VASYD

NITRIT



COD brist

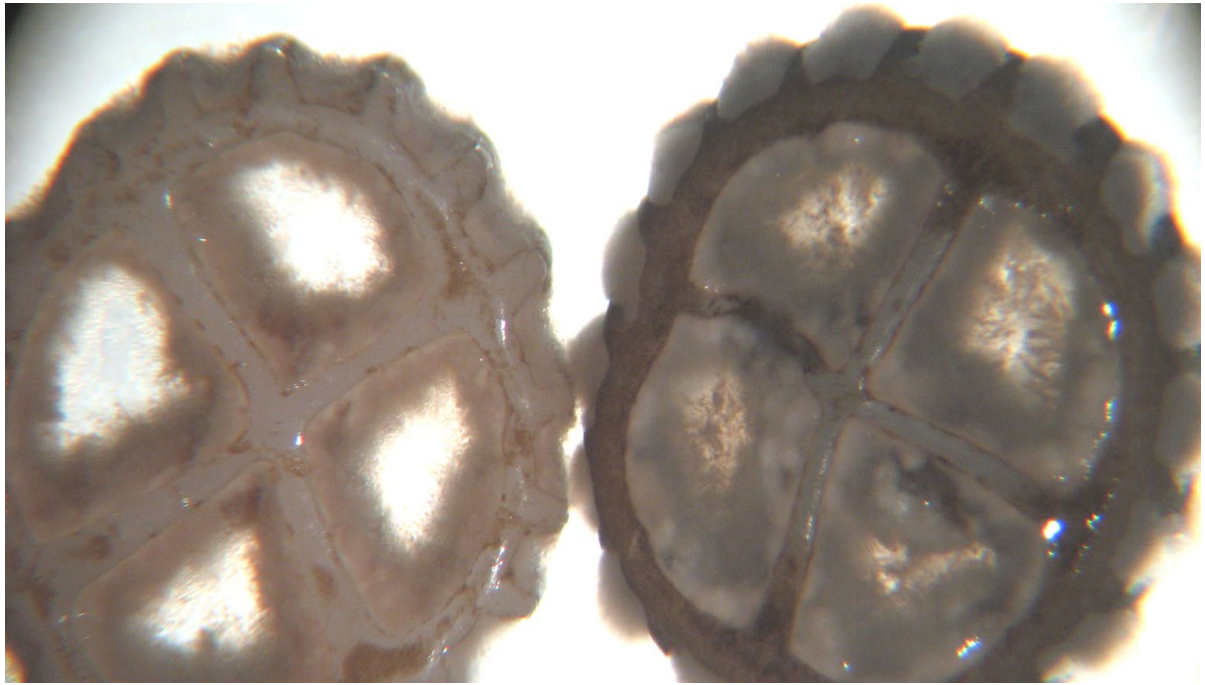
Fosforbrist

BIOFILM

1:a zonen

Sjölunda

Klagshamn



13-19 mg NOx-N/l

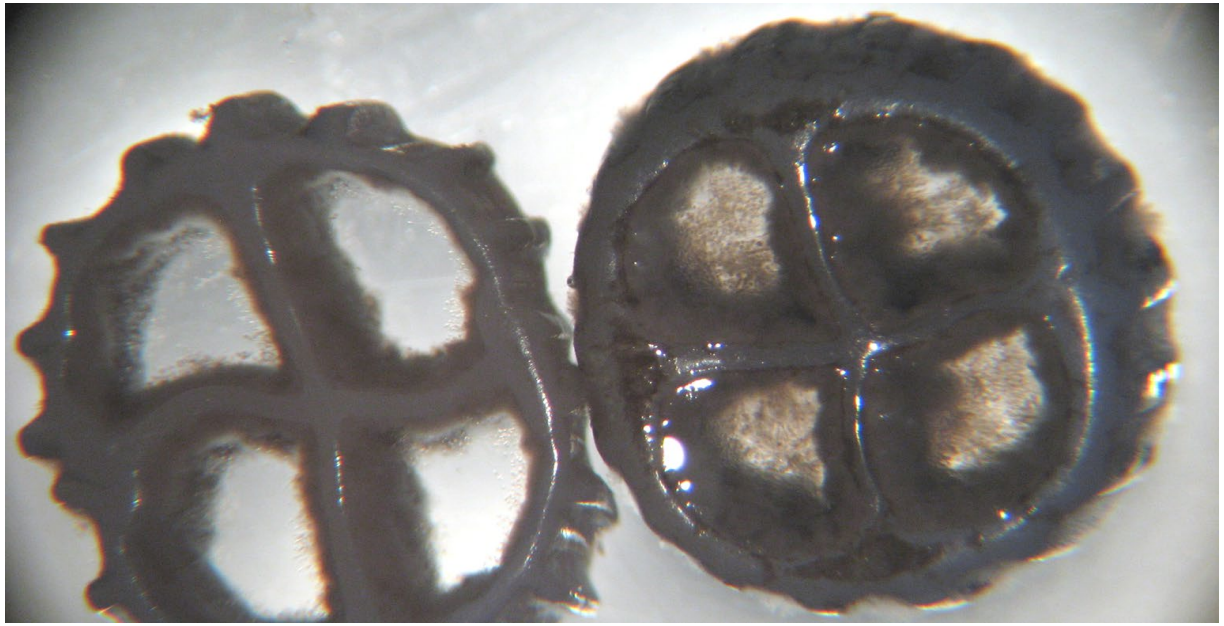
17-28 mg NOx-N/l

BIOFILM

2:a zonen

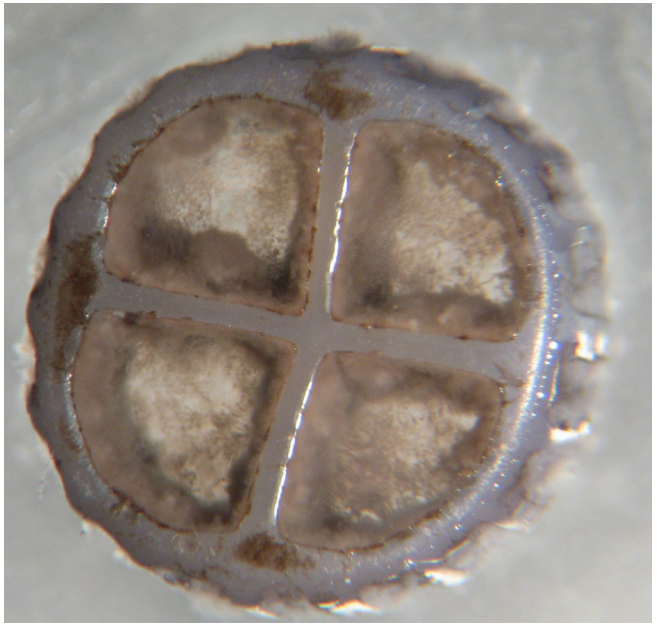
Sjölunda

Klagshamn



BÄRARNA

Klagshamn mer slitna



36 %

Sjölunda mer deformerade

50 %

KVANTITAV ANALYS

	BIOMASSA (mg/bärrare)		Koncentration (kg SS/m3)	
	Zon 1	*Zon 2*	*Zon 1*	*Zon 2*
Klagshamn	7,6	6,1	2,9	2,2
Sjölunda	4,9	2,9	2,5	1,4

- *Rusten et al., 1994, 1995, 1996.* 2-5 kg SS/m3

- *Mosey et al, 1996*
- *30 g COD /m2*d: kompakt biofilm begränsad antal protozoa*
- *10-15 g COD/ m2 *d: fluffig biofilm med ciliater/protozoa (Klagshamn)*
- *<5 g COD/ m2 *d: fluffig biofilm med stalkade ciliater (Sjölunda)*

SLUTSATSER

- Olika driftstategier p g a olika process layout:
  KLG- reducerar inte hela NOx-N mängden, sandfiltret bidrar till 10-15 % reduktion
  SJÖ- krävs låga NOx-N ut, COD begränsad, ingen denitrifikation i DAF
- Olika driftstategier p g a olika process layout:
  Val av kolkälla- pris, tillgång, hastighet
- Nitritbildning:
  Hög belastning, brist på COD och/eller P
- Fosforbrist:
  Krävs kontroll på fällningen
- Bärarna:
  OK skick efter 20 år. Skillnad i biofilmen (belastning, kolkälla)
- Val av poleringssteg:
  Stor skillnad