CREATE KONFERANSE Bergen 4 nov 2010

FLOXY

Merdlengde, fisketetthet og oksygen.

HAVFORSKNINGSINSTITUTTET
INSTITUTE OF MARINE RESEARCH

Jan Aure og Frode Oppedal (HI)

Strømreduksjon i merder

$$V_x = V_1 \cdot m^* e^{-(fk \cdot x)}$$ (cm/sek)

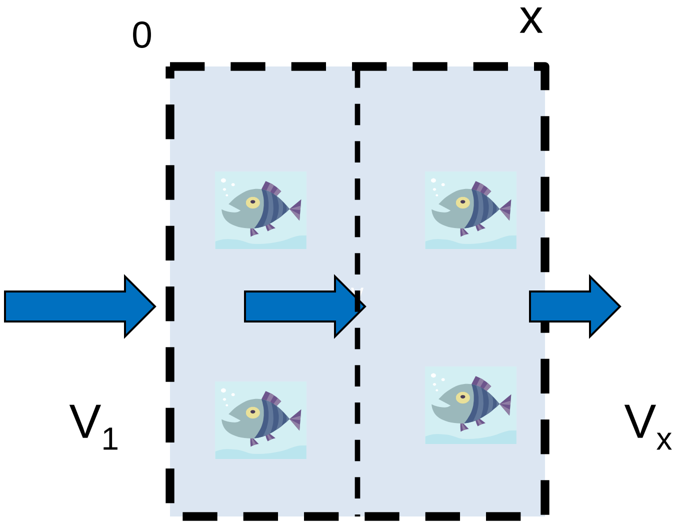
$$V_x / V_1 = m^* e^{-(fk \cdot x)}$$

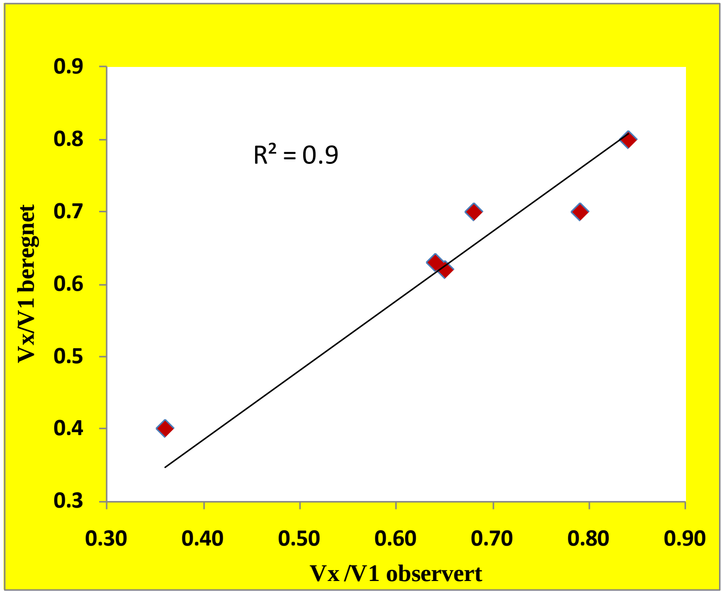
V_1 = Innstrøm V_x = Utstrøm

fk = friksjonskoeffesient fisk = $(0.0012 * F_{tett})$

Ftett = Fisketetthet

m = Friksjon merder(doble) (Vx/V1 = 0.72) (+begroing?)

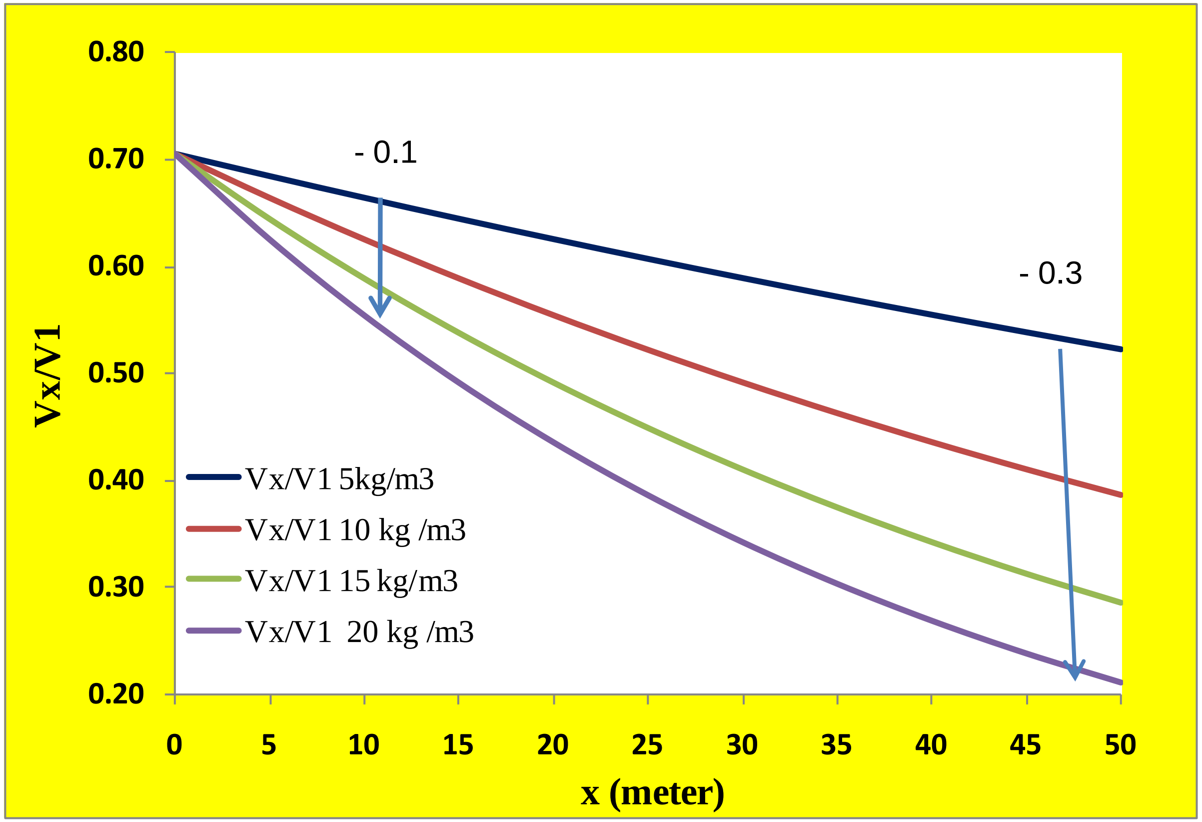




Strøm (Vx/V1) som funksjon av:

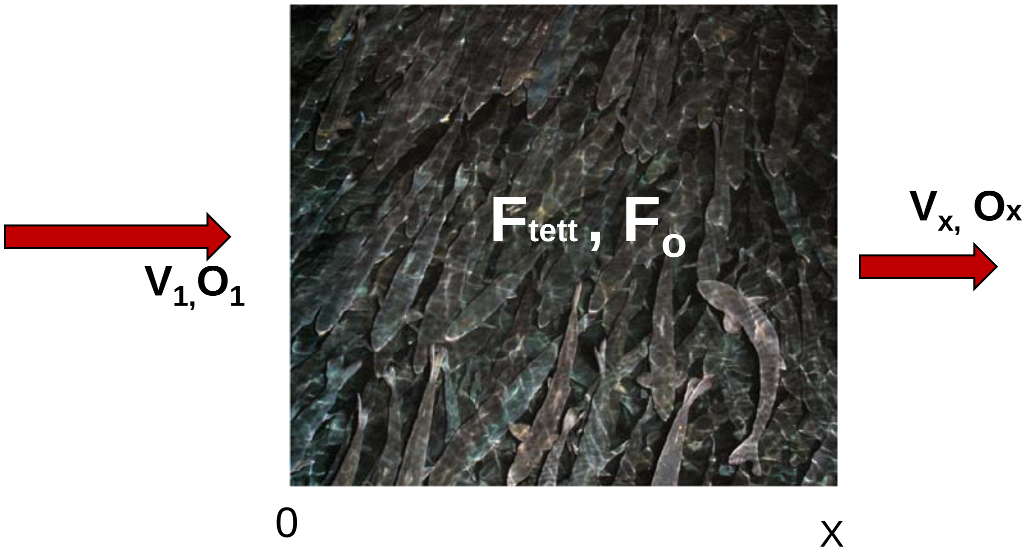
* merdlengde (meter)

* fisketetthet (kg/m^3)



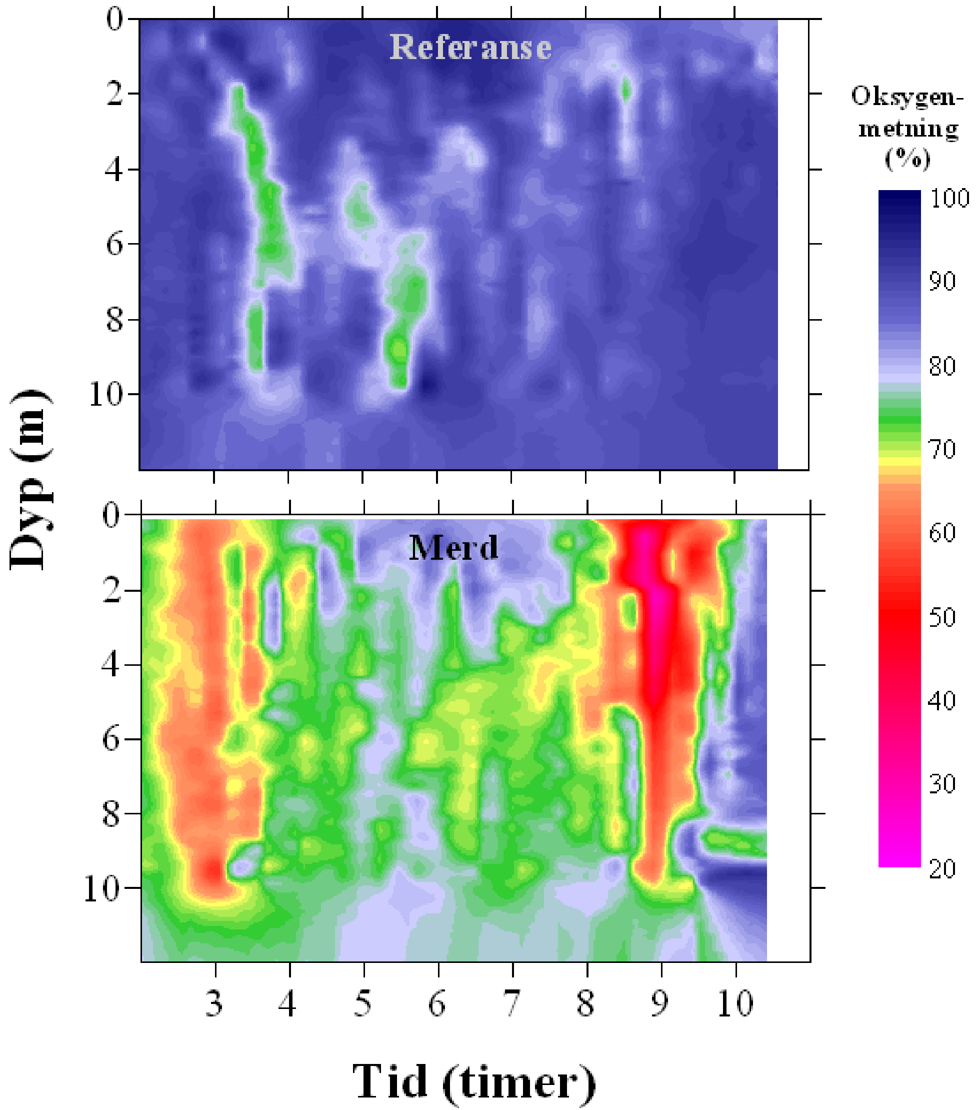
Oksygen i merd

$$Ox = O1+(Ftett*Fo)/(V1*m)/(fk)*(1-exp(fk*x) \qquad (mg/l)$$



O_1 = Oxygen inn (9.5 mg/l)
Ox = Oksygen ut
F_{tett} = Fisketetthet (kg/m^3)
F_O= Oksygen forbruk fisk (g O_2/kg/sek) (sommer)
V_1 = Strøm inn (m/sek)
Vx = strøm ut
m = Strømreduksjon doble merder (Vx/V1) = 0.7
fk = Friksjonskoeff . fisk = $(0.0012*F_{tett})$

Oxygenforhold i et oppdrettsanlegg i september med midlere fisketettet 7- 8 kg/m³. Periodevis svake tidevannstrømmer hvor oksygenmetning var nede i 30 % (fiskedød - røde områder).



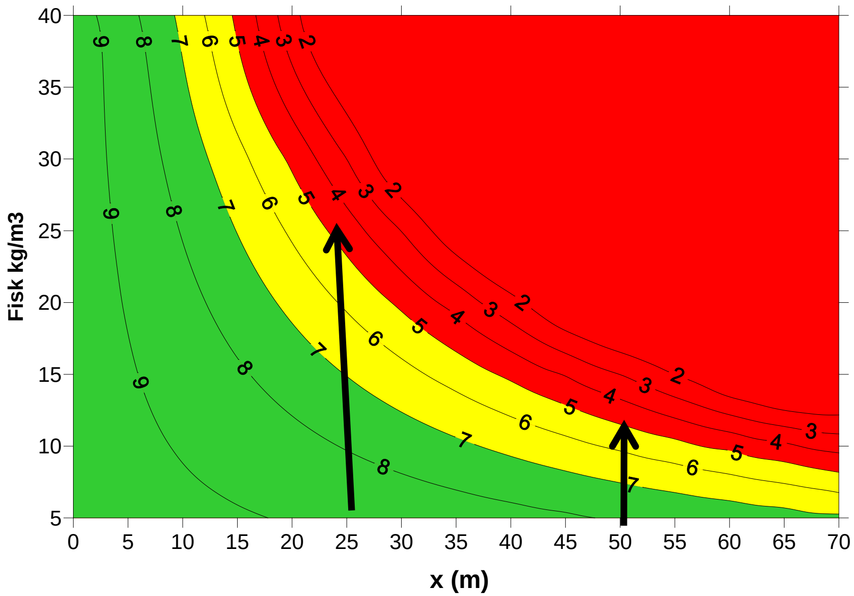
Beregnete oksygenkonsentrasjoner (O_2 mg/l) for V_1 = 2 cm/sek og 5 cm/sek

(midlere fisketetthet kg/m³ og $O_{1\ inn}$ = 9.5 mg/l, midlere oksygenforbruk sommer)

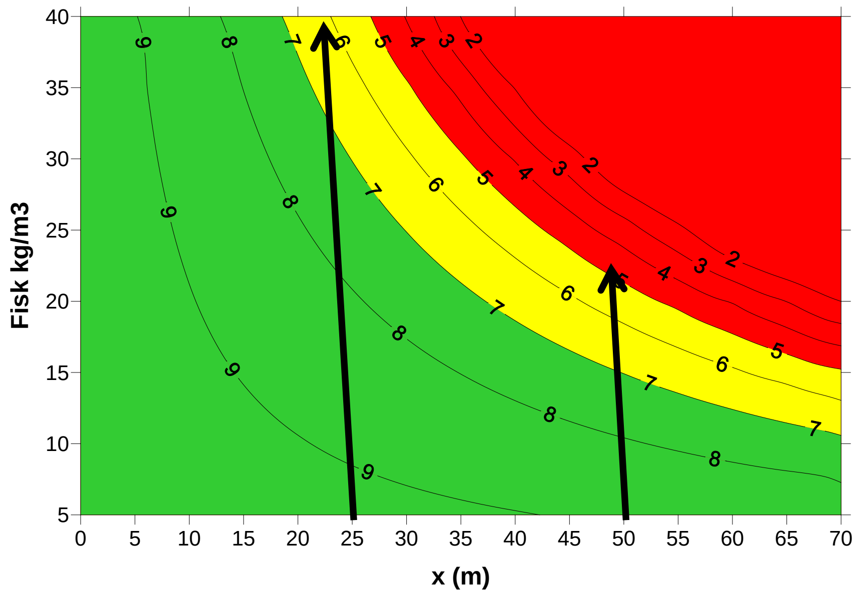
NB! Adferd i merd.

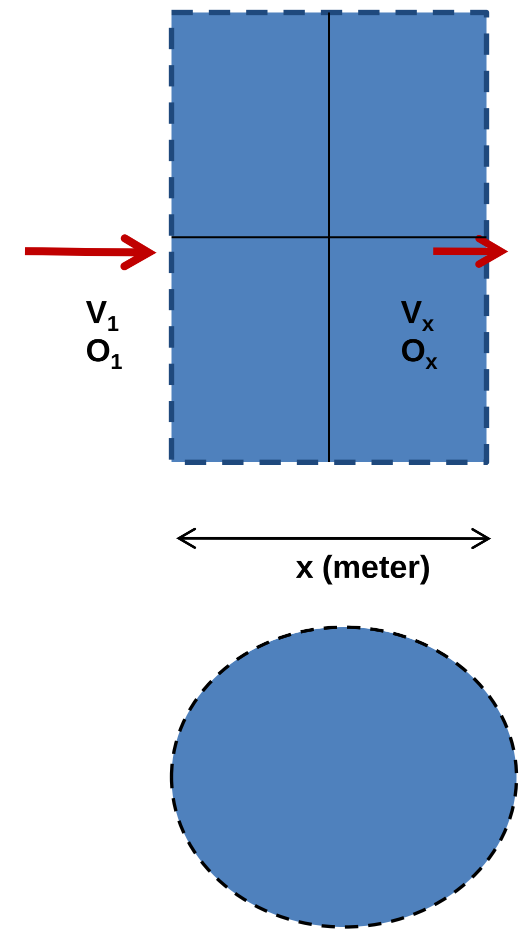
V0 = V1*1.3

Sommer, Oksygen (mg/l) V1= 2 cm/sek

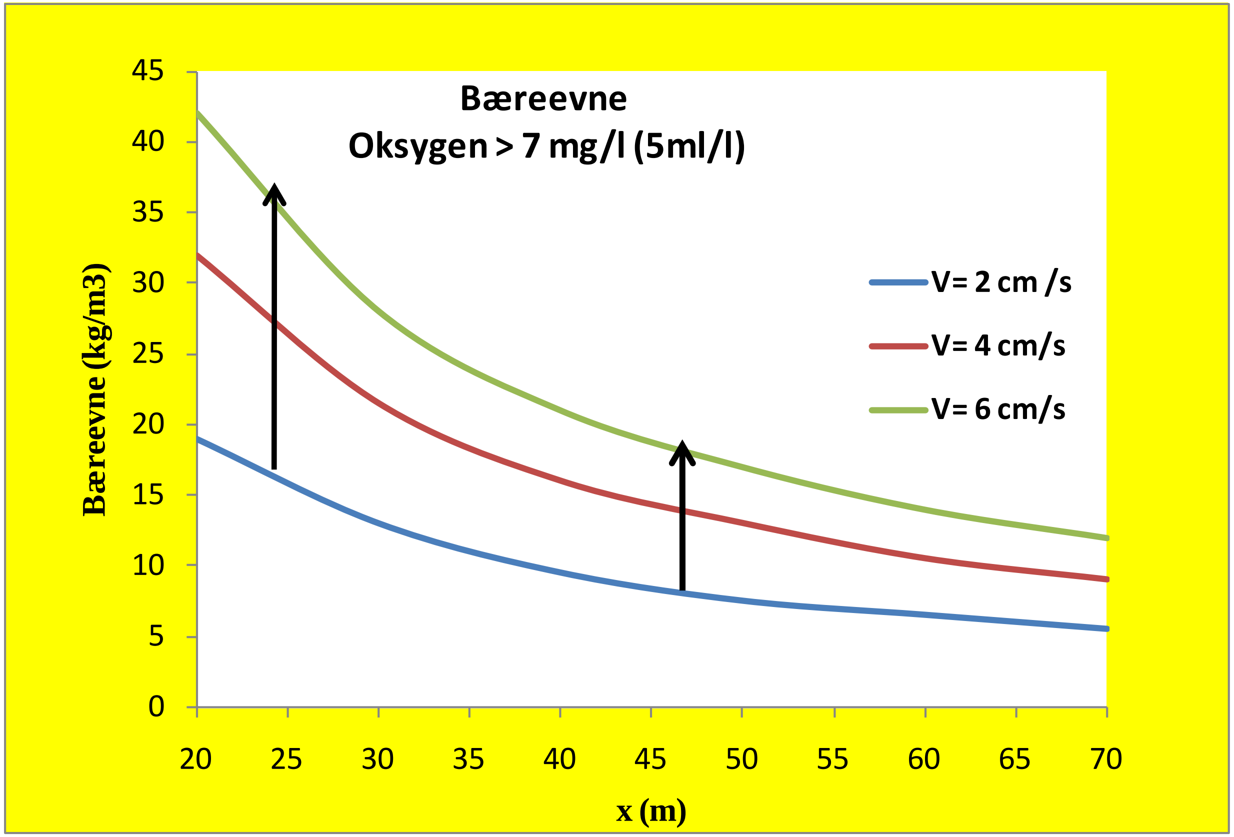


Sommer , oksygen (mg/l) V1= 5 cm/sek





Beregnet bæreevne (kg/m³) for oksygen > 7mg/l (5 ml/l), sommer



Konklusjoner

***Strømmen i fiskeoppdrettsanlegg er bestemt av:**

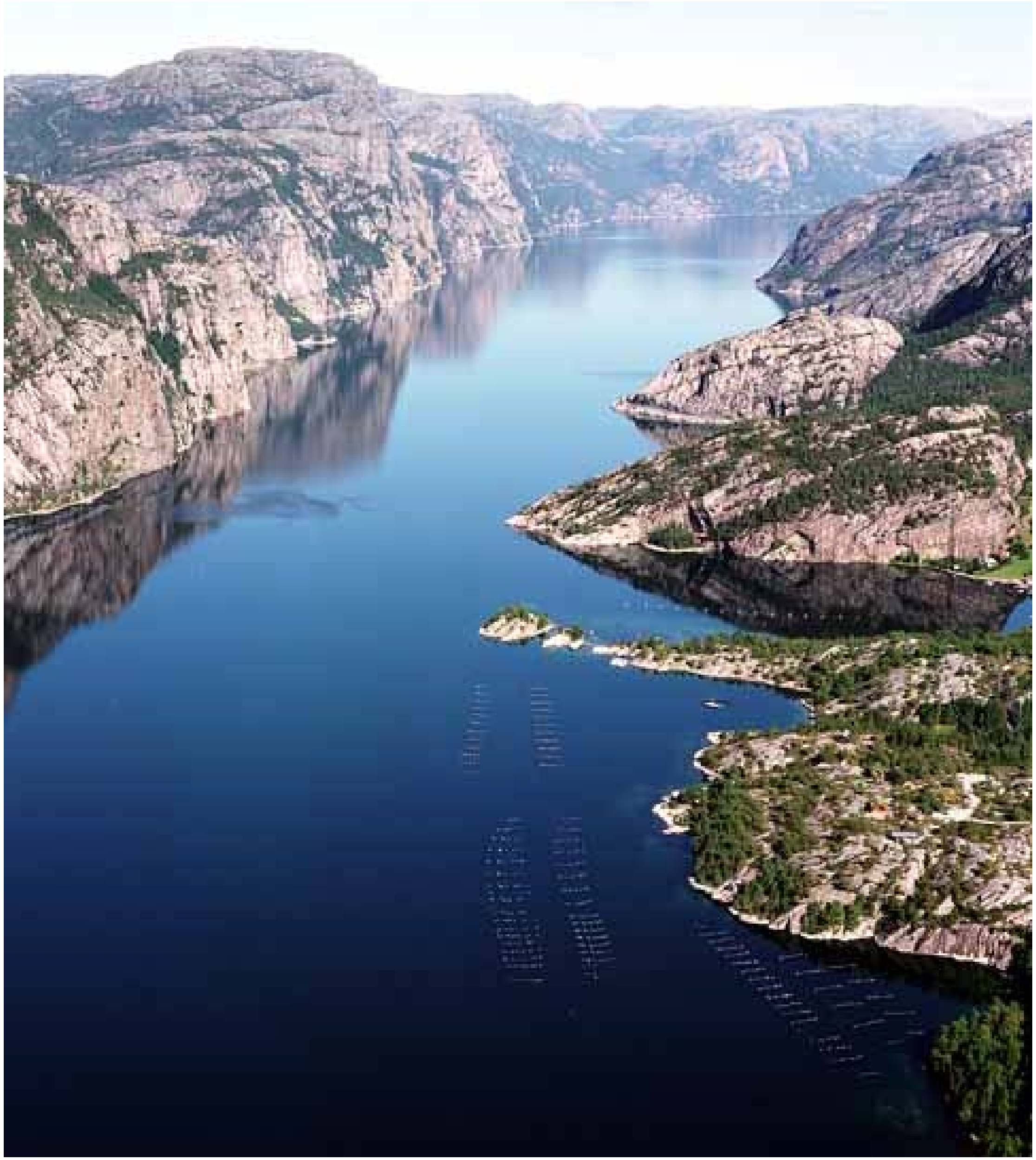
- **Bakgrunnsstrømmen**
- **Merdene (nøter, begroing osv)**
- **Merdlengde i hovedstrømretning, størrelse (sirkelmerder)**
- **Fisketetthet**

*** Oksygenforholdene i store (lange) merder er mer følsomme for endringer i strøm og fisketetthet.**

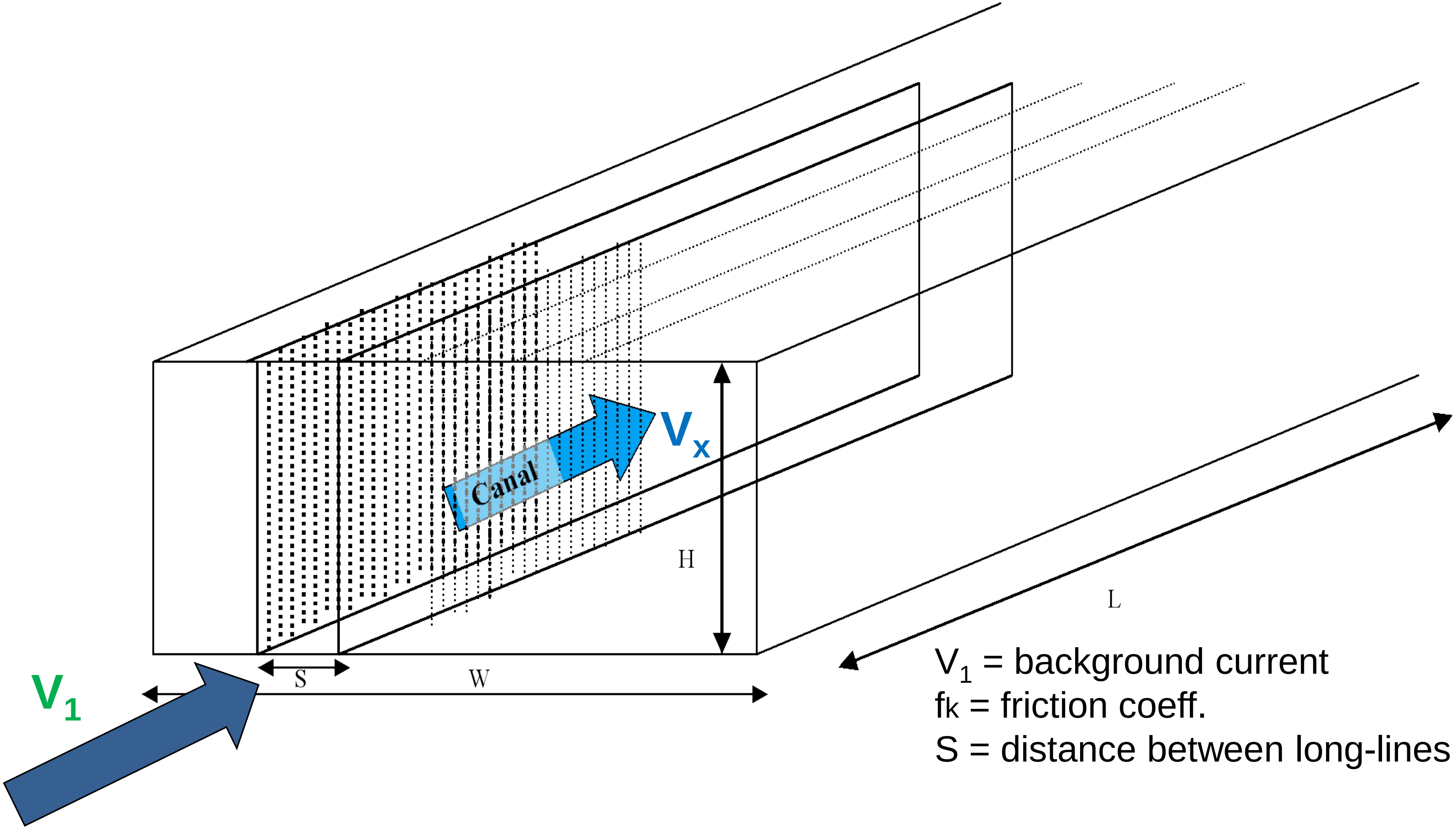
*** Bæreevnen (kg/m^3) mht. oksygen er mindre for store (lange) merder og øker med midlere bakgrunnsstrøm.**

THE END

Long-line mussel farm



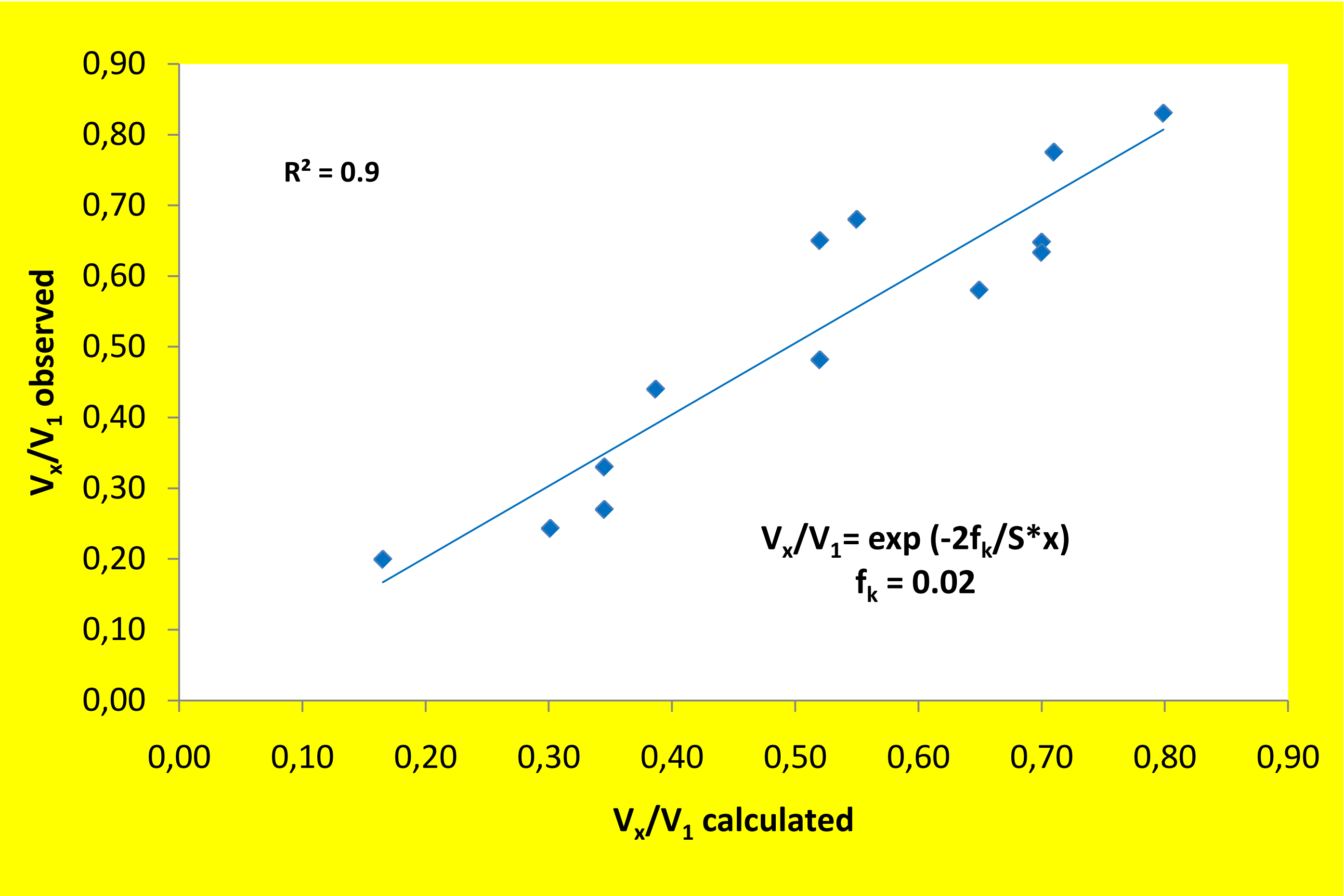
Current speed model



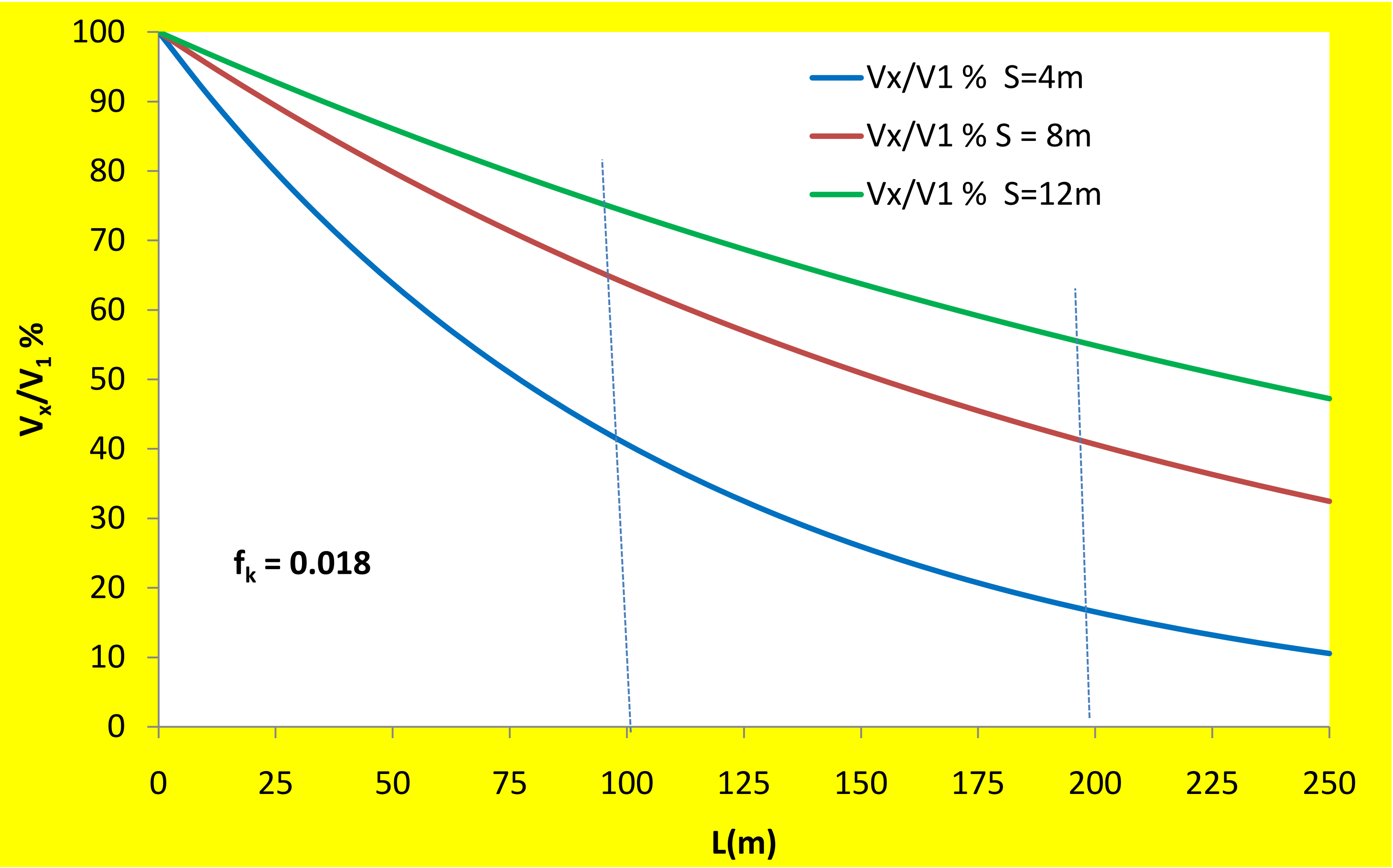
V_1 = background current
f_k = friction coeff.
S = distance between long-lines

$$V_x = V_1 * \exp(-2f_k/S * x)$$

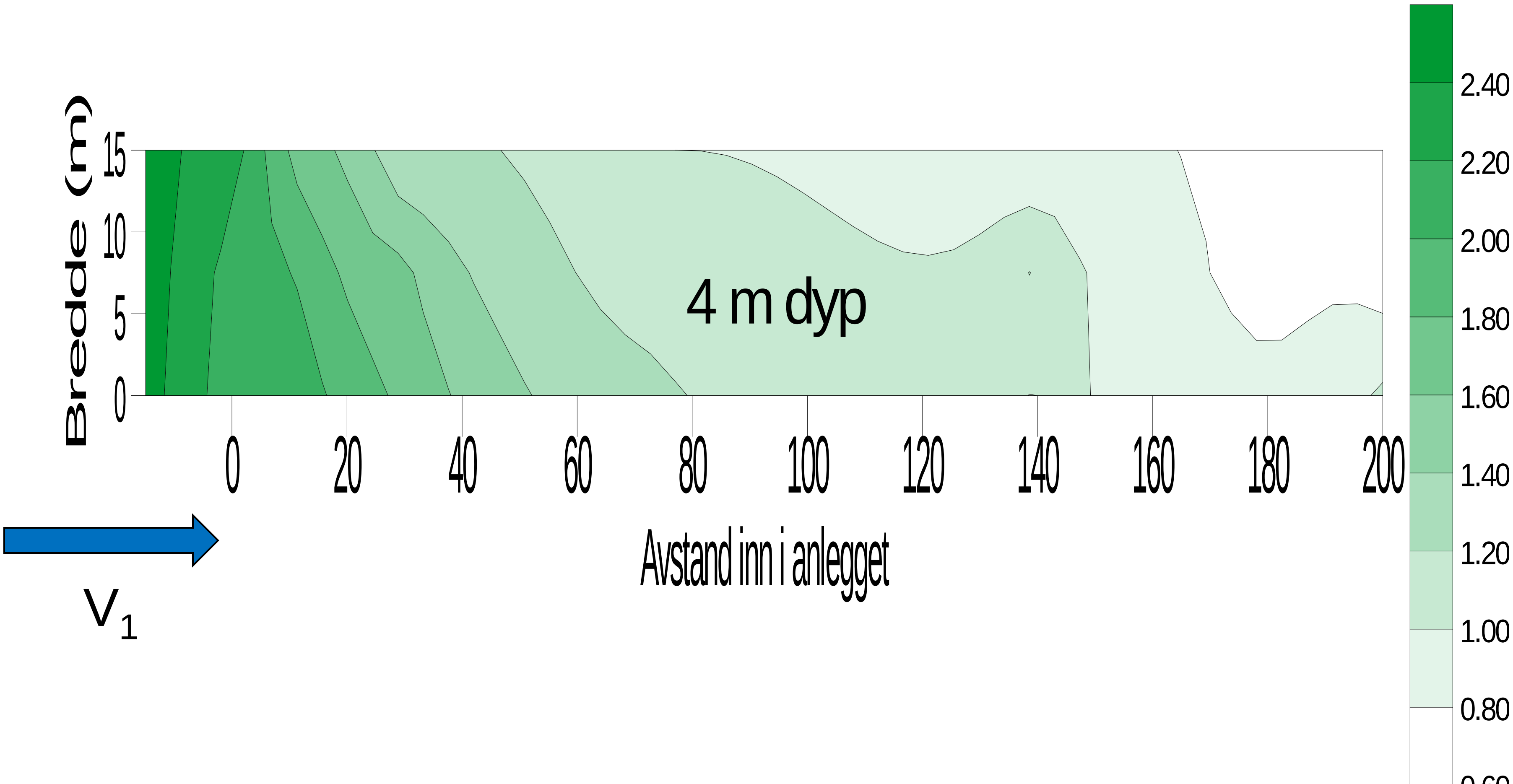
Observed and calculated relative currents (V_x/V_1) in a long - line mussel farm



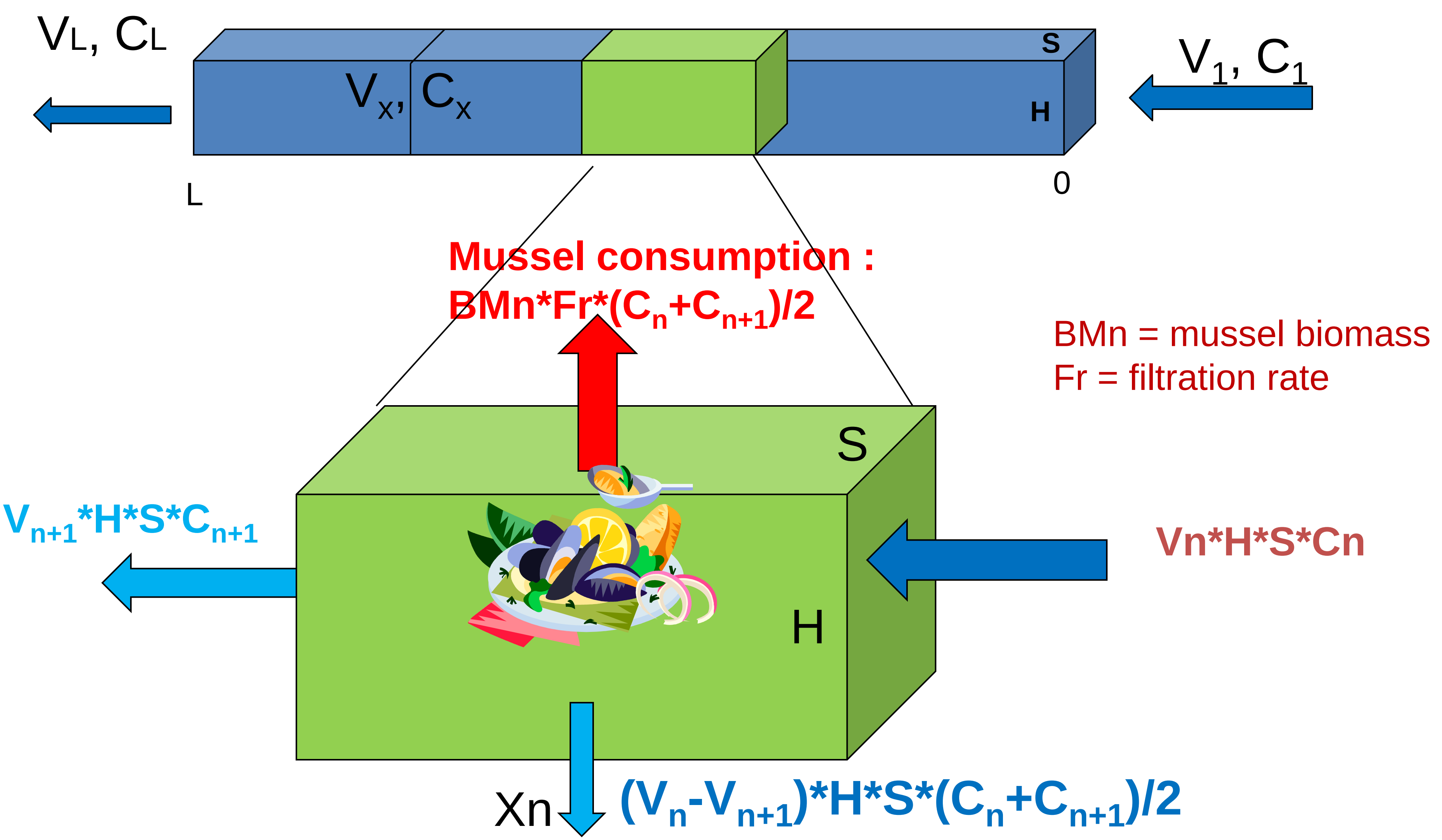
Calculated relative currents (%)



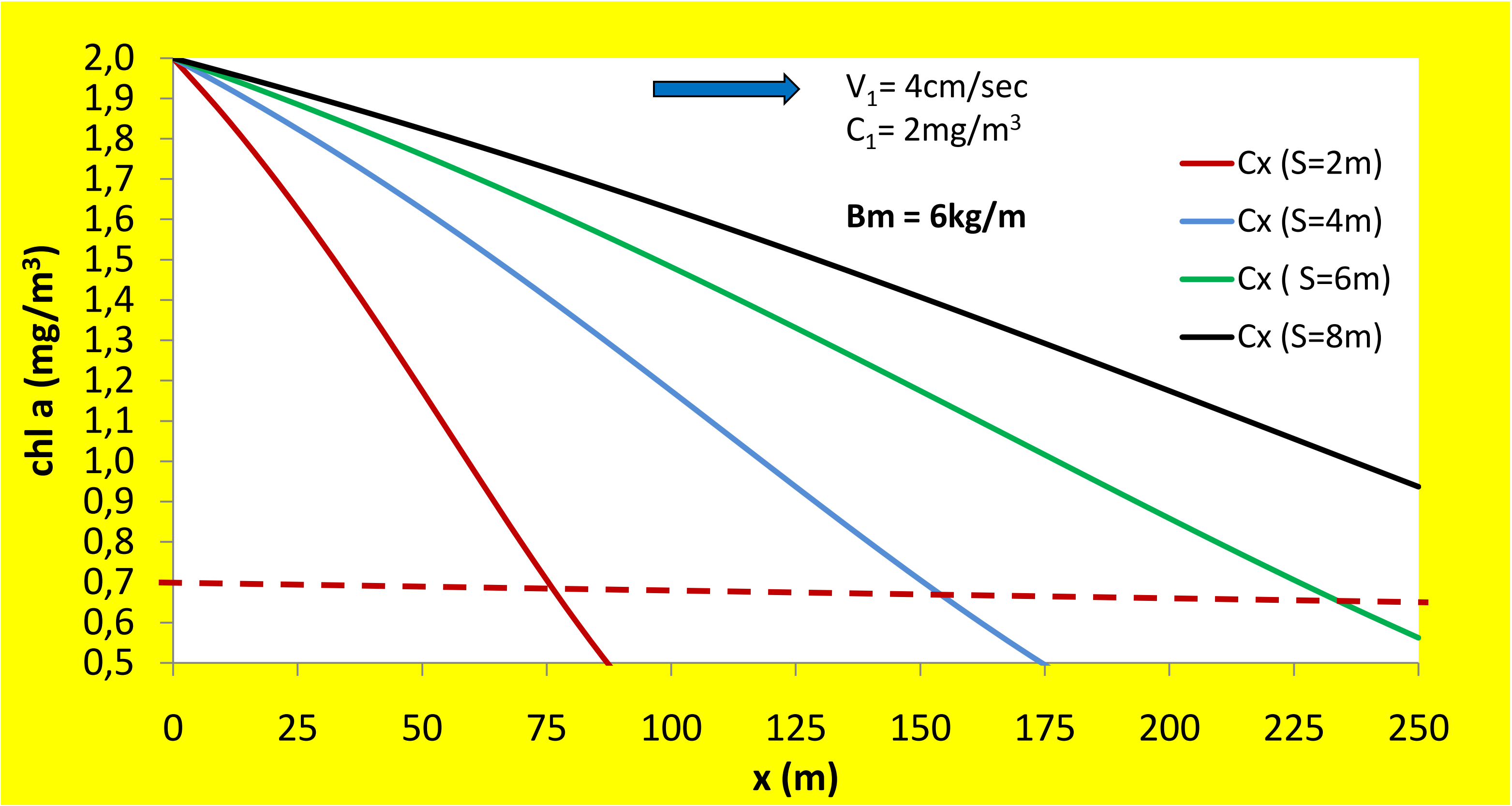
Seston deplition (Chla)



Seston (chla) deplition model

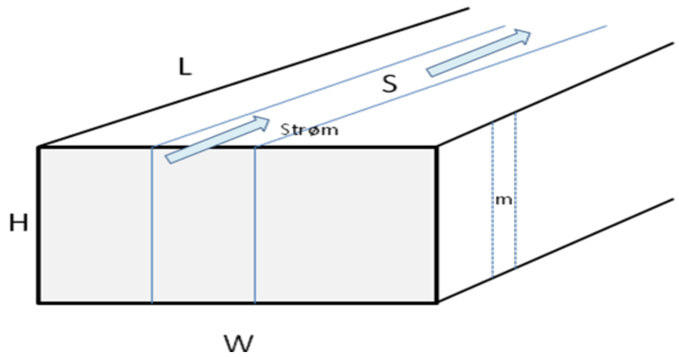


$$C_x = C_1 * \exp(B_{ix} * Fr / V_1 / (2 * f_k / S) * (1 - \exp(2 * f_k / S * x))$$



Carrying capacity model (BMC_{max})

(The largest biomass a mussel farm can hold without the seston (chla) concentration in the water leaving the farm dropping beneath a seston deplition threshold (Ct) during mean flow)



W = width

H = Height

L = length

S= Distance between long-lines

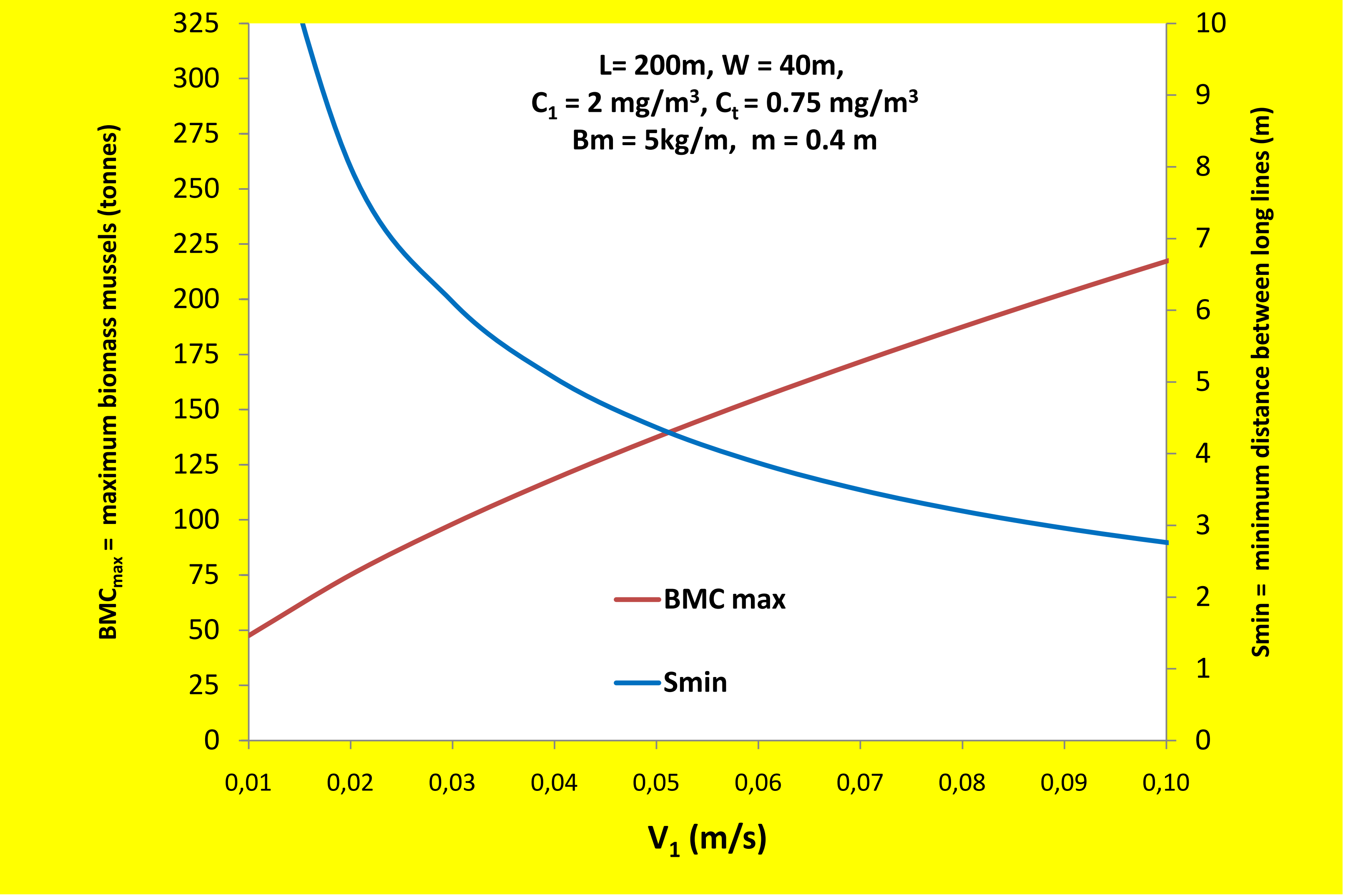
V_1 = Background current speed

C_1 = Background chla

Ct = Treshold chla

Fr = Filtration rate mussels

$$BMC_{max} = 2*H*W*V_1*(c*S/2L)^{0.5} *(C_1-C_t)/C_1+C_t)/Fr/1000 \text{ (tonnes)}$$



L= 200m, W = 40m,
C1 = 2 mg/m3, Ct = 0.75 mg/m3
Bm = 5kg/m, m = 0.4 m
BMCmax = maximum biomass mussels (tonnes)
Smin = minimum distance between long lines (m)
BMC max
Smin
325
300
275
250
225
200
175
150
125
100
75
50
25
0
10
9
8
7
6
5
4
3
2
1
0
0,01
0,02
0,03
0,04
0,05
0,06
0,07
0,08
0,09
0,10
V1 (m/s)