PICES 2009

The effect of netting twine contrast on escape of juvenile sea bream in model trawl cod-end

2009. 10. 23

Yonghae KIM and Daesung WHANG
Gyeongsang University, KOREA

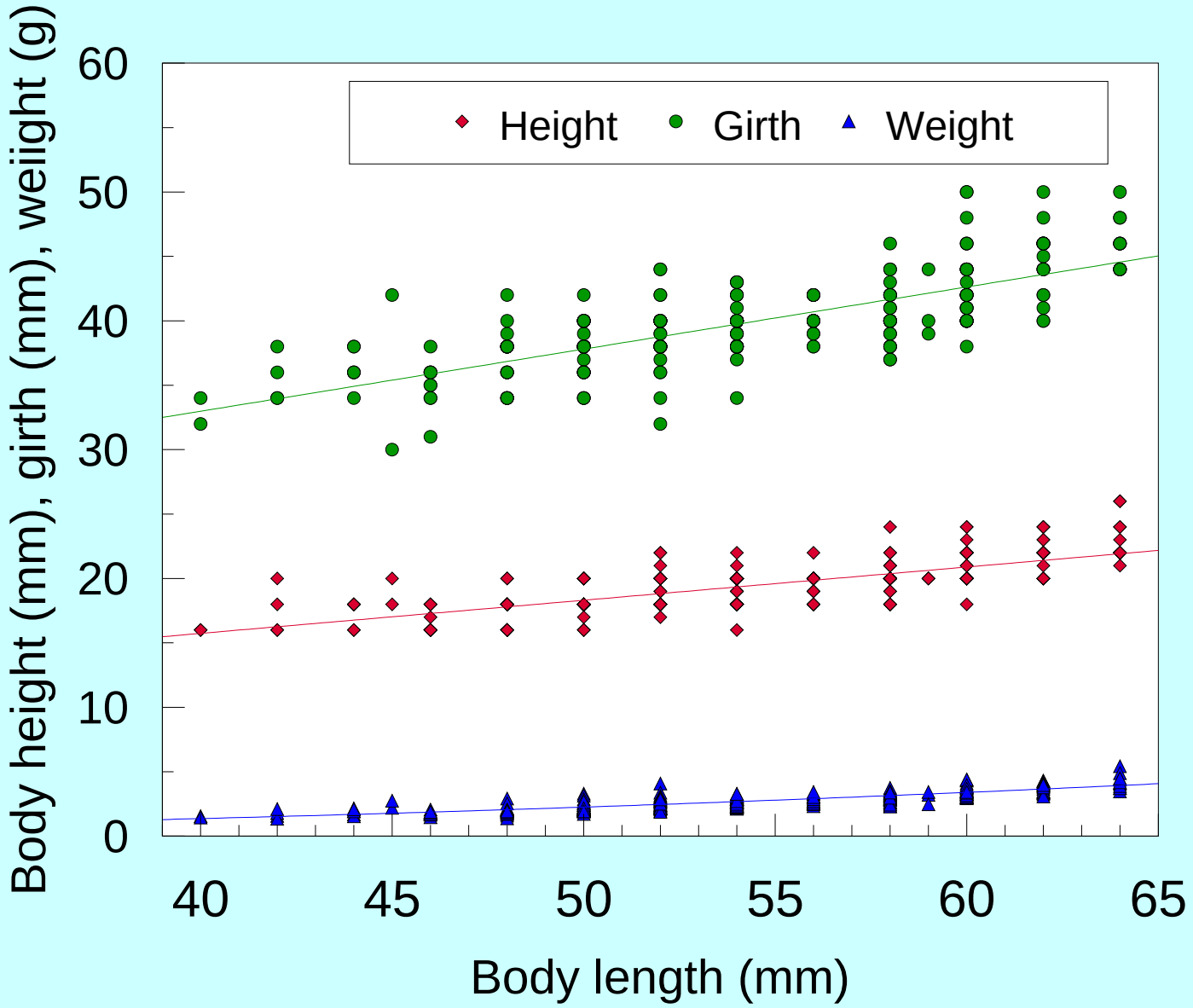
Introduction

Selectivity of the fishing gear can be controlled by mesh size, mesh shape, grid etc as physical elements in relation to the fish behavior as biological factors. Fish escapements were revealed higher at more approach to mesh net as an erratic reaction rather than keeping positions as an optomotor response (Kim et al., 2008).

Selectivity by netting

- Twine thickness: reduced 20–31% from 2.38mm to 2.89mm (Sala et al., 2007)
- Double codend impedes the escapement of immature fish (Ozbilgin & Tosunoglu, 2003)
- Square mesh window: increase selectivity of roundfish, not flatfish
- Black tunnel: increase escapement of juvenile fish (Glass & Wardle, 1995)

Juvenile sea bream (Pagrus major)


Height
Girth
Weight
Body height (mm), girth (mm), weight (g)
0
10
20
30
40
50
60
40
45
50
55
60
65
Body length (mm)

The relationship between body length and fish sizes

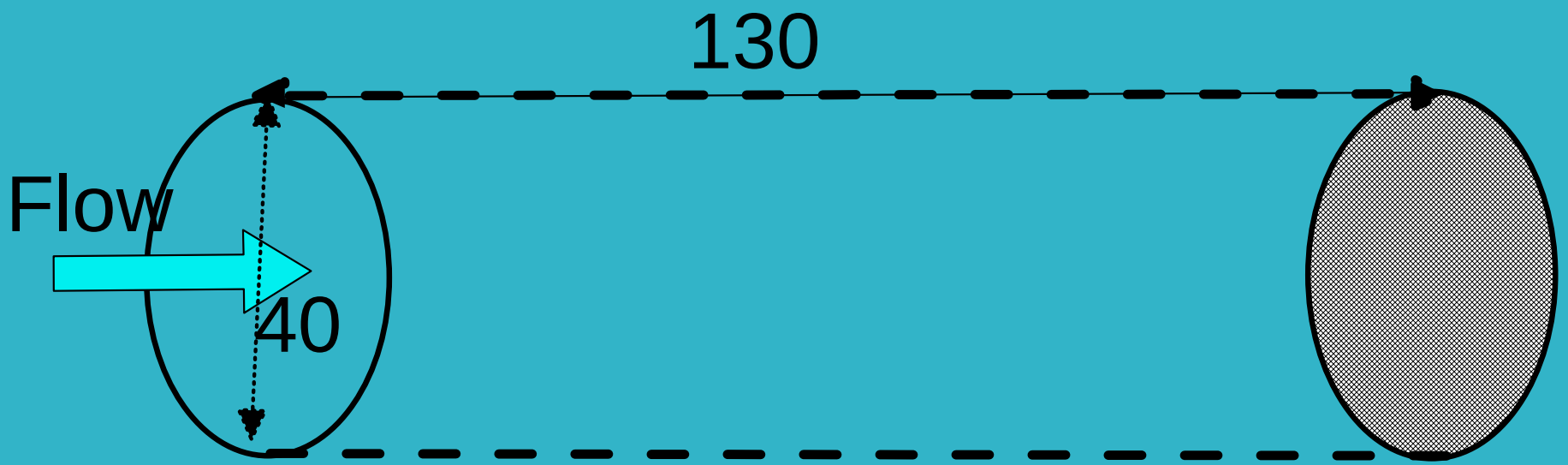
- Total body length: L (mm)
- Height (mm) = 0.231L+6.7 (r^2=0.488)
- Girth (mm) = 0.382 L+ 18.8 (r^2=0.497)
- Weight (g)= 0.000351 $L^{2.24}$ (r^2=0.703)

Netting twines

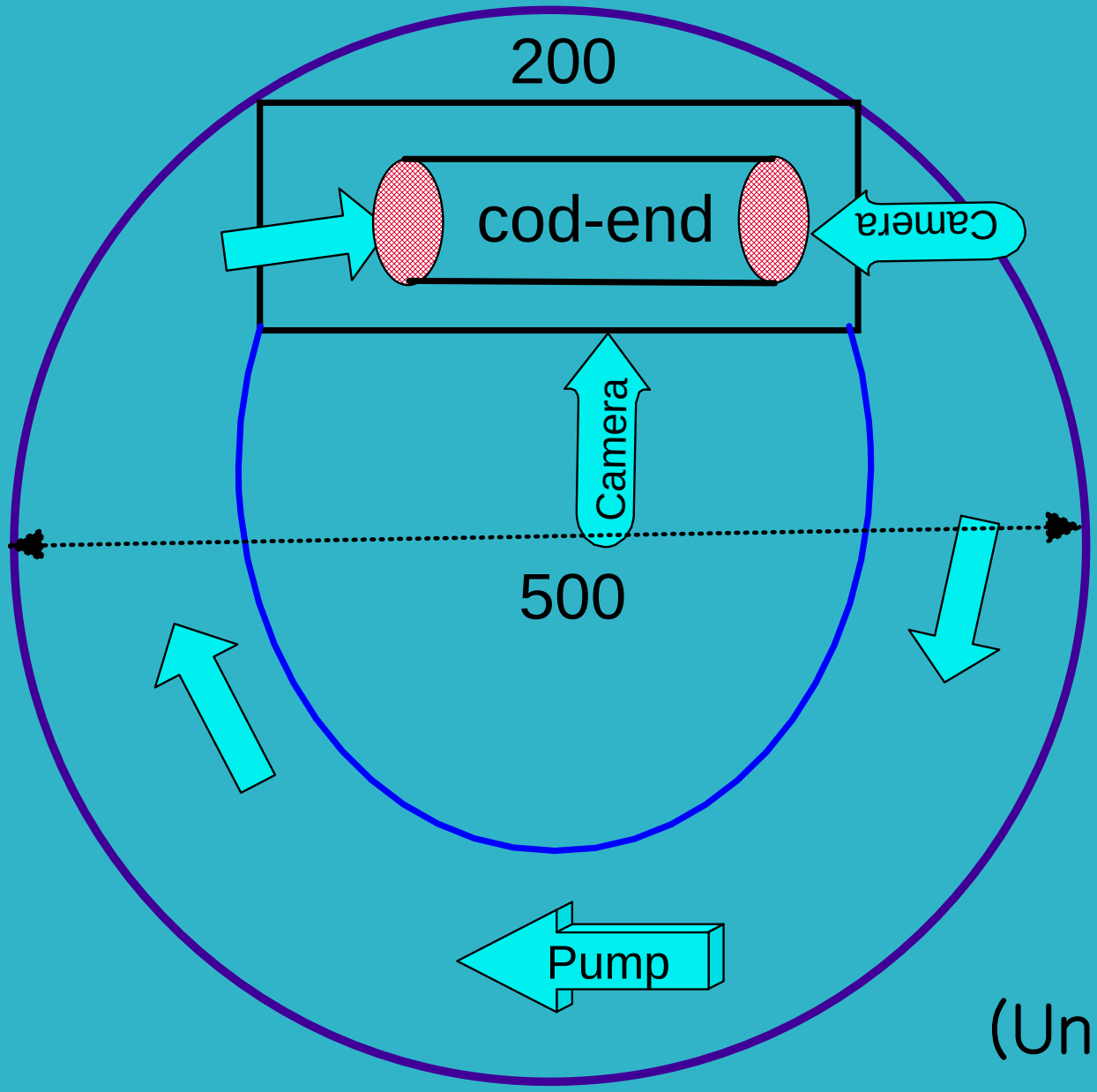
- 1. Mesh size 28mm
  PA gray dia. 0.5mm as high contrast
  PA mono, white, dia. 0.5mm as low (transparent) contrast
- 2. Mesh size 43mm
  PE brown dia. 0.5mm as high contrast
  PA mono, green, dia. 0.5mm as low contrast

Opaque?
High contrast

Transparent?
Low contrast



(Unit in cm)



(Unit in cm)

Light conditions

- 1. Dark : <0.0001lx
- 2. Dim : 1lx
- 3. Bright : 100 lx

- Measured by IM-5 lux meter (Topcon, Japan)

Optical property of sea water in the tank

Wave length (nm)	Vertical Absorption coefficient c	Beam attenuation coefficient k
488 (blue)	0.718	1.534
510 (blue green)	0.591	1.369
532 (green)	0.506	1.247

Measured by AC9+ (Web Lab, USA)

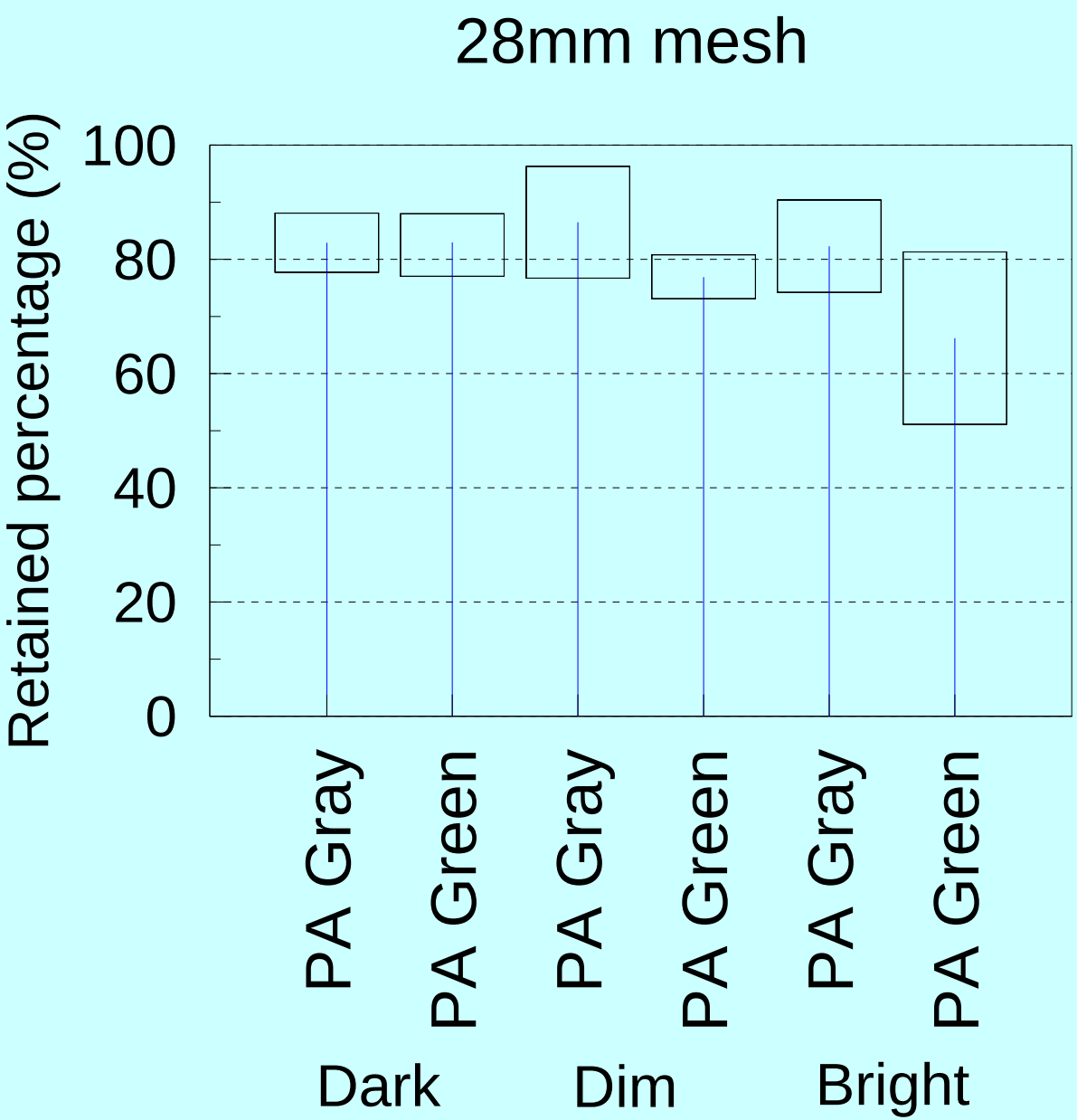
Contrast in underwater

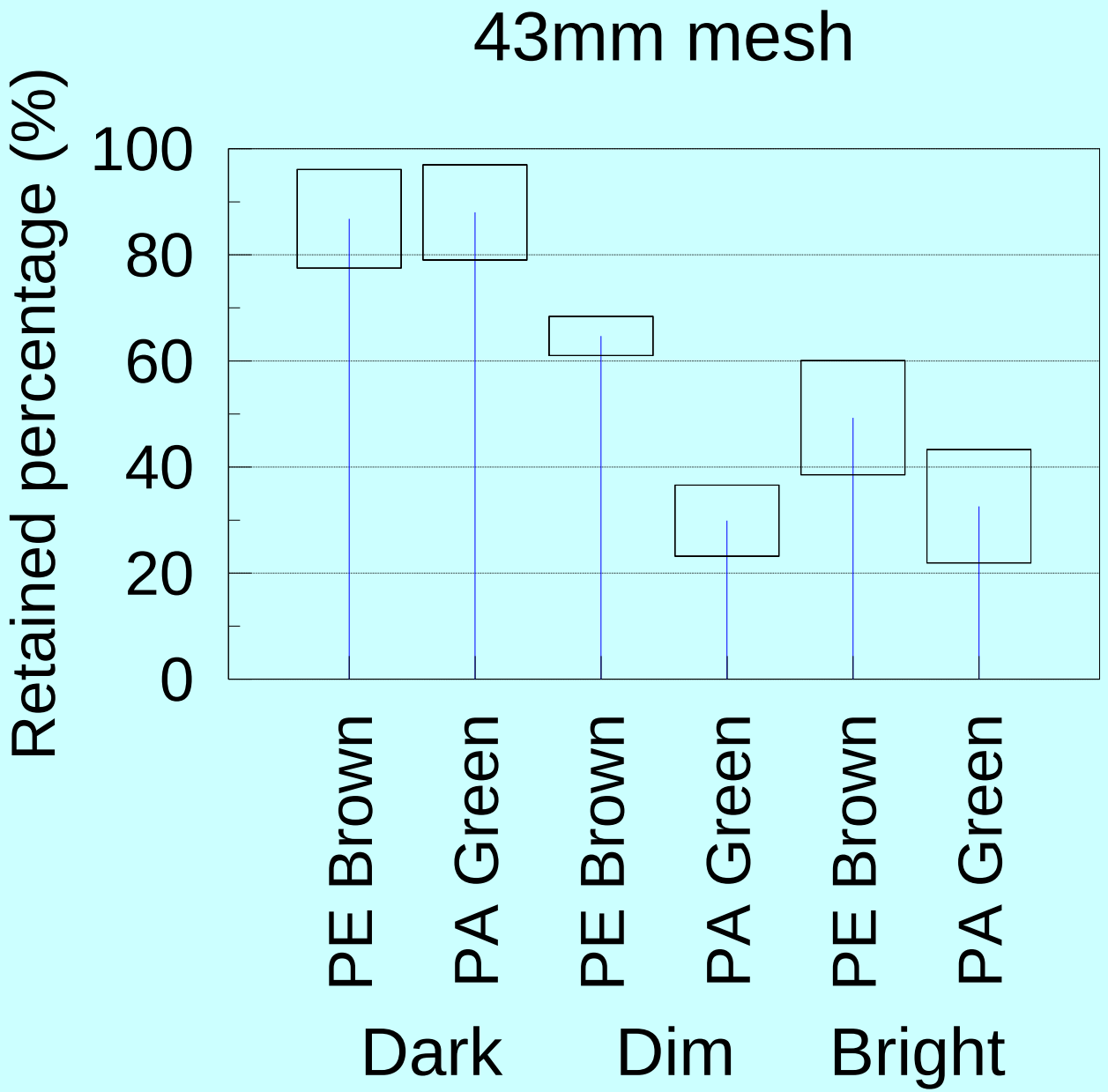
- Apparent contrast Cr =(Lo−Lb)/Lb
  $=Co\ \exp\{-cS+k\cos(Za)\ S\}$
- Object luminance Lo
- Background luminance Lb
- Distance S
- Inherent contrast Co of net at distance=0 is varied by luminance, attenuation coefficients, reflectance, twine diameter, zenith angle(Za) etc with wave length

Inherent contrast of nets

- Estimated from Kim & Wardle (1998)

- PA gray and PE brown dia. 0.5mm as high contrast : 1.12 at dim light
  1.38 at bright light
- PA green monofilament dia. 0.5mm as low contrast : 0.34 at dim light
  0.41 at bright light


28mm mesh
Retained percentage (%)
100
80
60
40
20
0
PA Gray
PA Green
PA Gray
PA Green
PA Gray
PA Green
Dark
Dim
Bright


43mm mesh
Retained percentage (%)
100
80
60
40
20
0
PE Brown
PA Green
PE Brown
PA Green
PE Brown
PA Green
Dark
Dim
Bright

T-test probability between retained ratios by high and low contrast nets

Light	28mm mesh	43mm mesh
Dark	$p<0.45$	$p<0.43$
Dim	$p<0.02$	$p<0.0001$
Bright	$p<0.03$	$p<0.0013$

Conclusion

- The retention of juvenile sea bream was 15-35% lower in the low contrast cod-end with green PA monofilament than with the high contrast netting of dark brown PE or gray PA twine under bright and dim light conditions
- Therefore low contrast of nets in the cod-end could help to reduce juvenile by-catch due to losing visual object as disturbing the orderly optomotor response.

Thank you very much!