Fish Population Dynamics

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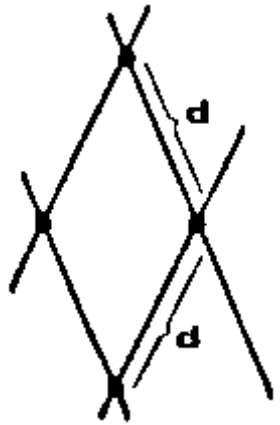
GEAR SELECTIVITY

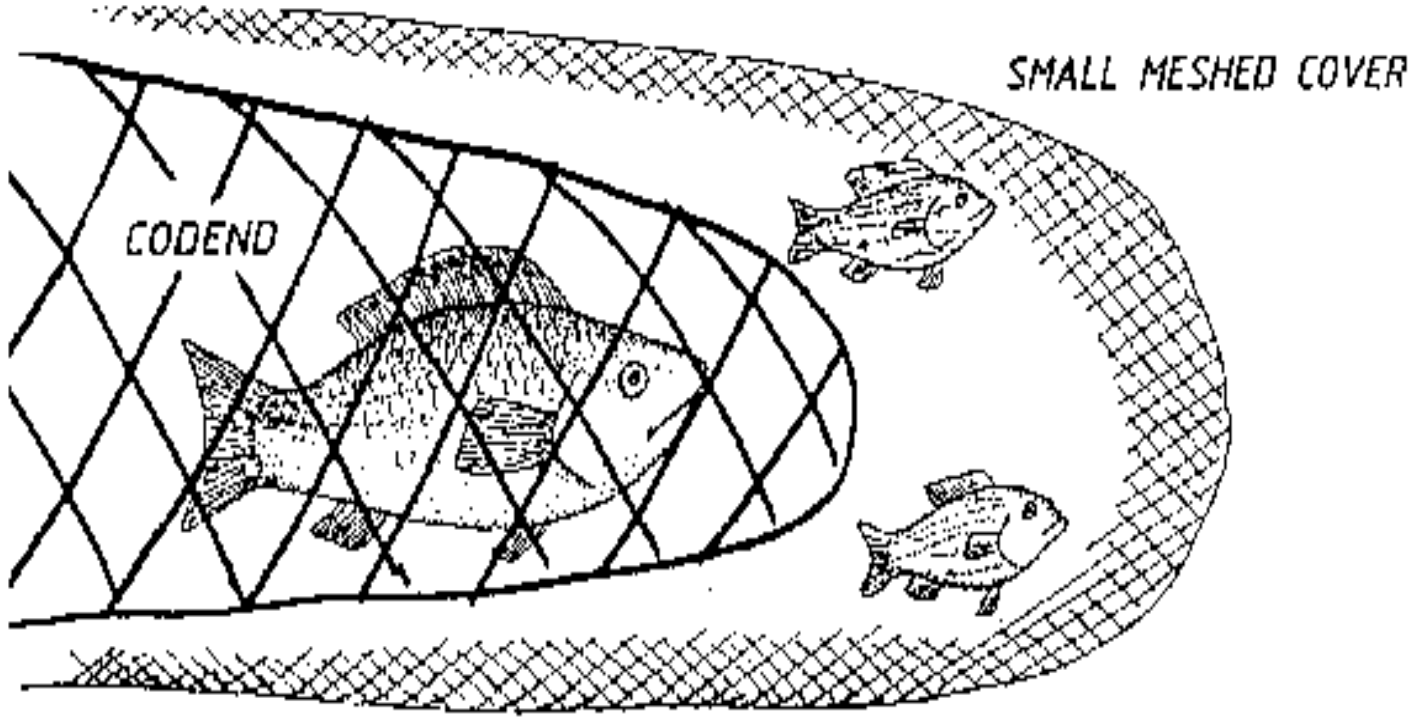
- Most fishing gears, for example trawl gears, are selective for the larger sizes, while some gears (gill nets) are selective for a certain length range only, thus excluding the capture of very small and very large fish. This property of fishing gear is called "*gear selectivity*". It needs to be taken into account when we want to estimate the real size (or age) composition of the fish in the fishing area. At the same time, it is an important tool for fisheries managers who, by regulating the minimum mesh sizes of a fishing fleet, can more or less determine the minimum sizes of the target species of certain fisheries.

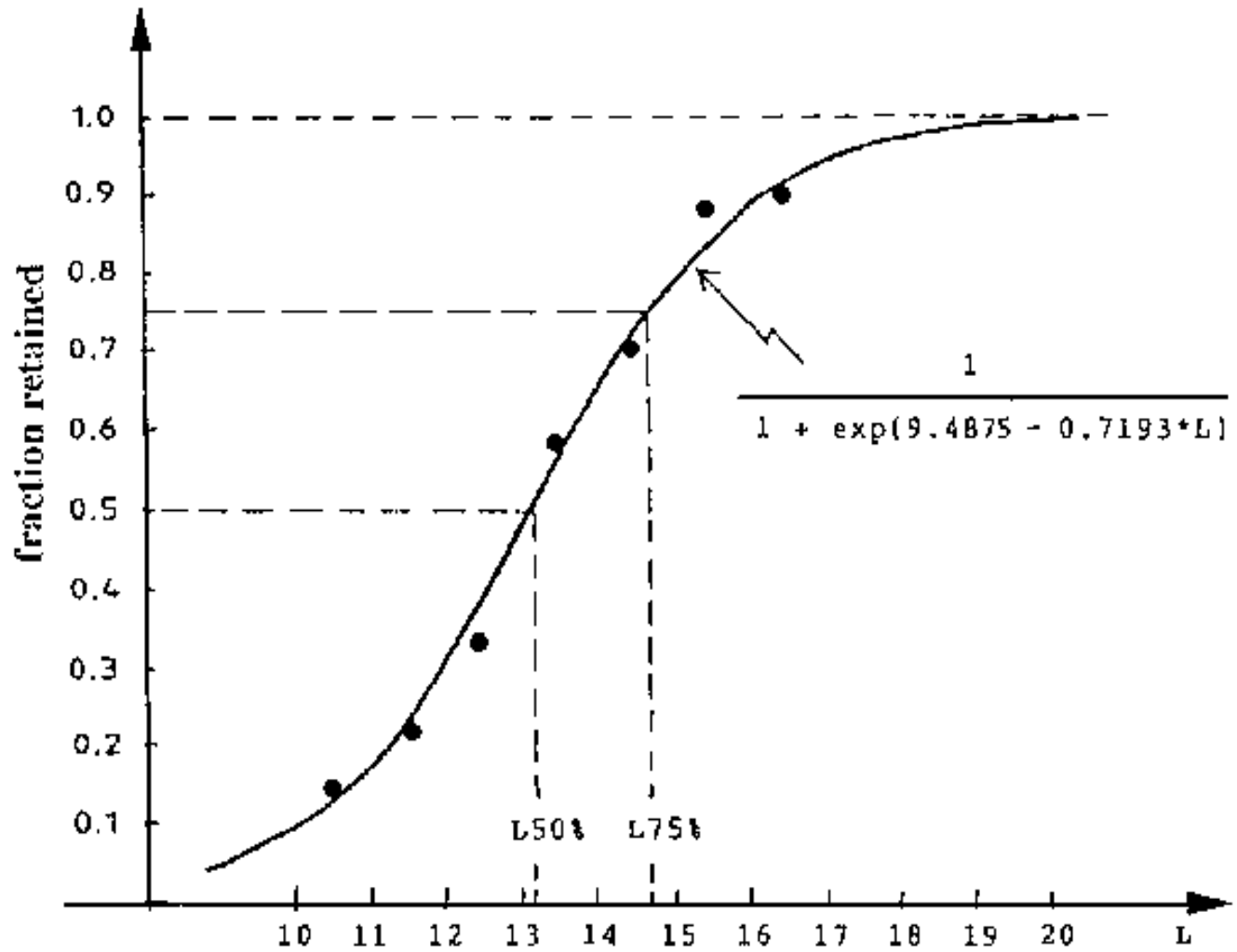
ESTIMATION OF TRAWL NET SELECTION

- The fine-meshed end of the net where the catch is collected is called the codend. It appears that the "*mesh size*" of the codend determines, to a large extent, the selectivity of trawl gear.



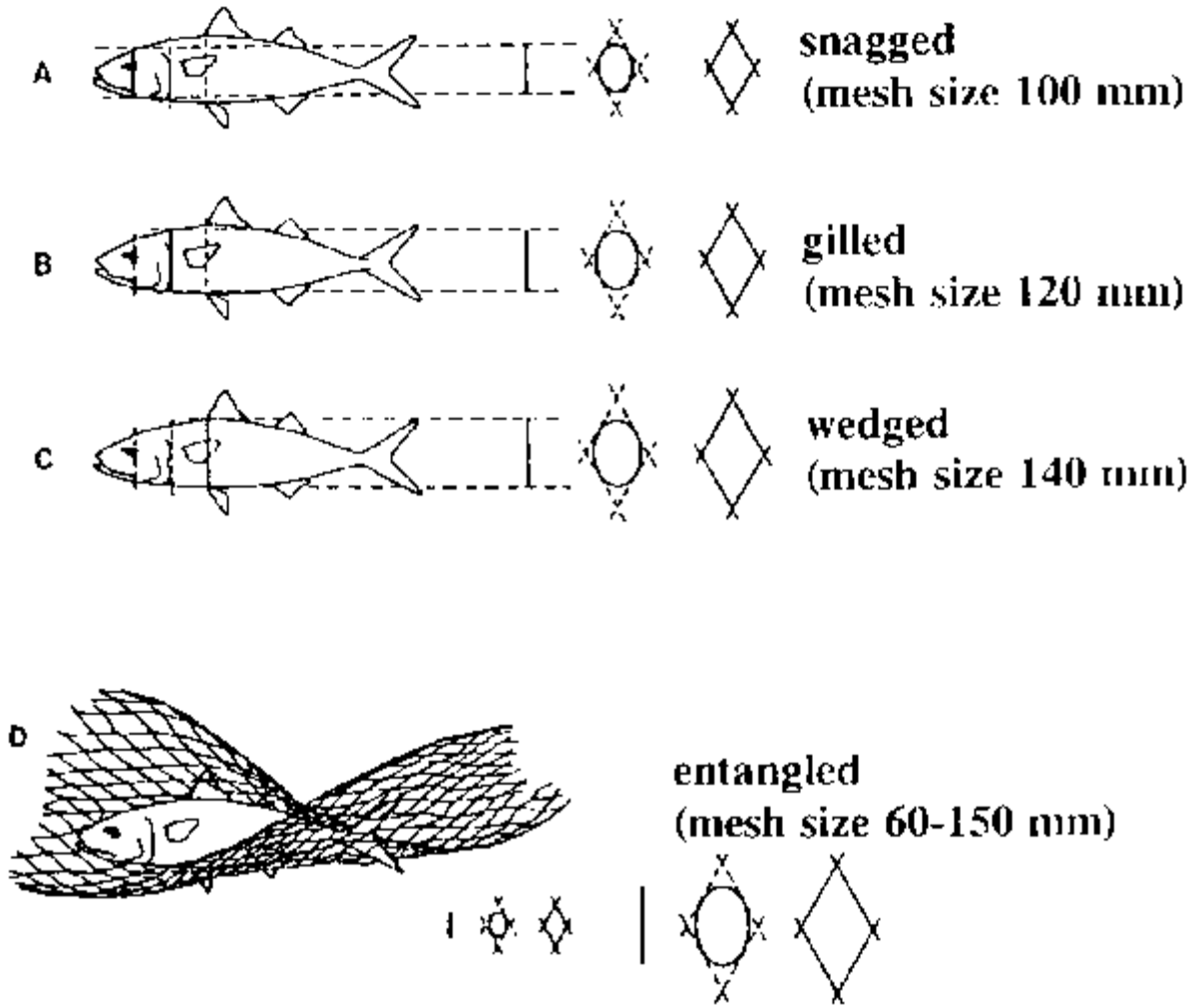
- The "*mesh size*" is usually defined as the length of the "stretched" whole mesh. The mesh size of the netting shown here is 2*d, where d is the length between two knots.
- For a detailed discussion of definitions of mesh size and mesh measuring techniques, see FAO (1978b).
- It is possible to determine the amount and sizes of fish that escape through the meshes of the codend by covering the codend with a much larger bag with much finer meshes. The idea behind the experiment is illustrated. The selectivity of the gear can then be determined by comparing the sizes of the fish in the codend with those of the fish in the cover. The "*covered codend method*" has been described, among others, by Pope *et al*., 1975, and Jones, 1976.

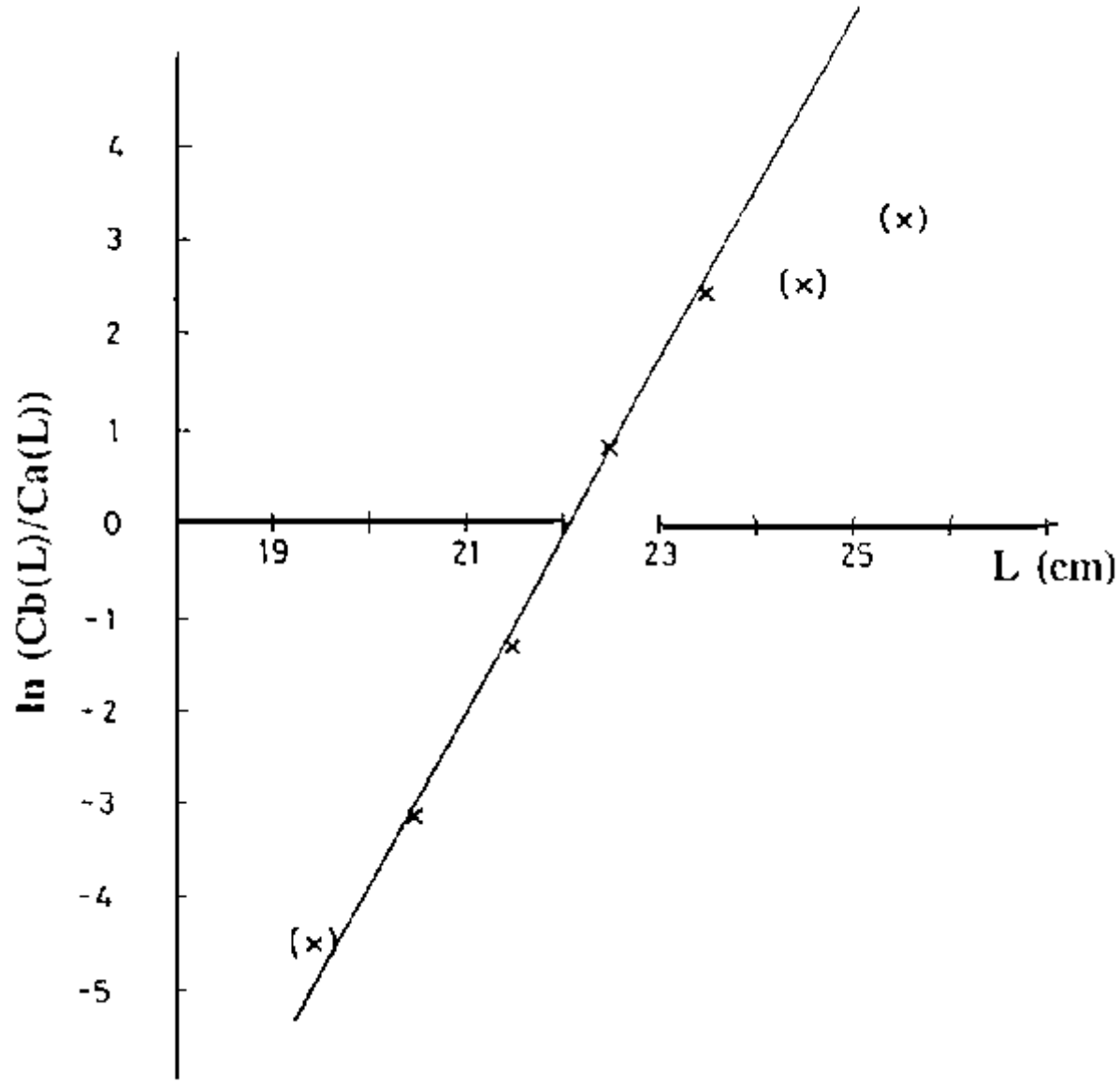

SMALL MESHED COVER
CODEND

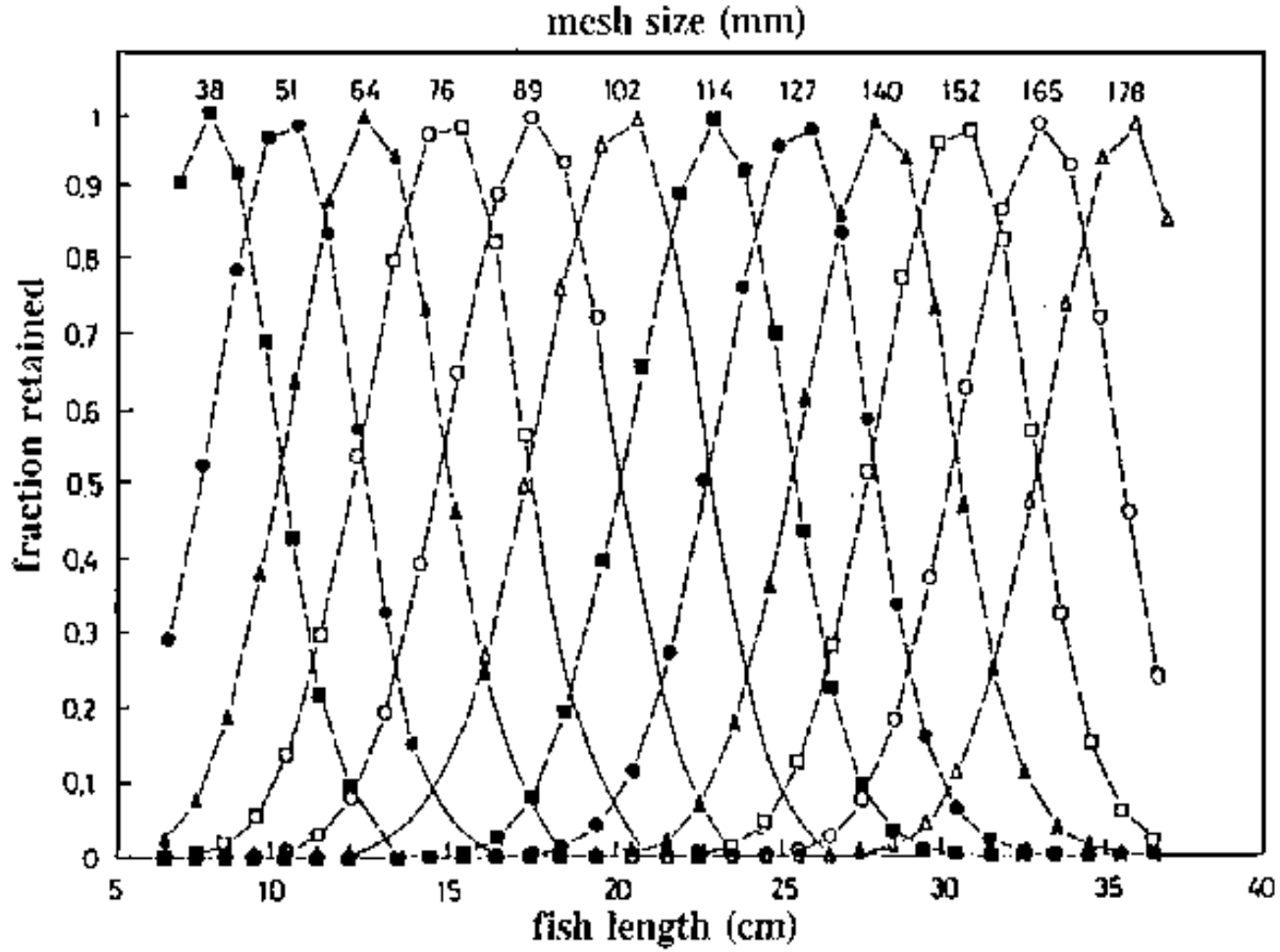

fraction retained
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
L50%
L75%
1
1 + exp(9.4875 - 0.7193*L)
10
11
12
13
14
15
16
17
18
19
20
L

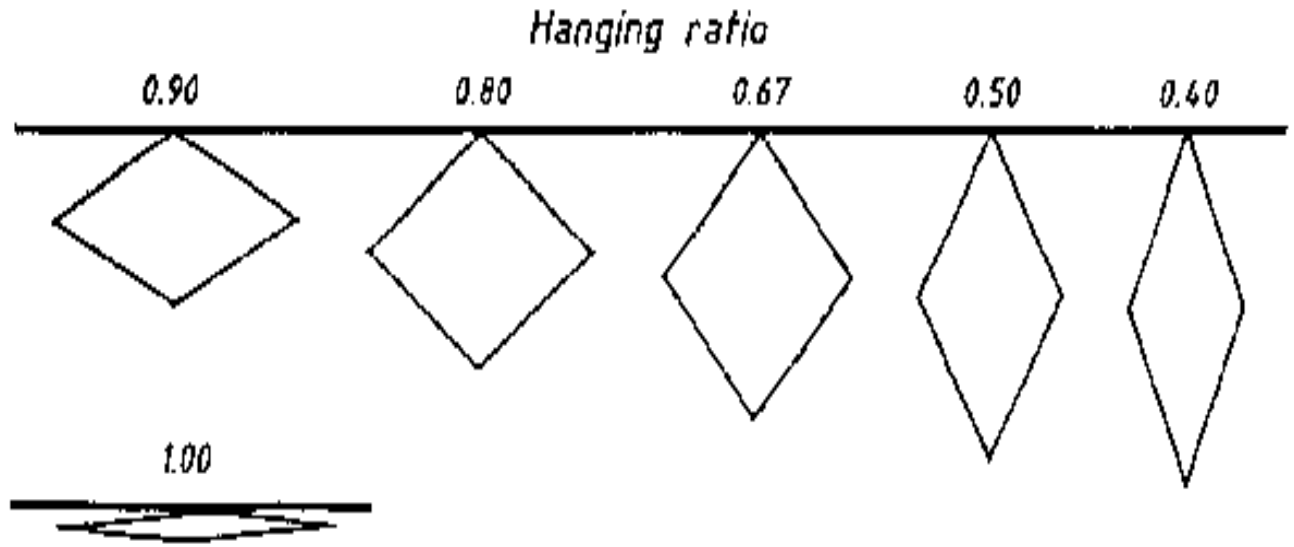
ESTIMATION OF GILL NET SELECTION

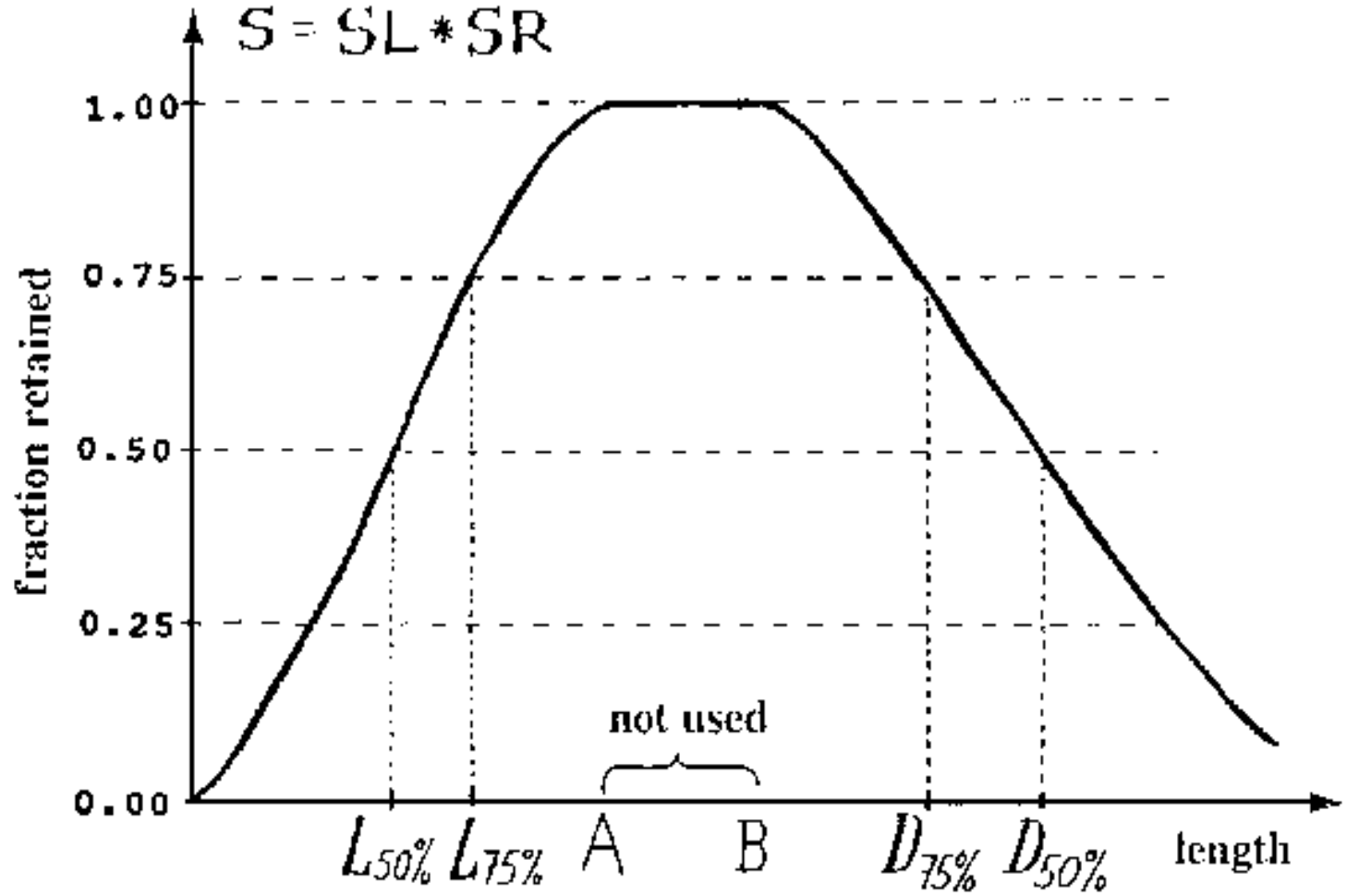
- Gill nets are "*passive gears*", i.e. the fish have to swim into the net to get caught. Theoretically, this implies that fish which move fast, have a larger probability of encounter with the gear than slow moving fish. Further it is known that large fish move faster than small fish of the same species. The swimming speed can be approximated by a constant times a power function of length:
- $A*L^B$ where A and B are constants (Yates, 1983).
- Rudstam, Magnuson and Tonn (1984) included swimming speed (with B = 0.8 for the cisco, *Coregonus artedii*, from Wisconsin, USA) into a model for gill net selection. They considered the selection as the product of two probabilities: (selection) = (probability of encounter) *(probability of being caught given encounter)


A
snagged
(mesh size 100 mm)
B
gilled
(mesh size 120 mm)
C
wedged
(mesh size 140 mm)
D
entangled
(mesh size 60-150 mm)


4
3
2
1
0
-1
-2
-3
-4
-5
19
21
23
25
L (cm)
ln (Cb(L)/Ca(L))
(x)
(x)
(x)


mesh size (mm)
38
51
64
76
89
102
114
127
140
152
165
178
fraction retained
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
5
10
15
20
25
30
35
40
fish length (cm)


Hanging ratio
0.90
0.80
0.67
0.50
0.40
1.00


S = SL*SR
1.00
0.75
0.50
0.25
0.00
fraction retained
not used
$L_{50\%}$
$L_{75\%}$
A
B
$D_{75\%}$
$D_{50\%}$
length