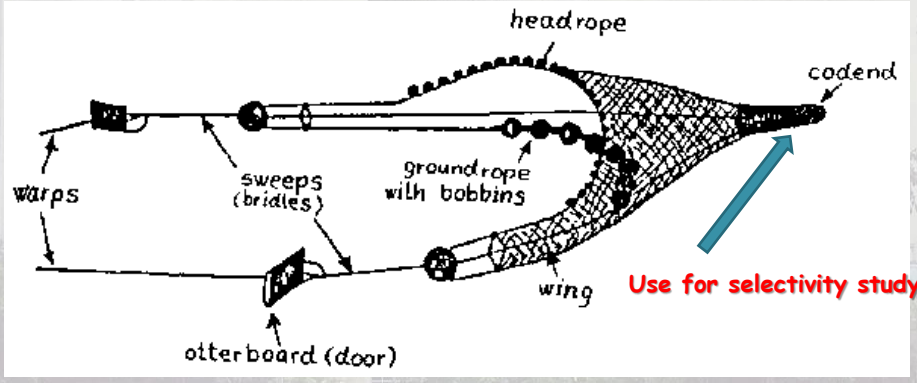
Course Outline

- Quick Looking: Bottom Trawl Survey
- One-tailed selectivity model (S-shaped or Selection Ogive Model) in trawlers
  - Proportion Retained Method
  - Probability of Captured Method
- Selection Factor (SF.)

The otter board trawl (OBT)



Notices for collecting data

- **Equal towing time** in the same survey cruise
- Catchability coefficient is a function of towing time
- For research purpose: towing time should be **0.5 hour to 1 hour**
- Easy to compute CPUE
- Well-designed fishing logsheet

Deck Sampling and Catch Recording Procedures

Cautions!!

- Before the survey begins, make sure that the equipment and working conditions are ready and un-risk
- The ship crew must be instructed *"not to remove any part of the catch before the sampling has been completed"*

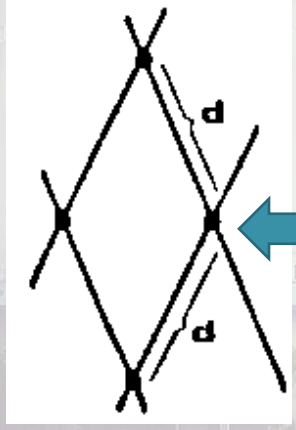
Deck Sampling and Catch Recording Procedures

- Fishery Biologist must response the following tasks:
  - Collecting LFD (no. in codend and no. in covered net, if you set up the experiment)
  - Others biological information (sex, maturity, parasites etc.)
  - Collecting and preserving specimens for onshore studies
  - Collecting oceanographic data

Selectivity Function

- Exploited stock
- Age at first recruit (t_r) = pre-exploited phase
- Age at first capture (t_c) = fully exploited
- Selectivity: function with age (=size of fish) / size of gear
- In this case: size of gear = codend mesh size

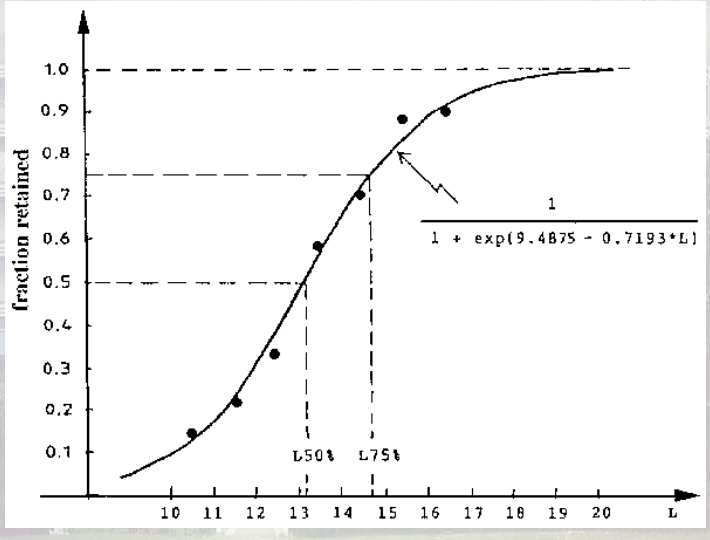
Codend Mesh Size



- The length of the "stretched" whole mesh

2*d

Selection Ogive Curve



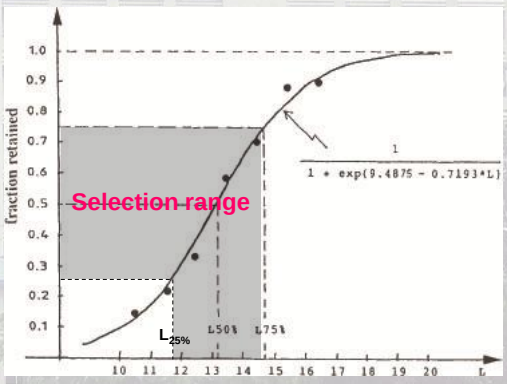
Proportion Retained

$$L_{50\%} = \frac{S_1}{S_2}$$

$$L_{25\%} = \frac{(S_1 - \ln 3)}{S_2}$$

$$L_{75\%} = \frac{(S_1 + \ln 3)}{S_2}$$

$$SF = \frac{L_{50\%}}{\text{mesh size}}$$



Selection Ogive Curve

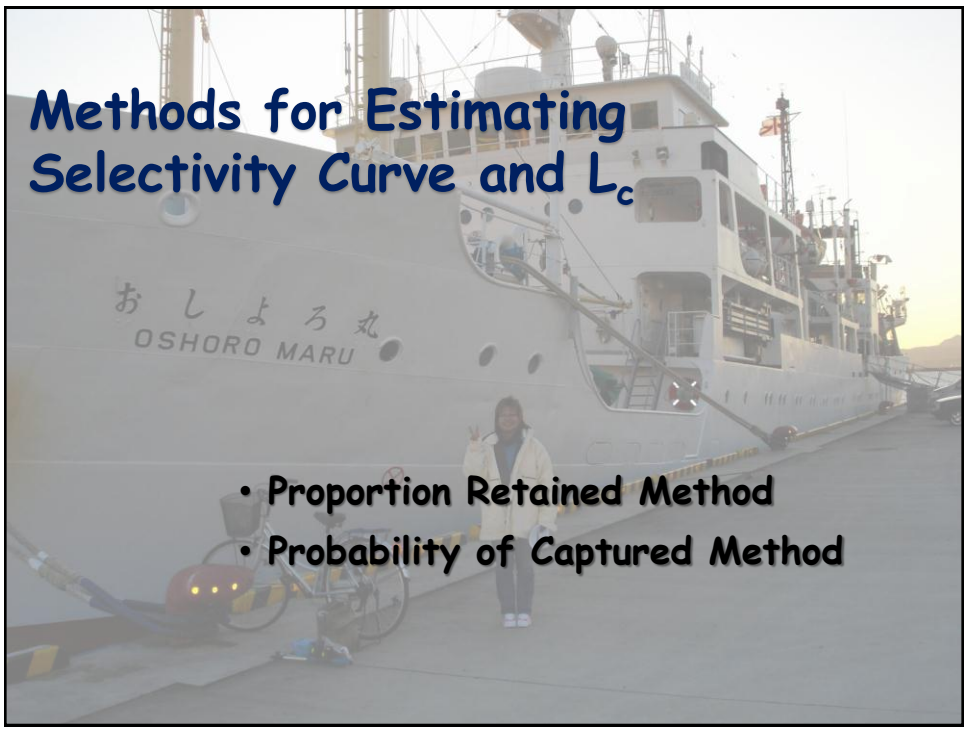
$$S_L = \frac{1}{1+e^{(S_1 - S_2 L)}}$$

Logistic Function

Unknown Parameters: S_1 and S_2

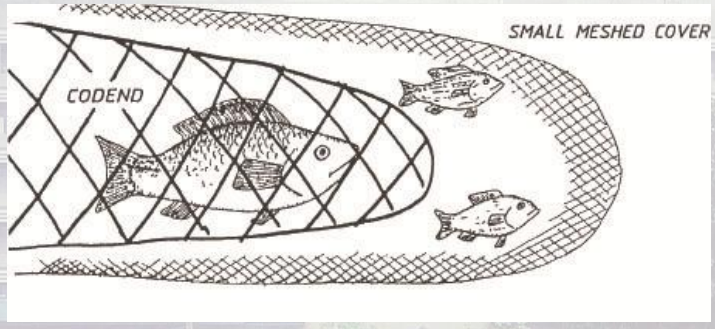
NONLINEAR MODEL

Methods for Estimating Selectivity Curve and L_c



- Proportion Retained Method
- Probability of Captured Method

Proportion Retained



- Need to set up an experiment (research vessel)
- Well-designed replication (spatial, temporal)

Proportion Retained

$$S_L = \frac{1}{1+e^{(S_1 - S_2 L)}}$$

Linear transformed

$$S_L = \frac{\text{no. of fish at length L in cod end}}{\text{no. of fish at length L in codend} + \text{covered net}}$$

$$\ln\left(\frac{1}{S_L} - 1\right) = S_1 - S_2 L$$

1. EXCEL for basic calculation (today)
2. SPSS or R Program for nonlinear estimation (self-study)
3. FiSAT

Probability of Captured Method

- Useful for covered net experiment is unavailable or
- Data collection from commercial fisheries

$$S_L = \frac{1}{1+e^{(S_1 - S_2 L)}}$$

S_L = Probability of cumulative no. of landed

Selection Factor

- Escaping chance: shape and body depth of fish compared to mesh size
- Assumption: "$d_{50\%}$ (body depth at which 50% of the fish are retained) is a function of mesh size"

$$d_{50\%} = A \times mesh\,size$$

- Body depth is a direct proportion to body length, hence

$$L_{50\%} = S.F. \times mesh\,size$$

Thank You

Case Study

- One-tailed Selectivity curve by two methods:
  - Proportion Retained
  - Probability of Capture
- What will be happened if we enlarge the mesh size to be 5.0 cm and reduced the mesh size to be 2.5 cm? (application of selection factor)
- Length at first maturity (Probability of Capture)

Proportion Retained

length interval	No. in codend	No. in cover	Total no.	fraction retained S_L obs	Ln Y	Mid length (x)	fraction retained S_L est
9-10	0	1					-
10-11	1	6					
11-12	2	7					
12-13	2	4					
13-14	7	5					
14-15	30	13					
15-16	61	8					
16-17	27	3					
17-18	7	0					
18-19	4	1					-