Introduction to Fisheries Resources Surveys

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- Majors
  - Stock Assessment / Fisheries Management
  - Cetology (Whale / Dolphin / Porpoise)

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Purpose of Surveys

1. Estimation of Proper Catch Amount
   - To establish a sustainable fisheries, and achieve to the Maximum Sustainable Yield (MSY)
2. Forecast of Fisheries Condition
   - Forecast of the fishing season, fishing ground, composition of fish for the efficiency of fishing operation and management.
   - For migratory pelagic species, the forecast is important.
3. Find the property of fish resources
   - For establishing efficient and proper stock enhancement activities.
   - Targeting coastal fish and shellfishes.

Category of Surveys

On land survey

- Statistical survey
- Port survey
- Market survey

Onboard survey

- Sampling survey
  - Trawl
  - Gillnet
  - Longline
- Acoustic survey
- Sighting survey

Survey Items 1/2

- Categories
  - By Species / by Gears / by Seasons / by Areas

- Statistical Survey
  - Catch / #boats / #operation days / #hauls / #gears /duration of towing net/ gear size etc.

Survey Items 2/2

- Sampling Survey
  - Density →Abundance estimation
  - Body length →Length frequency distribution
  - Body weight→Weight frequency, Length-Weight relationship
  - Sample collection (Otoliths, Scale for Age determination, stomach for diet analysis, muscle for DNA anal.)
  - Sex, maturation

Species Identification

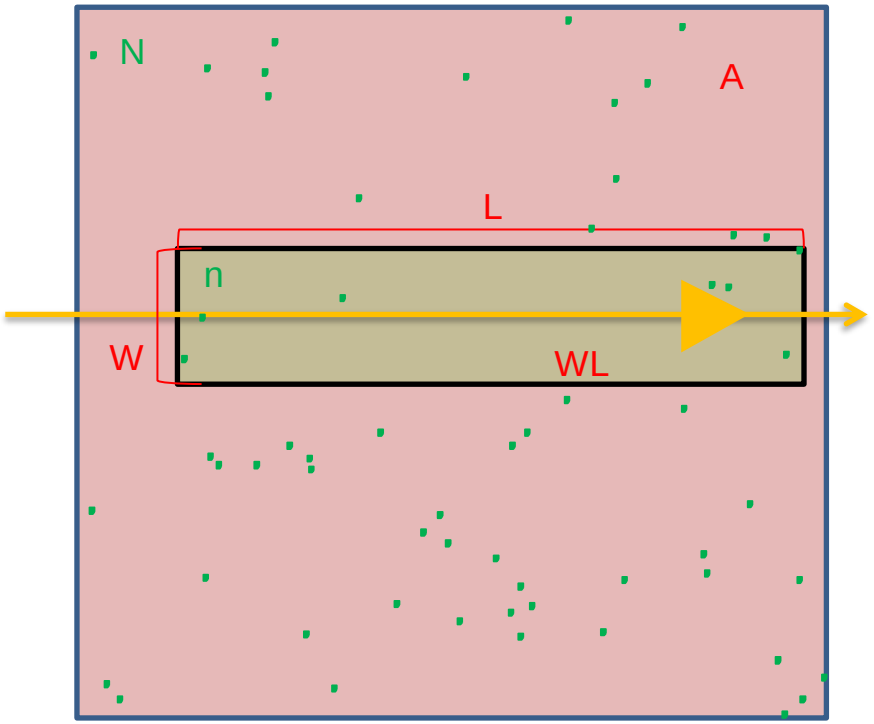
Abundance estimation

- Abundance = Density x Area
  - Measure the density (t/nm^2)
  - Assume the area that the distribution is homogenous and find the area (nm^2)
  - Abundance (t) is calculated from Density and Area

Density estimation

- # samples / gear swept area
- # samples / survey length L / gear width W

$$N = \frac{nA}{WL}$$



Catch per unit effort (CPUE)

- Index for fish density
- $CPUE = \frac{C}{X} = \frac{qXN}{X} = qN$

C : catch
X : effort
N : population (biomass)
q : a constant

- Effort : index of fishing activities quantity
- It is expected that the catch become twice if effort become twice
- #boats / #operation days / #hauls / #gears /duration of towing net etc

Abundance index

- If you have several areas and CPUE data, you can calculate the abundance index
- $\widehat{N} = \sum_i \left(A_i \frac{C_i}{X_i} \right)$

i : Area number
C : catch
X : effort
A : Area (nm^2)
N : population(biomass)

- Average density index : $\widehat{N}/A$
- Effective fishing effort : $\tilde{X} = AC/\widehat{N}$

Example of Calculation

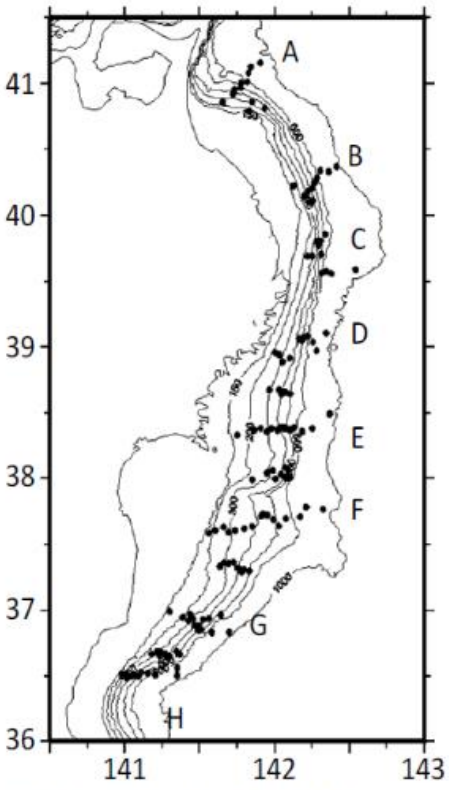
No. I	Area (km^2) A_i	Catch (kg) Y_i	Effort (haul) X_i	CPUE (kg/haul) $u_i=Y_i/X_i$	Abundance Index (km^2·kg/haul) $\tilde{P}_i = A_i \cdot u_i$
1	10	200	20	10	100
2	20	600	40	15	300
3	20	200	20	10	200
4	10	600	40	15	150
Total	60	1600	120		750

Effective Effort(haul) $$\tilde{X} = \frac{YA}{\tilde{P}} = \frac{1600 \times 60}{750} = 128$$

Effectiveness $$\varepsilon = \frac{\tilde{X}}{X} = \frac{128}{120} = 1.067$$

Effective fishing density(haul/km^2) $$f = \frac{\tilde{X}}{A} = \frac{128}{60} = 2.13$$

Trawl survey of Snow crab in Pacific coast of Japan



Survey stations

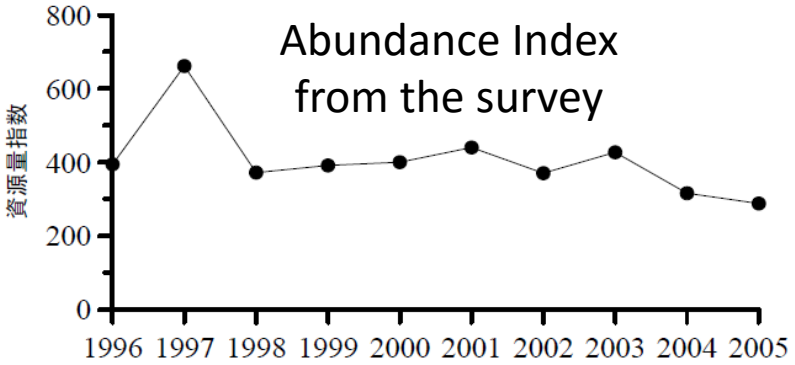


図 8. 福島県沖底漁船の中心漁場における資源量指数

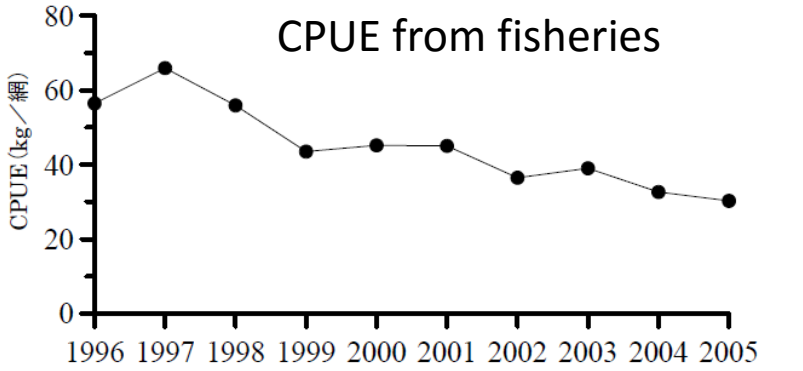
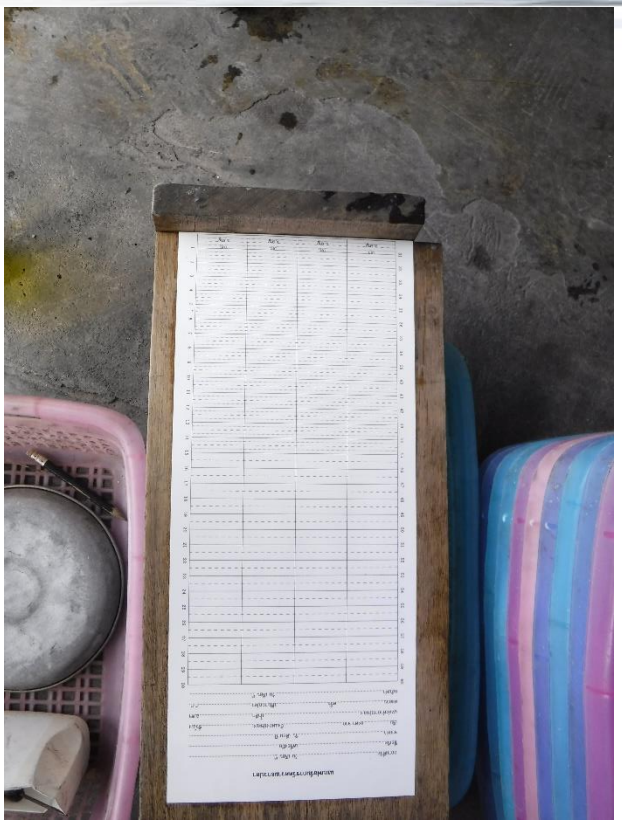
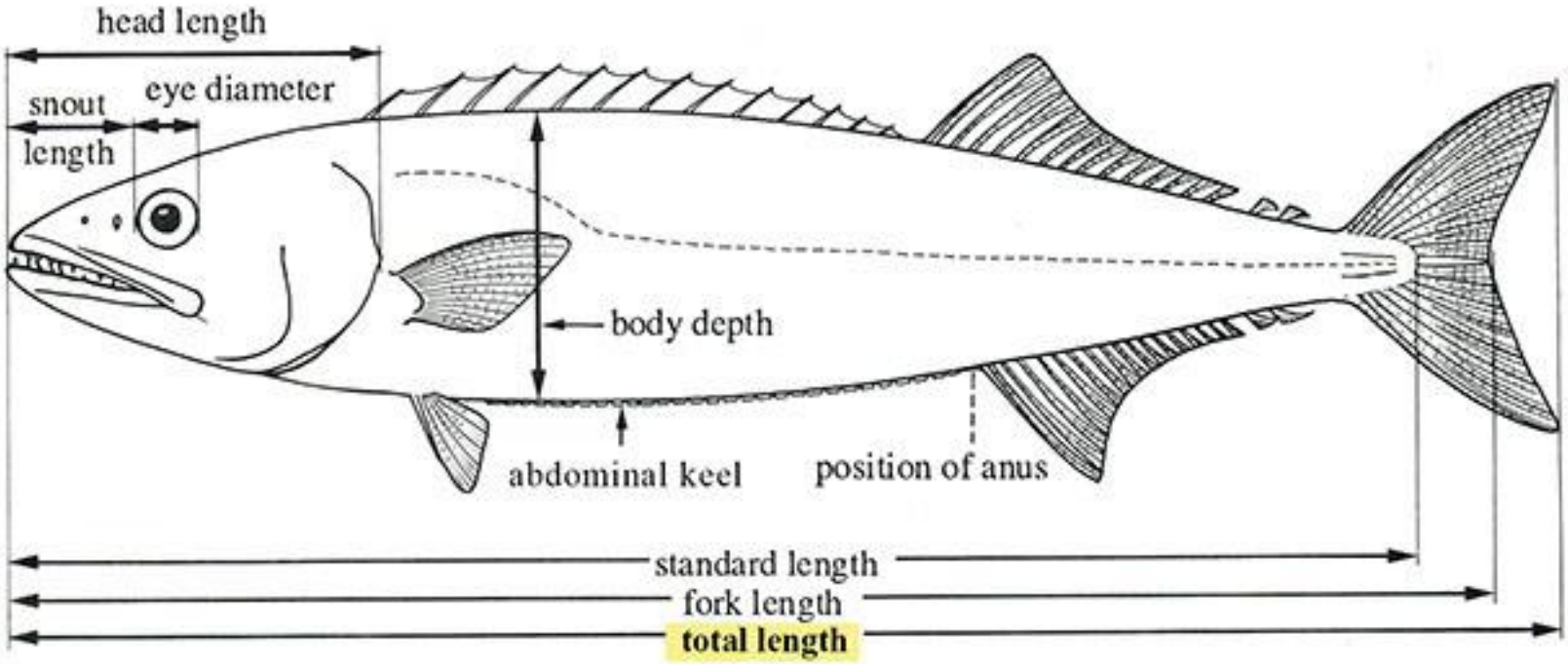


図 7. 福島県沖底漁船の中心漁場におけるオッタートロールによるズワイガニの CPUE（kg／網）の経年変化　※年は漁期年

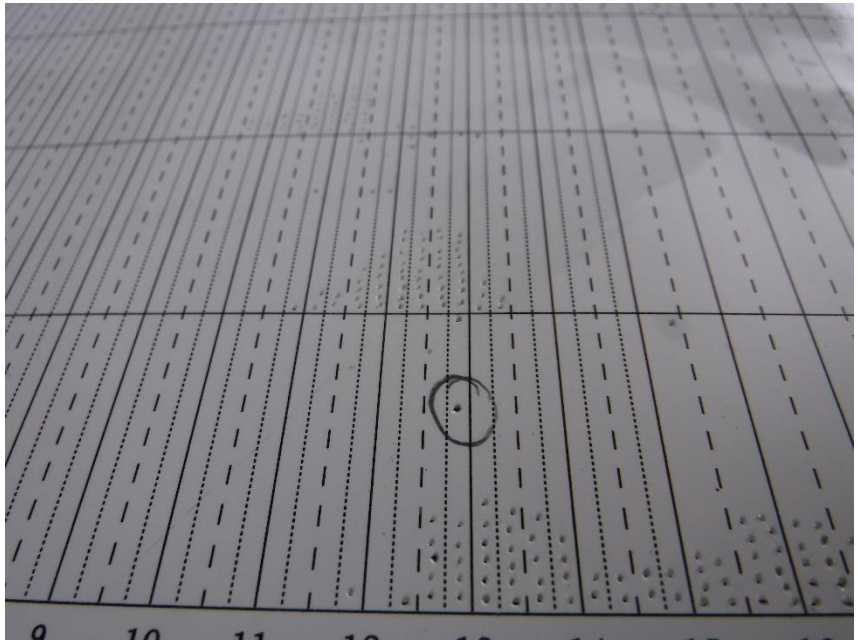
Body length measurement



Measurements



Body length measurement

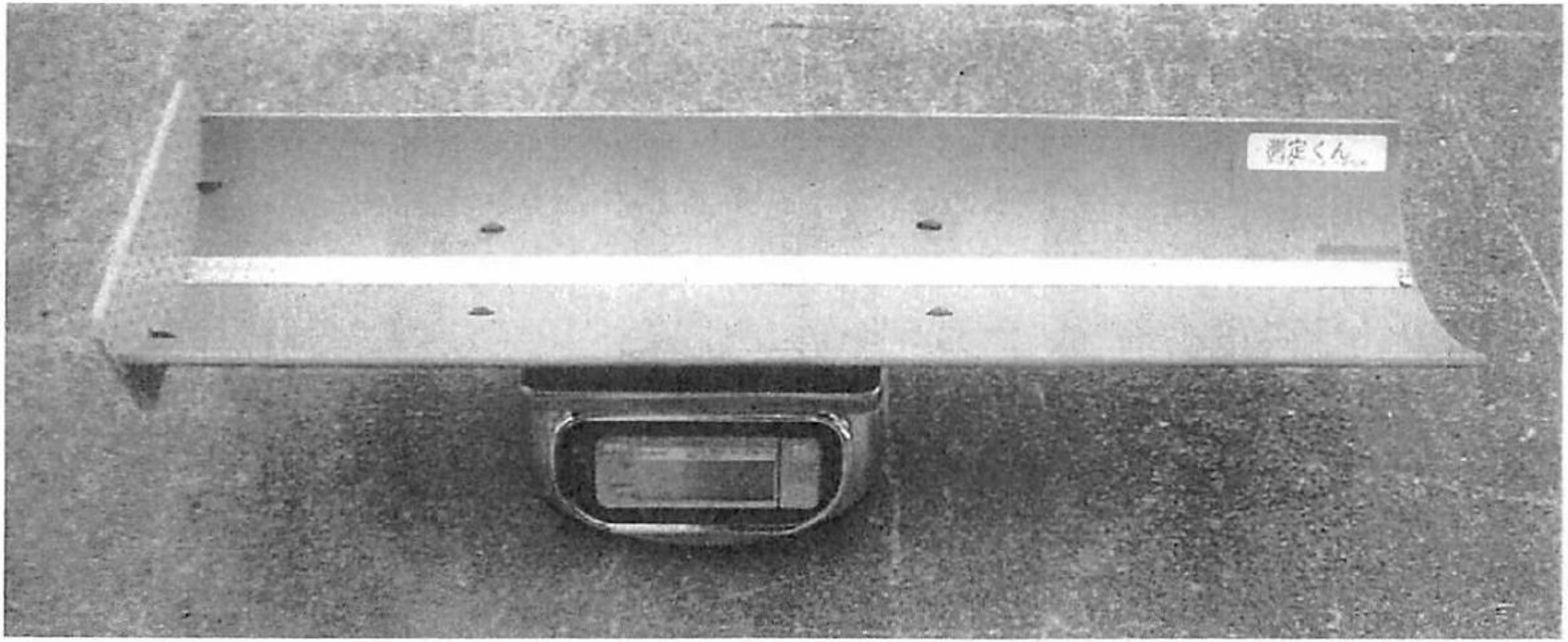


- Clearly specify the length class
- No need to record the real body length

Body weight measurement

TANITA Kitchen Scale
KW-220
0.1-2000g
Waterproof
5500JPY

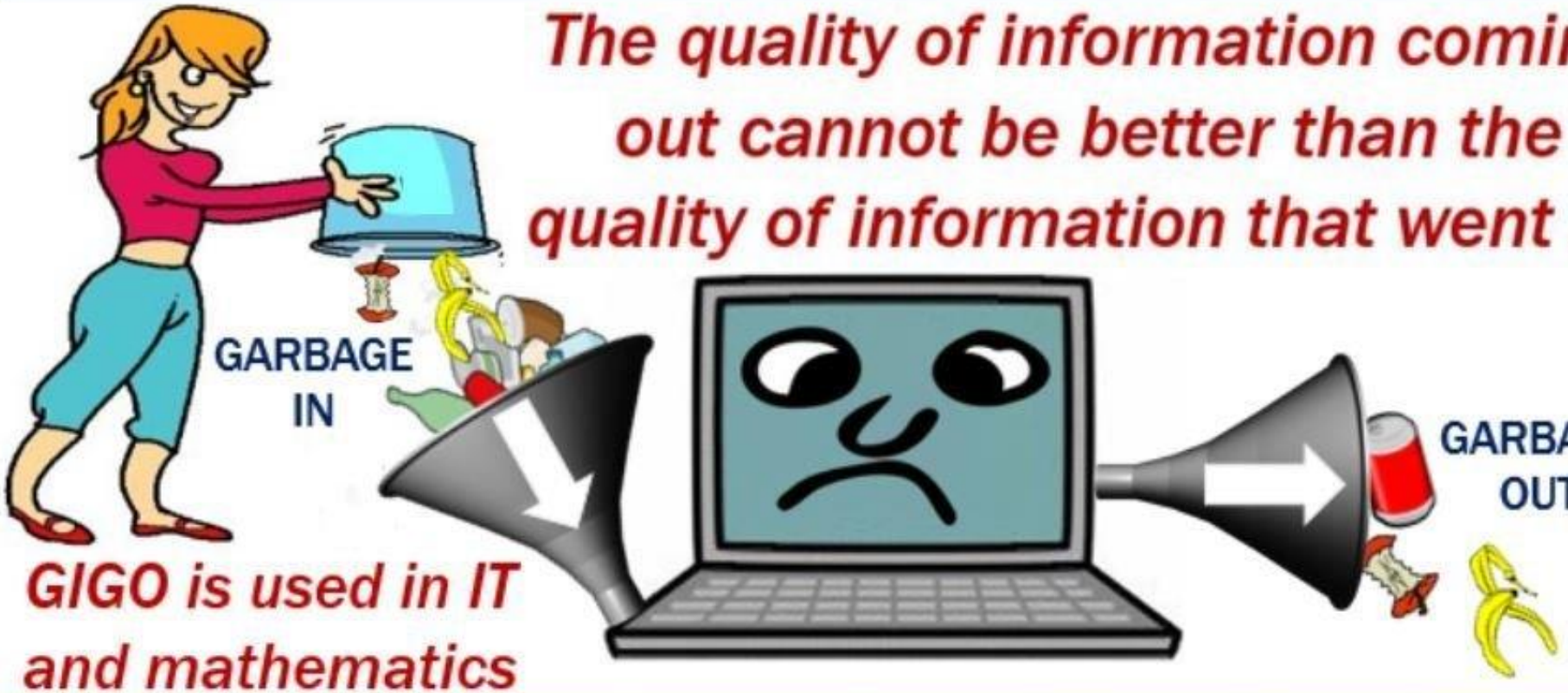
鷹見製作所製　測定くん



測定くん　さけ定リミテッド

What is GIGO?

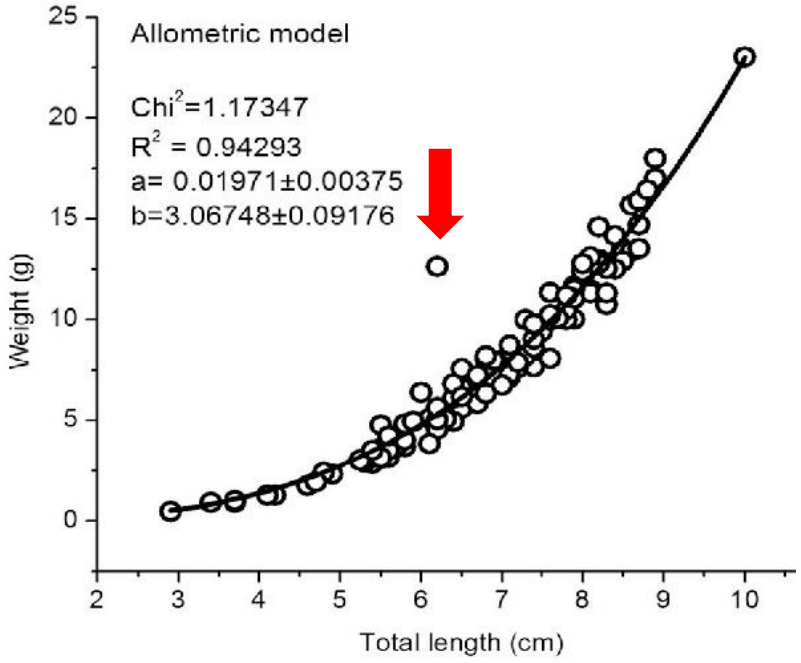
The quality of information coming out cannot be better than the quality of information that went in.

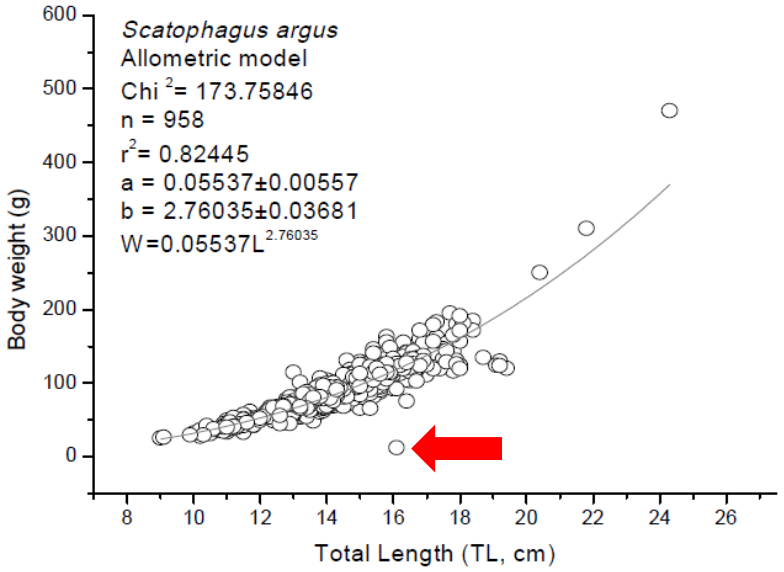


GIGO is used in IT and mathematics

Garbage In, Garbage Out

Data Check





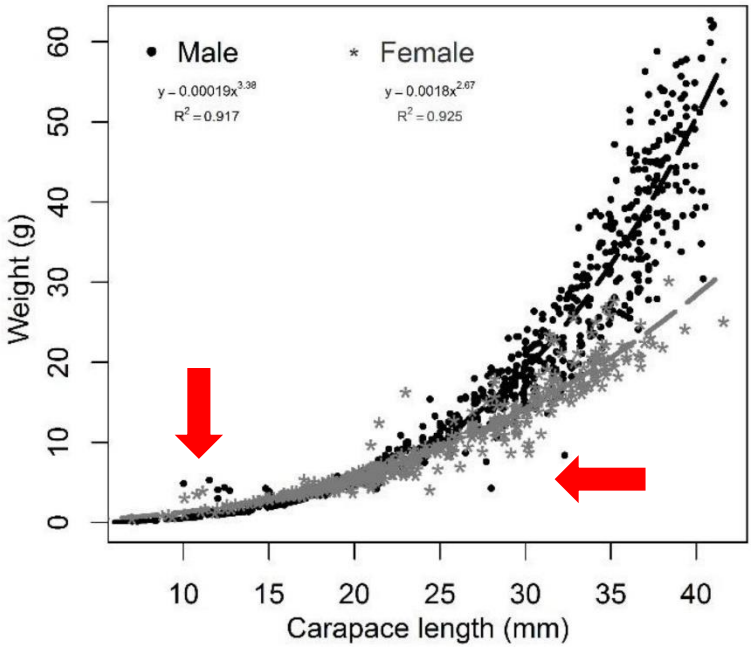
10.1016/j.ejar.2018.07.003

Data check

- Check the data by using Length-Weight Relationship
- Usually L-W relationship is precise.
- Outliers will be made from human error. (22cm -> 12 cm etc)
- If an individual have twice weight comparing to the similar size, person in charge of measurement should note it. No note means error.

Data check

- If you find two lines, consider sexual dimorphism or mixed species.



http://dx.doi.org/10.3856/vol46-issue2-fulltext-14

Allopetrolisthes punctatus

Tips for good survey

- Understand the basics in training course
- Design with well-experienced researchers
- Record everything you found in the survey even if it is not required
- Analyze the data with onboard researcher and data analyst
- Revise the survey design after data analysis

FIN