Chap#18

Classification, biodiversity and conservation

Classification

Species:

=> similar
- morphologically
- biologically
- ecologically.
- genetically.

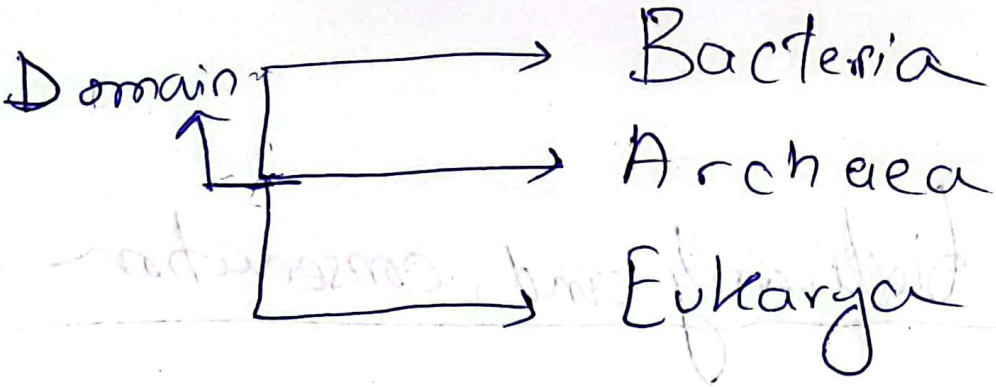
Morphological species concept:
=) share many physical features that distinguish them from other species

ecological species concept:
=) population of same species living in the same area/habitat at the same time occupy the same niche

Biological species concept
=> can interbreed successfully to produce fertile offsprings.
=) reproductively isolated from other species

Taxonomic Rank:

1. Domain
2. Kingdom
3. Phylum
4. Class
5. Order
6. Family
7. Genus
8. Species



Bacteria:

=) Cells with no nucleus

=) DNA is circular and does not have histone proteins associated with it.

=) Smaller circular molecules of DNA called plasmids are often present

=) No membrane ~~bound~~ bound organelles such as mitochondria, ER, golgi body, chloroplasts are present.

=) Ribosomes 70S smaller than eukaryotes

=) Cell walls are ~~waty~~ always present. and has peptidoglycans (not cellulose)

=) Cells divide by binary fission

=) Usually exists as single cell.

Archaea:

=) No nucleus

=) Circular ~~DN~~ DNA

=) Cell membrane composition different from bacteria/eukarya

=) No membrane bound organelles.

~~Meth~~ mitochondria, golgi, bodies, no ER

⇒ 70S ribosomes

⇒ Cell wall present

⇒ Cell wall does not have mitochondria peptidoglycan.

⇒ Cells divide by binary fission.

⇒ mostly unicellular.

⇒ Some have histones associated with DNA

Eukarya:

=) Cells have a nucleus.

=) Cells contain membrane organelles

=) Ribosomes are 80S.

=) DNA is linear.

=) Histones present

=) cell divides by mitosis.

=) Cell walls are present in some eukaryotes.

Archaea and Bacteria ~~have~~ are

Prokaryotes and

Difference: • Difference in membrane lipids. (1)

• In bacteria and archaea ribosomal ~~RARNA~~ (2)
smaller than eukarya ribosome

• but similar features of ~~archaea~~ eukarya.

• Cell walls of bacteria (3)
have peptido glycan but archaea
does ~~not~~ not have

* Membrane lipids in Archaea is ~~more~~ unique- they are one not found in the membranes of bacteria or eukaryotes

* In bacteria and archaea, rRNA smaller the eukarya rRNA.

Similar arch eukar rRNAs

Eukarya

Kingdom → Protoctista
→ Fungi
→ Plantae
→ Animalia.

① Plantae:

⇒ multicellular

⇒ cells differentiated to form tissues and organs.

⇒ Most have vascular tissue: xylem & Phloem.

⇒ Eukaryotic cell

⇒ Cells have chloroplast

⇒ Cells have large central vacuole.

=) Cell walls made up of cellulose

=) cell walls have plasmodesmata

=) They are autotrophic or photosynthetic.

=) Starch is storage compound

=) meristem

=) most are motile

=) motile gametes are found only in mosses and ferns.

Animalia

=) eukaryotic cell (dekri)

=) heterotrophic nutrition
↳ have food from other organisms to obtain the necessary compounds.

=) Stores ~~food~~ food as glycogen.

=) multicellular.

=) specialised.

=) Differentiated into tissues.

=) Some motile

=) Some cells have cilia.

=) Communication is by nervous system and chemical signaling

Fungi:

=) Eukaryotic cells

=) Heterotrophic mode of nutrition.

=) Store food as glycogen.

=) Do not have chlorophyll

=) Reproduce by the means of spores

=) Cell wall made up of

Chitin:

=) Can be unicellular

=) made up of hyphae.

=) Never have cilia.

Protostista

=) Eukaryotic cells

=) ~~Some~~ Mostly are single cell.

=) Some animal like cell protozoa

=) plant like cell is algae.
(chloroplast and cell wall)

Virus

=) Type of nucleic acid acid : RNA or DNA

=) It ~~has~~ may be double stranded
or single stranded.

Biodiversity :

What is ecosystem ?

=) functional, self-contained area;
(community + organisms)
=) where all living organism of all species.

=) interact
=) It has abiotic and biotic factors
=) linked by energy flow or food webs

Niche ?

=) the functional role of a species within an ecosystem and where it lives and how it obtains energy.

How biodiversity is ~~assed~~ assessed at different levels?

=) The number and diversity or range of different ecosystems and habitats.

=) Diversity of species

=) the relative abundance of each species

=) genetic diversity or variation within each species.

Explain how variation of ~~eee~~ ecosystem contributes to biodiversity:

=) Different habitats

=) Different niches.

=) large variety of species → so more complex food webs.

=) much genetic diversity within a species. ⇒ more biodiversity or variation

=) Different selection pressures

=) but better adaption

=)

Why genetic diversity important?

=) better chance of survival in changing conditions

=) change: climate / increased competition / new disease

=) less chance of harmful recessive alleles coming together so less chance of inbreeding depression

=) ~~less~~

More genetic diversity

→ more range of alleles

Why species diversity important?

What would happen to ecosystem if wolf (large predator) extinct?

=) No. of prey would increase

=) Decrease in biodiversity

=) Decrease in plants like grass

=) increased competition.

=) lack of food cause decline of herbivores

=) reduction of species diversity

=) Food web less stable so (changes)

=) change in genetic variation.

Random sampling is used to determine distribution and abundance of species, thus biodiversity of an area.

Importance of random sampling:

=) A habitat may be too large for actual counting so a sample is quick and gives a representation of the whole habitat. Sometimes, actual readings is higher than calculated, due to - mottle/stay inside deep water, camouflaged .../ma

~~Random Sampling~~

Random Sampling:

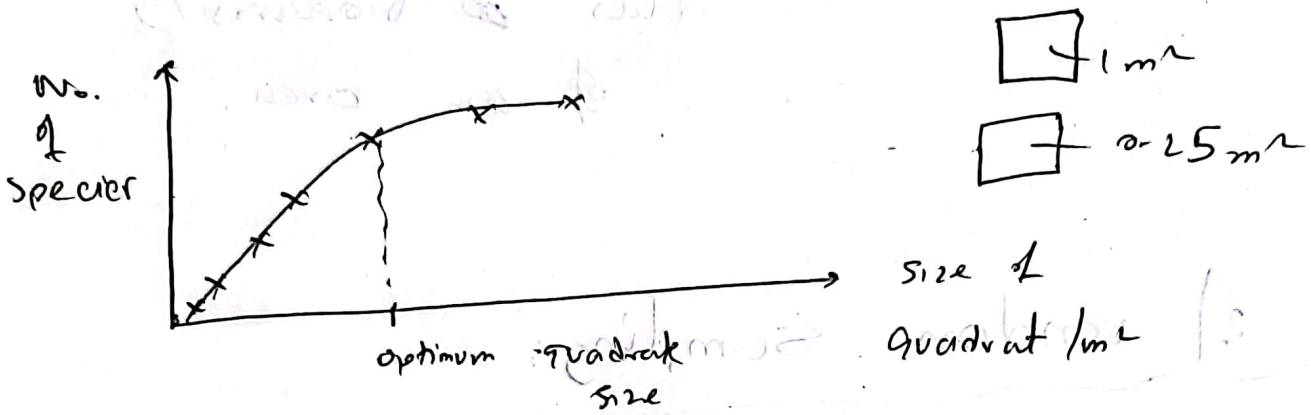
=) Quadrat

=) Mark and release

=) Simpson's Index of Biodiversity

Frame quadrat:

Determine optimum quadrat size:



Three types of DATA can be obtained:

(1) Density: $\frac{\text{No. of individuals}}{\text{Size of quadrat}}$

$1 m^2$

$= \frac{5}{1} = 5$

$5 m^{-2}$

Population size of this species = density × Total area

⇒ Use cover scale to estimate % coverage →

(2) Percentage Coverage: (For grass or moss)

% cover = $\frac{\text{No. of small squares occupied by species}}{\text{Total No. of squares}} \times 100\%$

Small square not fully occupied can be combined and counted as 1

(3) Species frequency = $\frac{\text{No. of quadrats the species found}}{\text{Total No. of quadrats}}$

Random quadrat Sampling: → throws reduces randomness as includes biasness.

⇒ Use random number generator for coordinates in both sides.

⇒ ~~Measure percentage cover~~ measure Percentage Coverage using Braw-Blanquet cover scale / frequency or dens

⇒ Using square frame quadrats.

⇒ repeat sampling and take ~~re~~ mean.

Mark-Release-Recapture:

Used for

=) Mobile organisms

=) eg:- mammals or insects

=) not for highly territorial organisms.

Assumption:

(1) Population is closed during the study (no birth / no death / no migration)

(2) Marking on the individual has no effect on their survival.

(3) Chance for ~~both~~ each individual ~~is~~ to be caught are equal and constant at for both first and second capture

(4) All members should mix randomly after first capture. So, long enough time should be given

(5) The animals should not lose their marks.
=) Should not be difficult to ~~re~~ capture.

How to do it?

=) Capture sample of the individual and count them.

=) Method to trap: ~~Gain~~ animal trap
net for small insects

=) mark the captured organism

=) Leg banging for birds or dyer (non-toxic)
no adverse effect

=) return them where they were caught

=) allow sufficient time for them to mix with the population.
(not too long as mixing may occur)

=) Capture second sample

=) Record the ~~to~~ total organisms recaptured.

=) count the marked organisms caught this time

=) Repeat

=)

$$N = \frac{n_1 \times n_2}{M_2}$$ (Lincoln index)

N = Population total

n_1 = 1st captured

n_2 = 2nd captured

M_2 = No. marked individual recaptured

Simpson's Index of Diversity (D) (species diversity)

Used to find the biodiversity of a habitat;

range of value is 0 (low biodiversity) to 1 (high biodiversity)

↓ more abundance of species and diverse species.

(more species evenness)

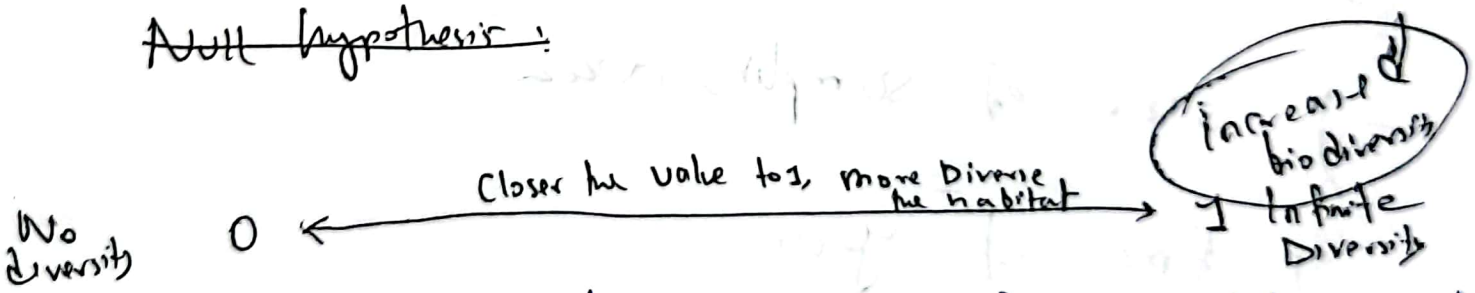
Calculation

$$D = 1 - \left(\Sigma\left(\frac{n}{N}\right)^2\right)$$

N = total population size

n = population size of each species

~~Null hypothesis:~~



- ⇒ Fewer successful species in the habitat
- ⇒ Less niches
- ⇒ Food webs relatively ~~short~~ simple
- ⇒ changes in environment causes less survival rate
- ⇒ less genetic diversity.

- ⇒ more stable ecosystem
- ⇒ more ecological niches
- ⇒ contains complex food webs
- ⇒ Environmental change less likely to damage ecosystem as a whole
- ⇒ more adaptions to selective pressures

Systematic Sampling

=) Use to determine species distribution curve conditions such as altitude, soil moisture content, pH, ~~light~~ light intensity varies (change in abiotic factor)

=) Line transect.

Use same!

=) length of transect

=) size of sampling area

=) time of year

=) location of transect.

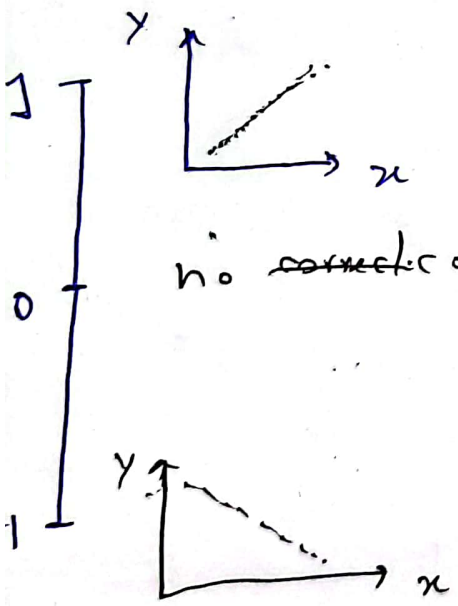
~~Pearson's correl~~

Pearson's Linear correlation :-

if data plotted is Scat di

↳ evaluates Linear relationship between two continuous variables which are normally distributed.

⟶ Describe strength & direction of the relationship.



+ve
Stronger n linear correlation

(1) Null hypothesis: There is no correlation between the two variables

(2) Calculate SD for both variables

$$S = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n-1}}$$

$\bar{x}$ => mean

(3) ~~Sum~~ Calculate Σxy

$$r = \frac{\Sigma xy - n\bar{x}\bar{y}}{n \cdot S_x S_y}$$

= -ve / +ve value

↑ negative correlation

↓ positive correlation

(4) Degree of freedom = $n - 2$

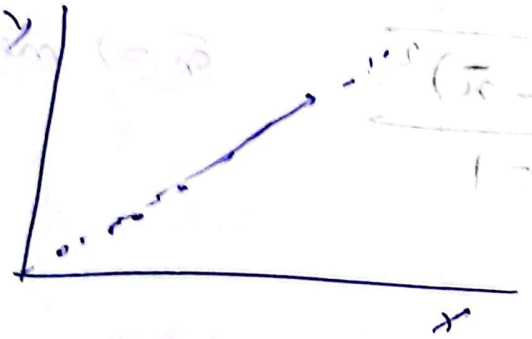
n => No. of pair data.

(without regression)

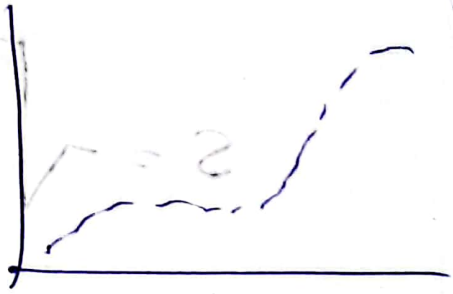
Calculated r > Critical r

Null rejected

and vice versa.



Pearson will be used ~~to~~.



Spearman will be used ~~to~~.

Spearman's Rank Correlation :

Usually used to determine correlation between two variables when one or both of them are not normally distributed / variables independent of each other.

(1) Null hypothesis,
No correlation between the two variables

(2) Rank the data.
(example in book)

Tied scores: take mean.

$$2 \quad 3 \quad 4$$
$$2 \quad 4 = 4$$
$$2 \quad 5 \quad 4$$

(3) Calculate Difference D

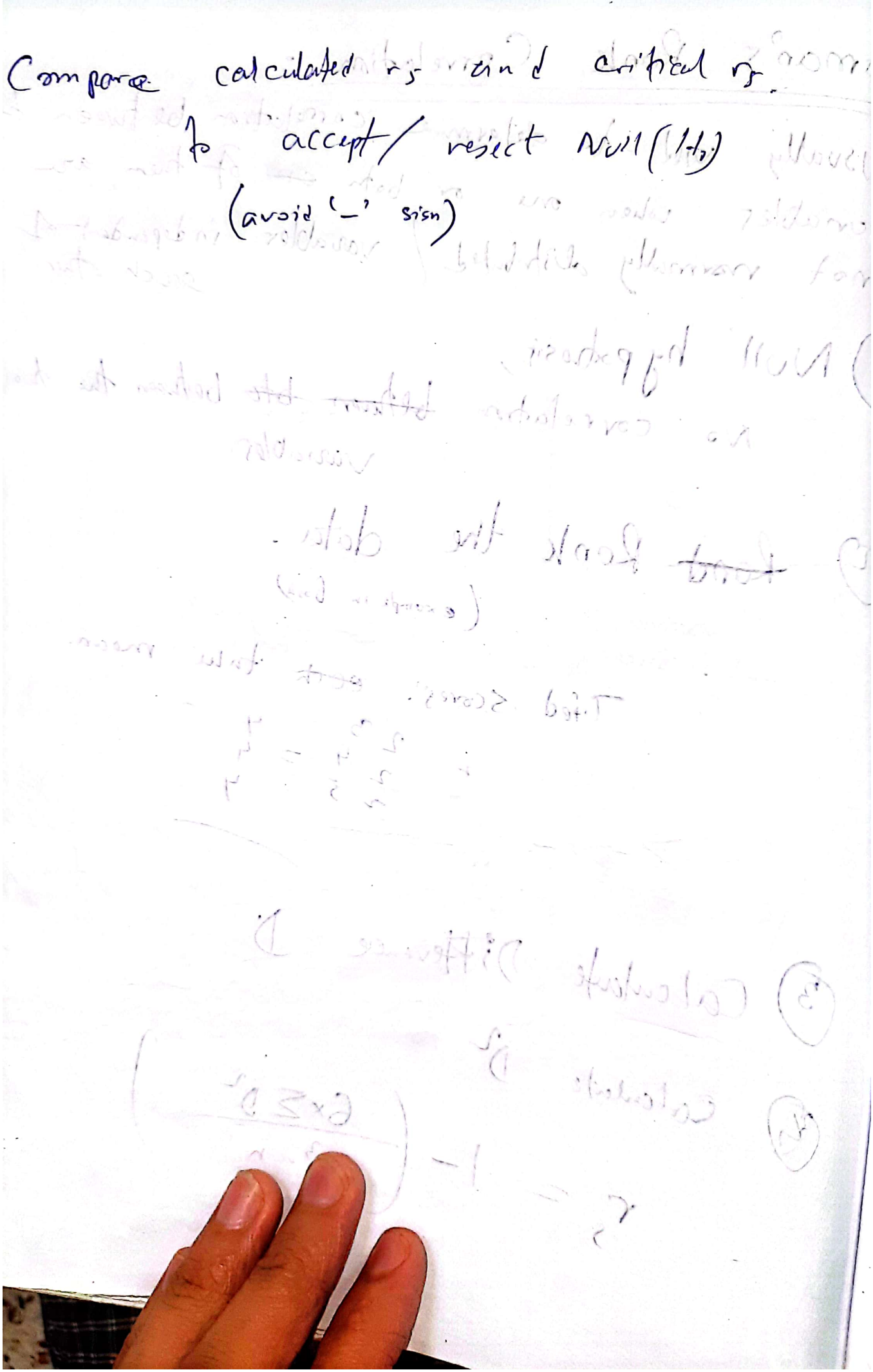
(4) Calculate D^2

$$r_s = 1 - \left(\frac{6 \times \Sigma D^2}{n^3 - n} \right)$$

Compare calculated r_s and critical r_s.

to accept / reject Null (H_0)

(avoid '−' sign)



Conservation

Why species become extinct?

- climate change
- competition
- hunting by humans
- degradation or loss of habitat.

=) Environment changes

=) Species cannot adapt fast enough.

=) occurs due to climate change like temperature / global war

=) also due to competition or predati
or ~~disease~~ disease from new / introduced alien species.

) Hunting by humans like ~~poachi~~ poaching or overfishing.

=) ~~Hence~~ Habitat loss or degradation due to agriculture / buildings /ps

=) Hence ~~en~~ extinct species:

- Hunting
- Predation
- New disease
- Degradation, Loss & habitats
- Climate change
- competition

Outline the reasons for the need to maintain biodiversity:

=) Economic reasons like medicines production or resources for human, eg. food or fuel.

=) Aesthetic reasons like ecotourism attract visitors and education/research.

=) Ethical reasons:
ethical or moral or local & cultural significance

=) maintain stability of food webs

=) climate stability.

=) maintain genetic diversity.

Roles of zoos for the conservation of endanger

=) Captive breeding

=) by assited reproduction like IVF, embryo transfer or surrogacy.

=) Raise funds

=) Reintroduce into the wild when Number grows

=) medical care.

=) ~~Research~~ Education for public awareness.

=) ~~Rea~~ Research for understanding ~~ha~~ breeding habit, ways to increase genetic diversity.

and to maintain genetic database to avoid inbreeding.

Disadvantage: ⊛ Reject mate or refuse breed due to stress and behaviour change

⊛ Do not have skills to survive in natural habitat, like avoiding predators and find foods.

Role of frozen zoos: # frozen sperm acts a gene bank

⊛ Genetic materials taken from animal (DNA or sperm or egg) are gathered and stored at very low temperatures for optimal preservation over a long period. # increases no. of breed stocks

increase in genetic v

sperm transported to other 2005

Conserved areas:

Marine Parks: conserve fragile ecosystems at risk of overfishing, dredging and pollution.

Advantages:

=) Keep animals in large areas like natural habitat.

=) Rangers patrol/monitor park

=) Human access restricted

=) controlled agriculture

=) @ u industry

=) banning hunting.

Conserved Areas:

⇒ education

⇒ Alien species removed
⇒ Increased biodiversity.

⇒ Disadvantage:
⇒ Animals cannot migrate

Botanic gardens → collect seeds from wild
⇒ store in seed bank, maintains genetic diversity

⇒ Protect endangered plant species

⇒ Research methods of reproduction and growth so can be grown in appropriate conditions.

⇒ reintroduce species in the habitat where they have become extinct.

=) ~~Feudal~~ Educate peoples about roles of plants in our ecosystem.

Seed banks

=) Seeds are small and so easier to store

=) variety of collection of seeds

=) long-term storage.
Storage to prevent germination

=) Little maintanance needed

=) Seeds regularly tested

for viability

=) Seeds restocked regularly with fresh ones.

=) maintain genetic diversity

=) act as gene bank

=) maintain biodiversity

=) Can be used in future, like after natural disaster a new disease.

=) frozen and stored at temp. below -13°C dried

=) Research and education.

Disadvantage ⊛ Some seeds are difficult to dry or frozen.

⊛ chance of altering genetic diversity.

Methods of assisted reproduction:

=) Female given hormone

FSH

=) for superovulation

=) secondary oocyte are harvested

=) using fine needle

=) sperm or semen is added to secondary oocyte in special growth medium.

=) Cultured for several days until embryo forms,

=) embryo placed in uterus.

=) sperm may be injected to oocytes.

~~Def~~ Procedure of embryo transfer :-

=) mating / IVF / AI

=) remove embryo from mated or AI female

=) check and select the healthy embryos.

=) may freeze embryos for stor

=) implant embryos in different female uterus.

=) surrogate mother.

Assited reproduction useful for conservation becaus:

=) Useful for species where ~~reprod~~ reproduction is difficult

=) increases the rate of offspring production.

=) IVF — details

=) embyo transfer —

=) surrogacy —

Reasons

Controlling alien species :

=) They reduce other organism's abundance/native species abundance.

=) alter food webs of native species.

=) Due to predation and competitions

=) Due to spreading disease

=) cause reduction in biodiversity.

=) may change habitat.

Effect to human (not all some alien species)

- may bite human
- spread disease to hum

≠ can controlled by humans and traps

roles of

IUCN

=) Global authority

=) to give advices to conserve and protect biodiversity

=) assess species conservation status

=) Red List of thretened species

=) influence government

=) educate to raise awareness

CITES

=) Trade ban if species is in danger of extinction

=) if species is not yet at risk of extinction, permit needed.

=) Border control and fine if caught

=) Encourage government to join CITES

=) Every few years they have conference with their members.

Smaller population means smaller gene pool so more chance of disorders -- lost genetic variation