

Seasonal variations for the concentrations of trace elements in common octopus (*Octopus vulgaris*) at Portuguese waters



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Introduction

Octopus vulgaris, is a benthic specie with a high growth rate, relatively short life cycle, widespread in various marine ecosystems at the Portuguese coast.

All the elements analysed, vanadium (V), manganese (Mn), iron (Fe), copper (Cu), zinc (Zn), arsenic (As) and selenium (Se) are considered micronutrients to animals.

V, Mn, Fe, Zn and As are important for enzymatic activity. Cu is the metal existent in hemocyanins, which are oxygen transport proteins. Se works as an antioxidant defence mechanisms.

Octopus can contribute to accumulation of these elements in food web.

There is an exposure concentration below which insufficiency effects are seen and a different concentration above which toxicity occurs, the area between them is the optimal concentration. For *Octopus vulgaris* this optimal concentration is not determine. This study pretends to be another contribution to the knowledge of the concentration of these trace elements in octopus.

Sampling Locations

- Samples collected at Cascais
- 10 individuals collected (5 males and 5 females) landing by the commercially fishery
- During a year: - Autumn (1999)
- Winter (1999-2000)
- Spring (2000)
- Summer (2000)



Methods

Biological Parameters

- Gender
- Weight (total body, and body without viscera)
- Length

Octopus tissues separated and analysed

- Arms
- Digestive Gland
- Gills

Sample handling and pre-concentration

- Freeze-drying
- Wet and dry weight determination
- Microwave Acid digestion (9:1 v/v HNO₃ and H₂O₂)

Elemental analysis

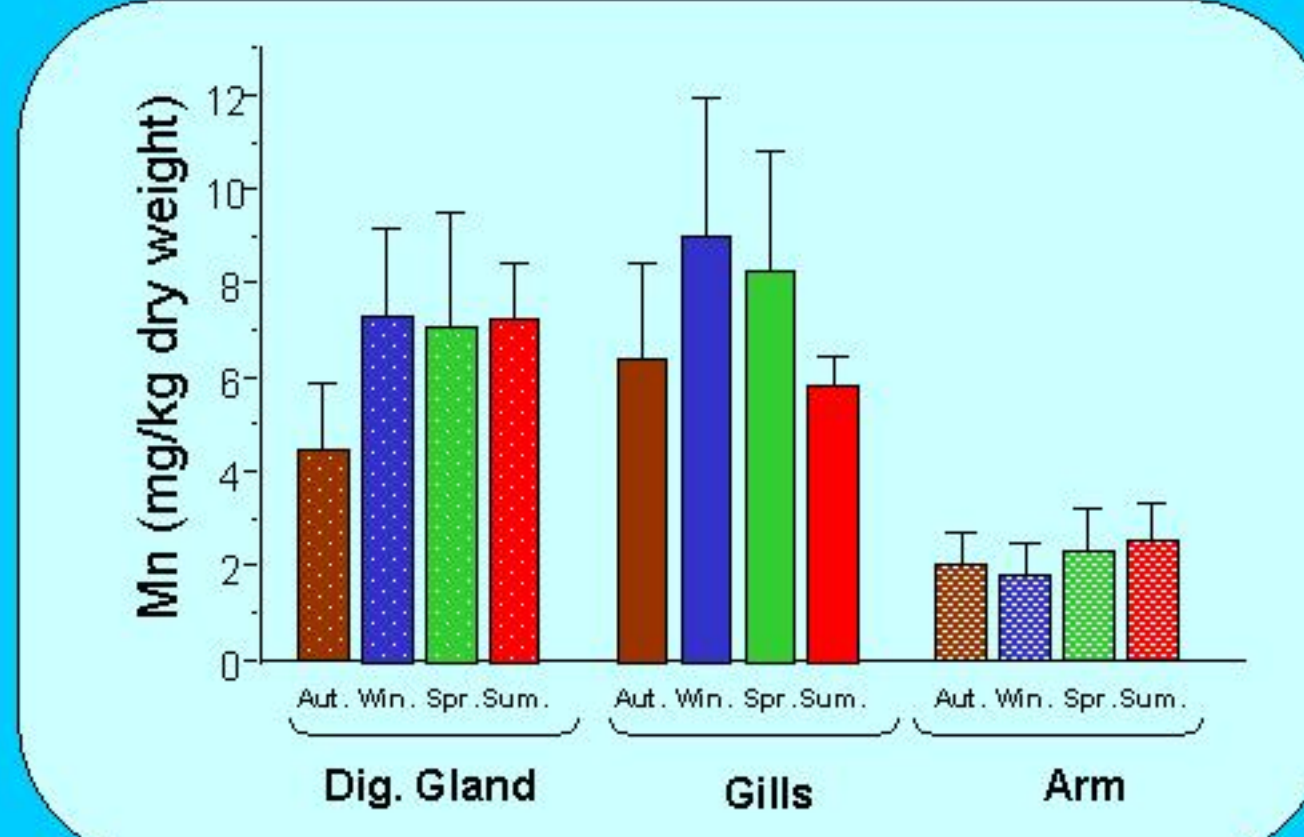
- Particle Induced X-ray Emission (PIXE)

Test statistically used for analysed the results

- Kruskal-Wallis and median test

Results

MANGANESE



The high concentration of Mn appears in digestive gland and gills.

Digestive gland - There are significant differences between:

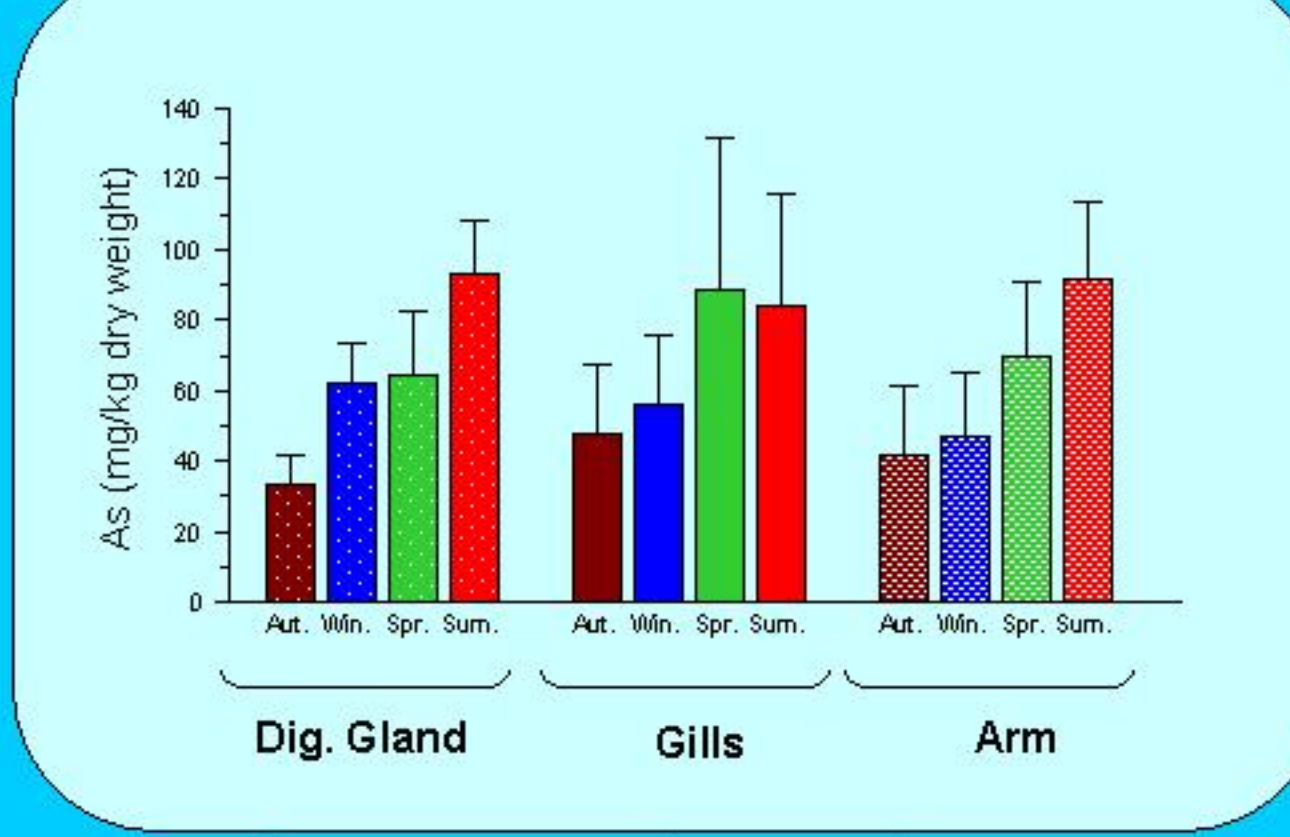
Autumn and the other seasons ($p < 0.05$ $X^2=12.98$)

Gills - There are significant differences between two groups:

Summer-Autumn and Winter-Spring ($p < 0.05$ $X^2=9.8$)

Arm - There are no differences between seasons.

ARSENIC



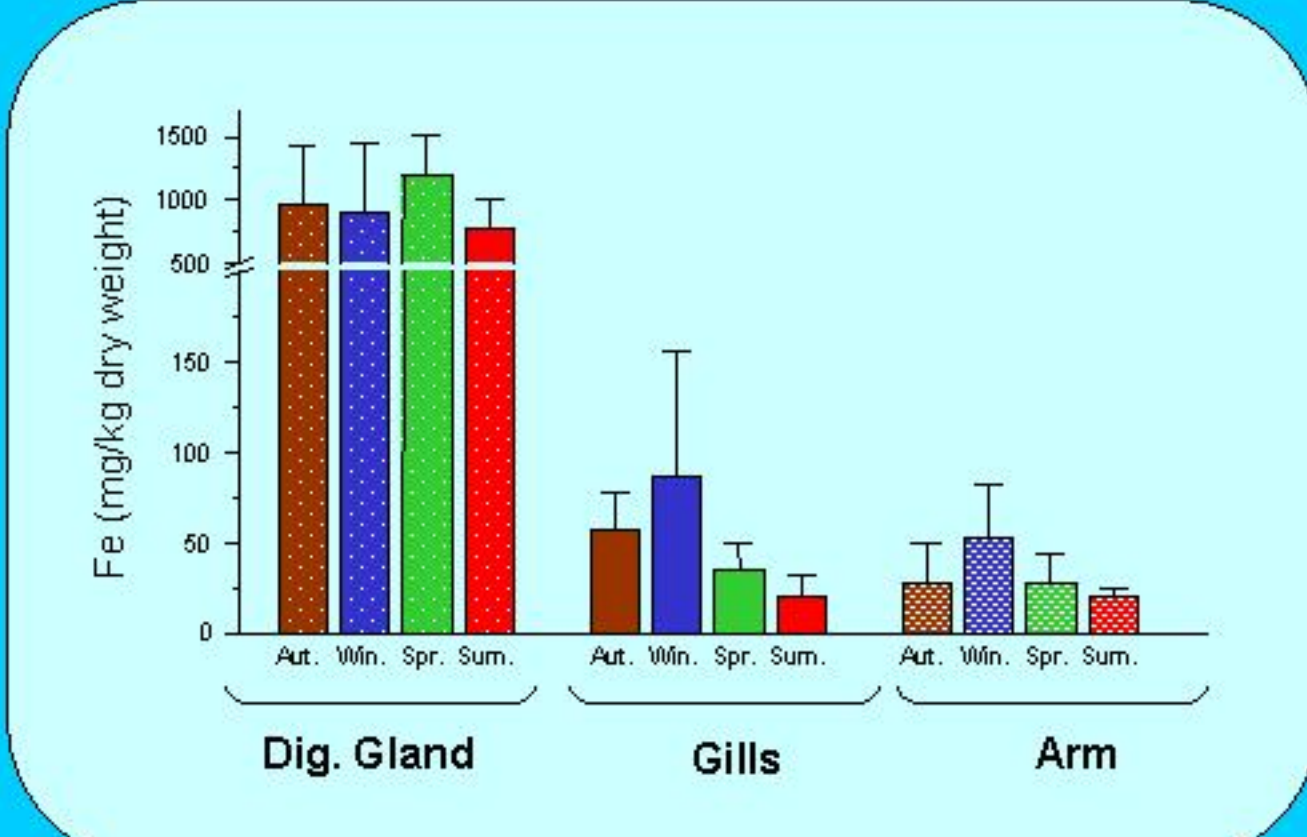
The concentration of As are similar in the tissues analysed.

Digestive gland - There are significant differences between 3 groups: Autumn and Winter-Spring ($p < 0.05$ $X^2=15.0$); Autumn and Summer ($p < 0.05$ $X^2=13.39$); Winter-Spring and Summer ($p < 0.05$ $X^2=10.18$).

Gills - There are significant differences between 2 groups: Autumn-Winter and Spring-Summer ($p < 0.05$ $X^2=7.8$).

Arm - There are significant differences between 3 groups: Autumn-Winter and Spring ($p < 0.05$ $X^2=4.55$); Autumn-Winter and Summer ($p < 0.05$ $X^2=13.98$); Spring and Summer ($p < 0.05$ $X^2=5.56$).

IRON



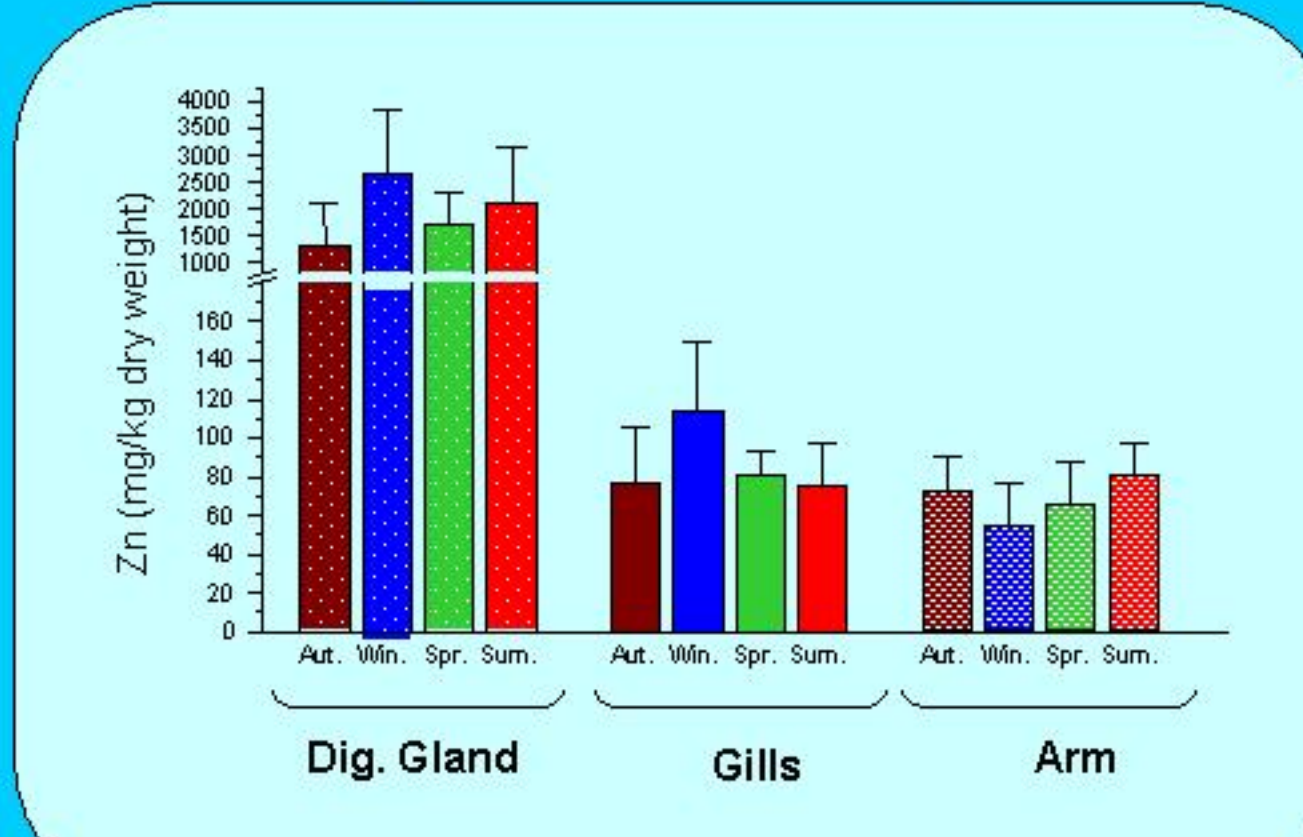
The high concentration of Fe appears in digestive gland.

Digestive gland - There are no significant differences between seasons.

Gills - There are significant differences between 3 groups: Autumn-Winter and Spring ($p < 0.05$ $X^2=2.88$); Autumn-Winter and Summer ($p < 0.05$ $X^2=6.5$); Spring-Summer ($p < 0.05$ $X^2=4.0$).

Arm - There are significant differences between two groups: Winter and other seasons ($p < 0.05$ $X^2=3.7$).

ZINC



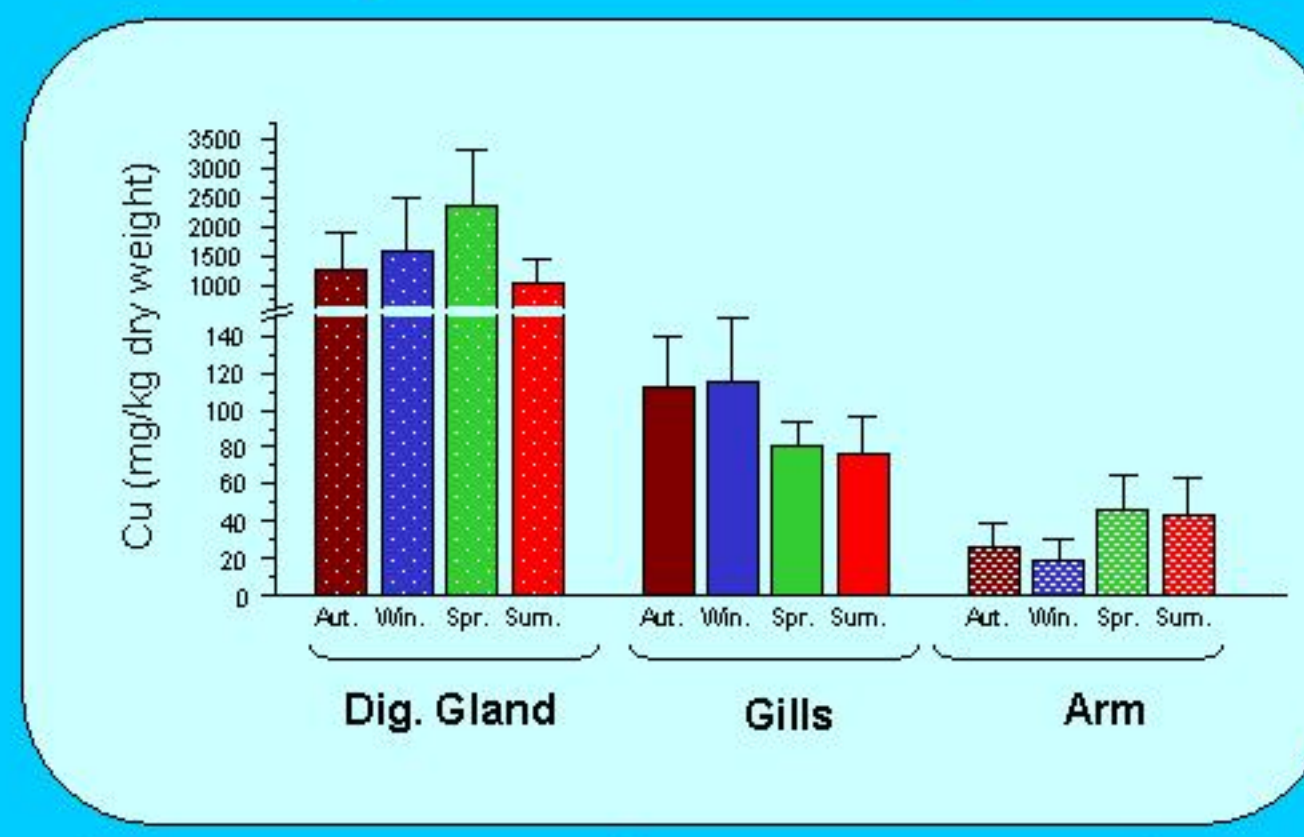
The high concentration of Zn appears in digestive gland.

Digestive gland - There are significant differences between: Autumn and other seasons ($p < 0.05$ $X^2=8.19$)

Gills - There are no significant differences between seasons.

Arm - There are significant no differences between seasons.

COPPER



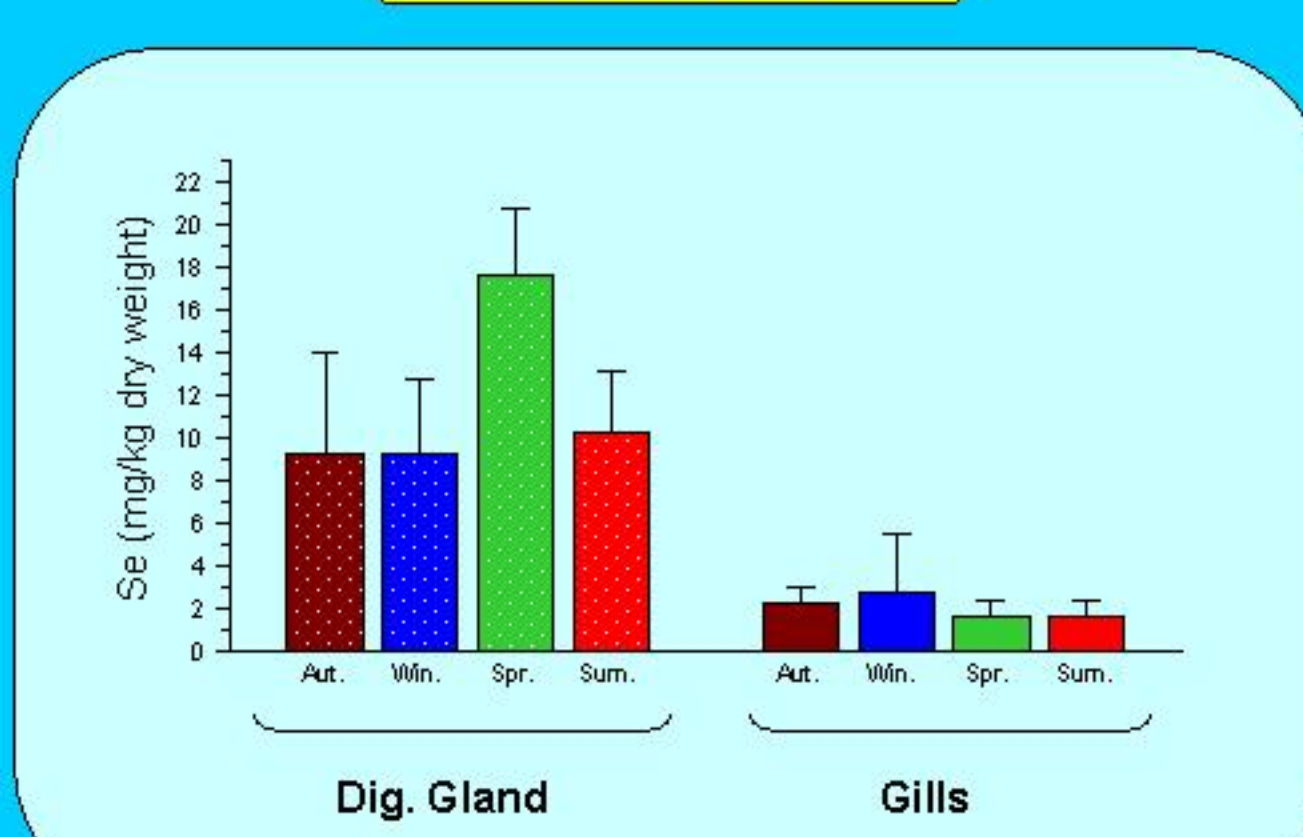
The high concentration of Cu appears in digestive gland and gills.

Digestive gland - There are significant differences between: Spring and the other seasons ($p < 0.05$ $X^2=6.63$)

Gills - There are significant differences between two groups: Autumn-Winter and Spring-Summer ($p < 0.05$ $X^2=6.76$)

Arm - There are significant differences between two groups: Autumn-Winter and Spring-Summer ($p < 0.05$ $X^2=6.76$)

SELENIUM



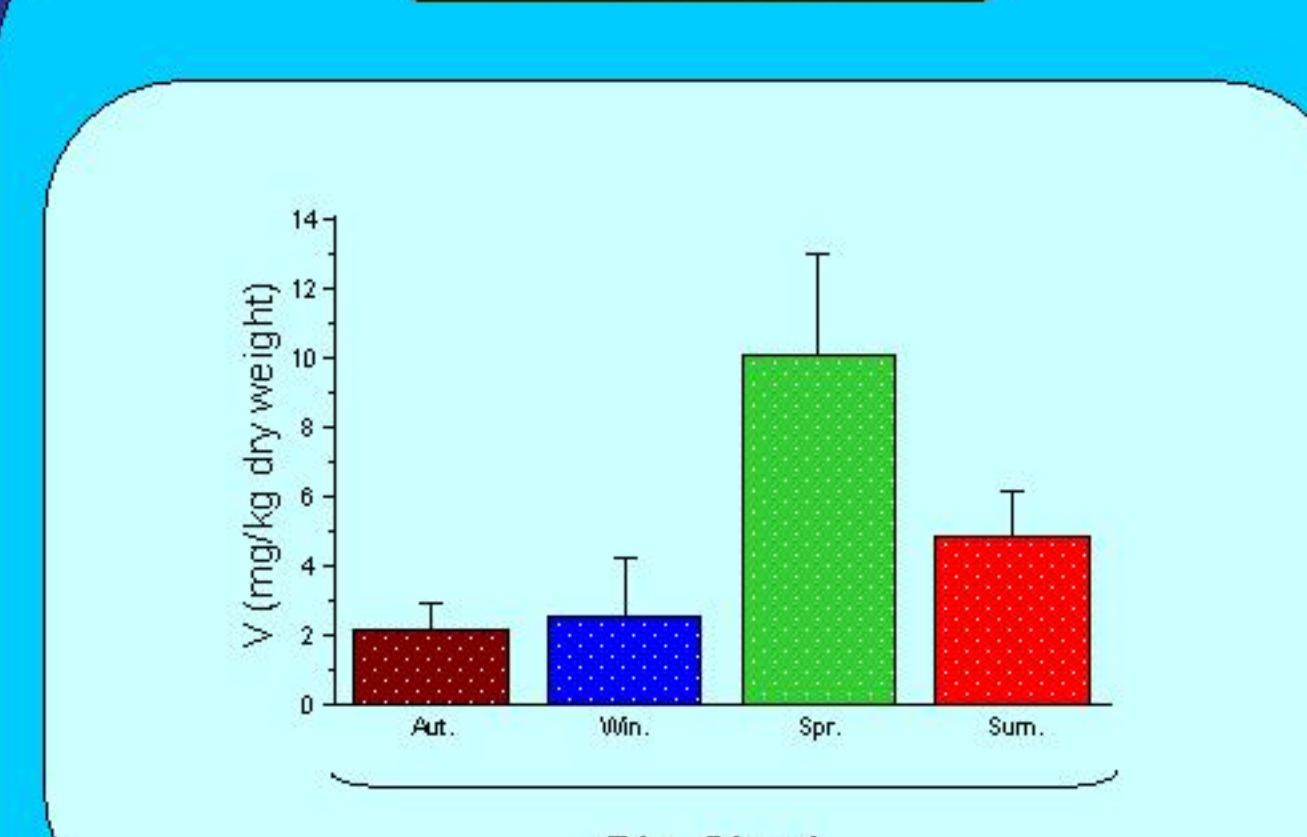
The high concentration of Se appears in digestive gland.

Digestive gland - There are significant differences between 2 groups: Summer-Autumn-Winter and Spring ($p < 0.05$ $X^2=14.47$)

Gills - There are no significant differences between seasons.

Arm - Se only detected in Winter in one animal and in Spring in 2 animals.

VANADIUM



The V is only detected in digestive gland.

Digestive gland - There are significant differences between 3 groups: Autumn-Winter and Spring ($p < 0.05$ $X^2=17.2$); Autumn-Winter and Summer ($p < 0.05$ $X^2=9.88$); Spring and Summer ($p < 0.05$ $X^2=10.58$)

Conclusions

There are no significant differences between the metals accumulated by males and females for Mn, Fe, Cu, Zn, V and Se.

There are no correlations between the weight of digestive gland and gills and the quantity of metals in those tissues.

AUTUMN

- Digestive gland presents the lowest levels for Mn, Zn and As. In this season the other metals are in generality low
- Gills present the lowest levels for V, Mn and As. And the high values of Fe and Cu;
- Arms shows the lowest values for As, and have low levels for the other metals.

WINTER

- Digestive gland presents low levels for V, Cu and Se and high levels for Mn and Zn
- Gills show high values for V, Mn, Cu and Fe
- Arms present the highest values for Fe and high values for Se. But low values of As.

SPRING

- Digestive gland presents the highest values for V, Cu and Se and high values for Zn and Mn.
- Gills present high values for V, Mn and As.
- Arms present high values for V, Mn and Se.

SUMMER

- Digestive gland presents the highest values for As, and high values for Zn and Mn.
- Gills present high levels for As and low levels for Fe
- Arms presents the highest values for As and high values for Cu