

In the name of GOD



**Environmental changes on Urmia lake and effect
of salinity on reproduction mode of *Artemia
urmiana* in the lake**

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(IFRO)**

Introduction:

Importance of Artemia

- As food for aquatic animals Esp. in larval stages
- As model for scientific researches (Physiology, Genetic, Classification, Life cycle,...)
- Artemia enriched as the carrier of antibiotic, protein, fatty acid & vitamins

Natural distribution of Artemia

- In the world
- In Iran

Use of Artemia as food for larviculture





Introduction:

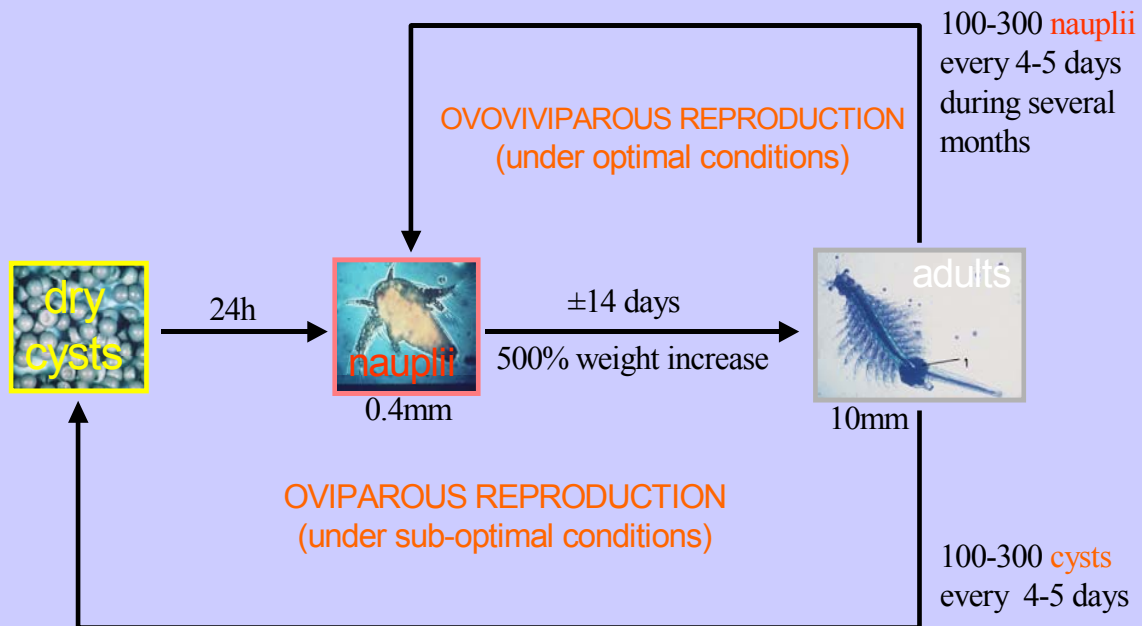
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Life cycle of Artemia



Oviparous reproduction
(Sub-optimal condition)



Ovoviviparous reproduction
(Optimal condition)

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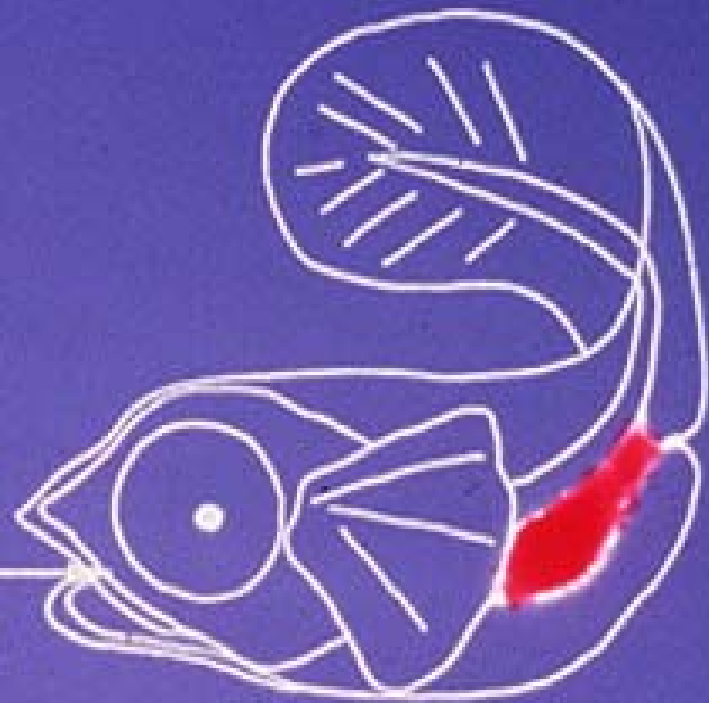
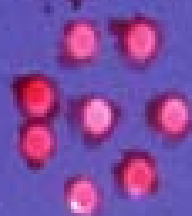
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**SPECIFIC
DIETARY
COMPONENTS**

HUFAs
phospholipids
pigments
vitamins
free amino acids
etc.



NATURAL PLANKTON

(copepods)

EXTRACTS

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World Distribution of Artemia



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Natural distribution of Artemia

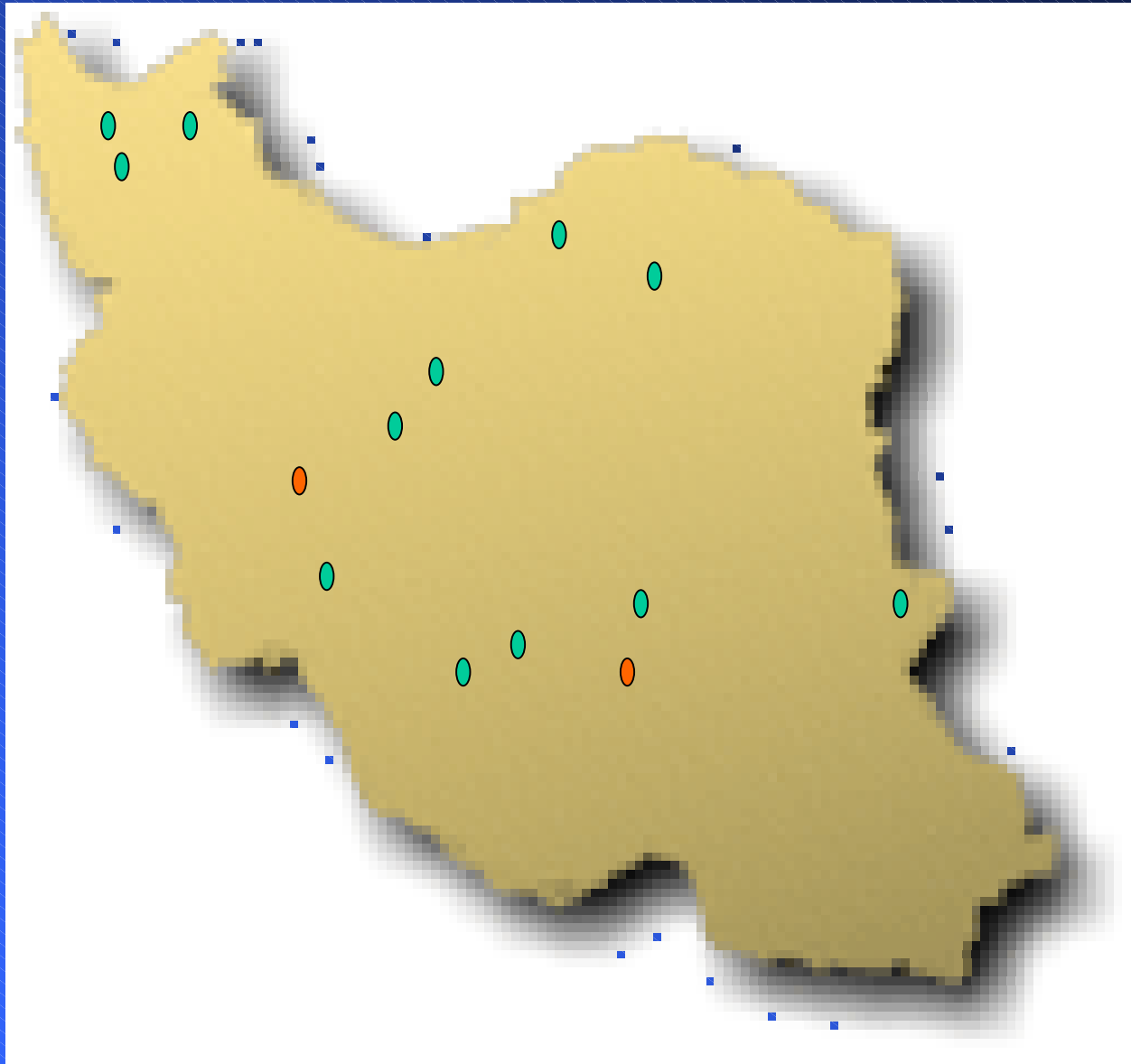
- In the world
- In Iran

In Iran There are

**14 natural resources of Artemia that is only
one bisexual species (*A.urmiana*) in Lake urmia
and the others are parthenogenetic strains
(Hafezieh, 2002)**

- 1) *A. urmiana* in Lake urmia (Urmia province)
- 2) *A. parthenogenetic* in the southern lagoons of lake urmia (Urmia province)
- 3) *A. parthenogenetic* in Shorabil lake (Ardebil province)
- 4) *A. parthenogenetic* in Shor and Incheh lake (Golestan province)
- 5) *A. parthenogenetic* in Kal shor Gonabad(Khorasan province)
- 6) *A. parthenogenetic* in qum lake (qum province)
- 7) *A. parthenogenetic* in Meyghan lake) markazi province)
- 8) *A. parthenogenetic* in Dorood (Lorestan province)
- 9) *A. parthenogenetic* in gachsaran(Khozestan province)
- 10) *A. parthenogenetic* in Nough Lagoon(Kerman province)
- 11) *A. parthenogenetic* in Maharlo lake (Fars province)
- 12) *A. parthenogenetic* in Bakhtegan lake) (Fars province)
- 13) *A. parthenogenetic* in Varmal Lagoon (Sistan province)
- 14) *A. parthenogenetic* in Batlagh Gavkhoni (Esfahan province)

Natural Distribution of Artemia in Iran



Urmia lake in northwest of Iran is the largest lake in the Middle - East. It covers an area that varies 5,200 to 6,000 km². Since 1967 it has enjoyed the status of a wetland protected region, and efforts have been made by the Iranian government to increase its wildlife. It is rich in number of natural resources, most notably its abundant minerals, a unique brine shrimp population, and a diverse and abundant migratory bird population. The lake has also been heavily utilized for the recreation, open space, and tourism opportunities it offers. Elevation of 4,183 feet (1.275 m) above sea level. The lake is about 87 miles (140 km) long and 25 to 35 miles (40 to 55 km) width, with a maximum depth of 53 feet (16 m). In its southern portion there is a cluster of **about 50 tiny islands.**



Urmia lake from the sky



Urmia Lake Pictures



The governing factor of Lake Urmia's hydrograph is its lack of an outlet. It forms the dead end of a large drainage system that covers an area of about 52,000 km² and is subject to great seasonal variation. The main affluent are the **Talkheh River in the northeast**, which gathers the melted snows from the Sabalan and Sahand massifs, and the twin rivers Zarineh and Simineh in the south.

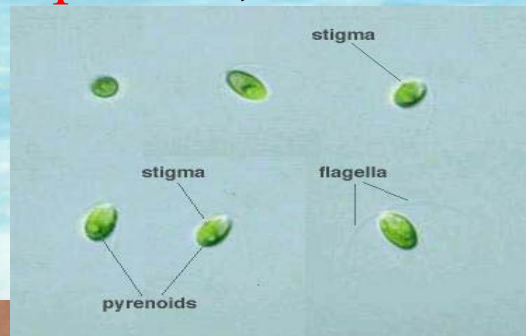


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The salinity in this lake is so high (8 to 11 percent in the spring to 26 or 28 percent in the late autumn). The main salts are chlorine, sodium, and sulfates.

Organic life in the lake's waters is limited to a few salt – tolerant species. Copious **algae** provide food for **brine shrimp** and cause a bad smell along the lake's shores. There are breeding populations of Sheldrake, **flamingo**, and **pelican**, as well as migratory birds.



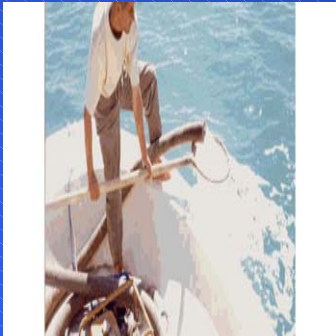
Urmia Lake Pictures



Materials and Methods

- **Sample- taking from 1993-2004 including:
Salinity and some physicochemical parameters**

Biomass of Artemia (by planktonic net, Transect(superficial) and pump (depth) were done



- **Microscopical observations for
determining oviparous and
ovoviviparous reproduction**



- **Statistical analysis by statgraph
programme**

PROJECT OF STOCKS ESTIMATION OF ARTEMIA URMIA LAKE

SAMPLING DATE : 80/04/02 – 23/06/2001 **SAMPLING TEAMLEADER:** R.Hosseinpour
HOUR: 11:30 **SORTER:** C.Ganji
SITE : C
AIR TEMP.: 29.0 **TRANSPARENCY (m):** 1.5 **SUN/SHADE:** sunny
EPTH (m): 2.5 **SITE DEPTH (m):** 6.6 **WAVE :** 0

REPLICATE	1	2	3
BIOMASS DATA:			
sample W.W.B (g)	5.8	4.3	4.1
sample D.W.B (g)	2.1	1.5	1.4
sample W.W.C (g)	1.3	1.0	0.8
sample D.W.C (g)	0.4	0.2	0.3
FREQUENCY DATA OF SUB SAMPLE			
- Cysts	29	31	25
- (meta) nauplii	4	1	3
- juv	9	9	5
- ad.males	8	6	2
- ad.females	6	3	2
- ad.fem.reprod.	3	1	1
REPROD.MODE			
(n=)	4	5	5
* oviparous (%)	100	100	100
x+s (max)	40+14(57)	39+16(57)	80+29(123)
* ovoviviparous (%)	-	-	-
x+s (max)	-	-	-

WATER PHYSICO-CHEMICAL INFORMATION
 water temp. : 25.5
 salinity : 258
 O2 : -

REMARKS :

An example of data collection sheet

In this project, we studied changes of some physical and biological parameters in lake urmia during 1993-2004

These parameters includes :

Changes of water surface of the lake from sea level

Changes of water salinity of the lake

Changes of water transparency of the lake (measured with cechi disk

Changes of Oviparous reproduction of *A. urmiana*

Changes of Ovoviviparous reproduction of *A. urmiana*

With comparison the years (1993-1998) as watery and (1997-2002) as drought years , we studied the effects of salinity on :

1) Reproduction mode of *A. urmiana*

2) Life of some aquatic birds

3) Agriculture around the lake

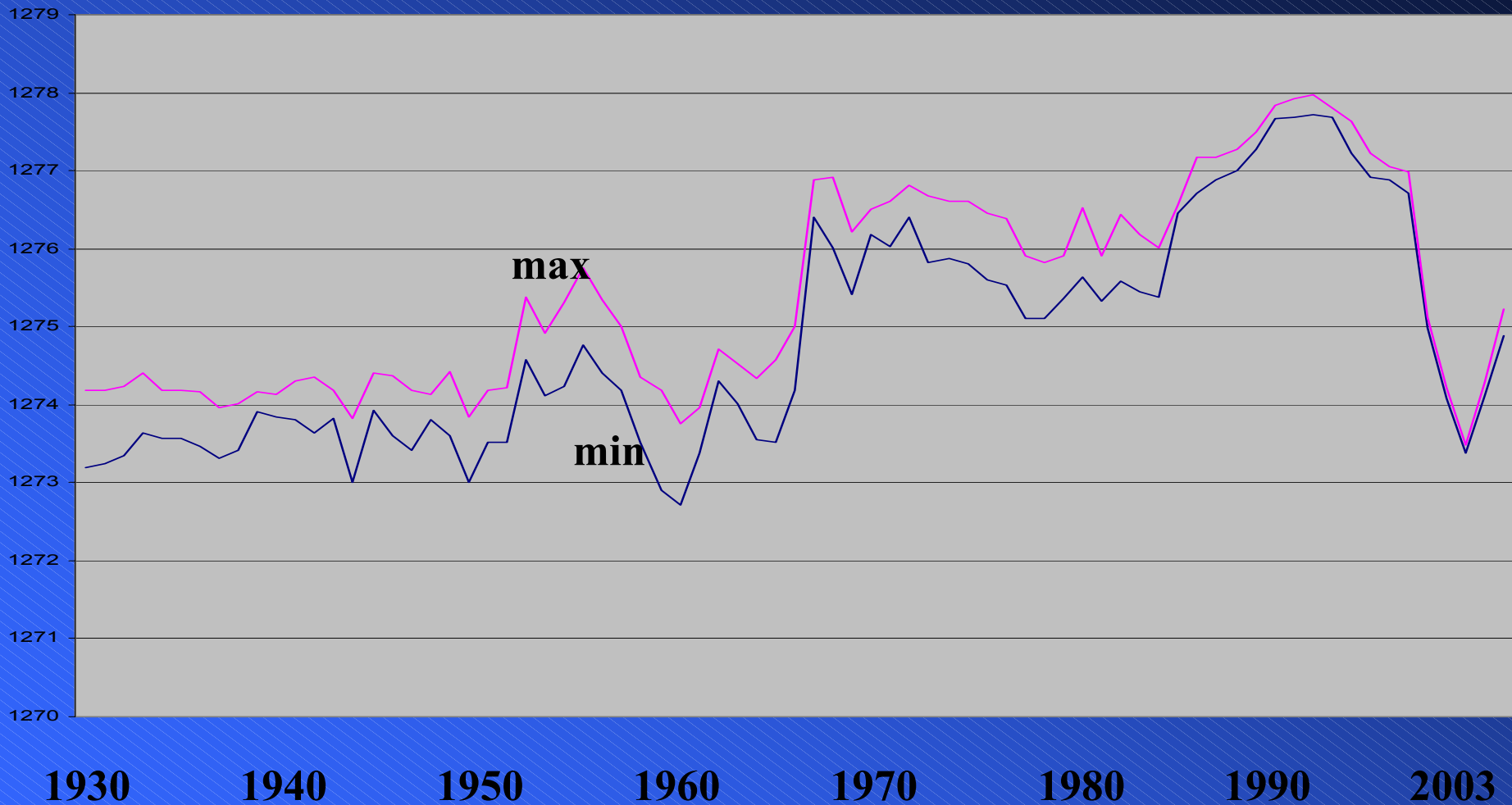
The volume of water discharged into the lake by these rivers varies considerably during the year. During the spring the Talkheh River and Simineh River may each discharge about 57 m³ /s, while the rate drops to only 3.7 or 1.7 m³ /s in the dry summer. This variation and evaporation causes the lake itself to rise and fall, fluctuating by 0.6 to 0.9m.

In addition to seasonal variations, there are also longer periods of fluctuations, lasting from 2 to 100 years, with water level fluctuations of 1.8 to 4 m.

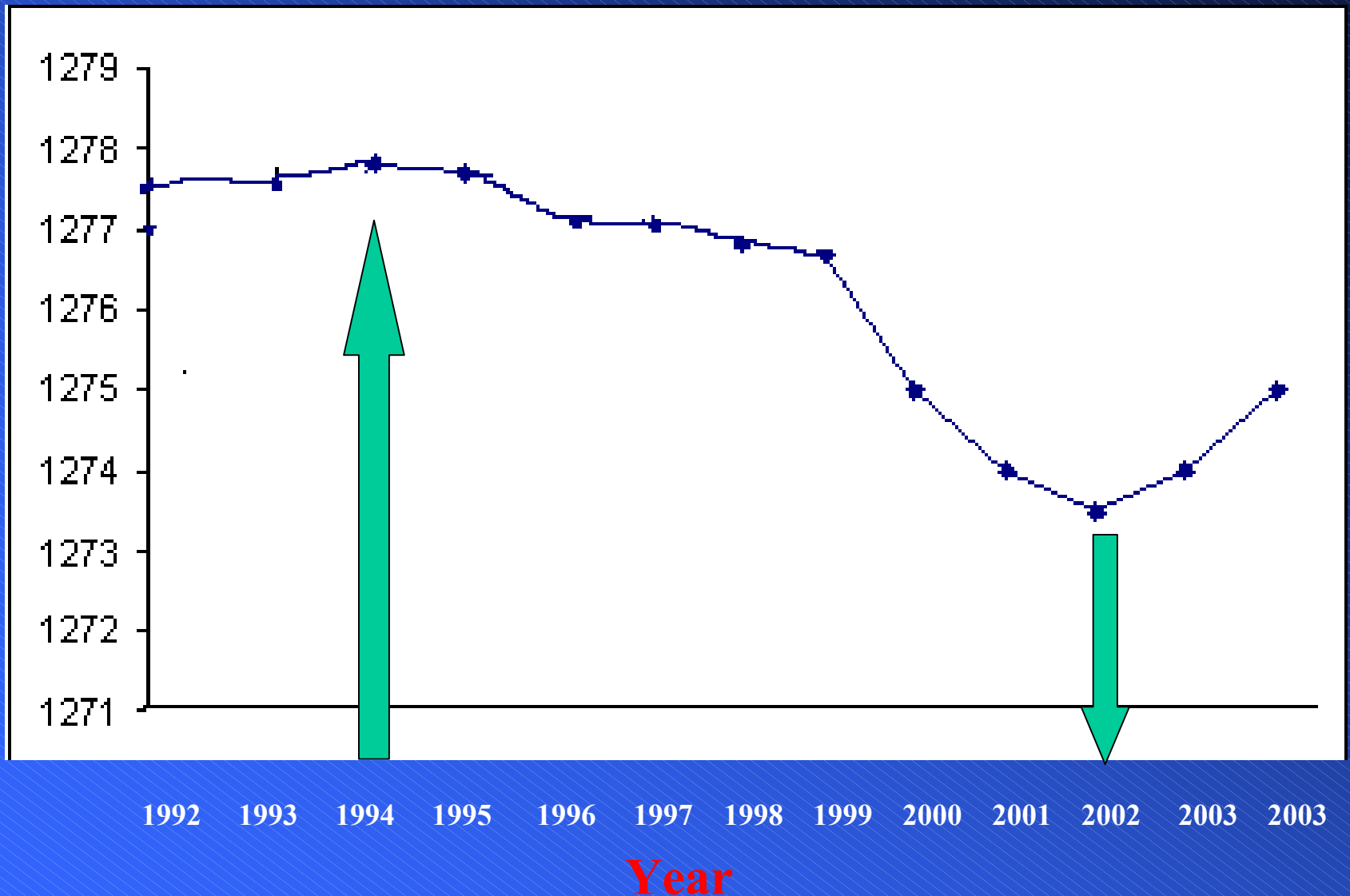
Return periods (upturn) Or Turn around time	2 (Year)	5 (Year)	10 (Year)	25 (Year)	50 (Year)	100 (Year)
Water surface of Urmia lake from sea level	1275.3 (m)	1276.6 (m)	1277.3 (m)	1278.1 (m)	1278.7 (m)	1279.0 (m)

According to statistical Collation and distribution(Hadi & Peersone III)

Changes of water surface in Urmia lake (1930-2003)



Changes of water surface in Urmia (1992-2003)



Physicochemical characteristics of Lake Urmiah

Parametrs	Range 1993	Range 2000
Water Temperature(°C)		
November	5-9.5	6-10
August	23-25	26-28
Air temperature (°C)	9.5-15	8-30
E. Conductivity(µm/Cm)	234000-300000	310000-420000
Total alkalinity(mg CaCO3/l)	206-312	350-440
Salinity(ppt)	160(Min=130, Max=190)	285(Min=260, Max=310)
Dissolve Oxygen(mg/l)	2.3-2.6	1.5-2.2



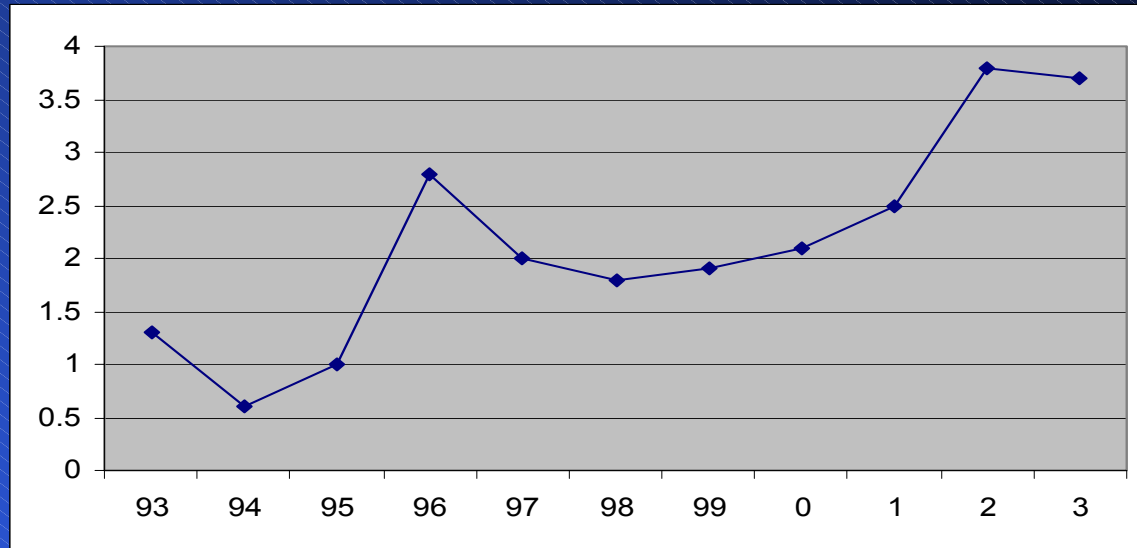
1996 ←



→ 2000

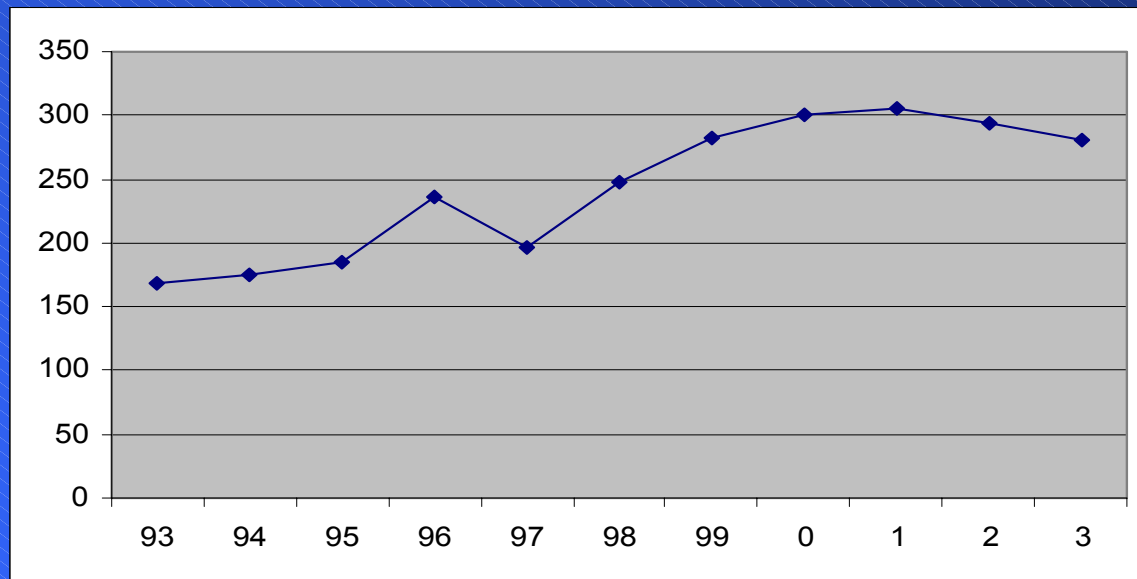
Changes of Urmia lake water Transparency during 1993-2003

Transparency (m)

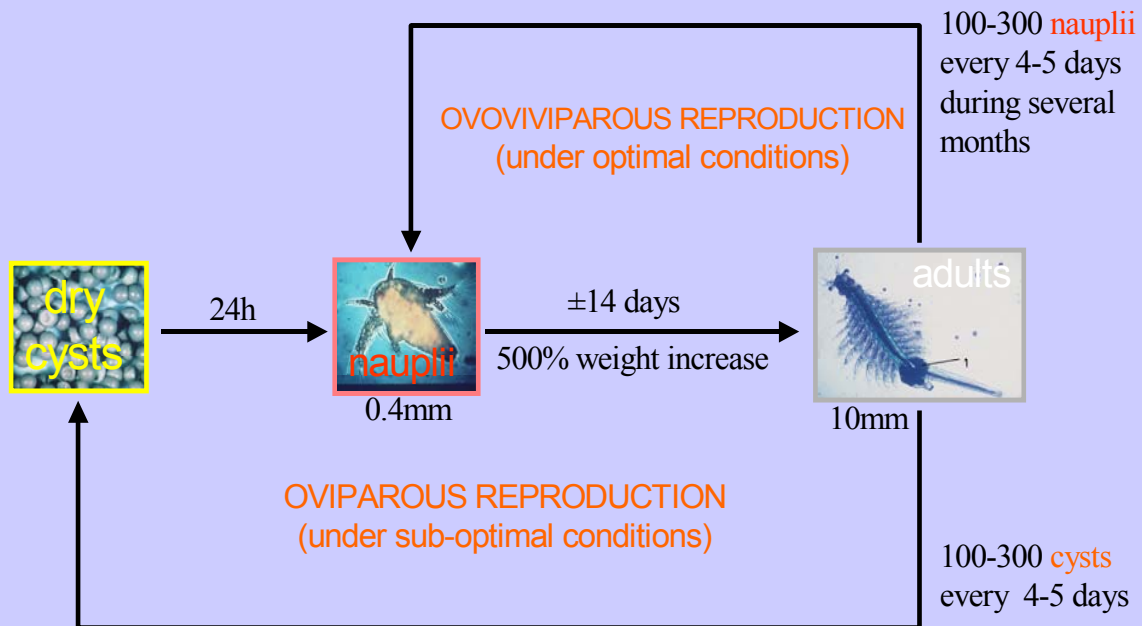


Changes of Urmia lake water Salinity during 1993-2003

Salinity (ppt)



Life cycle of Artemia



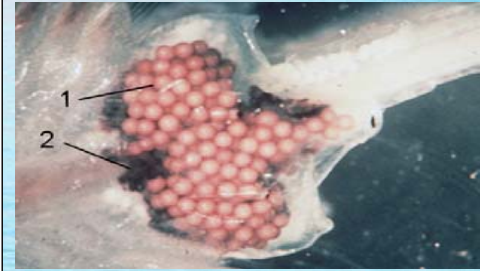
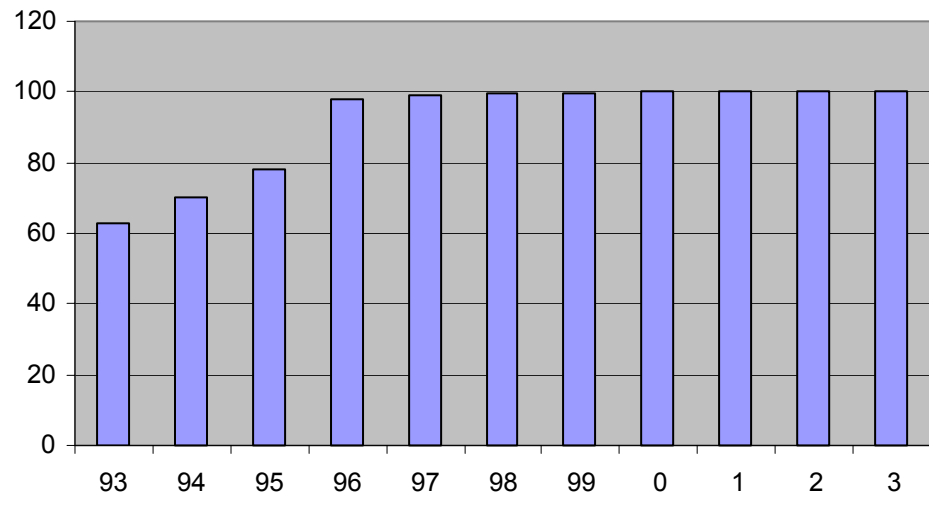
There are so many references about effects of salinity or the other stresses on biology and reproduction of Artemia but all of them were done in laboratories with limited conditions and without complexities which are present in the natural habitats.

In this project we focused on effects of salinity on reproduction mode of Artemia naturally.

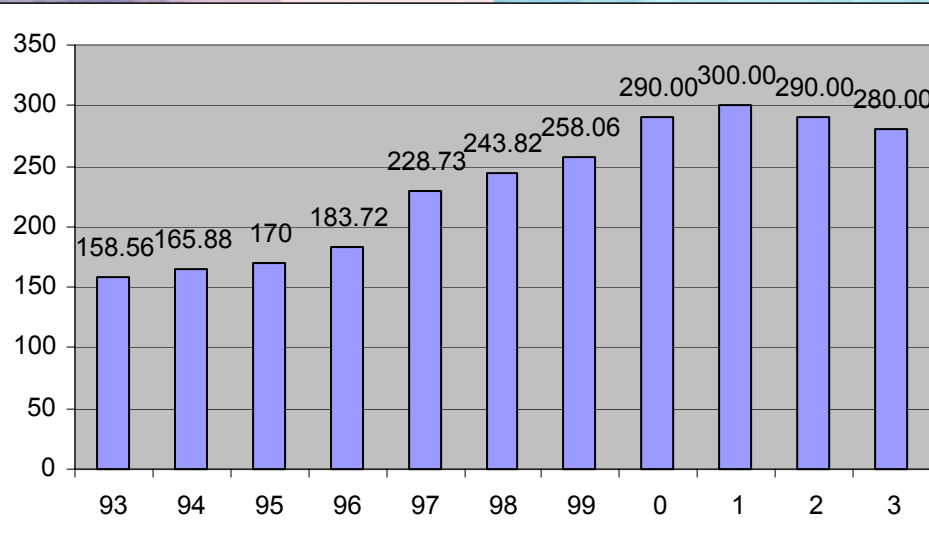
During the years 1993-2002 the salinity changes were noticeable. also samples of adult Artemia separated Oviparity from Ovoviviparity

Then correlation between them and also analysis of variance between averages was conducted

Oviparous %



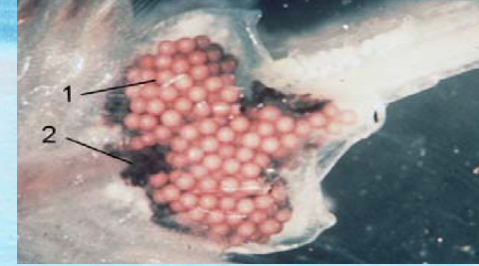
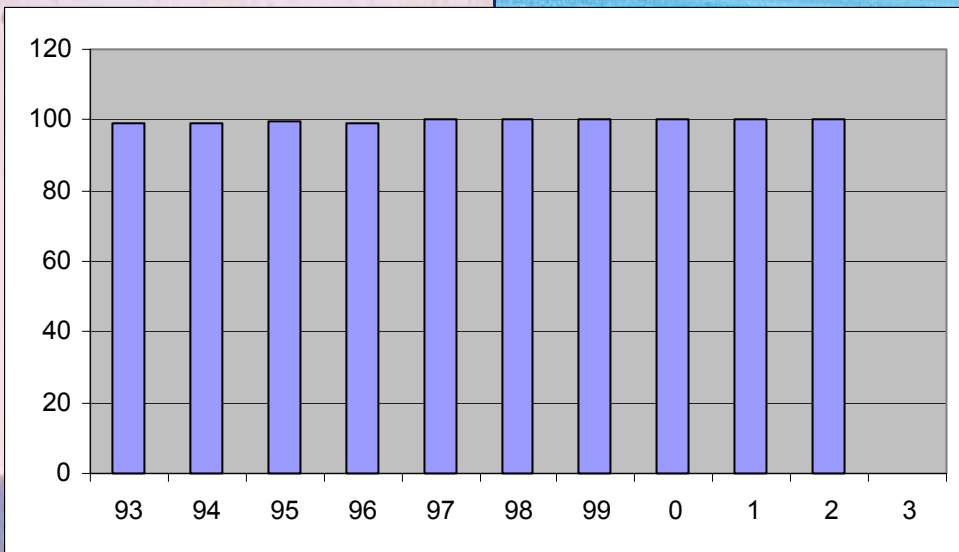
Salinity (ppt)



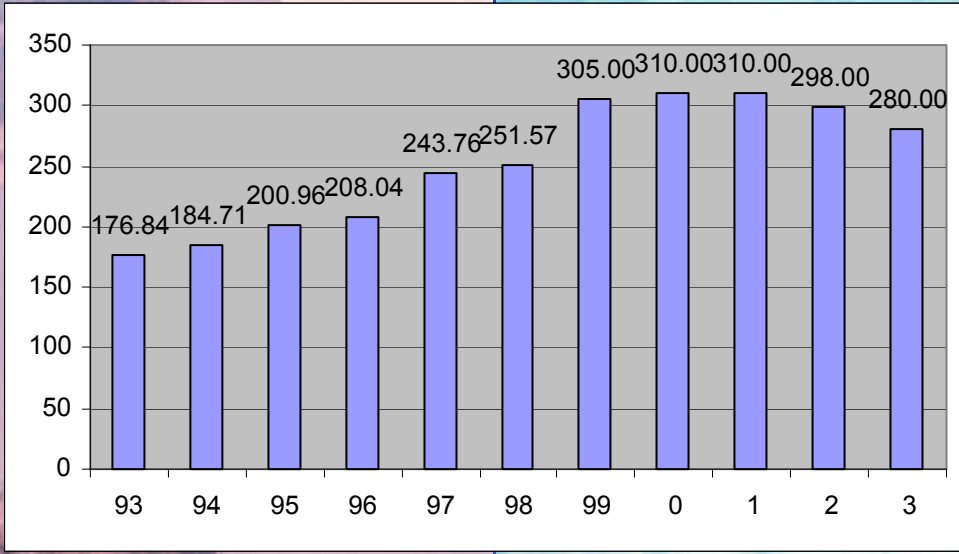
Year

1st, six months

Oviparous %



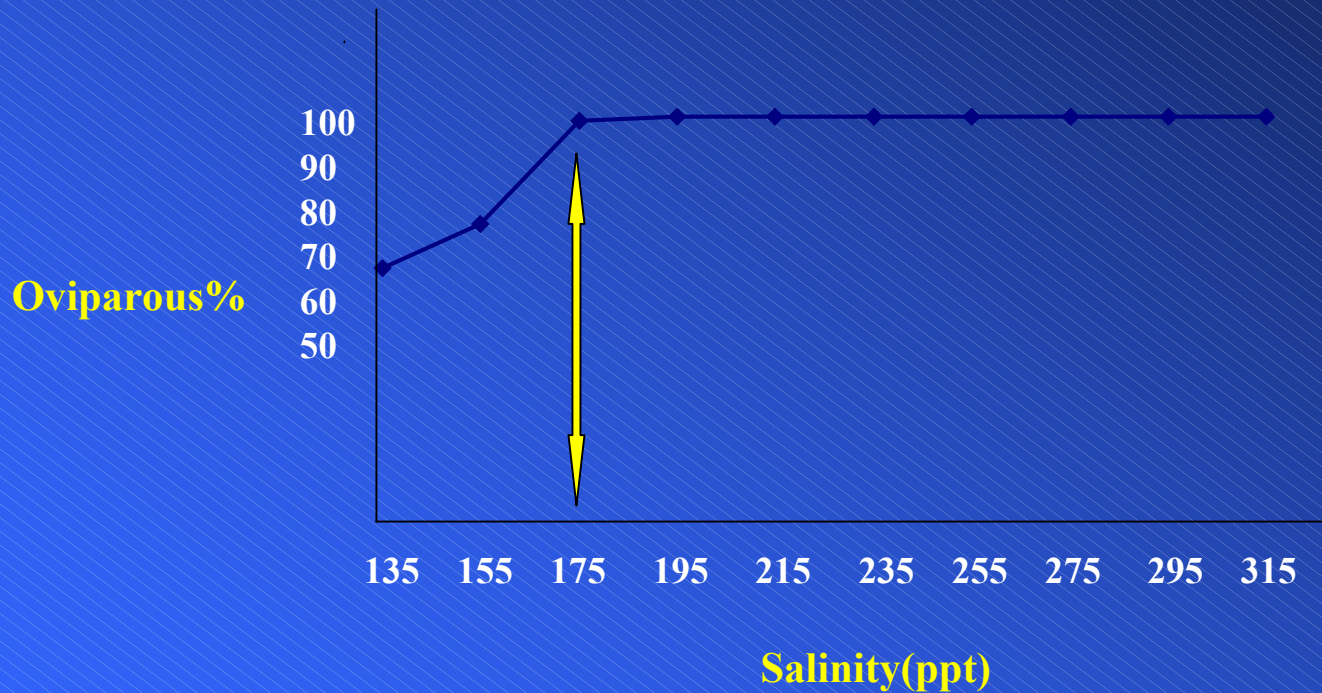
Salinity (ppt)



Year

2nd, six months

Average of changes of oviparous percentages in different salinity (1993-2003)



Statistical analysis with statgraph programme

ANOVA Table for oviparous by area

Analysis of Variance					
Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	47996.1	1	47996.1	325.66	0.0000
Within groups	155635.0	1056	147.382		
Total (Corr.)	203631.0	1057			

Group 1= Salinity<172 ppt

The StatAdvisor

Group 2= Salinity>172 ppt

The ANOVA table decomposes the variance of oviparous into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 325.659, is a ratio of the between-group estimate to the within-group estimate. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the mean oviparous from one level of area to another at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.

The Changes in the Ecosystem of Urmia Lake and its effects on birds

Increasing of water salinity caused death of the birds with two ways

- 1) Decreasing of Artemia biomass as food for birds
- 2) Crystallized feathers and eyes and consequently Inability in seeing and flying and finally death







The Changes in the Ecosystem of Urmia Lake and its effects on agricultural industries around the lake

With accumulation of salts around the lake they spread on agriculture lands around the lake with wind and consequently the earth has salted and agriculture was stopped

According to data from Agriculture Ministry between 1998-2002 Agriculture detriment arized from this phenomenon in West Azarbayejan province was more than 2000000 USD



**Artemia is stressed by high salinity but Normally ,
the tendency of *A. urmiana* is towards to oviparous**

**In Lake Urmia 100% Oviparous mode reproduction
was occurred in salinity more than 172 ppt**

**In Lake Urmia less than 40% Ovoviviparous mode
reproduction was occurred in salinity less than 172 ppt**

**According to ANOVA results , in high salinity, more
than 99% of females produced cysts**

- **High salinity not only directly , but also via decreasing phytoplankton densities can affect the oviparous reproduction and enhance cyst production.**
- **Physiological mechanisms can affect and change reproduction mode**

A formula can be developed comparing salinity data with reproduction mode

Thank you

The image features the words "Thank you" in a large, bold, sans-serif font. Each letter is filled with a different color from a rainbow spectrum, creating a vibrant gradient effect. The letters are outlined in white, giving them a 3D appearance. A soft, white shadow is cast beneath the text, extending to the left and slightly forward, suggesting a light source from the upper right. The background is a solid, deep blue color.