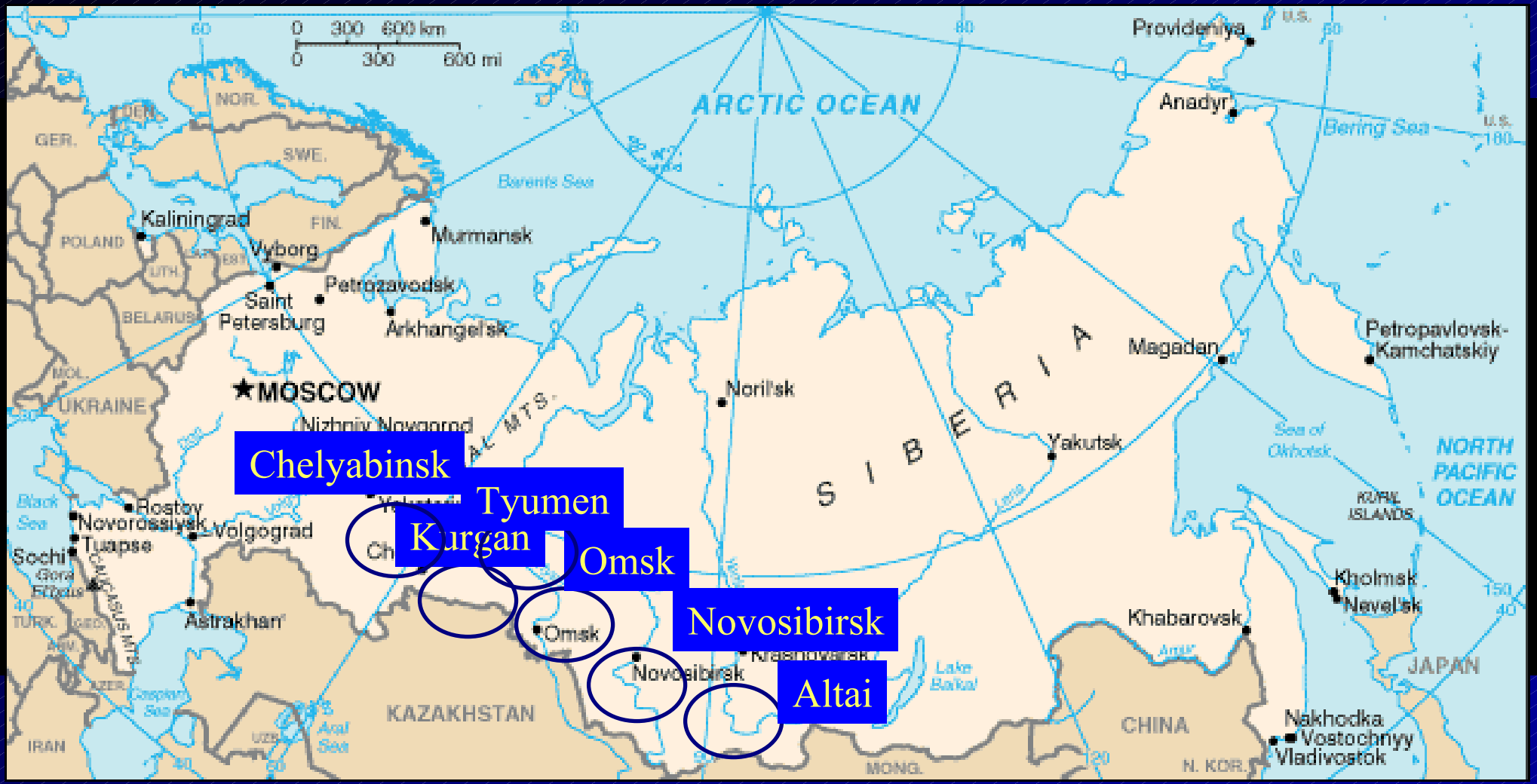
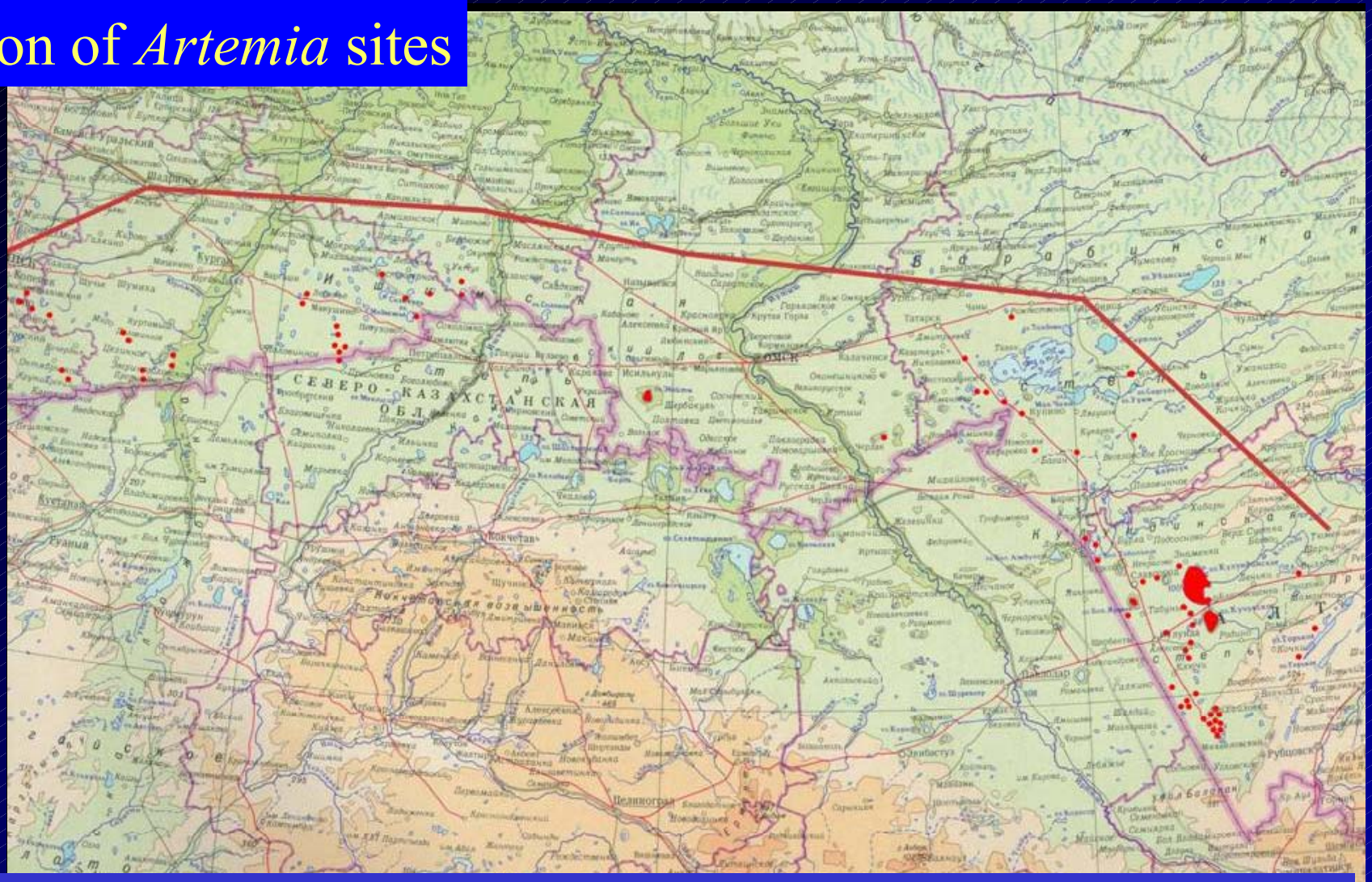
1. Distribution of *Artemia* in South-Siberia

Cooperation with *Sibrybniiproject (Siberian Science, Research & Project Construction Institute of Fishery), Tyumen State Agricultural Academy, Tyumen, Russia*

Survey of *Artemia* sites



Distribution of *Artemia* sites



- 90 sites
- total surface area of lakes : 1280 km² : generally between 1 and 10 km²

Chelyabinsk region

Tazatkul
Soleny Kulat
Solenoye
Kommunarskoye

Kurgan region

Kulat (Lavrushino)
Aslykul
Sulphatnoye
Vishnyakovskoye
Tibizlok
Solenoye (Setovo)
Gashkovo
Svetlenkoye
Aktoban
Nevidim
Ilyeney
Gorkoye
Sobachye
Filatovo
Solenoye (Umreshevo)
Voskresenskoye (Kurtamysh)
Medvezye
Maloye Gorkoye (Chastoozerskoye)
Shashmura (Pegan)
Solenoye (Kurtamysh)

Tyumen region

Siverga
Solenoye 18

Omsk region

Ebeyty
Ulzhay

Novosibirsk region

Gorkoye (Tzarizinao)
Lechebnoye
Gorkoye (Olhovka)
Chebakly
Karachy
Gorkoye (Konevo)
Ostrovnoye
Mihkaylovskoye
Gorkoye (Barabashy)
Gorkoye (Novokluchy)
Solenoye

Altai region

Bolshoye Yarovoye
Kulak – Sor
Dzul – Suldy
Bura
Belenkoye
Retuhovo
Maloye Yarovoye
Karatal
Bolshaya Gorchina
Chekurtuz
Krivaya Ruchina
Retuhovskoye
Dzhomnsor
Bauzhansor
Kurichye
Kulundinskoye
Pravy Bliznets
Dunay
Vshivka
Lomovoye
Gornastalevo
Malinovoye
Burlinskoye
Kucukskoye
Severny Zaliv
Ministral
Yodnoe
Levy Bliznets
Nikolayev Bereg
Tanatar 2
Tanatar
Dushnoye
Solenoye (B. Gorkoye)
Mormyshanskoye
Baltabay
Zhirkoin
Vulduh
Kaskul-Chistoye
Sazanda
Toluboy
Bulduk
Mirabilit

Topography-climate-(a)biotic conditions

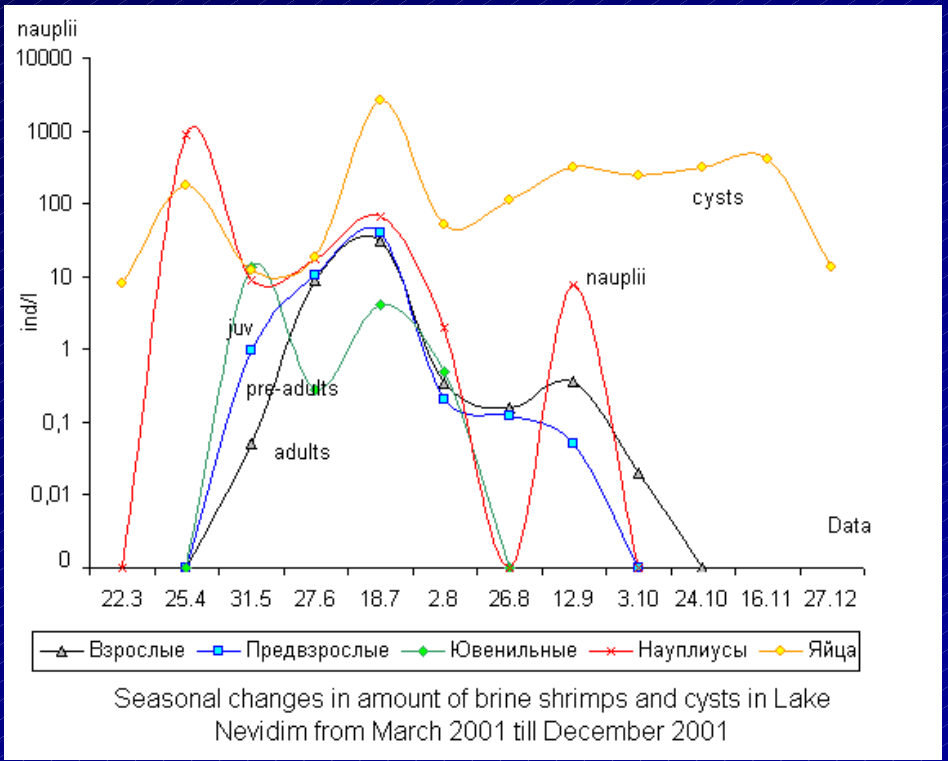
- flat
- (semi-) arid area; variable precipitation
- continental climate:
  - winter water temperatures down to –19°C
  - ice layer up to 20 cm thick
  - hot summers (water temperatures up to 25-30°C)
- shallow => high fluctuations in salinity (40-320 ppt)
- phytoplankton: seasonal dynamics; species composition:
  - spring peak
  - late autumn peak

Artemia populations

- parthenogenetic populations, except L. Solenoye, Sobachye, Yodnoye
- growth & reproduction: end of April-early October
- cyst biometrics: 257-289 µm
- detailed population dynamics:
  - lake Medvezhye ("Bear")
  - lake Nevidim
  - lake Vishnakovskoy

Artemia population dynamics

- maximal densities late spring, early summer
- decline of population as consequence of food depletion
- 3-4 generations yearly; small/shallow lakes: 1-2
- low productivity (compared to other areas), low brood sizes

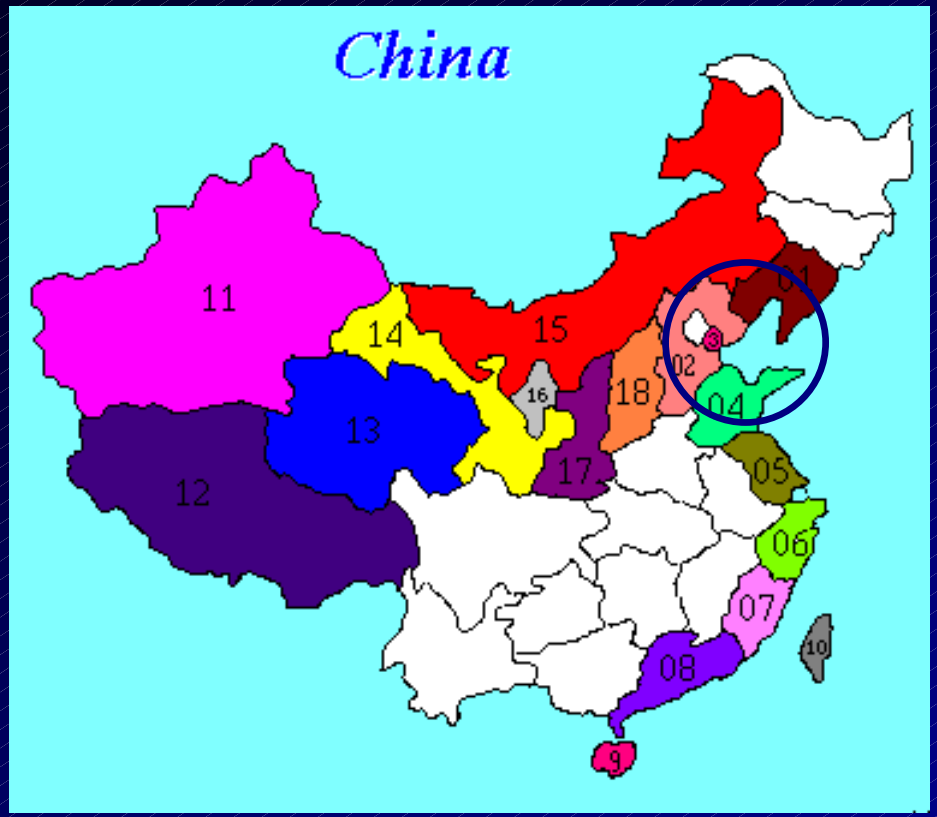


Seasonal changes in amount of brine shrimps and cysts in Lake Nevidim from March 2001 till December 2001

Ongoing & future studies

- cytogenetics: PhD study
- continued population monitoring (cfr issuing harvesting licenses)
- bisexual populations: but no samples available yet !

2. Contamination of Bohai Bay *Artemia* population by introduced *A. franciscana*



1. Liaoning
2. Hebei
3. Tianjin
4. Shandong

First approach: culture tests

ARC code	Province- Site	Year of harvest	Year of arrival	Max H%	% survival	Sex ratio (male/fem)
1211	Tianjin – Hangu	1990	-	42 %	88 %	**0.3-99.7** (n=1317)
1187	Tianjin - Tanggu	-	1991	66 %	87 %	**0.3-99.7** (n=1310)
1210	Shandong - Chengkou	1991	1992	34 %	65 %	**0.1-99.9** (n=975)
1214	Shandong - Yangkou	1991	-	22 %	40 %	**45-55** (n=594)
1233	Hebei - Canghzhou	-	1992	35 %	61 %	**31-69** (n=915)
1261	Hebei - Luannan	-	1993	29 %	31 %	**46-54** (n=459)
1350	Hebei - Luannan	-	1997	53 %	92 %	**44-56** (n=1385)
1351	Hebei - Luannan	-	1997	38 %	79 %	**39-61** (n=1186)
1438	Hebei - Luannan	-	1998	49 %	66 %	**48-52** (n=987)
1467	Hebei – Luannan	-	1999	78 %	86 %	**43-57** (n=1290)
1580	Shandong - Wudao	2002	2003	91 %	62 %	**50-50** (n=932)
1583	Shandong - Xinhu	2003	2003	80 %	70 %	**43-57** (n=528)
1584	Shandong -Huanggualin	2002	2003	90 %	90 %	**42-58** (n=1345)
1586	Shandong -Guangyanghi	2002	2003	91 %	93 %	**47-53** (n=1399)
1587	Shandong -Guangyanghi	2003	2003	92 %	88 %	**45-55** (n=1318)

to be continued by :

- further screening (focusing on specific areas/time periods)
- DNA analysis (SFB ? GSL ?)

3. NATO Collaborative Linkage Grant
"*Artemia* colonization of the Aral Sea: hope for a dying ecosystem"

Cooperation with:

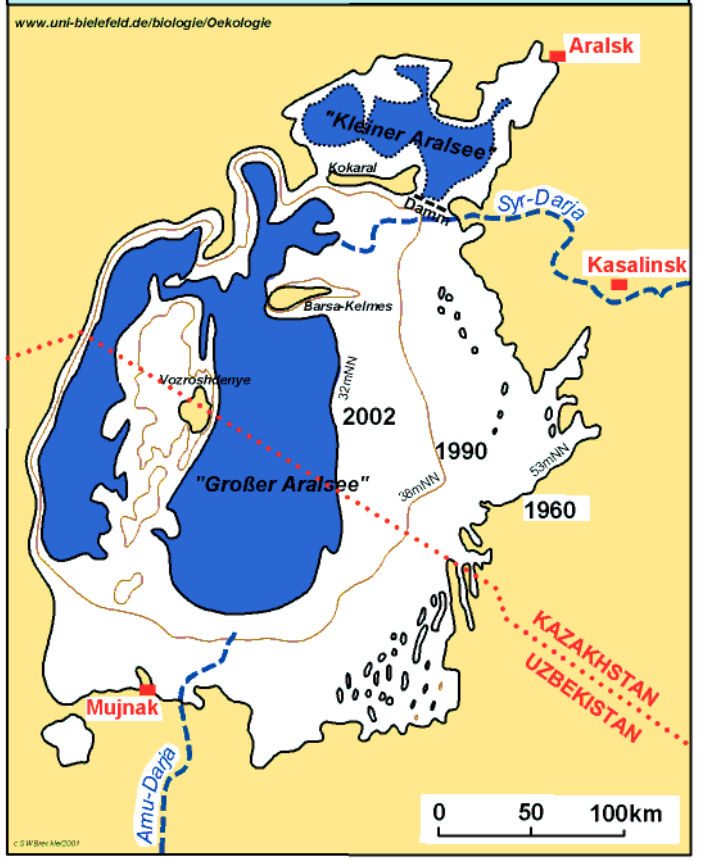
1) Laboratory of Ichthyology and Hydrobiology, Institute of Zoology, Tashkent, Uzbekista
2) Institute of Bioecology of the Karakalpak Branch of the Uzbek Academy of Sciences, Nukus, Uzbekistan
3) Inve Aquaculture, Inc.

Coordinator: ARC

Uzbekistan map

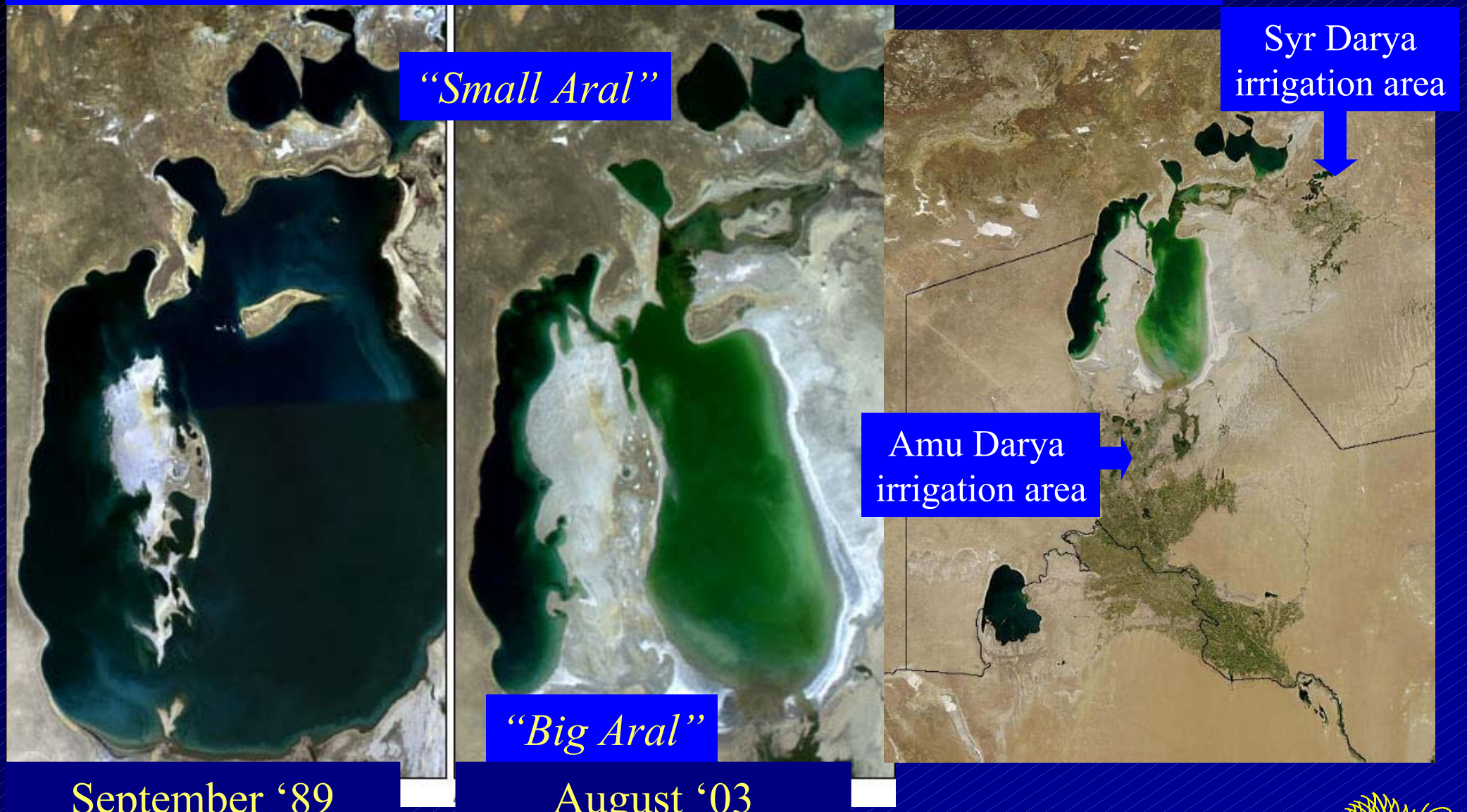
Evolution of Aral Sea 1960-now

	Wasserfläche	Wasservolumen	Salzgehalt
1960:	100%	100%	0,9 % Salz
1970:	90%	89%	1,0 %
1980:	76%	59%	1,7 %
1990:	66%	26%	3,5 %
2000:	40%	19%	4,3 %
2002:	34%	15%	ca. 4,9 %



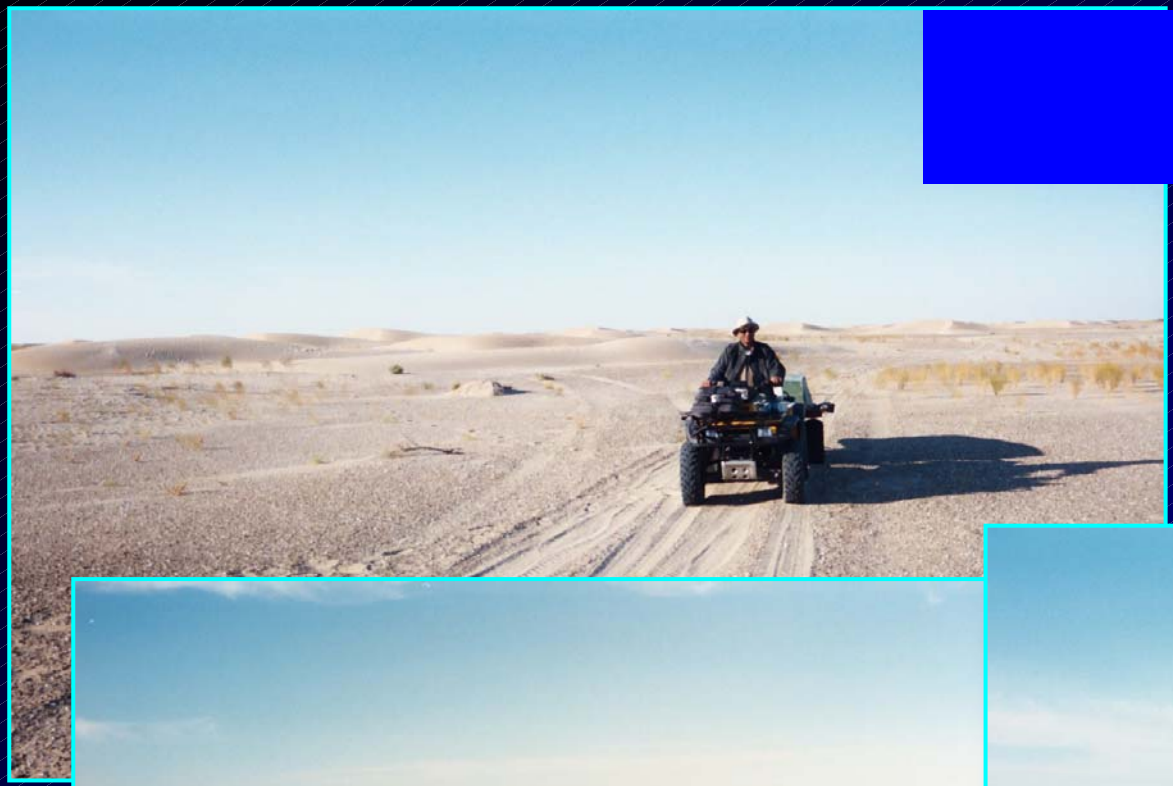
Das Verschwinden des Aralsees 1960-2002

Evolution of Aral Sea 1960-now



Moynak Ship Cemetery

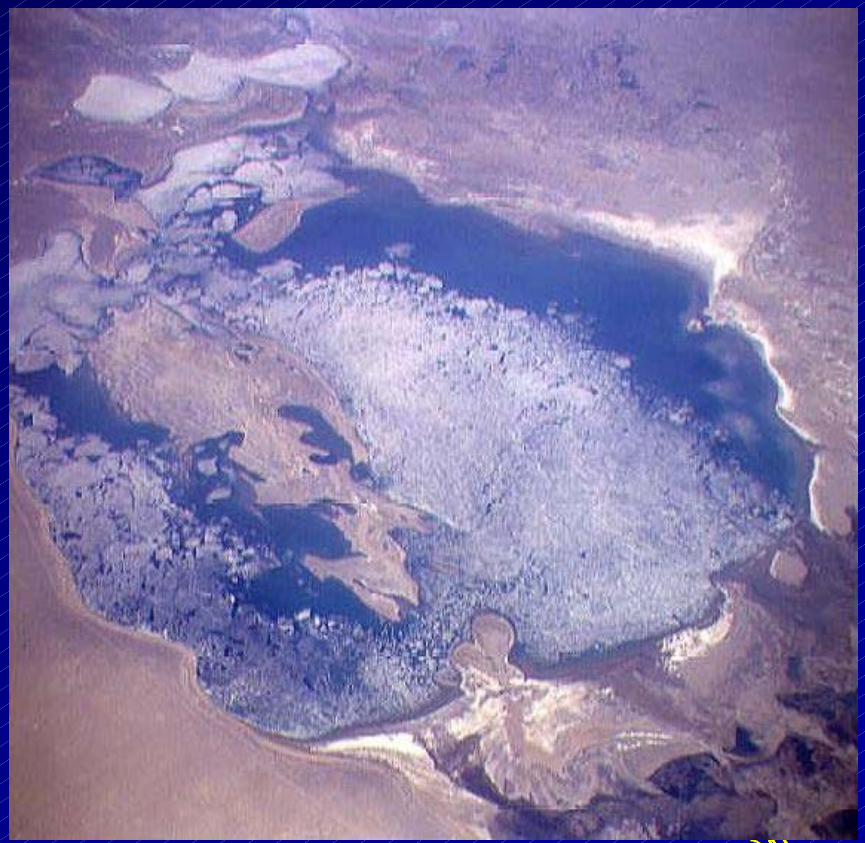
Aralkum desert
(= former seabed)



Project objectives

- establish a team of biologists, limnologists, chemists, and natural resource experts
- document ecological characteristics of Aral Sea: hydrobiological and hydrochemical status cfr. gradual colonization by *Artemia* population.

sampling and monitoring programme



Present *Artemia* situation

Northern Aral sampling area
(not included in NATO Grant)

- ± 80-110 ppt (autumn 2003)
- expanding parthenogenetic Artemia population
- low to moderate nutrient & phytoplankton levels
- low to moderate density *Artemia* population
- low reproductive capacity
- first small cyst accumulations

Western Aral sampling area

Eastern Aral sampling area

bisexual population !

Future for *Artemia* population ?

HUGE SOCIO-ECONOMIC & ECOLOGICAL PROBLEMS !!

- *Small Aral* : stabilized or back to lower salinity

- *Large Aral* :

→ Difficult balance:
  - sufficient river inflow as to assure nutrient input; cfr phytoplankton composition !!
  - not too high river inflow as to assure sufficiently high salinity
  - fits in *economical and political framework* of Central Asian region

→ Perspective: *doom scenario ?*

→ Extra problems for commercial harvest :
  - several levels of authority: national, regional, local…
  - difficult accessibility of area: no roads; mudflat shores
  - recommendation: moratorium on commercial harvests until more information is collected