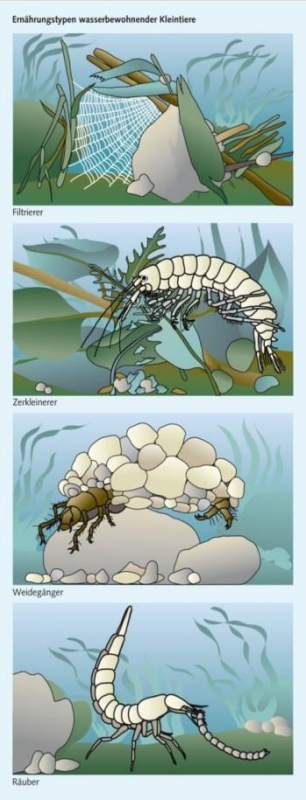
Aquatic Biodiversity of the Tarim River referring to macro invertebrates and fish

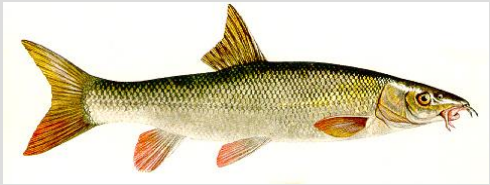
SuMaRio final public conference, Munich - Dec 10 -11, 2015

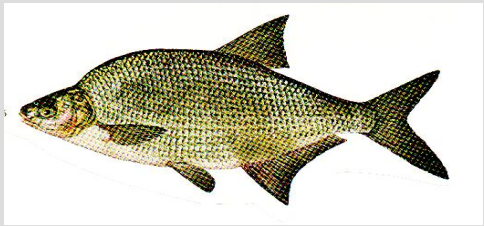


Work Package 4.1.5

Aquatic Biodiversity of the Tarim Ecosystem applied by Fish Diversity and Macro Invertebrates related to Ecosystem Function (ESF) and Ecosystem Services (ESS)

Dr. Benno Kügel & Prof. Dr. Bernd Cyffka, Catholic University of Eichstaett / Ingolstadt, Germany





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Questions

1. Fish fauna in Tarim River - species and abundance today and in the past ?
   Which species were used by fisher men? Who lived of the fish?

2. MIV-communities in Tarim River – species and abundance?
   How can MIV survive in a sandy-muddy river? What are the MIV-habitats?

3. What are the pressures and impacts for fish and miv communities?
   How does water quality (salinity, pesticides) and degraded hydromorphology (dams, reservoirs, missing alluvial forest) affect fish and MIV?

4. Ecological Concept of Tarim River from the aquatic point of view ?

Conducted work

Cooperation with Tarim University, Alar

1. Selecting chemical and biological sampling sites

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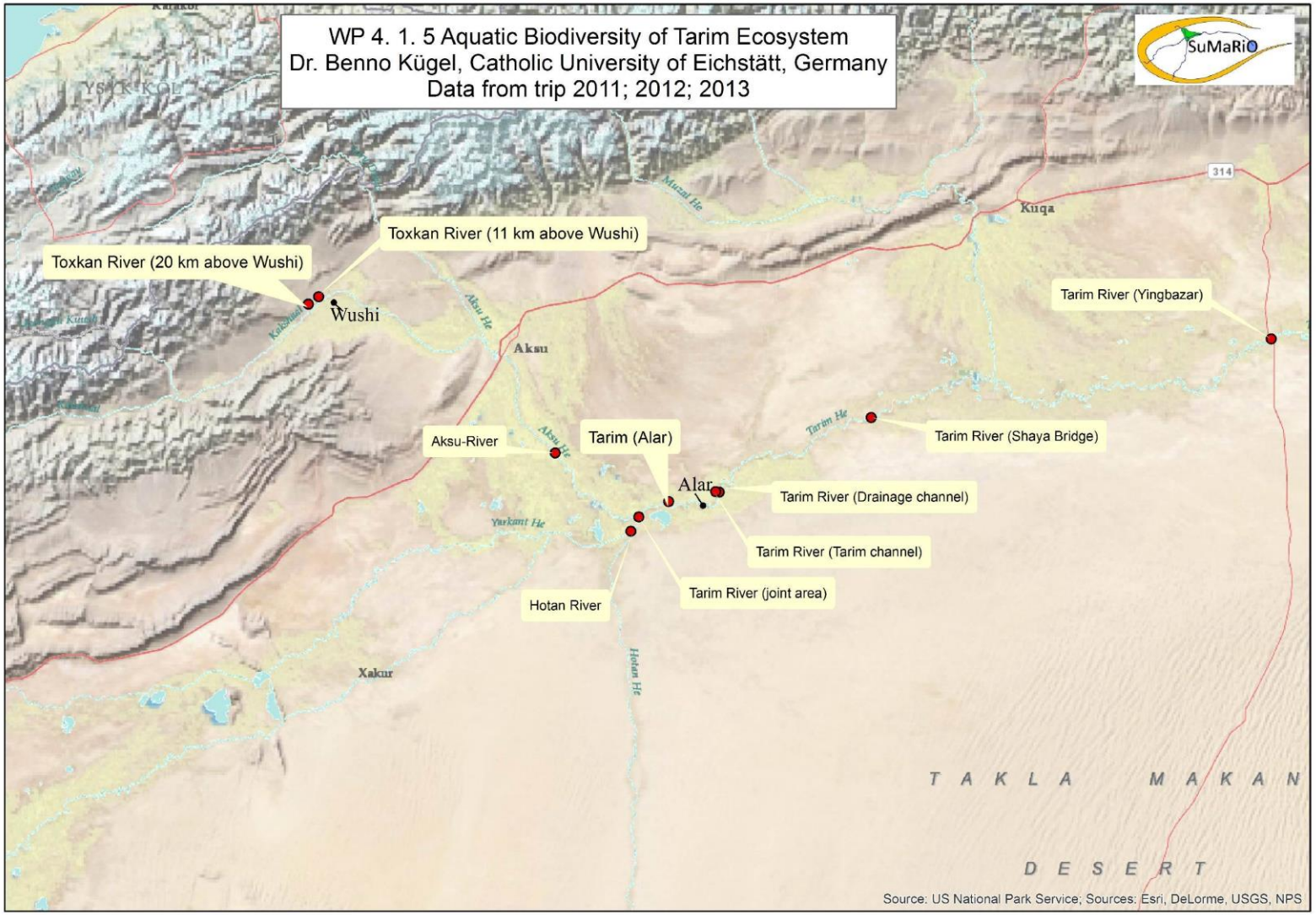

Conducted work

Cooperation with Tarim University, Alar

1. Selecting chemical and biological sampling sites

2. Recording physiographical data of each sampling site

WP 4.1.5 Aquatic Biodiversity of Tarim Ecosystem
Dr. Benno Kügel
CU Eichstätt

Physiography 1

River	TARIM Alar No 9		
Sampling site	10 km above Alar		
Easting		Date, Time	Sun 03.06.2012
Northing		Processor	Dr.Benno Kügel

Meteorological data

Before sampling	precipitation		no precipitation		dry period		
During sampling	precipitation		heat		frost		
	snow melt in progress	x					

Hydrological Data

Discharge	very low		low		medium	x	high	x	
Discharge [m³ / s]	approx. 2 0 0 0				measured		estimated	x	
Water level [cm]	1 to 3								
Velocity	very fast (>1m/s)	x	fast (1- 0,3 m/s)	x	slow (< 0,3 m/s)				
	stationary								
Flow Diversity	high		medium		low		none		
Lenitic areas	< 10%	x	10 - 25%		25 - 50%		50 - 75%		> 75%

Shade/vegetation

Shade	sunny	x	semi-shade		shady				
Riparian vegetation	trees		species:	Tamarix					
				High ground water level ! approx. 20 cm difference dry & wet					
	bushes		species:	Tamarix in flood plain					
	reed		species:	Carex + Juncus in flood plain					
	shrubs		species:						
	gras		species:				none		
Special elements	bay		dead tree		roots	x	overgrowing vegetation	x	

Substrate

Mineral Substrates	[5%steps]	Organic substrates	[5%steps]
Lithal (6- 20 cm)		Debris (organic sediment)	1 0
Gravel (2-6 cm)		Dead Wood	1 0
Sand (6 µm- 2 cm)	3 0	Roots	1 0
Silt (< 6 µm)	4 0	Phytobenthos	
		Submerged Macrophytes	

Species of submerged Macrophytes:

Physiography 2

River	TARIM Alar No 9	Date	Sun 03.06.2012
Sampling site			

Sediment texture

Riverbed	non- solid		solid		muddy	x	
Pelalart	saprobel						
Periphyton	green algae		diatoms		cyanobacteria		sulphurbacteria	
Pollution	none	x	waste		sewage		others	

Water features

Turbidity	clear		turbid		very turbid	x		
	naturaly	x	polluted					
Colour					Ground visibly	yes		no x
Smell	none		muddy	x	musty		sewage	

Impairments on aquatic communities

none		no water		mudd	x	toxic impacts	
flood		snow melt		dams	x		
others							

Chemical/ physical data

Temperature °C	1 9 , 2	pH	8 , 1 6
Oxygen O2- Sat [%]	8 9 , 5	Conductivity [µS/cm]	6 7 3
Oxygen O2 [mg/l]	7 , 2 9		
water sample	x Salinity 0.38 g/l	Photo documentation	x

Comments to Physiography

high ground water level in flood plane 20cm differ between wet and dry

water bed moved within flood plain

Aquatic life

Fish species: fish alrvae 4

MIV species: Mysidae 4

Gomphus 2 Chironomidae red 6 Baetis 2

Comments to Biology

Conducted work

Cooperation with Tarim University, Alar

1. Determination of chemical and biological sampling sites

2. Recording physiographical data of each sampling site

3. Measurements of physico-chemical parameters at various flow
   (temperature, pH, conductivity, oxygen, secchi-depth, suspended material)

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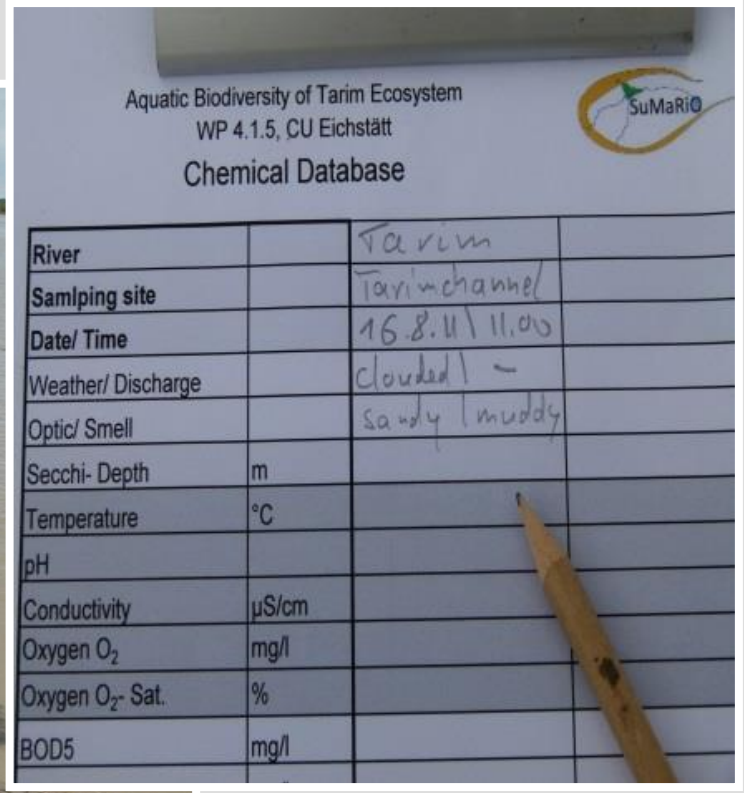

Aquatic Biodiversity of Tarim Ecosystem
WP 4.1.5, CU Eichstätt

SuMaRiO

Chemical Database

River		Tarim
Samlping site		Tarimchannel
Date/ Time		16.8.11 | 11.00
Weather/ Discharge		clouded | -
Optic/ Smell		sandy | muddy
Secchi- Depth	m	
Temperature	°C	
pH		
Conductivity	µS/cm	
Oxygen O_2	mg/l	
Oxygen O_2- Sat.	%	
BOD5	mg/l	

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Conducted work

Cooperation with Tarim University, Alar

1. Determination of chemical and biological sampling sites

2. Recording physiographical data of each sampling site

3. Measurements of physico-chemical parameters at various flow
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4. Setting fish traps

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   (temperature, pH, conductivity, oxygen, secchi-depth, suspended material)

4. Setting fish traps

5. Sampling macro invertebrates by kick-sampling

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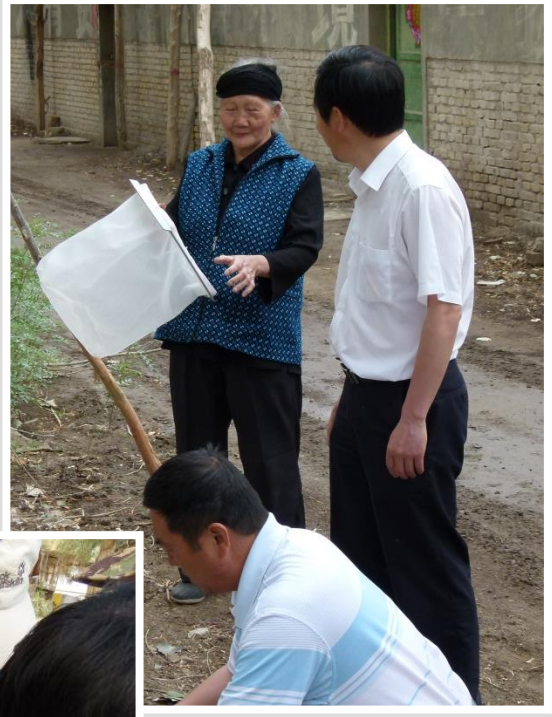

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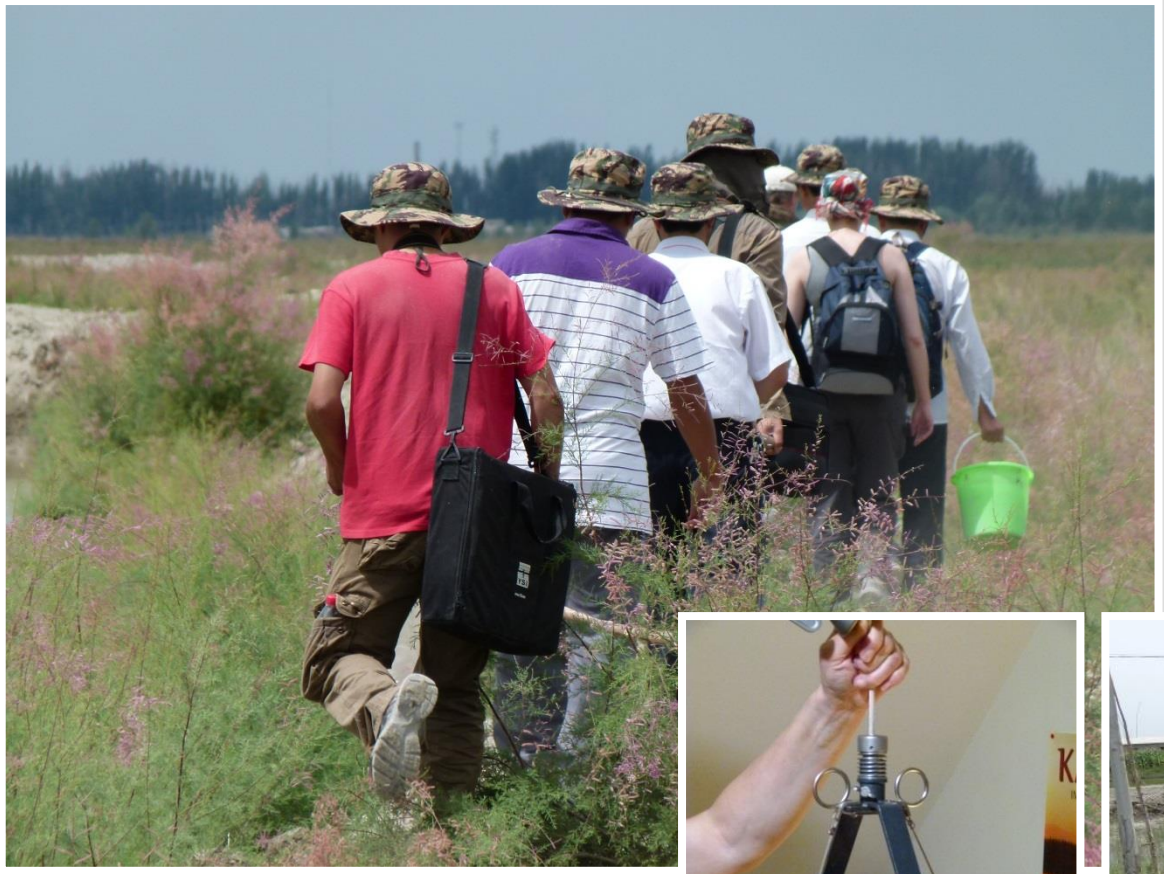

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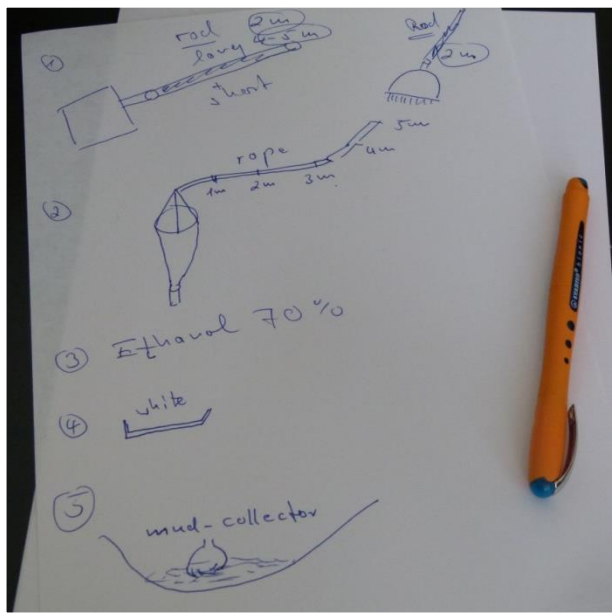

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During flooding: extremely high amount of suspended material, turbidity almost zero, sedimentation rate > 25 %

Sustainable Management of River Oases along the Tarim River (SuMaRiO)

Fish kill through pesticides

Sand and silt/mud with low density of MIV

Physiographical data

Aksu River (500 m below flood gate)	10.08.2011	31.05.2012	23.10,2013
Discharge	high (snow melt!)	medium / rising	Low to medium
Velocity	very fast (>1m/s)	very fast (>1m/s)	fast
Flow Diversity	high	medium	medium
Shade	sunny	sunny	sunny
Mineral Substrates	**70% sand** **30% silt**	**60% sand** **40% silt**	**60% sand** **40% silt**
Organic Substrates		50% debris 10% dead wood 10% roots	
Riverbed	solid	muddy	muddy
Turbidity	very turbid	very turbid	turbid
Colour	ocher	ocher	ocher
Smell	muddy	none	none
Impairments on Aquat. Communities	mud flood	mud dams	mud dams
Sedimentation rate [ml/l]	> 250	> 100	1
Secchi [cm]	<1	< 3	< 3

Biological data (Aksu River)

	Macroinvertebrates	Fish	Aquatic Macrophytes	Flora
10.August 2011		Triplophysa yarkandensis Triplophysa bombifrans	Potamogeton pectinatus Myrhiophyllum spicatum Polygonum sp.	Typha angustifolia Tamarix sp. Scirpus yagara Pragmites comm. Chara sp
31. May 2012	Baetis 5 Chironomidae red 2	T. yarkandensis T. Bombifrans Carps		Thypha angustifolia Tamarix spec Scirpus yagara Phragmites comm.

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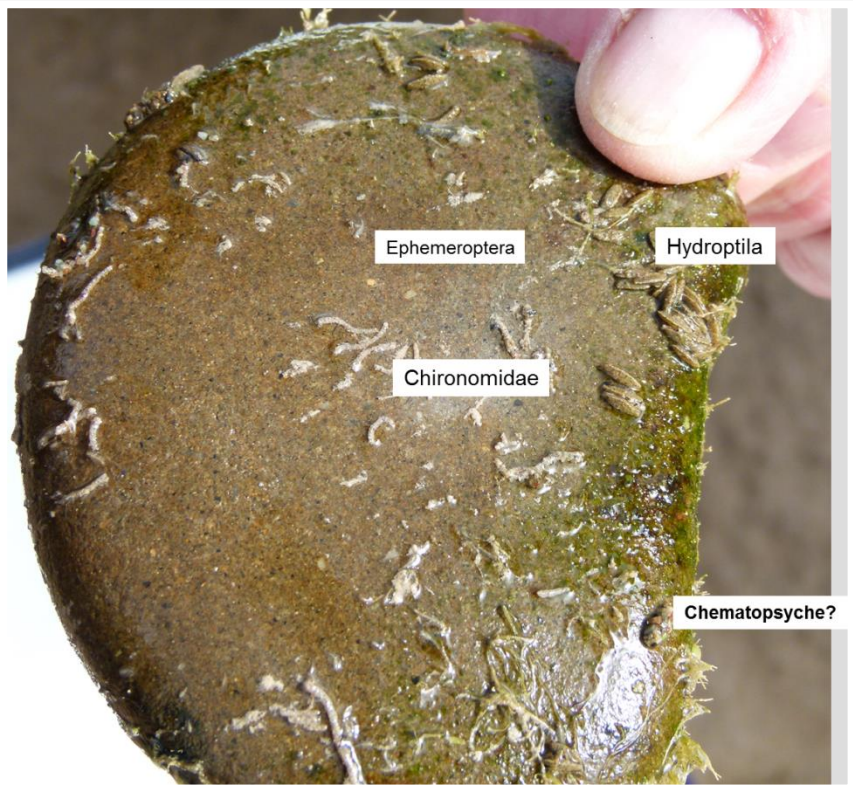

Gravel stones offer habitat to settle on the stones and in the interstitial space.

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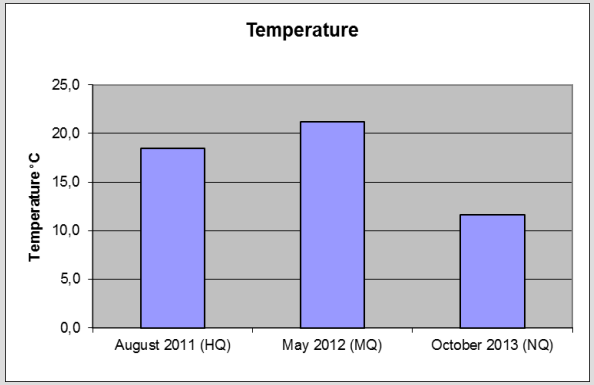
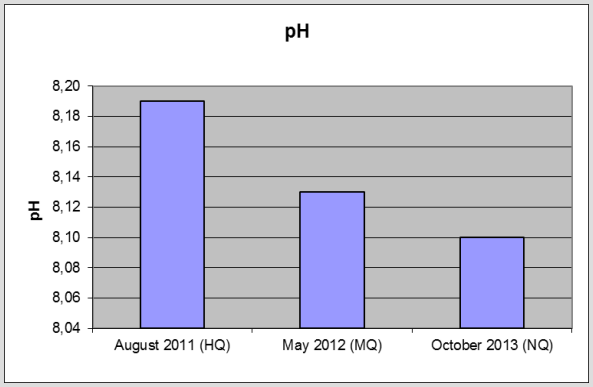
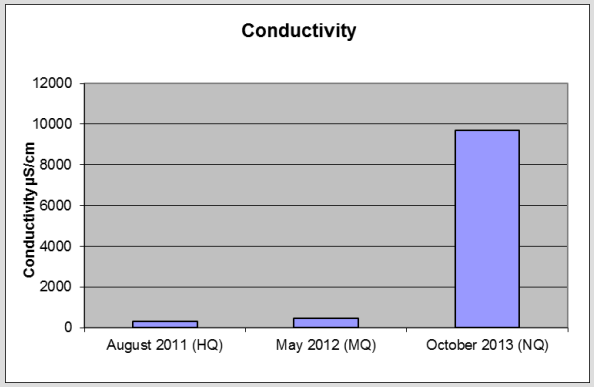
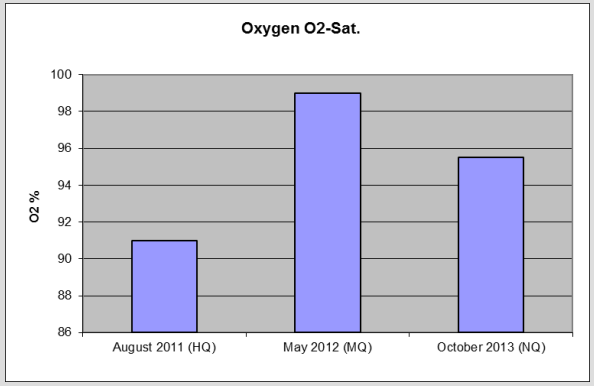
Chemical data (Aksu River)

Parameter	10.08.2011	31.05.2012	23.10.2013
Temperature [°C]	18.5	21.2	11.6
pH	8.19	8.13	8.1
Conductivity [µS/cm]	309	452	**9700**
Oxygen O2 [mg/l]	8	9.7	9.2
Oxygen O2- Sat. [%]	91	99	95.5









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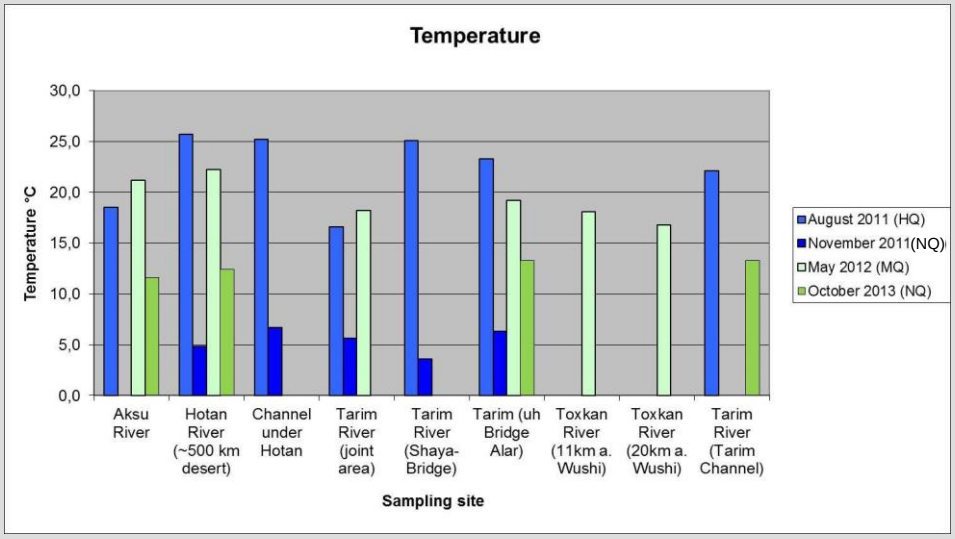

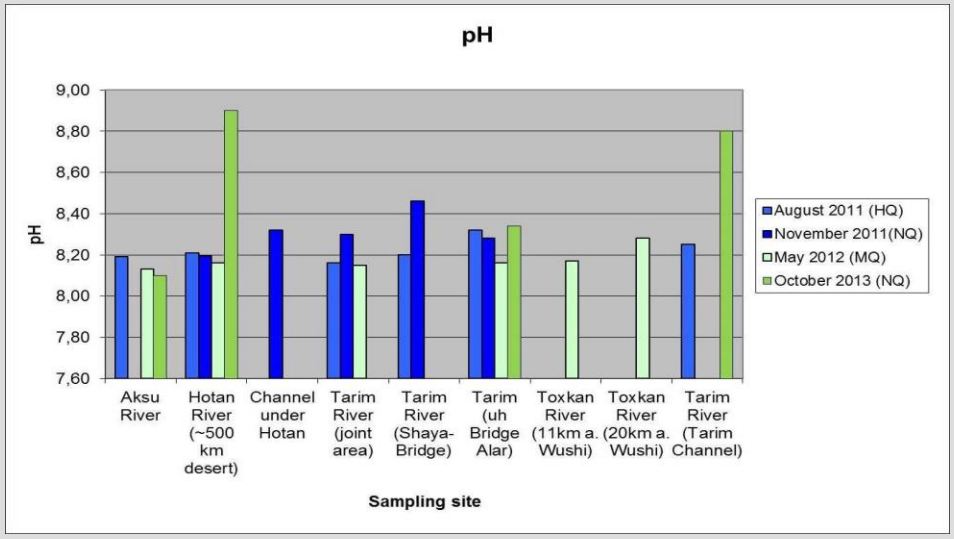

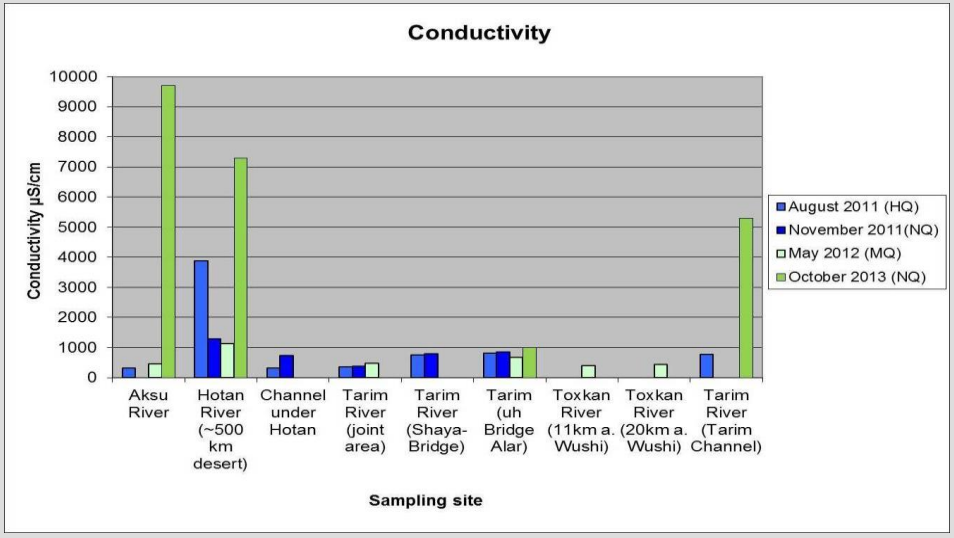

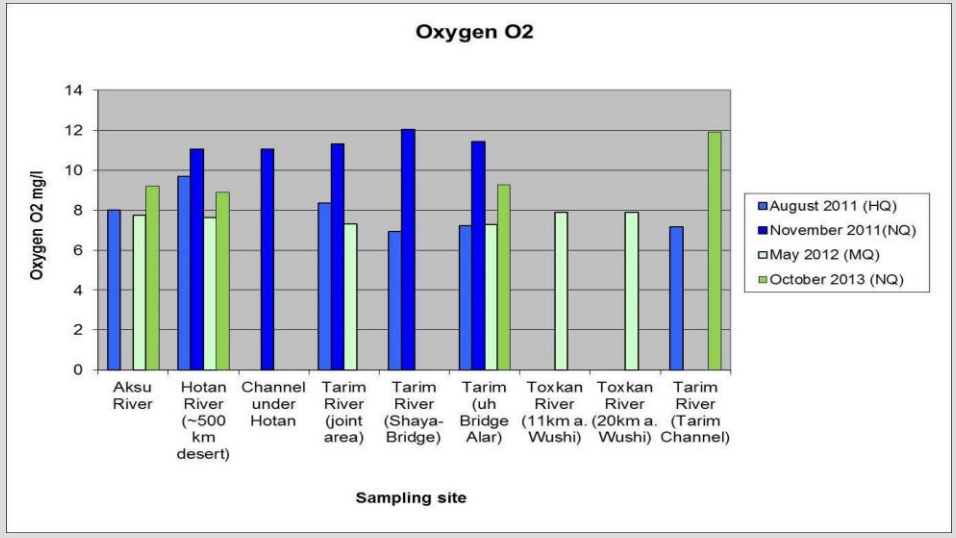

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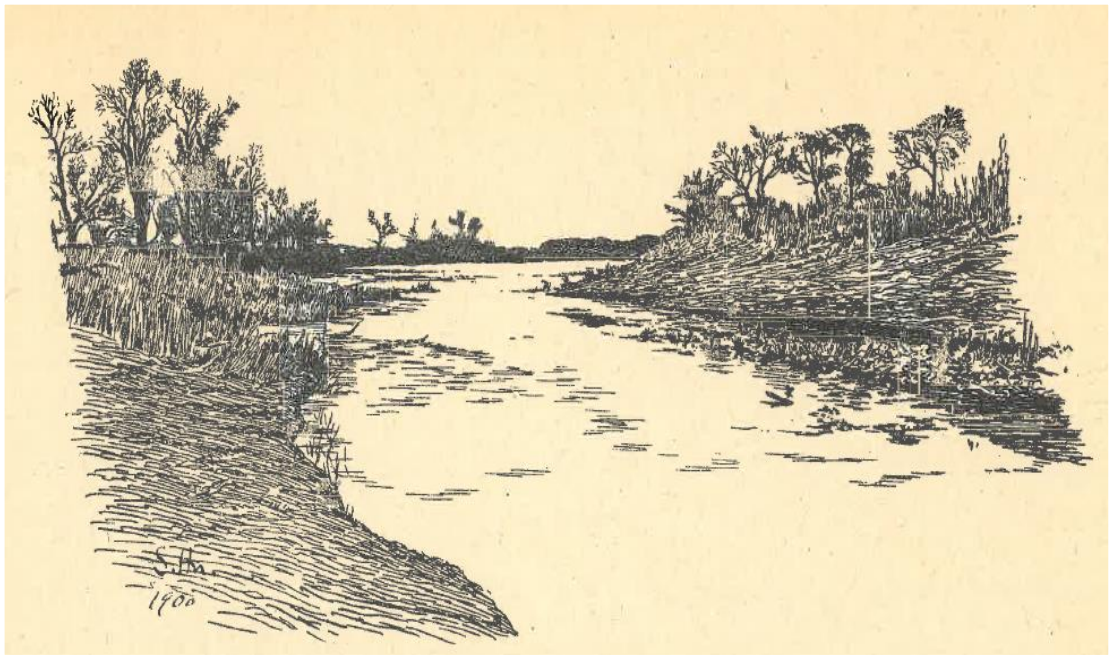

Recent reference site with alluvial forest similar to historical drawings from 1900 (Sven Hedin)

- Input of wood, leaves and adult insects as a food supply for fish
- Land-water-connection which supplies habitat for adult MIV to pass the whole life cycle

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General results of aquatic investigations in Tarim river

for macro invertebrates and fish

1. **Low aquatic biodiversity and low richness of species**

2. **Small individual abundance and little biomass**

General speaking: **Little aquatic life in Tarim River !!**

Concept of Tarim River Disturbances

1. The missing alluvial forest allows no supply with dead wood, leaves and POM

2. Due to the misssing alluvial forest there is no input of adult insects to the river, which are an essential food supply for fish

3. The lack of dead wood (and may of gravel) offers no substrate and no habitat for MIV and fish: no shelter, no spawning habitat, food shortage

4. The dominance of sand and silt is hostile for aquatic organisms through sandblisting and missing interstitial space. Erosion from logging is detoriating this effect (may be covering gravel stones)

5. Dams from reservoirs are blocking the transport of gravel and drift wood

6. Dams from reservoirs interrupt river contiunuum and migration of aquatic animals

7. Toxic substances and increasing salinity put stress on aquatic communities

Thank you for your attention! 衷心感谢！

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