Characterization and conservation of carp genetic resources

Planned joint R&D activities between Hungary and Vietnam

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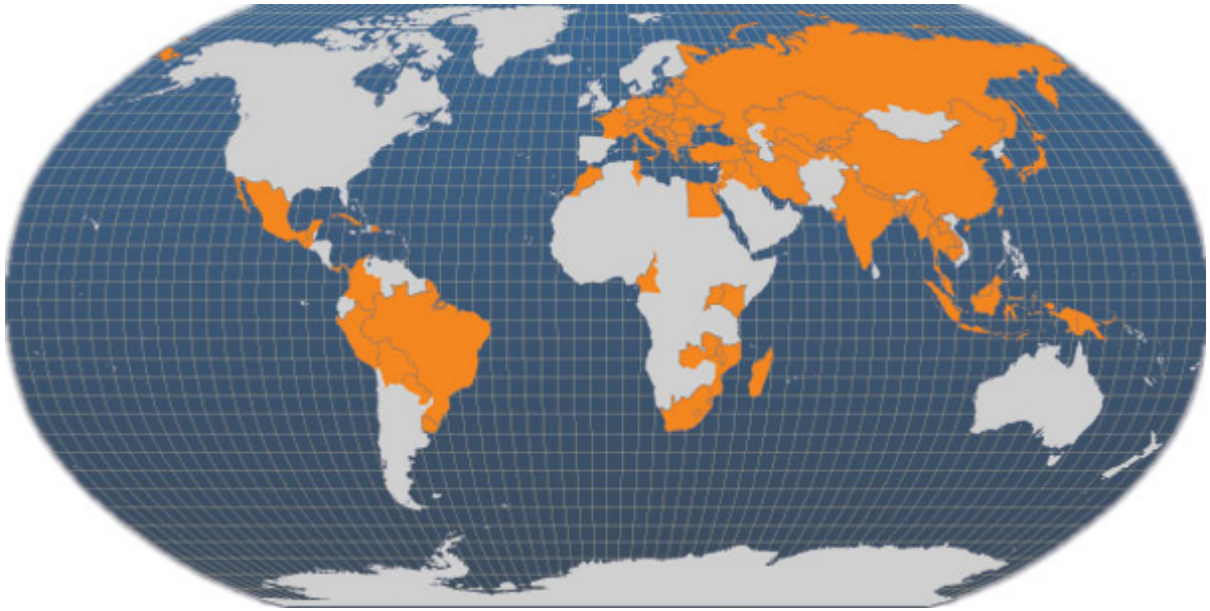
5th Vietnamese-Hungarian Conference on Small Animal Breeding and Aquaculture
Cantho, Vietnam, August 13-14, 2007

Content of the lecture

- Why common carp is important?
- Common carp in the World, Asia, Europe and Central-Eastern Europe
- Common carp gene banks
- Common carp gene bank in HAKI, Szarvas, Hungary
- Plan for cooperation on carp genetic resources

Common carp production around the world

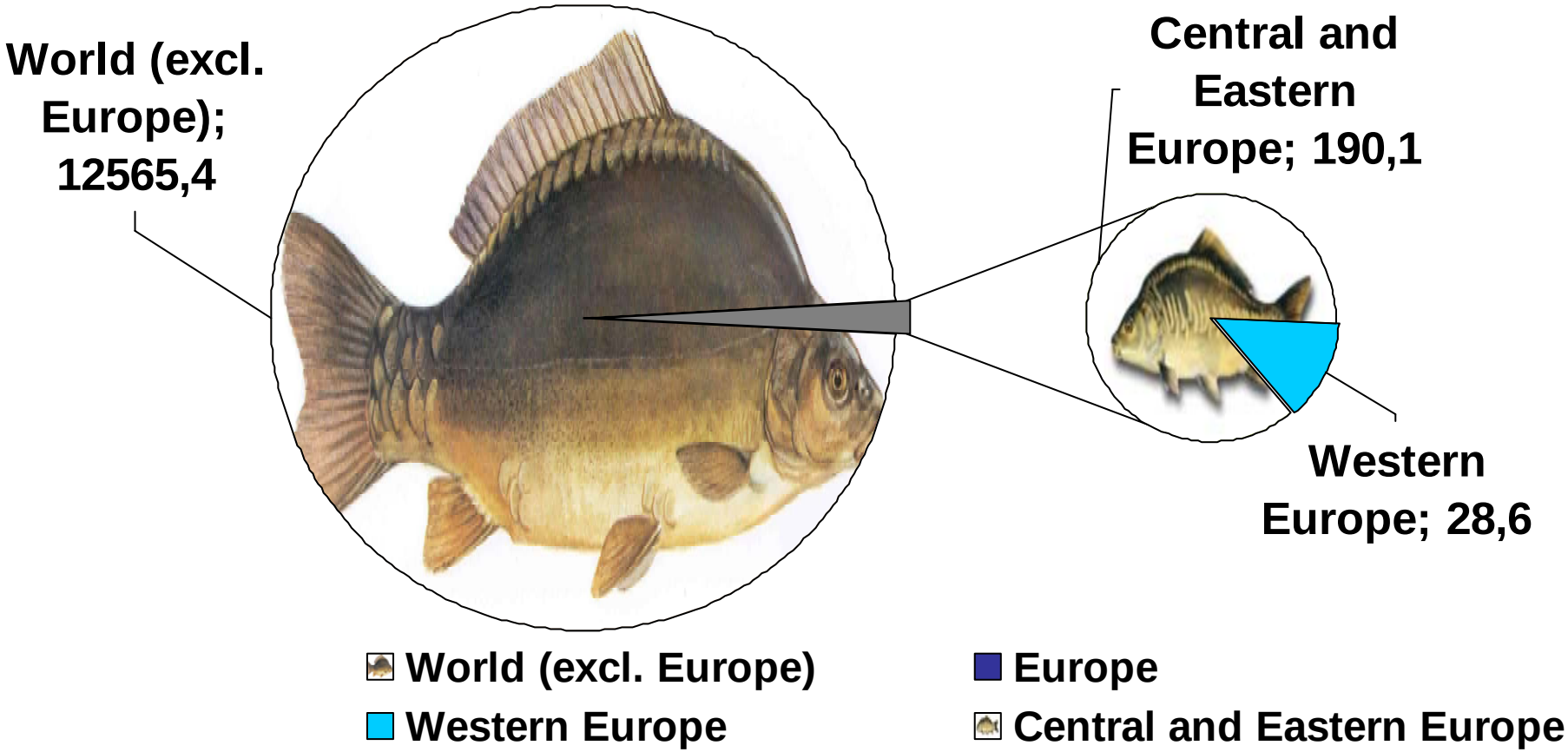


CULTURE OF CARPS – 2004

(1000 tons)

World total: 12,784
Common carp: 3,388

Europe total: 219
Common carp: 147



Szűcs et al, 2005

3,4 million MT of common carp = 13% of global freshwater fish production

Common carp production increased by an average global rate of:

9.5% during 1985-2004

10.4% during 1993-2004

Asia is the main producer

China claims 70% of world production

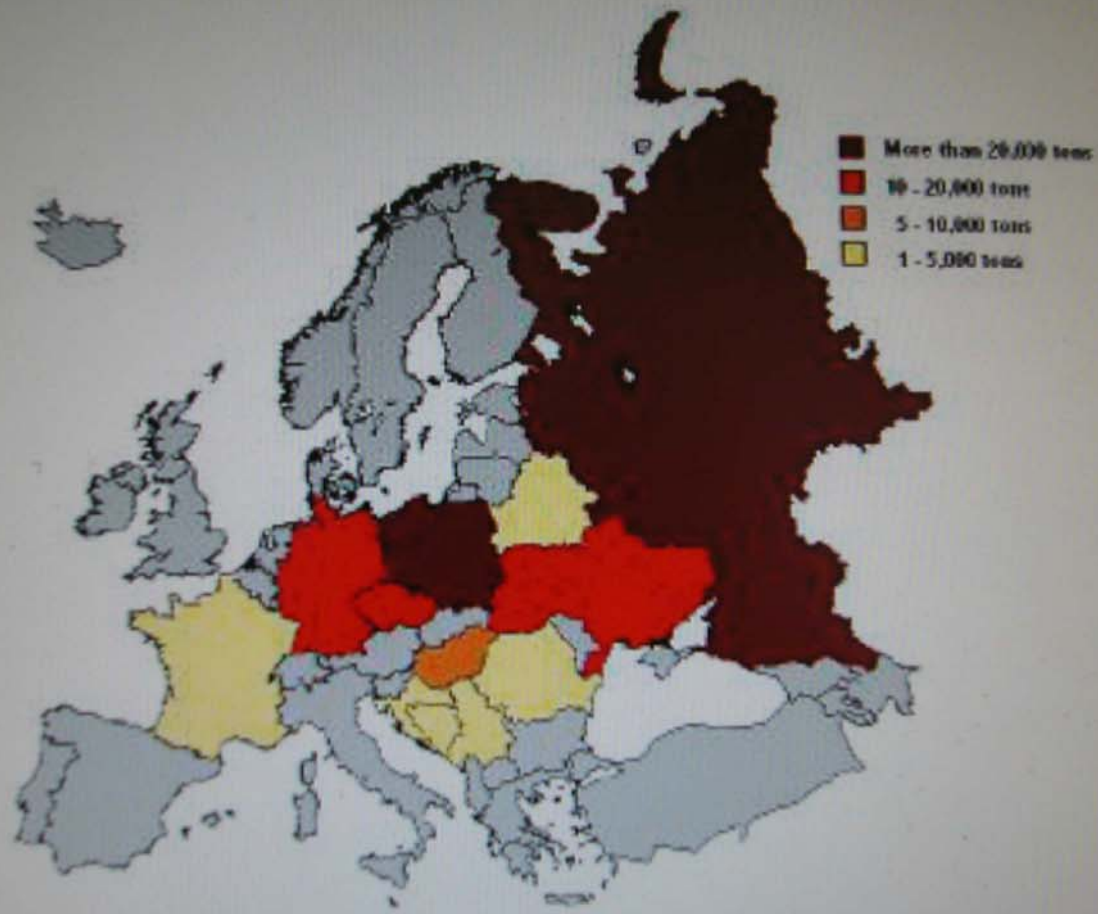
Importance of carp in Europe

- food
- recreational fisheries
- ornamental fish
- water quality- and weed control

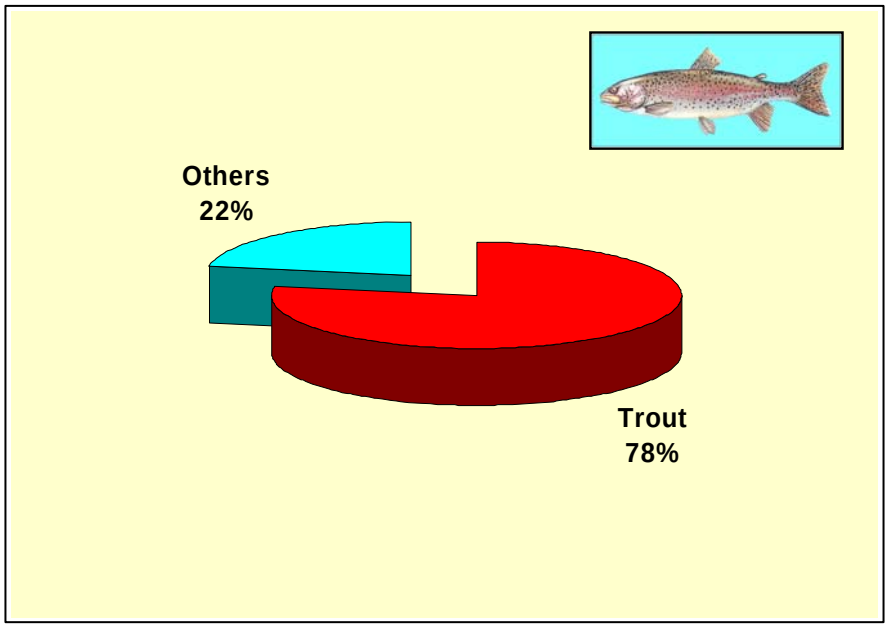
Main achievements in carp culture in Europe

- artificial propagation (Woynarovich)
- hatchery and pond rearing technologies
- breeding and gene banking

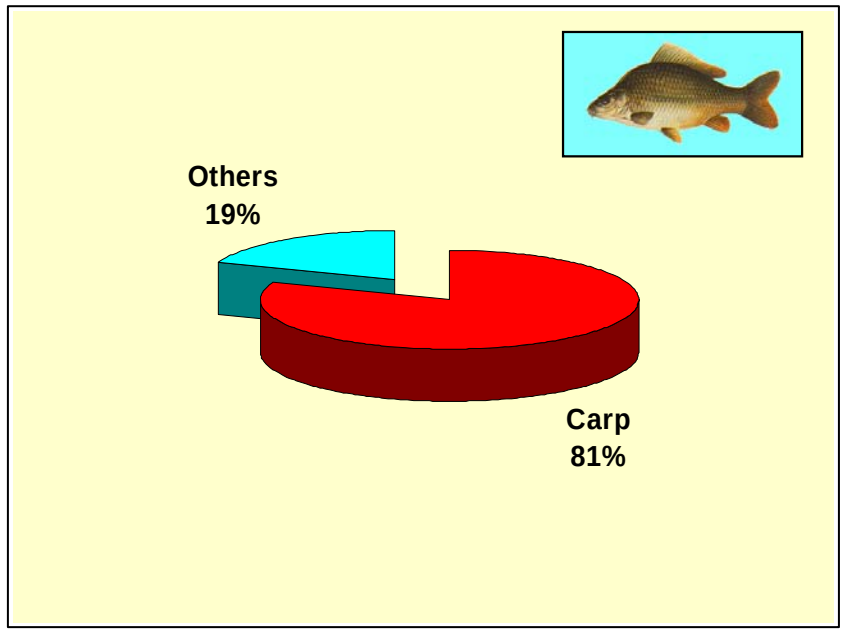
Common carp producing countries in Europe



Main species in freshwater aquaculture in Europe, 2003



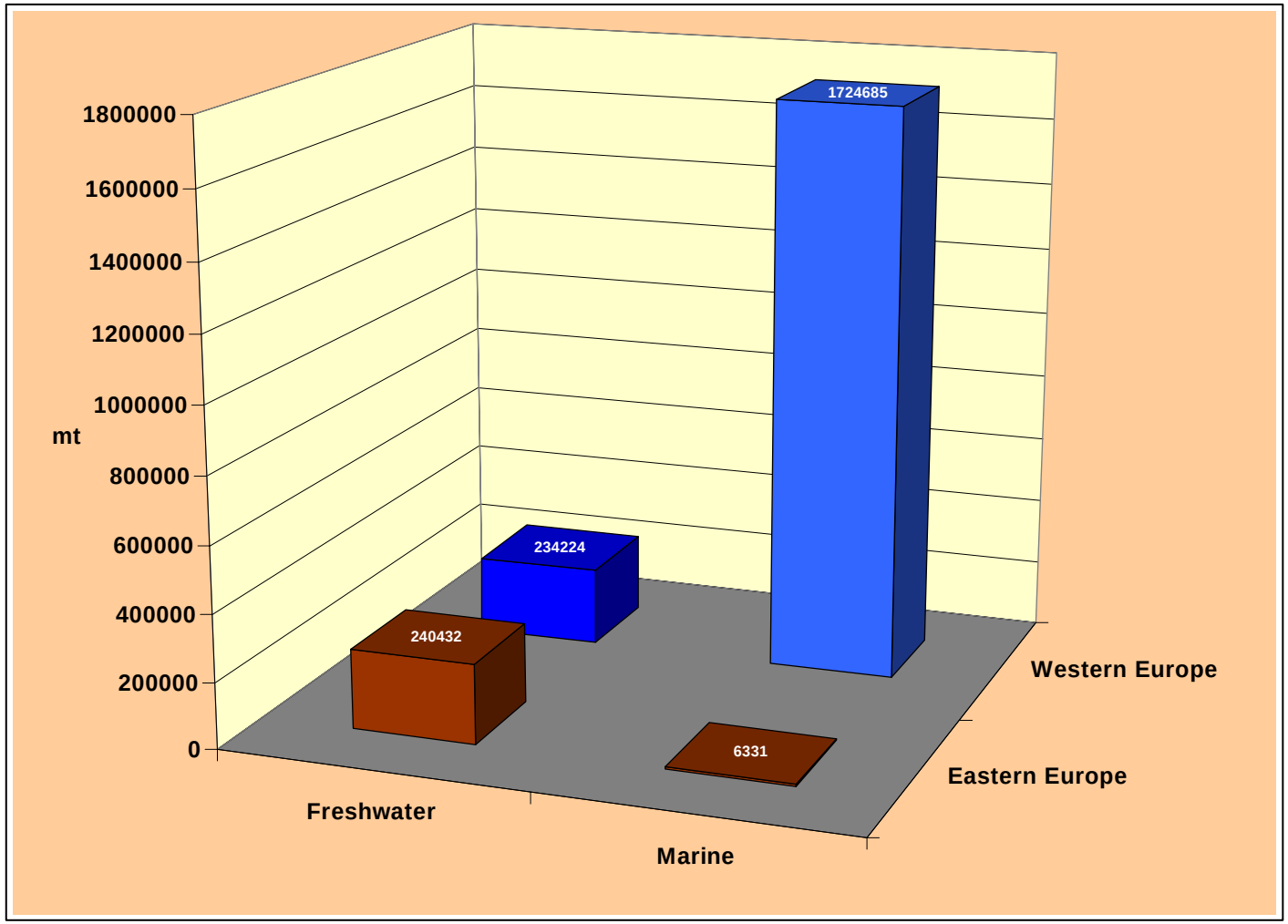
Western Europe



Central and Eastern Europe

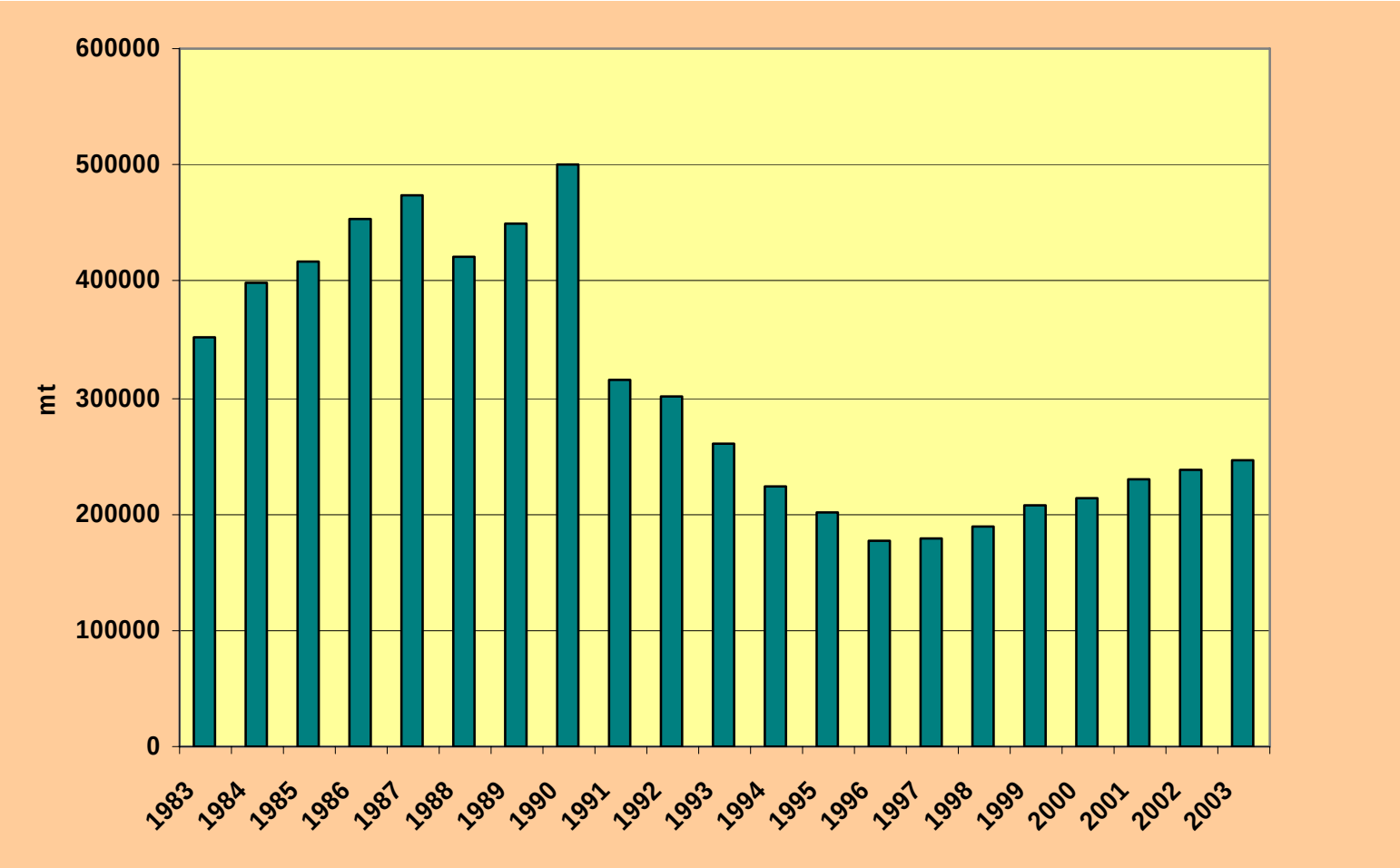
Source: Fishstat Plus, 2005

Marine and freshwater aquaculture production in Europe, 2003



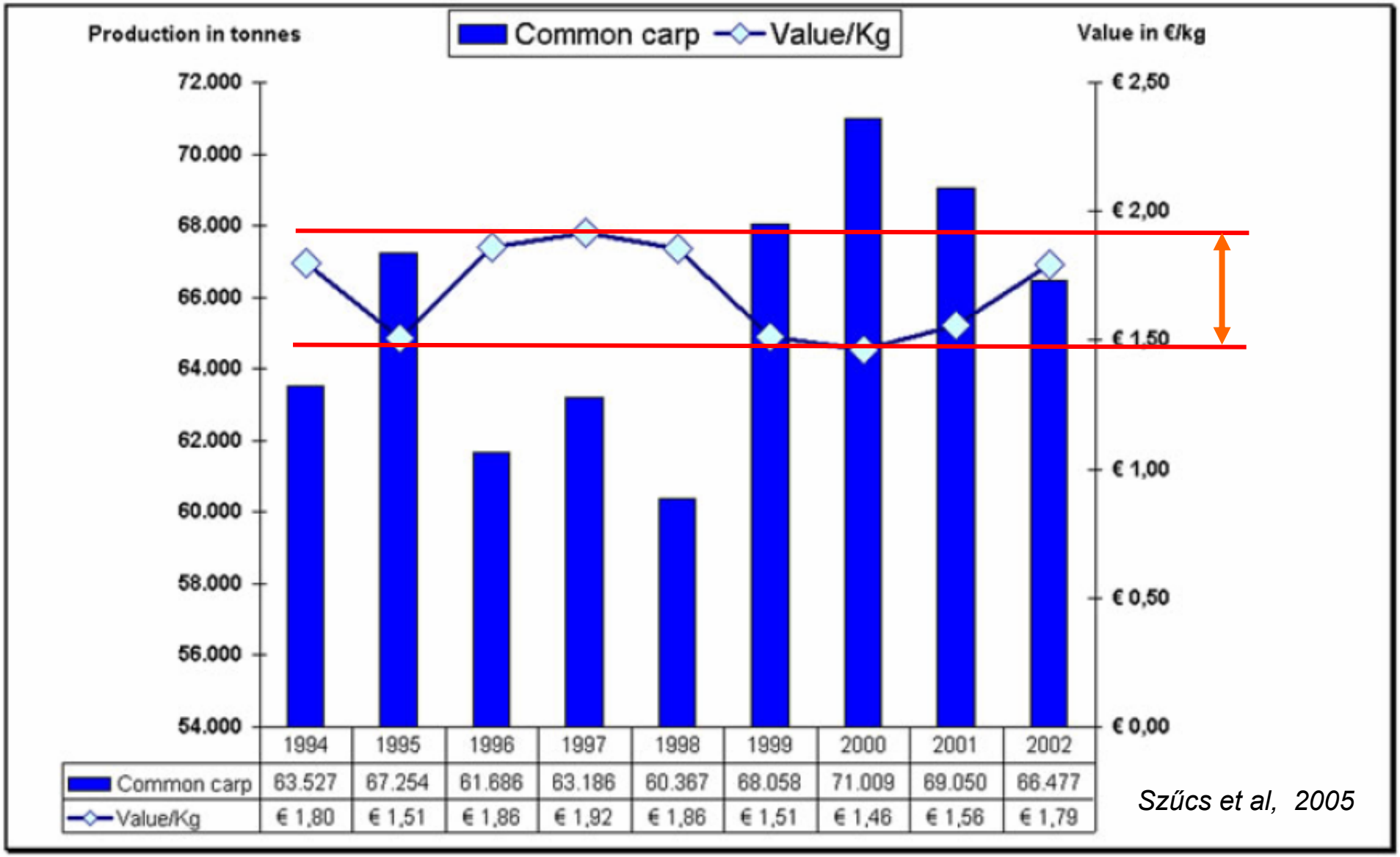
Source: Fishstat Plus, 2005

Aquaculture production in Eastern Europe 1983-2003



Source: Fishstat Plus, 2005

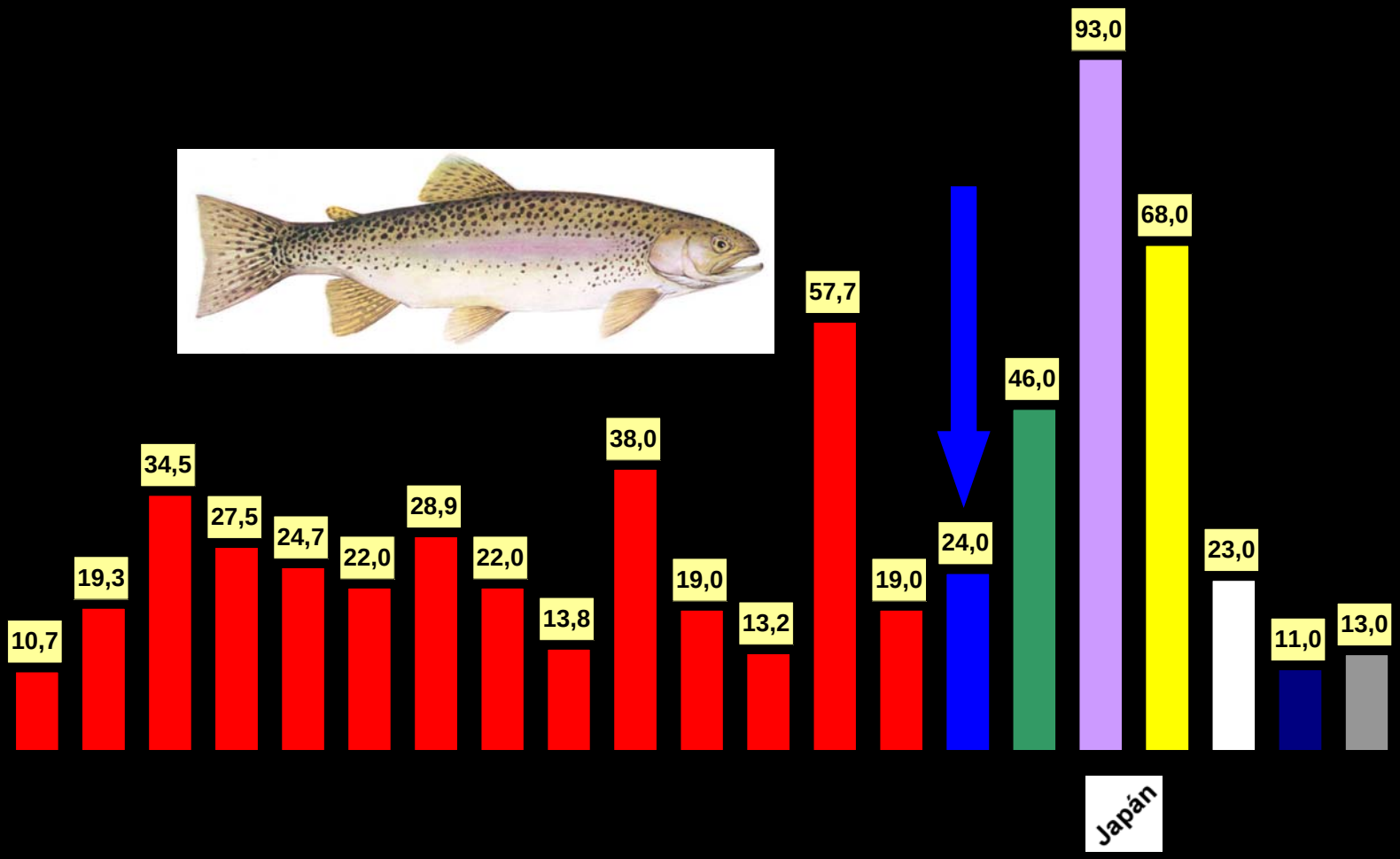
EVOLUTION OF COMMON CARP PRODUCTION IN THE EU15



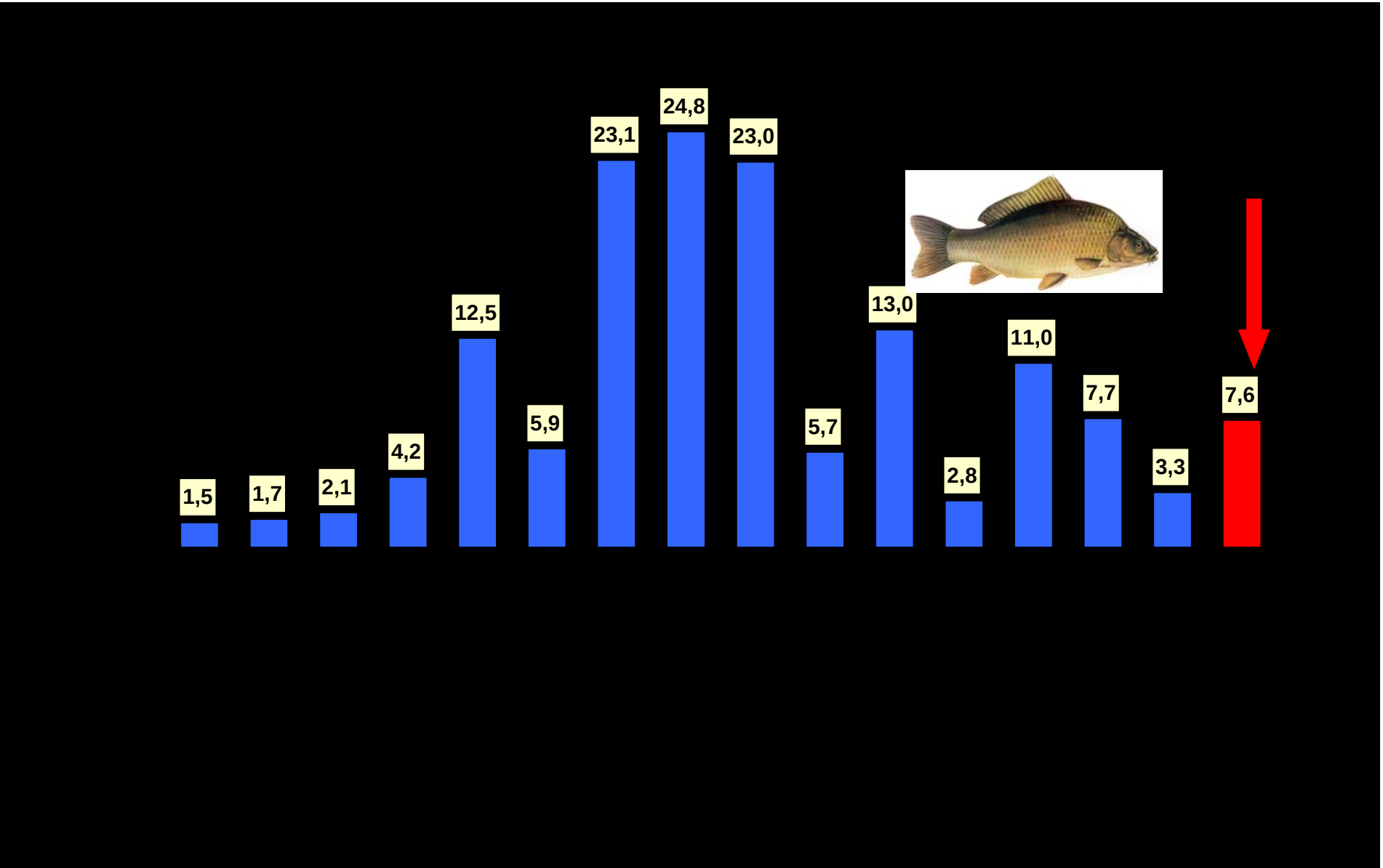
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Common carp	63.527	67.254	61.686	63.186	60.367	68.058	71.009	69.050	66.477
Value/Kg	€ 1,80	€ 1,51	€ 1,86	€ 1,92	€ 1,86	€ 1,51	€ 1,46	€ 1,56	€ 1,79

Szűcs et al, 2005

THE ANNUAL CONSUMPTION OF FISH AND FISHERY PRODUCTS IN THE EU (AVERAGE OF 3 YEARS)



THE ANNUAL CONSUMPTION OF FISH AND FISHERY PRODUCTS IN EASTERN EUROPE (AVERAGE OF 3 YEARS)



Major common carp gene banks in Europe

Dr. János Bakos
founder of live gene banking of common carp

Ponds for gene banking and breeding works at HAKI

Historical background

- Establisment of the live gene bank: 1962
- Original objectives:
  - maintaining, completing and preserving the strains of common carp;
  - production of hybrids with enhanced productivity
  - gene exchange

Hungarian and foreign carp strains

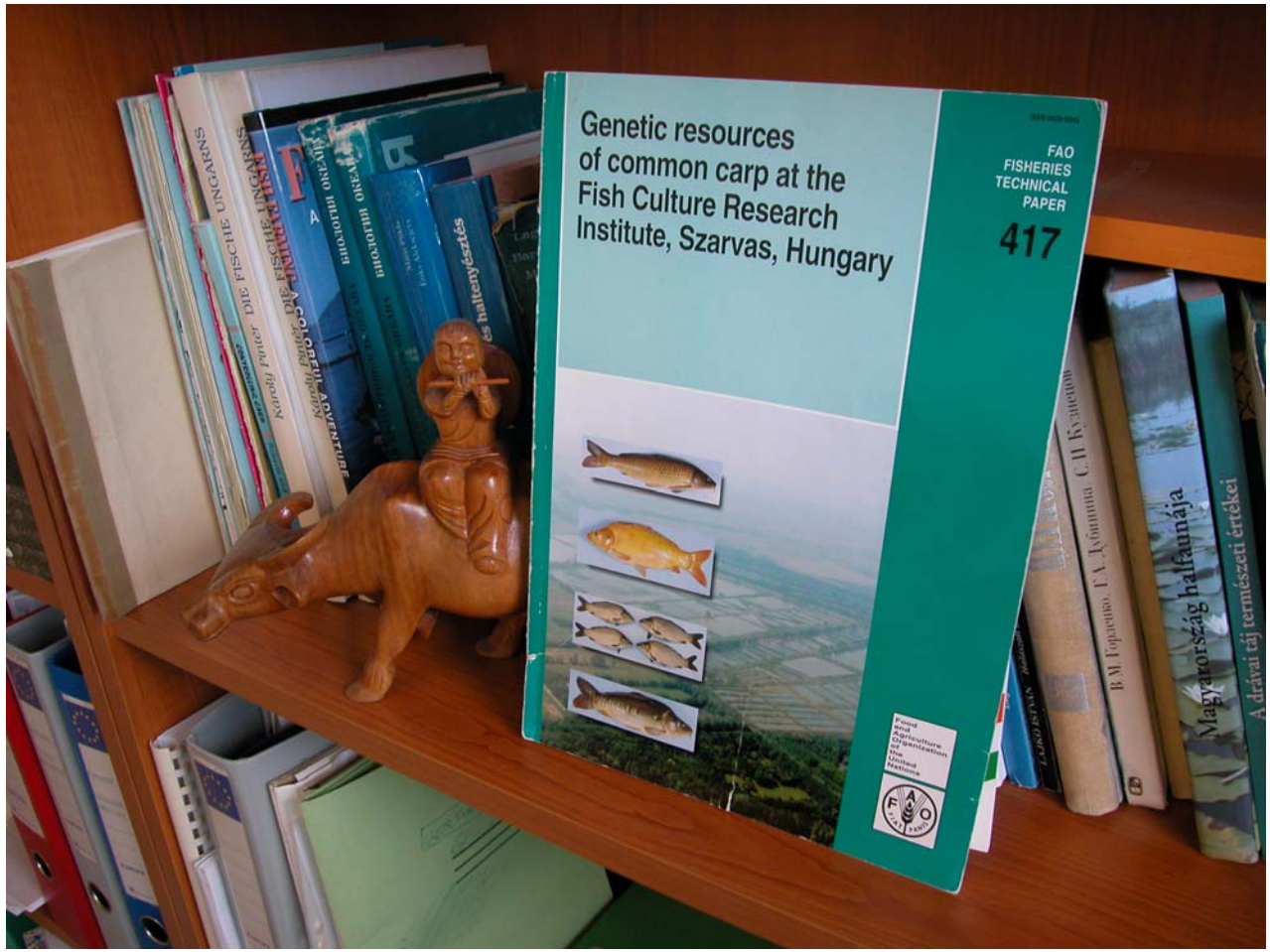
Hungarian strains

Bikal mirror carp
Dinnyés mirror carp
Felsősomogy mirror carp
Göd mirror carp
Hortobágy mirror carp
Nagyatád mirror carp
Palkonya mirror carp
Sumony mirror carp
Szarvas mirror carp
Szarvas red mirror carp
Szeged mirror carp
Tata scaly carp
Tisza wild

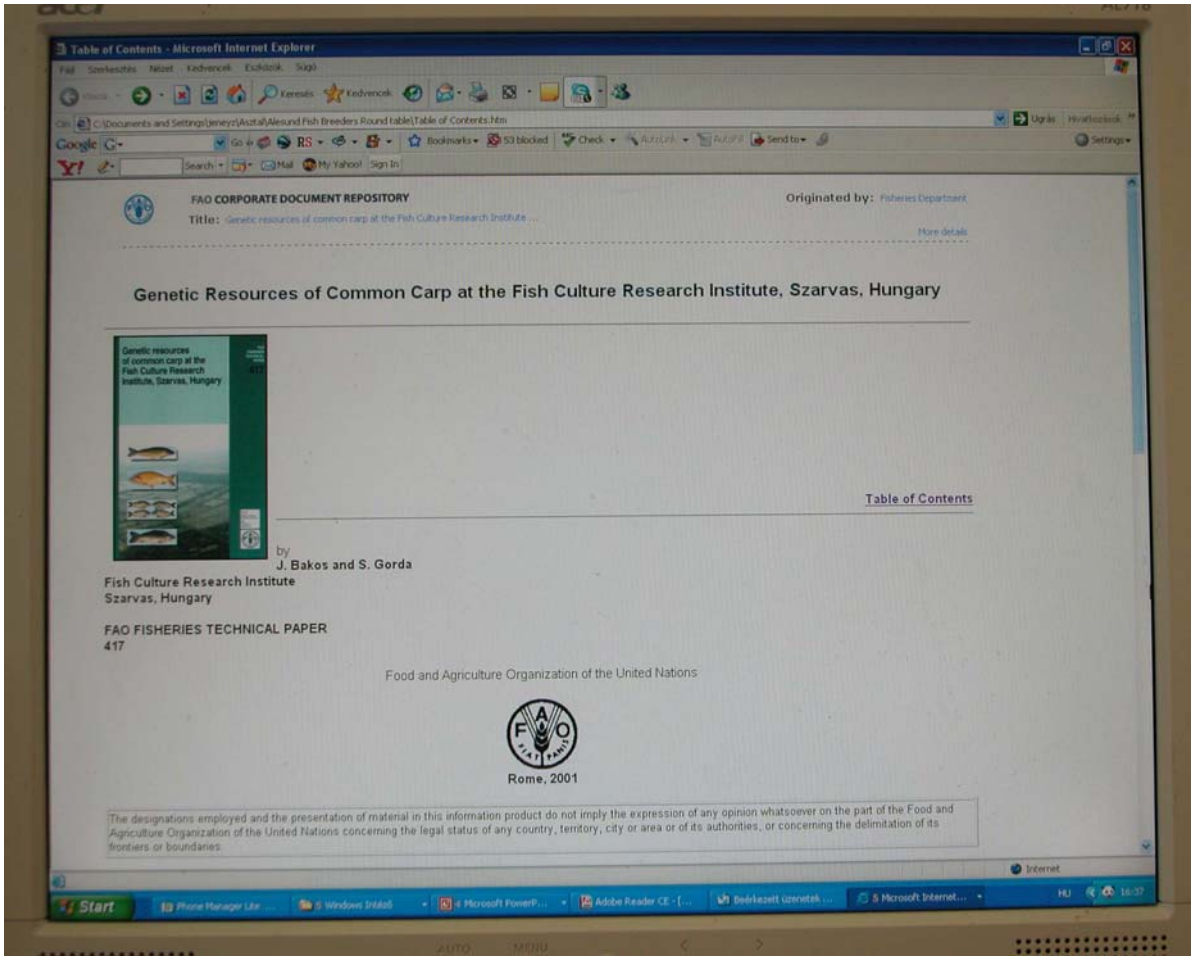
Szarvas 22 mirror carp
Szarvas P33 scaly carp
Szarvas P31 scaly carp
Szarvas P34 scaly carp
Szarvas 215 mirror carp

Foreign strains

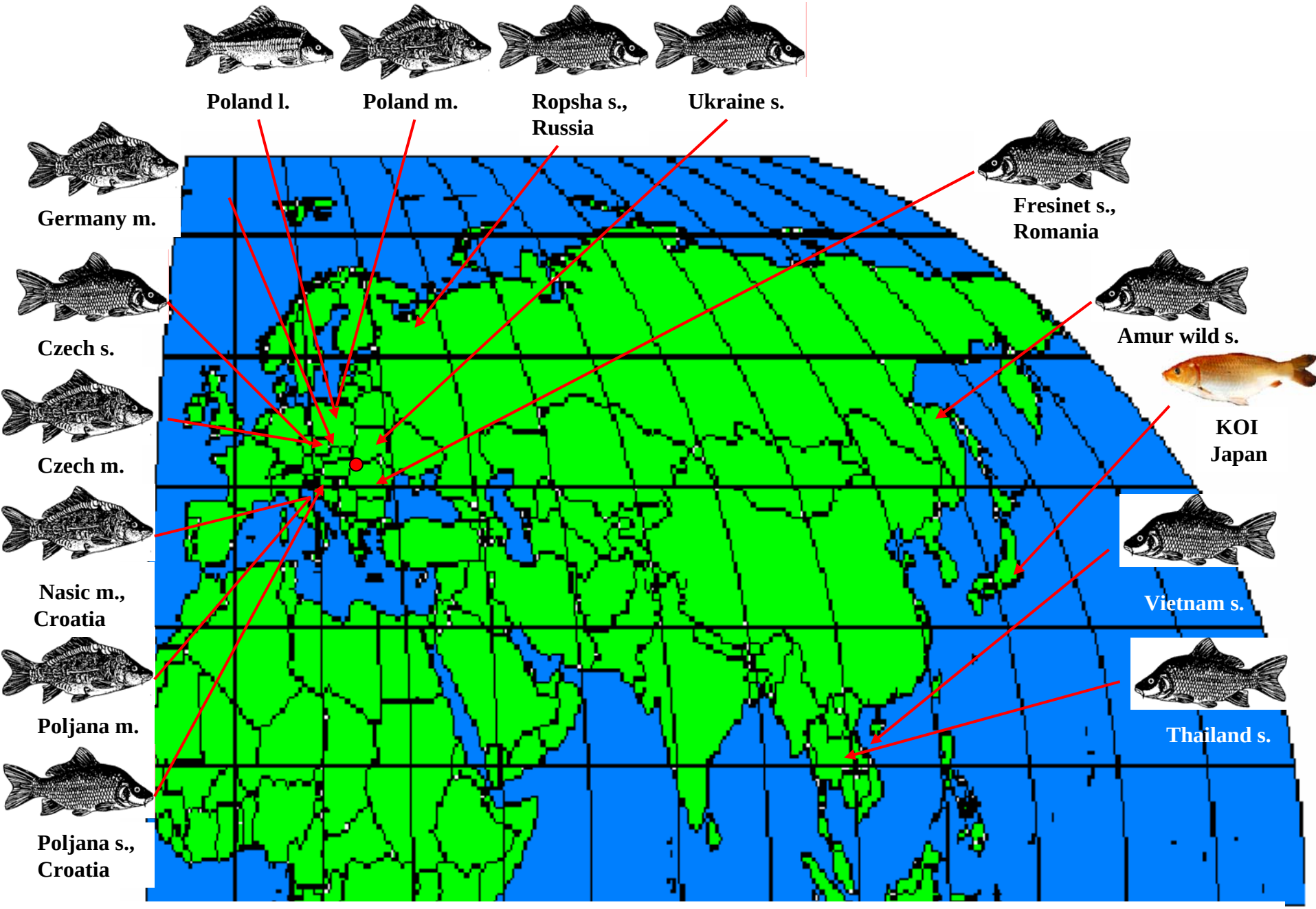
Amur wild carp
Czech scaly carp
Czech mirror carp
Fresinet scaly carp
German mirror carp
Nasic mirror carp
Polish linear carp
Polish mirror carp
Poljana scaly carp
Poljana mirror carp
Ropsha scaly carp
Ukrainian scaly carp
Vietnam scaly carp


Genetic resources
of common carp at the
Fish Culture Research
Institute, Szarvas, Hungary
FAO
FISHERIES
TECHNICAL
PAPER
417
DIE FISCHE UNGARNS
Magyarország halfaunája
A dráva táj természeti értékei

http://www.fao.org/DOCREP/005/Y2406E/Y2406E00.HTM



Hungarian races and strains of live common carp gene bank at HAKI, Szarvas



Foreign races and strains of live common carp gene bank at HAKI, Szarvas

Three high quality hybrids have been produced in HAKI using the strains in the live common carp gene bank

Lessons 1

- The breeding program of common carp was succesfull in Hungary and resulted in:
  - Live gene bank of common carp
  - Methodology of maintaining live genebanks
  - Three top productive hybrids for different conditions of fish farms and natural waters
  - National Breeding Program of carp

Lessons 3

- Close cooperation between stakeholders
  - National Association of Fish Producers (HOSz)
  - National Research Institute for Fisheries (HAKI)
  - National Institute for Agricultural Quality Control (OMMI)

Lessons 2

- National Breeding Program
  - Methodology of Progeny Performance Testing
  - Methodology of licencing and controlling fish farms and hatcheries
  - Methodology of fish seed distribution

Objectives of live gene bank today

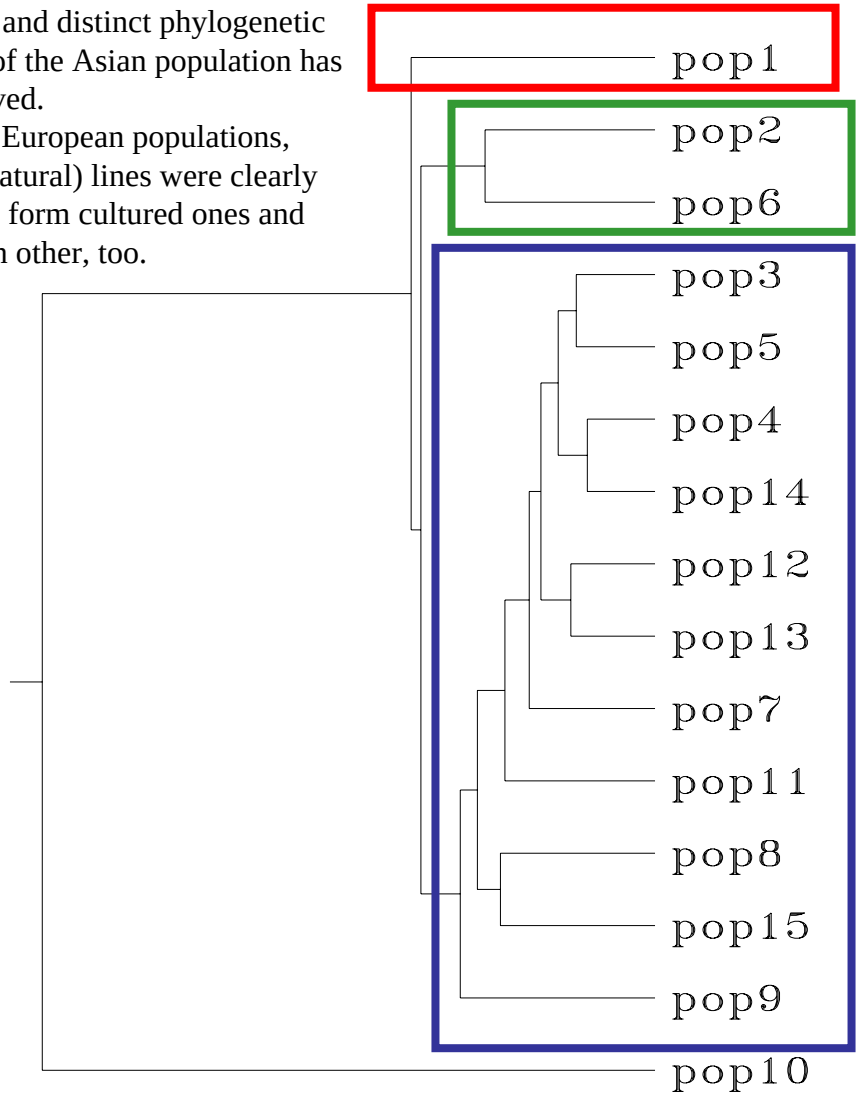
1. gene bank is maintained;
2. gene bank is studied;
3. gene fond is used for rehabilitation purposes;
4. strains are used for gene exchange.

1. Gene bank is maintained

- Live gene bank;
- Cryopreserved gene bank;
- Tissue collection;
- Experimental crosses;
- Data bank: progeny performance tests, experimental data on stress and disease resistance, immunological potential, infection studies, etc.

2. Gene bank is studied:
Relationships of carp lines using microsatellite markers

- A basal and distinct phylogenetic position of the Asian population has been proved.
- Among European populations, “wild” (natural) lines were clearly separated form cultured ones and from each other, too.



Amur scaly (Asian wild line)

Danube scaly (European
Tisza scaly wild lines)

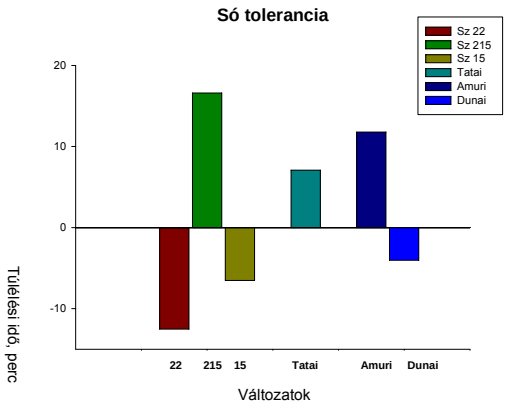
cultured carp lines kept in gene bank

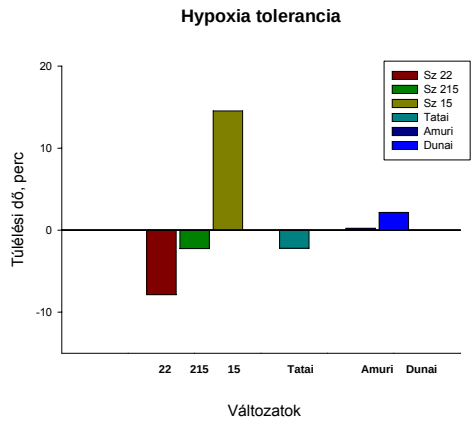
- The cultured lines in Hungary showed closer genetic relationship to each other according their known breeding history.
- Inbreeding effects at a certain extent could be observed as a result

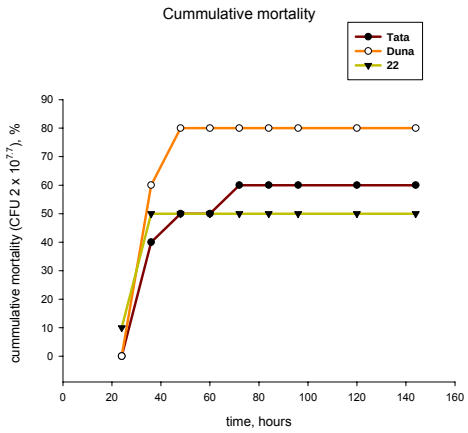
of the loss of heterozygosity.

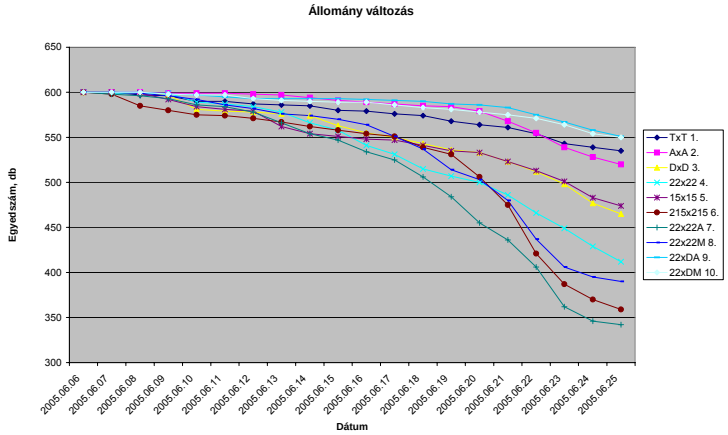
koi ← outgroup

2. Gene bank is studied: Disease and stress resistance studies

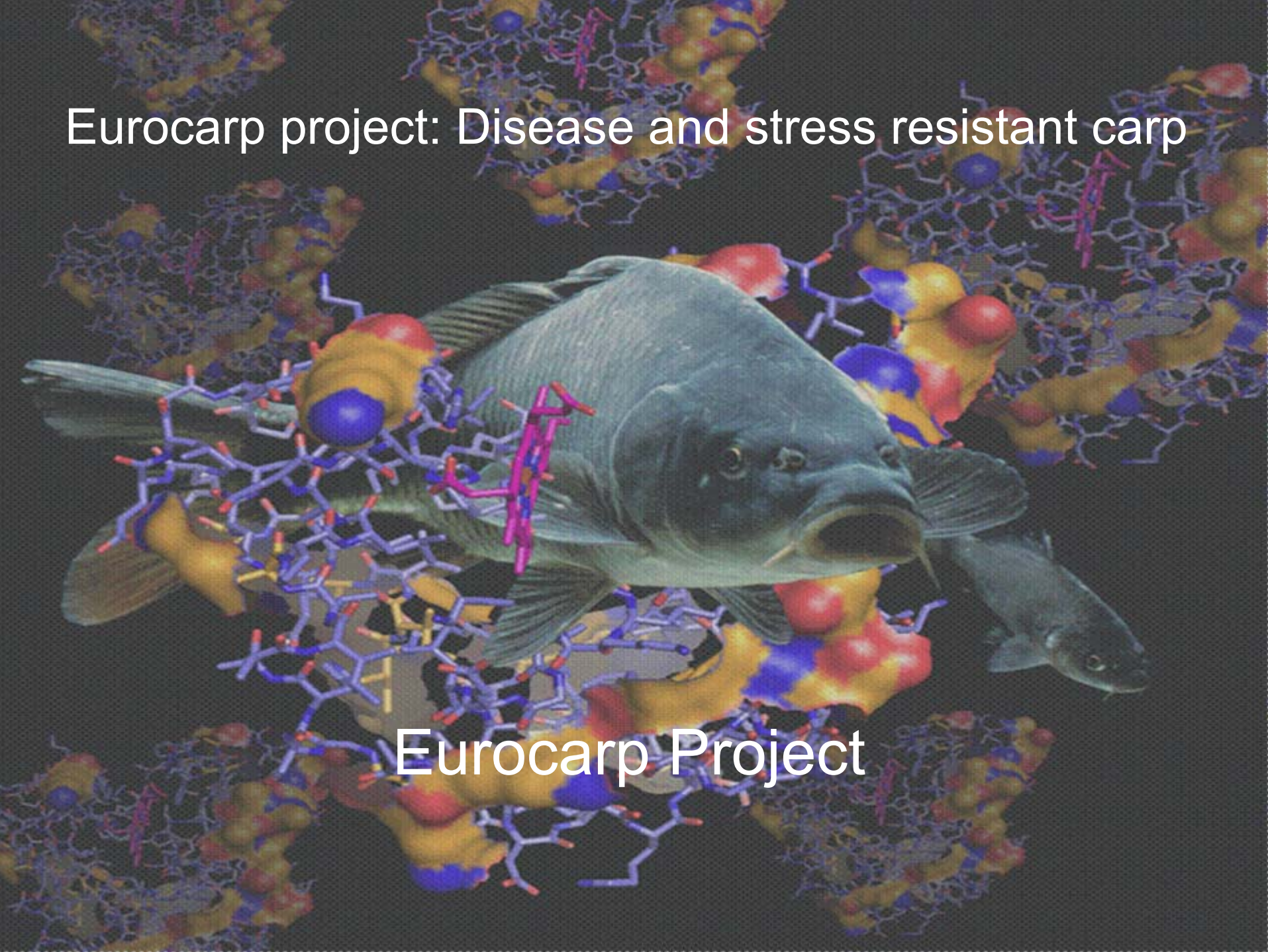








Eurocarp project: Disease and stress resistant carp



Eurocarp Project

3. Gene bank is studied:
Eurocarp project: Disease and stress resistant carp

	Duna	Amur	Tata	15
Duna	D1xD1	A1xD7	T1xD3	15-1xD9
	D1xD2	A1xD8	T1xD4	15-1xD10
	D2xD3	A2xD9	T2xD5	15-2xD1
	D2xD4	A2xD10	T2xD6	15-2xD2
	D3xD5	A3xD1	T3xD7	15-3xD3
	D3xD6	A3xD2	T3xD8	15-3xD4
Amur	D1xA5	A1xA1	T1xA7	15-1xA3
	D1xA6	A2xA2	T1xA8	15-1xA4
	D4xA1	A4xA7	T4xA3	15-4xA9
	D4xA2	A4xA8	T4xA4	15-4xA10
	D5xA3	A5xA9	T5xA5	15-5xA1
	D5xA4	A5xA10	T5A6	15-5xA2
Tata	D2xT1	A2xT7	T2xT3	15-2xT9
	D2xT2	A2xT8	T2xT4	15-2xT10
	D3xT3	A3xT9	T3xT5	15-3xT1
	D3xT4	A3xT10	T3xT6	15-3xT2
	D4xT5	A4xT1	T4xT7	15-4xT3
	D4xT6	A4xT2	T4xT8	15-4xT4
15	D1x15-3	A1x 15-9	T1x15-7	15-1x15-1
	D1x15-4	A1x15-10	T1x15-8	15-1x15-2
	D2x15-5	A2x15-1	T2x15-9	15-2x15-3
	D2x15-6	A2x15-2	T2x15-10	15-2x15-4
	D5x15-1	A5x15-7	T5x15-3	15-5x15-9
	D5x15-2	A5x15-8	T5x15-4	15-5x15-10

3. Gene fond is used for re-habitation purposes: Resettlement of Croatian strains

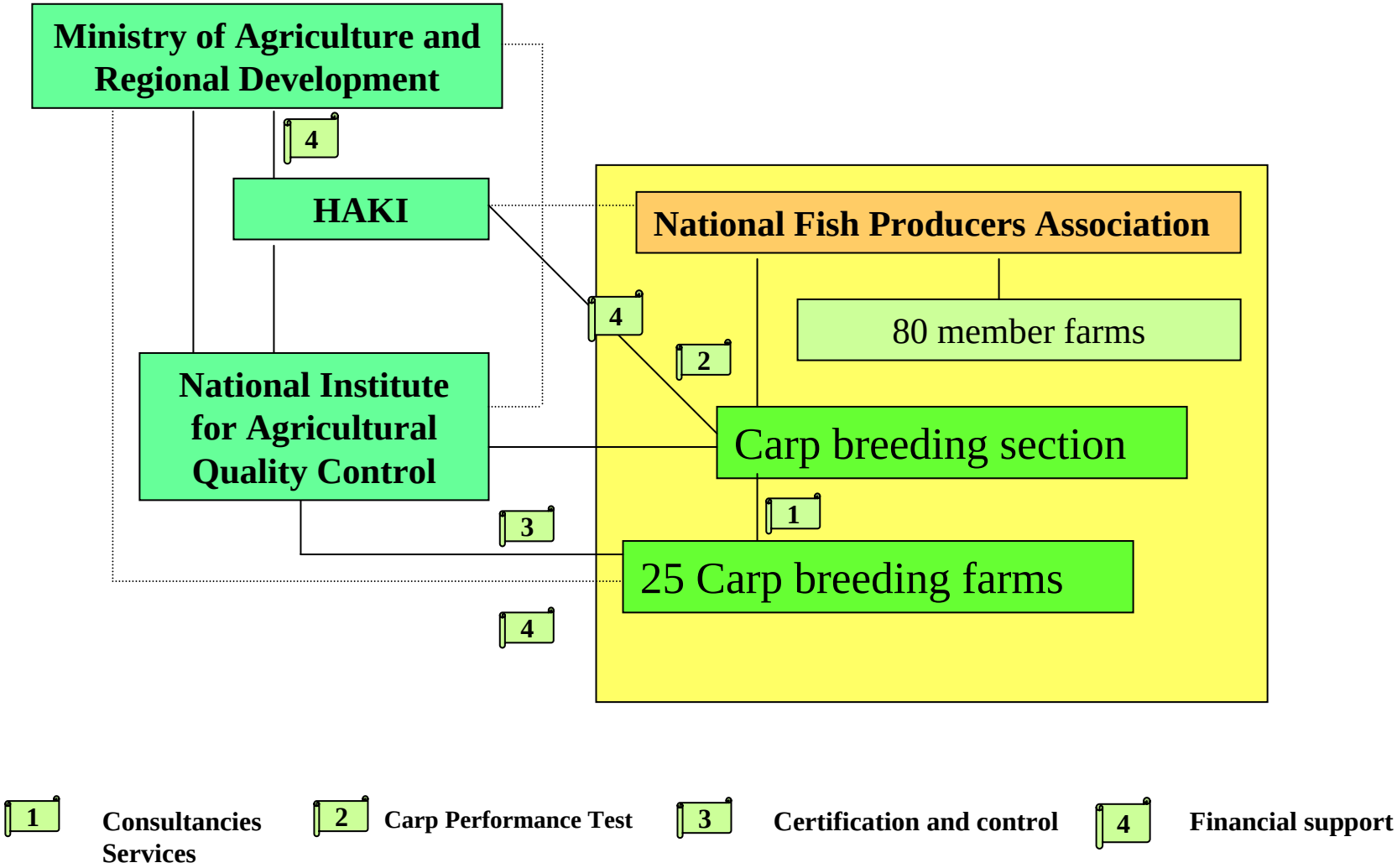
- Nasice mirror carp
- Poljana mirror carp
- Poljana scaly carp

Lost in recent war,
but preserved in live gene bank of HAKI

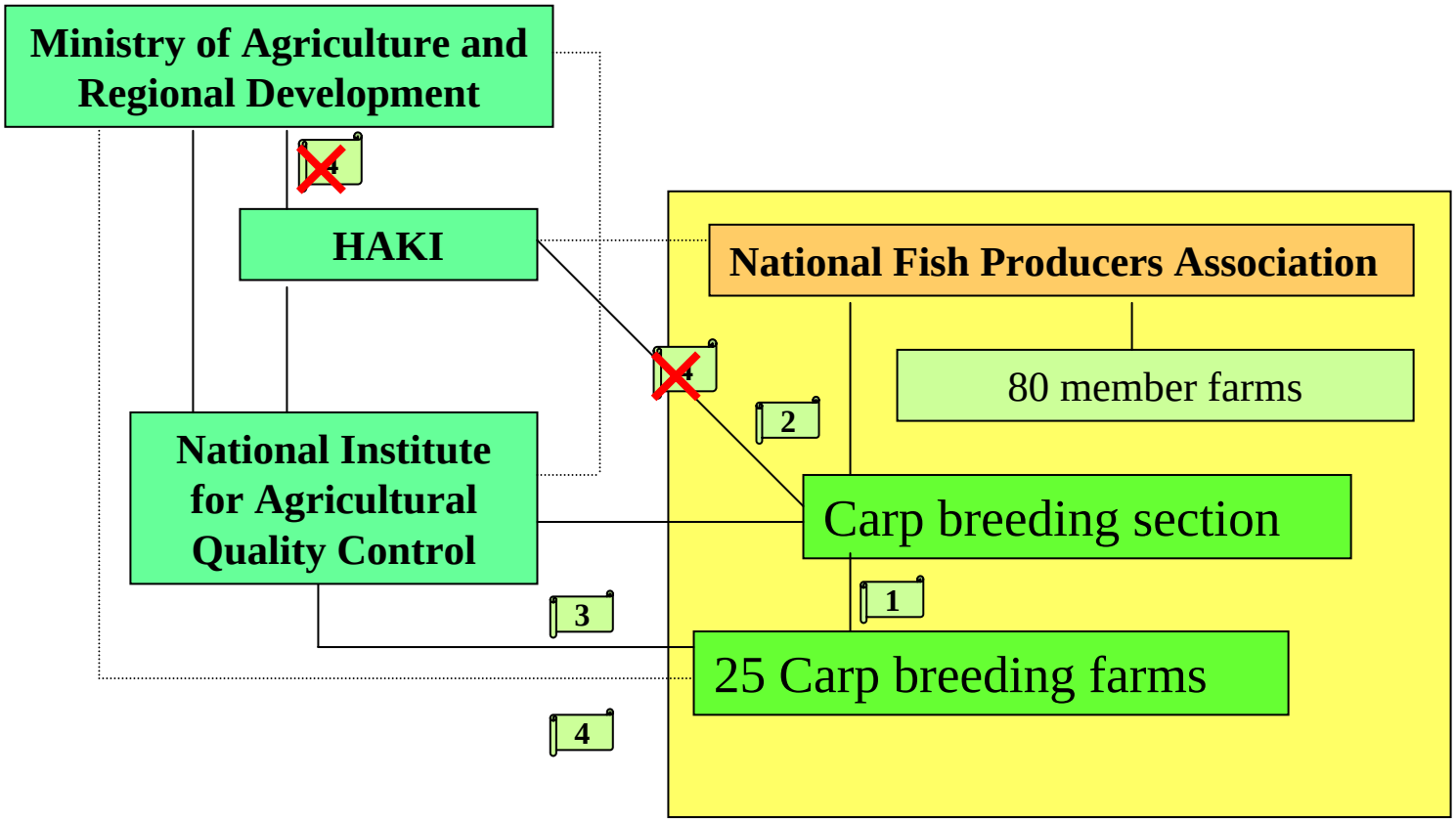
4. Strains are used for gene exchange:

- Indonesia
- Vietnam
- Laos
- India (DFID project)

Lessons learned with gene bank maintenance was used in implementation of the National Carp Breeding Program



Loosing the battle?



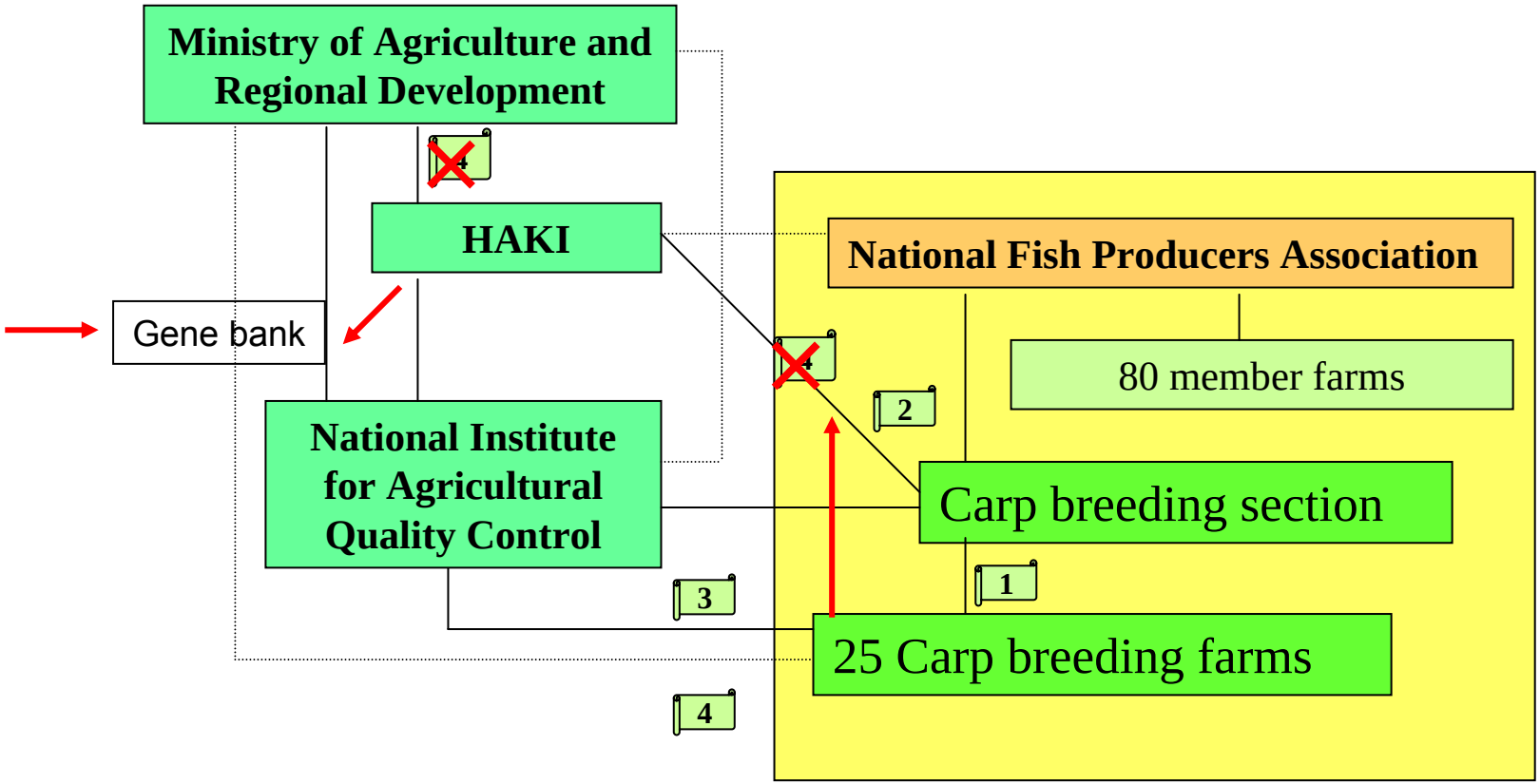
1 Consultancies Services

2 Carp Performance Test

3 Certification and control

4 Financial support

Solution?



1 Consultancies Services

2 Carp Performance Test

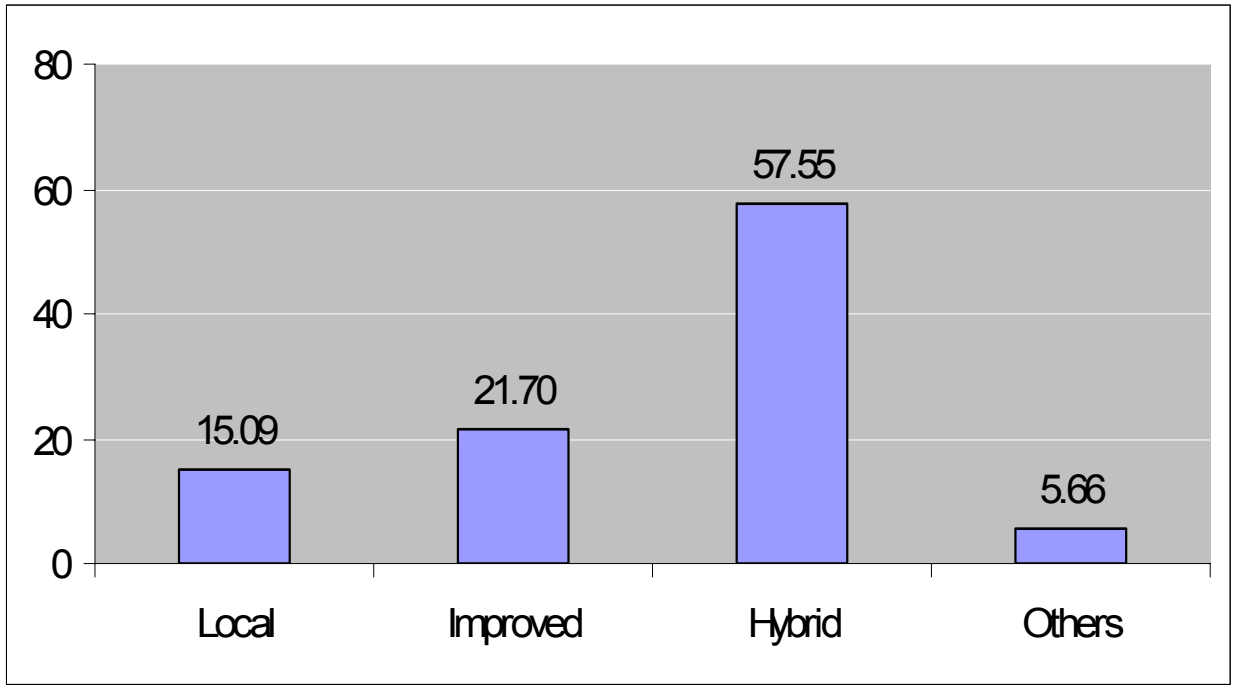
3 Certification and control

4 Financial support

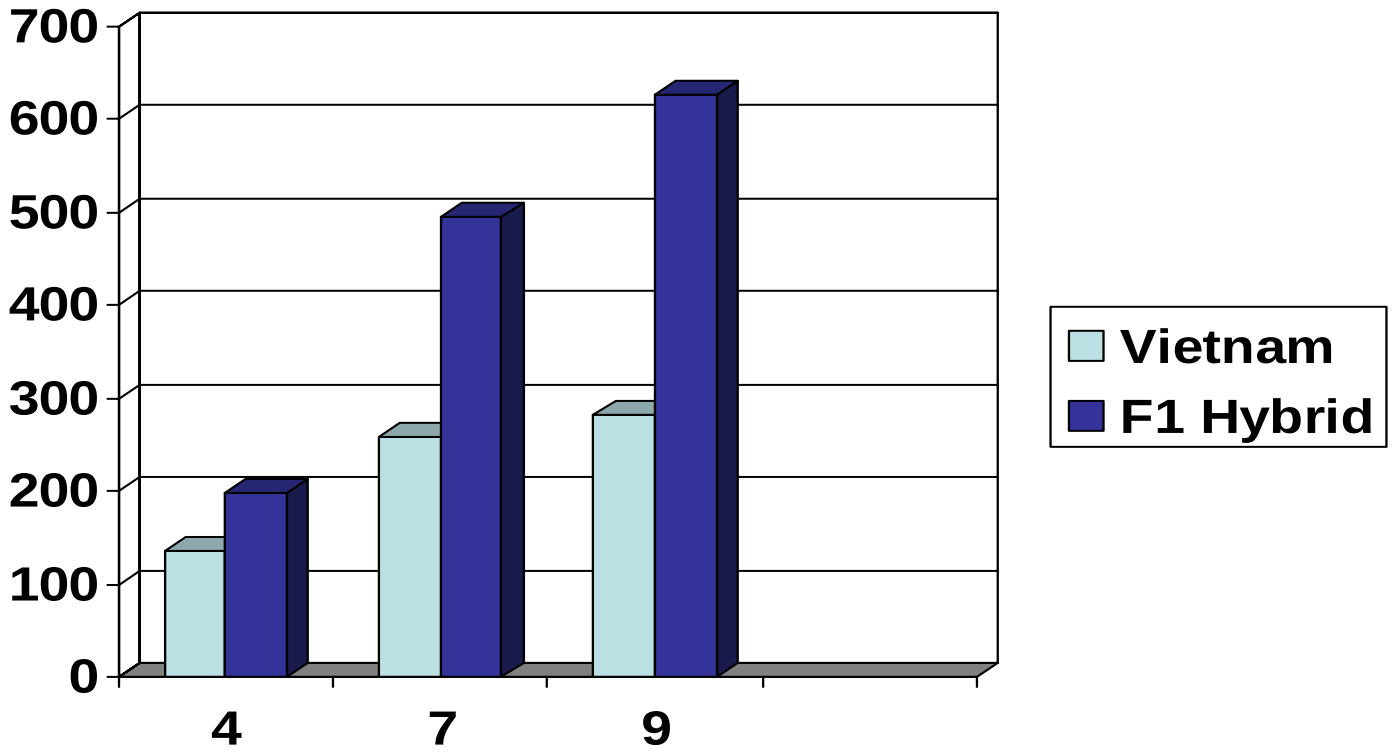
Lesson

- Funding is a driving force
  - Private basis?

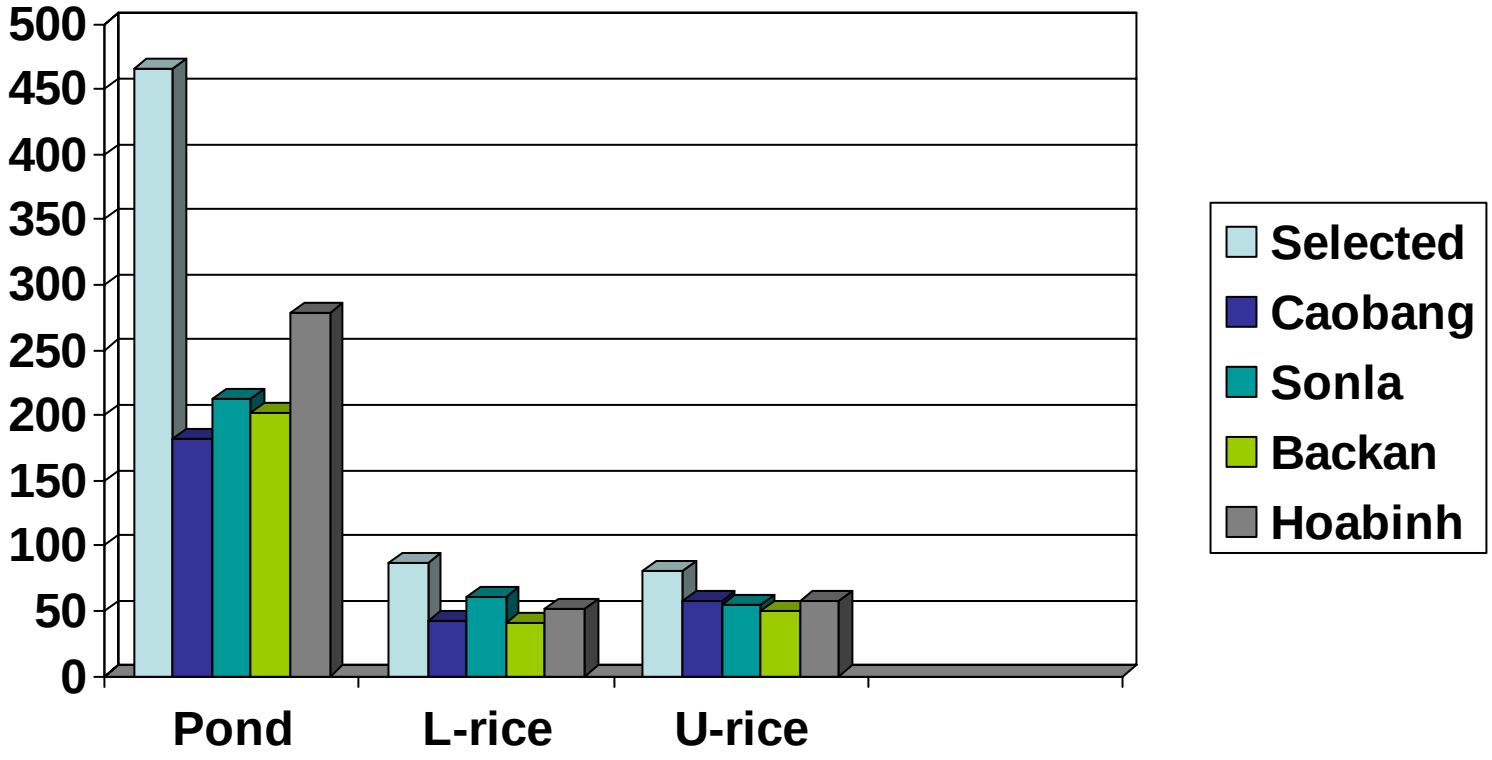
Current status (%) of common carp breeds cultured in Vietnam



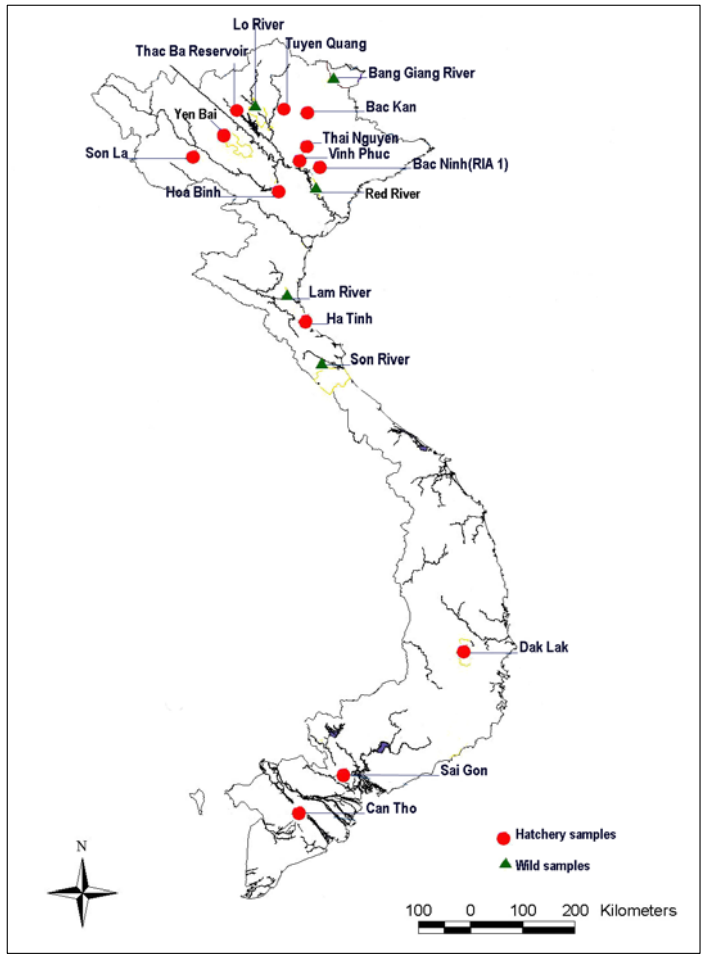
Growth performance (4,7 & 9 months of culture) of Vietnam and Vietnam x Hungary hybrid



Growth performance of selected and local varieties in pond, lowland rice and upland rice fields



Sites of Common carp samples:



Genotyping results:

- Genetically different between improved breeds (Hungarian, Indonesian and Vietnamese)
- Low genetic variation in improved breeds
- Stock mixing and inbreeding
- Some wild populations are genetically different from hatcheries, not substantial

Gene banking and conservation:

- Common carp sperm cryopreservation protocol developed
- Gene bank of Common carp strains established

Plan for co-operation VN-HUN

- Subject:

  Characterization and conservation of carp genetic resources

- Framework:

  Vietnamese-Hungarian bilateral science and technology cooperation (based on inter-governmental) agreement

Thank you for your attention!

xin cám on!