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in České Budějovice

Current production problems of Czech traditional production aquaculture

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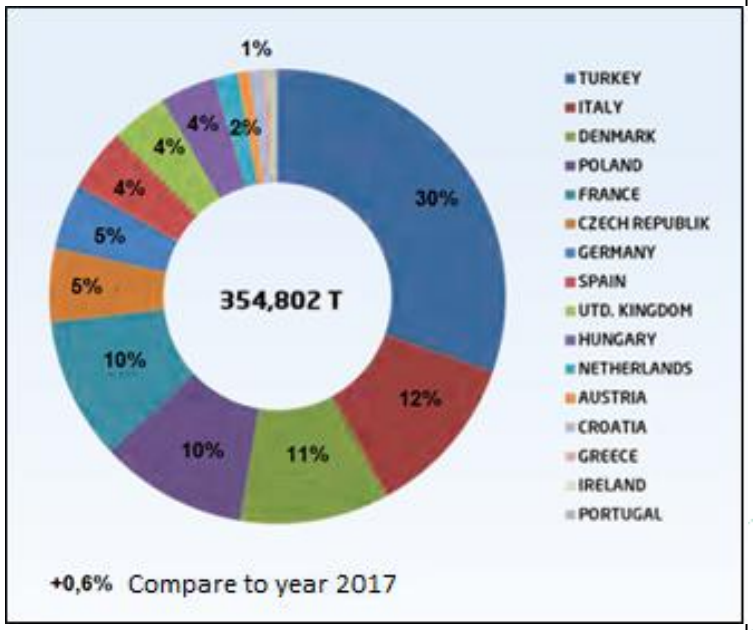
Current status

- A unique pond system (24,000 production ponds with an area of 51,800)
- The long tradition of producing fishery (11th-12th centuries),
- The production is based on polyculture stock of cyprinid species combined with predatory fish,
- Annual production of market fish 19 - 20 000 tons,
- Salmonid fish production in flow-through systems or RAS with annual output (300-600 tones with a view of 1500-2000 tones),
- 1800 employees mainly in the countryside.

Current status

- The Czech Republic is an important and respected European producer of freshwater fish (Common Carp)
- Volume: 5% of European freshwater production (6-7th position in Europe).

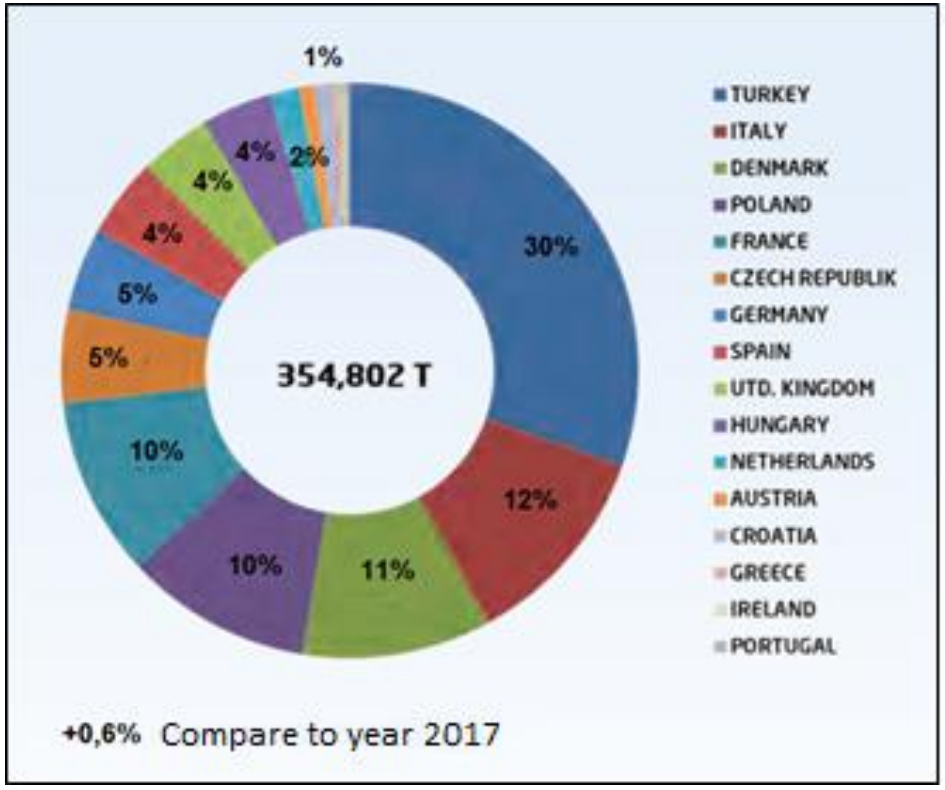


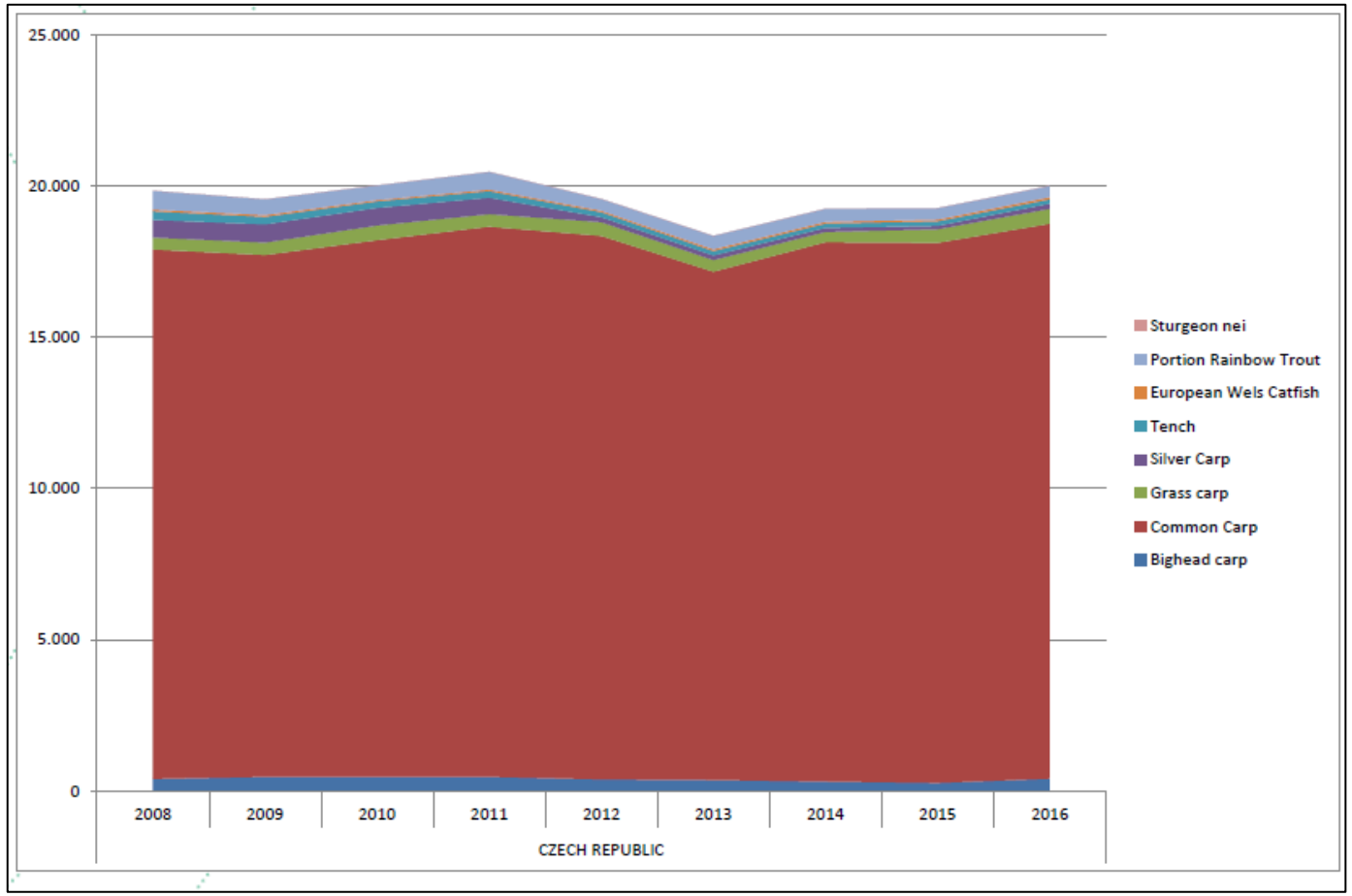
CZECH REPUBLIC

PRODUCTION (tons)		YEAR								
COUNTRY	SPECIES	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZECH REPUBLIC	Common Carp	17.507	17.258	17.746	18.198	17.972	16.809	17.833	17.860	18.354
	Portion Rainbow Trout	614	526	476	580	388	439	426	368	367
	Grass carp	394	409	488	412	456	384	337	445	490
	Bighead carp	394	461	461	460	379	358	309	264	402
	Silver Carp	586	601	583	546	162	150	133	113	172
	European Wels Catfish	60	58	47	52	50	61	54	63	74
	Sturgeon nei									2
Total CZECH REPUBLIC		19.555	19.313	19.801	20.248	19.407	18.201	19.092	19.113	19.861

Current status

- Annual fish production is stable ± 2-4%.





Current problems

- Production has a high seasonal character (60% volume in the short pre-Christmas season),
- 90 - 95% of the production consists of one species – Common Carp,
- Low domestic consumption of fish and low processing of produced fish.

Fish consumption kg/person/ year

Species	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total, fish	5,5	5,5	5,1	5,4	5,4	5,3	5,4	5,5	3,8*
Freswater fish from local production	1,3	1,4	1,4	1,5	1,5	1,4	1,3	1,4	1,3

Current problems

A very limited choice of products,

Their non-continuous, very limited and poor distribution among consumers (people do not get used to fish)

Only 10% of fish production is processed (raw material is sold without large added value),

Most businesses have no marketing strategy - selling fish on trucks with minimal rebate and profit.

Current problems

In Czech Republic 45 - 55% of production is sold as live fish,

Consumers are unable to process fish, so they prefer not to buy them,

Fish have bones and fishy smell - the modified product (precooked and/or processed) are preferred ,

Stagnation of fish consumption in young generation,

It is easy to blackmail farmer selling live fish, because he has to sell quickly and relatively cheap.

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Export of fish from Czech Republic

40-50% of live fish are exported to the following countries:

Germany
Slovakia
Poland
France
Austria
Italy

Recently, the production and the fish market in this countries have changed.

Preferred species are salmonid, marine and valuable freshwater species.

Current problems

GERMANY

PRODUCTION (tons)		YEAR								
COUNTRY	SPECIES	2008	2009	2010	2011	2012	2013	2014	2015	2016
GERMANY	Portion Rainbow Trout	23.000	23.000	22.300	10.062	8.116	8.333	8.466	7.642	7.642
	Common Carp	10.500	9.000	9.783	5.082	5.521	5.700	5.285	4.916	4.916
	Large Rainbow Trout	1.250	1.250	1.250	1.200	1.278	1.267	1.471	1.506	1.506
	European eel						700	927	927	927
	Sturgeons nei	214	106	120	120	240	150	300	225	225
Total GERMANY		34.964	33.356	33.453	16.464	15.155	16.150	16.449	15.216	15.216

Note: No current data available

- Germany as the leader of the European economy has a relatively large gaps in aquaculture fish production, which declined in recent years (especially in carp and rainbow trout - small piece weight)
- The Germans recently recognize and invest quite considerable financial resources in order to achieve innovation in fish farming whole species (perch, pike perch and marine species)
- In Germany, there is an increase eel production market with the view that this species will be produced primarily for introduction into open waters in order to strengthen and save its population in nature.

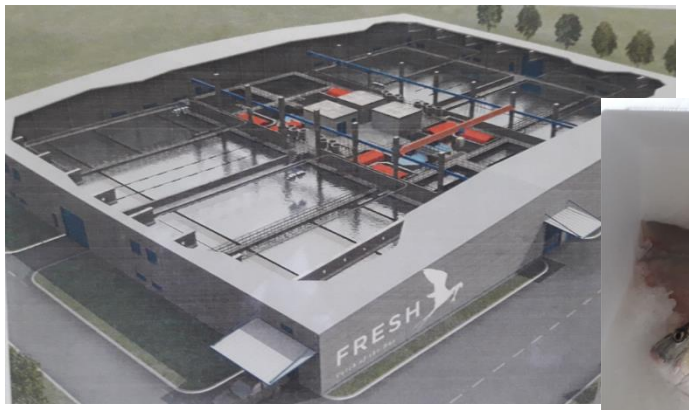
Germany

Rietschen (Saxony) - 40 tones of pikeperch (combination of ponds and RAS)

Fulda, caviar and market sturgeon (10 and 100 tons)

Production of market pikeperch (100 t) in RAS Hohen-Wangelingen

Inland production of marine species of 150 tones (Völklingen)



Situation abroad

FRANCE

PRODUCTION (tons)		YEAR								
COUNTRY	SPECIES	2008	2009	2010	2011	2012	2013	2014	2015	2016
FRANCE	Portion Rainbow Trout	25.000	25.000	22.000	23.500	23.500	20.870	22.000	23.947	24.200
	Large Rainbow Trout	9.000	9.000	12.000	12.500	12.500	11.130	12.000	12.766	13.000
	Common Carp	6.000	6.000	4.000	3.500	3.500	3.500	3.000	3.000	3.000
	Sea Bass	3.968	3.204	2.779	3.000	2.300	1.970	2.021	1.980	1.928
	Sea Bream	1.636	1.648	1.377	1.500	1.300	1.477	1.105	1.502	1.671
	Meagre	206	121	268	500	420	200	377	226	236
	Atlantic salmon	0	0	802	700	300	300	300	300	450
	Sturgeons nei	250	250	380	280	250	280	298	241	450
	Turbot	850	531	394	300	250	255	279	303	288
	Sole	0	0	142	200	220	223	261	256	248
Total FRANCE		46.910	45.754	44.142	45.980	44.540	40.205	41.641	44.521	45.471

Note: No current data available

- Even though France has a fairly long coastline of ocean and seas, the main species is rainbow trout with a slightly decreasing tendency at a small piece weight and a rising tendency for larger fish of this species,
- Within freshwater aquaculture the importance of common carp is also reducing,
- Production of sturgeon is stagnating, and new species are being tested (perch and the pikeperch)
- Within marine aquaculture is increasing production of salmon, other marine species have stable or stagnating trend.
- French farmers are aware of their unused capacity in marine aquaculture, so they want to strengthen it significantly in the future.

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Situation abroad

POLAND

PRODUCTION (tons)		YEAR								
COUNTRY	SPECIES	2008	2009	2010	2011	2012	2013	2014	2015	2016
POLAND	Common Carp	17.150	18.300	15.400	14.400	16.500	17.700	18.000	18.000	18.000
	Portion Rainbow Trout	15.000	14.000	11.000	13.000	14.500	14.500	17.500	19.000	18.000
	African Catfish	500	1.100	1.100	400	400	400	500	500	1.000
	Silver Carp	600	600	600	260	374	320	360	360	0
	Grass carp	550	550	550	225	290	270	320	310	0
	European Wels Catfish	300	350	400	220	219	250	250	250	200
	Sturgeons nei	270	148	200	240	241	95	140	193	560
	European eel									51
Total POLAND		34.370	35.048	29.250	28.745	32.524	33.535	37.070	38.613	37.811

- Poland is similar to Hungary agriculturally based country with a long fishing tradition.
- Thanks to current investments from EU funds in Poland is increasing its production of carp, sturgeon and the oven (the construction of a large amount of flow or modern breeding RAS)
- In Poland, it is used similarly to us polyculture breeding ponds where mainly produces carp, along with herbivorous species, which in recent years experienced a significant decline.
- In this country is wide amount of family farms producing African catfish or European catfish in RAS.

Situation abroad

ITALY

PRODUCTION (tons)		YEAR								
COUNTRY	SPECIES	2008	2009	2010	2011	2012	2013	2014	2015	2016
ITALY	Portion Rainbow Trout	38.900	40.500	39.000	39.000	36.300	36.000	36.800	37.000	33.800
	Sea Bream	9.600	9.600	9.600	9.700	8.700	8.400	8.200	7.360	7.600
	Sea Bass	9.800	9.800	9.800	8.700	7.200	6.800	6.500	6.450	6.800
	Large Rainbow Trout	500	600	1.000	2.000	1.500	2.000	2.000	1.000	2.500
	Sturgeons nei	1.350	1.350	1.900	1.900	1.700	1.900	2.000	1.480	1.000
	European eel	1.550	1.070	960	1.100	1.100	1.000	1.000	1.000	850
	Common Carp	750	750	700	750	750	700	700	700	700
	European Wels Catfish	230	215	300	550	550	600	600	300	350
	Meagre	300	320	320	300	300	190	190	190	190
Total ITALY		62.980	64.205	63.580	64.000	58.100	57.590	57.990	55.480	53.790

Note: No current data available

Italy is the leading European producer of rainbow trout both normal and large sizes, and sturgeon.

Within the freshwater aquaculture in this country have produced the following species: eel, carp and catfish.

For marine fish species is the most important sea bream and sea bass.

All species except rainbow trout (large size) and catfish reported declining production.

Current problems

In the near future, we can expect further declining of interest in market Common Carp

Lowing profitability of the pond production due to:

- low domestic consumption of fish and low processing of produced fish
- lack of technological innovation and climate change
- higher production costs and slowly rising fish prices

How to deal with the current situation?

Innovation of pond culture

- Support for the production of secondary fish - grass carp, tench, pikeperch and others;

- Production of predatory species in ponds supported with the production of forage fish in lakes;

- Direct sales to final customers and abroad;

- Increase fish processing and deal with product development;

- Promote fish consumption among younger generations - "fish for schools";

- The introduction of the "fish days" - as in the former USSR “Fish Thursday” (utopia ???);

- Combination of fish farming and tourism.

How to deal with the current situation?

Reasonable step-by-step introduction of intensive farming

- It is necessary to identify the final customer, his product requirements, estimate the volume of the market and a realistic price;
- Focus on the end customer and the local market;
  100% processing production and maximizing added value;
- Having a reliable breeding technology without significant production issues with closed stock turnover;
- Maximum use of the capacity production systems(no more than 10-20% of the losses due to technological and breeding problems);
- Immediate problem identification;
- Some tanks could be stocked with higher biomass even with potential growth reduction.

Possibilities of fish production in RAS

- Intensive breeding of salmonid and sturgeon fish;
- Intensive rearing of African catfish;
- Combination of ponds and RAS to produce stocking material (juveniles);
- Combination of ponds and RAS for the production of market fish or juveniles of common pike, pikeperch, perch or burbot;
- Stable, high quality and balanced production of reophilic fish in RAS (Common Barbel);
- Production of European eel and Grayling for stocking into open water;
- Production of pike juveniles in RAS;
- Intensive culture of Rainbow trout in RAS;

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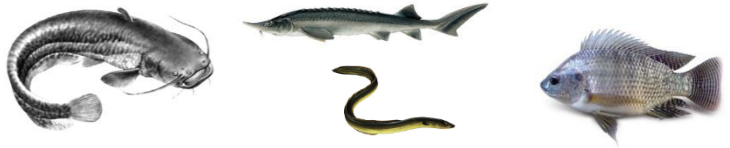
The current planned production capacity fish in RAS

- "FISH Farm Bohemia" Ltd. – 1000 t 
- "Pstruhařství Jizerské hory" Ltd. – 1000 t 
- "BioFish" Ltd. – 120 t 
- "Tilapia" Ltd. – 60 - 100 t 
- "SALMOFARM" Ltd. – 80 t 
- "Šumavský pstruh" Ltd. – 40 – 60 t 
- "NDC-ryba" Ltd. – 5 - 10 t 

Annual production: 2370 t

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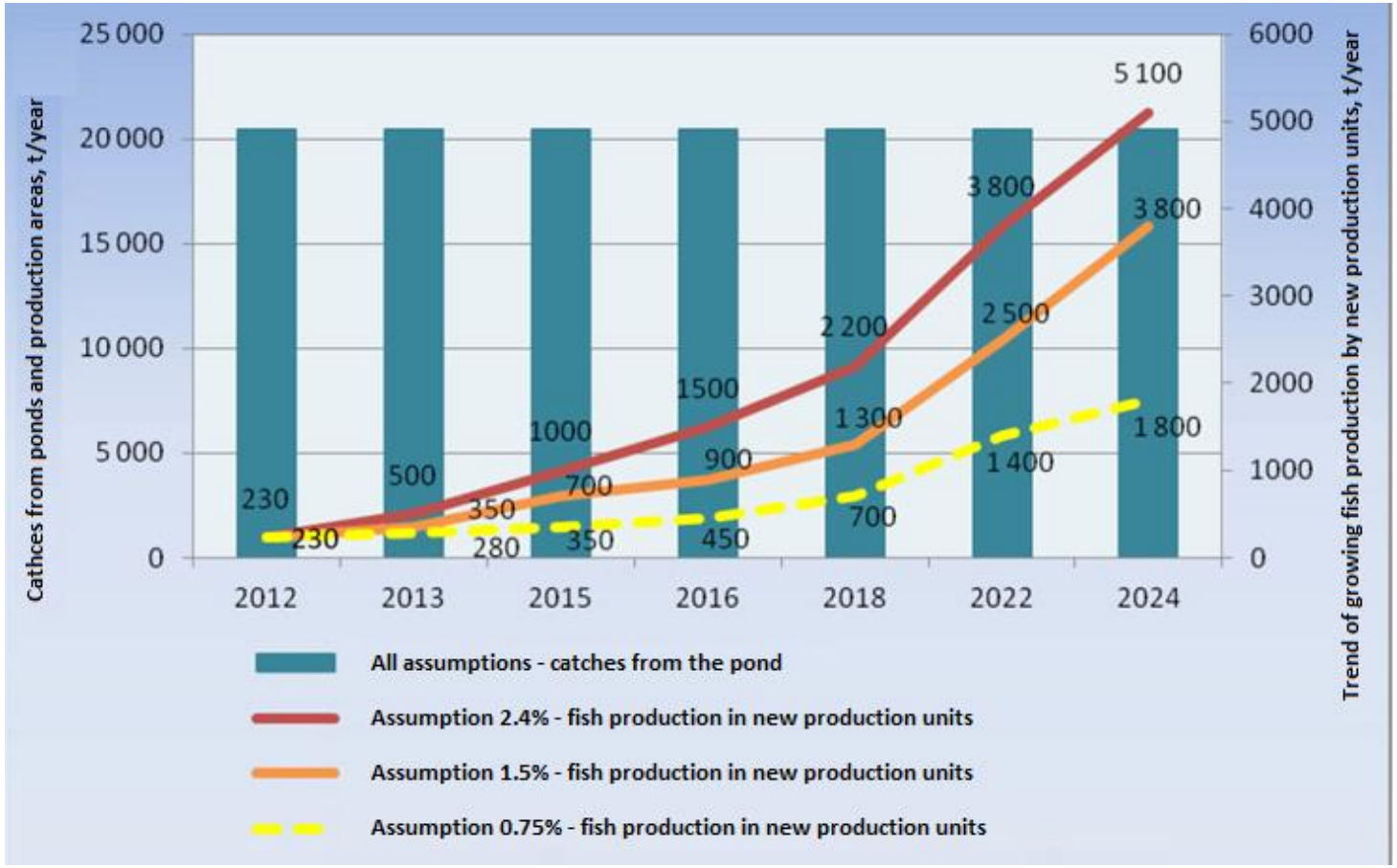
Intensive culture of fish in Czech Republic



- Intensive farming has are at least 2 to 3 years of loss (the necessary start of production and effective sales),
- The right technology, system capacity tanks type tanks must be chosen accordingly to the fish species
- There must be a well-prepared realistic production and sales plan,
- A breeder must have sufficient financial reserves, strong nerves and a lasting faith in breeding and business success.

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Future of combined system pond-RAS in Czech Republic

- Start and development of RAS (low production and minimal impact),
- Start-up of production in RAS (intensive farms will complement production from ponds in out-of-season)
- Achieving final production in RAS (continuous supply of fish and fish products to the market and receiving new customers).

Future of combined system pond-RAS in Czech Republic

The emergence of a new situation and two possible scenarios:

1) Customers will use new products and provided by intensive farming without increased total fish consumption (shifting carp with new range of products) - **CRITICAL SITUATION FOR CURRENT FISHERIES PRODUCTION**,

2) Customers will increase the consumption of fish and consume new products at the same time as carp - **IDEAL SITUATIONS.**

For the second possible scenario, close cooperation between the two sectors is necessary.

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Intensive fish culture in Czech Republic

- Big concern and mistrust from classic fishermen's (pond fisheries)
- The great distrust that these systems can produce fish efficiently and profitably,
- Certainly, these systems require a different approach of labor and a highly skilled and experienced operators.
- They can be effective and profitable,

- **a well-built and designed system for a particular species production**

(optimal flow, volume, suitable size, shape and color of tanks, sufficient filtration, etc.)

- **Managed breeding and technology**

(constructive errors and inappropriate systems for our climatic conditions - Danish-type RAS must be avoided),

- **There should not be any forcing into intensive culture of fish!!!**

Intensive fish culture in Czech Republic

Bad experience from previous use:

- RAS and its individual components are by far more reliable,, more efficient and stable compare to the past century,
- There are more ways to apply RAS potential
- More efficient marketing tools are available.

Intensive fish culture in Czech Republic

Interest from traditional fisheries enterprises?

“Rybníkářství Pohořelice” a.s. – RAS built for sturgeon fish, new hatchery unit

“Blatenská ryba” considered RAS in combination with poultry?

Other enterprises?

Positive examples of intensive breeding abroad



The Netherlands

- The Netherlands is the largest European producer of African catfish, European eel and pikeperch in RAS
- It is a country with a relatively small land resources, especially where the fish are reared in commercial aquaculture conditions, with which local farmers have quite good experience,
- Other important species bred here are: scaldfish, rainbow trout and sturgeon (mainly for caviar)
- In this country there is a big boom of aquaponics systems, because of the great local tradition of cultivating plants in greenhouses.

THE NETHERLANDS

PRODUCTION (tons)		YEAR								
COUNTRY	SPECIES	2008	2009	2010	2011	2012	2013	2014	2015	2016
NETHERLANDS	African Catfish*	4.500	3.500	3.200	3.000	3.000	3.100	3.100	3.100	3.100
	European eel	3.700	3.200	3.000	2.800	2.300	2.885	2.885	2.885	2.885
	Pike-perch	100	115	100	120	120	150	150	150	150
	Turbot	90	245	200	180	150	100	100	100	100
	Portion Rainbow Trout	50	50	50	50	50	70	70	70	70
	Sturgeons nei								50	50
Total NETHERLANDS		8.440	7.110	6.550	6.150	5.620	6.305	6.305	6.355	6.355

Note: No current data available

Positive examples of intensive breeding abroad

The Netherlands

- Family farm (owner Eric Philipsen)

- 3 workers

- Production of 100 tones of market sized pikeperch (2 kg)

- Consulting services

- selling of domesticated juveniles

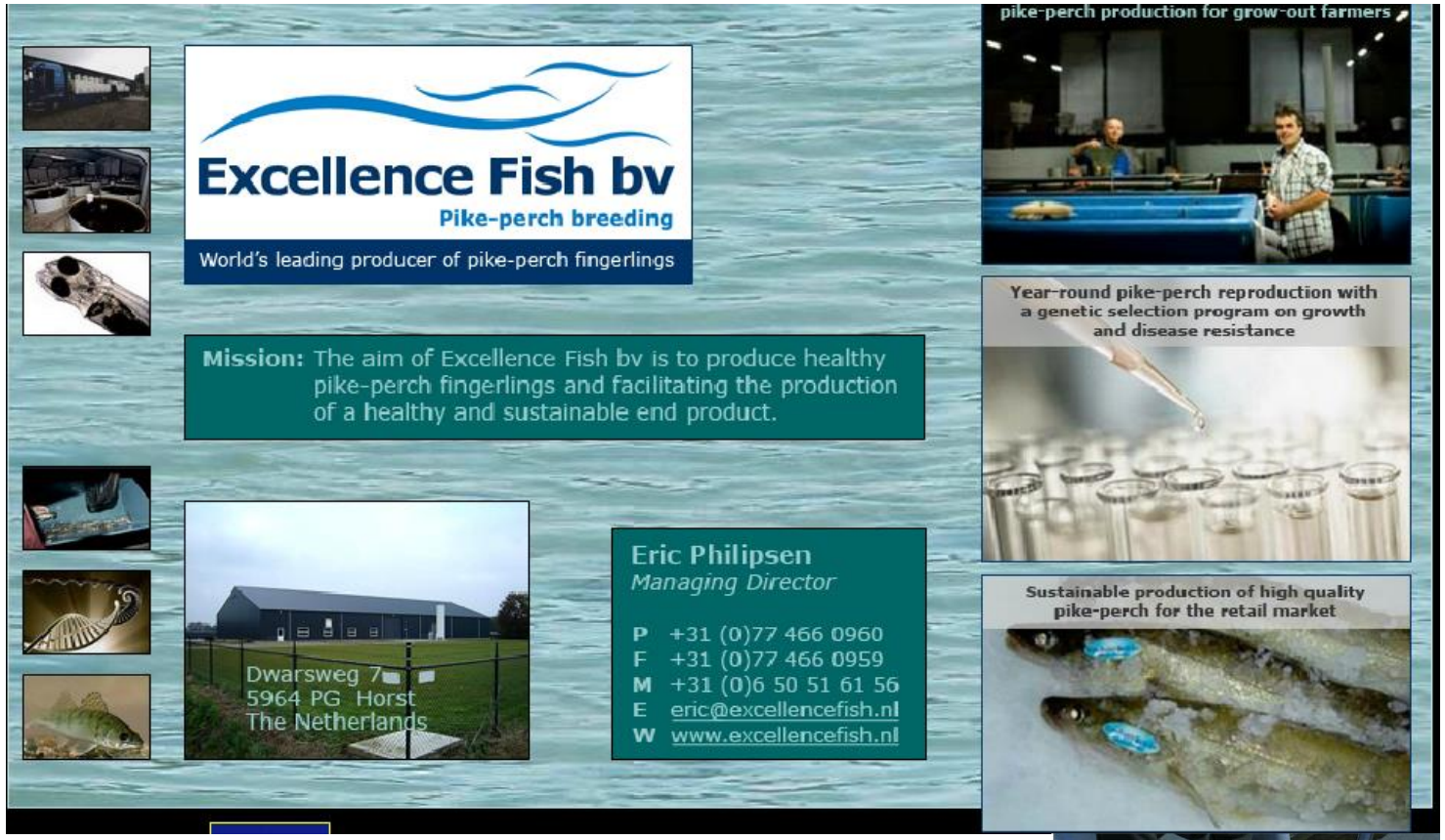
- production of 200,000 juvenile pikeperch for the Dutch, Danish and French market

- Fully automatized

- Domesticated fish

- Out-of season spawning, larvae production every month

- semi-controlled reproduction, hormonal induction with carp hypophyses



Positive examples of intensive breeding abroad

Swiss market and intensive breeding of perch

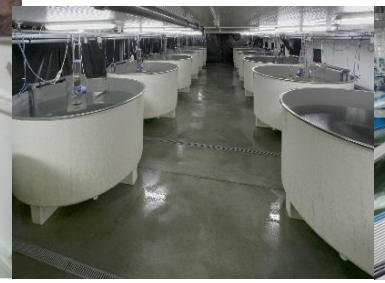
- The annual consumption of perch in filetách (30-50 g) from 6000 to 7000 tons (approximately 15,000 - 18,000 t market perch)
- In Switzerland, 200-300 tonnes per year are produced, the rest is export,
- A lot of countries wanted to produce perch for the Swiss market (F, I, D, P etc.) but without significant commercial success,
- The most advantageous and most profitable is to supply fish to the local market,
- Three categories:
  - **the most valuable** intensively reared bass in CH, F (56 EUR per 1 kg of filets on ice),
  - **less valuable** perch bred in pond culture (29 per 1 kg of fillets on ice)
  - **the least valuable** is catches from Estonia and Russia (18 EUR per 1 kg, fillet on ice),

100 CHF = 110 EUR

The condition is balanced, high-quality and stable production all year round.

Percitech s.a.

VALPERCA



coop

MIGROS

Positive examples of intensive breeding in Czech Republic

Experimental fish breeding hall FFPW

Investment of 5 725 000 CZK with VAT,
2 modern independent RAS with a volume of 30m3
15 m3 for rearing fish in 10 tanks,
Expert staff with 1.5 payment rate

Current use

Annual expenses

Type of expences	Amount in CZK	Part, %
Water and electricity	320 000	22,6
Oxygen	70 000	4,9
Feed	100 000	7,1
Stocking	100 000	7,1
Stuff	600 000	42,4
Ammortization	175 000	12,4
Materials	50 000	3,5
Total	**1 415 000**	**100**

Pikeperch breeding with a combination of ponds and RAS, 50 - 70,000 juveniles during 4 months with monetization of CZK 1 - 1.4 million,

Performing of experiments with 8 months duration.

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Experimental fish breeding hall FFPW

Investment of 5 725 000 CZK with VAT,
2 modern independent RAS with a volume of 30m3
15 m3 for rearing fish in 10 tanks,
Expert staff with 1.5 payment rate

Maximum use

Roční Annual expenses

expences	Amount	Part, %
Water and elect.	520 000	23,3
Oxygen	120 000	5,4
Feed	250 000	11,2
Stocking	250 000	11,2
Stuff	800 000	35,8
Ammortization	175 000	7,8
Materials	120 000	5,4
Total	2 235 000	100

Covering production costs

Pikeperch juveniles with combination pond - RAS (3.5 month cycle)

- 3 x per year (our-of season, autumn and spring fry) for 50,000 pieces each
- 150 000 pcs selling price of 15 - 25 CZK (20 CZK)

TOTAL CZK 3,000,000 (profit 765,000 CZK)

Market sized pikeperch up to 1 kg (15 months cycle)

- 0.8x per year

Total biomass 1000 kg (800 kg) with the realization price of 350 CZK per 1 kg
TOTAL CZK 280,000 (loss CZK 1955,000)

Positive examples of intensive breeding in Czech Republic

Tilapia s.r.o. – HAPPY FISH

- Nuzbely near Tábor,
- Establishment in 2015, annual production of African catfish of about 60-100 tons per year.
- Modern, clean and perfectly equipped breeding without technological problems,
- Breeding of relatively easy species - fish processing on the place,
- 100% processed produce in the form of fish products,
- High added value,
- Combination with biogas station,
- Approximately 10 to 15 fish products are continuously marketed in stores and retail chains.

Importance of intensive Aquaculture and using of RAS in the Czech Republic

- Enhancing the species spectrum of fish and promoting valuable species,
- Balanced production during the year in terms of quality and quantity,
- Complete or significant limitation of predator effects on farmed fish,
- Minimum flow requirements (water resources),
- Low or no surface water pollution,
- Minimum requirements for built-up area,
- Low risk of disease,
- Neutral impact on existing fish farming,
- Increasing the share of food from Czech production on the domestic market,
- Combined with biogas stations or other heat sources,
- Increasing employment and promoting its development,
- Financial support for the construction of modern aquaculture facilities,
- Support for applied research.