ANNEX 8.1

PROGRESS REPORT OF THE "HIGH VALUE AND NEW SPECIES" WORKING GROUP

The work during the first year after the establishment of the Working Group in Astrakhan last year was mainly devoted to the survey by the lead centres of each sub-groups on the status of ongoing research and future plans in the partner institutions. There have been however notable initiatives to intensify exchange of information and scientists and also to start joint projects. The main findings and conclusions of the work are summarised in the followings by each sub-groups:

1. Intensive pikeperch and pike culture

Lead Centre: HAKI, Hungary
Partner institutions: IFA, Bulgaria; IRS, Poland; VURH, Czech R.; IF, Belarus; GOSNIORKH, Russian Federation; IZASM, Moldova.

- **Information from the Institute of Fisheries and Aquaculture, Varna, Branch of Freshwater Fisheries, Plovdiv (Bulgaria)**

During the last years IFA worked on the following problems of pike (*Esox lucius*) culture:

1. Gonad development and fecundity of pike reared under pond condition.
2. Reaching of maturity under pond condition in male and female pike
3. Effect of low and high temperature on embryonic and larval development of pike
4. Semi-artificial reproduction of pike in tanks
5. Natural reproduction of pike in small ponds
6. Growth of pike larvae up to 1 month age in spawning ponds
7. Investigation on feed selectivity of pike fingerlings in ponds.
8. Pike rearing as an additional species in ponds up to one summer age

We plan to elaborate a new pike project during the next year. It will be funded by the National Center of Agricultural Science at the Bulgarian Ministry of Agriculture and Forestry. The aim of the project will be: Intensification on mass production of one summer old pike in ponds.

- **Information from the Stanisław Sakowicz Inland Fisheries Institute, Olsztyn, Poland (IRS)**

IRS is involved in joint project with HAKI:

Intergovernmental Cooperation Joint Project for the years 2006–2007: Application of medicinal herbs to improve stress resistance in pikeperch (*Sander lucioperca*) farmed in intensive systems.

The primary goals of the project are the followings:

- Investigating the stress response of juvenile pikeperch;
- Investigation on the impact of various stress factors on the immunological system and the histology of the internal organs;
- Determination of the optimal amount of vegetable matter in feed in order to increase pikeperch resistance to stress and disease.

- **Information from the Research Institute for Fisheries, Aquaculture and Irrigation (HAKI), Szarvas, Hungary**

HAKI is collaborating with IRS, Olsztyn in the frame of an Intergovernmental Cooperation Joint Project for the years 2006–2007: Application of medicinal herbs to improve stress resistance in pikeperch (*Sander lucioperca*) farmed in intensive systems as described above.

HAKI's partner the Aranyponty Fish Farm started a pilot-scale project: Mass rearing of pike larvae and fingerling in intensive systems. Pike larvae has been successfully reared up to 15 cm in tanks on artificial diet. As a result of the first trials 12 000 pike fingerling were produced and various elements of the technology have been elaborated. However, further investigations are needed to improve efficiency and safety of the production. Aranyponty Fish Farm expressed its intention to collaborate with NACEE institutions in particular IFA, Plovdiv, in the development of rearing technology of pike fingerling and one summer age fish.

- **Information from the State Research Institute on Lake and River Fisheries (GosNIORKH), St-Petersburg, Russian Federation**

1. In 1985–1995, the following research on breeding biotechnology of pike-perch was performed in GosNIORKH:

a) Methodology of winter keeping of pike-perch breeders in intensive conditions (tanks) was developed with the objective of obtaining eggs earlier. As a result of the application of the technology, high-quality eggs were obtained 1 month before the natural spawning period (Korolev and Tereshenkov, 1995; Tereshenkov and Korolev, 1997). The longer growout period due to earlier obtaining of eggs allowed to raise in pond conditions large fingerlings of pike-perch that already switched to predation and were characterized by a greater survival rate as compared to normal-size (5–10 g) pike-perch fingerlings.

b) The methodology of obtaining eggs from breeders damaged due to fishing from deep waters (inflated swimbladder) was developed (Korolev and Tereshenkov, 1996, 2000; Tereshenkov and Korolev, 1997; Korolev, 2000). The method was praised also when obtaining eggs from other fish species, in particular, from Arctic cisco (*Coregonus autumnalis*) in fish farms located on Baikal Lake.

c) The methodology of artificial stimulation of spawning of pike-perch breeders in plastic and concrete tanks with water depths of 0.4–0.5 m was developed (Korolev and Tereshenkov, 1995; Tereshenkov and Korolev, 1997; Korolev, 2000).

d) Research was done on selection of artificial starter feeds for pike-perch fry on the basis of known receptures for other fish species. The optimum stocking densities of pike-perch larvae in vertical-flow units were determined. Feeding, growth and survival rates of fry from weaned larvae were determined under different rearing conditions (Korolev, 2000, 2005).

e). Research was done into the survival of pike-perch fingerlings in lakes, from stocking fry raised on artificial feeds into the lake (Korolev, 2000).

2. Short description of the scientific and technical programme: GosNIORKH has highly qualified specialists in the field of artificial feed development. GosNIORKH was the first to develop starter feeds for coregonids and common carp, which allowed their rearing in intensive conditions. Currently, the lack of quality starter feeds for pike-perch fry slows down the introduction of this species into aquaculture. GosNIORKH suggests a programme for development of artificial starter feeds for pike-perch larvae.

3. Status of the research programme:

a) Preparatory stage: analysis of literature sources;
b) Initial stage: development of feed recipes;
c) Working stage: experiments on rearing pike-perch fry in tanks and other facilities exclusively on artificial feeds.

4. Sources of financing: From 1996, research on elaboration and development of the intensive technology of pike-perch fry nursing has been discontinued due to the lack of financing. In 2007, financing of GosNIORKH for performing research in the proposed programme should amount to 2300 thousand RUB (65.7 thousand euro).

5. Participating partners: Members of the Subgroup on intensive pike-perch rearing and the Russian institute KaspNIIRKH can be involved in the implementation of the programme.

6. Publications or relevant information:

Korolev A. E. 1984. Energetical balance and feeding rates of pike-perch and peled fry during their joint rearing in ponds (Энергетический баланс и рационы молоди судака и пеляди при их совместном выращивании в пруду) // Sb. Nauch. Tr. GosNII Oz. i Rech. Ryb. Kh-va. Issue 222. Pp. 21-30.

Korolev A. E., Tereshenkov I. I. 1985. Incubation of pike-perch eggs in trays (Инкубация икры судака в лотках) // Rybnoe khozyaystvo. № 7. Pp. 31-32.

Korolev A. E., Tereshenkov I. I. 1986. Biotechnology of pike-perch egg incubation (Биотехника инкубации икры судака) // Sb. Nauch. Tr. GosNII Oz. i Rech. Ryb. Kh-va. Issue 221. Pp. 17-19.

Korolev A.E. 1989. Evaluation of the biomeliorative role of two-year-old pike-perch (on the example of Lake Gusinoe) (Оценка биомелиоративной роли двухлеток судака (на примере оз.Гусиного)) // Sb. Nauch. Tr. GosNII Oz. i Rech. Ryb. Kh-va. Vol. 292. Pp. 51-59.

Korolev A. E., Tereshenkov I. I. 1995. How to get pike-perch eggs and larvae earlier (Как получить икру и личинок судака в ранние сроки) // Rybovodstvo i rybolovstvo. № 1. Pp. 11-12.

Korolev A. E., Tereshenkov I. I. 1996. Obtaining eggs from pike-perch breeders with inflated swimbladder (Получение икры от производителей судака с раздутым плавательным пузырём) // Rybovodstvo i rybolovstvo. № 2. P. 19.

Korolev A. E., Baranova L. P. 1998. On the diel rhythm of feeding of fry of pike-perch *Stizostedion lucioperca* (L.) (Percidae) (О суточном ритме питания молоди судака *Stizostedion lucioperca* (L.) (Percidae)) // Voprosy ikhtiologii. Vol. 38. № 6. Pp. 818-824.

Korolev A. E. 1998. Unfavourable consequences of films appearing on the water surface from artificial feeds and methods for their removal in intensive pike-perch fry rearing (Неблагоприятные последствия возникновения на поверхности воды пленки кормов и способы их устранения при индустриальном подращивании личинок судака) // Mat. Mezhdunar. Simpoziuma “Itogi tridtsatiletnego razvitiya rybovodstva na teplykh vodakh i perspektivy na XXI vek”. Pp. 196-200.

Korolev A. E. 1999. Biological characteristics of pike-perch (*Stizostedion lucioperca* (L.)) on early stages of its ontogenesis (Биологические особенности судака (*Stizostedion lucioperca* (L.) на ранних этапах онтогенеза) // Izdat. GOSNIORKH. 34 p.

Korolev A. E., Tereshenkov I. I. 2000. The problem of inflating of the visceral cavity of fishes and a method for its treatment (Проблема вздутия брюшной полости у рыб и метод

ee устранения) // Sbornik tezisov na nauchno-tekhnicheskom simpoziume “Sovremennye sredstva vosproizvodstva i ispol’zovaniya vodnykh bioresursov”. Vol. 4. Pp. 88-91.

Korolev A. E. 2000. Biological bases of obtaining viable pike-perch fry (Биологические основы получения жизнестойкой молоди судака) // Avtoref. kandid. dis., 24 p.

Korolev A. E. 2005. Experiences of applying artificial feeds in pike-perch larvae nursing (Опыт применения искусственных кормов при подращивании личинок судака) // Sb. Nauch. Tr. GosNII Oz. i Rech. Ryb. Kh-va., 2005, Issue 333, Pp. 287-316.

Tereshenkov I. I., Korolev A. E. 1997. Methodological recommendations on rearing viable pike-perch fry (Методические рекомендации по выращиванию жизнестойкой молоди судака) // Izdat. GosNIORKH. L. 28 p.

7. Information on scientific and technical work on the same species in other institutes of the country: In Russian Federation, technology development in this field of aquaculture is done only in GosNIORKH and KaspNIIRKH. Currently, the specialists of KaspNIIRKH (Astrakhan) develop starter feeds for pike-perch fry and evaluate their effect on fry growth and metabolism. A number of feed recipes were proposed that resulted in quite high pike-perch fry survival rates from weaned larvae. The main results of the studies of KaspNIIRKH are summarized in the works of M. V. Mikhaylova and E. A. Gamygin.

8. Comments and suggestions: In our opinion, one of the weaknesses of the experiments done in KaspNIIRKH is the presence of zooplankton in the water entering the tanks, which reduces the reliability of the obtained results. A methodology of rearing pike-perch fry from larvae exclusively on artificial feeds (without using live organisms) should be developed.

9. Contact person: Ivanov Dmitriy Ivanovich, director of GosNIORKH (e-mail: niorkh@mail.lanck.net)

2. Culture of coregonids

Lead Center: GOSNIORH, Russian Federation
Partner institutions: IGC, Belarus; Gosrybtsentr, Russian Federation; IRS, Poland

1. Coregonid species:

Ladoga lake coregonids:
Common whitefish, lake form (*Coregonus lavaretus lavaretus* Linnaeus)
Common whitefish, migratory form (*Coregonus lavaretus baeri* Kessler)
Humpback whitefish (*Coregonus lavaretus pidschian* (Gmelin)
Peled (*Coregonus peled* Gmelin)
Muksun (*Coregonus muksun* Pallas)
Broad whitefish (*Coregonus nasus* Pallas)
Inconnu (*Stenodus leucichthys nelma* Pallas)
Arctic cisco (*Coregonus autumnalis* Pallas)

2. In case of non-indigenous species, status of introduction: Coregonids are indigenous on all territory of Russian Federation. In the 1920s, extensive work was done on acclimatization of Siberian coregonids (peled, broad whitefish, muksun) in waters of the European part of Russian Federation. In many water bodies broodstocks of peled were established or its natural spawning was observed.

3. Brief description of the scientific and technical programme: GosNIORKH was the first to develop the biotechnology of full-system rearing of different coregonid species in intensive conditions. GosNIORKH has highly qualified specialists in the field of artificial feed development, which has allowed to organize the entire process of coregonid rearing from

larvae to breeders based on artificial feeds. Currently, introduction of this method into practice has been limited by the lack of stocking material, which is related to the difficulty of catching breeders in spawning areas and the overall decrease of the natural coregonid populations. Establishment of full-system coregonid farms based on intensive technologies allows to efficiently solve these problems.

For introduction of new cultured species – inconnu, Arctic cisco, humpback whitefish – it is indispensable to perform wide-range research on development of biotechnologies of their rearing in intensive conditions. In connection with this, GosNIORKH proposes the following research programme on development of modern biotechnologies of coregonid rearing in intensive conditions.

4. Status of the research programme:

a) Preparatory stage (2 years):

- selection of promising coregonid species for rearing in tanks and cages;
- selection of research grounds based on existing farms, adapting the bases to needs of experimental work;
- obtaining and incubation of eggs, obtaining free embryos.

b) Initial stage (3 years):

- experimental work on rearing coregonids in tanks and cages to market weight;
- study of the growth rate and feeding requirements of coregonids under intensive conditions;
- development of the main elements of biotechnology for each coregonid species: stocking densities, feeding regimes and rates, conditions of keeping in tanks and cages;
- development of recipes of artificial feeds for coregonids taking into consideration the food requirements of fish of different age;
- study of the effect of rearing conditions on morphological indices and physiological status of coregonids;
- preparation of preliminary guidelines for market rearing of new cultured species in intensive conditions.

c). Working stage (3 years):

- fine-tuning and perfecting of the biotechnologies of intensive coregonid rearing developed in the initial stage;
- performing experimental work on establishing coregonid broodstocks in tanks and cages in order to develop guidelines for full-system intensive coregonid farms:
- study of the growth rate, food requirements, variability of morphological traits and physiological condition of the coregonid broodstock in intensive conditions using morpho-ecological, physiological, biochemical and histological study methods;
- development of the basic elements of industrial biotechnology of broodstock establishment for each coregonid species, including guidelines for stocking densities, feeding, conditions of keeping, mass and correction sorting and obtaining mature sexual products;
- development of artificial feed recipes and feeding regimes for coregonid breeders taking into consideration their feeding requirements;
- evaluation of the quality of sexual products obtained from coregonid breeders reared under intensive conditions exclusively on artificial feeds;
- preparation of guidelines for rearing coregonids in full-cycle intensive fish farms.

5. Source of financing: Until 2002, research work on elaboration and development of the industrial technology of coregonid farming was financed by the Rosrybkhoz Association. Financing of the research on development of the biotechnology of establishment of peled broodstocks was 1500 thousand RUB (~43 thousand euros) in 2002. From 2003, targeted financing of research has been finished, work has been done in an initiative-based regime.

In 2007, financing of GosNIORKH for performing research in the proposed programme should amount to 4 200 thousand RUB (120 thousand euros), or, taking into consideration the participating partners, about 300 thousand euros.

6. Participating partners: Partner institutes of the Subgroup on coregonid farming can be involved in the implementation of the programme: IGC (Belarus), Gosrybtsentr (Russian Federation), IRS (Poland), and the Russian institute VNIIR (Moscow Province).

7. Publications or relevant information:

Title	Printed pages	Publication
1. Effect of different artificial feeds on growth and development of the larvae of broad whitefish *Coregonus nasus* (Pallas) Salmonidae (Влияние разных искусственных кормов на рост и развитие личинок чира *Coregonus nasus* (Pallas) Salmonidae). (Knyazeva L. M., Ostroumova I. N., Bogdanova L. S.)	0.4	Vopr. ikhtiologii, Vol. 24, Issue 1, 1984
2. Commercial rearing of coregonid fry in tanks and cages on artificial feeds (Промышленное выращивание молоди сиговых в бассейнах и садках на искусственных кормах). (Knyazeva L. M., Kostyunichev V. V., Shumilina A. K., Korenev A. M.)	0.4	Rybnoe khoz-vo, № 7, 1987
3. Results and perspectives of raising and feeding of coregonids in intensive fish farming conditions (Итоги и перспективы выращивания и кормления сиговых рыб в условиях индустриального рыбоводства). (Knyazeva L. M.)	0.5	Sb. Nauch. Tr. GosNIORKH, Issue 275, 1988
4. Changes in morpho-physiological indices of peled fry depending on its age and rearing conditions (Изменение морфофизиологических показателей молоди пеляди в зависимости от возраста и условий выращивания). (Shumilina A. K.)	0.5	Sb. Nauch. Tr. GosNIORKH, Issue 266, 1987
5. Technology of coregonid rearing on artificial feeds (Технология выращивания сиговых на искусственных кормах). (Knyazeva L. M., Kostyunichev V. V.)	0.2	Ekspress-inform. Series: rybokhoz. ispol'z. vnutr. vodoemov. Otechestv. Opyt. Issue 3, M., 1989
6. Physiological-biochemical characteristics of peled fry reared on artificial feeds (Физиолого-биохимическая характеристика молоди пеляди, выращиваемой на искусственных кормах). (Shumilina A. K., Antonova R. S.)	0.3	Sb. Nauch. Tr. GosNIORKH, Issue 275, 1989
7. Peculiarities of growth of coregonid fish during rearing on artificial feed ponds. (Knyazeva L. M.)	0.1	International Symposium on biology and management of coregonid fishes. Quebec, Canada, 19-23 August 1990
8. Methodological recommendations on the biotechnology of industrial rearind of coregonid stocking material (Методические рекомендации по биотехнике индустриального выращивания рыбопосадочного материала сиговых). (Knyazeva L. M., Kostyunichev V. V.).	2.0	Izd. GosNIORKH, L., 1991

Title	Printed pages	Publication
9. Hatching and rearing of large numbers of coregonid young with heated water. (Knyazeva L. M., Kostyunichev V. V., Ernandes S. A.)	0.1	International Symposium on biology and management of coregonid fishes. Olsztyn, Poland, 22-27 August 1993
10. Methodological recommendations on calculation of the basic fish culture indices of coregonid rearing with intensive methods (Методические рекомендации по расчету основных рыбоводных показателей выращивания сиговых рыб индустриальным способом). (Knyazeva L. M., Kostyunichev V. V., Baranova V. P.)	1.5	Izd. GosNIORKH, L., 1995
11. Outrup of commercial whitefish in conditions of cage farming using man-made feeds. (Kostyunichev V. V., Knyazeva L. M.)	0.1	International Symposium on biology and management of coregonid fishes. Constance, Germany, 1996, 23-28.09
12. Dynamics of the variability and correlative relationships of the morphological traits of coregonids in intensive rearing conditions (Динамика изменчивости и корреляционные связи морфологических признаков сиговых рыб при выращивании в индустриальных условиях). (Knyazeva L. M., Kostyunichev V. V., Shumilina A. K., Vinnikova A. Ya.)	1.2	Sb. Nauch. Tr. GosNIORKH, Issue 324, 1997
13. Results and perspectives of the development of intensive coregonid farming (Результаты и перспективы развития индустриального сиговодства). (Kostyunichev V. V.)	0.3	Sb. Nauch. Tr. GosNIORKH, Issue 325, 1997
14. Incubation of eggs and obtaining early larvae of coregonids in warm effluent waters (Инкубация икры и получение ранних личинок сиговых в условиях сбросных теплых вод). (Kostyunichev V. V.)	1.5	Sb. Nauch. Tr. GosNIORKH, Issue 325, 1997
15. Biotechnology of market coregonid rearing under intensive conditions (Биотехника выращивания товарных сигов в индустриальных условиях). (Kostyunichev V. V., Knyazeva L. M., Shumilina A. K.)	0.2	Rybovodstvo i rybolovstvo, № 2, 1998
16. Methodological recommendations on growing market coregonids (broad whitefish, muksun) under intensive conditions. (Методические рекомендации по выращиванию товарных сигов (чир, муксун) в индустриальных условиях). (Kostyunichev V. V., Knyazeva L. M., Shumilina A. K.)	1.5	Izd. GosNIORKH, L., 1998
17. Status and perspectives of intensive coregonid farming (Состояние и перспективы индустриального сиговодства). (Kostyunichev V. V., Knyazeva L. M.)	0.2	Rybovodstvo i rybolovstvo, № 2. 2000
18. Establishing coregonid broodstocks in intensive conditions (Формирование ремонтно-маточных стад сиговых в индустриальных условиях). (Kostyunichev V. V., Knyazeva L. M., Shumilina A. K.)	0.2	Rybovodstvo i rybolovstvo, № 4, 2000

Title	Printed pages	Publication
19. Methodological recommendations on rearing and establishing broodstocks of coregonids (peled, broad whitefish, muksun) in intensive conditions on artificial feeds. (Методические рекомендации по выращиванию и формированию ремонтно-маточных стад сиговых (пелядь, чир, муксун) в индустриальных условиях на искусственных кормах) (Kostyunichev V. V., Knyazeva L. M., Shumilina A. K.)	1.75	Izd. GosNIORKH St-Petersburg, 2001
20. Rearing and establishment of broodstocks of coregonids under a new technology (Выращивание и формирование маточных стад сиговых по новой технологии) (Kostyunichev V. V., Knyazeva L. M.)	0.2	Tez. dokl. nauch. prakt. konf. "Biologiya, biotekhnika razvedeniya i promyshlennogo vyrashchivaniya sigovykh ryb". Tyumen', 2001
21. Investigations of growth and external characteristics of coregonids during rearing with artificial feeding. (Kostyunichev V. V., Knyazeva L. M.)	0.1	International Symposium on the Biology and Management of Coregonid. Fishes. Rovaniemi, Finland, 26-29.08. 2002, VIII. Poster 26
22. Problems of aquaculture development in Leningrad Province (Проблемы развития аквакультуры в Ленинградской обл). (Kostyunichev V. V., Popov N. V.)	0.4	Agroinform, Issue 30, № 1, 2002. St-Petersburg. JSC „Triconsult"
23. Early gametogenesis of Volkhov whitefish, *Coregonus lavaretus baeri*. (Bogdanova V. A.)	0.2	Ann. Zool. Fennici. 2004. 41.
24. Technology of rearing and establishment of broodstocks of coregonids in intensive conditions (Технология выращивания и формирования маточных стад сиговых в индустриальных условиях). (Kostyunichev V. V.)	0.9	Sb. Nauchn. Tr. FGNU GosNIORKH. Issue 333, 2005.
25. Early gametogenesis of Volkhov whitefish (*Coregonus lavaretus baeri* Kessler) (Bogdanova V. A.)	0.3	Finnish Zoological and Botanical Publishing Board, 2003
26. Physiological condition of the broodstocks of peled and muksun during rearing in intensive conditions (Физиологическое состояние ремонта и производителей пеляди и муксуна при выращивании в индустриальных условиях). (Shumilina A. K., Koz'mina A. V., Kostyunichev V. V.)	0.9	Sb. Nauchn. Tr. FGNU GosNIORKH. Issue 333, 2005
27. Fisheries biological characteristics of the broodstock of coregonids reared in cages on artificial feeds (Рыбоводно-биологическая характеристика ремонта и производителей сиговых рыб, выращиваемых в садках на искусственных кормах). (Knyazeva L. M., Kostyunichev V. V.).	1.5	Sb. Nauchn. Tr. FGNU GosNIORKH. Issue 333, 2005
28. Rearing and evaluation of the pedigree stock for establishment of a broodstock of Volkhov whitefish using intensive technology (Выращивание и оценка племенного материала для формирования маточного стада волховского сига по индустриальной технологии). (Kostyunichev V. V., Knyazeva L. M.)	1.2	Sb. Nauchn. Tr. FGNU GosNIORKH. Issue 333, 2005

Title	Printed pages	Publication
29. Experiences of stocking lakes with peled fingerlings raised on artificial feeds and establishment of broodstocks under intensive conditions (Опыт зарыбления озер подрощенной на искусственных кормах молодью пеляди и формирование ее маточных стад в индустриальных условиях). (Kostyunichev V. V., Knyazeva L. M., Shumilina A. K.)	0.7	Sb. Nauchn. Tr. FGNU GosNIORKH. Issue 333, 2005
30. Physiological characteristics of peled breeders reared under intensive conditions and their feeding requirements (Физиологическая характеристика производителей пеляди, выращиваемых в индустриальных условиях и их пищевые потребности) (Shumilina A. K.)	2.2	Sb. Nauchn. Tr. FGNU GosNIORKH. St-Petersburg 2005. Issue 333
31. Early gametogenesis of peled and muksun during rearing under intensive conditions (Ранний гаметогенез пеляди и муксуна при выращивании в индустриальных условиях) (Bogdanova V. A.)	0.8	Sb. Nauchn. Tr. FGNU GosNIORKH. Issue 333, 2005
32. Efficiency of including inorganic phosphates, different protein and astaxanthin sources into starter feeds for coregonids (Эффективность включения неорганических фосфатов, различных источников белка и астаксантина в стартовые корма для сиговых) (Ostroumova I. N., Shumilina A. K., Kostyunichev V. V., Smirnova E. N., Smirnova L. V., Koz'mina A. V.)	0.9	Sb. Nauchn. Tr. FGNU GosNIORKH. Issue 333, 2005
33. Morphological characters of the Volkhov whitefish reared in net cages using artificial feed. (Valeriy V. Kostyunichev, Lidiya M. Knyazeva, Dmitriy A. Panin)	0.1	International Symposium of the Biology and Management of Coregonid Fishes. IX Olsztyn IX Poland. 21-27 August 2005. Poster 63
34. Reproduction of the Volkhov Whitefish (*Coregonus lavaretus baeri*) in aquaculture. (Bogdanova V. A., Kostyunichev V. V., Shumilina F. K., Kaidanova Y. T., Yakubez T. G.)	0.1	International Symposium of the Biology and Management of Coregonid Fishes. IX Olsztyn IX Poland. 21-27 August 2005. Poster 63
35. Methodological directions on market rearing of trout and coregonids in cages under a natural temperature regime (Методические указания по товарному выращиванию форели и сиговых рыб в садках при естественном температурном режиме) (Kostyunichev V. V., Shumilina A. K., Knyazeva L. M.)	1.3	Izd. GosNIORKH, St-Petersburg, 2005

8. Information on scientific and technical work on the same species in other institutes of the country: The necessity to develop new technologies of coregonid rearing arose in connection with the depletion of their stocks in natural waters, lack of stocking material both for reproduction and market and capture-based fisheries. One of the difficult obstacles to commercial rearing of coregonids is the low quantity of zooplankton in water bodies in early spring, the period of stocking with coregonid larvae, which leads to significant larval mortality when shifting to exogenous feeding. The only possible solution to this problem was nursing larvae in hatcheries.

The first experiments on rearing coregonids in floating cages installed in reservoirs were done in VNIIPRKH (Rybnoe, Moscow Province) in 1972. Fish were fed with zooplankton catched in the water body or attracted in the dark hours by electric light. This method did not spread widely because of the difficulty of providing live food to the fry. The results of rearing in cages with artificial light are unstable and depend on the density of zooplankton, which changes significantly in the water body, depending on the climatic conditions throughout the year and other factors. Catching food organisms in the lake is a labour-intensive and inefficient process. The application of high-protein granulated trout feeds for coregonid fry nursing by VNIIPRKH researchers (in 1975) did not produce satisfactory results.

In the beginning of the 1980s, research on development of the technology of intensive coregonid rearing was started in GosNIORKH. The experimental work was based on a principially new approach – nursing larvae and fry exclusively on formulated feeds. Special recipes of granulated feeds were developed for coregonics: LS-81 for larvae and MS-84 for fry. Application of starter feeds for nursing larvae allowed to increase the yield of first-year fish by two to five times and to half the quantity of stocking material required for stocking.

The biotechnology of producing stocking material of coregonids developed by GosNIORKH includes two variants of fry nursing on formulated feeds:

1. Fry nursing from larvae to fingerlings of 20 g in tanks and trays.
2. Fry nursing in trays and tanks up to a weight of 0.3–0.5 g with their subsequent stocking into net cages and rearing of fingerlings to a weight of 20 g in floating cages fixed on a ponton line in the lake.

Using the new technology, up to 3 million fry of different coregonid species weighing 10 to 28 g were produced by fish farms of Russian Federation.

In the 80s, simultaneously with GosNIORKH, work on fry nursing in tanks and cages was done in the All-Union Research Indtitute of Pond Fish Farming (VNIIPRKH), All-Union Research Institute of Irrigation (VNIIR) and the Krasnoyarsk Branch of VostsibrybNIIproekt.

In VNIIPRKH, as a result of experiments on coregonid rearing on the granulated feeds RGM-SS and RGM-3MS, a combined method was developed: until the end of the larval stage, fish are reared in tanks, then in net cages and in ponds and lakes. The weight of peled, when reared in tanks on the coregonid starter feed RGM-SS, reached 29.3 mg in 27 days, while the weight of Chud lake whitefish larvae – 35.3 mg at a temperature of 10-19^{o}C.

In VNIIR, a microcapsulated feed (MSK) was used for nursing larvae of peled and pelchir (hybrid of peled and broad whitefish). The recipe and technology of preparation of this feed was developed by VNIIR in collaboration with several research institutions. 40-litre plastic tubs were used for rearing. After 20 days (8 to 28 May) the weight of peled was 13.5 mg, while the weight of pelchir larvae reached 15.7 mg by the 16th day (1 to 16 May) at a temperature of 7.5 to 18^{o}C. The yield of larvae was the same, 60%.

At the Krasnoyarsk Branch of VostsibrybNIIproekt, fry of peled and *Coregonus migratorius* were nursed in 1988-1989 in tanks and cages on feeds LS-81 and MS-84 prepared according to recipes of GosNIORKH. Fry was nursed in tanks up to a weight of 30 to 50 mg, then were stocked into cages made of kapron mesh. The further fingerling rearing was done for a period of two months in net cages installed on Krasnoyarsk Reservoir. The weight of first-year peled fingerlings changed between 6.2 and 12.2 in different cages. The fingerlings of Arktic cisco reached a weight of 4.6 to 5.6 g. With this method, 2 064 thousand coregonid fingerlings were reared in two years. The fingerlings were released into the reservoir.

An important drawback of the methods proposed by VNIIPRKH and the Krasnoyarsk Branch is that nursing of larvae and young fry is done in cages made of kapron mesh that quickly gets overgrown and clogged and is difficult to clean. As a result, after a short time, the hydrochemical conditions become unfavourable for the larvae. It must be noted that none of the listed coregonid rearing methods became widely used in the industry for mass production of coregonids.

In the 90s, GosNIORKH developed feeds and guidelines for market rearing of coregonids that were tested in production. In Leningrad Province, over 10 mt of peled, broad whitefish and muksun with individual weight of 0.5–1.5 kg were reared on artificial feeds at the Forvat cage trout farm.

In other research institutions, work in the field of intensive fish farming has been stopped in these years due to the lack of financing.

Currently, a new technology of rearing and establishment of coregonid broodstocks in intensive conditions has been created, which is the most recent achievement of the Russian intensive aquaculture. The use of this method in fish farm practice solves the problems with guaranteed production of the necessary quantity of eggs for reproduction and obtaining of high-quality coregonid produce for the market.

In the cage farm on Sukhodol'skoe Lake, experimental broodstocks of the following size are kept on artificial feeds: 1 800 peled, 1 000 muksun, 200 broad whitefish. In addition, successful research is being done on creating a pedigree broodstock of Volkhov whitefish, a species included into the Red Data Book, the actual broodstock size of which is 2 000 fish. Annually, over 10 million eggs are obtained from breeders of different coregonid species and are used for reproduction purposes.

The new biotechnology of intensive coregonid breeding developed in GosNIORKH does not have analogues in the world practice. By request of SibrybNIIproekt (currently: Gosrybtsentr, Tyumen') the method was adapted to the conditions of Western Siberia. On the basis of this technology, the specialists of Gosrybtsentr are currently establishing broodstocks of peled, muksun, broad whitefish and inconnu on Volkovskaya Oxbow, Tobol'sk District, Tyumen' Province, for the seed supply of lake farms. The specialists of Gosrybtsentr managed to obtain eggs from live breeders of the river form of peled and tugun. In the fish farming practice of other countries, such results do not exist.

Since 2000, experimental work on domestication of „belorybitsa" (inconnu) by rearing breeders in controlled conditions has been done in the coldwater unit of Forelevyy Pedigree Farm, Stavropol Territory. Belorybitsa (a subspecies of inconnu living in the Caspian basin) – is the largest and, from a nutritional point of view, the most valuable coregonid fish that is on the verge of extinction in its natural range. Currently, a 1 000-head broodstock of inconnu, a species earlier considered impossible to rear in captivity, is being formed for the first time in the world at Forelevyy Pedigree Farm. In 2004, sexual products were obtained for the first time from spawning breeders. But, because of the poor quality of eggs and the high temperatures in the first days of incubation, the experiment had to be stopped. For 2005, it was planned to obtain no less than one million fertilized eggs of inconnu.

In 2005–2006, due to the lack of targeted financing, research on intensive coregonid farming has been done by the laboratory of market fish production of GosNIORKH in an initiative-based regime.

The main directions of research are:

- development of the biotechnology of market production in cages of the most promising species: Ladoga lake coregonids – the lake form and the Volkhov form; Siberian species – muksun, broad whitefish, peled;
- development of the biotechnology of broodstock rearing of these coregonid species in intensive conditions;
- collection and incubation of the eggs of coregonids;
- study of the variability of the morphological features of individual species during intensive rearing;
- evaluation of cage-reared coregonid breeders in the basis of reproductive indices;
- evaluation of the quality of sexual products oblained from breeders reared in intensive conditions;
- evaluation of the physiological condition of market coregonids and the breeders when feeding with artificial feeds.

The next stage of research at GosNIORKH includes selection work for improvement of broodstocks of coregonids kept in intensive conditions, development of full-value local extruded feeds for coregonids, which should contribute to the development of full-system intensive coregonid farms where the necessary amount of market coregonids could be reared for fulfilling the needs of the population.

In the near future, it would be necessary to work on establishing broodstocks of Ladoga lake and Gulf of Finland coregonids. By now, anthropogenic factors have led do depletion of coregonid populations of Lake Ladoga, some of which are already on the verge of extinction. In the first place, this applies to the Volkhov whitefish that was earlier the main commercial species while currently it is included in the Red Data Book of the Russian Federation. In the last decades, the populations of Svir' and Vuoksa river whitefish have decreased drastically, they have almost lost their commercial importance, the stocks of *Coregonus fera* are also reducing. Because of overfishing and the disturbance of the natural reproduction conditions, the coregonid populations of the Eastern Gulf of Finland have also lost their commercial importance.

Taking into consideration that most of the natural coregonid populations of Lake Ladoga and the Gulf of Finland are currently in a depressed state, establishment of coregonid broodstocks will have a great conservation value as such broodstocks function as genetic reserves or live collections, allowing to preserve unique gene pools. This is especially important for rare and endangered species and forms, as well as decreasing populations.

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3. Culture of black carp *Mylopharyngodon piceus*

Lead Center: VURH, Czech Republic; Contact scientist: Zdenek Adamek (adamek@ivb.cz)

Partner institutions: IFA, Bulgaria; IF, Belarus; IZASM, Moldova; GOSNIORKH; IF, Ukraine; Tekhrybvod, Ukraine.

- **Information from the Research Institute for Fish Culture and Hydrobiology (VURH), Czech Republic**

VURH is the only research institute in the Czech Republic where research work is carried out with black carp. The research program is focussing on the followings:

(1) growth and survival rates evaluation under climatic conditions of southern Moravia (Czech Republic) with respect to available food resources,
(2) black carp ability to ingest snails of different species, shell thickness and size in comparison with native (common carp, *Cyprinus carpio*) and invasive (topmouth gudgeon, *Pseudorasbora parva*) fish species
(3) food habits of mature black carp in reservoirs (IFA Bulgaria)

The program is financed by VURH, and one NACEE institution, IFA, Bulgaria is involved in the experimental works. The plan for next year is to continue studies on black carp food habits both under experimental (Czech Republic) and natural conditions (Bulgaria).

Publications:

Adámek Z., 1998: Amur černý - *Mylopharyngodon piceus* (Richardson, 1845). Přehled. [Black carp - Mylopharyngodon piceus (Richardson, 1845). A review]. Bul. VÚRH, 34(1):16-24 (in Czech)

Adámek Z., 2003: Size selective predation by black carp (Mylopharyngodon piceus) on water snail Planorbarius sp.: Laboratory studies. In: Beyond Monoculture, Aquaculture Europe 2003, Trondheim, EAS Spec.Publ. 33:99-100.

4. Crayfish culture

Lead Center: IFA, Bulgaria
Partner institutions: VURH, Czech R.; HAKI, Hungary; GOSNIORKH, Russian Federation; IRS, Poland; IF, Ukraine; Tekhrybvod, Ukraine.

- **Information from Institute of Fisheries and Aquaculture, Varna, Bulgaria**

The table below gives a good overview on the ongoing research works with crayfish in the partner institutions and provide information regarding possible future collaboration.

	IFA, Bulgaria	**VURH, Czech R.**	**IRS, Poland**	**HAKI, Hungary**
Institutions	Institute of Fisheries and Aquaculture Varna (IFA), Freshwater Fisheries Branch, Bulgaria	University of South Bohemia, Research Institute of Fish Culture and Hydrobiology (VURH) Vodnany, Czech Republic	The Stanislaw Sakowicz Inland Fisheries Institute in Olsztyn, Poland	Research Institute for Fisheries, Aquaculture and Irrigation (HAKI); Szarvas, Hungary
Crayfish contact persons	Angel Zaikov, azaikov@yahoo.com	Zdenek Adamek, adamek@ivb.cz Pavel Kozak	Dr Dariusz Ulikowski 11-610 Pozezdrze, Pieczarki 50, POLAND Tel. +48 (89) 428 36 66; e-mail: ulikowski@infish.com.pl	Réka Hegedűs, hegedusr@haki.hu

	IFA, Bulgaria	VURH, Czech R.	IRS, Poland	HAKI, Hungary
Native crayfish species in the country	*Astacus astacus, Astacus leptodactylus, Astropotamobius torentium*	*Astacus astacus, Astropotamobius torentium*	*Astacus astacus L., Astacus leptodactylus Esch.*	*Astacus astacus; Astacus leptodactylus; Austropotamobius torrentium)*
Alien crayfish species in the country	No alien crayfish	*Actacus leptodactylus, Orconectes limosus, Pacifastacus leniusculus*	*Pacifastacus leniusculus Dana, Orconectes limosus Raf.*	*Orconectes limosus; Pacifastacus leniusculus*
Species of main interest	*Astacus astacus, Astacus leptodactylus, Astropotamobius torentium*	*Astacus astacus, Astropotamobius torentium, Actacus leptodactylus, Orconectes limosus, Pacifastacus leniusculus*	All of this species, but especially native crayfish yet	*Astacus astacus; Astacus leptodactylus*
Field of interest of the institution	Culture, reproduction, monitoring, feeds and feeding, investigation of natural populations	Culture, reproduction, monitoring, feeds and feeding, investigation of natural populations, physiology	Improve culture, reproduction, feeds and feeding, monitoring and investigation of natural populations	Investigation of natural populations
Running projects	No project with crayfish is running presently. Last project: Reproduction of *Astacus leptodactylus* and its rearing up to summerlings .	Study of alien spiny cheek crayfish *O.limosus* Raf. biology under laboratory conditions (2003-2006, Pavel Kozák) Population ecology of terminal and residential sub-populations of invasive crayfish (2003-2005, Pavel Kozák) Development of new technologies of rearing commercially important riverine species of fish and crayfish endangered by environment degradation (2003-2007, Pavel Kozák)	Shortening of the animal life cycle for an example of native narrow-clawed crayfish (*Astacus leptodactylus* Esch.).	Investigations on natural populations of noble crayfish (*A. astacus*)
Next year funded Projects	No	Yes	Yes	No

Based on a survey by questionnaire, institutions of the sub-group confirm their interest to continue research with crayfish in the following topics: reproduction, monitoring, feeds and feeding, investigation of natural populations, physiology. Species of main interest for culture are *Astacus astacus* and *Astacus leptodactylus.* Institutions also expressed their interest in the exchange of publications.

ANNEX 8.2

REPORT OF THE AD HOC MEETING OF THE "HIGH VALUE AND NEW SPECIES" WORKING GROUP

Representatives of the following institutions attended the ad-hoc meeting:

- Institute of Zoology of the Academy of Sciences of Moldova (IZASM), Chişinau, Moldova
- Institute of Fisheries and Aquaculture, Branch of Freshwater Fisheries (IFA), Plovdiv, Bulgaria;
- Research Institute for Fisheries, Aquaculture and Irrigation (HAKI), Szarvas, Hungary;
- Latvian Crayfish and Fish Farmers'Association, Riga, Latvia;
- Department of Aquaculture, Estonian University of Life Sciences, Tartu, Estonia;
- State Research Institute on Lake and River Fisheries (GOSNIORKH), St-Petersburg, Russian Federation;
- State Scientific and Production Center for Fisheries (GOSRYBTSENTR), Tyumen, Russian Federation;
- Federal Research Institute for Fisheries and Oceanography (VNIRO), Moscow, Russian Federation.

Main conclusions of the meeting are summarised in the following:

Pike, pike perch, perch

Experimental work with **pike** is carried out in Bulgaria and Hungary (Keszthely University/Aranyponty Fish Farm), however, no collaboration has been established so far between the Bulgarian and Hungarian research groups. HAKI will assist the establishment of collaboration between relevant parties.

Collaboration in the development of **pike perch-**rearing technologies between HAKI, Hungary and IFI, Poland will continue in 2007. HAKI will assist exhange of information between GOSNIORKH, Russian Federation, the Estonian University of Life Sciences and HAKI, Hungary. There is a growing interest in the intensive production technology of pikeperch on formulated feed. HAKI got good results on this area in the frame of an EU financed, so-called CRAFT Project, however, the results are owned by the SMEs involved in the project. HAKI will check the possibility of collaboration with these SMEs. GOSNIORKH provided information in electronic form to HAKI during the Directors' Meeting in Dubrovnik, which will be shared with interested parties.

Astrakhan Technical University offered that results on the experiments with **European perch** would be sent to HAKI for further distribution.

Crayfish

Experiments with crayfish (*Astacus leptodactylus and Astacus astacus*) have been carried out in several NACEE institutes (IFA, Bulgaria; GOSHIORKH, Russian Federation; GOSRYBTSENTR Russian Federation; Latvia; Estonia; HAKI, Hungary) aiming at the production of market crayfish (e.g. for restaurants at the Black Sea) and also at restocking (e.g. reservoirs in Siberia and River Volga). It was decided that the valuable results and experiences would be published in a magazine/journal in English with the provisional title "Status and trends of crayfish culture in Central and Eastern Europe". Collaborating parties will submit their contributions to IFA, Bulgaria by 14 October 2006. IFA and HAKI will edit

and finalise the paper and seek for a journal for publication (e.g. EAS or EUROFISH Magazine).

Coregonids

Experimental work with coregonids continued in the past period in a collaboration between GOSNIORKH and GOSRYBTSENTR. Results of the R&D work have already been utilised in the practice. In the St-Petersburg area, 10 tonnes, in the Tyumen area, 30 tonnes of coregonids were produced last year. International collaboration has also started with Norway and also with Asian countries (China and Vietnam). A comprehensive review paper has been elaborated by the collaborating institutions. NACEE may assist the translation of the review into English and its publication in a magazine/journal but it may also be published as a special FAO-NACEE publication.

Black carp

Experimental work with black carp will continue in 2007 in a collaboration between IFA, Bulgaria and VURH, Czech Republic.

Saltwater species

There is an emerging interest in marine and saltwater species (e.g. mullets, and in particular, so-iuy mullet, *Mugil soiuy*) in IZASM, Moldova and VNIRO, Russian Federation. IZASM collaborates with the Ukrainian „Odessarybvod", wherefrom they received larvae of so-iuy mullet. There have been promising experiments with this species in Moldova. In a reservoir with 3 ppt salt content market size fish were successfully reared. Moldova is ready to widen the collaboration on this species and ask NACEE to explore partnership and to provide information. Work with saltwater species is proposed to be integrated into the activity of a newly established WG on Marine Aquaculture.

It was also decided that the short reports submitted by various institutions on the R&D work with pike, pike-perch, black carp, coregonids and crayfish would be put on the NACEE website.