CONVENTION SUR LE COMMERCE INTERNATIONAL DES ESPECES
DE FAUNE ET DE FLORE SAUVAGES MENACEES D'EXTINCTION

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Genève (Suisse), 20 – 24 avril 2009

Esturgeons et polyodons

RAPPORT DU SECRETARIAT

1. Le présent document a été préparé par le Secrétariat.

2. La résolution Conf. 12.7 (Rev. CoP14), *Conservation et commerce des esturgeons et des polyodons*, demande au Secrétariat de soumettre à chaque session du Comité pour les animaux un rapport écrit, sur ses activités relatives à la conservation et au commerce des esturgeons et des polyodons, avec des références aux documents pertinents. Le présent document est son deuxième rapport; il couvre la période allant d'avril 2008 à janvier 2009. Une mise à jour orale sera faite au sujet des activités entreprises depuis le 1er février 2009, date à laquelle le document a été préparé.

Quotas d'exportation

3. Concernant les quotas d'exportation des stocks partagés du fleuve Amour/Heilongjiang pour l'année de quota allant du 1er mars 2008 au 28 février 2009, le Secrétariat a reçu, le 29 décembre 2007, le détail des quotas de prises et des quotas d'exportation de chair et de caviar proposés par la Chine et la Fédération de Russie, ainsi que les données scientifiques utilisées pour établir ces quotas.

4. Après avoir résolu un certain nombre de points techniques avec les pays concernés, le Secrétariat a publié les quotas sur le site web de la CITES le 22 mai 2008, ainsi que certains quotas d'exportation volontaires établis par la Chine pour le caviar d'aquaculture.

5. Concernant les quotas d'exportation pour l'année de quota allant du 1er mars 2008 au 28 février 2009 pour les stocks partagés de la mer Caspienne, à la demande des pays concernés, le Secrétariat a publié sur le site web de la CITES, le 22 mai 2008, une clarification au sujet des quotas d'exportation du Kazakhstan et de la Fédération de Russie, précisant le volume de caviar que ces deux pays exportent au nom du Turkménistan.

6. S'étant assuré qu'il n'existait pas d'accord entre les pays concernés au sujet des quotas d'exportation de chair d'esturgeon, le Secrétariat a publié sur le site web de la CITES, le 23 juillet 2008, un quota d'exportation zéro pour la chair d'esturgeon pour tous ces pays.

7. Au moment de la rédaction du présent rapport (1er février 2009), le Secrétariat n'avait pas reçu de propositions de quotas d'exportation pour le caviar et la chair d'esturgeon pour l'année de quota allant du 1er mars 2009 au 28 février 2010 respectant les obligations découlant de la résolution Conf. 12.7 (Rev. CoP14).

Renforcement des capacités et évaluation des méthodologies utilisées pour l'évaluation et le suivi des stocks partagés

8. Pour aider les Etats des aires de répartition à définir une stratégie incluant des plans d'action pour la conservation des Acipenseriformes, et pour aider le Comité pour les animaux à évaluer les méthodologies utilisées pour l'évaluation et le suivi des stocks d'Acipenseriformes partagés, le Secrétariat a pris contact avec la Banque mondiale et l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO). La FAO a un projet de programme de coopération technique intitulé "Renforcement des capacités pour le rétablissement et la gestion des pêcheries d'esturgeons de la mer Caspienne" d'un montant de 380.000 USD et la Banque mondiale a mis en place un projet intitulé "La gestion des pêcheries de la mer Caspienne" avec un budget planifié de 990.000 USD.

9. Les deux organisations ont accueilli à Rome du 28 au 30 avril 2008, un premier atelier technique sur les pêcheries de la mer Caspienne avec les Etats des aires de répartition. Le Secrétariat y a participé, en particulier pour promouvoir la tenue d'un atelier pour examiner la méthodologie utilisée pour déterminer l'évaluation des stocks d'esturgeons et le total de prises autorisées (TAC), et pour définir une méthodologie scientifique acceptable au plan international, s'appuyant sur la méthodologie utilisée par la FAO pour examiner le stock de la mer Caspienne. Le Comité pour les animaux avait proposé la tenue d'un tel atelier à sa 23e session (Genève, avril 2008).

10. Lors de l'atelier technique sur les pêcheries de la mer Caspienne, les participants se sont accordés sur un mode de fonctionnement pour l'atelier demandé sur l'évaluation des stocks et les méthodologies utilisées pour déterminer l'évaluation des stocks et le TAC. L'atelier a eu lieu à Rome du 11 au 13 novembre 2008 avec la participation d'un représentant du Comité pour les animaux et est évoqué dans le document AC24 Doc. 12.2. Les participants ont notamment décidé de tenir d'autres réunions axées sur les écloseries, la lutte conte la pêche illégale et le commerce international illégal, et d'appuyer l'élaboration de normes pour les tests génétiques applicables aux produits d'esturgeons – normes susceptibles d'être utilisées pour réglementer le commerce intérieur et international de caviar et pour définir les unités biologiques pour la gestion des pêcheries.

11. Concernant l'évaluation par le Comité pour les animaux des méthodologies utilisées pour l'évaluation et le suivi des stocks d'Acipenseriformes partagés autres que ceux de la mer Caspienne, le Secrétariat a reçu des informations sur les stocks partagés de la mer d'Azov et du fleuve Amour/Heilongjiang. Pour la mer d'Azov, la Commission Ukraine/Russie sur les pêcheries de la mer d'Azov (Berdiansk, Ukraine, 22-24 octobre 2008) s'est accordée à sa 20e session sur une "technique globale d'évaluation des stocks et de détermination du TAC pour les espèces d'esturgeons de la mer d'Azov", jointe dans l'annexe au présent document dans la langue dans laquelle elle a été soumise. Concernant le fleuve Amour/Heilongjiang, une réunion de spécialistes mandatée par la 18e session du Comité des pêches mixte Chine/Russie (Moscou, Fédération de Russie, 15-19 septembre 2008), a eu lieu à Harbin (Chine, 18-20 novembre 2008) et a convenu que l'approche à l'évaluation présentée dans l'annexe 2 du document AC23 Doc. 13.2 (Rev. 1) s'appliquait encore et que cette méthodologie serait confirmée à la conférence Chine/Russie sur la pêche prévue en mars 2009. Pour le stock partagé du nord-ouest de la mer Noire et du cours inférieur du Danube, le Secrétariat a reçu aucune autre information que celles incluses dans l'annexe 3 du document AC23 Doc.13.2 (Rev.1).

12. A sa 23e session, le Comité a recommandé que l'évaluation des méthodologies utilisées pour l'évaluation et le suivi des stocks d'Acipenseriformes partagés mentionnés ci-dessus au point 10 soit examinée comme cela avait été fait pour l'évaluation relative à la mer Caspienne (si possible par la FAO), et que le Secrétariat promeuve la tenue d'un atelier pour examiner la méthodologie utilisée pour déterminer l'évaluation des stocks d'esturgeons et le TAC et pour définir une méthodologie scientifique acceptable au plan international. Le Secrétariat s'y emploiera mais il note que la responsabilité de cette évaluation incombe au Comité pour les animaux et que la Conférence des Parties n'a pas prévu de trouver des fonds externes à cette fin.

Contrôle du commerce

13. Le PNUE-WCMC continue de gérer la base de données sur le commerce du caviar et le Secrétariat note avec plaisir que la soumission de copies de permis et de certificats a semblé s'améliorer ces

derniers mois. Il est essentiel que les Parties soumettent les documents à temps pour que cette base de données soit efficace.

14. L'aquaculture est une source de caviar toujours plus importante pour les marchés internationaux, aussi le Secrétariat continue-t-il d'encourager les autorités nationales à suivre ces établissements de près. Il a profité de l'opportunité offerte par une mission en Arabie saoudite en novembre 2008 pour inspecter un établissement qui venait d'y être créé.

15. Il ne fait pas de doute que le commerce illégal de caviar, bien qu'apparemment moins actif qu'au début de cette décennie, se poursuit; le Secrétariat communique tous les renseignements qu'il reçoit à ce sujet. L'alerte n° 33, émise en janvier 2009, porte sur une forme spécifique de commerce illégal de caviar.

Conclusion

16. Le Comité est invité à prendre note du contenu de ce rapport.

Comprehensive technique of the stock assessment and TAC determination for the sturgeon species in the Azov Sea

[As agreed by the Ukraine-Russian Commission concerning Fisheries in the Azov Sea at its 20th session (Berdiansk, Ukraine, 22-24 October 2008)]

Stock assessment

The sturgeon species stocks in the Azov basin were assessed with methods of biological statistics till the late 1960s (Makarov, 1970).

Since 1958, scientists have assessed the abundance of the Azov Sea demersal fish species through direct counts in trawl catches taken at particular stations during biomass surveys. In the early 1970s, this technique became the principal one in determination of abundance and biomass of the Azov sturgeon species.

The population abundance (N) is computed with a common formula (Mayskiy, 1967):

$$N = x \cdot F / f \cdot q, \text{ where} \quad (1)$$

▯ is the mean catch at a given station,

F is the area of the sea (region),

f is the area covered by the given gear,

q is the catchability coefficient.

The trawling area is computed with the following formula:

$$f = v \cdot t \cdot l, \text{ where} \quad (2)$$

v is the trawling velocity, m/min;

t is the trawling time, min;

l is the length of the trawl horizontal opening, m.

Empirically, we have found that the optimal time of trawling equals 30 minutes and the trawling velocity totals 1,5 m/s.

The length of the trawl horizontal opening (i.e. distance between the boards) depends on the trawl size and resistance, the board performance, as well as the trawl length, and could be determined with the help of the following techniques:

1. To test the angle (α) between warps with the known length (a): $l = 2a \cdot \sin(\alpha/2)$
2. To tie buoys to the boards and measure the distance between the buoys floating on the surface.
3. To tie the trawl boards with threads of the definite length and observe at what length the thread does not break.

Determination of the catchability coefficients is a rather difficult task. Table 1 summarizes catchability coefficients which have been used for the Azov sturgeon species for many years; these coefficients were estimated through comparison of biological statistics and direct counts, as well as determination of the fish abundance on basis of catches taken with mobile and stationary fishing gear.

Table 1 – Catchability coefficients of various fishing gear used to catch the Azov sturgeon species

Species	Catchability coefficients
	Trawl
Starred sturgeon	0.50
Russian sturgeon	0.50

Traditionally, the mean catch at a given station is computed as the arithmetic mean of catches taken at all the surveyed stations:

$$x = \frac{\sum_{i=1}^{n} x_i}{n}, \text{ where} \qquad (3)$$

x_i is the catch at a station and

n is the number of the surveyed stations.

Here, the essential condition for use of the arithmetic mean is that fish is uniformly or normally distributed over the entire sea area. But as a rule, catches at the stations were distributed asymmetrically. J.W.Tukey showed that the more the actual distribution differed from the normal one, the less the arithmetic mean fitted the role of a reliable value of the distribution center (cited by Dubrov, 1978). To get a more reliable estimate of the mean catch of the sturgeon species we have also used other mean values.

1. Transformation of the asymmetric distribution to the normal one

First of all, we could normalize the asymmetric distribution through the following transformation (Klepikov and Sokolov, 1964):

$$y(x) = \int \frac{dx}{h(x)}, \text{ where} \qquad (4)$$

x is the initial random variable,

$h(x)$ is the function which represents relationship between the mean deviation and the standard one for different samples from a general population:

$$\sigma_{x_i} = h(x_i) \qquad (5)$$

Such relationships are often represented by the following expression:

$$h(x) = a + b \cdot x \qquad (6)$$

Finally, we obtain the transformation formula:

$$y(x) = \frac{1}{b} \ln|a + b \cdot x| \tag{7}$$

After computing the arithmetic mean of the normalized series, we can translate the mean value into the initial data with the following formulas:

$$X_{cp} = \frac{1}{b} e^{b \cdot \left(y_{cp} + \frac{\sigma_y^2}{2} \right) - a}, \tag{8}$$

$$\sigma_x^2 = e^{2 \cdot y_{cp} + \sigma_y} \cdot e^{\sigma_y^2 - 1} \ . \tag{9}$$

2. Rule of "three σs".

Assuming that catches taken at different stations are normally distributed (which is sometimes true for some populations), we can use the rule of 3σs and reject extreme values which have significant influence on the mean value of the catch, but are highly improbable (Ventcel, 1970). First, we should find the arithmetic mean of catches taken at all the surveyed stations and the standard deviation, and then develop the confidence interval: $x_{mean} - 3\sigma <= x_i <= x_{mean} + 3\sigma$. The catch values which do not fit into the interval are rejected; the rest are used to reestimate the mean value and the standard deviation.

3. α - truncation.

The mean catch could be also assessed with the α - truncation and α - winsorization techniques (Gasukov, 1975). In accordance with the α - truncation method, the initial data are arranged in an ascending order and values of α are set in the interval (0.0, 0.5). The preset number of the extreme values [α*n] are rejected. The rest are used to compute the mean catch:

$$C_t(\alpha, n) = \frac{1}{n - 2 \cdot [\alpha \cdot n]} \cdot \sum_{i=1+[\alpha \cdot n]}^{n-[\alpha \cdot n]} y_i \ , \tag{10}$$

where [α*n] is the integral part of a number, determined as [α*n+0.5].

Dispersion is found with the following formula:

$$\sigma_t^2(\alpha) = \frac{1}{(1 + 2 \cdot \alpha)^2} \cdot \frac{1}{n \cdot (n-1)} \cdot \left(\sum_{i=[\alpha \cdot n]+1}^{n-[\alpha \cdot n]} (y_i - C_t(\alpha, n))^2 + 2 \cdot \alpha \cdot (y_{[\alpha \cdot n]+1} - C_t(\alpha, n))^2 \right) \ , \tag{11}$$

4. The α - winsorization method

Similarly to the above mentioned technique, there is an arrangement of the initial series with the choose of the α value. Then, the mean catch is found with the following formula:

$$C_w(\alpha, n) = \frac{1}{n} \cdot \left(\sum_{i=[\alpha \cdot n]+2}^{n-[\alpha \cdot n]-1} y_i + [\alpha \cdot n] \cdot \left(y_{[\alpha \cdot n]+1} + y_{n-[\alpha \cdot n]} \right) \right) \tag{12}$$

Dispersion is determined as follows:

$$\sigma_w^2(\alpha)=\frac{1}{n\cdot(n-1)}\cdot\left(\sum_{i=[\alpha\cdot n]+1}^{n-[\alpha\cdot n]}(y_i-C_w(\alpha,n))^2+[\alpha\cdot n]\cdot\left(y_{[\alpha\cdot n]+1}-C_w(\alpha,n)\right)^2+[\alpha\cdot n]\cdot\left(y_{n-[\alpha\cdot n]}-C_w(\alpha,n)\right)^2\right) \quad (13)$$

The mean values obtained with formulas (10) and (12) are biased. To reduce the bias we should make additional transformations:

$$C_n^o=\frac{1}{n}\cdot\sum_{i=1}^{n}C_{n_i}^o; \quad (14)$$

$$C_{n_i}^o=n\cdot C_n(y_1,y_2\ldots y_n)-(n-1)\cdot C_{n-1}(y_1,y_2\ldots y_{i-1},y_{i+1}\ldots y_n),$$ where (15)

C_n is the mean value.

Besides, there is software which allows for the fish stock assessment without computing of the mean catch, e.g. SURFLINE based on the SURFER utility. The sea is divided into 650×650 squares, which allows for a fairly precise determination of the area of the surveyed region, the fish stock and areas with different density of the fish distribution, as well as the total stock. This tool produces a map of the Sea of Azov with distribution of the surveyed object either in the bay, or in the proper sea, or both in the bay and the proper sea, etc. We can even obtain zones of a high mortality of fish due to the oxygen deficit. SURFLINE produces a table which contains the stock levels, areas with the preset density, and the total stock size.

Another approach to the stock assessment without computation of the mean catch is the area method (e.g. FISHERY and Ichthyoanalyst software). This technique allows for drawing isolines of areas with the same density of the fish distribution.

With both these approaches, the input data are taken from the data base which comprises observations collected during ichthyologic surveys.

Upon the ichthyologists' requests, the same materials could be used to perform the following:

1. Stock assessment.

The assessment included eleven regions in the Sea of Azov:

1. The eastern bay;

2. The western bay;

3. The Kamyshivat region;

4. The Akhtarsk region;

5. The Achuev region;

6. The Temruk region;

7. The central region;

8. The south-western region;

9. The Obitochniy bay;

10. The Berdyansk bay;

11. The Belosaraysk bay.

The areas of the regions are determined automatically: the software uses the reference and adds together all areas of the squares in the given region. The mean catch at a station in the given region is represented by the arithmetic mean in the given region.

Abundance of different size groups of fish (i.e. commercial-sized fish, undersized fish, and yearlings) should be assessed separately.

The obtained values allow for determination of the age composition of the given population (either the total, or by regions). The following variables are computed:

- Abundance of fish in each age group;
- Percentage of fish of each age group;
- Abundance of mature fish; and
- Percentage of mature fish.

2. Composition of the size variation series.

The size variation series can be built on various scales: a fishing square, a region, or a total basin. Three kinds of requests are possible:

- abundance + percentage;
- abundance + weight; and
- mean variables.

There are two reports produced for each of the first requests: one on the fish of the commercial size and undersized fish and the other on yearlings. Our specialists have developed transfer of data to the Excel utility to be able to draw diagrams, etc.

3. Computation of mean variables.

It is possible to compute mean variables for each region and all the surveyed regions altogether. The results are presented as follows:

Size groups	L mean, cm	W mean, g
Commercial size	NNN	NNNNN
Undersized fish	NNN	NNNNN
TOTAL	NNN	NNNNN
Yearlings	NN	NNN

4. Determination of the age composition.

In this case, it is possible to obtain tables with the following variables for each age group:

i. Total: Abundance and percentage.
   - Females: Abundance and percentage.
   - Males: Abundance and percentage.
   - Non-identifiable sex (NIS): Abundance and percentage.

   Total: females, males, NIS: Weight and percentage.

ii. Mature fish (abundance and weight):
   - Females, percentage mature females of the total females,
   - Males, percentage mature males of the total males,
   - Both females and males, percentage of the total.

iii. Four groups (juvenile fish, females, males, and total for each age groups):
   - Mean length,
   - Mean weight,

- Abundance, and
- Percentage of the total abundance

iv. An extended request concerning the same four age groups could include the following variables:

- Mean length,
- The length range (min-max),
- Mean weight,
- The weight range (min-max),
- Abundance,
- Percentage of the total abundance,
- Weight,
- Percentage of the total weight, and
- Percentage of the mature fish (except the juvenile fish)

It is possible to make estimates for each preset region or for the entire selected area of distribution.

5. The size-at-age variation series.

The resultant tables are similar to the above mentioned ones, but in this case there is indication of a mean age for each size group.

For the age composition and the size-at-age variation series, it is possible to plot diagrams, charts, and histograms with one or four variables.

6. The size-at-age key.

Here, the table includes the percentage of fish in each size-at-age group. Additionally, there is the total percentage and abundance for each size group.

7. Feed stocks.

For each kind of feed organisms, the table presents frequency of occurrence separately in the proper sea and in the Taganrog Bay.

The total allowable catch (TAC) forecast for one or two years, or even longer terms requires evaluation of rates of natural and fishing mortality. If there is ample information about the age composition of the population and about commercial catches, the assessment will be quite easy. The computation is made with the common formulas (Zasosov, 1976). Rates of the instant mortality are found with the following formulas:

Total mortality:

$$Z = \ln (N_i/N_{i+1}), \text{ where} \quad (16)$$

Z is the rate of the total instant mortality,
N_i, N_{i+1} are the abundance of the generation at age I and in the subsequent year.

Natural mortality:

$$M = - \ln (N_{i+1} - C_{i+1}))/N_i, \text{ where} \quad (17)$$

M is the rate of the instant natural mortality,
C_{i+1} is the catch of the generation at age i+1.

Fishing mortality:

$$F = \ln (C_i/N_i). \quad (18)$$

Rates of the annual total, natural, and fishing mortality are calculated with the following formulas:

Total mortality:

$$\varphi = (N_i - N_{i+1})/ N_i. \quad (19)$$

Natural mortality:

$$\varphi_M = (N_i - C_i) / N_i \quad (20)$$

Fishing mortality:

$$\varphi_F = C_i / N_i \quad (21)$$

Scientists have developed a program to compute rates of the instant and annual mortality (natural, fishing, and total). These rates are determined by age groups. As there are errors in the abundance assessment on the levels of both populations and generations, it has become conventional to decrease errors in computation of the mortality rates through finding mean rates for age groups of several generations which dwell in similar habitats. The mortality rates should be revised each time when there are any abrupt changes in feed stocks, fishery intensity, the fish stock abundance, reproduction conditions, etc.

Mortality rates of the Azov sturgeon species are computed for various periods and various levels of the year-class strength. Proceeding with the TAC forecast, an expert determines the population state and what rates of mortality are more appropriate.

FORECAST OF THE TOTAL ALLOWABLE CATCH

The essentials of the TAC forecast are generally the same for all fish species. One should know abundance, rates of natural and fishing mortality, mean weight in the age groups, maturation rates, and abundance of recruits in the given stock. Nevertheless, biological peculiarities of a fish species introduce some variations in forecast of the respective TAC.

The technique of the Azov sturgeon species TAC determination is a modification of 'conventional' biological statistics (see Babayan, 1985). The core of this technique is estimate of the expected catch of generations, which form the fish stock, under the preset catch level. Rates of fishing mortality are computed by age groups through the VPA analysis using data on the actual catch of generations and could be called weight factors, which make the basis for estimation of the rate of removal. Abundance of the generations in the fish stock is assessed with the use of the survey data.

The forecast abundance of individual generations is found with the following formula:

$$N_{t+1} = N_t \cdot e^{-(F_t + M_t)} \quad (22)$$

, where

F_t, M_t are rates of instant fishing and natural mortality, respectively.

A catch from a generation is computed as follows:

$$C_{t+1} = \frac{N_{t+1} \cdot F_{t+1}}{F_{t+1} + M_{t+1}} \cdot \left(1 - e^{-(F_{t+1} + M_{t+1})}\right) \quad (23)$$

VIF we know the abundance of generation R_{t+1} in year t+1 and the age distribution of the fishing mortality rate (F_i), we can determine the TAC:

$$TAC_{t+1} = w_i \cdot F_{t+1}^i \cdot R_{t+1} + \sum_{i=1}^{g-1} \frac{\left(w_{i+1} \cdot F_{t+1}^{i+1} \cdot N_t^i\right)}{F_{t+1}^{i+1} + M_{t+1}^{i+1}} \cdot \left(1 - e^{-\left(F_{t+1}^{i+1} + M_{t+1}^{i+1}\right)}\right) \cdot e^{-\left(F_t^i + M_t^i\right)} \quad (24)$$

, where

i is the age group index,

g is the index of the eldest age group in the fish stock.

The overall rate of removal (F) is distributed between age groups in accordance with the following relationship:

$$F_i = \varepsilon_i \cdot F \quad (25)$$

To draw the curve of a balanced catch, we should determined catches at various values of the fishing mortality rate (F).

In case of sturgeon species, this calculation is made for males and females separately. Because the maturation of the sturgeon species comes late, the recruitment is determined with the survey data. The TAC estimate is based on abundance of the spawning stock.

The basic input data are:

- abundance of generations in the given population in the year of the forecast development;

- rates of fishing mortality by age groups obtained with the VPA;

- rates of natural mortality by age groups.

Because of the biological peculiarities of sturgeon species (difference in the maturation age between females and males), all the calculations are made separately, for mature and immature females and males. Hence we classify generations by sex and maturation. Here, we use the modeling results, i.e. percentages of females, mature females, and males in the population under various degrees of intensity of the fish stock exploitation. The intensity of removal is identified by the sex ratio in the biological samples from catches taken at the inspection points.

The input data for the TAC determination are:

- rates of natural mortality by age groups of immature fish;

- rates of natural mortality by age groups of mature fish;

- mean weight by age groups of mature and immature fish (classified by sex);

- percentage of mature females, males, and females in the population (by age groups);

- abundance of the population (by age groups);

- rates of fishing mortality;

- rates of fishing removal.

Here is a short algorithm for calculating the TAC of sturgeon species:

1. Determination of the female and male abundance in the population:

$$ZISSK_i = ZIS_i \cdot PRSK_i; \quad (26)$$

$$ZISSM_i = ZIS_i \cdot ZISSK_i, \text{ where} \quad (27)$$

ZIS_i is the abundance of age group *i*;

$ZISSK_i$, $ZISSM_i$ are the abundance of females and males in age group *i*, respectively;

$PRSK_i$ is the percent of females in age group *i*.

2. Determination of the mature female and male abundance:

$$ZISKZ_i = ZISSK_i \cdot ZRELSK_i; \qquad (28)$$

$$ZISMZ_i = ZISSM_i \cdot ZRELSM_i, \text{ where} \qquad (29)$$

$ZISKZ_i$, $ZISMZ_i$ are the abundance of mature females and males in age group *i*, respectively;

$ZRELSK_i$, $ZRELSM_i$ are the percent of mature females and males, respectively.

3. Determination of abundance of immature fish in the 1st year of the forecast term (this is the difference between the total abundance and the abundance of the mature stock).

4. Calculation of biomass of mature, immature females and males.

5. The preset overall rate of fishing mortality (*F* is the fishing intensity) is distributed between age groups in accordance with the following relationship:

$$F_i = \varepsilon_i \cdot F, \text{ where} \qquad (30)$$

F_i is the rate of fishing mortality for age group *i*;
ε_i is the proportionality constant or the age factor of the fishery selectivity.

6. Catch in the current year is estimated for each age group in the mature stock..

$$CATCH_{i,j} = ZREL_{i,j} \cdot F_j/Z_j \cdot (1-\exp(-Z_j)). \qquad (31)$$

7. Abundance of females and males for the subsequent year is calculated in accordance with the formula:

$$ZIS2_{i+1,j} = ZISN_{i,j} \cdot \exp(-yest_j) + ZREL_{i,j} \cdot \exp(-Z_j). \qquad (32)$$

8. To determine abundance, biomass and catch of mature and immature fish follow steps 2-6.
Biomass is calculated with the weights by age groups of mature and immature females and males.

The determined values of possible catches at various rates of fishing mortality allow us to draw the curve of a balanced catch and to determine the TAC.

This technique was used by AzNIIRKh specialists to develop a program for Delphi.

Tables 2-11 summarize normative/reference data for Russian sturgeon and starred sturgeon which are used in the forecast development.

The program called "Model of populations of the Azov Russian sturgeon and starred sturgeon exploited with different intensity" provided the sex ratio and percentage of mature females and males. The mean weight of mature and immature females and males was based on the mean long-term data.

Table 2 – Mean weight of Russian sturgeon, Kg

Age	Females		Males	
	mature	immature	mature	immature
1	-	0.2	-	0.2
2	-	0.8	-	0.8
3	-	1.6	-	1.6
4	-	2.1	-	2.1
5	-	2.9	-	2.9
6	-	3.8	5.8	4.0
7	-	4.9	7.4	5.0
8	-	6.0	8.2	6.1
9	-	7.0	8.8	7.2
10	11.6	8.1	9.7	8.9
11	13.4	9.4	10.5	10.0
12	16.5	11.6	11.4	11.3
13	18.9	13.5	13.1	12.8
14	20.0	15.5	14.1	13.8
15	21.6	16.7	15.5	15.1
16	22.3	17.4	15.8	15.4
17	23.6	18.3	16.7	16.3
18	26.3	20.4	-	-
19	29.5	22.9	-	-
20	32.5	25.2	-	-
21	34.7	26.9	-	-
22	35.1	27.2	-	-

Table 3 – Number of females in the Russian sturgeon spawning stock, %

Age	Removed percentage									
	0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
12	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9	1.9
13	8.6	8.8	9.1	9.3	9.6	9.9	10.2	10.5	10.9	11.2
14	15.4	16.3	17.2	18.1	19.2	20.6	22.1	23.9	25.8	28.2
15	23.9	25.7	27.6	29.7	32.2	35.4	39.1	44.0	49.6	57.3
16	39.6	42.1	44.8	47.7	50.9	54.9	59.3	64.7	70.5	77.6
17	51.0	54.4	57.9	61.6	65.6	70.3	75.3	80.8	86.4	92.7
18	48.0	51.9	56.1	60.5	65.3	70.8	76.6	82.8	88.8	94.8
19	43.1	47.5	52.3	57.5	63.3	70.0	77.0	84.4	90.8	96.5
20	43.5	47.4	51.7	56.4	61.7	68.0	74.9	82.5	89.5	95.9
21	53.1	56.4	60.0	63.9	68.1	73.2	78.7	84.9	91.0	96.9
22	73.1	75.6	78.2	80.6	83.2	86.1	88.9	91.9	94.8	97.8
23	77.3	79.6	81.9	84.2	86.5	89.0	91.5	94.0	96.3	98.6
24	80.6	82.6	84.5	86.4	88.3	90.4	92.4	94.5	96.4	98.3
25	93.8	94.6	95.3	96.0	96.7	97.4	98.1	98.7	99.2	99.7
26	98.0	98.3	98.5	98.7	98.9	99.2	99.4	99.6	99.8	99.9
27	98.9	99.1	99.2	99.3	99.4	99.5	99.6	99.7	99.8	99.9
28	99.8	99.8	99.9	99.9	99.9	99.9	99.9	100.0	100.0	100.0
29	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4 – Number of mature females in the Russian sturgeon population, %

Age	Removed percentage									
	0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
12	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
13	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.5	2.5
14	3.9	3.9	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
15	8.2	8.2	8.3	8.4	8.4	8.5	8.5	8.6	8.7	8.7
16	16.7	17.0	17.2	17.5	17.7	18.0	18.3	18.6	18.8	19.1
17	26.5	27.3	28.2	29.1	30.1	31.2	32.3	33.6	35.0	36.4
18	18.7	19.6	20.6	21.7	22.9	24.5	26.3	28.5	31.0	34.2
19	18.1	19.2	20.5	21.9	23.6	25.9	28.6	32.3	37.0	43.8
20	17.4	18.3	19.3	20.6	22.1	24.2	27.0	31.3	37.4	48.9
21	20.8	21.4	22.2	23.0	24.0	25.3	27.2	30.2	35.0	47.0
22	28.0	28.9	29.8	30.8	31.9	33.3	34.8	36.8	39.5	45.9
23	20.4	21.5	22.7	24.1	25.7	27.8	30.5	34.5	40.8	58.9
24	19.7	20.8	22.2	23.7	25.6	28.2	31.6	36.7	45.2	77.6
25	19.2	20.2	21.3	22.7	24.5	27.0	30.8	37.3	51.0	100.0
26	24.0	24.6	25.2	26.1	27.2	29.0	31.9	38.0	56.8	100.0
27	38.0	38.4	38.8	39.5	40.3	41.8	44.6	51.9	88.9	100.0
28	37.8	38.6	39.5	40.7	42.4	45.3	51.2	69.4	100.0	100.0
29	47.2	48.6	50.3	52.5	55.9	62.1	76.3	100.0	100.0	100.0

Table 5 – Number of mature males in the Russian sturgeon population, %

Age	Removed percentage									
	0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
7	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
8	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
9	7.6	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7
10	12.9	13.0	13.2	13.3	13.4	13.6	13.7	13.8	14.0	14.1
11	22.3	22.8	23.4	23.9	24.5	25.1	25.7	26.4	27.1	27.8
12	23.4	24.3	25.3	26.3	27.5	28.8	30.3	32.1	33.9	36.1
13	26.4	27.6	28.9	30.3	31.9	34.0	36.5	39.7	43.4	48.5
14	22.2	23.0	24.0	25.0	26.3	28.1	30.3	33.5	37.9	45.2
15	27.2	28.0	29.0	30.0	31.1	32.6	34.4	36.8	40.3	46.8
16	27.4	28.8	30.2	31.9	33.8	36.3	39.4	43.8	50.3	64.0
17	28.4	29.6	31.0	32.6	34.4	36.8	39.9	44.2	50.5	65.9
18	24.7	25.5	26.4	27.5	28.8	30.7	33.3	37.5	44.9	73.2
19	33.8	34.3	34.8	35.5	36.3	37.6	39.6	43.4	52.3	100.0
20	42.7	43.4	44.2	45.3	46.6	48.8	52.3	59.7	81.5	100.0
21	52.2	53.1	54.1	55.4	57.1	60.0	65.3	79.7	100.0	100.0
22	53.6	54.9	56.6	58.8	62.2	68.6	83.5	100.0	100.0	100.0
23	59.6	62.1	65.5	70.8	80.1	100.0	100.0	100.0	100.0	100.0
24	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
25	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
26	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
27	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
28	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 6 – Number of females in the Russian sturgeon population, %

Age	Removed percentage									
	0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
6	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
7	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
8	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.1
9	50.0	50.1	50.1	50.2	50.2	50.3	50.4	50.4	50.5	50.5
10	50.0	50.3	50.6	50.8	51.0	51.3	51.6	51.8	52.1	52.4
11	50.1	50.7	51.3	51.9	52.5	53.1	53.8	54.4	55.1	55.8
12	50.2	51.4	52.6	53.8	55.1	56.5	58.0	59.5	61.1	62.8
13	50.4	52.2	54.1	56.0	58.0	60.3	62.8	65.6	68.4	71.5
14	50.7	53.1	55.7	58.4	61.2	64.6	68.3	72.4	76.6	81.5
15	51.1	54.0	57.1	60.3	63.7	67.8	72.2	77.1	82.1	87.8
16	51.8	55.1	58.7	62.4	66.4	71.0	75.9	81.2	86.4	92.1
17	52.8	56.4	60.2	64.2	68.6	73.7	79.0	84.7	90.2	95.9
18	55.0	58.4	62.1	66.0	70.2	75.2	80.6	86.4	92.0	97.5
19	58.5	61.7	65.1	68.7	72.6	77.3	82.3	87.9	93.3	98.4
20	65.4	68.1	71.0	74.0	77.3	81.1	85.2	90.0	94.9	98.0
21	74.0	76.2	78.6	81.0	83.6	86.6	89.9	93.7	96.7	98.5
22	83.9	85.5	87.1	88.8	90.6	92.7	95.1	96.9	97.9	99.0
23	90.9	91.9	92.9	94.0	95.2	96.7	97.2	97.8	98.4	99.1
24	95.5	95.8	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7
25	98.7	98.9	99.0	99.1	99.2	99.3	99.4	99.5	99.6	99.7
26	99.5	99.6	99.6	99.7	99.7	99.8	99.8	99.9	99.9	99.9
27	99.6	99.6	99.7	99.7	99.7	99.8	99.8	99.8	99.8	99.9
28	99.9	99.9	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0
29	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 7 – The starred sturgeon mean weight, Kg

Age	FEMALES		MALES	
	mature	immature	mature	immature
1	-	0.1	-	0.1
2	-	0.8	-	0.8
3	-	1.6	-	1.6
4	-	3.3	3.4	3.2
5	-	3.9	3.8	3.7
6	6.0	4.5	4.5	4.3
7	6.6	5.3	5.3	4.9
8	7.3	6.0	5.9	5.4
9	8.0	6.5	6.5	5.9
10	8.7	7.1	6.9	6.2
11	9.4	8.0	7.2	7.1
12	10.2	8.4	8.0	7.9
13	11.6	9.4	8.5	8.4
14	12.2	10.5	9.0	8.9
15	13.0	11.4	9.6	9.5
16	13.6	12.5	10.2	10.1
17	14.3	13.4	10.6	10.5
18	15.1	14.7	12.2	12.1
19	15.9	15.4	12.7	12.6
20	16.6	16.1	13.2	13.1
21	18.7	18.1	13.7	13.6
22	19.7	19.1	14.2	14.1
23	20.7	20.1	14.7	14.6
24	21.7	21.0	15.2	15.0
25	22.7	22.0	15.7	15.5
26	23.7	23.0	16.2	16.0
27	24.7	24.0	16.7	16.5
28	25.7	24.9	17.2	17.0

Table 8 –Number of females in the starred sturgeon spawning stock, %

Age	Removed percentage									
	0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
7	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
9	4.0	4.0	4.1	4.1	4.2	4.3	4.3	4.4	4.4	4.4
10	14.8	15.5	16.3	17.2	18.2	19.2	20.5	21.9	22.4	23.2
11	35.8	37.9	40.3	43.0	46.1	49.5	53.6	58.5	60.5	63.3
12	40.5	43.0	46.1	49.4	53.4	58.0	63.6	70.5	73.4	77.5
13	53.0	55.8	59.1	62.5	66.4	70.7	75.5	81.0	83.1	86.1
14	55.4	59.0	63.0	67.1	71.5	76.1	80.8	85.8	87.7	90.0
15	51.3	55.6	60.5	65.6	71.2	77.0	82.8	88.6	90.6	93.0
16	53.9	57.5	61.8	66.2	71.4	76.9	82.9	89.1	91.3	94.0
17	58.1	61.2	64.8	68.5	72.8	77.4	82.4	87.9	90.0	92.6
18	75.3	77.7	80.3	82.8	85.5	88.1	90.8	93.4	94.4	95.7
19	78.8	81.2	83.8	86.1	88.5	90.8	93.1	95.2	95.9	96.9
20	90.5	91.8	93.1	94.3	95.6	96.7	97.7	98.6	98.9	99.2
21	93.2	94.0	94.8	95.6	96.4	97.1	97.8	98.5	98.8	99.1
22	96.2	96.6	96.9	97.3	97.7	98.0	98.4	98.8	98.9	99.1
23	98.8	99.0	99.1	99.3	99.4	99.5	99.6	99.7	99.7	99.8
24	99.3	99.4	99.5	99.6	99.6	99.7	99.8	99.9	99.9	99.9
25	99.3	99.4	99.5	99.5	99.6	99.7	99.7	99.8	99.8	99.9

Table 9 – Number of mature females in the starred sturgeon population, %

Age	Removed percentage									
	0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
11	13.6	13.6	13.7	13.8	13.8	13.9	14.0	14.1	14.1	14.1
12	17.6	17.9	18.2	18.5	18.8	19.1	19.4	19.8	19.9	20.1
13	24.9	25.8	26.7	27.6	28.7	29.8	31.1	32.4	33.0	33.6
14	20.1	21.3	22.6	24.1	25.9	27.9	30.3	33.2	34.4	36.0
15	18.9	20.2	21.7	23.5	25.7	28.4	32.0	36.8	39.0	42.3
16	21.6	22.3	23.2	24.2	25.5	27.3	29.9	33.9	36.0	39.5
17	22.1	22.6	23.4	24.2	25.2	26.6	28.6	31.9	33.8	37.1
18	29.9	30.9	32.0	33.3	34.8	36.6	39.1	43.0	45.2	49.3
19	26.6	27.8	29.2	30.8	32.7	35.1	38.3	43.3	46.2	51.7
20	33.9	35.2	36.8	38.8	41.3	44.8	49.9	59.5	65.9	80.4
21	31.8	33.0	34.6	36.5	39.3	43.5	51.0	70.0	87.6	100.0
22	41.3	42.5	44.2	46.5	50.0	56.0	69.4	100.0	100.0	100.0
23	44.2	46.3	49.2	53.2	60.1	73.8	100.0	100.0	100.0	100.0
24	56.6	60.3	66.0	74.8	93.5	100.0	100.0	100.0	100.0	100.0
25	65.1	74.1	91.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 10 – Number of mature males in the starred sturgeon population, %

Age	Removed percentage									
	0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
5	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
6	11.2	11.2	11.3	11.3	11.3	11.4	11.4	11.4	11.5	11.5
7	22.5	22.8	23.2	23.5	23.8	24.2	24.6	24.9	25.1	25.3
8	28.8	29.9	31.1	32.3	33.7	35.1	36.7	38.5	39.2	40.1
9	25.9	27.4	29.1	30.9	33.2	35.9	39.1	43.2	44.9	47.4
10	21.8	22.7	23.8	25.0	26.7	28.8	31.7	36.0	38.0	41.3
11	28.7	29.4	30.2	31.2	32.4	33.9	36.1	39.5	41.3	44.4
12	33.2	34.2	35.4	36.5	37.8	39.3	40.9	42.9	43.9	45.3
13	31.7	33.4	35.3	37.5	40.1	43.2	47.0	52.3	54.7	58.7
14	26.0	27.2	28.8	30.6	33.2	36.6	41.5	50.0	55.0	64.4
15	33.1	33.9	35.0	36.3	38.2	41.0	45.8	56.1	63.9	84.2
16	43.5	44.2	45.0	46.0	47.6	50.1	55.1	70.4	87.5	100.0
17	55.3	56.8	58.9	61.5	65.6	72.5	88.1	100.0	100.0	100.0
18	59.1	62.2	66.7	73.2	85.2	100.0	100.0	100.0	100.0	100.0
19	77.8	85.2	98.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
20	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
21	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
22	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
23	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
24	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
25	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 11 – Number of females in the starred sturgeon population, %

Age	Removed percentage									
	0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
4	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
5	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
6	50.1	50.2	50.3	50.3	50.4	50.5	50.6	50.7	50.7	50.7
7	50.4	50.8	51.1	51.5	51.8	52.2	52.6	53.0	53.1	53.3
8	51.0	51.9	52.9	53.8	54.9	55.9	57.0	58.1	58.5	59.1
9	51.9	53.5	55.3	57.2	59.2	61.4	63.7	66.2	67.2	68.5
10	52.8	55.1	57.7	60.4	63.4	66.7	70.4	74.5	76.1	78.3
11	54.1	56.8	59.8	63.0	66.6	70.5	74.9	79.8	81.8	84.4
12	56.2	59.1	62.5	65.9	69.8	74.0	78.6	83.8	85.9	88.6
13	58.9	62.1	65.7	69.3	73.4	77.7	82.3	87.3	89.1	91.5
14	61.6	64.8	68.4	72.1	76.3	80.7	85.3	90.1	91.9	94.2
15	64.8	67.8	71.2	74.7	78.6	82.8	87.3	92.2	94.0	96.4
16	70.2	72.9	75.9	78.9	82.3	85.9	89.9	94.4	96.2	97.5
17	77.6	79.9	82.3	84.7	87.4	90.3	93.5	95.8	96.4	97.1
18	85.8	87.5	89.5	91.4	93.5	95.3	96.2	97.1	97.4	97.8
19	91.6	93.0	94.6	95.3	95.9	96.6	97.2	97.9	98.1	98.4
20	96.5	96.9	97.4	97.7	98.1	98.5	98.8	99.1	99.3	99.4
21	97.7	97.9	98.1	98.3	98.5	98.7	98.9	99.0	98.9	99.1
22	98.4	98.5	98.6	98.7	98.8	98.9	98.9	98.8	98.9	99.1
23	99.5	99.5	99.6	99.6	99.6	99.6	99.6	99.7	99.7	99.8
24	99.6	99.6	99.7	99.7	99.7	99.7	99.8	99.9	99.9	99.9
25	99.5	99.5	99.5	99.5	99.6	99.7	99.7	99.8	99.8	99.9

Reference: All citations are taken from the "Methodology of fishery and conservation studies in the Azov and Black seas" – Krasnodar, 2005, 352 p. in Russian.