COMMISSION OF THE EUROPEAN COMMUNITIES

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2009/0057 (CNS)

Proposal for a

COUNCIL REGULATION

establishing a multi-annual plan for the western stock of Atlantic horse mackerel and the fisheries exploiting that stock

{SEC(2009) 524}
{SEC(2009) 525}

EXPLANATORY MEMORANDUM

CONTEXT OF THE PROPOSAL

Grounds for and objectives of the proposal

This proposal establishes a long-term plan for the management of the western stock of Atlantic horse mackerel (*Trachurus trachurus*) and the fisheries exploiting this stock, encompassing into one plan all stages foreseen in the recovery and management plans referred to in Articles 5 and 6 of Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of the fisheries resources under the Common Fisheries Policy[1]. The plan is intended to ensure that the exploitation of this stock is guided towards maximum sustainable yield, on the basis of scientific advice, and to ensure stability for the fishing sector. These objectives are in line with the objectives in paragraph 30 of the Implementation Plan of the World Summit on Sustainable Development, Johannesburg, 2002, as adopted by Resolution 2 of this conference[2] and with those of the Common Fisheries Policy as set out in Article 2 of Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of the fisheries resources under the Common Fisheries Policy.

The plan is the second concerning a pelagic stock in Community waters, after the Council Regulation (EC) No 1300/2008 of 18.12.2008 establishing a multi-annual plan for the herring stock distributed to the west of Scotland. For widely distributed pelagic stocks which are jointly managed with coastal states in the North Atlantic, management arrangements are already in place which have been agreed bilaterally or multilaterally, namely for Northeast Atlantic Mackerel, Blue Whiting, Atlanto-Scandian herring, and North Sea herring.

The Western stock of Atlantic horse mackerel is by far the most important of the three horse mackerel stocks which inhabit the Community's continental shelf. The current management system does not serve the horse mackerel situation very well. Taking into account scientific advice on an *ad hoc* basis is hampered by the fact that the stock areas of scientific advice do not coincide with the areas for which total allowable catches are fixed. It is foreseen to resolve the problem of this area mismatch together with the implementation of the long-term management plan. Scientific advice for the stock is based on only a poor assessment. As the most important fishery-independent information source, international egg surveys have been conducted every three years since 1977. Resulting data and complementary information have so far not allowed fisheries scientists to conclude on a full stock assessment.

It is not unusual that scientific advice for a stock cannot be based on a full stock assessment. Reasons for the shortcomings of scientific advice are manifold, including for example reduced quality of data coming from fisheries which are in decline. So far, the Commission has introduced management plans only to stocks the state of which is relatively well understood, adding provisions for momentary conditions of data paucity. In the case of horse mackerel, knowledge of the stock has improved over time, but is still poor. Following a strong interest from the pelagic sector for a science-based long-term management relying on biological information already available, and encouraged by scientific advice approving of management that is based on biological indicators for trends in stock health, this

[1] OJ L 358, 31.12.2002, p. 59

[2] UN Document A/CONF.199/20**

Regulation places the egg survey results, which are a biological indicator for the increase or decrease of the stock, at the centre of a harvest control rule which has been risk-tested by scientific modelling. In view of the revision clause built into the plan, the harvest rule could be adapted to more precise scientific assessments once these are available.

General context

In 2002, the Member States were signatories to the Implementation Plan of the World Summit on Sustainable Development (Johannesburg). That Implementation Plan includes a commitment to rebuild stocks to maximum sustainable yields (MSY) by 2015.

Also during the 2002 reform of the Common Fisheries Policy, the Commission and Council agreed to implement multi-annual plans and recovery plans concerning fisheries resources of interest to the Community. Plans have been established concerning most stocks of cod in Community waters, two stocks of hake, two stocks of *Nephrops*, two stocks of sole, the stocks of plaice and sole in the North Sea, and for the herring stock to the west of Scotland.

Existing provisions in the area of the proposal

Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy sets the general framework for sustainable exploitation of fisheries resources.

Commission Regulation (EC) No 1542/2007 establishes rules on landings, weighing and inspection for herring, mackerel and horse mackerel. An extension of the area of application of that Regulation will be necessary in order to cover all areas of catches of western horse mackerel.

Council Regulation (EC) No 850/1998 on technical measures contains specific provisions for the landing of undersized horse mackerel and restricts the use of automatic grading equipment on board of vessels targeting this species.

Consistency with the other policies and objectives of the Union

The proposal's objective of sustainable development is consistent with the Community's environmental policy, especially the elements of that policy dealing with protecting natural habitats and preserving natural resources.

CONSULTATION OF INTERESTED PARTIES AND IMPACT ASSESSMENT

Consultation of interested parties

Consultation methods, main sectors targeted and general profile of respondents

Stakeholders were consulted by communicating with the pelagic Regional Advisory Council (PelRAC). This body has been established for consultations with parties having an interest in the Common Fisheries Policy in respect of pelagic fish stocks. Its members come from the catching sector (ship owners, small-scale fishermen, employed fishermen and producer organisations), from processors and traders, from environmental NGOs, from aquaculture producers, and from the recreational civil society. Given that the initiative for a management plan for the Western horse mackerel came from the PelRAC itself, discussion took place upon the formal submission of the

PelRAC's proposal during 2007 and 2008, in the PelRAC's working group II (dedicated to blue whiting, sprat and horse mackerel) and with its executive committee.

The Commission also communicated to Member States its intention to formalise the PelRAC's proposal, during the latest discussions on rearranging the TAC-areas for Atlantic horse mackerel, which latter is a precondition for a harvest control rule being based on the development of a stock-specific TAC and on the stock-specific egg surveys. This discussion has taken place with Member States and with the Committee for Fisheries and Aquaculture since May 2008.

Summary of responses and how they have been taken into account

Collection and use of expertise

Scientific/expertise domains concerned

External expertise has been sought from the International Council for the Exploration of the Sea (ICES) concerning long-term management of fisheries resources of interest to the European Community. This organisation collates the expertise of fisheries scientists mostly working in the national fisheries laboratories of Member States and provides a systematic and standardised advice to the European Community and to Member States. The advice given by ICES has been submitted to the Commission's Scientific, Technical and Economic Committee (STECF).

Summary of advice received and used

The spawning-stock biomass (SSB) of the Western horse mackerel stock was dominated by an outstanding 1982 year class (~18 times the long-term average). This year class has been gradually fished down, whereas recruitment has remained low, resulting in a steady decline of SSB since its peak in 1988, and then resuming an at least stable trend since 2001. Fishing mortality on this stock is perceived to be low, and the 2001 recruitment to the stock is considered to be particularly strong, providing for a robust reproductive capacity for still some time. The long decline, a reorientation of important parts of the fishery towards juveniles, the "indeterminate" spawning behaviour, and insufficient sampling of the fishing activity make it difficult to provide advice on sustainable management based on time series of catches and on estimated egg production. In response to a joint EU–Norway request to ICES to "advise on appropriate management systems including management strategies, objectives and ecosystem considerations" for the stock, several stock assessment approaches and management based on a simulation study were first evaluated in 2005[3].

In 2006 ICES advised for the first time that harvest control rules based on the trend in the egg survey data appeared promising[4]. Simulations were undertaken within the Study

[3] Report of the *ad hoc* Group on Long Term Advice (AGLTA). (2005b) 126. 12–13 April 2005**,** ICES Headquarters. ICES Document CM 2005/ACFM: 25.

[4] ICES, 2006. Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2006. ICES Advice, Book 9, p.7.

Group on Management Strategies in 2006 and 2007, as requested by the EU jointly with Norway[5]. Based on this work and assisted by a separate group of scientists, the PelRAC presented to the Commission a management plan outline in July 2007[6]. The Commission asked ICES for a valuation of this plan. ICES in 2007 concluded that the plan was consistent with the precautionary approach in the short term, but not at later stages of the simulation period of 40 years. ICES has built its most recent advice on the proposed plan[7]. The STECF endorsed ICES' conclusions[8].

A research project concerning the horse mackerel stock identity was also funded by the European Community[9]. This proposal is based on the advice received.

Means used to make the expert advice publicly available

The advice from ICES and STECF is publicly available on their respective websites (www.ices.dk and fishnet.jrc.it/web/stecf).

Impact assessment

The impact assessment is based on three kinds of input:

– Consultations with the PelRAC, based on scientific modelling of harvest control rules;

– Biological analysis carried out by STECF and ICES;

– An economic analysis of fleet segments engaged in the fishery, based on information collected in the Commission's Annual Economic Reports on the performance of selected EU fishing fleets.

The impact assessment will be available at DG MARE's website and on the Commission's website reserved for accessing impact assessments.

LEGAL ELEMENTS OF THE PROPOSAL

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5 ICES SGMAS Report 2007. Report of the Study Group on Management Strategies (SGMAS), p. 28. ICES CM 2007/ACFM:04.

6 Based on the study "Towards a management plan for western horse mackerel", Ad hoc group of scientists in collaboration with members of the Pelagic RAC, Pelagic RAC et .al., 2007

7 ICES, 2007. Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2007. ICES Advice, Book 9, p.13 and 55

8 Report of the Scientific, Technical and Economic Committee for Fisheries. Review of scientific advice for 2007. Consolidated advice on stocks of interest to the European Community in the ICES areas, endorsed at the 26th STECF Plenary session November 2007, http://www.ices.dk/products/icesadvice.asp

9 HOMSIR project, A multidisciplinary approach using genetic makers and biological tags in horse mackerel (trachurus trachurus) stock structure analysis, QLK5-Ct1999-01438. A summary is provided by Abaunza et al., Stock identity of horse mackerel (Trachurus trachurus) in the Northeast Atlantic and Mediterranean Sea: Integrating the results from different stock identification approaches, Fisheries Research 89 (2008) 2, 196.

Legal basis

The legal basis for establishing long-term plans is Article 37 of the Treaty establishing the European Community.

Subsidiarity principle

The proposal falls under the exclusive competence of the Community. The subsidiarity principle therefore does not apply.

Proportionality principle

The proposal complies with the proportionality principle. It introduces a rule that guides the setting of annual fishing opportunities, thereby providing predictability to the private sector and harvest limits that follow the biological state of the stock.

BUDGETARY IMPLICATION

The proposal has no implication for the Community budget.

ADDITIONAL INFORMATION

Review/revision/sunset clause

The proposal includes a provision for evaluation of management measures each sixth year from the date of entry into force of the Regulation.

Scientific advice indicates that the plan is precautionary and provides a very low risk of stock decline in the short term. The reason for the qualification limiting this statement to the short term is that the harvest control rule assures a minimum catch of 54% of recent catch limits, even in case where recruitment to the stock would be continuously failing. The first TAC-setting – for 2010 - would be based on the positive trend coming from the 2007 egg survey. The second TAC-setting would be adapted so that it takes into account provisional results from the egg survey 2010. This TAC would then be rolled over two times. After the second adaptation of the TAC (for 2014), a review would take place which ensures that the harvest control rule could be adapted to any unusually strong signals of stock decline. In addition, whenever scientific advice suggests that the harvest rules based on the egg surveys are no longer suitable for ensuring a precautionary exploitation, Council may decide on modifying the reference point at any time.

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THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 37 thereof,

Having regard to the proposal from the Commission[10],

Having regard to the opinion of the European Parliament[11],

Whereas:

(1) In view of the Plan of Implementation adopted at the UN World Summit on Sustainable Development in Johannesburg in 2002, the European Community is committed *inter alia* to maintain or restore stocks to levels that can produce the maximum sustainable yield with the aim of achieving these goals for depleted stocks on an urgent basis and where possible not later than 2015. The Common Fisheries Policy, according to Article 2 of Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of the fisheries resources under the Common Fisheries Policy[12], aims at ensuring an exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions.

(2) The western stock is economically the most important stock of horse mackerel inhabiting the waters of the Community. The biological information on this stock is not sufficient for a full stock assessment that would allow setting a fishing mortality target related to maximum sustainable yield and relate total allowable catches to scientific catch predictions. However, the index of egg abundance which is being calculated since 1977 in triennial international surveys can be used as a biological indicator for the development of the stock size.

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10 OJ C, p.
11 OJ ...
12 OJ L 358, 31.12.2002, p. 59

(3) Advice from the Scientific, Technical and Economic Committee for Fisheries (STECF) indicates that a harvest control rule based on the trend in egg abundance from the last three egg surveys would provide for sustainable stock management.

(4) For a number of years since 2003, precautionary scientific advice has indicated that catches for western horse mackerel should be below 150 000 tonnes annually, assuming that this would keep exploitation sustainable even in the continuous absence of an extraordinarily strong recruitment event. A harvest control rule should be based in equal parts on this precautionary advice and on a continued TAC adjusted by a factor that reflects trends in egg production.

(5) The harvest control rules need to take account of discards including slipped fish, because all removals from the stock are relevant.

(6) The areas for which limitations in total catch of horse mackerel are fixed each year do not coincide with the stock boundaries of Atlantic horse mackerel. In the context of fixing the fishing opportunities for 2009, Council and Commission have undertaken to rearrange these TAC areas which would allow this plan to work properly.

(7) The stock is primarily distributed in Community and Norwegian waters. Norway has an interest in the exploitation of the western horse mackerel. The stock is so far not subject to joint management.

(8) With a view to ensuring compliance with the measures laid down in this Regulation, specific control and surveillance measures should be adopted in addition to those provided for in Council Regulation (EEC) No 2847/93 of 12 October 1993 establishing a control system applicable to the common fisheries policy[13] and to those provided for in Commission Regulation (EC) No 1542/2007 of 20 December 2007 on landing and weighing procedures for herring, mackerel and horse mackerel[14]. These measures should in particular counteract area and species misreporting.

(9) It is appropriate to ensure periodic evaluation of the plan and, where such evaluation would show that the harvest control rules do no longer ensure a precautionary approach to stock management, adaptation of the plan should be ensured.

(10) For the purposes of points (i) and (iv) of Article 21(a) of Council Regulation (EC) No 1198/2006 of 27 July 2006 on the European Fisheries Fund[15] the plan should be a recovery plan in the meaning of Article 5 Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and the sustainable exploitation of fisheries resources under the Common Fisheries Policy[16] when the size of the spawning stock is estimated to be less than 130% its size in 1982, when it generated an extraordinarily large recruitment, and should be a management plan in all other cases. The spawning stock of 130% relative to the 1982 size indicates the precautionary biomass level.

(11) The establishment and allocation of fishing opportunities and the fixing of the biological references are measures of prime importance in the Common Fisheries

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13 OJ L 261, 20.10.1993, p. 1.
14 OJ L 337, 21.12.2007, p. 56.
15 OJ L 223, 15.8.2006, p. 1.
16 OJ L 358, 31.12.2002, p. 59.

Policy and have a direct impact on the socio-economic situation of the fishing fleets of the Member States. It is appropriate that the Council should reserve to itself the right to exercise directly implementing powers in relation to these specific matters.

HAS ADOPTED THIS REGULATION:

CHAPTER I
SUBJECT MATTER, SCOPE AND DEFINITIONS

Article 1

Subject matter

This Regulation establishes a long-term plan for the conservation and management of the western stock of horse mackerel (hereinafter referred to as 'the plan').

Article 2

Scope

The plan shall apply to the stock of horse mackerel which inhabits EC and international waters of ICES Divisions IIa, IVa, Vb, VIa, VIb, VII a, b, c, e, f, g, h, j, k, VIIIa, b, c, d and e.

Article 3

Definitions

For the purposes of this Regulation the following definitions shall apply:

(a) "ICES" means the International Council for the Exploration of the Sea, and "ICES Division" a statistical fishing region as defined by that organisation;

(b) "western horse mackerel" means horse mackerel of the stock referred to in Article 2;

(c) "total allowable catches" (TAC) means the quantity of western horse mackerel that can be taken and landed each year;

(d) "total removal" means the quantity of western horse mackerel removed from the sea, encompassing the TAC applicable and an estimate of discarded fish as calculated for the relevant year in accordance with the provisions of this regulation;

(e) "egg survey index" means the estimated number of horse mackerel eggs resulting from the triennial international egg survey for mackerel and horse mackerel in the Atlantic, divided by 10^{15};

(f) "slipped fish" means fish caught and subsequently released into the sea without being brought on board the vessel.

CHAPTER II
OBJECTIVE FOR LONG TERM MANAGEMENT

Article 4
Objective of the plan

The plan's objective is to maintain the biomass of western horse mackerel at a level that ensures its sustainable exploitation, and to provide the highest long-term yield. To this end, the harvest control rule should be based in equal parts on precautionary advice given for average recruitment conditions, and on recent total allowable catches adjusted by a factor that reflects the recent trend in the stock abundance as measured through egg production.

CHAPTER III
HARVESTING RULES

Article 5

Procedure for setting the TAC

1. In order to achieve the objective laid down in Article 4, each year the Council, acting in accordance with the procedure laid down in Article 20 of Council Regulation (EC) No 2371/2002 and after consultation of the STECF, shall decide on the TAC for western horse mackerel for the following year.

2. The TAC shall be set in accordance with this Chapter.

Article 6
Calculation of the TAC

1. The TAC shall be calculated by deducting from the total removal calculated in accordance with Articles 7 and 8 a quantity of fish equivalent to the discards, including slipped fish, having occurred in the year preceding the year in which the latest scientific assessment has been made, as estimated by STECF.

2. Where the STECF is not able to estimate the level of discards including slipped fish for the year preceding the year in which the latest scientific assessment has been made, the deduction shall be equal to the highest relative amount of discards including slipped fish scientifically estimated as having occurred within the last 15 years, but not lower than 5%.

3. Where the TAC is calculated on the basis of the total removal calculated provisionally in accordance with Article 7(3), it shall be adapted during the year of its application to the final calculation of the removal.

Article 7

Calculation of the total removal for a year following an egg survey

1. Where the TAC is to be set for a year that follows a year in which an egg survey has been carried out, the total removal shall be calculated on the basis of the following elements:

   (a) a constant factor equal to 1.07, reflecting a final increase of the total removal as simulated in underlying mathematical models that aims at maximising the annual yield without compromising the objective of keeping the risk to stock size decline at a very low level;

   (b) the TAC set for the year in which the egg survey was carried out, hereinafter referred to as "reference TAC";

   (c) a weighting factor set in accordance with the Annex, reflecting the trend in stock abundance on the basis of egg survey indices;

   (d) a minimal total removal amount, including estimates of discards, of 75 000 tonnes.

2. The total removal referred to in paragraph 1 shall be calculated in accordance with the following formula:

   1.07 * (75 000 tonnes + (reference TAC * weighting factor) / 2)

3. Where only a provisional calculation of the latest egg survey index is available, the total removal shall be calculated in accordance with paragraphs 1 and 2 based on the provisional index and adapted during the year of application of the relevant TAC to the final result of the egg survey.

Article 8

Calculation of total removal for subsequent years

1. Where the TAC is to be set for a year that does not follow a year in which an egg survey has been carried out, the total removal shall be equal to the total removal calculated for the previous year.

2. However, if more than three years have expired since the last egg survey, calculated from the year for which the TAC is to be set, the total removal shall be reduced by 15%, unless STECF advises that such a reduction is not appropriate, in which case the total removal shall be equal to the previous one or calculated with a lower reduction, based on the advice of STECF.

Article 9

Transitional rule for establishing the TAC

1. Where the first TAC to be set in accordance with Articles 6 and 7 concerns a year that does not follow a year in which an egg survey has been carried out, the TAC

shall be calculated pursuant to those Articles as if the latest egg survey had occurred in the preceding year.

2. Where the reference TAC to be used for calculating the first TAC was set for areas differing from those mentioned in Article 2, the reference TAC shall be calculated taking into account recent scientific advice on appropriate catch levels, or recent catch levels in the absence of such advice, relating to the ICES Divisions mentioned in Article 2.

Article 10

Adaptation of measures

In the event that STECF advises that the egg survey indices as defined in Article 3(e) or their weighting as referred to in Article 7(1)(c), or the constant factor referred to in Article 7(1)(a) are no longer appropriate in order to maintain a very low risk of stock depletion and a high yield, the Council shall decide on new values for those elements.

CHAPTER IV
MONITORING AND SUVEILLANCE

Article 11

Special fishing permit

1. In order to fish for western horse mackerel, vessels shall hold a special fishing permit issued in accordance with Council Regulation (EC) No 1627/94 of 27 June 1994 laying down general provisions concerning special fishing permits[17].

2. It shall be prohibited for any fishing vessel not holding a fishing permit as referred to in paragraph 1 to fish for, or retain on board, any quantity of horse mackerel while the vessel is engaged on a fishing trip that has included the presence of that vessel in one of the ICES Divisions mentioned in Article 2.

3. Each Member State shall establish and maintain a list of vessels holding the special permit referred to in paragraph 1 and make it available, on its official website, to the Commission and other Member States.

Article 12
Cross-checks

1. Member States shall carry out with regard to western horse mackerel the administrative cross-checks and data verifications provided for in Article 19 of Regulation (EEC) No 2847/93. Particular emphasis shall be placed on the possibility

[17] OJ L 171, 6.7.1994, p.7.

of small pelagic species other than horse mackerel being reported as horse mackerel, and vice versa.

2. For vessels fitted with a vessel monitoring system (VMS), Member States shall verify, based on a representative sampling, that the information received at the fisheries monitoring centres (FMC) corresponds to activities recorded in the logbook by using VMS data. Such cross-checks shall be recorded in computer-readable form for a period of three years. Particular emphasis shall be placed on the coherence of area data concerning activities observed in areas where horse mackerel stock boundaries meet, namely ICES Divisions VIIIc and IXa, IVa and IVb, VIIe and VIId.

3. Each Member State shall maintain and make available to the public, in particular on its official website, the contact details for the submission of logbooks and landing declarations.

CHAPTER V
FOLLOW UP

Article 13

Evaluation of the plan

The Commission shall, on the basis of advice from STECF and after consultation of the pelagic Regional Advisory Council, evaluate the impact of the plan on the western horse mackerel and the fisheries exploiting that stock, at the latest in the sixth year of application of this Regulation and then each sixth successive year of application of this Regulation and, where appropriate, propose relevant measures to amend the plan.

CHAPTER VI
FINAL PROVISIONS

Article 14

Assistance under the European Fisheries Fund

1. For those years in which the spawning stock is scientifically estimated as having at least 130% of the size it had in 1982, the plan shall be deemed to be a management plan within the meaning of Article 6 of Regulation (EC) No 2371/2002, and for the purposes of Article 21(a)(iv) of Regulation (EC) No 1198/2006.

2. For those years in which the spawning stock is scientifically estimated as having less than 130% of the size it had in 1982, the plan shall be deemed to be a recovery plan within the meaning of Article 5 of Regulation (EC) No 2371/2002, and for the purposes of Article 21(a)(i) of Regulation (EC) No 1198/2006.

Article 15

Entry into force

This Regulation shall enter into force on the twentieth day of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Council
The President

ANNEX

Calculation of the weighting factor as referred to in Article 7, paragraph 1(c)

1. The weighting factor referred to in Article 7, paragraph 1(c) shall be set as follows on the basis of the slope calculated in accordance with in point 2 of this Annex :

   (a) If the slope of the last three egg survey indices is equal to or smaller than – 1,5, the weighting factor is 0,

   (b) If the slope of the last three egg survey indices is bigger than –1,5 and smaller than 0, the weighting factor is equal to 1 – (– 2/3 * the slope),

   (c) If the slope of the last three egg survey indices is equal to or bigger than 0 and not bigger than 0,5, the weighting factor is equal to 1 + (0,8 * the slope),

   (d) If the slope of the last three egg survey indices is bigger than 0,5, the weighting factor is 1,4.

2. The slope of the last three egg survey indices shall be calculated in accordance with the following formula:

   (egg survey index 3 – egg survey index 1) / (3 – 1),

   whereby the three most recent egg survey indices are being put in a row as marking point 1, point 2 and point 3 on the x-axis of a coordinate, thereby the egg survey index 3 being the latest egg survey index, and the egg survey index 1 being the egg survey index estimated six years previously.