

“Animal Welfare Indicators” Guidelines

with recommendations for the implementation of self-monitoring in
accordance with Sec. 11 (8) of the German Animal Welfare Act in
aquaculture establishments



“Animal Welfare Indicators” Working Group
of the Verband Deutscher Fischereiverwaltungsbeamter und Fischereiwissenschaftler e.V.
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I. Introduction

An animal welfare-friendly handling of fish is part of “Good Management Practice” in aquaculture, and is also required for ethical, legal and economic reasons.

According to Sec. 11 (8) of the German Animal Welfare Act¹ (*Tierschutzgesetz*, TierSchG), anyone who keeps livestock for commercial purposes must ensure by means of self-monitoring that the requirements of Sec. 2 TierSchG are complied with. In order to ensure within the framework of self-monitoring, that the requirements are being met, persons keeping livestock must collect and evaluate appropriate animal-related indicators (Animal Welfare Indicators).

According to Sec. 2 TierSchG, any person keeping, caring for or required to care for animals must provide the animal with food, care and accommodation appropriate to its species, its requirements and behaviour. It may not restrict the animal’s possibility of species-specific freedom of movement to such an extent as to cause the animal pain or avoidable suffering or harm, and must therefore possess the knowledge and skills necessary for providing the animal with adequate food, care and accommodation in accordance with its behavioural requirements.

Fish intended for slaughter or stocking is considered to be farm livestock, in accordance with the general administrative provisions for implementing the Animal Welfare Act² for agricultural livestock. The requirement to collect and evaluate Animal Welfare Indicators therefore also applies to aquaculture. Fish are not considered to be farm livestock (*Nutztiere*) within the meaning of the Animal Welfare – Farm Animal Husbandry Ordinance (*Tierschutz-Nutztierhaltungsverordnung*, TierSchNutzV), so the general requirements of Sec. 3 and Sec. 4 of the Ordinance do not apply to aquaculture.

The requirements to collect and evaluate Animal Welfare Indicators not only apply to the keeping of fish, but also to the temporary storage of fish (e.g. in tanks), for example, before slaughter or transportation.

These Guidelines are intended to serve as a tool for the practical implementation of self-monitoring by fish farmers.

¹ German Animal Welfare Act as amended by the announcement of May 18, 2006 (Federal Law Gazette (BGBl.) I, page 1206, 1313), last amended by Article 141 of the Act of March 29, 2017 (BGBl. I, page 626).

² General administrative regulation for the implementation of the Animal Welfare Act of February 9, 2000

II. Explanatory notes for data collection, assessment and the templates

Various factors, such as the type of animal involved, determine which Animal Welfare Indicators are suitable for self-monitoring. Examples of Animal Welfare Indicators include mortality and the organ findings gathered at slaughter (Schiwy, 2015³). For fish, to date no specific proposals have been made.

In Germany, various species of fish with different habitat requirements are kept or contained for food or stocking purposes in aquaculture environments. In addition to the species of fish involved, the age group, environmental conditions and the type of production are also relevant for the determination of suitable Animal Welfare Indicators.

For reasons of practicality, these Guidelines make a distinction between three forms of aquaculture production:

1. Salmonid production in flow-through systems, partial recirculating aquaculture systems and fish cages

Production of rainbow trout and other salmonids in flow-through ponds, flow channels and other holding units or in cages suspended in a natural water body. This section also deals with salmonid farming in partial recirculating aquaculture systems with a low recirculation rate of the system water.

2. Carp pond farming including the production of additional fish species

Production of carp and other cyprinid species as well as additional pond fish species such as pike, European perch and/or pike-perch in pond farms.

3. Fish production in recirculating aquaculture systems (RAS)

Production of fish such as eel, catfish, sturgeon, tilapia or pike-perch in RAS. For the purposes of these Guidelines, RAS are systems that have water treatment facilities, a low daily fresh water intake and a high recirculation rate for the system water.

The purpose of these Guidelines is to define meaningful Animal Welfare Indicators which can in practice be collected and assessed with a reasonable amount of effort and cost. The data collection and assessment forms are prepared as templates, and include the following characteristics for fish farmers to assess animal welfare:

- Animal losses/mortality
- Growth
- Water quality
- Behaviour
- Appearance
- Health status
- Findings at slaughter

³ Schiwy, P. (2015). Deutsche Tierschutzgesetze, Kommentar zum Tierschutzgesetz und Sammlung deutscher und internationaler Bestimmungen, Verlag Rehm, as of June 1, 2015.

Although the quality of the water is not an animal-related characteristic, water quality is central to fish holding evaluation, and should therefore be included in the animal welfare assessment. Especially the water quality parameters temperature, oxygen content, pH, ammonia, and nitrite content have a direct influence on the metabolism of the fish, and consequently play a major role in their well-being. Water quality also plays an important role in the emergence of fish diseases.

In the templates B1 and B2, the benchmarks, not the threshold values of certain water quality parameters are given: exceeding or falling below these may not necessarily affect animal welfare.

Mortality and growth as indirect animal-related indicators with regard to safeguarding compliance with the requirements stipulated in Sec. 2 TierSchG are well suited for self-monitoring purposes. According to Sec. 8 (1) No. 1 letter (d) of the German Fish Disease Control Ordinance (*Fischseuchenverordnung*⁴, FischSeuchV) a fish farm operator is in all cases obliged to keep a record of increased mortality on the fish farm. Reference should be made to reporting obligations under Sec. 4 of the German Animal Health Act (*Tiergesundheitsgesetz*⁵, TierGesG) if there is a suspicion of an outbreak of a notifiable disease or an outbreak of a notifiable fish disease has been identified, and the obligation to notify in accordance with Sec. 7 (3) of FischSeuchV where there are fish mortalities that cannot unequivocally be attributed to husbandry conditions or transportation conditions.

The assessment of fish growth depends on water temperature and fish species. Mortality requires, amongst other things, a consideration of the age group. Both characteristics can be collected in the course of operational processes with little effort, over a long period of time. In aquaculture practice, a record of mortality on a daily basis is only feasible for salmonid production in flow-through or partial recirculating aquaculture systems and – to a limited extent - in fish production in RAS depending on the age group. In carp pond farms, it is usually only possible to record mortality after the fish have been harvested. In this context, losses due to predators or predation should also be mentioned.

The data concerning “Behaviour” and “Appearance” characteristics of the fish, their “Health status” as well as “Findings at slaughter” are collected directly for the animal being farmed. Behavioural abnormalities, like refused feed intake, apathy/lethargy or an increased ventilation rate may be indicative of inadequate water quality and/or health problems. Changes in appearance, such as fin lesions, eye changes, mucosal detachment, skin shedding or discolouration provide information about the health status and possibly also about the keeping conditions. Findings gained during slaughter can provide information about health status, the nutritional state of the fish, as well as about their keeping and handling.

⁴ The Fish Disease Control Ordinance of November 24, 2008 (BGBl. I, page 2315), as last amended by Article 1 of the Ordinance of May 3, 2016 (BGBl. I, page 1057).

⁵ The Animal Health Act of May 22, 2013 (BGBl. I, page 1324), as last amended by Article 6 of the Law of July 17, 2017 (BGBl. I, page 2615).

The weighting that is given to any individual characteristic or the frequency of inspections depends, amongst other things, on the type of production.

These Guidelines includes templates that can be used for recording and assessing the Animal Welfare Indicators. However, self-made templates or recordings without a specific form can also be used, provided the information needed for the assessment is recorded. It is left to the discretion of the animal owners as to whether the performance of daily and/or regular inspections is documented, for example, by providing a date and initials.

III. Collecting the data and data assessment

III.1 Salmonid production in flow-through or partial recirculating aquaculture systems or in cages

III.1.1 Daily inspections

An inspection of the general condition and state of health of the fish should be carried out at least daily for all holding units and for tanks temporarily keeping fish within the frame of Sec. 9 of the German Animal Welfare Slaughter Ordinance (*Tierschutz-Schlachtverordnung*)⁶ at least twice a day. This can be done for example, during feeding. An inspection of any technical equipment and the condition of the holding facilities should be made at least once a day.

In the templates, only actually identified and relevant abnormalities should be entered. In the “Changes” column, any abnormalities compared to the last inspection have to be entered. Details about the measures taken should be entered in the “Measures for clarification of abnormalities” column. Whether the measures taken and/or the results of the investigations conducted contributed to the resolution of the problems should be entered into the “Success control” column, stating any additional measures.

Whether the losses observed during daily inspections may actually be regarded as increased mortality and the corresponding data have to be collected within the framework of self-monitoring depends on many factors as well as on the production system. Daily recording of losses is recommended, nevertheless. In contrast, an increase in mortality (the accumulation of dead fish) as compared to the previous inspection, must be recorded in any case. Losses resulting from predators or predation should also be documented. If mortality cannot clearly be attributed to the keeping conditions, transport conditions, technical faults, predators or similar, an examination by a veterinary should be arranged.

For recording and assessing any abnormalities found in the daily inspections [Template A](#) may be used.

Any other Animal Welfare Indicators may be recorded using [Template F](#).

III.1.2 Regular inspections

III.1.2.1 Water quality parameters

It is recommended to check the following water quality parameters regularly (at least once a month) or have them checked:

- water temperature;
- pH value;
- oxygen concentration and oxygen saturation;

⁶ Ordinance on the protection of animals involved in slaughter or killing and to implement Council Regulation (EC) No 1099/2009 (Animal Welfare Slaughter Ordinance - TierSchlV) of December 20, 2012 (BGBl. I, page 2982).

- ammonium and nitrite concentration
- The ammonia concentration can be determined with the help of [Table 1](#) or calculated from the ammonium concentration, the pH value and the water temperature ([Template B1](#)).

Measurements or sampling should be risk-oriented at appropriate points, taking the water flow into account, for example, at the outlets of ponds or a chain of ponds, and/or in holding units with a high stocking density.

For water temperatures above 16 °C, weekly collection and for water temperatures above 20 °C daily collection of the above-mentioned parameters is recommended.

The measuring equipment used should be maintained regularly in accordance with the general operating instructions.

It is advisable to document all the water quality parameters recorded. Deviations from the benchmarks should always be recorded ([Template B1](#)).

III.1.2.2 Behaviour, appearance, mortality and weight gain in harvested fish

In the context of harvest, e.g. for sorting, relocation or slaughter, the behaviour (see III.1.1), appearance (see III.1.1), mortality (see III.1.1) and where appropriate, weight gain, may be assessed. A reduced weight gain and/or an increased variance in growth between the different fish during the production phase may indicate some impairment in animal welfare. However, other factors, such as water temperature, fish species or age group should also be taken into account.

For recording and evaluating abnormalities observed in the context of harvest, **templates [A](#), [C](#) and [F](#)** may be used.

In the templates, only actually identified and relevant abnormalities should be entered.

III.1.2.3 Findings at slaughter

At slaughter, observations made that could be indicative of impairment in animal welfare during husbandry, containing or handling of the fish have to be recorded and assessed. [Template D](#) may be used for this purpose. Findings at slaughter should refer to the holding units in which the fish were kept until slaughtering. Findings due to the method of slaughter used shall not be recorded.

In the template, only actually identified and relevant abnormalities should be entered.

III.1.3 Health status check

In the event of increased mortality due to unexplained causes or the presence of disease-specific symptoms, the health status of the fish stock involved should be determined by a veterinarian. [Template E](#) may be used to record the information, results and measures taken.

In addition, results of routine examinations, for example those conducted in accordance with Sec. 7 FischSeuchV or collected in the course of stock management, may be documented using [Template E](#).

III.2 Carp pond farming, including the production of additional pond fish species

III.2.1 Regular inspections

III.2.1.1 Behaviour, appearance and increased mortality

Due to the size of pond units and/or areas of water, the extensive husbandry in carp ponds and the limited visibility of the water during the production phase, a daily inspection of the general condition and health status of the fish is only feasible to a limited extent in practical terms, for instance during feeding. However, pond units should be checked regularly for abnormal fish behaviour and appearance, as well as increased mortality.

An inspection of the general condition and state of health of the fish should be carried out at least daily for tanks temporarily keeping fish within the frame of Sec. 9 of the German Animal Welfare Slaughter Ordinance⁷ at least twice a day. An inspection of any technical equipment and the condition of the holding facilities should be made at least once a day.

In the templates, only actually identified and relevant abnormalities should be entered. In the “Changes” column, any abnormalities compared to the last inspection have to be entered. Details about the measures taken should be entered in the “Measures for clarification of abnormalities” column. Whether the measures taken and/or the results of the investigations conducted contributed to the resolution of the problems should be entered into the “Success control” column, stating any additional measures.

Whether the losses observed during regular inspections may actually be regarded as increased mortality and the corresponding data have to be collected within the framework of self-monitoring depends on many factors. An increase in mortality (the accumulation of dead fish) as compared to the previous inspection, must be recorded in any case. Data related to losses resulting from predators or predation should also be collected. If mortality cannot clearly be attributed to the keeping conditions, transport conditions, technical faults, predators or similar, an examination by a veterinary should be arranged.

For recording and assessing any abnormalities found in the regular inspections [Template A](#) may be used.

Any other Animal Welfare Indicators may be documented using [Template F](#).

III.2.1.2 Water quality parameters

It is recommended to check the following water quality parameters during the production period from May until September at least once a month or have them checked:

- water temperature;
- pH value;
- oxygen concentration and oxygen saturation;
- ammonium concentration

⁷ Ordinance on the protection of animals involved in slaughter or killing and to implement Council Regulation (EC) No 1099/2009 (Animal Welfare Slaughter Ordinance - TierSchlV) of December 20, 2012 (BGBl. I, page 2982).

- The ammonia concentration can be determined with the help of [Table 1](#) or calculated from the ammonium concentration, the pH value and the water temperature (**Templates [B2](#), [B3](#)**).

Measurements or sampling should be risk-oriented at appropriate points, taking the water flow into account, for example, at the outlets of ponds or a chain of ponds, and/or in holding units with a high stocking density. At water temperatures above 28 °C and in the case of seasonally anticipated strong fluctuations in certain parameters (pH, O₂) keeping a weekly record of the aforementioned parameters is recommended.

The measuring equipment used should be maintained regularly in accordance with the general operating instructions.

It is advisable to document all the water quality parameters recorded. Deviations from the benchmarks should always be entered (**Templates [B2](#), [B3](#)**).

III.2.1.3 Behaviour, appearance, mortality and weight gain in harvested fish

In the context of harvest, e.g. for sorting, relocation or slaughter, the behaviour (see III.2.1.1), appearance (see III.2.1.1), mortality (see III.2.1.1) and where appropriate, weight gain, may be assessed. A reduced weight gain and/or an increased difference in weight between the different fish during the production phase may indicate some impairment in animal welfare. However, other factors, such as water temperature, fish species, age group or condition of the ponds should also be taken into account.

For recording and evaluating abnormalities observed in the context of harvest, **templates [A](#), [C](#) and [F](#)** may be used.

In the templates, only actually identified and relevant abnormalities should be entered.

III.2.1.4 Findings at slaughter

At slaughter, observations made that could be indicative of impairment in animal welfare during husbandry, containing or handling of the fish have to be recorded and assessed. **Template [D](#)** may be used for this purpose. Findings at slaughter should refer to the holding units in which the fish were kept until slaughtering. Findings due to the method of slaughter used shall not be recorded.

In the template, only actually identified and relevant abnormalities should be entered.

III.2.2 Health status check

In the event of increased mortality due to unexplained causes or the presence of disease-specific symptoms, the health status of the fish stock involved should be determined by a veterinarian. **Template [E](#)** may be used to record the information, results and measures taken.

In addition, results of routine examinations, for example those conducted in accordance with Sec. 7 FischSeuchV or collected in the course of stock management, may be documented using **Template [E](#)**.

III.3 Fish production in recirculating aquaculture systems (RAS)

III.3.1 Daily inspections

An inspection of the general condition and state of health of the fish has to be carried out at least daily for all holding units and for tanks temporarily keeping fish within the frame of Sec. 9 of the German Animal Welfare Slaughter Ordinance (*Tierschutz-Schlachtverordnung*)⁸ at least twice a day. This can take place for example, in the context of feeding. An inspection of the technical equipment and the condition of the holding facilities should be made at least twice a day.

In the templates, only actually identified and relevant abnormalities should be entered. In the “Changes” column, any abnormalities compared to the last inspection have to be entered. Details about the measures taken should be entered in the “Measures for clarification of abnormalities” column. Whether the measures taken and/or the results of the investigations contributed to the resolution of the problems should be entered into the “Success control” column, stating any additional measures.

Whether the losses observed during daily inspections may actually be regarded as increased mortality depends on many factors as well as on the production system. Daily recording of losses is essential in RAS, however. Losses resulting from predators or predation should also be documented in case of outdoor RAS. If mortality cannot clearly be attributed to the keeping conditions, transport conditions, technical faults, predators or similar, an examination by a veterinary should be arranged.

For recording and assessing any abnormalities found in the daily inspections [Template A](#) may be used.

Any other Animal Welfare Indicators may be documented using [Template F](#).

III.3.2 Regular inspections

III.3.2.1 Water quality parameters

It is recommended to check the following water quality parameters regularly or have them checked:

- water temperature;
- pH value;
- oxygen concentration and oxygen saturation;
- ammonium, nitrite and nitrate concentrations.
- The ammonia concentration can be determined with the help of [Table 1](#) or calculated from the ammonium concentration, the pH value and the water temperature ([Templates B1, B2, B3](#)).

A continuous measurement of water temperature, pH value and oxygen concentration or oxygen saturation is recommended. The ammonium, nitrite and nitrate concentration should be determined in the start-up phase, when using medications or in the event of an increase in mortality, on a daily basis. Otherwise, it is advisable to perform measurements of the ammonium, nitrite and nitrate concentrations on a system- and fish-type-dependent basis several times a week.

⁸ Ordinance on the protection of animals involved in slaughter or killing and to implement Council Regulation (EC) No 1099/2009 (Animal Welfare Slaughter Ordinance - TierSchlV) of December 20, 2012 (BGBl. I, page 2982).

The measurements or sampling should be carried out at appropriate points in each cycle in a risk-oriented manner, for example, in holding units with high stocking densities.

Regular determinations of the total bacterial count of the system water may be advisable in case of high stocking densities.

The measuring equipment used should be maintained regularly in accordance with the general operating instructions.

It is advisable to document all the water quality parameters recorded. Deviations from the benchmarks should always be entered (**Templates [B1](#), [B2](#), [B3](#)**).

III.3.2.2 Behaviour, appearance, mortality and weight gain in harvested fish

In the context of harvesting, e.g. for sorting, relocation or slaughter, the behaviour (see III.3.1), appearance (see III.3.1), mortality (see III.3.1) and weight gain may be assessed. A reduced weight gain and/or an increased variance in growth between the different fish during the production phase at constant water temperatures may indicate some impairment in animal welfare. However, other factors such as the species of fish, age group or adaptation phase after restocking should be taken into account.

For recording and evaluating abnormalities observed in the context of harvesting, **templates [A](#), [C](#) and [F](#)** may be used.

In the templates, only actually identified and relevant abnormalities should be entered.

III.2.3. Findings at slaughter

At slaughter, observations made that could be indicative of impairment in animal welfare during husbandry, containing or handling of the fish have to be recorded and assessed. **Template [D](#)** may be used for this purpose. Findings at slaughter should refer to the holding units in which the fish were kept until slaughtering. Findings due to the method of slaughter used shall not be recorded.

In the template, only actually identified and relevant abnormalities should be entered.

III.3.3 Health status check

In general, veterinary stock supervision is recommended.

In the event of increased mortality due to unexplained causes or the presence of disease-specific symptoms, the health status of the fish stock involved should be determined by a veterinarian. **Template [E](#)** may be used to record the information, results and measures taken.

In addition, results of routine examinations, for example those conducted in accordance with Sec. 7 FischSeuchV or collected in the course of stock management, may be documented using **Template [E](#)**.

IV. Templates

- [Template A](#) “Behaviour, appearance, increased mortality”
- [Template B1](#) “Water quality – salmonids”
- [Template B2](#) “Water quality – carp, tench”
- [Template B3](#) “Water quality – other fish species”
- [Template C](#) “Weight gain”
- [Template D](#) “Findings at slaughter”
- [Template E](#) “Health status”
- [Template F](#) “Other Animal Welfare Indicators”

Template A “Behaviour, appearance, increased mortality”

Holding unit: _____ Fish species: _____ Date of stocking: _____ Initial stock (number): _____

No.	Inspection date	Age group ⁹	Behaviour, if applicable according to legend ¹⁰ , with the number of animals affected (estimated)	Appearance, if applicable according to legend ¹⁰ , with the number of animals affected (estimated)	Losses since the last inspection	Measures taken to eliminate the deviations identified	Success control
						<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
						<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
						<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:

⁹ H = Hatchlings; F = Fry; FF = Food fish; SF = Spawning fish.

¹⁰ See: V. [Legend for Templates A and D.](#)

Template B1 “Water quality – salmonids”

Holding unit: _____ Fish species: _____ Date of stocking: _____ Initial stock (number): _____

No.	Inspection date	Age group ¹¹	Parameter	Benchmark	Measured value	Measures taken to eliminate the deviations identified	Success control
			T (°C)	4 – 18		<input type="checkbox"/> Aeration <input type="checkbox"/> Increase in water flow rate <input type="checkbox"/> Cleaning the holding unit <input type="checkbox"/> Change in feed/feed reduction <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
		pH	6 – 8				
		O ₂ (mg/l)	> 6				
		NH ₄ ⁺ (mg/l)	< 0.5				
		NH ₃ (mg/l) ¹²	< 0.01				
		NO ₂ ⁻ (mg/l)	< 0.5				
			T (°C)	4 – 18		<input type="checkbox"/> Aeration <input type="checkbox"/> Increase in water flow rate <input type="checkbox"/> Cleaning the holding unit <input type="checkbox"/> Change in feed/feed reduction <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
		pH	6 – 8				
		O ₂ (mg/l)	> 6				
		NH ₄ ⁺ (mg/l)	< 0.5				
		NH ₃ (mg/l) ¹²	< 0.01				
		NO ₂ ⁻ (mg/l)	< 0.5				
			T (°C)	4 – 18		<input type="checkbox"/> Aeration <input type="checkbox"/> Increase in water flow rate <input type="checkbox"/> Cleaning the holding unit <input type="checkbox"/> Change in feed/feed reduction <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
		pH	6 – 8				
		O ₂ (mg/l)	> 6				
		NH ₄ ⁺ (mg/l)	< 0.5				
		NH ₃ (mg/l) ¹²	< 0.01				
		NO ₂ ⁻ (mg/l)	< 0.5				

¹¹ H = Hatchlings; F = Fry; FF = Food fish; SF = Spawning fish.

¹² $NH_3 = 0.94412 \times NH_4^+ / (1 + 10^{((0.0925 + (2728.795 / (t + 273.15))) - pH)})$ or according to [Table 1](#).

Template B2 “Water quality – carp, tench”

Holding unit: _____ Fish species: _____ Date of stocking: _____ Initial stock (number): _____

No.	Inspection date	Age group ¹³	Parameter	Benchmark	Measured value	Measures taken to eliminate the deviations identified	Success control
			T (°C)	4 – 30		<input type="checkbox"/> Aeration	<input type="checkbox"/> Clarified/resolved
			pH	6 – 8.5		<input type="checkbox"/> Increase in water flow rate	Date:
			O ₂ (mg/l)	> 4		<input type="checkbox"/> Cleaning the holding unit	<input type="checkbox"/> Not clarified/resolved
			NH ₄ ⁺ (mg/l)	< 1.0		<input type="checkbox"/> Change in feed/feed reduction	Additional measures:
			NH ₃ (mg/l) ¹⁴	< 0.03		<input type="checkbox"/> Other:
					
					
			T (°C)	4 – 30		<input type="checkbox"/> Aeration	<input type="checkbox"/> Clarified/resolved
			pH	6 – 8.5		<input type="checkbox"/> Increase in water flow rate	Date:
			O ₂ (mg/l)	> 4		<input type="checkbox"/> Cleaning the holding unit	<input type="checkbox"/> Not clarified/resolved
			NH ₄ ⁺ (mg/l)	< 1.0		<input type="checkbox"/> Change in feed/feed reduction	Additional measures:
			NH ₃ (mg/l) ¹⁴	< 0.03		<input type="checkbox"/> Other:
					
					
			T (°C)	4 – 30		<input type="checkbox"/> Aeration	<input type="checkbox"/> Clarified/resolved
			pH	6 – 8.5		<input type="checkbox"/> Increase in water flow rate	Date:
			O ₂ (mg/l)	> 4		<input type="checkbox"/> Cleaning the holding unit	<input type="checkbox"/> Not clarified/resolved
			NH ₄ ⁺ (mg/l)	< 1.0		<input type="checkbox"/> Change in feed/feed reduction	Additional measures:
			NH ₃ (mg/l) ¹⁴	< 0.03		<input type="checkbox"/> Other:
					
					

¹³ H = Hatchlings; F = Fry; FF = Food fish; SF = Spawning fish.

¹⁴ $NH_3 = 0.94412 \times NH_4^+ / (1 + 10^{((0.0925 + (2728.795 / (t + 273.15))) - pH)})$ or according to [Table 1](#).

Template B3 “Water quality – other fish species”

Holding unit: _____ Fish species: _____ Date of stocking: _____ Initial stock (number): _____

No.	Inspection date	Age group ¹⁵	Parameter	Benchmark ¹⁶	Measured value	Measures taken to eliminate the deviations identified	Success control
			T (°C)			<input type="checkbox"/> AerationIncrease in water flow rate <input type="checkbox"/> Cleaning the holding/filter unit <input type="checkbox"/> Change in feed/feed reduction <input type="checkbox"/> Other:	<input type="checkbox"/> clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
		pH					
		O ₂ (mg/l)					
		NH ₄ ⁺ (mg/l)					
		NH ₃ (mg/l) ¹⁷					
		NO ₂ ⁻ (mg/l)					
		NO ₃ ⁻ (mg/l)					
			T (°C)			<input type="checkbox"/> AerationIncrease in water flow rate <input type="checkbox"/> Cleaning the holding/filter unit <input type="checkbox"/> Change in feed/feed reduction <input type="checkbox"/> Other:	<input type="checkbox"/> clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
		pH					
		O ₂ (mg/l)					
		NH ₄ ⁺ (mg/l)					
		NH ₃ (mg/l) ¹⁷					
		NO ₂ ⁻ (mg/l)					
		NO ₃ ⁻ (mg/l)					
			T (°C)			<input type="checkbox"/> AerationIncrease in water flow rate <input type="checkbox"/> Cleaning the holding/filter unit <input type="checkbox"/> Change in feed/feed reduction <input type="checkbox"/> Other:	<input type="checkbox"/> clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
		pH					
		O ₂ (mg/l)					
		NH ₄ ⁺ (mg/l)					
		NH ₃ (mg/l) ¹⁷					
		NO ₂ ⁻ (mg/l)					
		NO ₃ ⁻ (mg/l)					

¹⁵ H = Hatchlings; F = Fry; FF = Food fish; SF = Spawning fish.

¹⁶ Enter benchmarks according to literature for the respective fish species.

¹⁷ $NH_3 = 0.94412 \times NH_4^+ / (1 + 10^{((0.0925 + (2728.795 / (t + 273.15))) - pH)})$ or according to [Table 1](#).

Template C “Weight gain”

Holding unit: _____ Fish species: _____ Date of stocking: _____ Initial stock (number): _____

No.	Harvest date	Age group ¹⁸	Growth retardation/Variance in growth		Measures to clarify or eliminate the reduction in weight gain or variance in growth	Success control
			Average weight gain g/day since the last inspection (if known)	Abnormalities since previous inspection		
			ø initial weight, Date: ø current weight, date: Difference: Increase/Day (g):.....	<input type="checkbox"/> Delayed growth <input type="checkbox"/> Some fish emaciated <input type="checkbox"/> Noticeable variance in growth of fish	<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Sorting <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved, additional measures:
			ø initial weight, Date: ø current weight, date: Difference: Increase/Day (g):.....	<input type="checkbox"/> Delayed growth <input type="checkbox"/> Some fish emaciated <input type="checkbox"/> Noticeable variance in growth of fish	<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Sorting <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved, additional measures:
			ø initial weight, Date: ø current weight, date: Difference: Increase/Day (g):.....	<input type="checkbox"/> Delayed growth <input type="checkbox"/> Some fish emaciated <input type="checkbox"/> Noticeable variance in growth of fish	<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Sorting <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved, additional measures:

¹⁸ H = Hatchlings; F = Fry; FF = Food fish; SF = Spawning fish.

Template D “Findings at slaughter”¹⁹

From holding unit: _____ Fish species: _____ Date of stocking: _____ Initial stock (number): _____

No.	Slaughter date	Findings/Abnormalities: information according to legend, if applicable ²⁰	Measures taken to clarify or resolve abnormalities in the unit, in which the slaughtered fish were kept	Success control
			<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
			<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
			<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
			<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Change in feed <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:

¹⁹ Slaughter findings for fish kept in the containers in which they were kept until slaughtering have to be used.

²⁰ See: V. [Legend for Templates A and D.](#)

Template E “Health status”

From holding unit: _____ Fish species: _____ Date of stocking: _____ Initial stock (number): _____

No.	Examination date	Age group ²¹	Reason for the veterinary examination	Findings of the veterinary examination and measures taken	Success control
			<input type="checkbox"/> Increased mortality <input type="checkbox"/> Findings from the daily/routine inspections or from slaughter ²² <input type="checkbox"/> Routine examination <input type="checkbox"/> Other reason:	<input type="checkbox"/> Report is available, findings: <input type="checkbox"/> Treatment: <input type="checkbox"/> Other measures:.....	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
			<input type="checkbox"/> Increased mortality <input type="checkbox"/> Findings from the daily/routine inspections or from slaughter ²² <input type="checkbox"/> Routine examination <input type="checkbox"/> Other reason:	<input type="checkbox"/> Report is available, findings: <input type="checkbox"/> Treatment: <input type="checkbox"/> Other measures:.....	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
			<input type="checkbox"/> Increased mortality <input type="checkbox"/> Findings from the daily/routine inspections or from slaughter ²² <input type="checkbox"/> Routine examination <input type="checkbox"/> Other reason:	<input type="checkbox"/> Report is available, findings: <input type="checkbox"/> Treatment: <input type="checkbox"/> Other measures:.....	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:

²¹ H = Hatchlings; F = Fry; FF = Food fish; SF = Spawning fish.

²² According to Template [A](#) and/or [D](#).

Template F “Other Animal Welfare Indicators”

From holding unit: _____ Fish species: _____ Date of stocking: _____ Initial stock (number): _____

No.	Inspecti on date	Age group ²³	Description of abnormalities with the number of animals affected (estimated)	Measures taken to eliminate the deviations identified	Success control
				<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
				<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
				<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:
				<input type="checkbox"/> Water testing <input type="checkbox"/> Fish examination <input type="checkbox"/> Other:	<input type="checkbox"/> Clarified/resolved Date: <input type="checkbox"/> Not clarified/resolved Additional measures:

²³ H = Hatchlings; F = Fry; FF = Food fish; SF = Spawning fish.

V. Legend for Templates A and D

Behaviour

Behaviour	Abbr.	Illustration
Scouring	SC	
Apathy, lethargy	AP	
Fish staying near edge of pond	RS	Illustration 1
Fish staying close to surface	OS	Illustration 2
Central nervous system disorders	ZS	Illustration 3
Clamped fins	FK	
Loss of balance	VG	
Fish laying on the bottom of the tank	BO	Illustration 4
Nervousness	SV	
Increased respiration rate	EA	

Organ changes²⁴

Organ	Change	Abbr.	Illustration
Body shape	Increased girth	UV	Illustration 5
	Emaciation	AM	
	Crippling/Malformations	VK	Illustration 6
Skin	Discolourations, e.g. dark discolouration	HF	Illustration 7
	Reddening, bleeding	HR	Illustration 8
	Injuries	HV	Illustration 9
	Ulcers, lumps	HG	Illustration 10
	Fungus	VP	Illustration 11
	Mucosal proliferation and mucosal detachment, grayshine	HS	
	Other skin changes	HH	
Eyes	Exophthalmia	AG	Illustration 7
	Enophthalmia	AE	Illustration 12
	Corneal opacity	AH	Illustration 12
Fins	Fin shortening	FK	Illustration 13
	Fin rot	FF	
	Fin injuries	FV	
Gills	Bleeding	KB	
	Mucidity	KV	Illustration 12
	Whitening	KA	
	Gill necrosis	KN	Illustration 14
Muscles	Petechiae	MP	Illustration 15
	Bleeding, planar	MF	Illustration 16
	Brightening	MA	Illustration 17
	Necrosis	MN	

²⁴ No findings related to the method of slaughter.

Organ	Change	Abbr.	Illustration
Internal organs	Spleen enlargement	MV	Illustration 18
	Fatty liver	LV	
	Increased abdominal fat	BF	
	Bleeding	BL	Illustration 19
	Other organ changes	SO	

VI. Table 1: Ammonia (NH₃) as a percentage of total concentrations of ammonium (NH₄⁺) and ammonia as a function of pH value and water temperature (after Baur, Bräuer and Rapp, 2010)²⁵

pH value	Water temperature (°C)					
	5	10	15	20	25	30
6.5	0.04	0.06	0.09	0.13	0.18	0.25
7.0	0.12	0.19	0.27	0.40	0.55	0.79
7.5	0.39	0.59	0.85	1.24	1.73	2.48
8.0	1.22	1.83	2.65	3.83	5.28	7.46
8.5	3.77	5.55	7.98	11.18	14.97	20.30
9.0	11.02	15.68	21.42	28.47	35.76	44.60

²⁵ Werner H. Baur, Grit Bräuer and Jörg Rapp (2010). Nutzfische und Krebse – Lebensraum, Erkrankungen und Therapie (Commercial fish and crayfish - habitat, diseases and therapy). Enke publishers, Stuttgart.

VII. Illustrations



Illustration 1: Fish staying near edge of pond (picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 2: Fish staying close to surface (picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 3: Trout with central nervous system disorder "Flashes" (picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 4: Carp laying on the bottom of the tank (picture: University of Veterinary Medicine Hannover, Foundation)



Illustration 5: Increase in girth of European catfish
(picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 6: Malformations (swimming bladder displacement) in a koi
(picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 7: Dark discoloration, exophthalmia (picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 8: Redness of skin, anus and fin base in koi
(picture: Lower Saxony State Office for Consumer Protection and Food Safety)

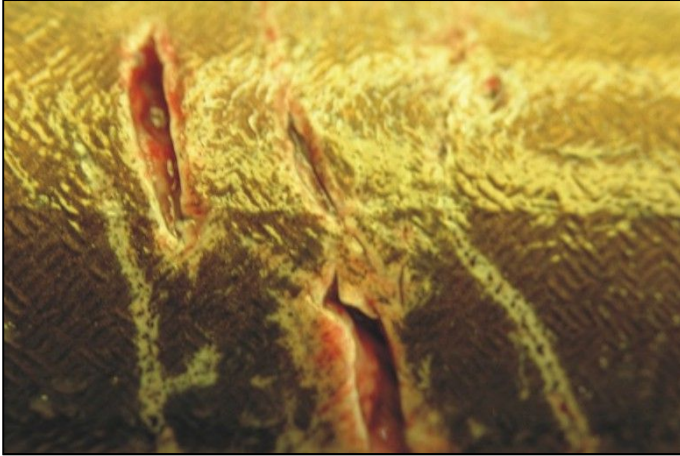


Illustration 9: Skin lesions ("Cormorants") in an eel (picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 10: Skin ulcers in carp (picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 11: Fungus (picture: University of Veterinary Medicine Hannover, Foundation)



Illustration 12: Invaded eyes, enophthalmia, mucosal proliferation of the gills (picture: Lower Saxony State Office for Consumer Protection and Food Safety)



Illustration 13: Tail fin shortening, fin erosion
(picture: Bavarian State Research Center for Agriculture,
Institute for Fisheries)



Illustration 14: Gill necrosis (picture: Lower Saxony State
Office for Consumer Protection and Food Safety)



Illustration 15: Petechiae in the muscles (picture: Lower
Saxony State Office for Consumer Protection and Food
Safety)



Illustration 16: Extensive planar bleeding in the muscles
(picture: Lower Saxony State Office for Consumer
Protection and Food Safety)

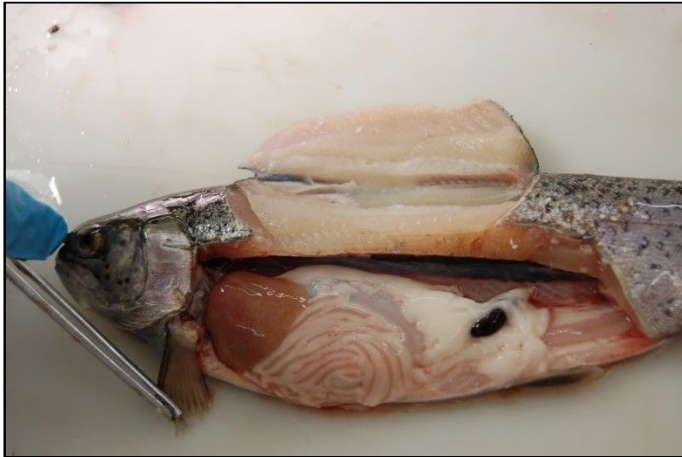


Illustration 17: Pale muscles (picture: Lower Saxony State Office for Consumer Protection and Food Safety)

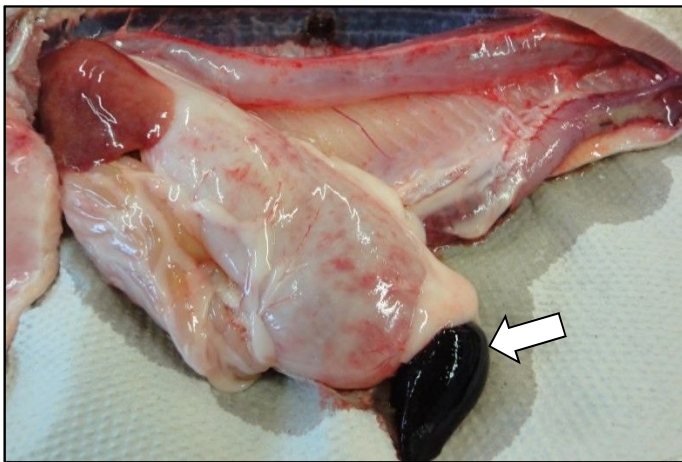


Illustration 18: Spleen enlargement (picture: University of Veterinary Medicine Hannover, Foundation)

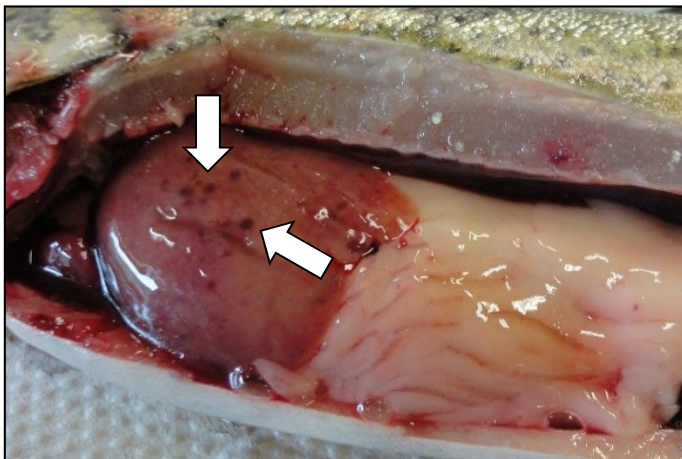


Illustration 19: Bleeding on the liver (picture: University of Veterinary Medicine Hannover, Foundation)