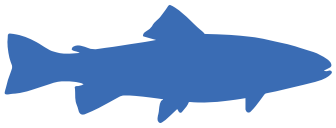
Farming, transport, and slaughter

Rainbow trout

Survey guidelines

for a National Animal Welfare Monitoring



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1 Information on the species

Rainbow trout (*Oncorhynchus mykiss*) is a salmonid fish found in lakes and rivers on the west coast of North America. The species has its geographic range from southern California to Alaska and the Kamchatka Peninsula in northern Russia. Rainbow trout was introduced to Europe for human consumption in the second half of the 19th century and formed the basis for the development of trout aquaculture. Today, rainbow trout is widespread in aquaculture and globally distributed by introduction into natural waters across almost all regions of the temperate zone. Within the family of salmonids, rainbow trout belongs to the genus of Pacific salmon and trout. Different local variants have developed in the original area of distribution. Anadromous populations spawn in the upper reaches of rivers. The young fish migrate to the sea to grow and return to their home waters for spawning. There are also variants at all locations that live in freshwater throughout the year and do not conduct spawning migrations. There is also a large number of genetic subspecies, which differ in their phenotype (coloration, appearance, life strategy) and range of distribution. Based on this natural diversity, a large number of different breeding forms, hybrid lines and lineages have been developed. These breeds differ, for example, in colouration and colour patterning, growth characteristics, and fillet yield or immunity towards certain pathogens.

Rainbow trout are predatory fish at all life stages. Rainbow trout feed on aquatic invertebrates, primarily insects, insect larvae and crustaceans, but also consume other fish and even small mammals. In aquaculture, rainbow trout are fed almost exclusively with extruded pelleted feed. The feed is formulated according to the species-specific requirements and has a high protein and fat content. The feed conversion ratio, which is a measure of the conversion efficiency of feed into body mass, can be around 1 when conditions are good. In European aquaculture, the average rearing period from fry to portion trout is between one and two years.

Rainbow trout prefer clean water that is rich in oxygen and cool in temperature. The optimum temperature range is 13-17°C. However, they can also tolerate 21-24°C for some time in well-oxygenated water. Eggs and fry require lower water temperatures. In recent years, the effects of climate change have become increasingly apparent in trout aquaculture. Water shortages, high water temperatures and, as a consequence, oxygen deficiency in the water have a particular impact on trout aquaculture. In addition, extreme weather events may cause turbidity and nutrient inputs from surrounding areas, leading to significant deteriorations in water quality.

Two production systems are common in German trout farming: semi-intensive rearing in traditional pond systems with cool and oxygenated water flowing through them. In these ponds, the fish are reared at a density of 15-30 kg of fish per cubic meter of water. In addition, elongated, narrow troughs and channels, so called raceway systems are commonly used, where stocking density is usually somewhat higher. The amount produced can vary quite considerably depending on the type of design, location and management, but generally does not exceed 60 kg of fish per cubic meter of water.

In German aquaculture, around 5,800 tons of rainbow trout are produced as portion trout with a weight of up to 250-400 g. In addition, there are almost 2,000 tons of large trout with a weight of up to 2.5 kg (as of 2022). Large trout are rainbow trout that get a red flesh through a specific feed additive. Rainbow trout and other salmon-like fish (salmonids) account for over half of the total finfish aquaculture production in Germany. There are currently (as of 2022) around 1,700 farms producing salmonids. This is around 24% less than in 2015, which means that the level of self-sufficiency with fish in Germany is continuing to decrease. The continuous decline in ova and juvenile fish producers is a matter of particular concern. This is leading to a loss of regional breeds and thus to a loss of aquatic genetic diversity and resources.

In trout, an insufficient water supply, poor water quality and the way in which fish are handled during catch, sorting and transport, as well as during stunning and killing can affect animal welfare.

2 Biosecurity and occupational safety during farm visits

2.1 Biosecurity

Biosecurity is of paramount importance in ensuring good animal health in husbandry. The biosecurity requirements are enshrined in law (e.g., Regulation (EU) 2016/429 (EU Animal Health Law (AHL) and the Animal Health Act (TierGesG)). As these legal norms can change and be adapted, it is necessary to regularly observe the current legal situation and, in particular, changes to it. Biosecurity serves to protect against the spread of pathogens, both within animal populations, herds or groups on a farm and between different farms as well as the environment.

Individuals who conduct surveys on farms as part of an "animal welfare monitoring" may pose an increased risk with regard to biosecurity as observers visit different fish farms and/or fish processing companies in close chronological order. It is therefore of particular importance to follow all measures to ensure good biosecurity.

Before the farm visit

When **planning farm visits**, the disease status of the farms must be taken into consideration. Farms can be assigned to one of the following four categories in accordance with the EU Animal Health Law (Regulation (EU) 2016/429):

(1) **Recognized disease-free**

(2) **Participation** in an **eradication program** to achieve disease-free status

(3) **Voluntary surveillance program** for certain diseases (no infection known)

(4) **Neither** disease-free **nor** under an eradication program

It is recommended that, where possible, no more than one farm visit should be carried out per day. Following each visit, a risk assessment should be carried out, with any necessary adaptations made to the plan for subsequent farm visits. If several farms are visited in quick succession, it is advised that all farms in category one should be visited first, followed by farms in category two, and so on.

In principle, farm visits must be planned in such a way that thorough cleaning and disinfection of equipment and working materials is possible and carried out between each visit in accordance with the requirements of the materials used. Equipment and materials should be allowed to dry completely between visits. It is recommended that cleaning and disinfection be carried out directly on-site following a farm visit and, if necessary, again right before a visit.

During the farm visit

Attention should be given to the following points **when visiting** a farm:

Depending on the farm and/or site-specific risk assessment, fish farms implement measures to safeguard their fish stocks. During on-site surveys, these measures, as specified by the farms, must be adhered to (access restrictions, disinfection measures, occupational safety).

Footwear is one of the greatest risk factors with regard to the entry and spread of pathogens. Therefore, it is important that boots or shoes are always kept clean and disinfected. It may be advisable to disinfect footwear again before a farm visit. If necessary, disposable overshoes or farm own footwear can be used.

Wearing disposable gloves can also be useful.

Contact of external **equipment or working materials** with fish or water of a fish farm should be avoided as far as possible. The following notes apply:

Water samples:

- Take water samples with the farm's own containers
- Transfer water samples without direct contact into a clean and disinfected container (e.g., bucket)
- If necessary, take samples in clean, labelled sample vessels from decanted samples
- Perform measurements with external probes (e.g., pH value) in the decanted sample
- Always dispose water in a manner that it cannot return into the rearing unit. This can be achieved by emptying containers on the dam or disposing water via the sewage system)

Fish samples:

- Catch fish with the farm's own equipment
- Transport with the farm's own containers
- Fish that have been removed from their holding unit and have come into contact with external equipment or personnel must not be returned to the holding unit.

After the farm visit

The following points should be taken into consideration **at the end of the farm visit**:

In principle, all cleaning and disinfection should be carried out in such a way that the resulting waste water and wastes do not come into contact with the fish holding unit (ideally, they should be disposed directly into the sewage system or appropriate waste containers). General instructions for disinfection, e.g., from the manufacturer, and possible sources of error should be considered. Only clean surfaces and materials can be thoroughly disinfected. In addition, the dilution error, the soap defect and the cold defect of disinfectants have to be considered in particular.

When possible, an initial cleaning and disinfection of working materials should be carried out right after the end of the farm visit. If equipment and materials that have not been cleaned and/or disinfected are transported, strict care must be taken to ensure that they do not come into contact with unused equipment and materials during transportation.

If samples and/or wastes are transported, closed, watertight containers should be used in such a way as to ensure that there is no contact with fresh or already cleaned and disinfected equipment and materials at any time.

2.2 Occupational safety

Maintaining occupational safety and health precautions during farm visits is essential to prevent accidents. The safety of the personnel conducting the survey and the farm staff must be guaranteed during all activities of any welfare monitoring. If this is not possible, the respective work must not be carried out or, if necessary, must be discontinued. This applies to all levels of the survey: operational level, stock level, stunning and killing, as well as the individual animal level. Particular hazards during a farm visit include, e.g., unsafe and impassable terrain, slippery surfaces, water in combination with electricity as well as sharp and pointed objects. To reduce the risk of slipping on unpaved or wet ground, slip-resistant shoes should be worn (the aspects described in "2.1 Biosecurity" must be taken into account as well). In principle, a risk assessment should be carried out for all activities on the farms. Individuals should not put themselves in situations that are considered to be a risk. This applies in particular:

- The safety instructions of the farm management or farm employees must be followed at all times.
- All pathways on farm premises or within the farm premises should be travelled together with farm employees.
- Inaccessible areas of the company premises must not be entered.
- Slippery, icy or inadequately secured boards, planks, or other crossings over ponds, channels and other bodies of water must not be entered.
- A sufficient safety distance must be maintained from the edge of water bodies.
- A sufficient safety distance must be maintained from company-owned and external vehicles (forklift trucks, loaders, excavators, tractors, trucks, etc.). Standing behind moving vehicles is prohibited. Be aware of the blind spots of vehicles.
- During stunning and killing, a sufficient safety distance must be maintained from the electrical stunner. Under no circumstances should anyone reach into the stunning tank! A sufficient safety distance must be maintained from company employees handling percussion tools and knives during stunning and killing.
  In general: stunning and killing is only carried out by company employees!
- A sufficient safety distance must be maintained from devices for scaring and/or hunting (shooting apparatus, traps, etc.) on the premises.
- Whenever possible, travel between different locations of a farm should be carried out independently and in one's own car (exceptions to this are unpaved roads for which certain vehicles (e.g., four-wheel drive vehicles) are required).
- Clothing appropriate to the weather conditions and temperature must be worn.
- Standard safety measures for handling wet conditions must be observed.
- Furthermore, the regulations for ensuring occupational health and safety, as stipulated by the respective employer apply.

3 Approach

The welfare indicators to be collected are used to assess various aspects of animal welfare. These are indicators related to farm and stock management, indicators related to resources, and indicators related to the animals. The latter include those that are recorded directly on individual animals or a group of animals. The indicators of these various welfare aspects are collected at four different levels:

(1) Indicators at the operational level (these are mainly management- and resource-related indicators)

(2) Indicators at stock level (these are management-, resource- and animal-related indicators)

(3) Indicators on stunning and killing (these are both management- and animal-related indicators)

(4) Indicators at the individual animal level (these are animal-related indicators).

The collection of indicators at the operational level is conducted by an interview. Background information on the farm is recorded as well as indicators related to transportation of live fish.

The indicators at the stock level are collected from a single representative stock of fish at the end of the grow-out phase.

The indicators on stunning and killing are collected during a regular slaughter procedure on the farm. Following slaughter, a series of indicators are recorded at the individual animal level using a sample of 30 randomly selected rainbow trout.

A comprehensive picture of animal welfare at all levels and in all dimensions can be derived from the background information, indicators collected at the operational level, indicators collected at the stock level, indicators related to stunning and killing, as well as animal-related indicators. In a final evaluation, individual pieces of information should be linked in order to obtain information about certain correlations between factors affecting the welfare of aquaculture animals.

The order in which the indicators are presented in this survey guidelines follows the sequence of data collection on-site at the farm.

Important: If an enterprise/farm does not slaughter rainbow trout (e.g., hatchery, farms producing fingerlings or fish used for stocking), the survey on stunning and killing shall not to be carried out. Consequently, the survey at the individual animal level is omitted. In this case, the survey is limited to indicators at the operational level (data collected via interview and during subsequent farm visit).

3.1 Workflow for rainbow trout farm visit

Operational level

Interview with the farm management or a representative on the following topics (approx. 60 min):

- Type of management, production method, operating mode, and structure
- Water supply, water use
- Predators and predator management
- Hygiene and biosecurity

Stock level

Survey at stock level on a stock of trout ready for marketing:

- Oxygen supply
- Swimming behaviour
- Occurrence of dead fish
- Occurrence of abnormal fish

Stunning and killing

Observation by the surveyor of the standard stunning and killing procedure carried out on the farm on 30 rainbow trout from the current stock ready for marketing. These 30 rainbow trout are then also used as a sample to collect data at the individual animal level.

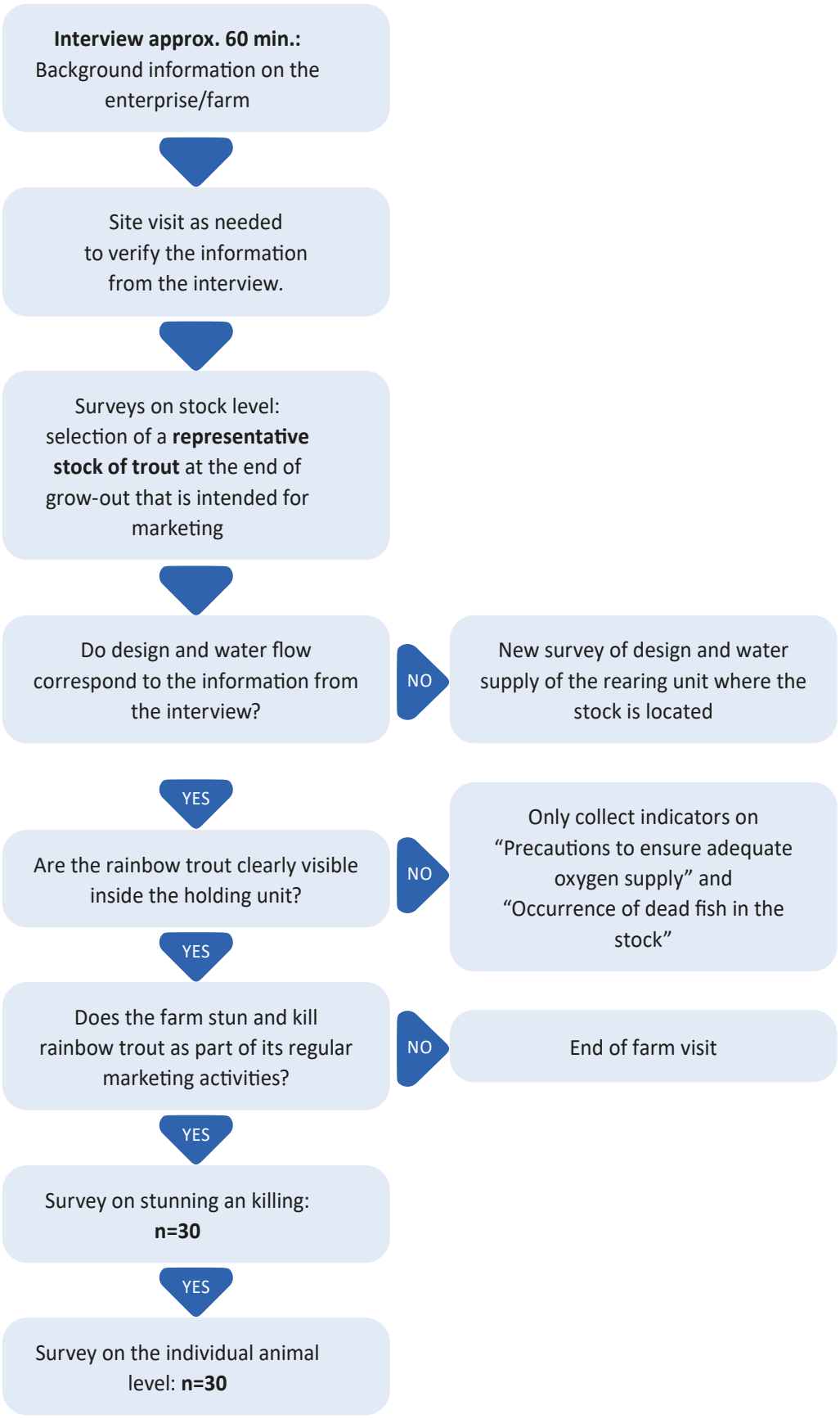
- Method used for stunning and success of stunning
- Killing

No survey on stunning and killing is carried out on farms that do not slaughter rainbow trout for marketing.

Individual animal level

Survey of indicators based on the sample of 30 rainbow trout by the observer using this survey guide.

3.2 Decision tree for rainbow trout farm visit - indicators to be collected



4 Material Checkliste

Material for the survey	Number
Rainbow trout survey guidelines	1x
Stationery	as required
Examination tray	1x
Work table (mobile table, folding table, filleting table)	1x
Disposable gloves	as required
Disposable towels	as required
Cleaning agents and disinfectants including other consumables	as required
Disposable shoe covers, disposable overalls (if necessary)	as required
Camera (if necessary)	1x
Polarised sunglasses (if necessary)	as required
Fish tubs 60-80 l (if necessary)	as required

The farm must provide:
Water supply
Area for assembly (approx. 10 m²)

5 Sample size

The specific sample size for each information and indicator to be collected is specified on the corresponding sheet.

6 Background information about the enterprise

In addition to the animal welfare indicators collected, several information about the operational structure and management of the farm are useful for contextualizing, linking, and interpreting the collected welfare indicator data. This information is referred to as background information. It includes, for example, the type of operation and production method. Indicators on animal health can be linked more easily with the professional experience of the farm management when information on the type of farming is available. This allows for the determination of whether, for instance, hobby farms are more frequently operated by individuals who entered fish farming as a second career. It further allows to identify whether these farms differ in indicators on fish health when compared to full-time farming operations.

Similarly, information on emergency fish harvests due to water shortage, for example, can help explain an increased occurrence of fin and skin abnormalities in certain years and/or regions. The design of the holding facilities, the water management and the building material of the side walls and bottom of the holding facilities are important background information as well.

By linking this information with animal health indicators, it can be determined whether and which of these parameters have a positive or negative effect on animal welfare and health in the long term. A long-term monitoring approach therefore directly contributes to generating information on animal welfare. The background information is necessary in order to interpret many of the collected data. Without this background information, an animal welfare monitoring would lose many of its benefits.

All background information is collected through an interview with the person in charge (management) of the operation, as well as through direct observations on the farm. In case of ambiguities or contradictions arising during the survey, the interview offers the opportunity to ask the person in charge of the operation directly and solve these discrepancies.

6.1 Type of operation

Synonyms

Operating mode

Acquisition level

Operational level

Subject of data collection

It is recorded whether the farm is managed as a full-time or part-time farming operation or as a hobby farm. The proportion of conventional and/or organic production is recorded as well.

Purpose of data collection

Background information for illustrating the structure of the German aquaculture sector.

Methodology

Inquiry about the type of operation. A distinction is made between:

- Full-time operation
- Part-time operation
- Hobby farm (no intention to make profit)

Inquiry about the type of management. A distinction is made between:

- Conventional farming
- Organic farming
- Mixed, conventional and organic farming

Inquiry for mixed farms on the **percentage shares** of **conventional** and **organic** production in total output.

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

The classification “organic production” requires at least the standards according to the EU Regulation on organic production and labelling of organic products (Regulation (EC) No. 2018/848) or a stricter certification scheme according to an association for organic production (e.g., Naturland, Demeter, and others).

References

-

6.2 Production method

Synonyms

-

Acquisition level

Operational level

Subject of data collection

The production methods of the farm are recorded. This includes a differentiation between breeding, rearing, grow-out and/or trading. It is possible that multiple production methods occur on a farm.

Purpose of data collection

Background information for illustrating the structure of the German aquaculture sector, where applicable as a basis for assessing the relationships between indicators.

Methodology

Inquiry of the production methods on the farm. A distinction is made between:

- Fish farm with broodstock
- Fish farm starting from eyed-eggs
- Fish farm starting from fry
- Fish farm starting from fingerling (On-growing)
- Grow-out farm (from approx. 150 g)
- Trading operation (holding units, regular delivery of fish ready for marketing)

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

-

References

-

6.3 Annual production and trade volume

Synonyms

Fish production, production volume

Acquisition level

Operational level

Subject of data collection

The total annual production in tons (t) (all species produced) and the annual production volume of rainbow trout as well as the annual trade volume are recorded.

Purpose of data collection

Background information for illustrating the structure of the German aquaculture sector, where applicable as a basis for assessing the relationships between indicators.

Methodology

Inquiry about the following aspects:

- Annual production volume (**total production)** (fed on the farm with the goal of significant weight gain > 50 g) in tons (t)
- Annual **production** volume of **rainbow trout** (fed on the farm with the goal of significant weight gain > 50 g) in tons (t)
- Annual **trade** volume of **rainbow trout** in addition to own production volume (short holding period, without significant weight gain < 50 g) in tons (t)

Inquiry about the annual production volume of rainbow trout. A distinction is made between:

- no own production, exclusively trading operation
- up to 10 t
- > 10 t to 60 t
- > 60 t to 100 t
- > 100 t to 200 t
- > 200 t

Inquiry about the annual trade volume of rainbow trout (in addition to the production volume, if applicable). A distinction is made between:

- No trading volume of rainbow trout beyond own production
- up to 10 t
- > 10 t to 60 t
- > 60 t to 100 t
- > 100 t to 200 t
- > 200 to 500 t
- > 500 t to 1000 t
- > 1000 t

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

In specifying the annual production, all marketed rainbow trout should be taken into account, including both those sold as food fish and those sold for stocking.

References

-

6.4 Target stocking density

Synonyms

Stocking density, space available per fish

Acquisition level

Operational level

Subject of data collection

The biomass of rainbow trout kept per cubic meter (m^3) of water volume in the rearing unit is recorded. This refers to the average stocking density achieved at the end of the grow-out period in the farm's rearing unit during the relevant calendar year.

Purpose of data collection

Background information for illustrating the structure of the German aquaculture sector.

Methodology

Inquiry about the targeted final yield during the grow-out phase in kilograms per cubic meter (kg/m^3) in relation to a calendar year, followed by assignment by the observers.

- up to 10 kg/m^3
- > 10 to 25 kg/m^3
- > 25 to 40 kg/m^3
- > 40 to 60 kg/m^3
- > 60 kg/m^3

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

If data per calendar year is not available, an estimated value (“approx. …”) can be provided by calculating or estimating the stocking density. Estimation, if necessary, through inquiry regarding the number of stocked rainbow trout and the number of rainbow trout ready for marketing. If necessary, also ask for the quantity of fish and average weight.

References

-

6.5 Water management and system design

Synonyms

Farm design

Acquisition level

Operational level

Subject of data collection

It is recorded how the water management on the farm is structured and which type of system design is mainly used.

Purpose of data collection

Background information for illustrating the structure of the German aquaculture sector, where applicable as a basis for assessing the relationships between indicators (e.g., water supply).

Methodology

Inquiry about the **main type of water management** used on the farm.

A distinction is made between:

- Flow-through
- Partial recirculating aquaculture system
- Recirculating aquaculture system
- Reservoirs (annual impoundment, deliberate filling and draining in a yearly cycle)
- Still waters (permanently standing bodies of water that are not drained, e.g., rain-filled ponds, groundwater, lakes, etc.)
- Other

Inquiry about the **main system** used for production. A distinction is made between:

- Pond system
- Channel system
- Circular tanks/tank system
- Net pen
- Other

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

If different systems are in use, the inquiry refers to the system with the highest production quantity in tons.

References

-

6.6 Authorized water withdrawal volume

Synonyms

Inflow, inflow volume, inflow rate, water source, water extraction volume

Acquisition level

Operational level

Subject of data collection

The amount of water withdrawal permitted under the prevailing water legislation at the time of the survey is recorded.

Purpose of data collection

Background information for illustrating the structure of the German aquaculture sector, where applicable as a basis for assessing the relationships between indicators (e.g., target stocking density). Usually, the quantity of water withdrawal is regulated by water legislation. The withdrawal volume should be proportional to the production quantity.

Methodology

Inquiry about the extracted volume of water permitted by water law and subsequent allocation by the observer.

- Permissible water withdrawal rate in liters per second (l/s)
- Unlimited withdrawal
- Withdrawal is not regulated by water law (e.g., rain-filled pond, spring-fed pond)

Allocation according to withdrawal quantity

- No legally prescribed maximum permissible withdrawal quantity
- up to 5 l/s
- > 5 to 10 l/s
- > 10 to 20 l/s
- > 20 to 50 l/s
- > 50 to 100 l/s
- > 100 to 250 l/s
- > 250 to 500 l/s
- > 500 l/s

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

-

References

-

6.7 Water supply

Synonyms

Reliability of inflow volume, continuity of water supply

Acquisition level

Operational level

Subject of data collection

It is recorded how stable the water supply is in the relevant calendar year.

Purpose of data collection

Background information for illustrating the structure of the German aquaculture sector, where applicable as a basis for assessing the relationships between indicators (e.g., target stocking density).

Methodology

Inquiry as to whether the legally permissible water quantity could be withdrawn throughout the relevant calendar year:

- yes, always
- partly during the course of the year
- never throughout the year
- cannot assess

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

-

References

-

6.8 Surface material of side walls and bottom of the primary rearing units

Synonyms

Surface texture and substrate of the rearing facility (bottom substrate, wall texture)

Acquisition level

Operational level

Subject of data collection

The building materials of the side walls and the bottom of the rearing units are recorded at the respective location (only units used for final grow-out). If different systems are in use at the respective location, entries are made based on production volume, arranged from large to small.

Purpose of data collection

Rainbow trout come into contact with the surfaces of the rearing units. It is important to ensure that the surfaces of the rearing units do not pose a risk of injury or potential harm to the rainbow trout. A precise correlation between specific surface materials and certain health indicators is not scientifically proven. Documenting surface materials can provide a basis for estimating the relationships between indicators (e.g., skin lesions).

Methodology

Inquiry about the main surface material **of the side walls** of the **rearing units used for final grow-out**. A distinction is made between:

- Natural substrate (rock fill, soil, sand, stone, gravel, etc.)
- Rock fill (with binder)
- Concrete
- Masonry
- Tiles
- Plastic (film, fiberglass, PVC, PE, etc.)
- Metal
- Wood cladding
- Other (if possible, with details of other material)

Inquiry about the main surface material of the **bottom** of the **rearing units** for **final grow-out**. A distinction is made between:

- Natural substrate (rock fill, soil, sand, stone, gravel, etc.)
- Rock fill (with binder)
- Concrete
- Masonry
- Tiles
- Plastic (film, fiberglass, PVC, PE, etc.)
- Metal
- Wood cladding
- Other (if possible, with details of other material)

Verification and supplementation by subsequent inspection of the system.

Sample size

One-time inquiry during the interview and verification during the visit of the operation.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

If the bottom is not visible, the survey is limited to the side walls.

References

Tschudi and Stamer 2012; RSPCA 2018; Noble et al. 2020.

6.9 Surface material of side walls and bottom of the primary holding unit

Synonyms

Surface texture and substrate of the housing facility (bottom substrate, wall texture)

Acquisition level

Operational level

Subject of data collection

The surface characteristics of the holding units are recorded at the respective location (only units used for holding rainbow trout ready for marketing at the end of the grow-out period). If different systems are in use at the respective location, entries are made based on production volume, arranged from large to small.

Purpose of data collection

Rainbow trout come into contact with the surfaces of the holding units. It is important to ensure that the surfaces of the holding units do not pose a risk of injury or potential harm to the rainbow trout. A precise correlation between specific surface materials and certain health indicators is not scientifically proven. Documenting surface materials can provide a basis for estimating the relationships between indicators (e.g., skin lesions).

Methodology

Inquiry about the main surface material **of the side walls** of the **holding units**.
A distinction is made between:

- Natural substrate (rock fill, soil, sand, stone, gravel, etc.)
- Rock fill (with binder)
- Concrete
- Masonry
- Tiles
- Plastic (film, fiberglass, PVC, PE, etc.)
- Metal
- Wood cladding
- Other (if possible, with details of other material)

Inquiry about the main surface material **of the bottom** of the **holding tanks**.
A distinction is made between:

- Natural substrate (rock fill, soil, sand, stone, gravel, etc.)
- Rock fill (with binder)
- Concrete
- Masonry
- Tiles
- Plastic (film, fiberglass, PVC, PE, etc.)
- Metal
- Wood cladding
- Other (if possible, with details of other material)

Verification and supplementation by subsequent inspection of the system.

Sample size

One-time inquiry during the interview and verification during the visit of the operation.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

If the bottom is not visible, the survey is limited to the side walls.

References

Tschudi and Stamer 2012; RSPCA 2018; Noble et al. 2020.

7 Indicators to be collected on the operation

Indicators at the operational level provide information on the resources available, the resources utilized, as well as information on farm management. The relationship of these indicators to animal welfare is often indirect. However, serious consequences for animal welfare may emerge when these topics are neglected. This group of indicators includes, for example, indicators that provide information on feed supply. Water quality is another vital resource for rainbow trout. Fish farmers, however, often have only indirect or limited influence on water quality. Implementing preventive measures against fish-eating wild animals (predators) or adopting a hygiene concept represent management measures that also can significantly influence animal welfare.

Many of these indicators are difficult to record during a farm visit. Therefore, the collection of indicators at the operational level is conducted through an interview (via questions). Either the person in charge of the operation or another individual fully acquainted with the operational situation (e.g., fish farm manager, or farm foreman) is interviewed. During a subsequent inspection of the operation, the collected information is, to the extent possible, verified by the person conducting the survey (e.g., the implementation of measures to exclude predators or the materials of the rearing units). In doing so, any ambiguity can be clarified with the interviewed person. If the interviewee is unclear during the interview, examples and explanations of the topic should be provided without specifically reproducing the content and/or answer options of the survey. In the case of predator management, for example, areas in which such management could exist may be mentioned without individually listing the predators.

7.1 Training level of the person in charge

Synonyms

Level of education, professional training, professional experience

Acquisition level

Operational level

Subject of data collection

The professional training and professional experience related to fish farming or fish care of the person in charge are recorded.

Purpose of data collection

Fish-relevant education and professional experience enable the person in charge to accurately assess the operational conditions. It allows them to identify emerging problems and address them effectively.

It can be assumed that, in addition to formal education, professional experience on the job also contributes to this qualification. The classification of the respective time periods (scores) was derived from the formal education system. Here, after 3 years of fish-relevant professional experience, even without formal education, an examination for the qualification of “Fischwirt” (fish farmer) can be taken. It can therefore be assumed that the respective knowledge can be acquired through practical work in fish farming.

Methodology

Inquiry of fish-related **professional training** and relevant **professional experience**. Subsequent classification into scores (categorized according to education and professional experience).

Classification

- Score 0: fish-related training + professional experience (> 3 years)
- Score 1: fish-related training + professional experience (< 3 years)
- Score 2: Career changer + relevant professional experience (> 3 years)
- Score 3: Career changer + relevant professional experience (< 3 years)

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

“Fish-related education” includes, for example, vocational training to become a fish farmer manager or fish farmer and also academic training, e.g., agricultural sciences with a focus on aquaculture or biology with a focus on aquaculture is also considered. “Relevant professional experience” generally refers to regular full-time job involving live fish on a commercial scale (based on the admission requirements for the final examination to become a fish farmer as set by the agricultural chambers).

References

DLG 2018; expert discussions in the NaTiMon 2019/2020 project.

7.2 Water quality measuring instruments

Synonyms

Measuring devices, measuring probes, multimeter, sensor, test device, thermometer, pH meter

Acquisition level

Operational level

Subject of data collection

It is recorded whether and which devices for determining water quality parameters (e.g., oxygen meter) are available on the farms. Both the farms' own measuring devices and, for example, those that can be provided by producer associations at short notice (on the same day) are taken into account. It is also taken into account whether measurements can be conducted at short notice (on the same day) through, e.g., service companies.

Purpose of data collection

Measuring devices for determining certain water parameters such as temperature, oxygen content/saturation and pH help the farmer in adjusting management practices to the current conditions. For some water parameters, such as oxygen content, temperature, and pH, an accurate assessment is only possible through on spot measurement.

Figure 1: Multi-parameter portable meter including probes. The water sample is collected in accordance with the method outlined in section 2.1 within an external container. Photo: © University of Veterinary Medicine Hannover / Felix Teitge.

Methodology

Inquiry regarding the availability of measuring devices for determining specific water parameters on the farm. At the very least, specific questions are asked about the possibility of measuring oxygen, pH value, and water temperature. All additionally available measurement methods are summarized under the term “additional parameters”. Verification and supplementation are carried out through additional observations during the operational visit. Subsequent classification into scores.

Classification

- Score 0: **Own a device** for measuring oxygen, pH and temperature, and **additional parameters**
- Score 1: **Own a device** for measuring oxygen, pH value and temperature
- Score 2: **Device** for measuring oxygen, pH value and temperature **available**
- Score 3: **no own or available device** for measuring oxygen, pH value and temperature

Sample size

One-time inquiry during the interview and verification during the visit of the operation.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

The three parameters oxygen, pH value, and temperature are most important for the classification into scores. Furthermore, it is important to determine which measurement devices are available. In this sense, both in-house measuring devices and measuring devices available at short notice (on the same day) must be taken into account.

References

MacIntyre et al. 2008.

7.3 Predators

Synonyms

Predators, fish-eating animals

Acquisition level

Operational level

Subject of data collection

It is recorded which fish-eating animal species are affecting the fish farm.

Purpose of data collection

In addition to indirect negative impact on animal welfare caused by animal species that are harmful to the farm (so-called pests), fish-eating animal species can have a direct negative impact on animal welfare. These animal species, also called predators, cause damage by directly preying on rainbow trout, injuring rainbow trout in an unsuccessful attempt to catch them, and also by chasing rainbow trout, during which they considerably stress the remaining fish in the pond. This can lead to a reduction in body condition, increased susceptibility to infectious disease, wound infections, reduced ability to escape and reduced growth due to impaired feed intake, and even increased mortality.

Methodology

Inquiry regarding the relevant animal species that negatively impact rainbow trout. Visual inspection of possible evidence. Subsequent classification according to the table.

Animal species relevant to fish farming/ categories	Birds		**Herons**	Grey heron (*Ardea cinerea*)	Great egret (*Ardea alba*)			
		Provision of evidence						
			Cormorants	Great cormorant (*Phalacrocorax carbo)*	European shag (*Gulosus aristotelis*)			
		Provision of evidence						
			Kingfisher	Common kingfisher (*Alcedo atthis*)				
		Provision of evidence						
			Seagulls	European herring gull (*Larus argentatus*)	Lesser black-backed gull (*Larus fuscus*)	Great black-backed gull (*Larus marinus*)	Black-headed gull (*Chroicocephalus ridibundus*)	
		Provision of evidence						
			Eagles	White-tailed eagle (*Haliaeetus albicilla*)	Osprey (*Pandion haliaetus*)			
		Provision of evidence						
			Harriers and kites	Western marsh harrier (*Circus aeruginosus*)	Red kite (*Milvus milvus*)	Black kite (*Milvus migrans*)		
		Provision of evidence						
			Goosanders	Goosander (*Mergus merganser*)	Red-breasted merganser (*Mergus serrator*)	Smew (*Mergellus albellus*)		
		Provision of evidence						
			Crows	Common raven (*Corvus corax*)	Carrion crow (*Corvus corone*)	Hooded crow *(Corvus cornix)*		
		Provision of evidence						
			Ducks	Mallard (*Anas platyrhynchos*)	Common goldeneye (*Bucephala clangula*)	Gadwall (*Mareca strepera*)		
		Provision of evidence						
			Grebes	Great crested grebe (*Podiceps cristatus*)	Red-necked grebe (*Podiceps grisegena*)	Black-necked grebe (*Podiceps nigricollis)*		
		Provision of evidence						
			Geese	Egyptian goose (*Alopochen aegyptiaca)*				
		Provision of evidence						
			Storks	White stork (*Ciconia ciconia*)	Black stork (*Ciconia nigra*)			
		Provision of evidence						
	Mammals		**Otter**	Otter (*Lutra lutra*)				
		Provision of evidence						
			other martens	American mink (*Neogale vison*)	Stone marten (*Martes foina*)	Pine marten (*Martes martes*)	European badger (*Meles meles*)	European polecat (*Mustela putorius*)
		Provision of evidence						
			Fox	Red fox (*Vulpes vulpes*)				
		Provision of evidence						
			Raccoon	North American raccoon (*Procyon lotor*)				
		Provision of evidence						
			Racoon dog	Common raccoon dog (*Nyctereutes procyonoides*)				
		Provision of evidence						
			Cats	Domestic cat (*Felis catus*)	European wildcat *(Felis silvestris)*			
		Provision of evidence						
			Rats	Common rats (*Rattus norvegicus*)				
		Provision of evidence						
			Jackal	Golden jackal (*Canis aureus*)				
		Provision of evidence						
	other							
		Provision of evidence						

Table 1: Data collection on predators and corresponding evidence.

Note: This list does not claim to be exhaustive and should be adjusted according to the current situation and relevance (e.g., reintroduction of otters, etc.).

The subgroups are arbitrarily defined based on the assigned relevance and according to information from farm managers. This classification must be regularly re-assessed and adjusted if necessary.

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

Evidence can be provided, for example, through statements, photos, videos, official reports, compensation payment or hunting records.

References

Huntingford et al. 2006; Baur et al. 2010; RSPCA 2018; Becke et al. 2019.

7.4 Pests

Synonyms

Vermin

Acquisition level

Operational level

Subject of data collection

The term “pest” is designated for all types of organisms that cause harm to humans and domestically kept animals, thereby affecting food security and economic success. In aquaculture, the effects of pests on the farm can directly or indirectly affect animal welfare. It is therefore recorded which animal species affect the respective fish farm.

Purpose of data collection

In addition to the direct negative impact of piscivorous animal species, species that do not directly affect rainbow trout, but rather the farm and/or the farm structure, can also lead to reduced animal welfare. For example, the relocation/re-construction of the inlet/outlet of ponds due to burrowing animals can result in deteriorated water quality or affect the water level in the rearing units. Damage can also occur to the structure of the rearing facility, posing a risk of rapid and sometimes immediate water loss (e.g., due to dam breakage). Additionally, feed quality may be compromised by feed pests and the transmission of germs and pathogens.

Figure 1: Strong burrowing activity by rodents in the dam of a fish pond, photos: © Thünen Institute / Vincent Lugert.

Methodology

Inquiry regarding the relevant animal species that negatively impact the operation. Visual inspection of possible evidence. Subsequent classification according to the table.

Animal species relevant to fish farming/ categories													
Birds		Crows	Common raven (*Corvus corax*)	Carrion crow (*Corvus corone*)	Hooded crow (*Corvus cornix*)								
	Provision of evidence												
		Ducks	Common goldeneye (*Bucephala clangula*)	Eurasian wigeon (*Mareca penelope*)	Tufted duck (*Aythya fuligula*)	Northern shoveler (*Spatula clypeata*)	Northern pintail (*Anas acuta*)	Eurasian teal (Anas crecca)	Garganey (*Spatula querquedula*)	Common shelduck (*Tadorna tadorna*)	Mallard (*Anas platyrhynchos*)	Common goldeneye (*Bucephala clangula*)	Gadwall (*Mareca strepera*)
	Provision of evidence												
		Geese	Egyptian goose (*Alopochen aegyptiaca*)	Greylag goose (*Anser anser*)	Barnacle goose (*Branta leucopsis*)	Canada goose (*Branta canadensis*)	Greater white-fronted goose (*Anser albifrons*)	Brent goose (*Branta bernicla*)	Lesser white-fronted goose (*Anser erythropus*)	Taiga bean goose (*Anser fabalis*)	Pink-footed goose (*Anser brachyrhynchus*)		
	Provision of evidence												
		Swans	Mute swan (*Cygnus olor*)	Whooper swan (*Cygnus cygnus*)	Black swan (*Cygnus atratus*)								
	Provision of evidence												
Mammals		Muskrat	Muskrat (*Ondatra zibethicus*)										
	Provision of evidence												
		Nutria	Nutria (*Myocastor coypus*)										
	Provision of evidence												
		Beaver	European beaver (*Castor fiber*)										
	Provision of evidence												
		other rodents	Mice (*Mus spec.*)	Rats (*Rattus spec.*)	Shrews (*Soricidae spec.*)								
	Provision of evidence												
		Wild boars	Wild boar (*Sus scrofa*)										
	Provision of evidence												
other													
	Provision of evidence												

Table 1: Data collection on pests and corresponding evidence.

Note: This list does not claim to be exhaustive and should be adjusted according to the current situation and relevance.

Minimum requirement: If available, mark one of the subgroups in the categories “birds”, “mammals”, “other specification”, as an option additionally mark the species listed next to it as examples.

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

Evidence can be provided, for example, through statements, photos, videos, official reports, compensation payment or hunting records.

References

Huntingford et al. 2006; Baur et al. 2010; RSPCA 2018; Becke et al. 2019.

7.5 Predator and pest management

Synonyms

Predator control, deterrence, protective measures against predators, measures against animals that have a negative impact on the fish and/or the operation

Acquisition level

Operational level

Subject of data collection

It is recorded whether protective measures are taken to prevent damage caused by predators and other animal species which may have negative impact. Protective measures may include, for example, fencing, netting, deterrence, and hunting. It is also recorded whether specific measures are not or cannot be taken or whether there is no need for them to be taken.

Purpose of data collection

Protective measures can reduce or prevent the harmful effects of predators and animals with a negative impact.

Figure 1: Installation of nets over circular tank to protect against fish-eating birds, photo: © Thünen Institute / Vincent Lugert.

Methodology

Inquiry about the protective measures taken against predators and pests with a negative impact. Subsequent classification according to the table. Verification and supplementation by subsequent observation during the visit of the operation.

Yes	Fencing	Exclusion	Hunting	Deterrence	other measure:	other measure:
	Implemented	Implemented	Implemented	Implemented		
Not necessary	Not necessary	Not necessary	Not necessary	Not necessary		
Not implemented for the following reasons	Nature conservation	Nature conservation	Nature conservation	Nature conservation		
	Bureaucratic reasons	Bureaucratic reasons	Bureaucratic reasons	Bureaucratic reasons		
	Financial reasons	Financial reasons	Financial reasons	Financial reasons		
	Local conditions	Local conditions	Local conditions	Local conditions		
	Building law	Building law	Hunting law, hunting tenants			
	Care and maintenance	Care and maintenance				
	other reasons:	other reasons:	other reasons:	other reasons:		

Table 1: Data collection on measures to protect the rainbow trout and classification into "implemented", "not necessary" and "not implemented for the following reasons" with a corresponding indication of the reasons.

Sample size

One-time inquiry during the interview and verification during the visit of the operation.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

Minimum requirement: A clear classification is needed for each column/management measure by selecting one of the three options (“Yes”, “Not necessary”, or “Not implemented for the following reasons”). When selecting “Other measure”, the specific measure can also be described as a free text entry.

Reasons for selecting “Not implemented for the following reasons” can include financial or bureaucratic reasons, as well as considerations related to nature conservation, building law, hunting law, or efforts needed for maintenance.

References

NKormoranVO 2010; Füllner et al. 2013; RSPCA 2018; LAVES 2019.

7.6 Hygiene concept and biosecurity

Synonyms

Hygiene, biosecurity, prevention against pathogens

Acquisition level

Operational level

Subject of data collection

It is recorded whether the operation has a hygiene concept. Additionally, it is documented which hygiene measures and other measures are in place to ensure biosecurity on the farm.

Purpose of data collection

Hygiene and biosecurity not only ensure the safety and welfare of the own stock, but also prevent the spread of diseases.

Figure 1: Various hygiene measures that can be included in a hygiene concept. Disinfection of work equipment (left). Disinfection of boots for people entering the plant (right). Photos: © Felix Teitge (left), Vincent Lugert (right).

Methodology

Inquiry of the hygiene and biosecurity concepts or measures that are in place and implemented on the farm. The need of a measure is assessed and then classified according to the table. Verification and supplementation through subsequent observation during the visit of the operation.

For each sub-category, the **necessity** must first be determined and, in a second step, it should be identified whether a concept for hygiene and biosecurity exists.

Hygiene concept and biosecurity									
	Live fish transport								
		Quarantine		Segmentation into compartments with separate water supply		Acquisition		Hygienization during the delivery of live fish	
		necessary/ required	implemented/ available	necessary/ required	implemented/ available	necessary/ required	implemented/ available	necessary/ required	implemented/ available

Hygiene concept and biosecurity					
	Visitors				
		Personnel/ Employees		Veterinarian, FHS		Other non-company individuals (e.g., customers, fishing guests, etc.)	
		necessary/ required	implemented/ available	necessary/ required	implemented/ available	necessary/ required	implemented/ available

Hygiene concept and biosecurity					
	Movement of goods and equipment				
		Feed		Other deliveries		Hygiene of work equipment	
		necessary/ required	implemented/ available	necessary/ required	implemented/ available	necessary/ required	implemented/ available

Table 1: Data collection on hygiene and biosecurity measures and classification according to its necessity.

Sample size

One-time inquiry during the interview and verification during the visit of the operation.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

Examples for determining necessity:

(1) If the operation has no angling guests, no hygiene concept is necessary in this regard.

(2) Every professional fish farmer should have a veterinarian in charge of the health of the stock.

Additional explanations of terms:

Quarantine: a separate holding facility whose water body is not linked to the regular holding facilities of the operation and which is physically separated from other parts of the facility

Acquisition: Acquiring live fish from known sources, with established long-term trading relationship, purchasing fish with tracked history and clarified health status

FHS: Fish health services or comparable institutions of the federal states

References

DLG 2018.

7.7 Live fish transport (out of the farm)

Synonyms

Fish transportation

Acquisition level

Operational level

Subject of data collection

It is recorded whether and at what frequency live rainbow trout are transported out of the operation.

Purpose of data collection

The transportation of rainbow trout can result in stress, which may negatively impact animal welfare. In addition to stress caused by loading and transportation, stress can also be induced by changing and/or deteriorating water quality, such as changes in water temperature, the supply with oxygen and accumulation of carbon dioxide in the water. These factors can be significantly influenced by fish density, but also by the duration of transportation and the technology used. The consequences of the adverse effects caused by loading and unloading, the transport itself and the associated handling measures can manifest immediately, e.g., in the form of stress, injuries or losses during transportation. They can also manifest with a delay, e.g., changes in swimming and feeding behaviour or even further losses within the first 24 hours after arrival. In this context, the losses should be directly attributable to transport and not be caused by other obvious reasons.

Methodology

Inquiry about transport, including the number and frequency of transports of live rainbow trout **out of the operation** within the relevant calendar year. The survey considers marketable food fish or food fish during the grow-out period or fingerlings and fish used for stocking in the corresponding age and/or size class.

A distinction is made between the following classifications:

- Eggs for incubation
- Fry fully adapted to dry feed (up to 10 g)
- Fingerlings (>10 g to 150 g)
- Fish for on-growing (>150 g to approx. 300 g)
- Portion sized fish (mostly larger than 300 g)

A distinction is made between the following categories:

- No transportation
- up to 10 transports per year
- > 10 to 50 transports per year
- > 50 to 100 transports per year
- > 100 to 250 transports per year
- > 250 transports per year

The frequency of transports is differentiated according to the following classifications:

- daily
- weekly
- regularly throughout the year, but less frequently than weekly
- seasonally (e.g., in spring and fall)

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

-

References

Berka 1986; RSPCA 2018; Noble et al. 2020.

7.8 Live fish transport (into the farm)

Synonyms

Fish transportation

Acquisition level

Operational level

Subject of data collection

It is recorded whether and at what frequency live rainbow trout are delivered/transported to the operation.

Purpose of data collection

The transportation of rainbow trout can result in stress, which may negatively impact animal welfare. In addition to stress caused by loading and transportation, stress can also be induced by changing and/or deteriorating water quality, such as alterations in water temperature, the supply with oxygen and accumulation of carbon dioxide in the water. These factors can be significantly influenced by fish density, but also by the duration of transportation and the technology used. The consequences of the adverse effects caused by loading and unloading, the transport itself and the associated handling measures can manifest immediately, e.g., in the form of stress, injuries or losses during transportation. They can also manifest with a delay, e.g., alterations in swimming and feeding behaviour or even further losses within the first 24 hours after arrival. In this context, the losses should be directly attributable to transport and not be caused by other obvious reasons.

Methodology

Inquiry about **deliveries/live arrivals** as well as the **number** and **frequency of arrivals** of live rainbow trout **into the operation** within the relevant calendar year. The survey considers marketable food fish or food fish during the grow-out period or fingerlings and fish used for stocking in the corresponding age and/or size class.

A distinction is made between **the following classifications:**

- Eggs for incubation
- Fry fully adapted to dry feed (up to 10 g)
- Fingerlings (>10 g to 150 g)
- Fish for on-growing (>150 g to approx. 300 g)
- Portion sized fish (usually larger than 300 g)

A distinction is made between the following categories:

- no live arrivals
- up to 2 live arrivals per year
- up to 10 live arrivals per year
- up to 25 live arrivals per year
- up to 50 live arrivals per year
- more than 50 live arrivals per year

The frequency of deliveries/live arrivals is differentiated according to the following classifications:

- daily
- weekly
- regularly throughout the year, but less frequently than weekly
- seasonally (e.g., in spring and fall)

Sample size

One-time inquiry during the interview.

Additional material requirements

-

Time required

The data is collected as part of an inquiry. The required background information and indicators are collected by means of an interview. An average of 60 min is required for this interview.

Notes

-

References

Berka 1986; RSPCA 2018; Noble et al. 2020.

8 Survey on stock level

Rainbow trout are typically reared in rather small and manageable husbandry units. Although in some cases relatively large ponds are used, the volume of these ponds rarely exceeds 500 m^3. At suitable weather and water conditions, rainbow trout in tanks, troughs, and ponds are often visible through the surface of the water. This is not always the case. On some farms, the water is naturally cloudy, milky or dark. This does not pose a problem for rainbow trout. However, observing the behaviour of individual rainbow trout or a group of fish becomes difficult or impossible under such circumstances. Whether turbidity in the rearing facility occurs regularly or only in exceptional cases should always be clarified with the farm manager. If the rainbow trout are clearly visible, all indicators related to the stock level are collected. If the fish are not clearly visible, only indicators 8.1 “Precautions to ensure adequate oxygen supply” and possibly 8.2 “Occurrence of dead fish in the stock” are collected. Only dead rainbow trout floating on the water surface can be recorded. Depending on the individual case, it has to be decided whether this indicator will be collected or not. For all other indicators, it is noted that “the rainbow trout are not visible”. In order to accurately assess the behaviour of rainbow trout, information on feeding times is required. Hungry rainbow trout are noticeably more active and respond to persons at the edge of the pond more actively in anticipation of being fed. Rainbow trout fed recently are much calmer and often show no reaction or even flight reactions when people approach the edge of the enclosure.

Introductory questions:

Where are the rainbow trout located?

- Rearing unit (corresponds to the information from the interview)
- Rearing unit (does **not** correspond to the information from the interview): **reassessment** of 6.5 “Water management and system design” and 6.8 “Surface material of side walls and bottom of the primary rearing unit”

Have the rainbow trout been fed within the last 12 hours?

- yes
- no

Have any dead rainbow trout been removed from the stock within today?

- yes
- no

Are the rainbow trout visible?

- yes: Survey of all indicators on the stock level
- no: only survey 8.1 “Precautions to ensure an adequate oxygen supply” and 8.2 “Occurrence of dead fish in the stock”

During the observation, indicators on swimming behaviour, the occurrence of abnormal fish and the presence of dead fish are assessed simultaneously as described below.

To observe the stock, the observer approaches the pond slowly and step by step. In a first step, the pond is observed from a distance from which the fish do not perceive the observer (casting shadows, disturbances caused by steps, etc.), but from which it is possible to get an initial impression of the behaviour of the fish. The observer then carefully approaches the pond for more detailed observations. The observation from a distance and the slow approach should take place over a period of at least five minutes. The duration depends on the size of the rearing unit and the size of the stock. As a general rule, the larger the rearing unit and the stock, the longer the observation should take.

8.1 Precautions to ensure adequate oxygen supply

Synonyms

Oxygen enrichment, aeration, aeration systems, water circulation

Acquisition level

Operational level

Subject of data collection

It is recorded whether and how an adequate oxygen supply for rainbow trout is ensured in the holding water at all times. The oxygen supply can be ensured by a reliable water supply of sufficient quantity, and/or by a technical system ready for deployment (such as aerators, technical oxygen, pumps or partial circulation, other water movement).

Purpose of data collection

Adequate oxygen supply at all times is vital for rainbow trout. This can be ensured by a stable inflow of water if it is proportional to the relevant production parameters (e.g., stocking density, feed quantity, water temperature).

In addition, the oxygen supply can be ensured through technical measures (aerators, introduction of technical oxygen, water circulation).

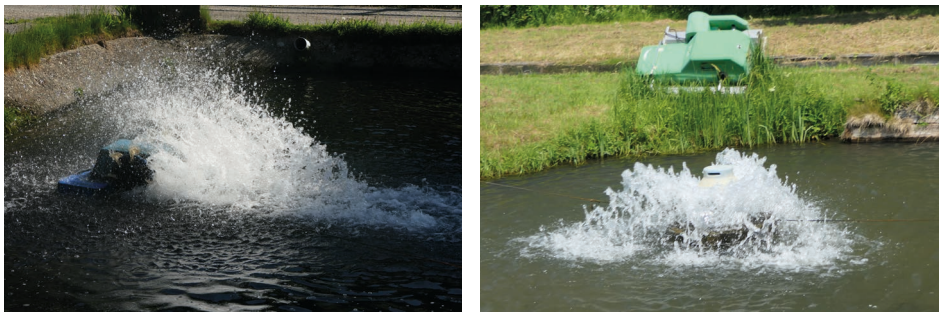


Figure 1: Various types of aerators to ensure adequate oxygen supply in rainbow trout rearing units, photos: © Thünen Institute / Vincent Lugert.

Methodology

Inquiry about the existing methods to ensure the oxygen supply and subsequent classification into categories. Verification and supplementation by subsequent observation during the visit of the operation. Subsequent classification into scores.

Which of the following options are available to ensure oxygen supply?

- Water inflow
  - available
  - not available
- Aerator, ready for deployment
  - available
  - not available
- Technical oxygen, ready for deployment (supply, supply option)
  - available
  - not available
- Pump, ready for deployment (partial circulation, water movement)
  - available
  - not available

Classification

- Score 0: Adequate oxygen supply is ensured by **multiple** options.
- Score 1: Adequate oxygen supply is ensured by **one** option.
- Score 2: Adequate oxygen supply is **not always** ensured.

Sample size

One-time inquiry during the interview and verification during the inspection of the operation.

Additional material requirements

-

Time required

-

Notes

-

References

Noble et al. 2020.

8.2 Occurrence of dead fish in the stock

Synonyms

Mortality

Acquisition level

Stock level

Subject of data collection

It is recorded whether dead rainbow trout are present in the rearing facility of the stock being inspected. Particular attention is given to the bottom, the edges and the area around the outlet of the holding unit, as far as these areas are observable.

Purpose of data collection

Dead fish in the husbandry system can indicate increased mortality, outbreak of disease, or environmental and/or management-related issues.

Methodology

Data collection through observation of the stock. Subsequent classification into scores. Please note the procedure for on-site survey as described in the introduction of this chapter and consider the additional information for the survey mentioned there.

When collecting data on the occurrence of dead fish, the entire rearing system must be taken into account. In particular, edges, bottom, and the area around the outlet must be inspected for the presence of dead fish.

Classification

- Score 0: **no** dead fish observed
- Score 1: dead fish observed **occasionally**: The number of dead animals can be recorded and counted individually.
- Score 2: **increased number of** dead fish: The number of dead animals can no longer be recorded and counted individually.

ADDITION: Rainbow trout were not visible in the water. The survey was limited to individuals floating dead on the surface.

ADDITION: The rainbow trout were not visible in the water. The survey was not carried out.

Sample size

Rainbow trout stock ready for marketing. The person in charge of the operation determines the stock.

Additional material requirements

Polarization glasses, camera with polarization filter if necessary

Time required

At least five minutes (stock observation in total approx. 10 min).

Notes

-

References

Ellis et al. 2002; Huntingford and Kadri 2014; VDFF 2016; Noble et al. 2018; Becke et al. 2019.

8.3 Occurrence of abnormal fish in the stock

Synonyms

-

Acquisition level

Stock level

Subject of data collection

Animals in poor physical condition, with discoloration and/or obvious wounds and/or other abnormalities (such as fungal infections) are recorded. Affected fish are often isolated from the shoal, smaller in body size and/or emaciated and/or exhibit abnormal coloration (such as dark coloration, pale or cloudy discoloration of the skin). The fish are often found at the water's edge and swim more frequently at the bottom or close to the water surface.

Purpose of data collection

These rainbow trout can serve as hosts for pathogens or indicate an early or advanced stage of infection within the stock.

Methodology

Data collection through observation of the stock. Subsequent classification into scores. Please note the procedure for on-site survey as described in the introduction of this chapter and consider the additional information for the survey mentioned there. If external conditions and visibility (e.g., water turbidity) make observation impossible, the indicator cannot be recorded.

During the observation, the entire rearing system is taken into account, in particular edges and the bottom are to be searched for fish with abnormal appearance and behavioural deviations.

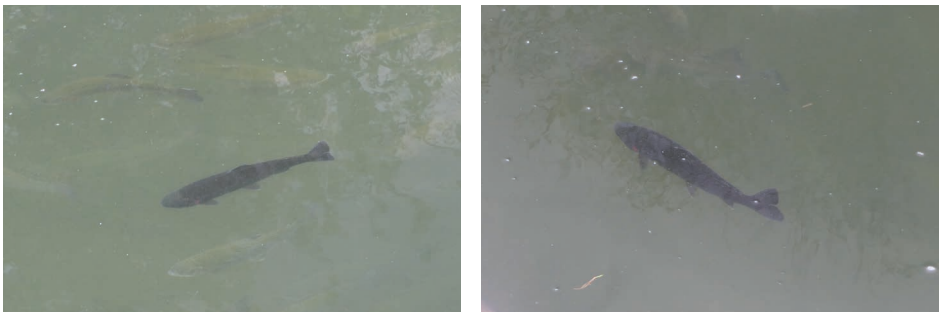


Figure 1: Rainbow trout with remarkably dark coloration. The individuals swim close to the water surface and are clearly separated from the shoal, photos: © Thünen Institute / Vincent Lugert.

Classification

- Score 0: **no** abnormal rainbow trout
- Score 1: abnormal rainbow trout observed **occasionally**, < 1 % of rainbow trout affected, easy to determine individually (individual rainbow trout)
- Score 2: **increased numbers** of abnormal rainbow trout in the stock, > 1 % of rainbow trout affected, too many to determine individually

ADDITION: The rainbow trout were not visible in the water. The survey was **not** carried out.

Sample size

Rainbow trout stock ready for marketing. The person in charge of the operation determines the stock.

Additional material requirements

Polarization glasses, camera with polarization filter if necessary

Time required

At least five minutes (stock observation in total approx. 10 min).

Notes

-

References

Expert discussions in the NaTiMon 2019/2020 project; Noble et al. 2020.

8.4 Swimming behaviour

Synonyms

Schooling behaviour, formation of schools

Acquisition level

Stock level

Subject of data collection

The swimming behaviour of rainbow trout is recorded both as a group and of individuals within the rearing facility. Attention is paid to whether the swimming behaviour is normal or whether there are changes or deviations from normal swimming behaviour. Examples for deviations may include apathetic and/or slowed down swimming, swimming in lateral position and/or separation from the shoal, standing at the water's edge.

Purpose of data collection

Altered swimming behaviour of a group of rainbow trout can indicate disease or stress. For instance, the presence of rainbow trout close to the bottom may suggest the influence of a stressor. Remaining close to the water surface and gasping for air or gathering near the inlet indicates oxygen deficiency. The separation of individual fish from the shoal/group is often an indication of disease in those fish. Deviation from normal behaviour may indicate compromised animal welfare.

Methodology

Data collection through observation of the stock. Subsequent classification into scores. Please note the procedure for on-site survey described in the introduction of this chapter and consider the additional information for the survey mentioned there. If external conditions and visibility (e.g., water turbidity) make observation impossible, the indicator cannot be recorded.

When observing swimming behavior, particular attention is initially given to the behavior of the fish shoal. Subsequently, the swimming behaviour of individual fish is closely monitored, with special focus on deviations from normal behaviour. The entire rearing system is taken into account during observation. In particular, edges and the bottom are searched for fish exhibiting noticeable behavioural deviations.

Figure 1: Normal swimming behaviour of a shoal of rainbow trout. The fish are evenly distributed in the rearing facility and show calm, uniform swimming movements. The animals are not always as clearly visible as in these examples, Photos: © Thünen Institute / Vincent Lugert.

Figure 2: Rainbow trout clearly swimming in a lateral position and unable to maintain its position in the water column, photo: © Thünen Institute / Vincent Lugert.

Classification

- Score 0: **no** signs of atypical swimming behaviour of the shoal or individual fish: all rainbow trout behave normally.
- Score 1: **minor** signs of atypical swimming behaviour: Some rainbow trout swim apathetically, slowed down, in a lateral position, or separate from the shoal. The number of rainbow trout exhibiting atypical behaviour **< 10 %** of the total population. The number of animals showing alterations can still be recorded and counted individually.
- Score 2: **severe** signs of atypical swimming behaviour: A significant number of rainbow trout swim apathetically, slowed down, in a lateral position or separate from the shoal (fish standing at the water's edge). The number of rainbow trout exhibiting atypical behaviour **> 10 %** of the total population. The number of animals showing alterations can no longer be recorded and counted individually.

ADDITION: The rainbow trout were not visible in the water. The survey was not carried out.

Sample size

Rainbow trout stock ready for marketing. The person in charge of the operation determines the stock.

Additional material requirements

Polarization glasses, camera with polarization filter if necessary

Time required

At least five minutes (stock observation in total approx. 10 min).

Notes

When assessing swimming behaviour, knowledge of the normal behaviour of rainbow trout of the corresponding age group and with respect to the rearing environment is necessary. In addition, the time since the last feeding must also be considered. Fish increase activity prior to feeding, and reduce activity post feeding.

References

Martins et al. 2012; Huntingford and Kadri 2014; Becke et al. 2019.

9 Indicators on stunning and killing

In Germany, many rainbow trout are slaughtered on farms for direct marketing. This eliminates the need for transportation to slaughterhouses, thereby sparing stress from transportation. In addition to the regulations on hygiene during slaughter and processing as well as on commercial marketing, requirements for slaughter in accordance with animal welfare regulations have to be considered (e.g., EG 1099/2009). According to the relevant German ordinance (TierSchlV), stunning must be carried out before killing. Stunning must be executed in such a way that the rainbow trout immediately lose consciousness. Subsequently the fish must be killed. Killing can be performed by exsanguination by means of a heart puncture/incision followed by evisceration or by cutting the gills (circular incision, bilateral severing of the large arteries and/or the artery between the heart and the gills) or evisceration. The terminology used may differ between regions across Germany.

In the course of stunning and killing, a multitude of aspects must be considered that can impact animal welfare. Improving animal welfare during stunning and killing can be achieved comparatively easily and cost-effectively.

Fish are adapted to life in water. The respiration of rainbow trout, for instance, functions properly only when their gills are fully submerged in water. Exposure to air burdens the fish with increasing duration, particularly restricting their respiration. As time out of water progresses, oxygen deficiency and thus severe stress may increase. However, in the context of stunning and killing, removing fish from water is inevitable. This time should then be kept as short as possible. For example, when transporting fish, even within the farm to the slaughterhouse, care should always be taken to ensure that there is a sufficient amount of water in the transport containers. Rainbow trout should never be transported out of the water, even for short distances on the farms. If the rainbow trout are handled carefully, stressful situations can be minimized.

Stunning rainbow trout, especially large rainbow trout, can be challenging. It requires a lot of knowledge, practical experience, and skills to apply stunning methods in such a way that rainbow trout lose consciousness, thus minimizing stress during slaughter as far as possible. For this reason, stunning and killing are important subjects during vocational training of fish farmers.

If stunning is not performed correctly, it is possible that fish may not lose consciousness and thus be subjected to significant stress during slaughter. To prevent this, it is necessary to verify whether stunning was successful. If it is found to be unsuccessful or if there is uncertainty about sufficient stunning, the stunning procedure must be repeated.

For rainbow trout, stunning methods permitted by the German ordinance (TierSchlV) include percussive stunning (blow to the head), electrical stunning, stunning with carbon dioxide, or the use of anaesthetics approved for animals intended for food production. To prolong the period of unconsciousness, a combination of several methods can be applied. When a group of rainbow trout is stunned, as may occur by electrical stunning in a water bath, success of stunning must be checked in each rainbow trout before killing to ensure that the fish is still unconscious. If this

is not the case or if there is uncertainty about the success of stunning, the stunning must be repeated. In such cases, a different stunning method, (e.g., such as percussive stunning) should be applied.

The success of stunning is assessed by observation of the absence of **reflexes**. Particular attention is paid to the so-called **eye-roll reflex** and coordinated movements of the gill covers **(breathing reflex)**. If the eye-roll reflex is present, the eye rotates within the eye socket as soon as the fish is tilted to the side. If the eye does not move in the eye socket and no longer rotates when the fish is tilted, the eye reflex has ceased. If the eye reflex is present after stunning, the rainbow trout is (again) conscious, and it is essential to perform a re-stunning immediately. It should be noted that even with successful stunning, uncontrolled muscle tremors may occur in conjunction with absent reflexes.

The survey must take place as part of a regular slaughter procedure on the farms, i.e., when the farm slaughters for regular marketing purposes. This ensures that the typical routine on the farm is applied. Slaughtering for the sole purpose of data collection should be avoided. Particularly in large farms, slaughtering numbers mostly exceed the number of 30 rainbow trout needed for an animal welfare monitoring. Accordingly, slaughtering of a smaller number of individuals can lead to a change in the standard routine, rendering observations less meaningful. As many farms only slaughter rainbow trout on certain days or at certain times, close coordination with the farm management is necessary prior to the survey. If a farm does not slaughter rainbow trout as part of its regular operations (e.g., a farm producing fingerlings or stocking material), no data on stunning and killing will be collected. Consequently, the survey at the individual animal level will not be conducted.

In principle, the entire slaughter procedure should be observed by the person conducting the survey. This includes the removal of the rainbow trout from the holding unit or from the short-term holding unit in the slaughterhouse (in this context the information on the construction materials of the side walls and the bottom, as collected during the interview, can be verified), transportation to the place where stunning is conducted, the stunning process as well as the killing. The duration of the procedure depends on the farm's structure and the size of the batch to be slaughtered. The slaughter process of at least 30 individual animals, the sample size that is needed for the survey, should be recorded. If a farm slaughters less than 30 rainbow trout in a day, either due to farm size or marketing strategy, or for any other reason, all rainbow trout slaughtered on that day should be used within the survey, if possible. The reduced sample size must be noted separately.

9.1 Time exposed to air in the course of stunning and killing

Synonyms

Exposure to air, contact with air, staying outside of the water

Acquisition level

Individual animal level

Subject of data collection

It is recorded whether the time outside of the water during stunning and killing (regular slaughter procedure) is as short as possible or longer than necessary.

Purpose of data collection

Prolonged exposure to air can lead to stress and oxygen deficiency in rainbow trout. Therefore, rainbow trout should always be transported in water. Any exposure to air should be kept as short as possible.

Methodology

Data collection involves observing a batch for slaughter or a part of a batch for slaughter during a regular slaughter procedure (30 animals). Subsequent classification into scores.

For the assessment, the sample of fish from a batch for slaughter is observed during a regular slaughter procedure, with attention given to whether the fish are out of the water for as short a time as possible and no longer than necessary.

In the process of stunning and killing, the following points should be particularly noted: transport routes and containers, transfer/handling of the fish. The transfer, e.g., with a net, should generally be done within a few seconds. Therefore, the stunning of the fish should be carried out next to the rearing or holding facility from which the fish are being removed whenever possible. Otherwise, the fish must be transported to the stunning facility in suitable containers filled with a sufficient amount of water of good quality. The fish should be able to remain in an upright position and be completely covered by water.

Figure 1: Rainbow trout on the way to the slaughterhouse. The animals are adequately covered with water and can align themselves, Photos: © Thünen Institute / Vincent Lugert.

Classification

- Score 0: The fish are removed from the water **for only as short a time as necessary**.
- Score 1: The fish are removed from the water **for longer** than necessary.

Sample size

Observation of a total of 30 animals in a slaughter batch or part of a slaughter batch as part of a regular slaughter procedure.

Additional material requirements

Timer/(stop) watch

Time required

Depending on operational procedures, adjustments may be made as necessary based on on-site conditions.

Notes

The Humane Slaughter Association, for example, recommends, that trout should spend less than 15 seconds out of the water, as stress and defensive reactions otherwise increase.

References

Noble et al. 2018; RSPCA 2018; EU Platform on Animal Welfare Own Initiative Group on Fish 2020; Humane Slaughter Association 2016.

9.2 Success of stunning

Synonyms

Anesthesia

Acquisition level

Individual animal level

Subject of data collection

It is recorded whether rainbow trout show reflexes after the stunning intervention, which indicates retained consciousness, and, if necessary, immediate re-stunning is applied. Observed reflexes can include both the eye-roll reflex and the breathing reflex (coordinated movements of the gill covers).

Purpose of data collection

A stunning intervention aims to induce a state of unconsciousness in fish, characterized by loss of muscle tone, eye-roll and breathing reflex. If reflexes can still be observed, it can be assumed that the fish were not stunned effectively. The killing of the rainbow trout must not be carried out in this state.

For successful stunning, it is necessary to choose a stunning method suitable for the fish species and prepare the procedure appropriately.

Methodology

Data collection by observing a regular slaughter procedure. Subsequent classification into scores.

Visual assessment of the stunning method and evaluation of the success of stunning in the course of the stunning and killing process. Special attention is given to ensuring that the stunned rainbow trout no longer show any reflexes (eye-roll reflex, breathing reflex). If reflexes persist, an additional assessment is made as to whether this applies to individual or more than individual rainbow trout.

To assess the eye-roll reflex and the presence of coordinated movements of the gill covers, the process of stunning and killing is observed during a standard slaughter procedure. Rainbow trout are generally well observable during handling by personnel during slaughter, allowing for the assessment of reflexes. To check the eye-roll reflex, the position of the eye in relation to the eye socket is assessed especially when the fish is tilted to its side. If the eye does not move in the eye socket and does not rotate in the course of the tilt, it can be assumed that the eye-roll reflex has ceased.

If the eye rotates when tilting the rainbow trout to the side, causing either the upper or lower part of the eyeball to protrude from the eye socket, then the eye-roll reflex is present, indicating that the rainbow trout is conscious.

Figure 1: Absent/lapsed eye-roll reflex of a rainbow trout (left): The eye does not move in the eye socket and does not rotate. Eye-roll reflex present (right): The eye rotates as the fish is tilted, photos: © Thünen Institute / Sebastian Kick.

To check the breathing reflex, attention is given to the movements of the entire gill cover. Simultaneous movements of the mouth may be clearly or faintly evident. Movements of the membranes on the gill cover (branchiostegal membrane) can also be considered for assessment. Coordinated movements of the gill covers can be checked at the same time as the eye-roll reflex is assessed.

Assessment of the stunning method:

- Percussive stunning
- Electrical current in a water bath
- Electrical current through skin contact with electrodes (grid, slide)
- Combination of electrical current in a water bath and percussive stunning
- Combination of electrical current through skin contact with electrodes (grid, slide) and percussive stunning
- Exposure to CO2
- Anaesthetics
- Miscellaneous
- no stunning conducted

Data collection ONLY for electrical stunning (water bath/grid): Are the rainbow trout stunned **individually** or in a **group**?

- Individual stunning
- Group stunning

Determination of the **success of stunning** based on the reflexes:

- Eye-roll reflex and/or breathing reflex: present or lapsed.

Classification

- Score 0: **All** rainbow trout in the sample show no reflexes.
- Score 1: **Some individual** rainbow trout in the sample show reflexes.
- Score 2: **A large number of** rainbow trout in the sample shows reflexes.
- Score 3: **No** stunning was carried out.

Sample size

Observation of a total of 30 animals in a slaughter batch or part of a slaughter batch as part of a regular slaughter procedure.

Additional material requirements

-

Time required

Depending on operational procedures, adjustments may be made as necessary based on on-site conditions.

Notes

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References

EFSA 2004; EFSA 2009a, b; Lines and Spence 2012; TierSchlV 2012; brochure “Empfehlungen zur Betäubung und Schlachtung” 2017a, b; LAVES 2020; Jung-Schroers et al. 2020.

9.3 Time between stunning and killing

Synonyms

-

Acquisition level

Stock level

Subject of data collection

The duration between stunning and killing is recorded.

Purpose of data collection

The fish must be killed immediately after stunning and while they are unconscious. This is ensured when killing takes place as soon as possible after stunning.

Methodology

Data collection involves observing a batch for slaughter during a regular slaughter procedure (30 animals). Subsequent classification into scores.

For the assessment, the sample of fish from a batch for slaughter is observed during a regular slaughter procedure, with attention given to whether the time between stunning and killing is as short as possible and no longer than necessary. It is also recorded whether killing by blood withdrawal or killing without prior stunning occurs. This is the case, for example, when rainbow trout are exposed to air for a prolonged time and then directly eviscerated. In this scenario, unconsciousness or even death occurs due to lack of oxygen.

Classification

- Score 0: Killing performed **immediately** after stunning.
- Score 1: Killing **not** performed **immediately** after stunning.
- Score 2: There is only stunning and **no** killing.
- Score 3: Killing **without prior stunning**.

Sample size

Observation of 30 animals in a slaughter batch or part of a slaughter batch as part of a regular slaughter procedure.

Additional material requirements

-

Time required

Depending on operational procedures, adjustments may be made as necessary based on on-site conditions.

Notes

-

References

TierSchlV 2012; brochure “Empfehlungen zur Betäubung und Schlachtung” 2017a, b.

9.4 Reflexes at the time of killing

Synonyms

Reflexes at the time of bleeding/evisceration

Acquisition level

Stock level/individual animal level

Subject of data collection

It is recorded whether rainbow trout show reflexes immediately before killing, which indicates retained consciousness. These can be both the eye-roll reflex and the breathing reflex (coordinated movements of the gill covers).

Purpose of data collection

Fish must be killed in a state of unconsciousness. The occurrence of reflexes before bleeding/evisceration may indicate that fish are conscious at the time of killing. This may be due to incorrect stunning or premature awakening from stunning.

Methodology

Data collection by observing a regular slaughter procedure. Subsequent classification into scores.

Visual assessment of the stunning method and assessment of the occurrence of reflexes such as the eye-roll reflex or the breathing reflex (coordinated movements of the gill covers) at the time of killing. Special attention is given to ensuring that the stunned rainbow trout no longer show any reflexes (eye-roll reflex, breathing reflex). If reflexes persist, an additional assessment is made as to whether this applies to individual or more than individual rainbow trout in the batch.

To assess the eye-roll reflex and the presence of the breathing reflex, the process of stunning and killing is observed during a standard slaughter procedure. To check the eye-roll reflex, the position of the eye in relation to the eye socket is assessed, especially when the fish is tilted to its side.

If the eye does not move in the eye socket and does not rotate in the course of the tilt, it can be assumed that the eye-roll reflex has ceased. If the eye rotates when tilting the rainbow trout to the side, causing either the upper or lower part of the eyeball to protrude from the eye socket, then the eye-roll reflex is present, indicating that the rainbow trout is conscious.

To check the breathing reflex, attention is given to coordinated movements of the gill covers. Simultaneous movements of the mouth may be clearly or faintly evident. Movements of the membranes on the gill cover (branchiostegal membrane) can also be considered for assessment. Coordinated movements of the gill covers can be checked at the same time as the eye-roll reflex is assessed.

Assessment of the **killing method**:

- Exsanguination by circular gill cut/throat cut
- Exsanguination by heart puncture/heart cut
- Exsanguination by gutting/evisceration. Fish is gutted (with the heart being removed) directly after stunning.
- Miscellaneous methods
- No slaughter/killing by exsanguination/blood withdrawal

Figure 1: Well-executed circular gill cut during the slaughter of rainbow trout. The isthmus has been completely severed. The cut blood vessels are clearly visible. Photo: © Thünen Institute / Vincent Lugert.

Assessment of **reflexes** (eye-roll reflex and breathing reflex) at the time of killing: present or absent.

Classification

- Score 0: **All** rainbow trout in the sample show no reflexes.
- Score 1: **Some individual** rainbow trout in the sample show reflexes.
- Score 2: **A large number of** rainbow trout in the sample shows reflexes.
- Score 3: Killing takes place **without prior stunning**.
- Score 4: There is **no** killing by exsanguination/blood withdrawal after stunning.

Sample size

Observation of 30 animals in a slaughter batch or part of a slaughter batch as part of a regular slaughter procedure.

Additional material requirements

-

Time required

Depending on operational procedures, adjustments may be made as necessary based on on-site conditions.

Notes

The slaughter method recorded is the one performed first. If additional slaughter methods are carried out subsequently, they are considered processing steps and are not recorded.

References

Lines and Spence 2012; brochure “Empfehlungen zur Betäubung und Schlachtung” 2017a, b; RSPCA 2018.

10 Indicators to be collected on the individual animal level

Animal welfare indicators on the individual animal level are often also referred to as animal health indicators. In fish, these indicators include alterations or injuries as well as deformities. Alterations and injuries not only affect the individual concerned, but prevalence and severity also provide insights into the husbandry environment and the management practices of the stock. These indicators can be evaluated individually to obtain information about the current state of animal health. In addition, by linking them with other indicators and background information, conclusions can be drawn about possible causes of certain health characteristics. For example, does the use of certain materials inside the rearing facilities lead to an increased incidence of lesions in the mouth area? Does the increased presence of certain predators lead to more frequent skin lesions?

In order to reliably assess health indicators in rainbow trout, it is necessary to examine the animals as soon as possible after slaughter, as some characteristics can change very rapidly post-slaughter. Any damage caused by the slaughter itself must be excluded from the assessment. If, for example, a rainbow trout is killed using a circular gill incision, then changes to the gill covers caused by this will not be recorded. This also applies to other areas affected by stunning methods such as percussive stunning. For example, percussive stunning may not only affect areas around the location of the brain, but may also cause injury to the upper jaw or neck. Such changes are then not considered in the assessment. Therefore, attention and training are necessary to perform these assessments properly.

Since the slaughter method can influence certain indicators, the slaughter method used and the way rainbow trout are marketed will be recorded again at this point. Since rainbow trout are almost exclusively marketed as eviscerated portion trout in German aquaculture (or further processed), it is rare to obtain round, i.e., ungutted, rainbow trout on the farms for the collection of animal welfare indicators. It is important to note here that the regular slaughter process used on the farms should not be altered for or by the monitoring. If a farm uses evisceration for slaughter, eviscerated animals should be used for the survey.

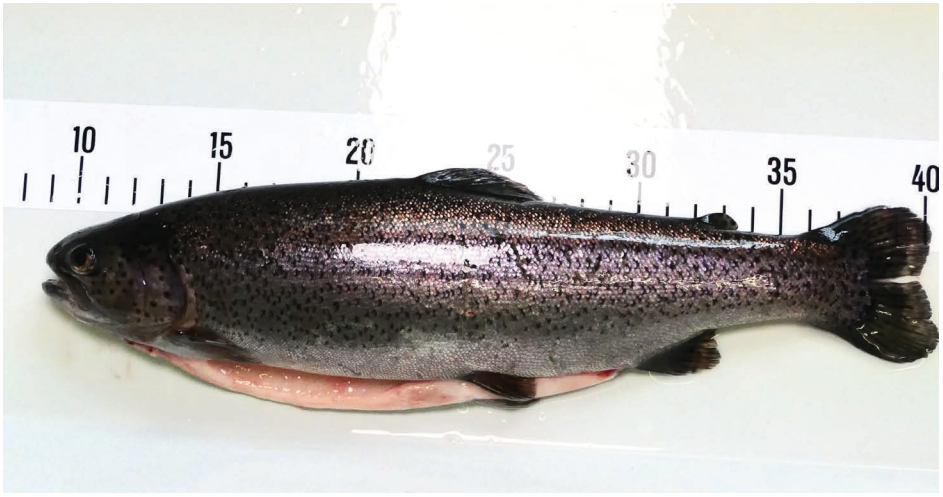

Figure 1: An eviscerated trout, as typically encountered during the surveys, photo: © Thünen Institute / Vincent Lugert.

At the beginning of the indicator assessment, the **breeding form** (e.g., rainbow trout, golden trout, blue trout) and the **marketing form** (round, gutted, gutted and gills removed, gutted and head removed) are noted for each individual. This will allow conclusions to be drawn at a later stage as to whether animal welfare is less or more influenced by certain management measures or similar factors for specific breeding types.

In general, all indicators are recorded sequentially for an individual. Once the assessment for one individual has been completed, the assessment will be carried out on the next specimen, starting again with recording breeding type and marketing form.

If it is not possible to collect certain indicators, note n/a or n.a.. This might occur, for example, if the head has been removed at slaughter and is no longer present. In this case, n/a or n.a. is noted for all indicators that are recorded on the head.

Breeding form and marketing form of the rainbow trout to be assessed

Breeding and marketing forms should always be recorded after consultation with the person in charge of the operation. Different terminologies for breeding forms and morphologies are used across the country.

Assessment of the **breeding form**. A distinction is made between:

- Regular type
- Golden trout
- Blue trout
- Steelhead
- Hybrid
- Other

Figure 2: Golden trout inside a rearing unit, photo: © Thünen Institute / Vincent Lugert.

Data collection on the production form of the rainbow trout **to be assessed**.
A distinction is made between portion trout and large trout.

Data collection on the **marketing form** of the rainbow trout to be assessed.
A distinction is made between

- round (whole fish, not gutted)
- eviscerated (gills not removed)
- eviscerated (gills removed)
- eviscerated (head removed)
- Other

10.1 Eye rupture and loss

Synonyms

Eye damage, eye injury

Acquisition level

Individual animal level

Subject of data collection

Extensive/severe perforating eye injuries such as rupture (loss of structural integrity) or complete loss are recorded. Less severe blunt eye injuries such as hemorrhages and bruise (haematomas) are not recorded here. A degree of severity is not recorded for eye rupture and eye loss, as eye rupture and eye loss always represent a significant alteration with corresponding impairment of animal welfare.

Purpose of data collection

Eye injuries can lead to restrictions in visual perception, behavioural impairments, and secondary infections, ultimately resulting in blindness or even death, depending on the severity.

Besides factors such as exposure to chemicals or infectious agents, mechanical injuries can also cause severe eye damage. Mechanical injuries can occur especially during activities such as transportation, pumping, or sorting. The consequences of severe eye injuries can include blindness and impairment of behaviour, such as avoidance behaviours and escape reactions, as well as impaired foraging behaviour.

Furthermore, eye injuries create an entry point for pathogens into the body and may thus be associated with increased susceptibility to secondary infections and higher mortality.

Methodology

Assessment of the eyes by visual inspection (adspection) immediately after slaughter. Subsequent classification into scores.

Severe (externally visible) penetrating eye injuries, such as eye rupture or loss, in rainbow trout in the sample are assessed by visual inspection of the carcass immediately after slaughter. The fish is laid flat on its right side in the examination tray or held in the hand for inspection. The left half of the head is cleaned of any external contaminants such as blood or mucus using a moist (paper) towel. The eye is examined for presence and structural integrity. The rainbow trout is then rotated, and the right half of the head is cleaned of any external contaminants such as blood or mucus with a moist (paper) towel, and the eye is visually inspected for presence and structural integrity.

Classification

- Score 0: **no** perforating injury (rupture) of the eyes, both eyes present
- Score 1: **unilateral** perforating injury (rupture) of the eye or eye loss
- Score 2: **bilateral** perforating injuries (rupture) of the eyes or eye loss, alternatively unilateral eye rupture and eye loss on the other side

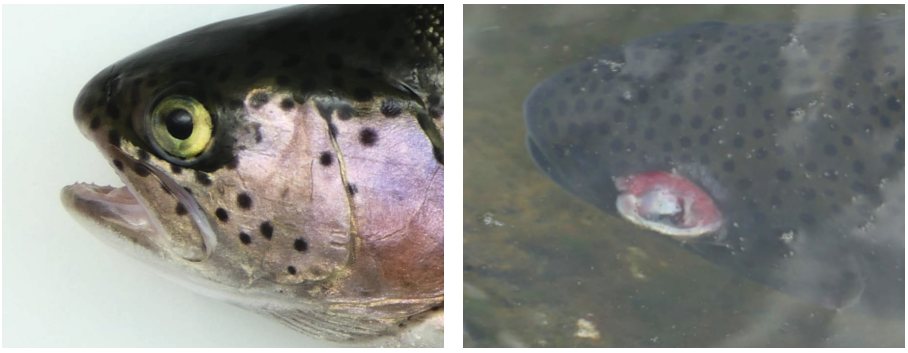

Figure 1: Eye of a rainbow trout without alterations (left). A rainbow trout with an eye rupture (right), Photos: © Thünen Institute / Vincent Lugert.

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are assessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels, water

Time required

The assessment of eye rupture and loss is conducted as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

Alterations that were caused by the stunning or killing method, and potentially other processing steps prior to the assessment of animal welfare indicators, must not be considered for evaluation. For example, bleeding in or around the eye caused by percussive stunning will not be recorded here.

References

Pettersen et al. 2014; Noble et al. 2018; RSPCA 2018; Becke et al. 2019.

10.2 Eye cloudy, cataract

Synonyms

Cataract, lens opacity or clouding, blindness

Acquisition level

Individual animal level

Subject of data collection

It is being recorded whether one or both eyes appear cloudy. A precise degree of severity is not recorded, as there is insufficient information regarding the relationship of the extent of opacity and the impairment of visual perception as well as the effects on animal welfare.

Purpose of data collection

Lens opacity leads to a continuous decline in vision/restriction of visual perception. Initially, details may not be perceived and eventually, vision may be lost completely. The process is gradual and continuous. Visual perception becomes increasingly blurred and out of focus. Spatial vision may also be impaired.

Consequences may include impaired avoidance and escape behaviours, and effects on foraging, as behavioural patterns of other individuals and feed pellets may not be perceived correctly. Lens opacity may be associated with increased susceptibility to intraspecific aggression, emaciation, injuries, and higher mortality.

Methodology

Assessment of the eyes by visual inspection (adspection) immediately after slaughter. Subsequent classification into scores.

Obvious (externally visible) clouding of the eyes of rainbow trout in the sample is assessed by visual inspection of the carcass immediately after slaughter. The rainbow trout is laid flat on its right side in the examination tray or held in the hand for inspection. The left eye is cleaned of any external contaminants such as blood or mucus using a moist (paper) towel. The fish is then rotated, and the right eye is cleaned of any external contaminants such as blood or mucus with a moist (paper) towel, and the eye again visually inspected.

Classification

- Score 0: **no** clouding of the eyes
- Score 1: **unilateral** clouding of the eyes
- Score 2: **bilateral** clouding of the eyes

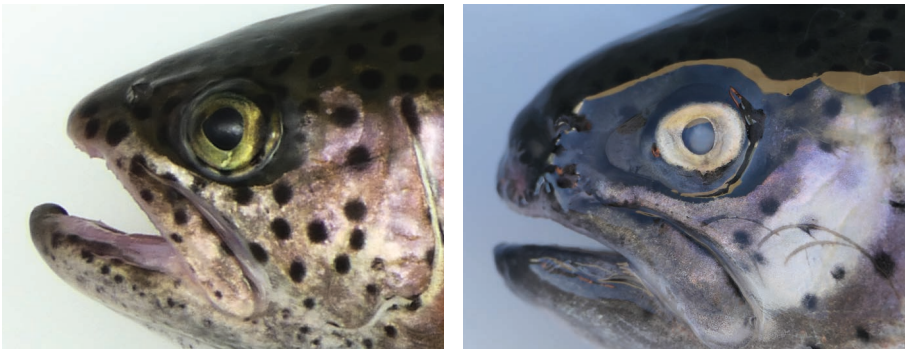

Figure 1: Eye of a rainbow trout without alterations (left). A rainbow trout with clouding of the eye (right), Photos: © Thünen Institute / Vincent Lugert.

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are assessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels, water

Time required

Eye opacity is recorded as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

The presence of eye opacity should be assessed immediately after slaughter, as the eye opacity changes over time.

References

Pettersen et al. 2014; Noble et al. 2018; RSPCA 2018; Becke et al. 2019.

10.3 Morphological changes of opercula

Synonyms

Gill cover length, missing gill covers, gill cover defects, gill cover damage, gill cover shortening

Acquisition level

Individual animal level

Subject of data collection

It is recorded whether rainbow trout have any deformations of the gill covers. A precise degree of severity is not recorded as there is insufficient information regarding the relationship between the extent of the deformation and the degree of animal welfare impairment. Deformations may include shortening, deformation (e.g., curled edges, missing sections, extension) or completely missing gill covers.

Purpose of data collection

Deformation of the gill covers may impair gill function. Due to deformation or complete absence, the active flushing of water through the gills, which is ensured by the movement of the gill covers, may be partially reduced or restricted. Consequently, there is a lack of oxygen supply and increased respiratory activity, especially in connection with poor water quality. As a result, the swimming activity of the fish may be increased. Furthermore, ion exchange through the gills may also be disrupted. Growth and performance may be reduced due to resulting energy deficits.

If gill tissue is exposed due to the deformation of the gill cover, there may be an increased risk of injury (e.g., during handling) as well as an increased susceptibility of the gills to parasites and pathogens. In this regard, there appears to be a link to an increased mortality rate and disease susceptibility.

There are many causes of gill cover deformities. Possible factors include genetic effects, unfavourable rearing conditions, nutritional deficiencies (e.g., phosphorus deficiency), and inadequate environmental conditions or environmental stressors.

Methodology

Assessment of the gill cover by visual inspection (adspection) and palpation (examination by touch) immediately after slaughter. Subsequent classification into scores.

For inspection, each rainbow trout is examined individually in the examination tray. The gill cover is first visually inspected for obvious shortening on both sides of the fish. Deformed gill covers are identified by exposed red gill filaments. In addition, by gently lifting the gill cover and palpating the edge of the gill cover, the gill cover edge area is examined for deformities (corners, curled edges, etc.). The examination is first conducted on the left side of the body, then identically on the right side of the body.

Figure 1: Gill cover of a rainbow trout, left side of the body, without alteration (left) and a deformation of the right gill cover of a rainbow trout (right). The exposed gill filaments are clearly visible, photos: © Thünen Institute / Vincent Lugert.

Classification

- Score 0: **no** morphological change of the gill cover
- Score 1: **unilateral** morphological change of the gill cover
- Score 2: **bilateral** morphological change of the gill cover

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are assessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels

Time required

Gill cover deformations are recorded as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

Alterations that were caused by the stunning or killing method, and potentially other processing steps prior to the assessment of animal welfare indicators, must not be considered for evaluation.

References

Pettersen et al. 2014; RSPCA 2018; Noble et al. 2018; Becke et al. 2019; Noble et al. 2020.

10.4 Changes to the upper jaw

Synonyms

Alterations/injuries to the snout, mouth lesions, jaw injuries, mouth injuries

Acquisition level

Individual animal level

Subject of data collection

It is recorded whether rainbow trout exhibit alterations/injuries in the mouth/snout area of the upper jaw. This includes alterations of the oral cavity, the jaws, and the dental ridge as well as the outer lateral upper jaw areas of the mouth. Injuries such as bleeding, inflammation, swelling and wounds as well as deformities, tears in the tissue, etc. are recorded.

Purpose of data collection

Injuries to the mouth can impair feed intake, thereby affecting behaviour. Possible causes of injuries include interaction with the housing equipment (e.g., collisions with tank walls due to lighting conditions or colouration, or due to increased/rapid activity, such as escape behaviour, due to noise or disturbance), nets (mesh size, material, knotting), as well as technical equipment and devices used during routine work. Repeated damage to the same areas of the body can lead to permanent deformities. Depending on severity, alterations/injuries in the mouth area can result in reduced growth and even increased mortality. Breathing can also be impaired. Rainbow trout thereby attempt to increase water flow through the gills (so-called ram ventilation). Due to injuries and inflammation in the mouth and the jaw area the fish may refuse to eat.

Methodology

Assessment of the upper mouth and snout area by visual inspection (adspection) immediately after slaughter. Subsequent classification into scores.

Obvious (externally visible) alterations/injuries to the upper mouth or snout area of the rainbow trout in the sample are recorded by visual assessment (adspection) on the carcass immediately after slaughter. The rainbow trout is held in the hand and visually inspected for this purpose. The head of the rainbow trout is cleaned of any external contaminants such as blood or mucus using a moist (paper) towel. The external area of the upper half of the mouth, as well as the lateral jaw areas of the mouth, are examined for injuries such as bleeding, inflammation, swelling, and wounds, as well as for tears in the tissue and for deformities. Subsequently, the mouth is opened with the fingers. The inner area of the upper jaw, the dental ridge, and the oral cavity are examined for alterations/injuries. The area to be assessed extends from the outermost end of the mouth to below the imaginary line connecting the nostrils, running beneath the eye socket to the end of the jaw joint.

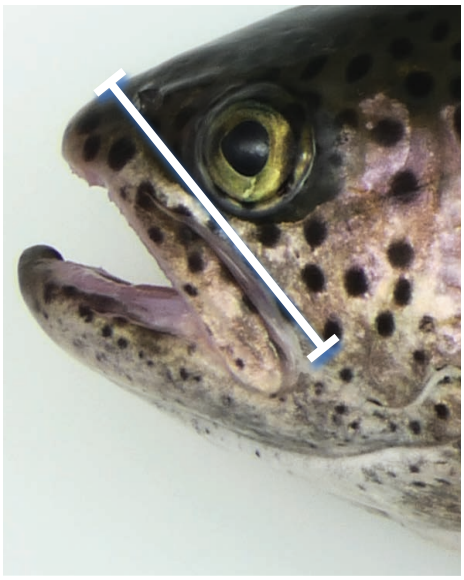

Figure 1: The area of the upper jaw of a rainbow trout to be assessed, starting from the outermost end of the mouth to below the imaginary line connecting the nostrils, running beneath the eye socket to the end of the jaw joint, photos: © Thünen Institute / Vincent Lugert.

Classification

- Score 0: **no** alterations or injuries to the upper jaw
- Score 1: **very minor to minor** alterations, injuries or deformities to the upper jaw (pressure sores, small, superficial wounds and/or skin damage)
- Score 2: **moderate to severe** alterations, injuries or deformities to the upper jaw (large, deep and wide-ranging wounds, areas with inflammation and/or deformities)

Figure 1: Mouth of a rainbow trout without alterations, photo: © Thünen Institute / Vincent Lugert.

Figure 2: Very minor to minor alterations, injuries or deformations to the upper jaw (pressure sores, small, superficial wounds and/or skin damage), photos: © Thünen Institute / Vincent Lugert.

Figure 3: Moderate to severe alterations, injuries or deformations to the upper jaw (large, deep and wide-ranging wounds, inflammations, and/or deformations), photos: © Thünen Institute / Vincent Lugert.

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are assessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels, water

Time required

Alterations/injuries to the mouth and snout area are recorded as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

Alterations that were caused by the stunning or killing method, and potentially other processing steps prior to the assessment of animal welfare indicators, must not be considered for evaluation.

References

Ashley 2007; Noble et al. 2018.

10.5 Changes to the lower jaw

Synonyms

Alterations/injuries to the snout, mouth lesions, jaw injuries, mouth injuries

Acquisition level

Individual animal level

Subject of data collection

It is recorded whether rainbow trout exhibit alterations/injuries in the mouth/snout area of the lower jaw. This includes abnormalities of the oral cavity, the jaws, and the dental ridge as well as the outer lateral lower jaw areas of the mouth. Injuries such as bleeding, inflammation, swelling and wounds as well as deformities, tears in the tissue, etc. are recorded.

Purpose of data collection

Injuries to the mouth can impair feed intake, thereby affecting behaviour. Possible causes of injuries include interaction with the housing equipment (e.g., collisions with tank walls due to lighting conditions or coloration, or due to increased/rapid activity, such as escape behaviour, due to noise or disturbances), nets (mesh size, material, knotting), as well as technical equipment and devices used during routine work. Repeated damage to the same areas of the body can lead to permanent deformities. Depending on severity, alterations/injuries in the mouth area can result in reduced growth and even increased mortality. Breathing can also be impaired. Rainbow trout thereby attempt to increase water flow through the gills (so-called ram ventilation). Due to injuries and inflammation in the mouth and jaw area the fish may refuse to eat.

Methodology

Assessment of the lower mouth and snout area by visual inspection (adspection) immediately after slaughter. Subsequent classification into scores.

Obvious (externally visible) alterations/injuries to the lower mouth or snout area of the rainbow trout in the sample are recorded by visual assessment (adspection) on the carcass immediately after slaughter. The rainbow trout is held in the hand and visually inspected for this purpose. The head of the rainbow trout is cleaned of any external contaminants such as blood or mucus using a moist (paper) towel. The external area of the lower half of the mouth, as well as the lateral jaw areas of the mouth, are examined for injuries such as bleeding, inflammation, swelling, and wounds, as well as tears in the tissue and deformities. Subsequently, the mouth is opened with the fingers. The inner area of the lower jaw, the dental ridge, and the oral cavity are examined for alterations/injuries. The area to be assessed extends from the outermost end of the mouth to the outermost area of the jaw.

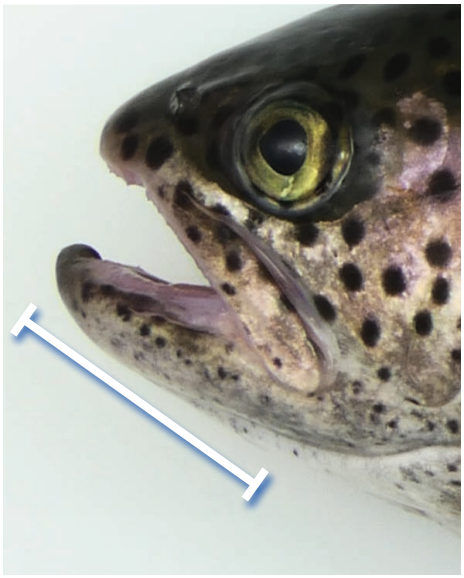

Figure 1: The area of the lower jaw of a rainbow trout to be assessed extends from the outermost end of the mouth to the end of the jaw, photo: © Thünen Institute / Vincent Lugert.

Classification

- Score 0: **no** injuries or alterations to the lower jaw
- Score 1: **very minor to minor** alterations, injuries or deformities to the lower jaw (pressure sores, small, superficial wounds and/or skin damage)
- Score 2: **moderate to severe** alterations, injuries or deformities to the lower jaw (large, deep and wide-ranging wounds, areas of inflammations and/or deformities)

Figure 2: Mouth of a rainbow trout without alterations, photo: © Thünen Institute / Vincent Lugert.

Figure 3: Very light to light alterations, injuries or deformations to the lower jaw (pressure sores, small, superficial wounds and/or skin damage), photos: © Thünen Institute / Vincent Lugert.

Figure 4: Moderate to severe alterations, injuries or deformations to the lower jaw (large, deep and wide-ranging wounds, inflammations, and/or deformations), photos: © Thünen Institute / Vincent Lugert.

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are reassessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels, water

Time required

Alterations/injuries to the mouth and snout area are recorded as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

Alterations that were caused by the stunning or killing method, and potentially other processing steps prior to the assessment of animal welfare indicators, must not be considered for evaluation.

References

Ashley 2007; Noble et al. 2018.

10.6 Skin lesions without tissue loss

Synonyms

Skin condition, skin damage, redness, haemorrhage, boils, inflammation

Acquisition level

Individual animal level

Subject of data collection

Skin lesions without tissue loss are general alterations to the skin, such as skin colour, elasticity, texture, and/or skin condition. In skin lesions without tissue loss, no skin erosion or open wounds can be registered. If erosions or open wounds occur, they will be recorded separately (see below). It is recorded whether and to what extent skin lesions without loss of tissue occur in fish. Skin alterations without loss of tissue include specifically classified harmful alterations of various degrees of severity, expression, and clinical symptoms, from minor **reddening of the skin** to **haemorrhage** and severe **inflammation**.

Purpose of data collection

Skin alterations and skin damage in fish can be caused by pathogens or mechanical trauma. The consequences of skin damage depend on the size and severity of the damage. Mechanical skin damage may serve as an entry point for pathogens and can therefore lead to secondary infections. If spread over a large area, these alterations can cause disturbances in osmoregulation, potentially leading to the death of the fish.

Methodology

Assessment of the skin by visual inspection (adspection) immediately after slaughter. Subsequent classification into scores.

Obvious (externally visible) alterations to the skin of rainbow trout in the sample are recorded. The body (excluding the head area and fins) is examined, starting from behind the opercula to the base of the caudal fin on both sides, as well as the dorsal and ventral sides. The assessment is conducted immediately after slaughter by visual inspection (adspection). The rainbow trout is laid flat in the inspection tray or held in the hand, cleaned of any external contaminations such as blood or mucus with a moist (paper) towel and visually examined. The occurrence of skin lesions without tissue loss and the respective intensity are classified.

Classification

- Score 0: **no** visible skin lesions
- Score 1: reddish alterations to the skin (**skin redness**), punctual or of small scale, with or without minor swelling
- Score 2: extensive reddening of the skin, **haemorrhage**, and hematomas, with or without swelling
- Score 3: **severe and extensive haemorrhage** and/or **inflammation**, with or without severe swelling

Figure 1: Intact skin of a rainbow trout (top left). Skin lesions without tissue loss in rainbow trout in various intensities and forms, classified as small-scale skin redness (top right), extensive skin redness (bottom left), severe and extensive haemorrhage (bottom right), photos: © Thünen Institute / Vincent Lugert.

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are assessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels, water

Time required

The assessment of skin lesions without tissue loss is carried out as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

Alterations that were caused by the stunning or killing method, and potentially other processing steps prior to the assessment of animal welfare indicators, must not be considered for evaluation.

References

Stien et al. 2013; Noble et al. 2018; RSPCA 2018; Becke et al. 2019; Noble et al. 2020.

10.7 Skin lesions with tissue loss

Synonyms

Skin condition, wounds, injuries, skin erosion, necrosis

Acquisition level

Individual animal level

Subject of data collection

Skin lesions with tissue loss are general alterations to the skin, such as skin erosions, tears in the skin, wounds, profound skin alterations and/or areas with necrotic tissue loss. It is recorded whether and to what extent such skin lesions with tissue loss occur in rainbow trout. Such skin lesions include specifically classified harmful alterations of various degrees of severity, expression and clinical symptoms, from minor superficial **skin erosion** to more severe skin abrasions and **wounds**, to profound **necroses and ulcers with tissue loss**. The degree of severity is divided into different levels (see classification). If there is also reddening of the skin or haemorrhage present, these are recorded separately.

Purpose of data collection

Skin alterations and skin damage in fish can be caused by pathogens or mechanical trauma. The consequences of skin damage depend on the size and severity of the damage. Mechanical skin damage may serve as an entry point for pathogens and can therefore lead to secondary infections. If spread over a large area, these alterations can cause disturbances in osmoregulation, potentially leading to the death of the fish.

Methodology

Assessment of the skin by visual inspection (adspection) immediately after slaughter. Subsequent classification into scores.

Obvious (externally visible) alterations/injuries to the skin of rainbow trout in the sample are recorded. The body (excluding the head area and fins) is examined, starting from behind the opercula to the base of the caudal fin on both sides, as well as the dorsal and ventral sides. The assessment is conducted immediately after slaughter by visual inspection (adspection). The rainbow trout is laid flat in the inspection tray or held in the hand, cleaned of any external contaminations such as blood or mucus with a moist (paper) towel and visually examined. The occurrence of skin lesions without tissue loss and the respective intensities are classified.

Classification

- Score 0: **no** visible lesions or injuries to the skin
- Score 1: minor lesions; **superficial skin abrasion** (skin erosion), subjacent tissue intact; small area
- Score 2: significant lesions; **extensive superficial** skin abrasion, **small areas of more severe** skin damage and **small wounds** (subjacent tissue damaged)
- Score 3: severe lesions; injuries and **extensive wounds** as well as **necrosis** or **ulcers** (deep and/or widespread tissue loss), possibly secondarily infected/ swelling

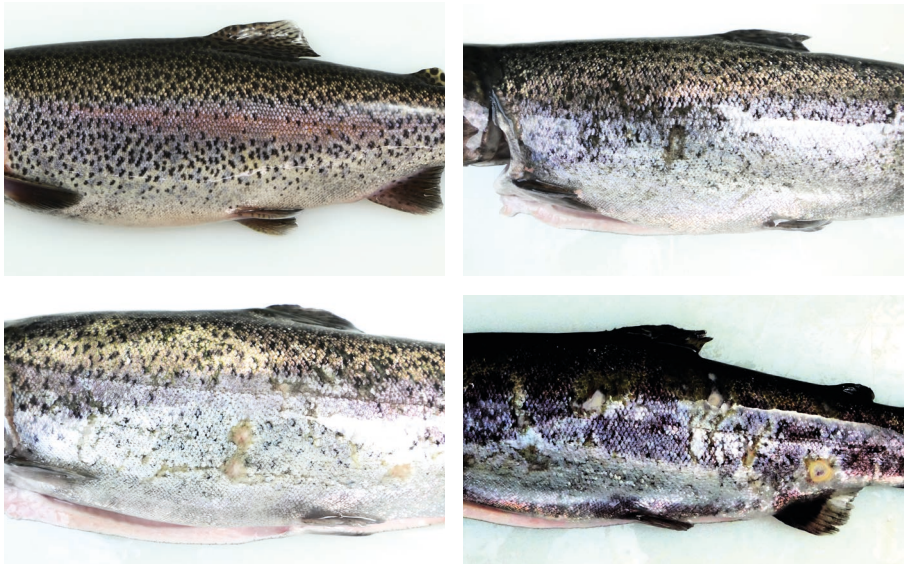

Figure 1: Intact skin of a rainbow trout showing no alterations (top left). Skin lesions with loss of tissue in rainbow trout in different intensities and forms, classified as superficial skin abrasion (top right), small wounds (bottom left), extensive wounds (bottom right), photos: © Thünen Institute / Vincent Lugert.

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are assessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels, water

Time required

The assessment of skin lesions with loss of tissue is carried out as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

Alterations that were caused by the stunning or killing method, and potentially other processing steps prior to the assessment of animal welfare indicators, must not be considered for evaluation. Scars are not recorded.

References

Stien et al. 2013; Noble et al. 2018; RSPCA 2018; Becke et al. 2019; Noble et al. 2020.

10.8 Spinal deformities

Synonyms

Deformities of the spine, lordosis, scoliosis, kyphosis

Acquisition level

Individual animal level

Subject of data collection

It is recorded whether the rainbow trout in the sample exhibit spinal deformities. A precise degree of severity is not recorded here, as there is insufficient information regarding the relationship between the severity of the deformation and the degree of animal welfare impairment. In addition, precise distinctions in the severity of spinal deformities can only be reliably determined through X-ray imaging.

Purpose of data collection

Deformation of the spine can be associated with reduced growth and performance. The deformities can restrict swimming ability (propulsion, locomotion) and the ability to compete for feed. Affected fish may be less tolerant of handling measures and stress.

The causes are manifold and often difficult to identify. Symptoms often become apparent only in an advanced stage or age, making it challenging to identify the possible cause retrospectively. Possible causes may include: a lack of nutrients in the feed, infections, high temperatures during egg development, injuries, poor water quality, undesirable vaccination reactions, environmental pollution and environmental stressors as well as genetic factors.

Methodology

Assessment of the spinal column area by visual inspection (adspection) immediately after slaughter. Subsequent classification into scores.

Obvious (externally visible) deformation of the spine of rainbow trout in the sample are recorded by visual assessment (adspection) on the carcass immediately after slaughter and before rigor mortis sets in. The fish is first laid flat on the right side of the body in the examination tray and visually inspected. In addition, the rainbow trout is oriented ventrally (laid on its belly) and an adspection of the spine is carried out. Abnormalities indicating spinal alterations include the appearance of a hump and/or a disproportionately shorter/narrower posterior half of the body starting from the dorsal fin, as well as an S-shaped deformation of the spine.

Classification

- Score 0: **no** spinal deformities
- Score 1: **Deformation** of the spine

Figure 1: Different forms of spinal deformation in rainbow trout. The picture on the left shows an S-shaped deformation of the spine. The picture on the right shows the typical formation of a hump and a shortened posterior half of the body. The rainbow trout appears stout and humpbacked due to the deformation, photos: © Thünen Institute / Vincent Lugert.

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are assessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels, water

Time required

Deformations of the spine are recorded as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

The examination must be carried out immediately after slaughter. Rigor mortis must not have set in yet. If rigor mortis has already set in, the animals must be stored properly until the end of rigor mortis and the examination must be conducted after rigor mortis has ended.

References

Stien et al. 2013; Pettersen et al. 2014; Noble et al. 2018; RSPCA 2018; Becke et al. 2019; Noble et al. 2020.

10.9 Fin status (pectoral, dorsal, caudal)

Synonyms

fin status, fin erosion, fin appearance, fin condition, fin damage, fin splitting, fin health

Acquisition level

Individual animal level

Subject of data collection

The condition of the fins is assessed, whereby only the two pectoral fins, the dorsal fin and the caudal fin are taken into account. Presence and degree of fin erosion, fin splitting, thickening, inflammation, scarring, folding, bleeding, fin ray fractures and other fin alterations/injuries, are recorded.

Purpose of data collection

Fin damage such as fin erosions, lesions or loss of substance impair swimming behaviour and ability, thereby impacting feeding, social behaviour and resting behaviour. Alterations of the fins can trigger agonistic behaviour and biting reflexes in conspecifics, with further damage to the fins. Progressive and persistent alterations and injuries can lead to inflammation and necrosis of the fin tissue.

Alterations in fins can be caused by, for example, husbandry conditions such as the surface quality of the husbandry facility, unfavourable water parameters, damage due to bites and injuries caused by handling (nets, sorting machines) with secondary infections caused as a result.

Methodology

Assessment of the fins by visual inspection (adspection) immediately after slaughter. Subsequent classification into scores.

The rainbow trout is laid flat on its right side in the examination tray. All fins are cleaned with a moist (paper) towel to remove any external contaminants such as blood or mucus. The fins are then individually inspected from all sides. To do this, the fin is spread apart and fanned out from the carcass using the fingers. Fin damages are determined using a multi-stage scale. Primary considerations include loss of fin area (erosion) and splitting of the fins. Other factors considered include **thickening, inflammation, scarring, folding, bleeding** as well as **fin ray fractures**. The individual scores are not endpoints, but rather ranges within which a wide spectrum can be classified.

The fins are examined individually in the following order:

- Pectoral fin, left side of the body
- Pectoral fin, right side of the body
- Dorsal fin
- Caudal fin

Classification

Two-step, dynamic evaluation of the fin status:

First step

- Score 0: **no change in fin status** (no to very minor alterations in fin area and fin splitting)
- Score 2: **noticeably altered fin status** (clearly visible alterations in fin area and/or fin splitting, minor reddening, fin ray fractures, scarring, folding)
- Score 4: **severely altered fin status** (severe to very severe change in fin area and/or fin splitting, often accompanied by inflammation of the tissue, bleeding)

Note: A score 4 may indicate that the fin area has been reduced to such an extent that splitting of the fin is no longer possible. However, a split without loss of fin area can also represent a score 4, e.g., if the fin is split once or several times very deeply, sometimes down to the base of the fin.

Second step

If **score 2** "noticeably altered fin status" was determined in the first step of the assessment, a further refinement of the classification is conducted:

- Score 1: tendency towards minor alterations (**minor** alteration)
- Score 2: no further tendency (**significant** alteration)
- Score 3: tendency towards stronger change (**severe** alteration)

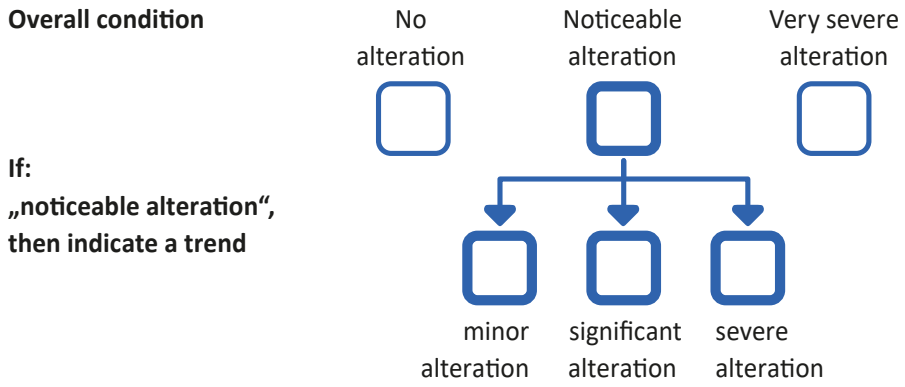

Figure 1: Scheme for the dynamic evaluation of fin status. The upper row assesses the overall condition, while the lower row assesses the tendency of the alterations, Source: Thünen Institute / Own illustration.

Application example:

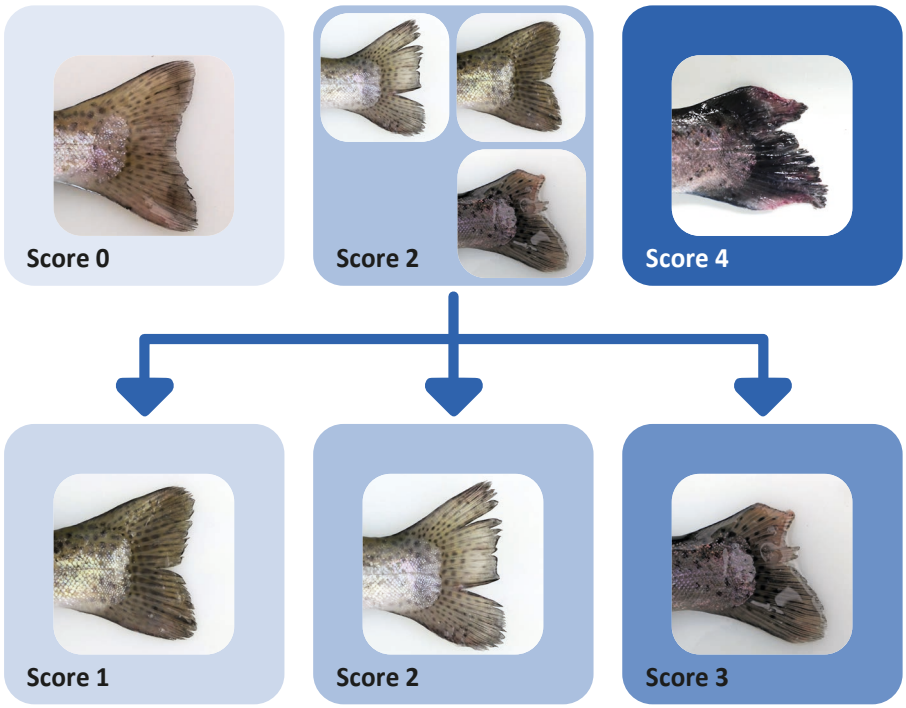

Figure 2: Practical example of the application of the dynamic assessment model, photos: © Thünen Institute / Vincent Lugert.

Sample size

As part of a regular slaughter procedure, 30 randomly selected rainbow trout from a stock are assessed after slaughter.

Additional material requirements

Examination tray, disposable gloves, (paper) towels, water

Time required

The fin status is recorded as part of the assessment of all indicators at the individual animal level. The assessment of all indicators takes approximately 6 minutes per individual.

Notes

The overall assessment (step 1) must always be conducted. This ensures a minimum data set that can be reliably collected. The tendency (step 2) may not be determinable under certain conditions, such as when the person assessing is unclear about a tendency of the fin condition. In such cases, “not determinable” should be noted for tendency.

References

Hoyle et al. 2007; Person-Le Ruyet et al. 2007; Latremouille 2010; Stien et al. 2013; Pettersen et al. 2014; Noble et al. 2018; RSPCA 2018; Becke et al. 2019; Noble et al. 2020.

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