

CODE OF GOOD ENVIRONMENTAL PRACTICES



For well managed salmonid farms



SalmonChile

Fundación Chile

2003

Code of Good Environmental Practices for well Managed Salmonid Farms

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INTRODUCTION

This Code of Good Environmental Practices (CGEP) for well managed salmonid farms provides criteria for the development of sustainable salmon farming in Chile, with particular concern for the environment and for optimizing the production processes. This involves the entire salmon and trout culture production process, that is, from the management of broodstock, eggs, fingerlings and smolts up to final harvest. The guidelines defined here apply to salmonid species.

This Code aims to establish a standard for salmonid fish farms in Chile to enable them to set up environmental management systems by following common and voluntary guidelines, so that they may qualify for an eco-label that certifies compliance with the application of good environmental practices in their farming operations, adding value to their products.

Since the salmon industry operates in the natural environment, companies can increase the productivity of their operations by implementing this Code of Good Practices, since environmental parameters influence the production processes. Nevertheless, it is recommended that these measures should be adopted within sector, zonal and global frameworks, enabling salmon producers to be jointly responsible for their enforcement as a common strategy for marketing products and for protecting the environment where these farming operations are performed.

The CGEP was created to optimize the environmental management of operational fish farms. The practices defined by this Code are guidelines for the improvement of the environmental performance of fish farms. For effective application, they require the direct commitment of the General Management of companies, and the entire organization.

These new challenges are occurring in a sector which is now addressing environmental issues through proper environmental management and certification. This translates into lower production costs, increased global competitiveness and provides a new marketing tool for the more demanding markets of the 21st century.



I. SCOPE, OBJECTIVES AND UPDATES

1.1 Scope

This Code of Good Environmental Practices (CGEP) has been created for companies cultivating salmonid species and covers all types of fish farms, including hatcheries, smolt and ongrowing centers.

1.2 General Objective

To demonstrate that fish farms are operated in compliance with standardized and defined environmental parameters for minimal environmental impact, taking account of relevant environmental legislation and the technology available in Chile.

1.3 Specific Objectives

- To establish a system of environmental management for salmonid farming in Chile, under a common set of standards and management structure that are verifiable and relevant to the activity.
- To design the CGEP as a voluntary tool to facilitate international trade of Chilean salmonid products.
- To certify compliance with defined good environmental practices for salmonid farming, by issuing an eco-label, based on a scientific methodology, that uses objective and demonstrable criteria to support this declaration.

- To motivate the fish farms with the conditions and/or opportunities to improve their environmental performance.
- To keep the market informed about the significant environmental aspects of this eco-label.

1.4 Updates

Periodically, Fundación Chile will issue updates of this Code covering, if applicable, modifications to the environmental legislation, new aquaculture technologies and market requirements.



II. POLICY, STRUCTURE AND RESPONSIBILITY

2.1 *Environmental Policy*

The company's General Management should define and implement their organization's environmental policy for fish farms under its responsibility, ensuring that the policy:

- Is appropriate to the nature and significance of the environmental impacts of the fish farms' activities, products and services.
- Includes the commitment to achieve and maintain compliance with the CGEP.
- Includes the commitment to comply with all environmental legislation applicable to the fish farms' activities and any other commitment that the company may voluntarily adopt.
- Is documented, implemented and communicated to all employees.
- Is signed by the General Manager and is available to the public.

2.2 *Structure and Responsibility*

The **General Manager** (CEO) is responsible for implementing and maintaining the CGEP dispositions in the organization of the company's fish farms. Therefore he/she should:

- a. Formally designate a Coordinator in the company who will manage and follow-up the implementation of the CGEP and related certification activities in the company.

- b. Formally define the responsibilities, functions and authorities of the Coordinator, Production and Operations Managers, Area Supervisors and Fish Farm Managers and Assistants, and any other person that he/she deems necessary in order to comply with the Code's requirements in every fish farm. This formal definition should be filed as a CGEP record.
- c. Provide the necessary resources to implement and maintain the Code's dispositions.
- d. Periodically check (at least once in every six months period), according to an **“Annual Performance Review Program for the Fish farms”** that:
 - The fish farms have implemented and maintained this Code's dispositions.
 - The fish farms are complying with the company environmental policy.
 - The environmental performance of each fish farm meets defined targets.
 - Monitoring is carried out as planned and shows that environmental impacts are under control.
 - The proper corrective actions have been implemented for all deviations detected and that these actions are effective.
 - The addition of new projects or new methodologies and/or technologies to the production processes is under control.

The formal CGEP records will include documentation of the **“Annual Performance Review Program”**, the proceedings of review meetings and the measures to be implemented to correct deviations and improve deficiencies.



Production Managers are responsible for:

- Implementing, assigning resources and ensuring compliance with this Code's dispositions, in their areas of responsibility.
- Verifying that the corrective actions implemented are effective.
- Regularly verifying that the fish farms for which they are responsible meet their expected environmental performance.
- Being an active part of the Committee which, under the General Manager, reviews the environmental performance of the fish farms and the measures that must be implemented to correct deviations and improve deficiencies.

Fish Farm Managers are responsible for:

- Complying with the dispositions in this Code that apply to fish farms under their control.
- Implementing effective corrective actions to avoid future repetition of non-conformities.
- Recording actions, as indicated in this Code, to show how activities directly related to the environmental impacts have been carried out.
- Regularly disseminating the contents of the CGEP to all personnel under their responsibility.
- Regularly monitoring to demonstrate that such activities are being performed correctly and adopting immediate corrective actions to address any deviations.

2.3 CGEP Documentation

The supporting documentation required to demonstrate compliance with the CGEP requirements (Appendix C, page 74) includes the programs, protocols, procedures, records and publications, which show that the fish farms' activities are being performed as described by this Code.

- a. This documentation must be listed and stored as paper copies or in magnetic, optical or electronic forms, assuring that:
 - The documents must be legible, identifiable and traceable to an activity, product or service.
 - They must be stored and maintained so they can be consulted quickly and protected from damage, deterioration, adulteration and/or loss.

- b. The supporting documentation required by the CGEP will include:
 - The legal requirements for the fish farms, including permits and concessions.
 - The **records** and **graphs** of production and administrative activities that are expressly required by the CGEP as proof of compliance.
 - Monitoring **records** and evaluations, for example trend **graphs**, that show the effectiveness of the application of CGEP dispositions at each fish farm.
 - **Records** of CGEP dissemination and training and related activities.



III. RELEVANT ENVIRONMENTAL LEGISLATION

The company should comply with the relevant environmental legislation regarding its activities, products and services and should clearly allocate responsibility for with them.

This Code includes all current legal resolutions, as well as the Clean Production Agreement adopted by SalmonChile and the Sustainable Production Agreement adopted by SalmonChile and Conama, dispositions that must be met in the development of activities directly related to salmonid farming and also those that refer to necessary support services. Therefore, all the temporary and permanent staff at the fish farms must be informed of - and understand - the dispositions of this Code.

Additionally, there are other documents, authorizations or permits that must be kept available for auditors and inspectors:

1. Concession Plan and Location Layout (smolt and ongrowing centers), approved by the Maritime Authority.
2. Environmental Impact Statement or Study plus its respective addenda and Environmental Impact Resolution for Fish Farms operating as of 3 April 1997. Requirements established by D.S. 90.
3. Resolution from the Fisheries Undersecretary approving the corresponding technical project and calendar of activities with reference to aquaculture concessions.
4. Contingency Plan for mass escapes and mortalities as required by Art. 5 of Supreme Decree N° 320 (RAMA).

III. Relevant Environmental Legislation

5. Updated log on the application of the Contingency Plan (Res. N° 404 associated with D.S. N° 320).
6. Copy of the Environmental Reports sent to date, in compliance with Art. 19 of D.S. N° 320 (RAMA).
7. Copy of the eventual Resolutions that compel the reduction of production or that permit its reestablishment (Art. 20 of D.S. N° 320), according to the Technical Project currently in force.
8. Copy of the Technical Project and updated calendar of activities approved by the Fisheries Undersecretary.
9. Resolution issued by the Marine Undersecretary, who awards the Aquaculture Concession or a Resolution issued by the Fisheries Undersecretary, who awards the Aquaculture Authorization.
10. Publication in the “Official Gazette” (Diario Oficial) of the Resolution Extract awarding the Aquaculture Concession or Authorization.
11. Copy of the Receipt from Form N° 37, General Treasury of the Republic, or the Receipt from the Prepaid License Fee (FIP), with the Aquaculture Permit stamped paid and up to date (except for private property such as non-navigable lakes or hatcheries).
12. Certificate from the National Aquaculture Register (NAR), issued by the National Fisheries Service.



13. Resolution of Water Use Rights issued by the Water Board (DGA), for hatcheries where surface or underground waters are abstracted.
14. Municipal Permit for Industrial Activity.
15. Copy of the monthly reports of the fish farm's production statistics (supply/operation), as required by Sernapesca.
16. Registrations for the fish farms' vessels, with the Maritime Authority's annual inspections.
17. Registrations for the Smaller Naval Artifacts in the fish farms (eg. floating warehouses) with the Maritime Authority's annual inspections.
18. Artisanal fishermen's licenses or shore worker's license.
19. Annual inspection of diving equipment.
20. Shellfish Collector's License or Commercial Diving License.
21. Restricted Radio Operator's License and Base Station License
22. Up-to-date maritime signaling devices for Naval Devices required by the Maritime Authority (Regulation N° 7-50/14 "Register of Ships and Naval Devices").

Companies are responsible for complying with amendments made to the current legislation and with new environmental dispositions that apply to Chilean salmon farming activities.



IV. ENVIRONMENTAL PERFORMANCE

4.1 Indicators of Environmental Performance

Fundación Chile has identified those environmental factors that cause significant impacts on hatcheries, smolt production and ongrowing centers, based on the following considerations:

- The specific activities at each type of fish farm, production and support, or services contracted out to third parties.
- Revised and updated regulations in force.
- The Life Cycle Analysis: “An Ecoprofile of Salmon Farming in Chile. A Cradle-to-Gate Study of Salmon Aquaculture Based on Life-Cycle Stressor-Effects Assessment”, by Scientific Certification System Inc., Oakland, California, for Fundación Chile.
- Workshops and consultations with national and international experts and institutions.
- Environmental monitoring of water bodies and sediments at salmonid farming fish farms.

The relevant environmental legislation for each fish farm’s activities must be fully met.

The relevant operational performance indicators of the activity for each type of fish farm were obtained from the information listed above. This, together with the current legislation, provides guidelines for measuring the effectiveness of good environmental practices employed at the farms. The operational indicators are the following:

4.1.1 Common Indicators of Environmental Performance

a. Legally Required Permits and Documentation

- i. Statement of Environmental Impact and Environmental Impact Resolution for Fish Farms operating as of 3 April 1997.
- ii. Copies of the monthly reports of the fish farm's production statistics (supply/operation), as required by Sernapesca.
- iii. Copy of the monthly reports of fish transfers made by the fish farm.
- iv. Supporting documentation showing compliance with the Drugs Control Program, required by Sernapesca, if appropriate.
- v. SIVA system, if appropriate, and the fish farm's signed receipts and sign-in book.
- vi. Registrations for the fish farm's vessels, with Maritime Authority's Annual Inspections.
- vii. Annual Inspection of Diving Equipment.

b. Regular controls

- i. Control of the general condition of vessels, hull, leakage and lights.
- ii. Index of Energy Consumption per production cycle and fallow period.
- iii. Index of Antibiotic Use per production cycle.
- iv. Economic Conversion Factor per production cycle.



4.1.2 Specific Environmental Indicators for Hatcheries

- a. For influent/effluent: Difference of dissolved oxygen and pH.
- b. For water in the hatchery: Total ammonia nitrogen (TAN); nitrites (NO₂) and total phosphorus concentrations.
- c. For the effluent: BOD₅ and total suspended solids (TSS).
- d. Amount of freon gas (CFC) used in the cooling system(s) per production cycle.
- e. Amount of ammonia used to refill the cooling system(s) per production cycle.

4.1.3 Specific Environmental Indicators for Smolt Centers

- a. In the sediment: diversity of macrozoobenthos; percentage of total organic matter and Redox potential/pH profile from the surface to a depth of 7 cm.

4.1.4 Specific Environmental Indicators for Ongrowing Centers

- a. In the sediment: diversity of macrozoobenthos; percentage of total organic matter; and Redox potential/pH profile from the surface to a depth of 7cm.

4.2 Environmental Monitoring

A “**Monitoring Procedure for the Fish farm**” must be established to define the monitoring plans for the operational indicators for each fish farm and for the environmental indicators defined in paragraphs 4.1.1, 4.1.2, 4.1.3 and 4.1.4, in order to have a common basis for comparison and for follow-up.

Some of this monitoring is additional to that required by current local standards and focuses on proper production, environmental and sanitary management for the national salmon farming sector.

This procedure must also include the methods for the evaluation of results for the environmental indicators and the actions that must be taken when those results deviate from the expected values or from those that are defined in the reference standards (page 23, point 4.3).

This procedure must make reference to the following **records** to show that the monitoring is being performed as defined in the Procedure:

- a. Monitoring Plans.
- b. Results of Laboratory Analyses.
- c. Results of Inspections and/or Measurements.
- d. Graphics of Results to demonstrate trends over time.
- e. Evaluation of Results.

The frequencies of monitoring of **water and sediment** are defined in the tables 4.2.1 (environmental monitoring for HATCHERIES), 4.2.2 (environmental monitoring for SMOLT CENTERS) and 4.2.3 (environmental monitoring for ONGROWING CENTERS). Monitoring must be carried out for periods of at least 6 months, 1 year and 1 ½ years, respectively, (covering at least one production cycle) in order to establish a set of historical data, and to evaluate whether or not the frequency of future monitoring should be modified.

The monitoring plan must include: “What”, “Where”, “How” and “When”, that is, it must define the parameters to be monitored, how to monitor, at what geographical locations or in which installation, and how often.



Sampling must be performed by trained personnel. The samples collected must be analyzed by a authorized laboratory according to standard methodologies recognized by the proper national authority.

The results of the analyses must be presented in graphs to measure trends over time and they must be available at the fish farm. Evaluations must be performed using:

- Reference standards showing the minimum and/or maximum acceptable values for a given parameter.
- The variations from previous readings and the information from monitoring performed during previous monitoring periods.

Each fish farm must have all the required legal permits and documentation on file. The lack of one or more documents will require immediate corrective action to obtain them within a period of 30 calendar days.

The essential parameters of a monitoring program for measuring environmental indicators and to provide a way of controlling operational management are presented, by type of fish farm, below.

4.2.1 Environmental Monitoring for HATCHERIES

Water Monitoring:

Parameter	Sampling frequency	Sampling place
Water Temperature (°C)	3 times a day	In farming units
Dissolved oxygen (mg/L)	3 times a day	In farming units
	Once a week	In the influent and effluent
Oxygen Saturation (%)	3 times a day	In farming units
	Once a week	In the influent and effluent
pH	Once daily	In farming units
	Once a week	In the influent and effluent
Water flow (L/s)	Once a week	In the influent
Water flow (L/s)	Once a month	In the water body that supplies the hatchery
BOD ₅ (mg/L)	Once a month	In the influent and effluent, in duplicate
* Total ammonia nitrogen (TAN) (mg/L)	Twice a month	In farming units, in duplicate
* Nitrite (NO ₂ ⁻) (mg/L)	Twice a month	In farming units, in duplicate
Total phosphorus (mg/L)	Once a month	In the influent and effluent, in duplicate
Total suspended solids (TSS) (mg/L)	Once a month	Before and after waste treatment, in duplicate
** Microbiological analysis	Once a month	Before and after waste treatment

* Water samples must be filtered (2 µm filter) before analysis.

** If using recirculation systems



These measurements must be made with calibrated instruments that provide reliable results. The values must be recorded and processed to prepare monthly and annual reports and graphs, showing the behavior of these variables over time.

Other Monitoring:

Parameter	Frequency	Place
Document paragraph 4.1.1 Point a.	Every 6 months	Fish farm's Administration Office
Condition of the vessels, hull, motor, leaks, electrical system and lights	Every 3 months	In each vessel, if there are any in the fish farm
* Energy consumption index (Electricity + fuels) (KWh /kg fry)	Per monthly production cycle	Fuel tanks and electrical energy meter
* Energy consumption (Electricity + fuels) (KWh / month)	Per fallow period	Fuel tanks and electrical energy meter
** Antibiotics use index (kg antibiotics /kg fry)	Per monthly production cycle	Fish farm's administration office and fish farm's facilities
Economic conversion factor	Per production monthly cycle	Feed shed and tanks
Amount of freon used	Per production cycle and per fallow period	In cooling equipment
Amount of ammonia used	Per production cycle and per fallow period	In cooling tank equipment

* See conversion formulas in Appendix G, page 84.

** Active compound

4.2.2 Environmental Monitoring for SMOLT CENTERS

If fish are cultured in tanks, the monitoring protocol described for a hatchery must be followed.

If fish are grown in floating cages, there must be a monitoring **record** for following environmental parameters:

In the water column:

Parameter	Sampling frequency	Sampling place
Temperature (°C)	3 times a day	Cage surface and mid-cage depth
Transparency (m)	Twice a day	Water column
Dissolved oxygen (mg/L)	Twice a day	Cage surface and mid-cage depth
Oxygen saturation (%)	Twice a day	Cage surface and mid-cage depth
pH	Once a week	Mid-cage depth
Eulerian current measurement (Direction in degrees and speed in cm/s)	Once	Defined on site, according to the placement of the set of cages

The company must estimate (with an annual summary) the monthly nutrient discharges (total nitrogen and total phosphorus) to the water body.


In sediment (only for growing in cages):

Parameter	Frequency of sampling	Sampling place
Granulometry	annual	In 3 different stations + 1 control *
Abundance, diversity and biomass of macrozoobenthos	biannual **	1 station under each set of cages + 1 control
Total organic matter (%)	biannual **	1 station under each set of cages + 1 control
Redox potential (mV) and pH in the first 7 cm depth	Biannual **	1 station under each set of cages + 1 control

* The control station must be representative of the study area.

** One of the samplings in the year should coincide with the period of greatest biomass under cultivation.

Other Monitoring:

Parameter	Frequency	Place
Documents paragraph 4.1.1, Point a	Every 6 months	Fish farm's Administration Office
Condition of the vessels, hull, motor, leaks, electrical system and lights	Every 3 months	In every vessel
* Energy consumption index (Electricity + Fuels) (KWh/kg smolt)	Per monthly production cycle	Fuel tanks and electrical energy meter.
* Energy consumption (Electricity + Fuels) (KWh/month)	per fallow period	Fuel tanks and electrical energy meter.
** Antibiotics use index (kg antibiotic/kg smolt)	Per monthly production cycle	In fish farm and Administration Office
Economic conversion factor	Per monthly production cycle	Warehouse and cages

* See conversion formulas en Appendix G, page 84.

** Active compound

4.2.3 Environmental monitoring for ONGROWING CENTERS

If ongrowing is undertaken in fresh water in land-based tanks, the monitoring protocol described for hatcheries must be followed.

If ongrowing is undertaken in cages, monitoring must be carried out for the following parameters:

In the water column:

Parameter	Sampling Frequency	Sampling Place
Temperature (°C)	3 times a day	Cage surface and mid-cage depth
Transparency (m)	Twice a day	Column of water
Dissolved oxygen (mg/L)	Twice a day	Cage surface and mid-cage depth
Oxygen saturation (%)	Twice a day	Cage surface and mid-cage depth
Salinity	Twice a week	At 5 m depth
Eulerian current measurement (direction in degrees and speed in cm/s)	Once	Defined on site, depending on the placement of the set of cages
Bathymetry	Once	Concession area
Phytoplankton (qualitative and quantitative)	Weekly or at least monthly	To be defined on site (surface and 3 m depth)

**In the sediment:**

Parameter	Sampling Frequency	Sampling Place
Granulometry	Annually	In 3 different stations + 1 control
Abundance, diversity and biomass of macrozoobenthos	biannual	*
Total organic matter (%)	biannual	*
Redox potential (mV) and pH down to 7 cm	biannual	*

- * One of the samplings during the year must coincide with the period of greatest biomass under cultivation. The sampling stations should be as follows:
- Under cage modules
 - At a distance of 30 m in the direction of the dispersion plume
 - Control station

The control station must be representative of the study area, that is, with similar conditions, within the same range of depth and with similar granulometry as the other stations.

Other Monitoring:

Parameter	Frequency	Place
Documents paragraph 4.1.1, Point a	Every 6 months	Fish farm's Administration Office
Condition of the vessels, hull, motor, leaks, electrical system and lights	Every 3 months	In every vessel
* Energy consumption index (Electricity + Fuels) (KWh/kg fish)	Per monthly production cycle	In fuel tanks and electric energy meters
* Energy consumption (Electricity + Fuels) (KWh/month)	Per fallow period	In fuel tanks and electric energy meters
** Antibiotics use index (kg antibiotics/kg fish)	Per monthly production cycle	Fish Farm and administration offices
Economic conversion factor	Per monthly production cycle	Warehouse and cages

* See conversion formulas in Appendix G, page 84.

** Active compound



4.3 Reference Standards for the Environmental Indicators

4.3.1 Hatcheries and/or Freshwater Land-based Establishments

ENVIRONMENTAL INDICATOR	REFERENCE STANDARD
Paragraph 4.1.1; point a	Must be in every fish farm
Difference in dissolved oxygen between influent and effluent	Must be zero or positive
Difference in pH between influent and effluent	No greater than 1.0 (maximum effluent range: 6.0 - 8.5 pH units)
BOD ₅ effluent	Less than 30 mg/L in freshwater and less than 60 mg/L in seawater
Total ammonia nitrogen (TAN) in center's water	Less than 1.0 mg/L
Total nitrite in center's water	Less than 1.0 mg/L; and 0.1 mg/L in soft water
Total phosphorus in effluent	Less than 2.0 mg/L if effluent empties into a lake Less than 5.0 mg/L if effluent empties into the sea Less than 10.0 mg/L if effluent empties into a river
Total suspended solids (TSS)	Removal of 85 % of the solids produced in the fish farm.
Control of vessels Paragraph 4.1.1; point b, item i	Annual registrations and inspections are current. Total absence of fuel or lubricant leaks. Tanks and hoses in good condition. Operating electrical system.
Energy consumption index (electricity and fuels) Paragraph 4.1.1; point b, item ii	Not more than 5.0 KWh/kg of fry
Antibiotics use index Active compound (grams of antibiotics/ kg of fry Paragraph 4.1.1; point b, item iii	The average of the last two historical periods must be used as a reference, and based on this weighted value for each fish farm, the value must decrease in each following period.
Economic conversion factor Paragraph 4.1.1; point b, item iv	Less than 1.5 for hatcheries Less than 1.4 for land-based smolt centers
Freon consumed per production cycle	Must be zero
Ammonia consumed per production cycle	Must be less than 5 % of the equipment's capacity

4.3.2 Smolt Centers using Cages

ENVIRONMENTAL INDICATOR	REFERENCE STANDARD
Paragraph 4.1.1; point a	Must be in every fish farm
Diversity of macrozoobenthos	There must be a least 1 species of macrozoobenthos present under cages in freshwater bodies or at least 3 in brackish water, to ensure adequate bioturbation of the sediments under the set of cages.
Total organic matter in sediment	Less than 8 %
Redox potential and pH in sediment	Differences no greater than 200 mV compared to the control station. pH no lower than 7.0
Control of vessels Paragraph 4.1.1; point b, item i	Annual registrations and inspections are current. Total absence of fuel or lubricant leaks. Tanks and hoses in good condition. Operating electrical system.
Energy consumption index (electricity and fuels) Paragraph 4.1.1; point b, item ii	Not greater than 2.5 KWh/kg smolts (expressed as an increase in the biomass produced in the fish farm)
Antibiotics use index (grams of antibiotics/ kg of smolts) Paragraph 4.1.1; point b, item iii	The average of the last two historical periods must be taken as an initial reference, and based on this weighted value for each fish farm, the value must decrease in each following period.
Economic conversion factor Paragraph 4.1.1; point b, item iv	Less than 1.5



4.3.3 Ongrowing Centers using cages

ENVIRONMENTAL INDICATOR	REFERENCE STANDARD
Paragraph 4.1.1; point a	Must be in every fish farm.
Diversity of macrozoobenthos	Must have at least 3 or more macrozoobenthos species present to ensure good bioturbation of the sediments under the set of cages. Anoxic zones with the appearance of beds of <i>Beggiatoa</i> sp., or similar, are not acceptable.
Total organic matter in sediment	Under 12 %
Redox potential and pH in sediment	Differences no greater than 200 mV compared to the base line. pH no lower than 7.0
Control of vessels Paragraph 4.1.1; point b, item i	Annual registrations and inspections are current. Total absence of fuel and lubricant leaks. Tanks and hoses in good condition. Electrical system is operational.
Energy consumption index (Electricity and Fuels) Paragraph 4.1.1; point b, item ii	Not greater than 0.5 KWh/kg of fish (expressed as an increase in the biomass produced in the fish farm)
Antibiotics use index (grams of antibiotics/ kg of fish) Paragraph 4.1.1; point b, item iii	The average of the last two historical periods must be taken as an initial reference, and based on this weighted value for each fish farm, the value must decrease in each following period.
Economic conversion factor Paragraph 4.1.1; point b, item iv	Less than 1.3

4.4 Evaluation of Environmental Performance

Following the Performance Review Plan for the Fish farms (see page 4), the General Manager and the Coordinator and the Production Managers must meet periodically with other appropriate staff in the Performance Evaluation Committee to verify, according to a pre-defined agenda, that:

- The actions agreed at the last meeting have been completed.
- The fish farms have implemented and maintained the dispositions of this Code.
- The fish farms are complying with the Management's Environmental Policy.
- The monitoring program is being followed as planned and shows that significant impacts are under control.
- The corrective actions identified for particular deviations have been carried out and are effective.
- The introduction of new projects, or of new procedures and/or technologies to the production processes, are under control.

At the end of each meeting a “**Record of the Performance Review**” must be written, signed by the General Manager, and copied to all participants and to the Code record file. It should include the following items:

- Date and place of the meeting.
- Participating personnel.
- Subjects covered.
- Agreements approved by the General Manager, indicating the people who are responsible for execution and the target dates for completion.



V. CORRECTIVE ACTIONS

A “**Procedure for Corrective Actions**” must be implemented and maintained. The Procedure defines the methodology to be followed in response to deviations from the dispositions in this Code or from company environmental policy, and appoints the personnel responsible for execution of the Corrective Actions.

This procedure must refer to the following records to prove that this activity is being implemented in an appropriate manner:

- The non-conformity or deviation identified, with reference to the appropriate CGEP paragraph to which the non-compliance refers.
- Immediate action.
- Analysis of the cause and determination of the corrective action. A maximum of 5 working days may be allowed for this activity.
- The corrective action implemented. A maximum of 60 consecutive days may be allowed for this activity.

The following topics must be included and documented during this procedure to show that the corrective actions ensure that the deviations do not recur:

Responsibility of the Production and/or Operations Manager:

- Verify that the corrective action has been implemented and that it was effective.
- Verify that the deviation will not occur in other fish farms under his/her responsibility.
- Include the deviation in the topics for discussion during the next Performance Evaluation Meeting.

Responsibility of the Fish Farm Manager:

- Immediate action(s) to correct the identified deviation(s).
- Analysis to determine the basic cause of the deviation.
- Identify the corrective action to eliminate the basic cause.
- Implement the corrective action in his/her fish farm.



VI. DESIGN, INSTALLATION AND INFRASTRUCTURE

The fish farm must show evidence of compliance with the following general principles, applied to both land-based and floating installations and infrastructure, as appropriate:

1. All equipment and systems must be designed, installed and operated to minimize the risk to the personnel, the fish being farmed and to the environment.
2. Alarm systems must be used for equipment and water levels in those cases where failures, if not quickly corrected, represent a risk to the survival of the fish.
3. There must be back-up systems available if failures in any mechanical or electrical equipment could endanger the health, survival or integrity of the fish. There must be alarms that activate these back-up systems which provide sufficiently early warning to ensure the survival of the fish.
4. Where appropriate, an **“Equipment Maintenance and Calibration Log”** must be at hand for each piece of equipment used in fish production. The Log must contain the schedule of the inspection program, names of the authorized technical service agency or of the competent personnel, description of the maintenance carried out, and the date of the next inspection. In addition to the above, if the fish farm uses freon equipment, every gas leak or refill must be recorded, indicating the amount of gas that was supplied.
5. All vessels must be maintained in order to avoid contamination of the water with fuel and/or lubricants.

6. Vessels made of metal, fiberglass, polyethylene or other easily disinfected materials, and with water tight compartments to ensure flotation, must be used to transfer personnel or materials to or within the fish farms.
7. Floating structures, such as cages, sheds or warehouses and walkways in the sea, lakes or estuaries must:
 - a. Meet the Maritime Authority's safety regulations.
 - b. Be regularly inspected to check their condition and repaired or replaced in case of damage, including mooring cables and/or chains.
 - c. Record these inspections and repairs for each fish farm's of cages and other floating structures must be kept in a **“Maintenance Logbook for Floating Structures”**
8. The design and construction of sheds or warehouses, floating or land-based structures and farming units, must be safe and strong enough to withstand adverse weather conditions.



OPERATIONAL CONTROL

VII. DISEASE CONTROL

7.1 *General Aspects*

- a. Compliance with the Sanitary Regulation (D.S. N° 319/2002) and its respective regulations is mandatory.
- b. To control diseases at the national level, fish farms must give immediate written notice to the Health Authority of the outbreak of exotic disease in the fish farm and/or in the geographic zone of the affected water body.
- c. To control diseases at the local level, the fish farms must establish agreements with other producers sharing the same water body. These agreements must cover sanitary measures in their fish farms and provide the basis for coordination of the sanitary measures to be adopted by all the producers in the area in response to outbreaks of specified diseases.
- d. To control diseases locally, a working team for each fish farm, led by a veterinarian, must implement:
 - A **“Disease Prevention Program”** and
 - A **“Sanitary Treatment Program”**.

7.2 Background

Prior to preparing these programs, a working group must be set up and the following information must be at hand :

- a. Composition of the working teams. These must include at least the Production Manager, Fish farm Manager and a Veterinarian (ichthyopathologist).
- b. Knowledge of the fish farm's sanitary history. A history of the health status of stock held at the fish farm must be prepared, covering both current and previous production cycles, as well as a list of diseases encountered at each fish farm. Information about the regional and global health situation must also be available.
- c. Profile of the Fish farm: Description of the activity, number of farming units, management, etc.
- d. **Production records** (Conversion Factor, Growth Rate, etc.).

7.3 Disease Prevention Program

This program aims to prevent pathogenic agents from entering the fish farm, to improve the farming environment together with the fishes' resistance to diseases and to minimize the impact of opportunistic pathogens.

Based on the information collected, as indicated in point 7.2 above, a specific “**Disease Prevention Program**” for each fish farm must be prepared and implemented.



This program includes protocols, intervention calendars, procedures, manuals and records, all of which are CGEP support documents and available for inspection, and must include the following activities:

- a. Definition of priorities.
- b. Health Watch Protocol for the Fish farm.
- c. Manual of Health and Hygiene.
- d. Vaccination Calendar and Protocol.
- e. Protocol for Reduction of Antibiotic Use.
- f. Handling Improvements

Each of these activities is defined below:

7.3.1 Definition of Priorities

According to the available information, “**Disease Prevention Activity Priorities**” must be defined in writing, taking account of the diseases that are present and the potential occurrence of others. Prevention strategies must be reviewed periodically.

7.3.2 Health Watch Protocol for the Fish farm

The “**Health Watch Protocol**” must reflect the disease prevention activity priorities and the phytozoosanitary situation of the fish farm. It must focus on performing inspections, sampling, and tests, and include the preparation of reports and the maintenance of clinical records for the current stocks of fish. It must be prepared by a specialized veterinarian, who must periodically visit the fish farm. The protocol **records** include the results of the inspections and tests, as well as the reports and clinical records organized by production cycle and batch of fish.

7.3.3 Health and Hygiene Manual

A “**Fish farm Health and Hygiene Manual**” must be prepared, including the following items:

a. Description of the Fish Farm

A “**General Plan or Layout of the Fish Farm**”, describing, for land-based hatcheries and smolt centers, the water flow and its treatments, and sanitary barriers (foot baths, wheel baths, hand baths).

A “**General Layout for the Fish Farm**” must be prepared for centers with smolts and on-growing in cages, indicating the sanitary barriers (foot baths, wheel baths, hand baths, etc.).

b. Personnel

i. Visitors

- A **register** of incoming visitors must be kept including the person’s name and company, and the name and date of the last fish farm that he/she has visited.
- Each fish farm must provide clothing and footwear for visitors and ensure that footwear is disinfected prior to entering the farm. A written statement of restrictions also must be presented to the visitor prior to the visit.

ii. Fish farm Personnel

- The working clothes used by the regular personnel at the fish farm should be allocated for their exclusive and personal use of individual employees. The protocol for, and frequency of, renewal/replacement of must be specified.



iii. Description of the “**Fish farm’s Cleaning and Sanitizing Procedure**”

- This must be defined for areas, implements and equipment, specifying the frequency of cleaning. Written **records** must be kept of when cleaning was carried out.

- All equipment and materials must be thoroughly disinfected with an authorized compound before entering the fish farm, and also before and after any fish transfers. The equipment used for the transfer of gametes or eggs must be disinfected in the fish farm of origin. Before arriving at the fish farm of destination, the outside surface of the containers must be disinfected, to prevent the propagation of diseases between different fish farms.

- Every farming unit (incubators, tanks, cages, etc) must have its own disinfecting and/or cleaning equipment, which must be stored in disinfectant solutions, before and after use.

iv. Infrastructure

- Construction with smooth, washable surfaces is preferred.

c. Physical Barriers

- i. Fish farms must have clearly identified physical barriers and entrances to prevent the accidental unauthorized entry of people, vehicles or animals. Domestic animals must not circulate freely within the fish farm.

- ii. Systems to protect the farm against the activities of predators (rodents, minks, or any other animal that may hunt or cause physical damage or stress to fish) may

be installed only if such systems do not kill or harm the animals of the wild fauna in the vicinity of the fish farm.

d. Sanitary Barriers

i. Sanitary barriers (foot baths, hand baths, wheel baths and/or hand-sprinklers) must be installed to disinfect people and vehicles when entering and leaving the fish farm. These barriers must be clearly labeled and the quality of the disinfectant must be maintained.

ii. The farming units must be drained, dried and disinfected at least between production cycles. The fallow period must be long enough to guarantee thorough disinfection and cleaning of all farming units and structures, as well as water inflow and outflow pipes, walls, floors, etc., in the case of land-based farms.

iii. The treatment of the influents (ultra violet, ozone, filters, etc.) and effluents (filtration, settlement, etc).

iv. Waste Management (see page 55).

v. Pest control

Access by rodents or other pests into the fish farm must be prevented by physical barriers and by implementing an “**Calendar for Pest Eradication**”. The feed sheds must be kept clean and isolated from surroundings.



7.3.4 *Vaccine Protocol and Calendar*

A “**Vaccine Protocol and Calendar**” to protect stock against major diseases must be prepared under Veterinary supervision. The Protocol must include the fish farm’s health history, the efficacy of existing vaccines and a **record** of previous vaccinations. The **records** of this protocol must indicate the timetable for vaccinations and the records of dosages and vaccines applied during the period defined by the calendar.

The vaccines used in the fish farm must be registered by the Livestock and Agriculture Service (SAG). The company must also have *in vivo* and *in vitro* certificates of safety for all these vaccines.

7.3.5 *Reduction in the Use of Chemotherapeutants*

A “**Protocol for Reducing the Use of Chemotherapeutants**” must be defined and documented in line with the company’s environmental policy. The dosages of antibiotics, parasiticides, disinfectants or other drugs used are **records** of this protocol, as well as the evaluation of results and the comparison of results obtained with statistics from previous years or production cycles.

7.3.6 *Handling Improvements*

A “**Protocol for Improving Handling in the Fish farms**” to reduce fish stress must be prepared and documented. The improvement measures, the follow-up, the periodic evaluation of these measures and the implementation of modifications to correct any deviations are **records** of this protocol.

7.3.7 Genetic Improvements

Those companies with genetic improvement programs must implement a “**Genetic Improvements Protocol**”, to establish systematic genetic selection of fish, including the necessary measures that favour selection for resistance to diseases endemic in its particular geographic area. The genetic selection mechanism used and the results obtained are **records** of this protocol.

7.4 Sanitary Treatment Program

A “**Sanitary Treatment Program**” must be prepared that defines the records and different protocols for applying therapies previously approved by the veterinarian.

The “**General Therapy Application Protocol**” must include at least the following sequence with the corresponding records:

- Identify of the infection by clinical tests.
- Collect samples to confirm the diagnosis and isolate the agent
- Perform antimicrobial sensitivity tests
- Determine the dosage, duration and method of administration of the therapeutant selected

7.4.1 General Standards for Treatments Applications

- a. The application of veterinary medicines, including lice treatments, in the fish farm must be based on - and endorsed by - a veterinarian’s written prescription, which must be filed at the fish farm’s administration office.



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- b. The application of veterinary drugs for health treatment must be formalized and carried out as part of Sernapesca's "Drugs Control Program".
 - c. When possible, the fish must starved for a period defined by the veterinarian before initiating any medical treatment.
 - d. Drugs for veterinary use may be used for treating diseases only when there is no other proven and available alternative using biological or physical methods, or inert chemicals.
 - e. The veterinary drug must be registered in the Agriculture and Livestock Service (SAG) and must be approved for salmonids.
 - f. The withdrawal period for each authorized drug, as established in the available scientific literature and as recognized by the appropriate national regulatory authority, must be followed and must not pose a health risk to consumers.
 - g. The fish farm's veterinary drugs, disinfectants and detergents must be stored in a special compartment for this purpose, according to the products' specifications and where they are inaccessible to unauthorized personnel, children or animals. Unused products must be disposed of in such a way as to prevent environmental pollution.
 - h. Before using veterinary drugs, it must be verified that the product is identified and/or labeled with information regarding treatment dose, expiry date and safety instructions for the protection of human health and the environment.

- i. To be effective, several aspects must be considered when using veterinary drugs, such as the proper mixture, dilution or reconstitution. Veterinary drugs must not be mixed together, since this could induce inactivation or adverse chemical reactions. The preparation of products prior to administration (eg mixing with feed, or preparation treatment baths) must be done only according to manufacturer's recommendations and as stated on the label.

7.4.2 *Specific Standards for Treatments*

a. Oral Therapies:

- i. The appetite of fish must be considered during application of oral therapies to ensure that the required amount of feed is fully consumed. Some drugs diminish palatability and therefore this must be taken into consideration when planning the delivery of the correct dosage during the therapy's application.
- ii. The thoroughly justified preparation of medicated feed at the fish farm must be supported by a Veterinarian's written prescription. Each fish farm must have a **"Medicated Feed Preparation Protocol"** available to veterinarian-trained personnel in charge of this activity.
- iii. The protocol **records** for **"Medicated Feed Preparation"** cover:
 - Veterinarian's prescription.
 - Chemicals or products used in the mixture and the quantities used.
 - Place and date of preparation and expiry.
 - Implements and/or materials used for the preparation.



- Amount of feed prepared.
- Personnel responsible for the preparation.
- Cleaning the equipment and materials after each batch production.

b. Bath Therapies:

- i. To apply a bath or dip treatment to a group of fish, measures must be taken to allow immediate interruption of the treatment at any time if problems should arise, in order to return the fish to their normal growing conditions. The behavior of the fish must be constantly monitored during treatment.
- ii. To ensure correct use of the Veterinary bath product, before the general treatment, it is preferable that tests be performed on a representative sample of fish to confirm that the administered dosage is safe to the fish. This practice must be routinely followed for every new product to be used in the fish farm and for those near their expiry date.

c. Injection Therapies

The following specific aspects must be considered in the specific **protocol** for injection therapies:

- Exact weight of the fish.
- Dosage of the veterinary product.
- Water temperature.
- Physiological condition of the fish.

The following activities must also be included:

- Prior to injection, the fish must be kept as prescribed by a veterinarian.
- All equipment used for the operation must be disinfected.
- Fish must be anaesthetized before the injection to avoid damaging internal organs and muscle tissue.
- The amounts administered must be matched to the weight of the fish to be treated to ensure that they receive the recommended dosage.
- Once injected, the fish should be returned immediately to the water and their recovery recorded.
- Qualified personnel, supervised by a veterinarian, must perform the operation.



7.5 *Specific Sanitary Considerations*

7.5.1 *Broodstock*

- a. In selecting broodstock, the health history and at least the feed conversion factor and growth rate of the fish stock must be known.
- b. Companies must have “**Screening Procedures**”, for the following diseases:
 - i. Bacterial Kidney Disease (BKD): At least all the females must be individually screened for BKD during spawning using IFAT, ELISA or PCR techniques.
 - ii. To control Infectious Pancreatic Necrosis (IPN), all the broodstock must be screened individually during spawning using cell line or PCR techniques.
 - iii. To control any other disease important to the fish farm, screening should be carried out if the analytical technique is available in Chile.

The diagnostic laboratories, recognized by Sernapesca, must issue a detailed report of the samples received, the analyses performed and the results obtained. The farm is responsible for eliminating all fish which tested positive, and their gametes. The fish farm must retain copies of the reports issued by the diagnostic laboratories, and of the destruction of stock and gametes. These will be the “**Screening Procedure**” records.

7.5.2 *Eggs*

- a. All positive eggs from a (BKD, IPN) screening must be eliminated. The negative eggs can continue the incubation process.
- b. Imported eggs and the broodstock that produced these eggs must meet all national requirements for health certificates required for import, as stated by the Health Authority.

- c. The eggs, and the broodstock used to produce eggs which are transported within Chile must meet the requirements set out in the national standard with reference to the health certificates required for importing, (except for those diseases or pathogens not present in Chile) as duly authorized by the proper authority.

- d. Eyed eggs arriving at incubation fish farms must be disinfected (after a thorough washing) for 10 minutes with an iodine solution that always contains at least 100 ppm (parts per million) of free iodine, before being placed in regular water. Each prepared liter of iodine solution must be used for no more than 2,000 eggs and there must be a continuous flow of the disinfectant solution during the procedure. The containers that held the eggs must be disinfected as well. Other disinfectants may be used, provided that they have been demonstrated to be equally, or more, effective than the iodophor. A record of this activity must be filed.



VIII. FEED QUALITY AND HANDLING REQUIREMENTS

The company must establish and implement a “**Feed Quality and Handling Procedure**” in each fish farm covering aspects of feeding, quality, feed storage, handling, distribution. It should contain the following **records**:

1. Reception of each feed shipment to verify that it meets required quality specifications such as pellet size, type of diet, percentage of fines, proximal analysis, medication (if applicable) and weight.
2. Amount of feed (weight) that comes into the fish farm and the date of arrival of each shipment.
3. Shipments of feed from the site to another fish farm and the supporting documentation for these movements.
4. Physical control of the inventory of stocks held in the warehouse.
5. The amount, diet and pellet size of the feed given daily to the fish.
6. Weekly checking of the calibration of weighing equipment and automatic and semiautomatic feeders.

8.1 Fish Feeding Practices

- a. To prevent dietary deficiencies or poor nutrition, the quality of the feed (diet) must meet the nutritional requirements of the fish, depending on their stage of development.
- b. Feed produces the most significant environmental impact in salmonid farming. The appetite of fish varies considerably with the water temperature, size, state of health and stage of development. Therefore, feeding must be adjusted to the demands of the fish and all changes in the routine must be gradual.

- c. All practices aimed at minimizing this impact will help to boost the activity's sustainability. For this purpose, the following must be considered:
 - i. The nutritional and digestibility requirements of the feed for species. Diets that favor the gradual replacement of animal protein should be preferred.
 - ii. Feeders must be cleaned regularly, paying special attention to dust or wet feed residues. Feeding must be restricted or suspended when the water temperature rises above 20°C, depending on an evaluation of the general environmental conditions and of the reaction of fish to feed.
 - iii. When using automatic feeders, the feed storage silos must be designed to avoid exposure of the feed to excess moisture and/or heat, which may alter its properties.

8.2 Feed Quality

- a. The company must specify on the Purchase Order the feed quality requirements for fish farm. The “**Feed Quality and Handling Procedure**” must include methods to verify that the incoming product meets the company's specifications. These specifications include: pellet size, type of diet, percentage of fines, proximal analysis, medication (if applicable) and weight of the shipment. Producers must demand from feed suppliers a guaranteed minimum percentage of lipids and proteins and a guaranteed maximum percentage of moisture and phosphorus.
- b. The fish feed must not contain greater than 1.2 % of phosphorus and must have a digestibility rate of more than 85%.



- c. Colorants (pigments) used must be accepted by the regulation issued by the National Health Service.

8.3 Feed Storage and Handling

- a. Regular bags (20 to 25 kg), *maxi-bag* (1,000 kg) or other containers used to hold feed must provide adequate protection for the product, in terms of safety to personnel as well as protecting the product from deterioration under correct storage conditions.
- b. Feed storage sheds should be used exclusively for storing feed. If this is not possible, clearly defined zones must be defined in a shared warehouse to ensure that other uses does not represent a risk to the feed quality.
- c. The oldest shipments of feed in the warehouse must be used first, as based on dated records of receipt (FIFO: First In - First Out).
- d. Producers must demand that feed manufacturers label their packages with at least the following information:
 - Manufacturer's name.
 - Additives (vitamins, antioxidants, pigments).
 - Amount of phosphorus.
 - Proximal analysis (% of proteins, lipids, carbohydrates, fiber and ash).
 - Lot number.
 - Type of diet.
 - Manufacturing and expiry dates.
 - Pellet size.
 - Net weight.

- e. If the feed is medicated (as prescribed by a veterinarian), in addition to the above information, the bags must be clearly marked and the medication incorporated and its concentration must appear on the label.

8.4 Feed Distribution

- a. All feed distribution systems must dispense feed efficiently, opportunely and safely, with an emphasis on minimizing feed losses.
- b. Prior to its distribution to the fish, all feed that leaves the shed must be handled in such a way as to avoid or minimize deleterious effects of moisture, heat and predators such as birds, rodents, etc.
- c. It is important that feeding is suspended for a period defined by the person in charge prior to handling fish, depending on the type of handling and the condition of the fish. A **record** must be kept of this activity.



IX. PRODUCTION HANDLING

9.1 Handling Considerations

- a. A “**Production Handling Procedure**” must be designed and maintained, including, at least, the following **records** of fish handling activities:
 - Weight control of the fish
 - Grading of the fish
 - Fish selection
 - Incubation of eggs
 - Counting of eggs and fish
 - Splitting fish
 - Internal transfers
 - Control of the photoperiod
 - Harvesting (only for on-growing centers)

- b. All fish handling protocols must assure the welfare of the fish, for example by avoiding mechanical damage to the skin and excessive manipulation or rubbing between fish from overloading. It is recommended that a daily work routine to which the fish can become accustomed be set up. Precautions must be taken not to stress the fish (eg. sudden movements, excessive light or loud noises).

- c. The traceability of each lot of fish throughout its growing cycle must be shown objectively, including at least origin, feeding, medication and transfers (up to the processing plant).

9.1.1 Handling Operations in Hatcheries and Land-based Smolt Centers

- a. Water temperature must be kept within tolerable ranges for the fish and not present any risk to their survival. Artificially introduced temperature changes must be gradual.
- b. During the incubation period, appropriate growing conditions must be maintained to encourage maximum survival rates. These include adequate water flow, appropriate levels of oxygen saturation, water temperature (°C), semi-darkness and a proper incubation substrate.
- c. The egg incubation **records** must include, at least:
 - From green egg:
 - Origin of the eggs.
 - % Survival from green egg to eyed egg stages
 - The thermal units used for the shocking.
 - Diameter of eggs (mm).
 - From eyed egg:
 - Accumulated thermal units (ATU) at hatching.
 - ATU at first feeding.
- d. A “**Fish Smolting Procedure**”, must be implemented and maintained to identify the right time for transfer to seawater. This procedure must include the following **records** to ensure that the fish are transferred at the right time:
 - Visual observations
 - Behavior



as well as some of the following indicators:

- Saline challenge
- ATP-ase test
- Blood plasma chloride level
- Other quantified indicators

e. Different species and different stocks grown in land-based hatcheries and smolt centers must be cultured and kept separate throughout their production cycle to minimize the risk of disease transmission.

9.1.2 Handling Operations in Smolt and Ongrowing Centers

a. Different salmonid species must not be farmed simultaneously in a single fish farm in any lake/estuary smolt centers or ongrowing centers at sea. Stock from different year-classes must be grown and maintained in separate set of cages throughout their production cycle to minimize the risk of transmitting disease.

b. Production strategies that include rest or fallow periods between production cycles must be defined for each fish farm with smolts and ongrowing in cages. Companies owning enough concessions must use site rotation, fallowing each site for one full production cycle.

c. For fish farms with smolts and ongrowing in cages, the set of cages must be moved to prevent a significant accumulation of organic matter on the sediment in a single place. This situation must be evaluated based on the results of the sediment analysis element of the monitoring program.

- d. Smolts and fish on-growing in cages must be held at densities that ensure adequate levels of oxygen for their development, prevent a significant accumulation of organic matter under the cages and permit optimum health status in the fish.
- e. The “**Production Operations Procedure**” must include a harvesting **record** that contains the following:
 - Fasting before harvesting.
 - Disinfection of materials and implements.
 - Anesthesia system / harvesting method.
 - Handling and disposal of blood water.
 - Disposal of slaughtering wastes.

9.1.3 Broodstock Handling

- a. If the company manages its own broodstock, a “**Procedure for Broodstock Transport and Spawning**” must be implemented and maintained, along with files for registering the reception and/or maintenance of the broodstock in the hatchery. These **records** must clearly show species, strain, origin of the fish, smolting date, average weight and date of transfer to freshwater.
- b. This procedure must define how to perform all husbandry activities to optimize the egg production, in addition to a detailed **record** of parameters for evaluating broodstock quality and the final production of gametes.



9.2 Cleaning Cages and Nets

A “**Procedure for Handling Nets and Cage Maintenance**” must be implemented and maintained. The record system for cages corresponds to the “**Maintenance Log Book for Floating Structures**” indicated in Section VI of this Code (page 30). The **record** for nets must contain the following information: the location of each net, previous use of the net, washing, disinfection, repairs and discards. The procedure must include aspects such as:

For nets:

- Quality standards and replacement policy.
- Net identification methods.
- Storage.
- A calendar for changing nets.
- Use of protective (anti-predator) nets.
- Use of antifouling agents (only at sea).
- Method for washing and disinfection.
- Records of the inspections of the condition of nets or barriers that prevent escapes of fish.

Cleaning and disinfecting nets must be undertaken on land and in an authorized establishment equipped with an effluent treatment system.

For cages:

- Cleaning and replacement of flotation devices (PVC, metallic or other).
- Inspection of anchoring or mooring equipment, cables and chains.
- Inspection and maintenance/replacement of joints or platforms.

9.3 Transport

Fish transport is important as a stress factor to farmed fish and as a possible cause of disease dissemination. A “**Procedure for Transporting Fish, Eggs and/or Gametes**” must be implemented and maintained, along with a record system showing the safety and hygiene measures taken for such transfers, to guarantee the least possible stress to the fish. This procedure must include:

- a. Information about fish being transported must be **recorded**, including origin of the fish, destination, species, number of fish, weight, total density per tank and state of health, as well as variables such as temperature, oxygen, condition of the fish before and after unloading, unloading method and the receiver’s name.
- b. A single species of fish must be transported in the tanks or containers.
- c. During fish transfer, the wastewater must not under any circumstances be discarded into any water body that is outside the reception area.
- d. All gamete or egg transfers must be authorized and endorsed by the National Health Service. The originating hatchery must have a health certificate accrediting the condition of the eggs, the screening of the broodstock and the results of the disease screening.
- e. The vehicles for transporting fish, eggs and/or gametes, by land, air or by water, must be washed and disinfected by trained personnel or by accredited services before and after each transport.



X. WASTE MANAGEMENT

The fish farm must organize its operations under the principle of pollution prevention, that is, it must minimize the generation of wastes, not focusing its efforts on waste treatment and/or disposal. When operations and/or cleaning technologies cannot entirely prevent the generation of wastes, these must be treated and/or disposed of as stipulated in this Code.

The containers used for collecting and moving the wastes (organic, inorganic and mortalities) off the fish farm must be disinfected before reentering the fish farm. The containers also must be clearly labeled with the name of the fish farm.

10.1 Organic and Inorganic Wastes

- a. A **“Waste Management and Disposal Procedure”** must be implemented and maintained, including the following general dispositions for the solid and liquid wastes, with different management and disposal procedures for organic and inorganic wastes. These procedures must include the **recording** of monthly amounts of solid and liquid wastes generated by the fish farm.
- b. The organic wastes generated by the fish farm must be adequately disposed of in containers that can be properly collected and closed. Then they must be moved to a location inside or outside the fish farm that has been previously approved for these purposes by the proper authority.
- c. Inorganic wastes generated by the fish farm, such as plastic bags, remains of PVC, fiberglass, metallic wastes, plastics or other wastes, must be handled and disposed of by the company or by a contractor approved by the proper authority.

- d. Precautions must be taken to minimize the impact produced by the release of chemicals, disinfectants or other substances used for treating fish or for cleaning the farming units.
- e. Wastes generated from equipment maintenance (fuel, lubricants, filter residues or others), must be removed for appropriate disposal , depending on the characteristics of each waste.
- f. Fish farms that use river water must remove at least 85% of the suspended solids produced by the fish farm.
- g. The recovered solids, or those removed by filters, must be properly handled, treated and/or disposed of, avoiding environmental degradation.
- h. The disposal of non-channeled waste waters into the municipal sewage system must be duly approved by the appropriate Health Authority.

10.2 Disposal and Handling of Moribund Fish and Mortalities

- a. A “**Procedure for Disposing of Mortalities**” must be implemented and maintained indicating the frequency of extraction of mortalities, the method used, transport, place of disposal, supervising staff and the proper legal authorizations for performing this activity. This procedure must include a **record** of weekly mortalities (kg) generated by the fish farm.
- b. All systems used for extracting mortalities must be efficient and safe, avoiding adverse interactions with the fish stock.



- c. Dead or moribund fish extracted during mortality removal operations must be examined by authorized people only in a properly equipped place (room or laboratory) and in no other part of the fish farm, in order to minimize the risk of transmitting diseases and pathogenic agents to the environment.
- d. Broodstock used during spawning and later eliminated as mortalities must be disposed of properly. The personnel who handle these fish must not come into contact with other fish without prior disinfection due to the risk of possible disease transmission.
- e. Disease-positive eggs and those eliminated after screening must be disposed of properly. Personnel must disinfect themselves before performing any other activity in the fish farm due to the risk of possible disease transmission.
- f. If mortalities are extracted by diving, the “**Mortality Extraction Protocol**” must focus on preventing the spread of diseases between cages, sets of cages and fish farms.
- g. The vehicles used for transporting mortalities, whether by land, air or sea, must be washed and disinfected by trained staff or by the services of accredited companies, before and after each transfer.



XI. PREVENTION AND MITIGATION OF FISH ESCAPES

1. Gametes, fertilized eggs or fish must never be intentionally released into the aquatic environment, except as part of special re-stocking programs by written request from the proper authority and authorized by the Fisheries Undersecretary and the National Fisheries Service.
2. The farming units must have effective systems to prevent both the entry of fish, birds or mammals and the escape of farmed fish.
3. The routine inspection and checking of barriers to prevent fish escapes must be followed as indicated in the “**Net Handling and Cage Maintenance**” procedure.
4. If a large escape of fish from a cage fish farm (smolts or on-growing) occurs, all measures must be taken to recapture the escaped fish in the shortest possible time.
5. A **record** must be kept of all involuntary or accidental escapes of fish.



XII. CHEMICAL AND FUEL MANAGEMENT

1. Every fish farm that handles liquid fuels must have a proper storage area for them and must comply, as appropriate, with Article 5.3 of D.S. N° 379/1985 MINECON, “Regulation on Minimum Safety Requirements for the Storage and Manipulation of Oil Based Liquid Fuels”, or with Article 2 of D.S. N° 90/1996, “Safety Regulation for the Storage, Transport and Sale to the Public of Oil-Based Liquid Fuels”.
2. Every fish farm that has storage facilities for liquid petroleum gas (LPG) must comply with Chapters II and III of D.S. N° 29/1986 MINECON, “Safety Regulation for the Storage, Transport and Sale of Liquid Gas LPG”.
3. A “**Chemicals and Fuels Handling Procedure**” must be implemented and maintained to ensure safe handling, to prevent accidents, spills, contamination of the water body or soil, or fires. This procedure must include the following considerations and records:

For fuels :

- a. Safety measures, applicable to each fish farm’s situation, as described in Article 6 of D.S. N° 379/1985 for packages, labels, location and specific measures for handling liquid fuels.
- b. The procedure for filling the fuel tanks in vessels, generators in cages or on land and any other tank that needs fuel transfer which may spill into the water or onto soil.
- c. Periodic inspection of the engines in vessels to quickly detect fuel or lubricant

leaks. Four stroke outboard engines are recommended to avoid polluting the water with oily exhaust gases.

- d. The requirements set out in D.S. N° 379/1985 or N°90/1996 (as appropriate) for tank trucks that transport liquid fuel to the fish farm and the requirements set forth in D.S. N° 29/1986 for gas transport trucks.
- e. The procedure must include a **record** of the amounts of all fuels and lubricants that come into the fish farm. Records must be kept of the monthly consumption by boilers or heaters, vessel engines, diesel generators and any other fuel and lubricant used in order to have a complete monthly account of the fish farm's supply and consumption.

For chemical compounds:

- a. Chemical compounds, including drugs, detergents and disinfectants that can harm the fish, must not be used in supply waters or on surfaces that may come into contact with the fish.
- b. The procedure must include a **record** of the receipt of every chemical compound into the fish farm (amount or weight), individually specified by chemical and classified under “drugs”, “detergents”, “disinfectants” and “others”; its location or storage area, label, type of package, proposed use, stock inventory and shipments (stating destination, amount and date).
- c. When using paints, detergents, metals, wood preservatives or any other substances that may be hazardous to the fish, measures must be taken such as air



drying, washing, exposure to sunlight and/or steam, to remove or prevent these substances from harming the fish.

d. Specific considerations:

- i. All chemicals must be labeled with at least: the product's name, the manufacturer's name, composition, expiry date and instruction for use.
- ii. Products must be stored at the proper temperature, avoiding direct contact with the floor.
- iii. Use and handling procedures must agree with the manufacturer's specifications.
- iv. One person must be responsible for the control, supply and storage of all chemicals used in the fish farm.
- v. Every chemical must be stored properly to avoid accidental spills that could contaminate the environment.



XIII. CONTINGENCY PLANS

The company must implement and maintain “**Contingency Plans**” for their fish farms to control the following events:

1. Fire in the land-based or floating installations
2. Fuel or chemical spills in water or soil
3. Cage or vessel shipwrecks
4. Vehicle crash or overturn
5. Fish escapes and/or theft
6. Harmful algae blooms

These plans must be designed in accordance to each fish farm’s individual situation. Therefore, to verify these plans, simulations must be programmed in accordance with a “**Calendar of Contingency Drills**” to record and evaluate their effectiveness, using the available resources.



APPENDIX A

GLOSSARY

Abiotic: Non-living physical or chemical factor or compound, present in a specific environment.

Abundance: Frequency of individuals of a species in a community.

Anoxic: Oxygen free environment

Antifouling: Antifouling agents. Copper-based paints or products or other net saturating component used to prevent fouling (see fouling).

Antimicrobial: Substance that inhibits the growth of prokaryotic organisms.

Antioxidant: Chemical products that prevent oxidation of the lipid component of feed.

Biomass: Total weight of organisms living in a specific place.

Bioturbation: Any kind of particle displacement and physical-chemical modifications of the sediment produced by the activity of benthic organisms.

Broodstock: Adult, sexually mature organisms that provide gametes to obtain next generation individuals.

Cages: Individual netting enclosure submerged in freshwater or seawater, where fish are confined to grow and be fed.

Calendar: CGEP document that establishes dates or periods when certain activities must be executed during the year or within the period of a production cycle.

Cell Lines: Cell strain from a primary culture, normally used to isolate viruses.

Chemical: Drugs, detergents, disinfectants, paints, preservatives, diluting agents, etc.

Concession: The administrative act by which the Ministry of National Defense awards a person the right to use and enjoy, for an indefinite time, certain national assets, for the performance of aquaculture activities.

Corrective Actions: The activities needed to correct non-conformities.

Cultivation Cycle: Cultivation and breeding of fish for commercial purposes that includes the stages of broodstock, eggs, smolts, ongrowing, up to harvest.

Detergent: Substance or product, normally a surfactant, that cleans an object without corroding it.

Digestibility: Proportion of feed components that can be absorbed through an animal's digestive tract.

Disinfectant: Chemical substance or physical procedure (heat, ultraviolet, radiation) that significantly reduces the population of harmful micro-organisms on surfaces, objects or living things.

Dispersion Plume: Form in which the particles originating from a set of cages are distributed, on the bottom or in a lake or marine water column.

Diversity: Amount of variety in a community or sample of a population.

Dosage: Amount of drug used to treat a disease in an animal.

Drug: Medicine. Pharmaceutical product for veterinary use. Any substance used to treat, alleviate or prevent a disease. Usually refers to an anti-microbial agent.

Economic Conversion Factor: Weight increase of an animal or population per kilo of feed provided.

Environmental Impact: All beneficial or adverse environmental changes caused by the fish farms' activities, products and/or services.

Environmental Monitoring: Regular collection, usually legally compulsory, of biological, physical or chemical data in predetermined places to quantify and evaluate ecological changes attributed to aquacultural waste products (GESAMP, 1996).

Environmental Performance: Quantifiable result of the environmental impacts arising from each fish farm's activities, products and/or services.

Etiological Agent: Causal agent of a disease.

Eyed Egg: Period during salmonid egg development from the moment eyes appear up to eclosion.



Fallow Period: Period when the fish farm has no fish in its operation.

Farming Unit: Any structure used for holding and growing fish. (eg. Incubators, troughs, tanks, cages, etc.)

Fish Farm: Any place or installation where reproduction or growing activities for hydrobiological resources are performed using technical procedures. One concession cannot hold more than one fish farm.

Feed Warehouse: Land-based or floating installation used to store feed.

Feed Shipment: Amount of feed with the same manufacturing date, the same pellet size and with the same chemical characteristics, which is received by or shipped from a fish farm in a single consignment.

Fish stock: Group of fish of the same age, stock and origin, sharing the same culture conditions for a specific period.

Foot Baths: Tray, basin or pit in the ground that contains a disinfectant solution for washing and disinfecting footwear

Fouling: All aquatic organisms that adhere to the underwater culture nets or materials and that use them as a growing substrate.

Fuel: All petroleum based substances, such as diesel fuel, gasoline, kerosene and liquid gas (LPG). Natural gas is also considered a fuel.

Green Egg: Period during salmonid egg development from the moment of fertilization up to the appearance of eyes in the egg.

Hand Washes: Trays or basins generally holding a disinfectant solution for washing and disinfecting hands.

Harmful Algal Blooms: Explosive growth of some microalgae, arising from favorable oceanographic conditions, which can endanger fish.

Health Certificate: Document issued by the exporting country's official authority, on a form prepared by the National Fisheries Service, accrediting the zoosanitary or phytosanitary condition of the imported hydrobiological species

Implementing a Document: The action of issuing and adapting a document to users' habits and use, to be consulted by all company personnel.

In vitro: Pertaining to a biological reaction taking place in an artificial apparatus.

In vivo: Pertaining to a biological reaction taking place in a living cell or organism.

Lot: Specific and identified part of a shipment or series.

Macrozoobenthos: Communities of animals over 1 mm in size that inhabit sediments.

Maritime Authority: The General Director of the Maritime Territory and Merchant Marine, the Maritime Governor and Port Captains and Ocean Masters. (DS 752/82)

Non-conformity: Non-compliance with the requirements specified in this Code.

Opportunistic pathogens: Agents usually present in the environment in a specific time or place.

Pallet: Wood or plastic structure used as a bottom support for feed in sacks or other goods. The pallet facilitates lifting of the load by fork lifts or front loaders.

Percentage of fines: Amount of ground feed (particles less than 0.6 mm in size).

Performance Standards: Parameters that set maximum and/or minimum acceptable values for environmental parameters in fish farms.

Prevalence: Number of animals that have a disease within a defined period of time, divided by the number of individuals at risk in the population over the same period of time.

Procedure: CGEP document appointing the responsible personnel and the sequence that must be followed in executing an activity in the planned way.

Production Cycle or Period: Period of time between the fish entering the fish farm and when they leave it.

Program (Sanitary): Set of protocols and calendars establishing the methods and dates for the animal health treatments, as applied to each fish farm's situation.



Protocol (Sanitary): CGEP document establishing the methodology and dosage for a specific sanitary treatment prescribed considering the fish farm's and the fish's sanitary background.

Records: CGEP document where data about an activity is noted to show evidence of the activity's results and/or the way it was performed.

Screening: Procedure to check for the presence of particular diseases in farmed fish.

Shipment: Product obtained from a single production cycle, by continuous stages, characterized by its homogeneity.

Shocking: Method used to separate fertile from non-fertile eggs. Non-fertile eggs turn white when the vitelline membrane breaks. Usually eggs are siphoned from one container of water to another, dropping them from a height of about 30 cm.

Stress: Situation of an individual or some of its organs or systems, which by above normal demands, puts them at risk of becoming sick.

Therapy: Treatment for a disease.

Thermal Unit: Equivalent to the product of degrees of temperature (°C) above zero and the number of days.

Tire Wash: Roll-through basin, generally located at the entrance to a land-based culture establishment, containing a disinfectant solution to clean and disinfect vehicle tires.

Traceability: Record of all the elements referring to the history of the animal, from birth to consumer, that is, up to the end of the commercialization chain.

Vaccine: Antigen preparations that after being administered to an animal induce an immune response for the organism's protection against one or several specific pathogens or toxins.

Veterinary Prescription: Document signed by a veterinarian or other individual legally authorized to prescribe veterinary medicines.

Veterinary Drug Product: All natural or synthetic products or their combinations which, presented in a specific pharmaceutical form is used for prevention, diagnosis,

cure, treatment and relief of animal diseases and their symptoms. Products for medicating feed, stimulating animal growth, and improving appearance are included within this concept, as well as any other product that used in animals or in their habitat, protects, restores or modifies their organic or physiological functions

Visitor: Any person not directly related to (eg employed at) the fish farm.

Withdrawal Period: Minimum period between a sanitary treatment and harvest of fishes needed to assure that the drug added has been metabolized and excreted by the fish, so it does not present any risk to the health of consumers.

**APPENDIX B ABBREVIATIONS**

- ATU Accumulated Thermic Units.
- BKD Bacterial Kidney Disease, Etiologic agent *Renibacterium salmoninarum*.
- CGEP Code of Good Environmental Practices.
- DGA General Water Board
- D.S. Supreme Decree
- ELISA Enzyme Linked Immunosorbent Assay. Technique based on binding specific antibodies to chromogenic enzymes.
- FIP Fund for Fisheries Research
- GESAMP Group of Experts on Scientific Aspects of Marine Pollution.
- IFAT Indirect Immunofluorescence Technique.
- IPN Infectious Pancreatic Necrosis Disease, Etiol. agent: IPN virus.
- LPG Liquid Petroleum Gas.
- MINECON Ministry of the Economy, Development and Reconstruction.
- NAR National Aquaculture Register.
- PCR Polymerase Chain Reaction.
- RAMA Environmental Regulation for Aquaculture
- SAG Livestock and Agriculture Service.
- SERNAPESCA National Fisheries Service.
- SIVA Documentary Endorsement System for Aquaculture.
- SRS Salmonid Rickettsial Syndrome or Septicemia, Etiologic agent: *Piscirickettsia salmonis*.

APPENDIX C CGEP SUPPORTING DOCUMENTATION

1. Environmental Policy
2. Formal definition of responsibilities
3. Performance Review Plan for the Fish farms
4. Proceedings of the Performance Review
5. Monitoring procedure for the Fish Farm
6. Corrective Action Procedure
7. Basic legal documents:
 - 7.1 Concession Plan and Location Layout (smolt and ongrowing centers), approved by the Maritime Authority.
 - 7.2 Environmental Impact Statement or Study plus its respective addenda and Environmental Impact Resolution for Fish Farms operating as of 3 April 1997. Requirements established by D.S. 90.
 - 7.3 Resolution from the Fisheries Undersecretary approving the corresponding technical project and calendar of activities with reference to aquaculture concessions.
 - 7.4 Contingency Plan for mass escapes and mortalities as required by Art. 5 of Supreme Decree N° 320 (RAMA).
 - 7.5 Updated log on the application of the Contingency Plan (Res. N° 404 associated with D.S. N° 320).
 - 7.6 Copy of the Environmental Reports sent to date, in compliance with Art. 19 of D.S. N° 320 (RAMA).
 - 7.7 Copy of the eventual Resolutions that compel the reduction of production or that permit its reestablishment (Art. 20 of D.S. N° 320), according to the Technical Project currently in force.



- 7.8 Copy of the Technical Project and updated calendar of activities approved by the Fisheries Undersecretary.
- 7.9 Resolution issued by the Marine Undersecretary, who awards the Aquaculture Concession or a Resolution issued by the Fisheries Undersecretary, who awards the Aquaculture Authorization.
- 7.10 Publication in the “Official Gazette” (Diario Oficial) of the Resolution Extract awarding the Aquaculture Concession or Authorization.
- 7.11 Copy of the Receipt from Form N° 37, General Treasury of the Republic, or the Receipt from the Prepaid License Fee (FIP), with the Aquaculture Permit stamped paid and up to date (except for private property such as non-navigable lakes or hatcheries).
- 7.12 Certificate from the National Aquaculture Register (NAR), issued by the National Fisheries Service.
- 7.13 Resolution of Water Use Rights issued by the Water Board (DGA), for hatcheries where surface or underground waters are abstracted.
- 7.14 Municipal Permit for Industrial Activity.
- 7.15 Copy of the monthly reports of the fish farm’s production statistics (supply/operation), as required by Sernapesca.
- 7.16 Registrations for the fish farms’ vessels, with the Maritime Authority’s annual inspections.
- 7.17 Registrations for the Smaller Naval Artifacts in the fish farms (eg. floating warehouses) with the Maritime Authority’s annual inspections.
- 7.18 Artisanal fishermen’s licenses or shore worker’s license.
- 7.19 Annual inspection of diving equipment.
- 7.20 Shellfish Collector’s License or Commercial Diving License.
- 7.21 Restricted Radio Operator’s License and Base Station License

- 7.22 Up-to-date maritime signaling devices for Naval Devices required by the Maritime Authority (Regulation N°7-50/14 “Register of Ships and Naval Devices”).
- 8. Equipment Maintenance and Calibration Logbook
- 9. Maintenance Logbook for Floating Structures
- 10. Disease Prevention Program
 - 10.1 Priorities for Prevention Activities
 - 10.2 Health Watch Protocol
 - 10.3 Health and Hygiene Manual
 - 10.3.1 General Layout of the Fish farm
 - 10.3.2 Cleaning and Sanitizing Procedure for the Fish farm
 - 10.3.3 Calendar of Interventions for Pest Eradication
 - 10.4 Vaccination Calendar and Protocol
 - 10.5 Protocol for Antibiotics Use Reduction
 - 10.6 Protocol for Reducing Chemotherapies Use
 - 10.7 Protocol to Improve Fish farm Operations
 - 10.8 Genetic Improvements Protocol
- 11. Health Treatment Program
 - 11.1 General Protocol for Therapy Applications and specifications for Injection– Bath – Oral Therapies
 - 11.2 Medicated Feed Manufacturing Protocol
 - 11.3 Screening Procedure
- 12. Protocol for Extracting Mortalities
- 13. Feed Quality and Handling Procedure



14. Production Operations Procedure
15. Fish Smolting Procedure
16. Procedure for Broodstock Transport and Spawning
17. Procedure for Net Handling and Cage Maintenance
17.1 Calendar of Net Changes
18. Procedure for Fish, Eggs and/or Gametes Transport
19. Procedure for Waste Handling and Disposal
20. Procedure for Disposal of Mortalities
21. Procedure for Handling Chemicals and Fuels
22. Contingency Plans
23. Calendar of Contingency Drills

Note:

The procedures and protocols must state which records must be kept to prove that a specific activity is performed as stated in this CGEP.

APPENDIX D GENESIS AND DEVELOPMENT OF THE CODE OF GOOD ENVIRONMENTAL PRACTICES (CGEP)

Fundación Chile, with the aid of the Production Development Corporation's (Corfo) Fund for Development and Innovation (FDI) and of the salmon production companies Marine Harvest Chile, Patagonia Salmon Farming and Pesquera Eicosal (Landcatch Chile), has carried out the project "Environmental Certification for Chilean Salmon Farming" in Regions X and XI.

The project aims to develop an Environmental Certification System for Chilean Salmon Farming, focusing on the use of production methods and resources that protect the environment where the operations are carried out and that also boosts the competitiveness and sustainability of specific companies and the industry in general.

A Code of Good Practices was prepared as a tool for this System, to provide the environmental-productive criteria and standards to be applied in the salmonid farming centers. The Product Certification Unit (PCU) with INN accreditation was also created, to apply the eco-labels to the final product coming from certified centers.

This Code was applied for three years in more than 50 farming centers in Regions X and XI. Its methodology and requirements were validated during this period and the practical applicability and relevance of the established standards were confirmed.

This project would not have been possible without the support of Corfo/FDI to whom we are very grateful. We would also like to thank the associated companies who gave us their confidence and support for a novel and challenging project. We would like to mention as well the technological support received from the North American company Scientific Certification Systems (SCS) with its tool for modeling the Salmon's Life Cycle Analysis, which was a great aid to the project as well as the outstanding cooperation from the government and non-government agencies and national and foreign professionals who provided their knowledge and enthusiasm for the success of this Code.

Fundación Chile



APPENDIX E ACTIVITIES UNDERTAKEN IN PREPARING AND ORGANISING THE CODE OF GOOD ENVIRONMENTAL PRACTICES

- Field surveys of the production processes carried out in different salmonid farms in Chile.
- Field observation of critical environmental aspects in the production process.
- Technical meetings with salmon company personnel (General Managers, Area Managers and Fish farm Managers)
- Environmental monitoring of water column and sediment in hatcheries and smolt and ongrowing centers.
- Analysis of the national and international environmental regulations.
- Life Cycle Inventory Surveys (material and energy going in and coming out of the system) in hatcheries and smolt and ongrowing centers.
- Development of a Life Cycle Analysis (LCA) for the production of salmonids in Chile, led by Dr. Chet Chaffee from Scientific Certification Systems, California, United States.
- Collecting bibliographic material relative to aquaculture, the environment and eco-labeling.
- Technical discussion meetings with national and international experts.
- Experts workshop to validate the CGEP (9 and 10 March 1999).
- Legal review of the CGEP in accordance with current national regulations.
- Analysis of significant environmental aspects according to the ISO 14000 series of standards.
- Technical visits to the United States, Canada, Germany, Scotland and Norway.
- Reviews of the CGEP by national and international experts and advisors.

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“Review and Validation of Preliminary Codes of Practice”
Santiago, March 9 and 10, 1999, Fundación Chile.

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National Institutions and Companies:

Chilean Salmon and Trout Producers’ Association.

Center for Environmental Planning and Research, CIPMA (ONG)

Cruz del Sur Insurance Company

Economic Commission for Latin America and the Caribbean, CEPAL. Environment and Development Division

National Commission for the Environment, CONAMA

Board of Maritime Interests, DIRINMAR

General Board for International Economic Affairs (DIRECOM), Ministry of Foreign Affairs



National Institutions and Companies (continuation):

Division of Environmental Health, Health Ministry

Heath Chile (Insurance Broker)

Institute of Political Ecology

Fisheries Development Institute, IFOP

National Institute of Standards, INN

JPV & Associates (Insurance Liquidator)

Marine Harvest Chile S.A.

Pollution Prevention Office, CORFO

Patagonia Salmon Farming S.A.

Pesquera Eicosal Ltda.

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Undersecretary of the Navy

Undersecretary of Fisheries

University of Concepción. Faculty of Natural and Oceanographic Sciences.
Departament of Oceanography.

Fundación Chile

APPENDIX G FUEL CONVERSION FORMULAS TO KILOWATT HOURS

- Liquid gas $1 \text{ m}^3 = 26 \text{ KWh}$
 $1 \text{ kg} = 13.8 \text{ KWh}$

- Diesel $1 \text{ m}^3 = 13,600 \text{ KWh}$
 $1 \text{ kg} = 11.6 \text{ KWh}$

- Gasoline $1 \text{ L} = 9.50 \text{ KWh}$

- Wood $1 \text{ kg} = 4.07 \text{ KWh}$



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