



**Norwegian Institute of Food, Fisheries
and Aquaculture Research
(NOFIMA AS - NCBC)**

Research Infrastructure Information

www.aquaexcel.eu

Contents

1	NOFIMA in AQUAEXCEL	3
1.1	Introduction	3
1.2	NOFIMA Research Infrastructure: National Cod Breeding Centre (NCBC)	3
1.2.1	Fish Line Information	4
1.2.2	Facility Unit 1 Information: National Cod Breeding Centre (NCBC)	4
1.3	Modality of access	6
1.4	Unit of access	6
1.5	News and Updates	6

1 NOFIMA in AQUAEXCEL

1.1 Introduction

Operating institution:	NOFIMA AS, www.nofima.no
Type Operating Institution:	Research institute
Research Infrastructure(s):	<ol style="list-style-type: none"> 1. National Cod Breeding Centre (NCBC) 2. Nofima Averøy Research Station (Averøy) 3. Nofima Centre for Recirculation in Aquaculture (NCRA)

1.2 NOFIMA Research Infrastructure: National Cod Breeding Centre (NCBC)

Name of the infrastructure:	National Cod Breeding Centre (NCBC)
Location:	Tromsø, Norway
Web site address:	Http://www.nofima.no/marin/en/about-nofima-marin/facilities/norwegian-cod-breeding-centre
Contact:	Atle Mortensen, Email: atle.mortensen@nofima.no
AQUAEXCEL TNA facility:	YES, Nofima has facilities which are open for Access to external research groups within the framework of the AQUAEXCEL project
Short description	The National Cod Breeding program in Norway was established in 2003, with the purpose of improving economically important traits in farmed Atlantic cod by selective breeding. Initially the program was conducted at the Aquaculture Research Station in Tromsø. The program uses traditional methods, a combination of family and individual selection, but efforts are also made to improve the selection efficiency by using molecular genetic methods (marker assisted selection). Since 2005 the production cod families for the breeding program has taken place at the National Cod Breeding Station in Tromsø. This facility is designed for an efficient production of a large number of cod families, and for the production of high quality cod eggs independent of season.
Keywords	Selective breeding, juvenile production, larvae feed, live feed production, disease resistance
Technical labs	NCBC can provide access to the following labs: <ul style="list-style-type: none"> • Metabolism chamber (at The Aquaculture Research Station in Tromsø) • Bacteriology and virology labs (at Nofima main office) • Disease challenge laboratory (at The Aquaculture Research Station in Tromsø)
Processing labs	NCBC's cage farm has access to slaughter facilities suited for slaughtering fish at an experimental scale. Nofima has special laboratory facilities for fish processing.
EU projects	
Number of researchers	8
Number of technicians	10 Permanent and 10 during juvenile production season
Lodging facilities	No
SERVICES - scientific support	National Cod Breeding Centre offer its services to produce family

	<p>groups to be used for selective breeding as well as for doing genetics related studies and for experiments aimed at improving the production protocols of cod larvae and juveniles. Nofima Marin has a highly competent scientific staff covering all these areas. We acknowledge the value of coordinated scientific collaborative research, and would appreciate the possibility of participating in a network where we can receive scientists, students and trainees from other institutions, and vice versa.</p> <p>NCBC has been partners of several Norwegian Research Council (NFR) applications this year. We offer the services of staff that are competent in marine finfish culture including broodstock management, live feed production, larval and juvenile production and husbandry.</p> <p>Currently we have been involved in collaborative work with industry and university researchers on formulated feed development and on enhancement of live feed production. We also accommodate students from the Aquaculture Program at the University of Tromsø and other countries who complete their work term projects at NCBC. The operation of the National Cod Breeding Centre is integrated with the Aquaculture Research Station in Tromsø, so scientists working at either one of these locations can easily coordinate activities at both.</p>
SERVICES - electronic databases	No
SERVICES – Quality Assurance	The production protocols at NCBC are not regulated by any formalised procedures
Safety and Ethical issues	All experiments at NCBC must be approved by The Norwegian Animal Research Authority.

1.2.1 Fish Line Information

Name Fish Line 1:	Own Line
Species:	Atlantic cod, <i>Gadus morhua</i>
General description	Offspring from both mass spawning and artificial fertilization is available.
Type:	Selected population
Traits selected (if relevant):	Body weight and resistance against vibriosis
Nb generations:	3
Effective population size:	100 males and 100 females will be used for each generation in 2012 (previous years: 150 males and 200 females). However, approximately 500 males and 600 females will be available during 2012 season.
Other:	Normal spawning season is March – April Photomanipulated broodfish spawn in May-June and July - August

1.2.2 Facility Unit 1 Information: National Cod Breeding Centre (NCBC)

Name Facility Unit 1	National Cod Breeding Centre (NCBC)
-----------------------------	--

TNA	Yes
Contact (Researcher)	Atle Mortensen, Email: atle.mortensen@nofima.no
URL	www.nofima.no
Postal Address	Postal Address Nofima P.O. Box 6122, NO-9291 Tromsø, Norway
General description	<p>NCBC produces all stages of Atlantic cod, from eggs to slaughter size. 200 family groups are produced every year for the purpose of selective breeding.</p> <p>To achieve this the facility possesses a unique combination of features:</p> <ul style="list-style-type: none"> - 24 brood fish tanks (25m³), including 8 with facilities for photoperiodic manipulation, and 4 of which are provided with cooled sea water for off season egg production. - 220 small (25 l) incubators for the family production and some larger incubators for incubation of larger volumes of egg. - 300 tanks (200 l) for start-feeding of cod larvae. Feeding is performed by two programmable feeding robots which can feed both live and formulated feed simultaneously. - 6 – 1000L tanks for pilot scale industry level juvenile production experiments. - Modern equipments for the production and enrichment of rotifers and Artemia. - 6 nursery tanks (25m³) for ongrowing of juveniles. <p>The breeding program also has its own cage farm where the breeding nucleus is kept until sexual maturation.</p>
Technical description	NCBC uses feeding robots for the juvenile production. These robots are programmed to provide each tank with a correct amount of either live feed or dry feed up to 24 times a day.
Water and environmental conditions	NCBC uses a flow through system with ambient sea water. A variety of water treatment technology is employed, including different filters for removal of particles, protein skimmer with ozone generator, UV disinfection, 2 heat pumps for heating and cooling of water, oxygenation and vacuum degassers.
Flowrate	Flow rate to the different tanks is determined mainly on the basis of the oxygen consumption of the fish (always more than 80 % saturation). Oxygen saturation in tanks is monitored manually; however, header tanks and larger broodstock tanks have sensors to detect lower water and oxygen levels.
Temperature	The inlet water varies between approximately 4 °C to 10 °C. Brood fish and eggs are supplied with water at 4 – 5 °C, while larvae and juveniles are given heated water at 10 °C. All temperature is monitored automatically, and the temperature of the heated water is automatically controlled.
Salinity	Salinity of the inlet water varies between 33 and 35 ppt. It is automatically monitored, but not controlled.
Oxygen	Oxygen saturation of the fish tanks is kept between 80 and 100 %. It is monitored manually.
pH	pH is not manipulated, average 8,0
Light intensity and wavelength	Approximately 200 lux provided by ordinary fluorescent tubes.

Photoperiod	NCBC uses both natural photoperiod and manipulated photoperiod to induce spawning at different times of the year. The photoperiod is automatically controlled.
Fish measurements	The following parameters are measured/registered: Body weight, deformities, sexual maturation at certain ages, and disease resistance (by challenge tests). All fish included in the breeding nucleus are pit-tagged.

1.3 Modality of access

The main function of the National Cod Breeding Centre is to produce family groups of cod juveniles to be used in the selective breeding. The ordinary production is a seasonal event, starting up in February – March every year, and lasting until November. This is the most convenient period for external users to attend the centre to work on egg through juvenile stages. However, research on broodstock can be accommodated almost year-around. . The users can couple their activity to the ordinary production, for instance by getting access to the material produced, such as sperm, eggs, larvae and fingerlings from 200 family groups and live feed (rotifers and Artemia). They can also be linked to on-going research projects regarding genetics and production protocol optimization, or they can use the overcapacity of tanks and other facilities to run their own projects.

1.4 Unit of access

The unit of access at NCBC is defined as one tank/week; equalling the occupation of one standard tank for seven days. For instance, 288 tank/weeks can imply an experiment using 24 tanks (e.g. a 2x4 factorial experiment in triplicate tanks) for 12 weeks.

1.5 News and Updates

NCBC has opened its facility to external scientific users in 2010. Prior to this period the main focus of NCBC was to standardize the production protocols through internal experiments and to support smaller industry oriented research. Since 2010, we have collaborated with two external projects funded by Norwegian Research Council (CODE – Codlife and Tripcod). CODE-Codlife project is an Atlantic cod early life history platform project, examining the long term programming effects of temperature experienced by early life stages. Tripcod project focuses on production of triploid cod families using pressure shock on eggs soon after fertilization and the performances of triploid cod families are compared with diploid counterparts in terms of growth, survival, deformity levels and gonadal development. CODE-codlife experiments have been successfully completed and currently samples are being analysed. Tripcod project is currently on-going at the sea cage site of the Aquaculture Research Station.