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**6<sup>th</sup> FISH & SHELLFISH LARVICULTURE SYMPOSIUM**

# larvi 2013

Ghent University, Belgium  
September 2-5, 2013



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Ghent University, Belgium

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Center of Fisheries and Aquaculture  
Norwegian University of Science and Technology, Trondheim, Norway

Amos Tandler  
COST action LARVANET  
National Center for Mariculture, IOLR, Eilat, Israel

## **SECRETARIAT**

Laboratory of Aquaculture & Artemia Reference Center  
Department of Animal Production, Faculty of Bioscience Engineering  
Ghent University, Belgium

## **CONFERENCE CHAIRMAN**

Patrick Sorgeloos  
Laboratory of Aquaculture & Artemia Reference Center  
Ghent University, Belgium

## **SCIENTIFIC COMMITTEE**

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UGent Aquaculture R&D Consortium, Ghent University, Belgium

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Israel Oceanographic and Limnological Research, National Center for  
Mariculture, Eilat, Israel

## **WELCOME ADDRESS**

We are very pleased to welcome you among the 400+ larvi 2013 participants coming from 50+ countries!

Four years have already passed since the organisation of the 5<sup>th</sup> International Fish & Shellfish Conference “larvi 2009” and many things have happened since, making it more than appropriate to review the state of the art in larviculture research and its industrial applications.

Upon general request we have kept the format and place of the previous five meetings. As in LARVI 2009 we are 3 organising parties:

- the “UGent Aquaculture R&D Consortium”, which groups 12 departments from 3 faculties who are involved in interdisciplinary research (and education) in aquaculture at Ghent University in Belgium
- the “Center of Fisheries and Aquaculture” at the Norwegian University of Science and Technology in Trondheim, Norway
- the “LarvaNET” project of the EU-COST (European Cooperation in Science and Technology) action FA0801 “Critical success factors for fish larval production in European aquaculture: a multidisciplinary network”, holding its last meeting at this occasion.

We had a large submission of abstracts and it was a real challenge for the scientific committee to select the best ones for oral and poster presentations.

The large number of participants, even without announcing the conference in the major aquaculture magazines, clearly proves the continued importance of larviculture as a crucial segment in the aquaculture process. Today it is very clear that it is no longer the number of fry/post larvae/seed that is of crucial importance, but especially the quality of stocking material for on growing and/or restocking purposes. Many of the presentations will indeed focus on these quality aspects that have a growing impact on the larviculture industry, currently estimated at the world level to about one billion euro annually.

We hope that larvi 2013 can meet all your expectations and we look forward to a fruitful conference with plenty of opportunities for scientific, technical, and social interactions, as well as for plans for future cooperation and exchange. The

important representation of the private sector should stimulate a critical review of the research accomplishments and identify priorities for future research.

We are most indebted to our King, Albert II of Belgium, for his patronage of larvi 2013.

As in previous meetings we had largely underestimated the effort it involves but thanks to a concerted effort of many we are looking forward to a successful meeting.

We thank the institutional and commercial sponsors who have contributed to this symposium, the scientific committee for their assistance in selecting the oral and poster contributions, the editor of the Book of Abstracts and Short Communications for all his efforts in finalizing in time this high quality publication, the poster rapporteurs for accepting to study the mini-papers and poster displays in preparation of their poster review presentation, the chairpersons for accepting the task of supervising sessions and keeping these within the time limits, and finally the UGent staff and students who assisted with the many practical aspects of preparing this event.

A special word of appreciation to Marc Verschraeghen, Caroline Van Geeteruyen and Alex Pieters for their key role in the organisation of larvi 2013.

We wish you a fruitful conference and hope that you will also find the time to enjoy the cultural heritage of the city of Ghent and taste the local food and beers.

Welcome to Belgium, to Ghent, to Ghent University and to larvi 2013

Patrick Sorgeloos  
Conference Chairman



## **SCOPE AND OBJECTIVES**

More than ever expansion of aquaculture will be needed in the coming years to fulfill mankind's needs for animal proteins, due to the increasing human population, combined with stagnation of yields from capture fisheries. In spite of major successes obtained in a recent past, larviculture of fish and shellfish remains a bottleneck in the industrial farming of several species of commercial interest. This is especially the case in the production of the rapidly growing group of so-called 'new' aquaculture species. Contemporary larviculture faces new problems inherent to the diversification of technologies utilized, to ecological and socio-economic considerations, to new and highly challenging microbiological issues etc. But research in this field is also increasingly supported and stimulated by a variety of novel and sophisticated techniques and methodological tools. These allow an unprecedented and often fascinating insight into biological processes. Although they generally raise new research questions, they stand for a major leap forwards as compared to the empirical approach of a relatively recent past.

Capitalising on the previous "larvi" symposia (in '91, '95, '01, '05, '09), the Aquaculture R&D Consortium of Ghent University, the Norwegian University of Science and Technology and the COST action "LARVANET" have joined again in the organizing committee for "larvi'13" and are inviting the academic as well as the private sector to attend the 6th Fish and Shellfish Larviculture Symposium. Bringing together European and non-European stakeholders, once again the latest progress in the sector will be reviewed, problems identified and avenues for future collaboration explored.

## **PROGRAMME AT A GLANCE**

Sunday, September 1<sup>st</sup>:

- Early registration and setting up of posters between 14:00 and 17:00.

Monday, September 2<sup>nd</sup>:

- International workshop: brine shrimp *Artemia* as a model in life science research
- Registration of participants at the Conference Center and setting up of posters from 9:00 onwards.
- Official Opening Session at 17:30 with keynote presentations by Philippe Léger (INVE Aquaculture, Dendermonde, Belgium) “Integration of science and market knowledge in marine fish and shrimp hatchery practices: 30 years of challenges and opportunities”, and Patrick Sorgeloos (UGent Aquaculture R&D Consortium) “*Artemia* as a model organism in larviculture research”
- Reception

Tuesday, September 3<sup>th</sup>:

- Session I – BROODSTOCK MANAGEMENT, MATURATION AND SPAWNING
- Session II - DEVELOPMENTAL BIOLOGY AND DEFORMITIES

Wednesday, September 4<sup>th</sup>:

- Session III – LARVAL NUTRITION
- Session IV – LARVICULTURE AT COMMERCIAL SCALE

Thursday, September 5<sup>th</sup>:

- Session V – MICROBIAL MANAGEMENT FOR HEALTH
- Session summaries & concluding remarks
- Symposium Banquet

## PRACTICAL INFORMATION

### Conference Site

All activities (with the exception of the banquet) will take place at the "Aula" of the Ghent University, Volderstraat 9 in the city centre. In your conference map you will find a general city map. A street map, indicating the conference venue, is also printed on the back of the take-out programme overview. A ground-plan of the "Aula" can be found on pages 14-15.

### Registration Desk

The Registration Desk will be open on Sunday 1<sup>st</sup> from 14:00 -17:00, Monday September 2<sup>nd</sup>, from 9:00 - 17:00, and September 3<sup>th</sup>-5<sup>th</sup> during session hours.

### Social Programme

#### Opening Ceremony of the Symposium

Monday, September 2<sup>nd</sup>, (17:30) at the "Aula", Volderstraat 9.

Musical intermezzo's by Ghent University Symphonic Orchestra (GUSO), followed by **Informal Reception** in the Peristylum of the Aula.

Music by "The DixieMates"

#### Banquet

Thursday, September 5<sup>th</sup> (20:00) at the "Oude Vismijn" (St. Veerleplein 5, Tel.: 09-223 20 00) located within walking distance from the city centre

Music by coverband "Green Onions"





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## Conference Floor

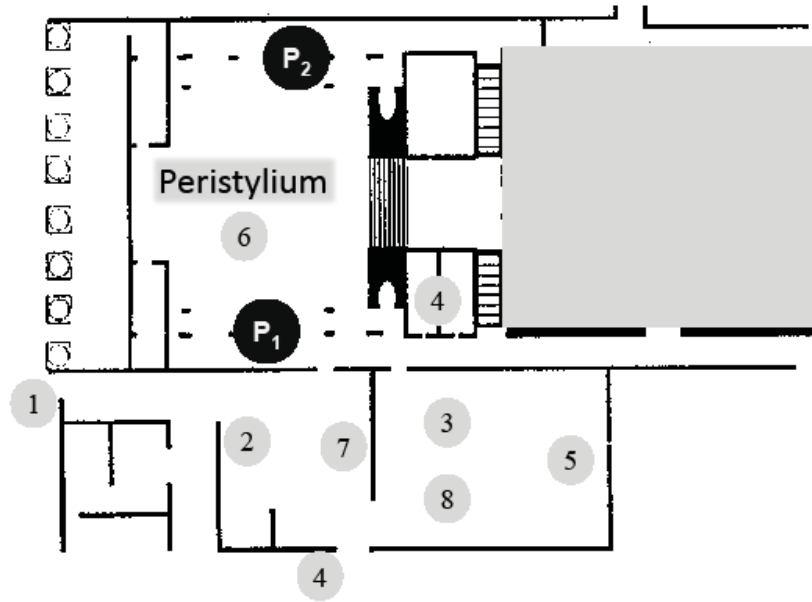
### Groundplan of the conference site

1. Entrance
2. Registration desk
3. WiFi zone & PC's
4. Toilets
5. Presentation viewing room
6. Coffee break & Lunch zone
7. Gold sponsor
8. Silver sponsors

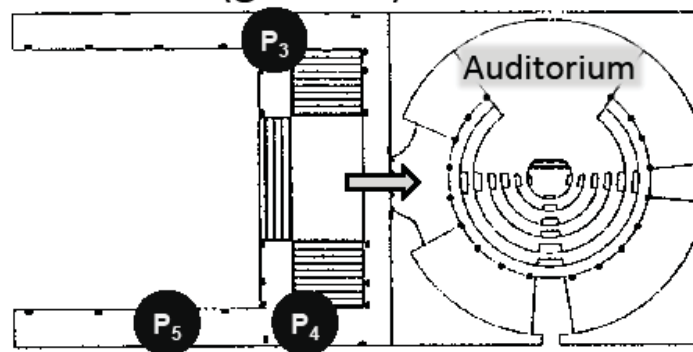
### Poster sections

- P<sub>1</sub> Session 1 - Broodstock management, maturation & spawning
- P<sub>2</sub> Session 2 - Developmental biology & Deformities
- P<sub>3</sub> Session 3 - Larval nutrition
- P<sub>4</sub> Session 4 - Larviculture at commercial scale
- P<sub>5</sub> Session 5 - Microbial management for health

## Ground floor



## First floor (galleries)



## **Public Transport**

In Ghent public trams/buses operate from 05:30 to 23:30 with a frequency of one every 10-15 minutes.

## **Meals**

### **Breakfast:**

- at your hotel or in the student restaurant "Kantienberg" (Stalhof, 45) close to the student dorms (city map D7).

### **Lunch:**

- at the Conference Site: people who ordered warm meals will receive tickets upon registration. Please note that it is not possible to take lunch at the conference venue if you have not made reservations for meals upon registration.
- in town: the biggest concentration of restaurants can be found at the Korenmarkt (city map C3), Groentenmarkt (city map C2), Donkersteeg (city map C3), Vlaanderenstraat (city map D4) and neighbouring streets

### **Dinner:**

- at your hotel or in town (see above).

## **Identification Badge**

The identification badge, which you will receive upon registration, must be worn throughout the conference. Only participants wearing their badge will be admitted to the conference rooms and social activities.

## **Coffee / Tea**

During the morning and afternoon breaks, free coffee and tea will be served in the Peristylum near the stairs to the Auditorium.

## **Banquet**

The banquet fee is included in the registration, except for students. Please note that the banquet tickets will be requested at the entrance.

The banquet takes place at the Oude Vismijn (Sint Veerleplein 5, Tel.: 09-223



20 00), which is located in the city center (City Map C8). The banquet venue is within walking distance of all hotels based in the city centre.

### **Electronic Mail**

There is open access WIFI connection and a limited number of available PC's at the 'academieraadzaal' (room adjacent to the registration desk). In the rest of the conference venue, there is only WIFI access via EDUROAM. Students and staff of EDUROAM member institutes can have free access to this service.

### **Posters - Poster Award**

Posters should be set up either on Sunday, September 1 between 14:00 and 17:00 or on Monday, September 2, between 10:00 and 17:00. To find out the location of your poster, please check the conference floor map on pages 12 - 13 and the poster service desk in the Peristylum. Posters should be removed on Thursday, September 5, after the last coffee break.

To ensure that the posters will be fully integrated in the symposium, considerable time has been allocated to view and discuss the posters.

Rapporteurs have been invited to review a number of posters, as well as the corresponding mini-papers, and to give a brief oral evaluation which should stimulate discussion. In addition a number of selected poster authors have been asked to briefly introduce their work as part of the oral programme ("poster teasers").

During the symposium banquet awards will be given for "best poster" and "best poster teaser" selected on the basis of their scientific value, layout and/or presentation qualities.

### **Bank and Money Exchange**

Several banks are located at the "Kouter" (city map C4). A money exchange office ("Gofin") is located in the Henegouwenstraat, 27 (city map D4). Opening hours during weekdays: 09:00 - 16:00.

### **Post Office**

The main post office is located at the "Lange Kruisstraat" (city map D3). Opening hours during weekdays: 09:00 - 16:00.

## **Group Picture**

On Tuesday, September 3, before lunch, a group picture will be taken in the main hall of the Peristylum. As of Wednesday September 4, the picture will be available online at the larvi 2013 website.

## **Speakers**

Please submit your presentation minimum half a day before your session starts at the registration desk either on a CD-ROM or USB-stick. You will have the opportunity to view the presentation until half a day before your session. The USB or CD-ROM can be retrieved after the session at the registration desk.

We plan to convert all ppt files into password protected pdf files and make these available on the larvi 2013 website. Speakers who do not want to make their presentation available should leave a signed statement in this respect at the registration desk. Please meet with your chairperson in the conference room 15 minutes before the start of your session and hand over the following written information for introduction: titles and name of speaker, affiliation and area of specialisation/activity.

## **Proceedings**

All participants receive a digital version of the Book of Short Communications and Abstracts “larvi 2013 – FISH & SHELLFISH LARVICULTURE SYMPOSIUM”. The full-length papers of the oral presentations will be peer reviewed and published in a special symposium volume of the journal “Aquaculture”.

## **Fact File**

**Time** is GMT + 2 from end of March until end of October.

Dutch is spoken in the North of the country, French in the South. Both **languages** are used in Brussels.

The **currency** unit is the Euro (€). There are bank notes of € 500, 200, 100, 50, 20, 10 and 5. Foreign currency and traveller cheques can be exchanged at most Belgian and foreign banks. In Ghent, there are exchange offices in the railway

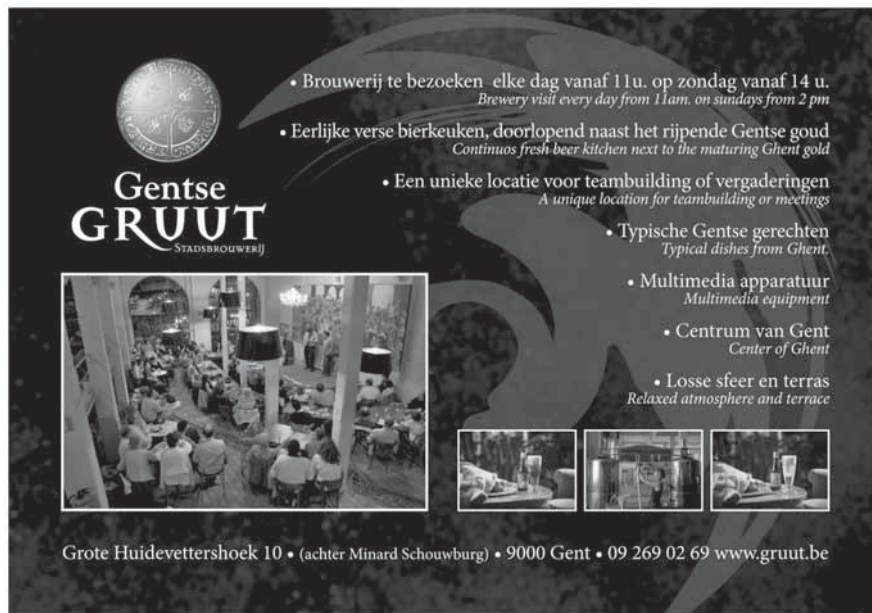
station Gent-St. Pieters and in the surroundings of the Korenmarkt and Mageleinstraat. € 1 equals approximately 1.3 US\$.

The **mail**-rate for postcards and letters up to 50 g to countries within the European Union is € 1.13 and € 1.34 for all other countries.

**Distances from Brussels** : Amsterdam 250 km, Antwerp 48 km, Arlon 187 km, Bruges 97 km, Charleroi 61 km, Ghent 55 km, Leuven 132 km, Luxemburg 300 km, Liège 94 km, Mons 67 km, Namur 63 km, Ostend 86 km, Paris 300 km.

To make an **international telephone call**, dial the number 00 followed by the country identification number: e.g. France (33), Germany (49), Great Britain (44), Italy (39), Japan (81), USA (1).

**Emergency services**: Accidents/Fire Brigade (112), Police (101), Anti-Poison centre (070-245.245).



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- smoked salmon from Marine Harvest Pieters,
- beer from Gruut, Gentse Stadsbrouwerij,
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## DETAILED PROGRAMME

### Sunday, September 1<sup>st</sup>

14:00-17:00 Registration

### Monday, September 2<sup>nd</sup>

9:00-17:00 Registration and Setting up of Posters

17:30-22:00 OPENING SESSION:

- **Musical intermezzo: GUSO** (Ghent University Symphonic Orchestra)  
GUSO stands for the colourful and vivacious Ghent University Symphonic Orchestra, a thriving student orchestra dedicated to students.  
Violin: Tinne Baelemans, Bram Jaques and Bavo Robben  
Cello: Liesbet De Meester  
Joseph Haydn: 6 divertimento in C dur
- **Welcome address by Paul Van Cauwenberge** - Rector Ghent University
- **Welcome address by Yngvar Olsen** - Member of the organizing committee
- **Musical intermezzo: GUSO** (Ghent University Symphonic Orchestra)  
Gabriel Fauré: Pavane  
Rolf Lovland: Nocturne from Secret Garden
- **Keynote presentation by Philippe Léger** (INVE Aquaculture)  
“Integration of science & market knowledge in marine fish and shrimp hatchery practices: 30 years of challenges and opportunities”
- **Keynote presentation by Patrick Sorgeloos** (UGent Aquaculture R&D Consortium)  
“Artemia as model organism in larviculture research”
- **Musical intermezzo: GUSO** (Ghent University Symphonic Orchestra)  
Joseph Haydn: 2 divertimento in E flat major
- **Opening reception in the peristylum of the Aula**

**Tuesday, September 3<sup>rd</sup>**

*Chairperson: Maria Teresa Dinis*

**Session 1. Broodstock Management, Maturation and Spawning**

- 9:00-9:20 REPRODUCTION OF EUROPEAN EEL AND LARVAL CULTURE: STATE OF THE ART  
**J. Tomkiewicz**, J.G. Støttrup, G. Corraze, S. Kausik, L.K. Holst, F. McEvoy, S. Dufour, A.G. Lafont, J. Asturiano, S. R. Sørensen, H. Tveiten, P. De Schryver, I.A.E. Butts, P. Munk, J. Zambonino-Infante, S.N. Politis, M. Krüger-Johnsen, and P. Lauesen
- 9:20-9:40 THE KEY NEUROENDOCRINE REGULATORS OF THE ONSET OF PUBERTY IN THE ATLANTIC BLUEFIN TUNA (*Thunnus thynnus*)  
**N. Berkovich**, A. Corriero, N. Santamaria, C.C. Mylonas, C.R. Bridges, Vassallo-Aguis R. Vassallo-Aguis, F. De La Gándara, A. Belmonte, I. Meiri-Ashkenazi, H. Gordin, and H. Rosenfeld
- 9:40-10:00 THE SELF-FERTILIZING MANGROVE KILLIFISH *Kryptolebias marmoratus* AS A MODEL FISH FOR BREEDING  
**Y. Sakakura**, K. Suga, A. Kanamori, and A. H. Sakakura
- 10:00-10:20 FACTORS AFFECTING SPERM QUALITY AND EMERGING TOOLS FOR SPERM ANALYSIS  
**E. Cabrita**, S. Martínez-Páramo, P. Gavaia, T. Pacchiarini, D.G. Valcarce, C. Saraquatte, and V. Robles
- 10:20-11:00 **Coffee Break and Poster Viewing**
- 11:00-11:10 **Poster Teaser Presentations Session 1. Broodstock Management, Maturation and Spawning**

Effect of Senegalese sole broodstock nutrition on early larval performance and metabolism of long-chain polyunsaturated fatty acids (DHA and E)

**S. Morais**, A. Candeias Mendes, F. Castanheira, J. Coutinho, N. Bandarra, J. Dias, L.E.C. Conceição, and P. Pousao-Ferreira

Genomics in bivalve aquaculture

**M. Gerdol**, G. De Moro, C. Manfrin, U. Rosani, P. Venier, and A. Pallavicini

11:10-11:30 DIGITAL IMAGE ANALYSIS TO AID BROODSTOCK MANAGEMENT AND EGG QUALITY ASSESSMENT

**A. Davie**, E. Leclercq, M.V. Medeiros, C. Talbot, and H. Migaud

11:30-11:50 GENOME-WIDE GENE EXPRESSION ANALYSIS DURING *Solea* sp. EMBRYO-LARVAL DEVELOPMENT

**X. Cousin**, G. Claros, D. Mazurais, R. Bautista, H. Benzekri, M.L. Bégout, M. Ponce, P. Armesto, J.Zambonino, J.V. Planas, and M. Manchedo

11:50-12:10 CURRENT STATUS OF CRAB LARVICULTURE IN THAILAND AND DEVELOPMENT OF A DIET FOR DOMESTICATED BROODSTOCK

**M. Tamtin**, M. Wille, J. Saeton, K. Kademuan, V. Tanasomwang, P. Sobhon, and P. Sorgeloos

12:10-12:30 **Poster Discussion Session 1. Broodstock Management, Maturation and Spawning**

*Rapporteurs: Ronaldo Cavalli, Patrick Kestemont and Elin Kjorsvik*

Effect of dietary bovine lactoferrin on rainbow trout (*Oncorhynchus mykiss*) fecundity and larval quality

E. Ahmadian, N. Agh, A. Tochmechi, and R. Jalili,



European sea bass larval early weaning development using greenwater and synbiotic in Alexandria, Egypt

A. Md. Salem, A.M Nour, S.S Assem, T.M Srour, H.S. El-Sayed, and H.A. Ebrahim

Effect of broodstock diet on hepatic status and reproductive performance in Atlantic halibut (*Hippoglossus hippoglossus* L.)

S. Bolla, O. Nicolaisen, and O.-L. Brekke

Gametogenic development and spawning of the freshwater clam, *Galatea paradoxa* (Born 1778) from the Volta river estuary, Ghana.

D. Adjei-Boateng and J. Wilson

Orthogonal analysis of elements affecting the formation of carpocysts on female gametophyte of *Gracilariopsis lemaneiformis*

D. Xu, L. Wang, X. Zhang, J. Wang, and X. Zang

Effects of dietary *Dunaliella salina* extract and highly unsaturated fatty acids on the fecundity and lipid content of pond-reared *Penaeus japonicus* broodstock

N. El-Bermawi

Fatty acid profile in eggs and newly hatched paralarvae of *Octopus vulgaris*, collected from the wild, and after 1-5 days starvation

J. Estefanell, J. Socorro, B. Ramírez, M. Izquierdo, and J. Roo

Reproductive capacity of *Hemiculter leucisculus* (Basilewsky, 1855) in Uzbekistan

E. Khurshut

Development of maturation diet for penaeid shrimp using herbal extracts

S. Kolkovski, and J. Kolkovski

The effect of pH on the fertilizability of rainbow trout (*Oncorhynchus mykiss*) eggs stored in a chilled state

M. Komrakova, U. Kuembet, and W. Holtz

Maturation and spawning induction in Hawaiian opihi *Cellana* spp. by hormone GnRH

N.T. Hua, and H. Ako

Genetic variability of wild horseshoe crabs (*Tachypleus gigas*) from west coast of peninsular Malaysia

M. Rozihan, E. Ismail, and J.B.Akbar

Quantitative characteristics of Atlantic halibut (*Hippoglossus hippoglossus* L.) egg production throughout the reproductive season and their relationship to embryo and larval quality

T. Skaalsvik, S. Bolla, and I. Babiak

Do immunostimulators affect sperm quality in Senegalese sole?

S. Martínez-Páramo, F. Arfuso, S. Engrola, J. Dias, C. Faggio, and C. Aragão

Muscle growth of triploid Atlantic cod larvae (*Gadus morhua*)

C.C. Vargas, Ø. Hagen, S. Peruzzi, and C. Solberg

Can dietary phospholipid and trace mineral supplementation influence zebrafish reproductive performance

W. Pinto, P. Diogo, S. Martínez-Páramo, P. Gavaia, L. Conceição, and J. Dias

Multiple vitellogenin yolk precursors in European sea bass (*Dicentrarchus labrax*)

O.Yilmaz, F. Prat, A.J. Ibáñez, H. Amano, S. Koksoy, and C.V. Sullivan

12:30-12:40      **Group picture**

12:40-13:40      **Lunch and Poster Viewing**

*Chairperson: Manuel Yufera*

## **Session 2. Developmental Biology and Deformities**

13:40-14:00      ONTOGENY OF THE REDOX BALANCE IN RELATION TO ORGANOGENESIS IN ATLANTIC COD (*Gadus morhua*) LARVAE

**K. Hamre, S.J. Penglase, J. Rasinger, and P.A. Olsvik**

- 14:00-14:20 REVIEW ON THE ONTOGENY OF LARVAE FROM NEOTROPICAL FRESHWATER FISHES: THE PACU MODEL  
**M.C. Portella**, N. de J. Leitão, O.C.C. Menossi, T.M. de Freitas, J.T. Kojima, T.S. Lopes, R.K. Jomori, J.A. Clavijo-Ayala and D.J. Carneiro
- 14:20-14:40 EXPLORING THE FEEDING MYSTERY OF LEPTOCEPHALUS LARVAE: A MOUTH FULL OF TEETH  
**M. Boulliart**, J. Tomkiewicz, P. Lauesen, and D. Adriaens
- 14:40-15:00 EFFECTS ON THE SKELETON DEVELOPMENT IN REARED GILTHEAD SEA BREAM (*Sparus aurata*)  
**L. Prestinicola**, C. Boglione, and S. Cataudella
- 15:00-15:20 HIGH DIETARY LEVELS OF ARACHIDONIC ACID NOT ONLY AFFECTS THE NORMAL PIGMENTATION PATTERNS IN POSTMETAMORPHIC SENEGALESE SOLE LARVA, BUT ALSO DISRUPTS THE PROCESS OF EYE MIGRATION IN PSEUDOALBINO FISH  
**A. Boglino**, A. Wishkerman, M.J. Darias, A. Estévez, K.B. Andree, and E. Gisbert

15:20-15:40 **Poster Discussion Session 2. Developmental Biology and Deformities**

*Rapporteurs: Dominique Adriaens, Clara Boglione and Wim Van den Broeck*

Ontogenetic development of the digestive system in reared fat snook (*Centropomus parallelus*) larvae

A. Teles, W. M. Costa, D. Ammar, E. M. Nazari, Y.M.R. Muller, V. R. Cerqueira

Effect of increasing DHA content in new weaning diets for longfin yellowtail *Seriola rivoliana*

A. Mesa-Rodriguez, C. Hernández-Cruz, M. Izquierdo, H. Fernández-Palacios, and J. Roo

Ontogeny of Kiss2 and Kiss 1r gene expression in gilthead seabream (*Sparus aurata*) larvae

C.C.V. Oliveira, A. Davie, E. Cabrita, M.F. Castanheira, M.T. Dinis, and H. Migaud

Towards the development of new quality indices in juvenile fish - relationship of caudal-fin morphology with the thermal history of juveniles

M. Christou , M. Iliopoulou , and G. Koumoundouros

Ontogeny of digestive system of paralarvae of *Octopus bimaculatus*

D. López-Peraza, M. Hernández-Rodríguez, and B. Barón-Sevilla

Correlation of saddleback syndrome with deformities of pelvic fins and lateral line in European sea bass, *Dicentrarchus labrax*

S. Fragkoulis, P. Kokkinias , and G. Koumoundouros

Thermally-induced phenotypic plasticity in Gilthead sea bream

E. Georgakopoulou, M. Loizides, M. Christou , M. Iliopoulou, I. Papadakis, P. Katharios, P. Divanach, and G. Koumoundouros

Larval diet determines juvenile and adult phenotype in zebrafish (*Danio rerio*)

A. Georgiou, M. Christou, M. Sxoinaraki, P. Kokkinias, and G. Koumoundouros

Evaluation of colour development of rosy barb, *Puntius conchoni* (Hamilton) during ontogeny

G. Mitra , J.K Jena, P. .Jayasankar , P.C. Das, and S.K. Swain

Development of techniques and technology for embryonic and larval rearing of the European eel

I. A. E. Butts, S.N. Politis, S.R. Sørensen, P. De Schryver, C. P. Unmack, and J. Tomkiewicz

Tank wall color affects swim bladder inflation in Eurasian perch, *Perca fluviatilis* L., under controlled conditions

K. Palinska-Zarska, D. Zarski, Slawomir Krejszeff, J. Nowosad, M. Bilas, and D. Kucharczyk

Identification and migration of primordial germ cells in Atlantic salmon (*Salmo salar.*) and Atlantic cod (*Gadus morhua*)

K. Nagasawaa, C. Presslauera, G.Yoshizakib, M. Miwa, J.M.O. Fernandes, and I. Babiaka

Allometric growth in *Nannacara anomala* (Regan, 1905) (Cichlidae, Pisces)

K. Kupren, M. Prusińska, D. Zarski, S. Krejszeff, and D. Kucharczyk

Ontogeny of the digestive tract of the omnivorous *Chelon labrosus*

M. Yúfera, V. de las Heras, J.A. Martos-Sitcha, C. Sarasquete, G. Martínez-Rodríguez, and J.B. Ortiz-Delgado

Expression and activity of three digestive proteases in larvae of the totoaba (*Totoaba macdonaldii*)

M.A. Galaviz, L.M. López, A. García Gasca, E. Gisbert, A.C. Alvarez, G. Sandoval, and C.D. True

Developmental staging and deformities characterization of the Eurasian perch, *Perca fluviatilis*

M. Alix, B. Schaerlinger, Y. Ledoré, D. Chardard, P. Fontaine

Amino acids profile and consumption during embryonic development and yolk sac larvae of Pacific red snapper *Lutjanus peru*

R. Peña, S. Dumas, I. Moguel-Hernández, and N. García-Aguilar

Is sinking mortality in southern bluefin tuna larvae caused by high light intensity?

P.I. Hilder, J. Cobcroft, N. Hart, and S. Battaglene

Dynamic of efficiency of MS-222 as an anesthetic for tench *Tinca tinca* (L.) larvae

S. Krejszeff, D. Zarski, P. Gomułka, K. Palińska, J. Nowosad, and D. Kucharczyk

Thyroid regulation in teleost embryonic and larval development - can it be a promise for aquaculture?

C.N. Walpita, A.D. Crawford, and V.M. Darras

15:40-16:20      **Coffee Break and Poster Viewing**

*Chairperson: Kristin Hamre*

16:20-16:40      VITAMIN A AND K, TWO FAT SOLUBLE VITAMINS  
REQUIRED FOR HARMONIC FISH LARVAL DEVELOPMENT  
**I. Fernández**, E. Gisbert, and P. Gavaia

16:40-17:00      EXPRESSION OF SKELETAL MYOSIN LIGHT CHAIN 2 IN  
GILTHEAD SEA BREAM (*Sparus aurata*, L): REGULATION AND  
CORRELATION WITH GROWTH MARKERS  
**S. Georgiou**, E. Sarropoulou, D.M. Power, H. Alami-Durante, Z.  
Mamuris, and K.A. Moutou

17:00-17:20      EPIGENETIC REGULATION OF MUSCLE DEVELOPMENT AND  
GROWTH IN SENEGALESE SOLE LARVAE  
**B. Campos**, L.M.P. Valente, L.E.C. Conceição, S. Engrola, and J.M.O.  
Fernandes

17:20-17:40      EMERGENCE OF CANNIBALISM IN EUROPEAN PERCID FISH  
SIZE HETEROGENEITY OR NATURAL BORN KILLERS  
CONSEQUENCE?  
**J. Król**, Z. Zakęś, and P. Kestemont

17:40-18:00      IMPROVING VISUAL ENVIRONMENT IN COD LARVAL  
REARING BY FACTORIAL DESIGNS  
**O. Nicolaisen**, M. Cuny, and S. Bolla

18:00 -18:10      **Poster Teaser Presentation Session 2. Developmental Biology and  
Deformities**

Investigating causes of skeletal malformation in Yellowtail kingfish *Seriola lalandi*  
J.M. Cobcroft, S.C. Battaglione, J.C.G. Biggs and D.S. Fielder

Wednesday, September 4<sup>th</sup>

*Chairperson: David Bengtson*

**Session 3. Larval Nutrition**

- 9:00-9:20 THE FUNCTION OF WAX ESTERS IN LARVAL FISH TRANSITION FROM ENDOGENOUS TO EXOGENOUS NUTRITION – ARE FRESHWATER FISH THE EXCEPTION OR THE RULE?  
**K. Dabrowski**, M. Korzeniowska, T. Farmer, S. Ludsin, and E. Marschall
- 9:20-9:40 GENE EXPRESSION IS STRONGLY REGULATED BY NUTRIENTS IN FIRST FEEDING ATLANTIC COD LARVAE (*Gadus morhua*)  
**M. Moren**, K. Kvalheim, A. Nordgreen, T. Harboe, and K.K. Lie
- 9:40-10:00 EVALUATION OF DAILY RHYTHMS IN FEEDING ACTIVITY AND DIGESTIVE FUNCTIONS IN GILTHEAD SEA BREAM (*Sparus aurata*) LARVAE  
**J.A.Mata**, G. Martínez-Rodríguez, F. Moyano, and M. Yúfera
- 10:00-10:20 ASSESSMENT OF PROTEIN DIGESTIVE CAPACITY AND UTILISATION DURING ONTOGENY OF SENEGALESE SOLE LARVAE: A TRACER STUDY USING IN VIVO PRODUCED RADIOLABELLED PEPTIDE FRACTIONS  
**N. Richard**, S. Engrola, P. Palma, W. Pinto, D. Simes, and L. Conceição
- 10:20-11:00 **Coffee Break and Poster Viewing**

11:00-11:20 **Poster Teaser Presentations Session 3. Larval Nutrition**

Linking weaning success to larval digestive capacity using radiolabelled peptide fractions

**S. Engrola**, N. Richard, A.F. Lopes, W. Pinto, L.E.C. Conceição

Influence of the forms and levels of dietary selenium on oxidative stress in rainbow trout fry

**S. Fontagné-Dicharry**, S. Godin, H. Liu, P. Antony Jesu Prabhu, B. Bouyssiere, M. Bueno, P. Tacon, F. Médale, S. Kaushik

Early-feeding exposure to a plant-based diet improves its future acceptance and utilization in rainbow trout

**I. Geurden**, P. Borchert, M. Balasubramanian, J. Schrama, M. Dupont-Nivet, E. Quillet, S. Kaushik, S. Panserat, and F. Médale

Gene regulation of Atlantic Cod (*Gadus morhua*) larvae with focus on lipid digestion and phospholipid metabolism

**K. Li**, M.-A. Ostensen, K. Attramadal, P. Winge, T. Sparstad, I. Bakke, A.M. Bones, O. Vadstein, E. Kjørsvik, and Y. Olsen

11:20-11:40 LIPID DIGESTION IN FIRST FEEDING LARVAE – VISUALIZATION IN VIVO

**Ø. Sæle**, and S. Farber

11:40-12:00 EURYHALINE ROTIFER *Proales similis* AS INITIAL LIVE FOOD FOR REARING FISH LARVAE WITH SMALL MOUTHS

**A. Hagiwara**, S. Wullur, N. Hirai, and Y. Sakakura

12:00-12:20 MICROPARTICULATE ENRICHMENT OF ROTIFER LIVE DIETS WITH TAURINE AND NUTRITIONAL EFFECTS ON NORTHERN ROCK SOLE (*Lepidopsetta polyxystra*) LARVAE.

**M. Hawkyard**, B. Laurel, Y. Barr, and C. Langdon



12:20-12:40 IMPORTANCE OF DHA FOR FIRST FEEDING PIKE PERCH LARVAE – INFLUENCE ON BEHAVIOURAL RESPONSES  
**I. Lund**, E. Høglund, and P.V. Skov

12:40-13:40 **Lunch and Poster Viewing**

*Chairperson: Hiroshi Fushimi*

13:40-14:00 OXIDATIVE STRESS IN SEA BASS *Dicentrarchus labrax* LARVAE: INTERACTION OF HIGH DIETARY DHA CONTENTS AND SEVERAL ANTIOXIDANT NUTRIENTS  
**M.B. Betancor**, M.J. Caballero, and M.S. Izquierdo

14:00-14:20 INTENSIFICATION OF *Litopenaeus vannamei* LARVICULTURE  
**M.L. Cobo**, R. Wouters, M. Wille, S. Sonnenholzner, J. Calderon, and P. Sorgeloos

14:20-14:40 ARCHITECTURE FOR AUTOMATION AND TELEPRESENCE IN A MARINE HATCHERY LABORATORY  
**J.A. Alfredsen**, M.O. Alver, and T.-I. Eriksen

14:40-15:00 OPTIMUM PHOSPHOLIPIDS AND ANTIOXIDANT LEVELS TO DEVELOP NOVEL MICRODIETS FOR GILT HEAD SEABREAM LARVAE  
**R. Saleh**, and M. Izquierdo

15:00-15:20 NANOPARTICLES AS A NOVEL DELIVERY SYSTEM FOR VITAMIN C ADMINISTRATION IN AQUACULTURE  
E. Jimenez-Fernandez, E. Zuasti, A. Ruyra, N. Roher, C. Infante, and **C. Fernández-Díaz**

15:20-15:40 **Poster Discussion Session 3. Larval Nutrition**

*Rapporteurs: Luis Conceição, Atsushi, Hagiwara, Marisol Izquierdo, Sachi Kaushik,*

Providing harpacticoid copepods via floating sieve improves fish larval feeding success  
C. Arndt, M. Moison, and U. Sommer

Studies of digestive physiology during early ontogeny of the Mayan cichlid *Cichlasoma urophthalmus*

C.A. Cuenca Soria, D. Tovar Ramírez, J.L. Ortiz Galindo, E. Gisbert, and C.A. Alvarez González

Effect of red crab meal (*Pleuroncodes planipes*) on growth and digestive enzyme expression in the intestine of white shrimp (*Litopenaeus vannamei*)

E.G. Ayala-Borboaa, D. Tovar-Ramírez, R. Civera-Cerecedo, M. Rojas-Contreras, M.A. Cadena-Roa, H. Nolasco-Soria, and E. Goytortua-Bores

Effects of combined phospholipids and selenium dietary contents on patterns of bone formation in the axial skeleton of *Sparus aurata*

T. Benítez-Santana, R. Saleh, M.B. Betancor, A. Mesa, C. Mari Hernández-Cruz, and M. Izquierdo

Fish larval performance fed with copepods (*Acartia grani*) and the dinoflagellate (*Oxyrrhis marina*) as supplement: the case of dusky grouper (*Epinephelus marginatus*)

M.E. Cunha, M. Gamboa, S. Castanho, H. Quental-Ferreira, L. Ribeiro, F. Soares, P. Gavaia, M. Mateus, P. Moura, N. Cordeiro, R. Goncalves, and P. Pousão-Ferreira

The development of new enrichment products and strategies for live feed in fish hatcheries

T. De Wolf, P. Cecconi, S. Lenzi, I. Labaere, and G. Rombaut

Surface area estimation of the gut segments of *Artemia franciscana* nauplii fed with mnn9 yeast vs. wild type yeast

R.A.Y.S.A. Gunasekara, C. Casteleyn, P. Bossier, and W. Van Den Broeck

Advances in larval rearing protocols of sole, *Solea senegalensis*

A.C. Mendes, S. Castanho, M. Gamboa, J. Coutinho, N. Bandarra, L. Conceição, S. Morais, and P. Pousão-Ferreira

Content of essential fatty acids in cultivated *Acartia tonsa* nauplii fed a DHA-deficient *Tetraselmis* sp. concentrate.

A. Hagemann, G. Øie, Y. Attramadal, R. Veiseth, and J.O. Evjemo

Effect of different feeds on larval growth of the snakehead *Channa striata* (Bloch, 1793)

H.M.J.C.B. Herath, T.V. Sundarabarathy, and M.H.S. Ariyaratne

Promoting of bacteria growth by manipulating of carbon/nitrogen ratio and use as microalgae substitution for filter feeders: A demonstration on *Artemia* culture.

Huynh Thanh Toi, Nguyen Van Hoa, P. Sorgeloos, P. Bossier, and G. Van Stappen

Microencapsulated diets for altricial freshwater fish larvae: production and evaluation.

N.J. Leitão, J.B. Rodrigues, C.R.F. Grosso, M. Dal Pai-Silva, and M.C. Portella

First feeding regimes for long-snout seahorse *Hippocampus reidi* larvae

J. García-Manchón, J. Socorro-Cruz, Á. Segade Botella, F. Otero-Ferrer, A. Mesa, and L. Molina-Domínguez

Interaction between dietary levels of LC-PUFA and vegetable oil sources in Senegalese sole (*Solea senegalensis*) post-larvae: puzzling results suggesting complete biosynthesis pathway from C18 PUFA to DHA

C. Navarro-Guillén, S. Engrola, F. Castanheira, N. Bandarra, I. Hachero-Cruzado, L.E.C. Conceição, and S. Morais

Potential uses of gut weed *Enteromorpha* spp. as a feed for herbivorous fish

Nguyen Thi Ngoc Anh, Tran Thi Thanh Hien, and Tran Ngoc Hai

New approaches for *Artemia* pond culture

Nguyen Van Hoa, Tran Huu Le, Nguyen Thi Hong Van, P. Sorgeloos and G. Van Stappen

Effect of DHA on the expression of the delta 6-desaturase in the larval development of yellow snapper, *Lutjanus argentiventris*.

B. Paz-Raymundo, D. Tovar-Ramirez, E. Palacios-Mechetnov, and J.C. Perez-Urbiola

Effect of poly-hydroxybutyrate on growth and digestive enzyme activity of Chinese mitten crab *Eriocheir sinensis* juveniles

L. Sui, G. Chang, Y. Liu, and Y. Deng

Cholecystokinin and tryptic enzyme activity in sea bass (*Dicentrarchus labrax*) larvae: a regulatory loop and the impact on feeding regimes

R. Tillner, I. Rønnestad, P. Dhert, and B. Ueberschär

Applying fresh water rotifer (*Brachionus angularis*) in rearing newly hatching fry of marble goby fingerling (*Oxyeleotris marmoratus*)

Tran Suong Ngoc, Nguyen Van Hoa, and Vu Ngoc Ut

Copepods enhance growth and development in atlantic cod (*Gadus morhua* L.) larvae

T. van der Meeren, Ø. Karlsen, A. Mangor-Jensen, I. Rønnestad, and K. Hamre

Effects of feeding time, rates and frequencies on survival rate of stripped catfish fries (*Pangasianodon hypophthalmus*) fed by freshwater rotifers (*Brachionus angularis*)

Vu Ngoc Ut, Nguyen Phi Long, and Tran Suong Ngoc

15:40-16:20      **Coffee Break and Poster Viewing**

*Chairperson:*

16:20-16:40      **Poster Discussion Session 3. Larval Nutrition – continued**

*Rapporteurs: Jo Arve Alfredsen, Konrad Dabrowski, Nancy Nevejan, Amos Tandler*

DHA requirement of larval Japanese flounder in the rotifer feeding period

A. Miyashima, H. Fushimi, N. Sato, T. Kotani, and T. Kusano

Endogenous metabolism of unsaturated fatty acids in *Artemia* nauplii as determined through incubation with <sup>14</sup>C-labelled fatty acid substrates

D.B. Reis, N.G. Acosta, E. Almansa, J.C. Navarro, D.R. Tocher, O. Monroig, J.P. Andrade, A.V. Sykes, and C. Rodríguez

Low-cost production of the marine thraustochytrid isolate, *Schizochytrium* sp. LEY 7 as live feed enrichment for the mangrove snapper, *Lutjanus* sp.

G. Ludevese-Pascual, M. dela Pena, O. Reyes, and J. Tornalejo

Burbot, *Lota lota*, L., larvae requirements for *Artemia* sp. nauplii during experimental rearing in laboratory conditions

K. Palinska-Zarska, D. Zarski, I. Trabska, S. Krejszeff, B. Laczynska, L. Misiewicz, R. Deptula, and D. Kucharczyk

The effect of different phytoplankton species and commercial enrichment products on the fatty acid profile, enzyme activity and overall condition of the rotifer *Brachionus plicatilis*

V. Kostopoulou, A. Tsopelakos, E. Zogopoulou, H. Miliou, P. Divanach, and P. Katharios

Fluorescent microspheres - a new approach to quantifying live feed intake in larval fish

K. Bonacic, R. Valles, X. Gómez-Arbonés, A. Estevez, and S. Morais

Gene expression profiling of *Litopenaeus vannamei* juveniles fed different protein sources and detection of digestive-related genes by functional genomics

J. Carmona Contreras, D. Tovar Ramirez, R. Civera-Cerecedo, M. Rojas-Contreras, M.A. Cadena-Roa, H. Nolasco-Soria, and E. Goytortua-Bores

Effects of probiotics on pompano (*Trachinotus carolinus*), common snook (*Centropomus undecimalis*) and red drum (*Sciaenops ocellatus*) larvae

M.R. Hauville, H. Migaud, J.L. Zambonino-Infante, J.G. Bell, and K.L. Main

Effects of glucose and probiotic supplementation in nursing juvenile clam *Meretrix lyrata*

Ngo Thi Thu Thao, and Le Quang Nha

Effect of environmental factors on heritability and its biometrics of *Artemia franciscana* Vinh Chau by mass selection for small sized cysts  
Nguyen Thi Hong Van , Nguyen Van Hoa, P. Bossier, P. Sorgeloos, and G. Van Stappen

Investigating the essential fatty acid requirements of the cephalopod *Sepia officinalis*: A molecular approach  
Ó. Monroig, F. Hontoria, I. Varó, D.R. Tocher, and J.C. Navarro

Does dietary amino acid profile modulate Senegalese sole larvae protein metabolism?  
P. Canada, S. Engrola, A.F. Lopes, L.M.P. Valente, and L.E.C. Conceição

Influence of feeding regimes on the digestive enzyme profile and ultrastructure of digestive tract of Indian major carp *Catla catla*  
R. Chakrabarti, and I. M. Lukram

Low *Artemia* consumption strategies in larval shrimp rearing  
R. Wouters, and E. Naessens

*Pavlova* - A “new” microalgae candidate species for live feed cultivation and fish larvae nutrition  
S. Rehberg-Haas, S. Meyer, S. Lippemeier, and C. Schulz

Effect of light conditions on the population growth of rotifer  
T. Yoshimatsu

Studies on the characterisation of biomarkers of nutritionally-derived stress in paralarval cultures of the common octopus (*Octopus vulgaris*)  
I. Varó, J.C. Navarro, J. Iglesias, J.J. Otero, J. Sánchez, E. Almansa, O. Monroig, F. Hontoria, E. Morales, and G. Cardenete.

#### Session 4. Larviculture at Commercial Scale

- 16:40-17:00 DEVELOPMENT OF AN NNV-FREE LARVAE REARING SYSTEM AND THE PRODUCTION OF SPR GROUPER FINGERLINGS  
**H.L. Yang**, H.Y. Lin, and C.C.Lin
- 17:00-17:20 RECENT ADVANCES IN *Seriola dumerilli* CULTURE  
**J. Roo**, A. Mesa-Rodriguez, C. Hernández-Cruz, M. Izquierdo, and H.Fernández-Palacios
- 17:20-17:40 COULD THE PACKHORSE LOBSTER, *Sagmariasus verreauxi*, BE THE BEST SPINY LOBSTER CANDIDATE FOR AQUACULTURE?  
S.C. Battaglione, **C.J. Simon**, Q.P. Fitzgibbon, G.G. Smith, and C.G. Carter

#### 17:40-17:50 **Poster Teaser Presentation Session 4. Larviculture at commercial scale**

Associated effects of bacteria on *Octopus tetricus* larvae rearing  
**S. Kolkovski**, J. King, N. Watts, M. Natale, J. Bannister, and F. Stephens

#### **Poster Discussion Session 4. Larviculture at commercial scale**

*Rapporteur: Yngvar Olsen*

Combating some of the crucial bottlenecks for calanoid copepod cultivation for live feed

B.W. Hansen, G. Drillet, and P.M. Jepsen

Effect of phytochemicals on stress tolerance of *Penaeus vannamei* postlarvae

E. Bequé, R. Phuthongphan, R. Wouters, and G. Rombaut

Culture systems in the coastal complexes which are used in the process of red king crab artificial reproduction in Russia

N.P. Kovatcheva, R.R. Borisov, A.V. Parshin-Chudin, D.S. Pechonkin, R.O. Lebedev

Larval rearing protocols for meagre *Argyrosomus regius*

P. Pousão-Ferreira, S. Castanho, L. Ribeiro, J. Coutinho, N. Bandarra, and A.C. Mendes

Domestication of mahseer (*Tor soro*) in Indonesia

R. Gustiano, E.K. Kusnendar, H. Wahyuningsih, J. Subagja, S. Asih, and A. Saputra

**Thursday, September 5<sup>th</sup>**

*Chairperson: Indrani Karunasagar*

**Session 5. Microbial Management for Health**

- 9:00-9:20      BACTERIAL COMMUNITY ASSEMBLY IN DEVELOPING COD LARVAE (*Gadus morhua*)  
**I. Bakke**, J. Skjermo, K. Attramadal, E. Coward, Tu Anh Vo, Y. Olsen, and O. Vadstein
- 9:20-9:40      THE APPLICATION OF ECOLOGICAL THEORY FOR MICROBIAL CONTROL IN LARVICULTURE  
**P. De Schryver**
- 9:40-10:00      LESSONS LEARNED FROM GNOTOBIOTIC SYSTEMS AND THE EFFECT OF BACTERIA ON GROWTH, SURVIVAL AND GENE EXPRESSION IN MARINE LARVAE.  
**T. Forberg**, and O. Vadstein



10:00-10:20      **Poster Teaser Presentations Session 5. Microbial Management for Health**

The development of an axenic blue mussel (*Mytilus edulis*) larvae test system

**A. Plovie**, F. Gonzaga, Nancy Nevejan, and Peter Bossier

Bacterial community compositions of ejected intestine of juvenile sea cucumber and the effect of seas sediment *Bacillus* on in vivo antagonism against pathogenic *Vibrio splendidus*

**Z-Z. QI**, S-Q. Chen, A-G Zou, L. Tang, M-M. Sun, H-Y. Zhang, C-L. Liu, J-P. Wang , and Y. Han

10:20-11:00      **Coffee Break and Poster Viewing**

11:00-11:20      CONTROL OF THE SELECTIVE PRESSURE ON MICROBES OF THE INCOMING WATER INCREASES SURVIVAL OF MARINE FISH LARVAE

**K. Attramadal**, G. Øie, E. Kjørsvik, G. Minniti, J. Skjermo, I. Bakke, M.-A. Østensen, Y. Olsen, and O. Vadstein

11:20-11:40      CONTROL OF BACTERIAL DISEASE IN CULTURES OF MARINE LARVAE AND LIVE FEED ORGANISMS BY A PROBIOTIC BACTERIUM

**P. D'Alvise**, S. Lillebø, H. Wergeland, K.F. Nielsen, Ø. Bergh, and L. Gram

11:40-12:00      EXPERIMENTAL CHALLENGE: THE QUEST FOR VIRULENCE - AND PROTECTION

**Ø. Bergh**

12:00-12:20      SELECTION STUDY OF POTENTIAL PROBIOTIC BACTERIA FOR SHRIMP HATCHERIES IN NEW CALEDONIA

**D. Pham**, D. Ansquer, A. Chevalier, A. Peyramale, C. Dauga, N. Wabete, and Y. Labreuche

12:20-12:40 **Poster Discussion Session 5. Microbial Management for Health**

*Rapporteurs: Oivind Bergh, Peter Bossier, Annemie Decostere, Olav Vadstein*

The protective and intestinal microbiota steering effect of a novel heat shock inducer on brine shrimp larvae

Y. Niu, T. Van de Wiele, and P. Bossier

Water management and biocontrol – selection of probiotic strains

B. Weber, G.A. Santos, M. Mohnl, and G. Schatzmayr

Effect of Heat Shock Protein (HSP70) homologue DnaK on gene expression of prophenoloxidase and transglutaminase in haemocytes of the Whiteleg shrimp (*Litopenaeus vannamei*)

B. Hu, P. Bossier, and P. Sorgeloos

Microparticles delivery system in gnotobiotic European sea bass larvae (*Dicentrarchus labrax* L.)

E.N. Yaacob, B. De Geest, D. Vanrompay, K. Dierckens, and P. Bossier

Microbial characterization of enriched *Artemia* sp. at two different temperatures and enrichments

F. Soares, S. Castanho, M. Moreira, A.C. Mendes, and P. Pousão-Ferreira

Evaluation of probiotic bacteria against aeromonads syndrome in common carp (*Cyprinus carpio* L.) larviculture

G. Suantika, P. Aditiawati, D.I. Astuti, A. Sjarmidi, N. Lim, and Z.F. Khotimah

Virulence genes and quorum sensing of *Vibrio harveyi*

H.A.D. Ruwandeepika, T. Defoirdt, T.S.P. Jayaweera, I. Karunasagar, and P. Bossier

Influence of virulent and avirulent bacterial strains on Hsp70 content of *Artemia* instar II larvae

Nguyen Thi Xuan Hong, D. Vanrompay, and P. Bossier

Application of a multi-strain probiotic improves utilization of microalgae in *Litopenaeus vannamei* post larvae

J. Zwielehner, T. Suyawanish, G.A. Santos, and P. Encarnação

The effects of dietary poly-beta-hydroxybutyrate on growth, feed utilization, and survival of Nile tilapia (*Oreochromis niloticus*) fry

M.L. Situmorang, K. Dierckens, and P. Bossier

Digestive and immune responses to probiotics or prebiotics in percid larvae

S.N.M. Mandiki, C. Mathieu, F. Chaffa, T.M. Rakotomalala, J. Douxfils, and P. Kestemont

Effect of Sanolife MIC-f as larval fish probiotic on host stress resistance, histology and microbiota in seabream

M. Corteel, G. Franchi, L. Chiappi, A. Rekecki, T. De Wolf, and G. Rombaut

Use of Poly-beta-hydroxybutyrate in bivalve larviculture

Nguyen Van Hung, P. De Schryver, P. Bossier, and N. Nevejan

Use of *Phaeobacter* sp. probiotic bacteria for the rearing of seabass larvae (*Dicentrarchus labrax*)

P. Makridis, N. Papandroulakis, and P. Divanach

The impact of the quorum sensing disrupting compounds on survival and growth of giant freshwater prawn (*Macrobrachium rosenbergii*) larvae

G.S.J. Pande, P. Bossier, and T. Defoirdt

Identification of nitrifying bacteria in intensive shrimp ponds in Soc Trang province, Vietnam by biochemical test and molecular technique

Pham Thi Tuyet Ngan, Truong Quoc Phu, Tran Suong Ngoc, and Nguyen Huu Hiep

Impact of quorum sensing system on motility in *Vibrio harveyi*

Q. Yang, P. Bossier, and T. Defoirdt

Selection and identification of probiotic bacteria for use in shrimp larviculture

S. Peixoto, J. Vogeley, R. Nery, C. Costa, I. Barbosa, J.V. Lima-Filho, and R. Soares

An assessment of biosecurity and hazard management practices in the larviculture of shrimp (*Penaeus monodon*) in Bangladesh

S.M. Sharifuzzaman, and S. Adhikari

A gnotobiotic model system: The case of *Artemia franciscana*

S. Vanmaele, T. Defoirdt, and P. Bossier

Host-induced increase of sea bass mortality in a gnotobiotic challenge test with *Vibrio anguillarum*

X. Li, T. Defoirdt, Q. Yang, P. Bossier, and K. Dierckens

*Vibrio* static activity in the culture of the *Picochlorum* sp. strain S1b can be attributed to the bacteria associated with the microalga

Y.H. Chang, J.C. Kuo, and Y.M. Chen

12:40-13:40      **Lunch and Poster Viewing**

*Chairperson: Huey-Lang Yang*

13:40-14:00      BACTERIOPHAGE APPLICATION AS A MANAGEMENT STRATEGY IN SHRIMP HATCHERIES

**I. Karunasagar**, S.K. Girisha, M.N. Venugopal, and M. Biswajit

14:00-14:20      INDUCERS OF HEAT SHOCK PROTEIN 70: A NEW DISEASE PREVENTIVE OPTION IN AQUACULTURE PRODUCTION SYSTEM

**K. Baruah**, P. Norouzitallab, P. Sorgeloos, and P. Bossier

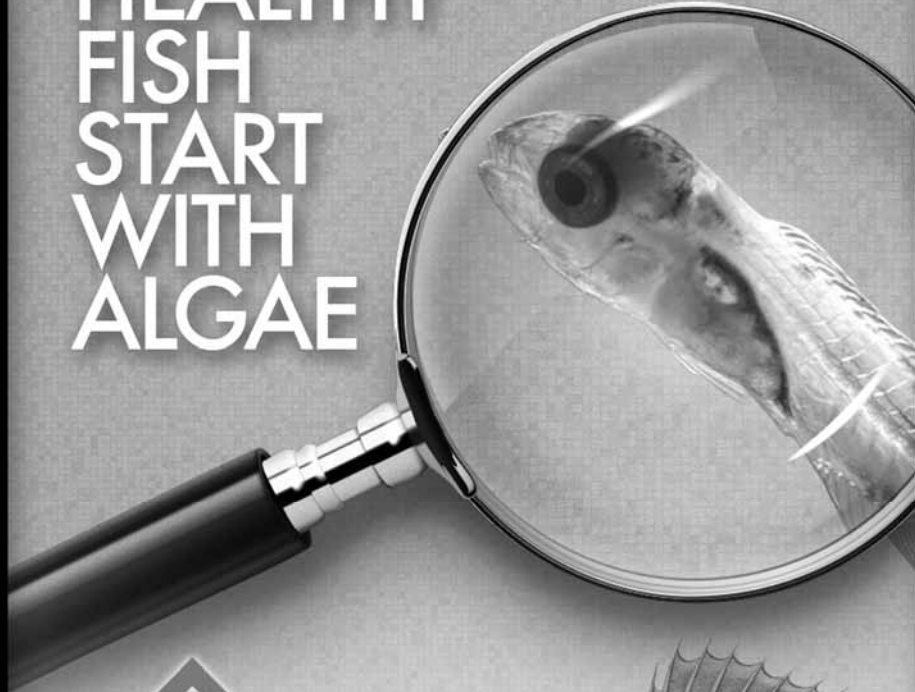
14:20-14:50      **Coffee Break and Removing Posters**

*Chairperson: Synnøve Helland*

14:50-16:00      **Concluding Remarks and Closing Session**

20:00-...        **Banquet**

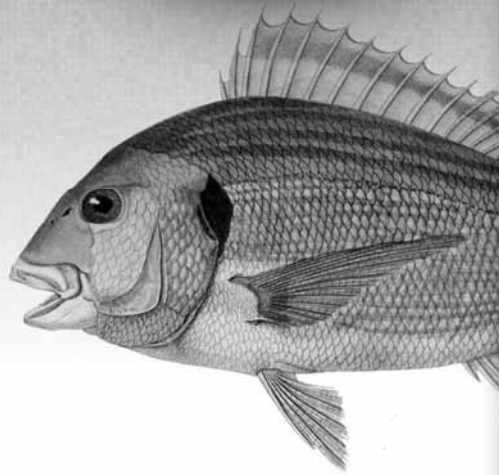
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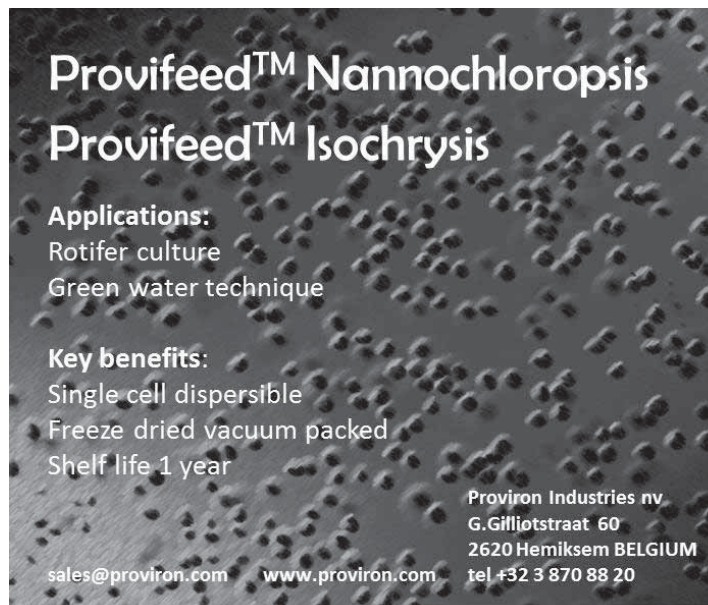
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*A solid tradition in a dynamic region*

Founded in 1817 as a Latin-speaking State University by William I, King of the Netherlands, Ghent University is a relatively young university. After its independence in 1830, the Belgian State was in charge of the administration of Ghent University; French was the new official academic language. In 1930 Ghent University became the first Dutch-speaking university in Belgium. The Decree of 1991 assigned great autonomy to the university.

Over the years eminent scientists such as Joseph Plateau (physicist, considered as a pioneer in the development of motion pictures), Leo Baekeland (inventor of Bakelite) and Corneel Heymans (Nobel Prize winner in Medicine) studied and worked at Ghent University.

With a view to cooperation in research and scientific service, numerous research groups, centres and institutes have been founded over the years. Several of them are renowned worldwide, in various scientific disciplines such as biotechnology, aquaculture, microelectronics, history,...

Located in Flanders, the Dutch-speaking part of Belgium and the cultural and economic heart of Europe, Ghent University is an active partner in national and international educational, scientific and industrial cooperation.

Because it plays a leading role in the academic and scientific world, Ghent University attaches great interest to a transparent organization structure, a dynamic human resources policy, an active environmental policy, its support to spin-offs and other new initiatives, ...

Nowadays, Ghent University (UGent) is a full-fledged university: Bachelor's, Master's and Doctorate Degrees can be obtained in practically all fields of study. It also organizes postgraduate, Open University and continuing education courses. With about 140 academic departments, 38,000 students and 7,100 staff members, Ghent University is an open, committed and pluralistic university with a broad international perspective and one of the leading institutions of higher education and research in the Low Countries. More detailed information about Ghent University can be found in the booklet in your conference bag.



Panoramic view of Ghent with some important University buildings: 1 Ufo – University forum, 2 Faculty of Economics and Business Administration, 3 Student restaurant De Brug, 4 Book tower of the central library, 5 Ledeganck – Faculty of sciences with botanical garden, 6 Blandijn – Faculty of Arts and Philosophy, 7 Plateau & Rozier – Faculty of Engineering and Architecture, 8 Observatory Armand Pien, 9 Thermanal – student house, 10 University hospital and Faculty of Medicine and Health Sciences, 11 Student dormitory Boudewijn

## **BELGIUM: CHARACTER AND CULTURE**

### **Introduction**

There's just something about Belgium. Maybe it's the friendly & welcoming people who with three official languages still find it easy to converse in English, the 4th unofficial language. Maybe it's the stunning architecture decorating the quaint cobblestone squares. Or perhaps it's the incredible cuisine found in the vast array of restaurants where each meal seems better than the last. Energetic and carefree, the overall mood in Belgium is infectious, summoning in all of us to live as Belgians and enjoy life to the fullest.

Well situated between France and Holland, the kingdom of Belgium encompasses all the best that Europe has to offer in an area no bigger than Maryland in the USA. Within the span of one day you can take a romantic cruise down a canal in Bruges, hunt for diamonds in Antwerp, enjoy waffles on the beach in Oostende, frolic in a festival in Binche, get lost in a castle in Namur, discover antiques at an outdoor market in Liege, and explore a fine art museum in Brussels. A dense train network connects all of Belgium and makes navigation simple and comfortable for travelers.

Often called the *Essence of Europe*, Belgium is both multicultural and multilingual. Flanders in the north, a flatland criss-crossed by canals, is proud of its medieval art cities, Antwerp, Bruges and Ghent. To the south in Wallonia, you will find the rolling hills of the Ardennes, countless castles, and the cities of Liège, Namur, and Tournai. The city of Brussels is one of the world's great cosmopolitan capitals, home to both the European Union and NATO, as well as a wealth of international trade and finance companies.

Belgium's history has always been linked to both commercial and cultural exchange, and much of its character is due to its role as the great meeting place of Western Europe. It would be difficult to name a European country who didn't want to stake their claim in Belgium at one time or another. Traces of the Austrians, Spanish, French and Dutch can still be seen in its architecture and in the lifestyle of its people. You will see superb examples of art and architecture past and present - Romanesque, Gothic, Baroque, and Art Nouveau.

Somehow, Belgium has maintained a low-key approach to all of this international sophistication. It is a country for connoisseurs, but connoisseurs who do not take themselves too seriously. Because the Belgians themselves certainly do not.

## **Eating**

Belgian cuisine is held in high regard worldwide, and in Europe at least is seen as second only to French in quality – indeed many feel it's of equal standing. For such a small country there's a surprising amount of provincial diversity, but it's generally true to say that pork, beef, game, fish and seafood, especially mussels, are staple items, often cooked with butter, cream and herbs, or sometimes beer, which is, after all, the Belgian national drink.

Belgian chefs are eclectic, dipping into many other cuisines, especially those of the Mediterranean, and also borrowing freely from across their own country's cultural/linguistic divide.

More traditional and commonplace dishes include:

### **Paling in't groen**

Eel in a delicious green herb sauce.

### **Asparagus "the Flemish Way"**

White asparagus served with a creamy sauce and eggs.

### **Stoverij or Carbonnades**

A beef stew cooked in Belgian dark beer.

### **Croquettes of North-Sea Shrimp**

A delicious cocktail snack or as an appetizer.

### **Filet Americain**

Raw beef with several secret ingredients. A must for the daring traveler.

### **Mussels & Fries**

Mussels are cooked in a variety of ways.

### **Oliebollen or Smoutebollen**

Fried pastry served hot at fairs & festivals. Children of any age adore them.

### **Speculoos**

Delicious cookies made throughout the year (but especially in December) in various shapes, available at good bakery shops.

### **Tomatoes Stuffed with North-Sea Shrimp**

Often served as appetizer, simply delicious.

### **Waffles**

From a street vendor or in a gourmet restaurant - a must have!

### **Waterzooi**

This soup-as-a-meal dish, with chicken or sometimes fish, is a delicacy from Ghent.

### **Belgian Fries**

Freedom fries, chips, or frites – whichever name you prefer to use – they’re Belgian! And we take this responsibility very seriously. Made with Belgian *Bintje* potatoes, cooked twice and served in a paper cone with a side of mayonnaise, they embody potato perfection. A favorite place to sample our fries are at *frietkots* or *fritures*, which are outdoor vendors who sell – you guessed it – Belgian fries. There are more than 4000 *frietkots* throughout Belgium and many carry a selection of over 50 dipping sauces to choose from. Whether enjoyed at a three star Michelin restaurant or right off the street, this Belgian specialty is not to be missed.

### **What’s in a Name?**

Fries are part of Belgian culinary and cultural heritage. Even if they are sometimes referred to as French Fries there is nothing French about them. Apparently the name originated due to a linguistic misunderstanding, because in old English ‘to French’ meant ‘cut into sticks’



A typical Belgian “frietkot”

### **Belgium for Chocolate Lovers**

Belgian chocolate has been the food of champions, a lure for lovers, the indulgence of the rich and later, the favorite of the masses.

Belgium produces 172,000 tons of chocolate per year with more than 2,000 chocolate shops throughout the country.

A beautifully sculpted chocolate shell conceals a center of filling which explodes with a surprising texture and flavor in your mouth. Many chocolatiers still make their pralines by hand. Every town and even small villages have chocolate stores with luxurious pralines.

### **Cuberdons – typical Ghent sweets (to be tasted at the opening reception)**

Cuberdons or neuzekes (little noses) are probably Ghent's most known sweets. These dark red triangles have been around since 1870. The little cones are made of sugar, arabic gum and raspberry syrup. They are liquid on the inside and have a saccharified outside. At the Groentenmarkt, the street stall of confiserie Geldhof sells these goodies on a daily base. The reason why you don't see (the authentic) cuberdons abroad is because they only have a short shelf life.



## Drinking

### **"Beauty lies in the hands of the beer holder." - Anonymous**

Beer in Belgium varies from pale lager, lambic beer, Flemish red to dark brown. There are approximately 178 breweries in the country, ranging from international giants to microbreweries, producing over 400 varieties

Beer in Belgium dates back to the age of the first crusades, long before Belgium became an independent country. Under Catholic church permission, local French and Flemish abbeys brewed and distributed beer as a fund raising method. The relatively low-alcohol beer of that time was preferred as a sanitary option to available drinking water. What are now traditional, artisanal brewing methods evolved, under abbey supervision, during the next seven centuries. The Trappist monasteries that now brew beer in Belgium were occupied in the late 18th century primarily by monks fleeing the French Revolution. However, the first Trappist brewery in Belgium (Westmalle) did not start operation until 10 December 1836, almost 50 years after the Revolution. That beer was exclusively for the monks and is described as "dark and sweet." The first recorded sale of beer (a brown beer) was on 1 June 1861.

### **Trappist beers**



The rare to find yellow, blue and green cap Westvleteren beers.

The brewing of Trappist beers takes place in Trappist monasteries. For a beer to qualify for Trappist certification, the brewery must be in a monastery, the monks must play a role in its production and the policies and the profits from the sale must be used to support the monastery and/or social programs outside. Only eight monasteries currently meet these qualifications, six of which are in Belgium, one in the Netherlands and one in Austria. Trappist beer is a controlled term of origin: it tells



where the beers come from, it is not the name of a beer style. Beyond saying they are mostly top-fermented, the beers produced by the Trappist have very little in common stylistically.

The current Belgian Trappist producers are Achel, Chimay, Orval (sells a "unique" dry hopped 6.2% amber beer), Rochefort, Westmalle, Westvleteren.

### **Abbey beers**

The designation "abbey beers" (Bières d'Abbaye or Abdijbier) originally applied to any monastic or monastic-style beer. After introduction of an official Trappist beer designation by the International Trappist Association in 1997, it came to mean products similar in style or presentation to monastic beers.

What connoisseurs now recognize as Trappist breweries began operations in 1838. Several French monasteries, however, maintained "working" breweries for 500+ years before the French Revolution (1789–1799) disrupted religious life across the northern French province of Wallonia. Even then, some Abbey beers such as Affligem Abbey, whose name now appears on beers made by the Heineken-owned Affligem Brewery, resumed brewing from "working" monasteries until the occupation of most of Belgium in World War I. Commercial Abbey beers first appeared during Belgium's World War I recovery.



Augustijn and Augustijn Grand Cru, abbey beers brewed by Brouwerij Van Steenberge

Although Abbey beers do not conform to rigid brewing styles, most tend to include the most recognizable and distinctive Trappist styles of brune (Belgian brown ale, aka dubbel), strong pale ale or tripel, and blonde ale or blond. Modern abbey breweries range from microbreweries to international giants. As of 2011 eighteen certified Abbey beers existed (Affligem, Grimbergen, Leffe,

## Most popular Belgian beer types

### Amber ales

These are beers similar to the traditional pale ales of England, although somewhat less bitterly hopped. A notable example is the 5% abv De Koninck brand, with its distinctive spherical glasses (called 'bollekes'). It is popular in its native city of Antwerp. Another is Palm Speciale. Some, such as Vieux Temps (nl), were based on British styles to please troops stationed in Belgium during World War I. Others were introduced by the UK-born brewer George Maw Johnson in the late 19th century. A very strong ambrée is brewed by "Bush" (Dubuisson), another brewery influenced by British styles.



Duvel, a typical blond Belgian ale

### Blonde or golden ale

These are a light variation on pale ale, often made with pilsner malt. Some beer writers regard blonde and golden ales as distinct styles, while others do not. Duvel is the archetypal Belgian blonde ale, and one of the most popular bottled beers in the country as well as being well-known internationally. Its name means "Devil" and some other blonde beers follow the theme—Satan, Lucifer and Judas for example. The style is popular with Wallonian brewers, the slightly hazy Moinette being the best-known example. Chouffe can be considered a spiced version (with coriander).

### Dubbel

Dubbel (double) has a characteristic brown colour. It is one of the classic Abbey/Trappist types, having been developed in the 19th century at the Trappist monastery in Westmalle. Today, some commercial brewers using abbey names call their strong brown beers "Dubbel". Typically, a dubbel is between 6 and 8%

abv. In addition to the dubbels made by most Trappist breweries, examples include St. Bernardus Pater, Maredsous 8 and Witkap Dubbel. Dubbels are characteristically bottle conditioned.

### Flemish Red

Typified by Rodenbach, the eponymous brand that started this type over a century ago, this beer's distinguishing features from a technical viewpoint are a specially roasted malt, fermentation by a mixture of several 'ordinary' top-fermenting yeasts and a lactobacillus culture (the same type of bacteria yoghurt is made with) and maturation in oak. The result is a mildly strong 'drinking' beer with a deep reddish-brown colour and a distinctly acidic, sour yet fruity and mouthy taste.

### Lambic beers (including Gueuze and Fruit Lambics)

Lambic is a wheat beer brewed in the Pajottenland region of Belgium (southwest of Brussels) by spontaneous fermentation. Most modern beers are fermented by carefully cultivated strains of brewer's yeasts; Lambic's fermentation, however,



Spontaneous fermentation at Timmermans brewery

is produced by exposure to the wild yeasts and bacteria that are said to be native to the Zenne valley, in which Brussels lies.

The beer then undergoes a long aging period ranging from three to six months (considered "young") to two or three years for mature. It is this unusual process which gives the beer its distinctive flavour: dry, vinous, and cidery, with a slightly sour aftertaste.

Lambic can be broken into three subclasses: Gueuze, Fruit Lambic, and Faro. The first of these, gueuze, blends both old and young mixtures to stimulate a second fermentation. In its most natural form, Lambic is a draught beer which is rarely bottled, and thus only available in its area of production and a few cafes in and around Brussels. Fruit beers are made by adding fruit or fruit concentrate to Lambic beer. The most common type is Kriek, made with sour cherries. The



last of the Lambic brews, Faro, is lambic with sugar or caramel added to prompt the fermentation.

Oude Kriek - artisanal and unsweetened cherry beer

### Pils or pale lager

This style makes up the bulk of beer production and consumption in Belgium. Belgian Pilsners are not particularly distinctive or renowned by connoisseurs. The top brands include Jupiler and Stella Artois (both brewed by Inbev), Maes pils and Cristal (both brewed by the Alken Maes branch of Heineken). Stella Artois, originating in Belgium, is distributed globally.

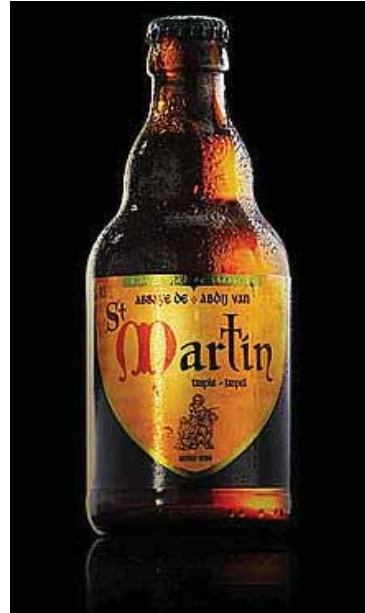
### Strong ale

Beers above 7%, such as tripels or strong dubbels, may be referred to in some sources as Belgian strong ale, and this is a style name used by American brewers influenced by the Beer Judge Certification Program, though is not a name used by Belgian breweries.

## Tripel

Tripel is a term used originally by brewers in the Low Countries to describe a strong pale ale, and became associated with Westmalle Tripel. The style of Westmalle's Tripel and the name was widely copied by the breweries of Belgium, then the term spread to the USA and other countries. Gulden Draak was awarded the best-tasting beer in the world in 1998 by the American Tasting Institute (now ChefsBest).

With 9% abv, Abbaye de Saint-Martin is a widely exported tripel Belgian ale.



## White or wheat beer

This type of beer, commonly called witbier in Dutch, bière blanche in French and wheat beer in English, originated in the Flemish part of Belgium in the Middle Ages. Traditionally, it is made with a mixture of wheat and barley. Before hops became widely available in Europe, beers were flavoured with a mixture of herbs called gruit. In the later years of the Middle Ages, hops were added to the gruit. That mixture continues today in most Belgian/Dutch white beers. Some notable current examples are Hoegaarden, Celis White, Blanche de Namur and Watou's Wit. Their alcohol strength is about 5-6 percent ABV, and these beers can be quite refreshing, especially during the warm summer months. The herb mixture traditionally includes coriander and bitter orange peel, among other herbs.

At the opening reception you can taste 3 different Belgian beers:

		
<p><b>Gruut White (5%)</b></p> <p>Gruut White beer is very aromatic with a fragrant fruity smell and a slightly herbaceous sharpness. The body is light, but soft; Thanks to the spices, the flavors are ‘round’, very fine and complex. The first impression is a spicy dryness, but there is also an underlying slight, creamy sweetness.</p>	<p><b>Gruut Amber (6.6 %)</b></p> <p>Gruut Amber Ale has an amazing rich taste, a deep copper colour and a smooth drink-ability and when using the typical open glass, you will see a fabulous head, discover its deep copper color and capture its delicate aroma.</p>	<p><b>? (6.5%)</b></p> <p>A mystery blonde produced at a micro-brewery specifically for Larvi 2013</p>

## **FLANDERS:**

### **TRADITIONAL YET TRENDY**

Flanders lies to the north of France, the east of Britain and the west of Germany. It is the northern part of Belgium. The most important cities and population centers of Europe - London, Paris, Amsterdam, Cologne, Frankfurt - are all situated within a radius of less than 300 km around Flanders' capital, the multilingual and international city of Brussels.

Ever since the Middle Ages, Flanders has been at the crossroads of the great European trade routes. Flemish merchants swarmed out to every corner of the then known world. Foreign merchants, bankers and artists came to Flanders endowing the magnificent Flemish cities with even more prosperity and cultural vitality. Flemings speak Dutch (not Flemish, which is not a language) and can look back on an illustrious past with culture, art, world famous painters and rebellious citizens. Flanders is the first region that saw citizens reclaiming individual rights from their kings and lords, thus reintroducing democracy to the West after Rome's fall. With many of its citizens (back then considered to be Southern Dutch) involved in the establishment of New Amsterdam, Flanders' core values of entrepreneurship, vocal citizenry and hard work strongly influenced the settlement of the US. Although at the heart of Europe and Europe's most globalized region, Flanders with its capital Brussels, is still a well kept secret. It is home to top contemporary & historical art, architecture (Art Nouveau), fashion designers, scientists, performers and to some of the most popular beers and foods...

#### **Population**

Flanders accounts for 60% of the total Belgian population. Its people and companies produce 70% of the Gross Domestic product of Belgium (and thus of its tax income) and 80% of all exports from Belgium. Flanders, and thus Belgium, is an open economy, well integrated into the world's global trade system. Flemings want to go forward in life. Their aim is prosperity and well-being for everyone. They are hardworking entrepreneurs, highly educated researchers and multilingual employees. Whatever they do, they always want to do it in the best possible way. Flemings strive for quality and attach great importance to efficiency and result orientation, though not at the expense of others.

The people of Flanders also like to enjoy life: they are often referred to as ‘loving the Burgundian life’ (in memory of Flanders heyday as Burgundy’s main stay of power), with great foods, beers, comfortable homes, and Flemish masters in their museums. On the other hand, they are accustomed to affordable medical care for everyone and to one of the highest levels of education in the Western world. To be able to participate in the rich Flemish social life, that includes the use of the extensive social, cultural and leisure facilities and easy accessible sports centers, is essential for Flemings.

While Flemish people are certainly receptive to the world, they have had to fight to maintain their own culture and language, pressured by their much larger and often very aggressive French, British and German neighbors. They realize much of their strength has to do with the constant interaction between their own ideas and traditions and those of neighboring (and other) peoples and cultures. They regard intercultural contacts and multilingualism as enrichments to their identity, but also demand respect for their language and culture. Look at the map! Flanders is like the ‘little engine that could’ between the three main behemoths of Europe’s often tragic history. Its location made it the main battle field of Europe. After World War I, a strong pacifist and emancipative movement started from its trenches. In Flanders fields, much of Europe’s past madness lays buried...

## **Politics**

Through peaceful and democratic reforms, Flemings were able to transform Belgium from a unitary, initially French-speaking country into a federal, multilingual state. It now has strong Regions (Flanders, Wallonia and Brussels capital) and Communities (Dutch and French speaking). Federalization began in the 1970’s and is an ongoing process. In this federal constitutional system Flanders has its own legislative and executive powers, including broad and exclusive, domestic and foreign responsibilities in the fields for which Flanders is competent, such as trade, investment, economy, innovation, culture, education, research and many others.

In all these, Flanders outlines its own policies and acts as an equal partner to foreign governments; it has treaty-making power and is not subsidiary to the federal level. Flanders has signed agreements with several states and regions both in Europe and around the world. Moreover, with its own policy for international development cooperation, Flanders assumes its responsibility towards developing countries. Flanders’ capital, Brussels, is also the capital of the federal state Belgium and of the European Union. Brussels is part and parcel of the international political, economic



and cultural stage. Bearing in mind that it has a multicultural and multilingual population, it is not surprising that many of Brussels' streets and squares have a decidedly international atmosphere.

## **Economics**

Flanders is central within Europe and is its most globalized region. It owes this position to its location smack in the middle of Western Europe's most advanced and industrialized area. The economy of Flanders is characterized by its high productivity. In Belgium Flanders accounts for 70% of the total GNP and tax income. Furthermore it produces high quality products at the right price. These products are mostly exported to the international market. Flanders represents 80% of all Belgian exports. An important advantage is the high level of education and multilingualism among its graduate and professional population. It has an extensive system of social consultation at its disposal.

Throughout history, Flanders has always been a very important link in the European economy. The Flemish textile industry was crucial for the economic wellbeing of The Low Countries through the ages. Nowadays the textile and carpet industry still plays a prominent part, together with the petrochemical, car assembly, diamond and metalworking industries.

Flanders has an excellent transport network. Next to a vast motorway and railway network, it has miles of navigable waterways. Antwerp, often dubbed Flanders' economical capital is the second largest port in Europe and one of the largest in the world. Its port possesses one of the biggest docklands of Europe. Next to the port of Antwerp, the seaports of Zeebrugge, Ghent and Ostend are also of major economic importance.

Brussels Airport (just outside of Brussels, in Zaventem) ensures Flanders is easily accessible for the traveler. It attracts many corporate headquarters and logistics & distribution companies. This area has been renamed Flanders Airport Area (FAA). Flanders works continuously at maintaining an innovative information economy. Every year, Flemish universities turn out qualified professionals and first-rate researchers. The top Flemish priority is an on-going cooperation between university centers, the government and trade and industry. Flanders' research centers and universities are leaders in bio-and plant technology, micro-and nanoelectronics, multimedia or information technology.

## THE CITY OF GHENT

### History

It is in Flanders and Italy that the first major towns emerged. Medieval Ghent developed in the shade of the impressive Castle of the Counts and was bordered by Flanders' two most powerful abbeys, St. Peter's and St. Bavo's. Thanks to its production of famous luxurious cloths, which were exported all over Western Europe and Northern Africa, Ghent becomes by far the largest and most populous city in Flanders, a city of European significance and north of the Alps surpassed only by Paris.

Ghent performs spectacular arts of freedom at the most important times in history, which always meet with fierce oppression. They express the permanent opposition of a large community, challenging forces much stronger than its own. Medieval Ghent is at one time Anglophile and at another Francophile, depending on a social dialect of its own, which always clashes with the Count of Flanders. Ghent obstinately plays France off against England, using both superpowers according to its own economic and political interests. To this end, Ghent enters into agreements against the foreign tyranny with other Flemish municipalities. In his distich Dante clearly shows insight in this mechanism when he warns Philip the Fair of France, who is planning to invade Flanders: "But if you conquer Douai, Ghent, Lille and Bruges, a fierce revenge awaits you". Ghent stubbornly hatches the uproar against the Burgundian dukes. Although born and growing up in Ghent until the age of 20, emperor Charles the Fifth was humiliated by his fellow townsmen at the peak of his power.

Ghent is republican and Calvinist in the era of triumphant catholic contra-reformation and of Spanish absolutist monarchy. Ghent is anti-French from its resistance against Louis XIV until the Napoleonic period; it is no coincidence that the city accommodates the routed king Louis XVIII during the Hundred Days. Furthermore, the Duke of Wellington takes up his quarters in Ghent on his way to Waterloo.

Ghent remains loyal to the House of Orange during the Belgian Revolution because of the Dutch colonial markets. But after having regained its industry and passage to the sea, the 19<sup>th</sup> century Ghent suddenly finds itself amidst a paupered proletariat of workers. Consequently, Ghent fights on the barricades for social emancipation.

## General impression

In the centre of Flanders, Ghent is one of the nicest towns in Europe with its historical heritage and its countless attractions. Ghent has more classified monuments than any other city in Belgium.

Visiting Ghent means strolling through European history and being enthralled by an interesting history moving between fierce intrepidity on the one hand and modest artistic sophistication on the other. It is here that the unsurpassed altarpiece “The Mystic Lamb” is painted. But at the same time there are sharp contrasts between the sumptuous lifestyle of a prosperous class of entrepreneurs and the characteristics of a densely populated town of factory workers. This is the way Ghent should be looked at: raw and also full of grace, surly and aristocratic too: the characteristics of the numerous preserved monuments and rich art and culture.



Ghent artists and scientists have spread their city’s fame throughout the world. Inhabitants of Ghent were Hugo van der Goes, Pedro de Gante, Jean-Baptiste Loeillet, Victor Horta, Maurice Maeterlinck, Jean Ray, Karel and Gustave van de Woestijne, Georges Minne, Adolphe Quetelet, Joseph Guislain, Leo Baeckeland (inventor of the bakelite), Corneel Heymans (Nobel price winner), George Sarton.

Present-day Ghent still is an uncommonly fascinating city, “one of the most beautiful historic cities in Europe”, as François Mitterand said during his visit in

1983. The high level of cultural life is maintained and Ghent is one of the few Belgian cities where artistic initiatives have an international aura.

That is not limited to the festival of Flanders or the Floralties or the International Film Festival or the Municipal Museum for Contemporary Art (The "SMAK"). The entire current art scene is vivid and creative. It feels on top of the world in the shade of the masters, whose works are carefully preserved in the Museum of Fine arts and St.-Bavo's Cathedral

### Things to see

Ghent has more classified monuments than any other city in Belgium.

The superb **St Bavo cathedral** is very characteristic with its successive architectural styles: romanesque, gothic, late-gothic and baroque. It contains one of the most renowned paintings in the world, the "Worship of the Mystic Lamb" by Jan van Eyck (1432), which is considered as the summit of the Flemish painting in the XVth century. The cathedral also owns a masterpiece of P.P. Rubens, "St Bavo's Entry into the Monastery" from 1623.

In 1180, the imposing **Count's Castle** ('t Gravensteen, St Veerleplein) was built by Philip Alsace to counterbalance the power of the burghers. Since the XIVth century it has lost its military purpose and was used as mint, court of justice, prison and cotton mill. The medieval castle includes crypts, dungeons, cells and torture rooms. The panoramic views from the keep are wonderful. One of the most brilliant historical monuments of Ghent is the **Belfry** (St Baafsplein) erected in 1300 as a tower of the borough to safeguard the obtained charters. The tower with its carillon and bells museum can be visited. The new **Ghent Stadshal** has been located at the Emile Braunplein since 2012. Long before it was finished, or even started, the building was controversial. Many people in Ghent don't like the look of the building, which is a square under cover. It was given all kinds of nicknames, including monstrosity and sheep pen. The comparison to a stable is not actually completely off the mark. The architect's intention is to refer to medieval market halls and the roof construction imitates the gables of the town hall next door. It's hard to establish if the building is an improvement to Ghent city, but it's obvious the steel and glass construction doesn't seamlessly blend into its surroundings. The Stadshal houses a semi subterranean bar, public toilets and an underground bicycle parking facility



The newly-built town hall ("sheeps pen")

The oldest part of the **Town Hall** (Botermarkt) is in late-gothic style. Each room has its own history and therefore it is advisable to join a guided visit.

The **St Nicolas church**, built between the XIIIth and the XVth century, is the most remarkable illustration of the gothic style in the Scheldt region (Korenmarkt).

The frontages of the small houses of the **Graslei and Korenlei** (Grass and Corn quay) reflecting in the river Lys (Leie), seduce all visitors. The whole town is rightly proud of this site. Each frontage reminds of the intense trade activities by the ancient Guilds. The most nicely indented frontages can be found in the old port of Ghent (Graslei, Korenlei and Hoogpoort) or in Patershol quarter (Oudburg). **St Michael's** is the most imposing bridge in Ghent. It offers an unforgettable sight on the two quays and the famous succession of Ghent's towers: the St Nicolas church, the Belfry and the St Bavo cathedral.

The numerous monasteries and convents in Ghent are real heavens of peace. The former monastery of the Dominicans "Het Pand" is impressing. Presently, it belongs to the Ghent University and is used as a cultural centre.

## Museums

The **Museum of Fine Arts** owns an overwhelming collection of classical and modern art: paintings, sculptures and drawings. The Flemish school is well represented. At the same address, you find the **Museum of Contemporary Art** (The "SMAK") with a rich collection of figurative art by Belgian and foreign masters of the XXth century. The **Museum of Ornamental Art** (Jan

Breydelstraat 5) displays beautiful antique furniture in adapted surroundings. The **A. Vander Haeghen Museum** (Veldstraat 82) is famous for its Chinese drawing-room with walls entirely recovered with Chinese coloured silk of the XVIII century. The **Michel Thierry School Museum** housed in the St Pieters monastery (St Pietersplein 14) has grown out into a unique museum in Europe. It is divided into several parts assigned to the different school subjects (geology, mathematics...). Life in Ghent at the beginning of this century is truly rendered in the 18 small houses of the “**Huis van Alijn**” (formerly Folklore Museum) in the heart of the Patershol quarter (Kraanlei 65). **The STAM – City Museum Ghent**, town's most modern museum will take you on a journey through eight centuries of Ghent history. In an entertaining and lighthearted manner you will encounter Ghent's rich history in three different groups of buildings, which are all very attractive. For centuries the former abbey, which houses the STAM, was hidden behind high walls. If this is your first visit to the city, you can get truck loads of relevant information here, which will liven up your visit even more. A gigantic aerial photograph of the city, which is dozens of metres in size and projected onto a mirror floor, is in itself reason enough to visit STAM.



The STAM City Museum Ghent

## Ghent Shopping

A walk through the old centre is very rewarding: you are drawn back in the atmosphere of the Flemish trade-towns of the Middle-ages. The first shops were situated in the centre of the borough, nowadays most of the better trades are still centred there. In the Kouter, Veldstraat, Brabantdam, Langemunt, Kaasmarkt, Vlaanderenstraat, you can admire the windows of the shops where jewellery, perfumes, antiques, lace, delicacies, fashion-clothes... are sold. At night, Ghent is very animated in neighbourhoods such as the three towers with the Patershol, Groentenmarkt, Korenmarkt and St Baafsplein or the surroundings of the St. Pieters railway-station. To mix with the lively crowds in the markets, you have a large choice: the fruit and vegetables market at the Groentenmarkt during the week. On the same square, but on Sundays, there is a market for artisans. Ghent is famous for its flowers: azaleas, rhododendrons, begonias... During the XVIIIth century, the Kouter was a favourite where-about of the good Ghent people, and the flower-market was the major event on Sundays. It still exists, without interruption since 1772. Sunday morning, the birds market is full of twittering (Vrijdagsmarkt) and other pets are found a little bit further (Oude Beestenmarkt). In the week-end, the flea-market (Beverhoutplein) attracts many.

## Ghent highlights you shouldn't miss

### Gravensteen Castle

Also known as the Castle of the Counts, this forbidding, gray fortress was built by the count of Flanders, Philip of Alsace, in 1180. The castle contains a crypt, a dungeon, a court museum and an exhibition of historical weapons and armor.



### St. Bavo Cathedral & Ghent Altarpiece

This beautiful cathedral combines Romanesque, high Gothic and late Gothic architectural styles but is best known for housing the 15th century polyptych, *Adoration of the Mystic Lamb*.



**The Mustard Store**

Offering more of a bite than its Dijon cousins, the mustard of Ghent at Tierenteyn has lured gourmets since 1790. Locals swear by it!



**Stadhuis (City Hall)**

Built partly in flamboyant Gothic style and partly in Renaissance style, it is a witness of the architectural development in Ghent during the 16th century. Each of the magnificent halls has its own identity.



**St Peter's Abbey**

Organizes cultural & historical exhibitions in the Abbey of St. Peter, one of the most beautiful monuments in Ghent, including a secluded garden and vineyard.



**Groot Vleeshuis**

Formerly the city's meat house, it has been converted into a one-stop showcase for the region's most delectable specialties. Country hams hang from the rafters slowly curing in the cool air while raw-milk cheeses, gift boxes of pralines, and six packs of living beers tempt your palate.



**The Graslei and Korenlei Rivers**

The elegant facades along these waterways reflect different periods in history through architectural style. Both open and covered boats are available for sightseeing tours day or night.





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