Bord Iascaigh Mhara
Irish Sea Fisheries Board

Aqua Culture

Newsletter from B.I.M.

Issue No. 60 July 2007.

Jason Whooley takes up his position as Chief Executive of BIM

Jason Whooley was appointed chief executive of Bord Iascaigh Mhara (BIM) in May 2007, and took up his post on 1st July. A native of Aughadown, Skibbereen, in West Cork, Jason is a graduate of University College Cork (UCC), where he was awarded a Bachelor of Commerce degree in management and marketing.

Prior to his appointment at BIM, Jason was chief executive of the Irish South and West Fish Producers' Organisation, a post he held for 11 years. In this capacity, and in collaboration with other representative organisations, he played a leading role in representing the interests of Irish fishermen both at National and European level. This key position allowed him to develop an extensive knowledge and experience of the fishing industry, attributes he now brings to his new role in BIM.

The recent Strategy for a Restructured, Sustainable and Profitable Irish Seafood Industry has been approved by the Irish Government and incorporated into the National Development Plan 2007-2013. As chief executive of BIM, Jason will be instrumental in the implementation of this strategy, which addresses the many challenges and opportunities facing the industry in the years to come.

Jason Whooley new CEO of BIM

Inside

BUSY COUNTDOWN FOR 2007 WORLD SEAFOOD CONGRESS

BIM will co-host the 2007 World Seafood Congress (WSC), a prestigeous event for the international seafood, food safety and health sectors.

500-plus delegates are expected to attend Dublin's Croke Park Conference Centre from 25-27 September next to participate in the Congress programme which will be dominated by the core themes of seafood and health benefits; nutrition and well being; trade and market access; seafood standards and assurance initiatives.

The Congress will offer a conference as well as an exhibition titled "Innovation in the Seafood Industry."

Commenting on the Congress, BIM Manager and Congress moderator, Donal Maguire said: "It is all systems go at this stage as we successfully implement months of planning for this very sizeable event.

Sponsorship support for the Congress has been strong. We are offering a superb programme as well as an excellent speaker line-up. Delegate and exhibitor registration for the Congress continues apace as we attract support from a global audience.

"BIM is proud to be associated with this event which is an essential diary date for any seafood professional looking for informed debate and timely discussion on critical issues for the seafood industry worldwide. The Congress organisers are looking forward to offering Ireland a real opportunity to showcase our island nation to the hundreds of delegates from the global catching, processing, aquaculture and marketing industries."

BIM has partnered with Food Safety Authority of Ireland and Enterprise Ireland for the 2007 WSC. Ireland emerged victorious from a global trawl for the Congress' 2007 host country. The Congress was previously hosted in 2005 by Australia.

For further information on the World Seafood Congress, or to register for the event, access the World Seafood Congress www.worldseafoodcongress07.com

Welcome to the virtual world of aquaculture Simulation

Benan Dallaghan, BIM, writes:

Desktop virtual aquaculture (i.e. simulation) software components have been designed by Benen Dallaghan of BIM. These are to be integrated into the BIM UISCE (Carrying Capacity and Water Quality) desktop application that is scheduled for completion in September 2008. The aquaculture module will be coupled with water quality and shellfish growth functional components by MARCON Computations and will allow virtual aquaculture scenarios to be run using the latest software, hardware and computer modelling techniques. The functionality provided by the application has being designed using a model independent approach and specifically reflects the requirements of the Irish shellfish (Blue mussel and *gigas* oyster) aquaculture industries. The design has also being future proofed and can cater for submerged mussel technology, for example, industry representatives will be able to run 'what if' scenarios in this virtual aquaculture environment at little or no cost to growers.

Below are prototype screens showing how a virtual mussel lines can be entered to a bay. There are similar screens designed for bottom mussel and trestle oyster industries. In the example below, the screen variables reflect the parameters associated with mussel aquaculture. This information is geo-referenced and therefore productivity predictions will be site specific.

Using these screens the end user will be able to populate a bay in Ireland with mussel lines and run predictive functions to get an estimate of site-specific productivity. This has to be of great benefit to the industry and is the way of the future. The impact of a new site on adjacent sites can also be addressed using this module.

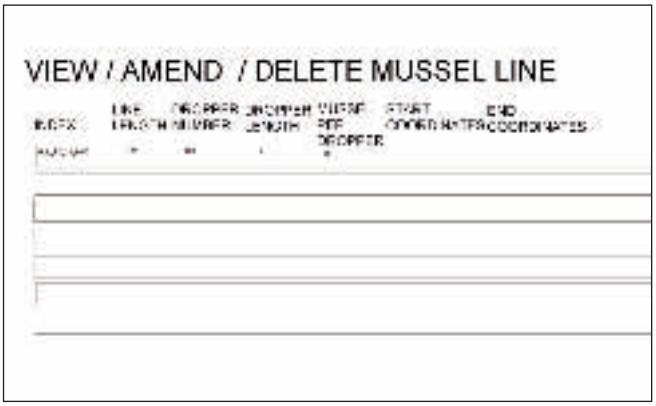
For more information on the software architecture and functional design for the project, please mail Benen on dallaghan@bim.ie

Screen 1 – Virtual mussel line input screen; there will be a number of screens designed to cater for the suspended mussel, bottom mussel and trestle oyster industries.

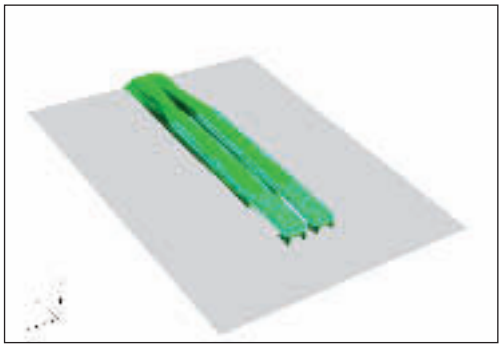
MUSSEL LINE CONFIGURATON SCREEN

LINE LENGTH	
NUMBER OF DROPPERS	
MUSSELS PER DROPPER	
START COORDINATES	
END COORDINATES	

Screen 2 – Virtual bay management screen.
Using this screen the end user can ADD, VIEW , AMEND or DELETE virtual mussel (and oyster) scenarios as required.



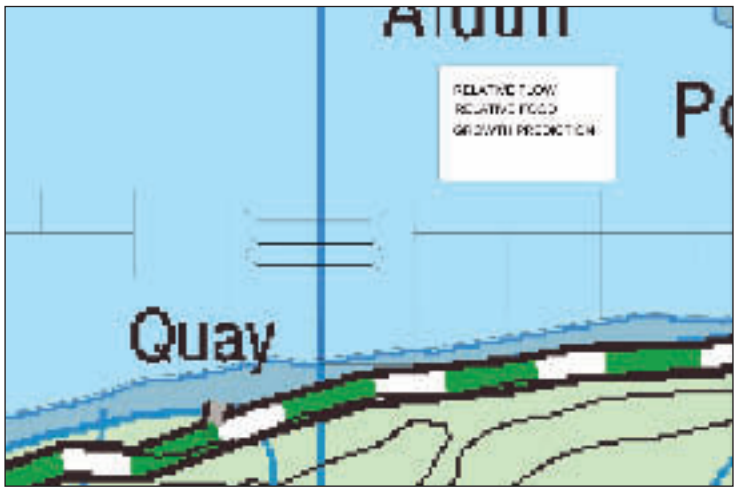
Screen 3 - A virtual oyster trestle depicting flow rates under certain tidal conditions, trestle height and orientation.
(Courtesy of C Newell & J Richardson)

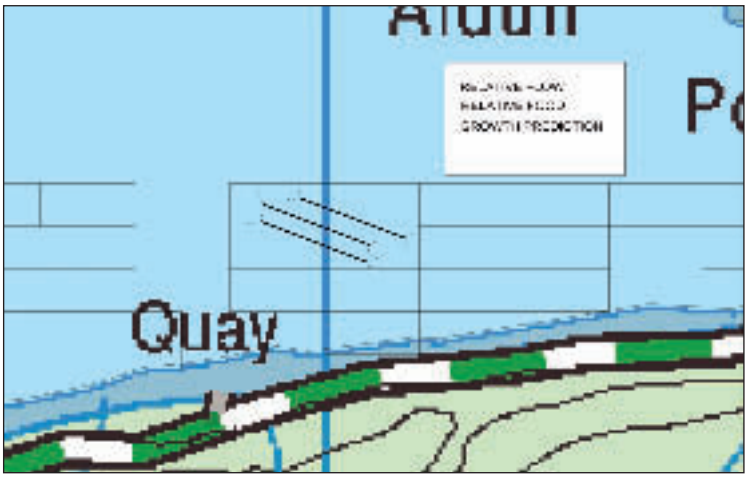


Screen 4 - Procedure for running a 'what if' scenario. Line reorientation in this example.

>Program the system to run 'scenario A'
>RUN simulation for 'scenario A'
>Reorient lines and RUN 'scenario B'
>Compare results for productivity; and assess changes in available food and flow

Screen 5 - Illustration of a 'what if' scenario. In this case, 'what if' we reorient the mussel lines. What are the flow and growth impacts for the grower in question.





BIM's Shellfish Carrying Capacity and Water Quality Modelling Project launches new name - U.I.S.C.E.

Brian O'Loan, BIM. reports

At an all partner meeting in Dublin June 11-12 June, BIM's Shellfish Carrying Capacity and Water Quality Modelling Project launched it's new name U.I.S.C.E., - *Understanding Irish Shellfish Culture Environments.* The new acronym encapsulates the goals of the program much better than the old title, as the program is all about attempting to understand the environment in which shellfish culture takes place in terms of: shellfish culture practice; structures used to support shellfish in water; shellfish growth; water quality, shellfish hygiene; farm and bay level impacts of shellfish culture, optimal shellfish production in terms of sustainable tonnage and ultimately economics with ultimately improved profits for shellfish growers.

The acronym came about at the end of a long day of intensive presentations and workshops on the first day of a two day all partner meeting in Dublin. Over the course of the meetings discussions on preliminary field data from the sampling program, sampling program design, historical datasets, data assimilation, application functions and end user requirements along with integration of models took place. In addition there was a presentation from Dr Suzanne Bricker National Oceanographic and Atmospheric Administration (NOAA) on the use of Assessment of Estuarine Trophic Status methodology (ASSETS)

The team resolved many of the difficulties that are encountered in such an ambitious project involving seven different modelling processes and ten different partner groupings. The pilot phase of the program will produce a desktop application that can model for different scenarios such as varying seeding densities, structure alignments, weather, culture practices, water quality and location of farms. The product will be used by industry and regulators to understand and manage better the culture of shellfish in Irish waters.

Left to Right: *Dr Tony Hawkins (Plymouth Marine Laboratory), Alan Berry (Marcon Computations International Ltd), Nicolas Chopin (BIM), Fergal O' Donncha (Martin Ryan Institute), Dr. Terence O' Carroll (BIM), Dr. John Richardson (Blue Hill Hydraulics, USA), Aodán de Paor (Compass Informatics Ltd), Dr. Carter Newell (Great Eastern Mussels Ltd, USA), Brian O' Loan (BIM), Benen Dallaghan (BIM), Dr. Suzanne Bricker, NOAA, USA, Prof. Joao Ferreira, IMAR, Portugal, Gearoid O' Riain (Compass Informatics Ltd.), Tomasz DaBrowski (Marcon Computations International Ltd) and Conor Delaney (Marcon Computations International Ltd). Dr. Rachel Cave (Martin Ryan Institute) and Dr.Brendan O' Connor (Aqua-Fact International Services Ltd.) were in attendance on Day 1 and are not in picture. Fabrice Richez (BIM) (photographer).*

Pectinid Workshop, Nova Scotia.

Geoff Robinson, BIM, reports

The 16th international Pectinid Workshop took place in Halifax, Nova Scotia between the 11th and 18th May.

As is typical at the Pectinid workshops the topics covered varied immensely ranging from gear selectivity and bycatch reduction, fisheries physiology, biology, genetics and aquaculture.

The main focus of the first few days was fisheries, gear selectivity, the effects of dredging and bycatch reduction. The areas covered by these topics included the northwest Atlantic, Mexico, Tasmania, New Zealand, the Isle of man and, last but not least, Ireland. Antonio Hervas, based in the BIM Galway office presented on the effects of the physical environment on scallop growth and abundance. This particular area could prove important in finding suitable bottom ongrowing areas to market following suspended culture. The survey was carried out on the South East coast of Ireland. Highest growth rates were found in areas of high water current and higher water temperature. Furthermore the results also suggest that scallops not only prefer gravel to sand but can differentiate between grades of these substrates. These findings were more fully explained by Eimear O'Keefe, also from the BIM Galway office, who presented information on mapping the distribution of different sediments in scallop fishing grounds. The use of a multibeam echosounder provided backscatter values that varied according to substrate with higher backscatter values occurring where coarser sediment was present. In using this system ground types that yielded high abundances of scallop could be readily differentiated from areas less favourable to scallops. Using dredge catch data, there is a positive correlation between acoustic backscatter values and numbers of scallops caught.

Moving onto more aquaculture themed presentations recruitment and enhancement were discussed. Unfortunately non related to the 'King scallop' Pecten maximus. However results suggested that closing the beds and restocking increased available stock between 5 and 9 fold. The resulting fishing was still considered commercially unviable, however, the enhancement was carried out in a small scale.

Several talks were given during the Aquaculture sessions and these topics covered the effects of initial stocking density on larval and post larval performance, post larval settlement in culture and the effects of environmental conditions. Post larval performance was enhanced by reduced stocking densities, which culminated in shorter larval lifespan and better larval survival. 16-20 of larvae attached in the lower stocking densities between 2 and 16 larvae/ml against 4% at 32 larvae/ml. The ideal number following the study was 4 larvae per ml.

Settlement in scallop larvae has always shown great variation but improvements have been made following the implementation of flow through systems in a Norwegian hatchery. Despite advances the settlement ratio has only occasionally exceeded 20 – 25%. Recirculation rate, varying between 60% and 90%, yielded no significant differences in survival. Bag colour and light conditions were also non significant post settlement.

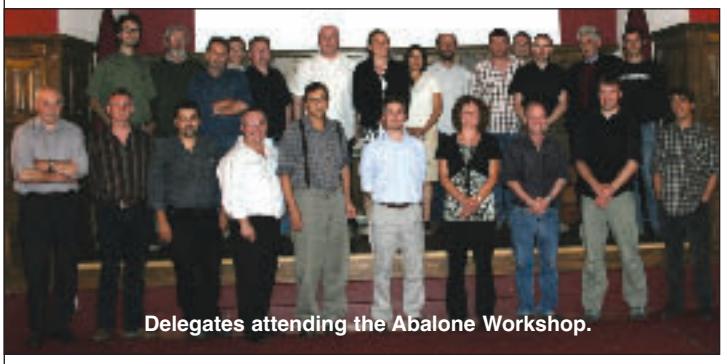
Contd. on page 6

Expansion of Abalone Farming.

Geoff Robinson, BIM, reports.

Following some sizeable investment in the abalone industry, BIM in conjunction with Taighde Mara Teo., decided the time was right to run an abalone workshop aptly titled *'Expansion of Abalone Farming'*.

The workshop took place at the Templegate Hotel in Ennis on the 5th June with the focus on several main aspects which are pivotal to future success.



Delegates attending the Abalone Workshop.

International speakers from as far afield as South Africa and New Zealand where called upon.

Our first speaker was Jimmy Miller from Oceanz Blue Ltd., New Zealand, who highlighted the need for scale with effective farm operation and business management.

Phil Heath, formerly managing C-MAR (N.I.) and now working for NIWA in New Zealand, spoke about the importance of water quality and the limiting levels and how most often these are not nitrates and nitrites, but oxygen saturation and pH/CO_2.

An apprehension amongst Irish abalone farmers exists due to the potentially small number of broodstock used in initial spawnings, these fears where allayed when Danie Brink from Stellenbosch University, South Africa, spoke about broodstock programmes currently being run in South Africa.

The topic of Abalone diet is always an interesting one with most Irish systems designed for an algal feed, with an increase in production over the next five years, more farmers are now looking for artificial feeds to supplement naturally collected algae.

Gerry Mousakitis, UCC, reviewed the information currently available on diets and provided some information on a diet he is about to trial. Evelyn Collins, Enterprise Ireland and Albert Girons, Vet Aqua, then reviewed abalone disease work, which was carried out in the last year with specific reference to Ireland. Albert highlighted the need for strict farm management protocols to prevent the spread of disease if an outbreak should occur.

Jean Le Dorven, Boet Mor Seafoods and Jackie Sullivan, Bere Island Sea Foods.

A market review was then given, but the emphasis of marketing was placed not in obtaining a price but designing a product to attract market interest, without this the price will inevitably be lower than desired.

The workshop did not finish there and ran on a further 4 days, with BIM and Taighe Mara Teo. staff and our three international speakers visiting abalone farms along the East coast, taking in all of Ireland's abalone farms, including those still in construction, for consultation with design and capacity increases.

Off shore cultivation of oysters looked at by French farmers.

Over the past five years, oyster growth has dramatically decreased in the Marennes-Oleron area. The latest studies show that on average, a typical farm, using either hatchery or wild seed, which produced 30 tonnes in 2002, reducing to around 23.9 tonnes in 2005, was probably producing under 20 tonnes in 2006. Therefore French oyster farmers and development agencies have been looking at different techniques to move production of oysters off-shore and this was the focus of off-shore cultivation at the La Tremblade exhibition in May 2007.

Some experiments have been carried out off Etang de Thau in the Mediterranean, by three shellfish farmers from La Rochelle. They set up 24 long-lines serviced by a 24m long boat with a 90m^2 working area. At a depth of 7m, they put out 2g hatchery seed in lantern nets in Spring 2006. By the end of June 2006, the seed had reached 10g and was then dispatched to 13 different oyster farms in Charente-Maritime (Marennes area) for further on-growing. At the start of winter 2007, the oysters had reached market size.

Plastic containers stacked together

Trials are also being carried out in Marennes-Oleron. In one experiment, the seed was initially grown on long-lines and then transferred to trestles for further on-growing to market size. In another experiment, oysters grown on trestles from seed were "finished-off" on long-lines. The first results show that in both cases, the oysters can reach market size in 18 months rather than 3-4 years for a full grow out cycle on trestles. Survival is also better with mortalities of 20% for 6 month old oysters initially grown on long-lines compared to levels of 50% mortalities for on-growing on trestles for the full life cycle.

Lantern Nets & Trestles

The biological results from all these experiments are very promising but there are still a lot of physical hurdles to face in order to develop these techniques in an efficient way. The weight and the handling of the structures need to be researched, as well as problems with fouling and the security of work crews. Another key element, which needs to be further investigated, is the size of boats capable of handling such structures and therefore the level of investments required by this type of cultivation.

Delphine Pouligny
Resource Dev. Officer
Aquaculture Initiative

News from the North-West

By Louise Collins, Regional Officer, Aquaculture Initiative.

Visit by Italian fish Veterinary students to the North West

Twenty five Italian students and their professor Rodolfo Ballestrazzi from Udine University in Italy were on a three day whistle-stop tour of

Hugh McGinley and Pro. Rodolfo Ballestrazzi, Italy, with students at the Freshwater Fanad Head

Ireland's aquaculture farms. They started their tour in Donegal, where they were given a very warm welcome at Marine Harvest Ireland, where Mr. Hugh Mc Ginley, Freshwater Manager took time out to show the students around their state-of-the-art breeding facility. The hatchery/brood facility located at Fanad Head in Co. Donegal, has been a model of broodstock technology. The company has been progressive and receptive to many new and innovative techniques over the years. They use tanks that are photoperiod/salinity/temperature controlled. "Production of ova is of such high quality that Marine Harvest Ireland has supplied the national and international industry for years" McGinley told the students. He also told the group that "they have close working ties with Trinity College Dublin and other institutions where they are continually working on their world class breeding programme". The next stop was Cloonacool Springs in Sligo, where the students got to see a 95% recirculation system in operation, with Bill Carthy telling students "We believe in keeping Arctic Charr as close to its natural environment as possible, that's why we add nothing to the process except food and oxygen"

Sligo Arctic Charr Farm makes it into the Bridgestone Food Guide 2007!

Described by the Irish Times as "The Bible" of Irish food, the eighth edition of John and Sally McKenna's Andre Simon Award-winning directory of the best food and food people in Ireland is recognised as the most essential guide to Ireland's food culture, has listed Cloonacool Springs in it's guide, which was launched on June 24th in Dublin.
"The slowness of the growth and the coldness of the water in Lough Talt, gives the flesh density and flavour, and already restauranteurs and fish wholesalers are beating a path to Cloonacool".

Innishowen Engineering, Buncrana to work with BIM in trial of new lights!

Innishowen Engineering has recently bought the patent to a new underwater light that is now available to the marine industry. They will trial these lights with a finfish farm, in conjunction with BIM, and results will follow. Most of the features evolve around the innovative water cooling feature. The marine light incorporates this unique, patented water cooled design that allows high wattage lights to be used at low voltages and without the need for the associated control gear to provide striking voltages. Lights are used at low voltages, making it safer to use. Lights are used widely in Norway and Chile. Underwater lights can have a good effect on shoaling, growth and controlling sexual maturation. In salmon farming lights are used in sea cages in the winter to extend and shift the growth period. Lights are also used to delay sexual maturation.

Donegal County Council agrees to real time monitoring for Mulroy CLAMS Group

Ireland's Planning Board granted approval in 2002 for the construction of a bridge from Rosguill and Fanad peninsulas in Co. Donegal. Construction of this bridge started in March 2007, and this will be the largest bridge to be built in Co. Donegal. It is a two and a half year project. Several meetings with Donegal County Council and the CLAMS of Group, Mulroy, have agreed that Donegal County is to have a real time monitoring station at the base of the bridge. Sensor and information technologies have now emerged that can provide the tools needed to continuously monitor water quality variables, transmit monitoring data in real time, validate, display and interpret the data, and predict the future state of these variables. The proposed system is to be implemented by TechWorks Marine, who has deployed similar systems in salmon farms in South Connemara, supported by BIM

Trawbreaga CLAMS group elects chairperson.

At the first meeting of 2007, the recently formed Trawbreaga Bay CLAMS elected a chairperson, Mr. Jim Walshe, Northshore Oysters. The meeting attended by ten producers, saw Mr. Joe Mc Elwee, Irish Shellfish Association attend the meeting to talk to the CLAMS group about the benefits of coming together as one group and the benefits of joining up with an organization of the Irish Shellfish association.

A newly developed oxygen injection system for a seatrout farm in Co. Mayo.

BIM have recently installed an oxygen injection and monitoring system for Curraun Blue in Mulranny Co. Mayo. This site, especially in summer and early autumn, can experience unusually high sea temperature which can caused stagnant growth and high mortalities. In addition to the high temperature, dissolved oxygen (DO) concentrations can be low and fluctuating during the day. The delivery of oxygen is controlled using a network of oxygen sensors connected to a PLC system to maintain a set point of dissolved oxygen in the cages

The monitor will be recording dissolved oxygen levels and each probe will be placed under the walkways to the appropriate cage. The dissolved oxygen levels will then be reported back, wireless, from the cage to the office PC. The oxygen is being supplied from the oxygen generators, via the DO Monitor to the cages which are stocked at the moment. The data from the cage probes is being relayed back to the office PC, the wireless signal being received. This way the oxygen supply can be regulated and so the safety of the fish farming operation increases. The significant advantage of application of pure oxygen is the high mass transfer rate between the pure oxygen and the water, because of high differences in concentration. One has to take into account the costs of oxygen and the investment in devices to dispense it. This well-designed and well-operated oxygen supply system will compensate for the higher investment costs because of its low energy requirement. This "oxygen generator" has been designed which can produce oxygen of 90 percent purity, removing the nitrogen from the air by a molecule filter. Results of this trial will be published in the future.

Tom Doherty Jnr., Curraun Blue, Peter McKeown, Market Tech, Cork and Louise Collins, Aquaculture Development Officer, AI.

Integrated Coastal Zone Management Initiatives

The Northern Ireland Coastal and Marine Forum held its first meeting in November 2006. The Forum is an independent non-statutory body made up of a cross-section of interests ranging from local government, business, agriculture, fishing and environmental bodies.

The Forum aims to provide meaningful stakeholder input into strategic policies affecting the coastal area, as well as raising awareness on Integrated Coastal Zone Management. In addition it will also provide expert advice, co-ordinate research, and provide support towards the achievement of the Northern Ireland Strategy objectives. It is also responsible for monitoring government's progress in implementing the Northern Ireland Strategy and reporting against the targets and objectives contained in it.

The Forum currently has several projects at an advanced stage. These include the development of a dedicated Northern Irish Coastal and Marine website, the production of an information booklet on the Forum and the publication of a Maritime Heritage brochure. The Forum is also pursuing funding opportunities for Coastal/Marine related projects under EU Structural Funds programmes such as INTERREG IV.

Further details about the Coastal and Marine Forum and Integrated Coastal Zone Management (ICZM) are available from the Department of Environment website: www.doeni.gov.uk/index/protect the environment/natural environment /marine and coast.htm

Source: Irish Coastal Network No. 10 - June 2007.

Market Comment

Global Shellfish Market:

During June traders witnessed a drop in demand for most species and most markets. Traditionally during July, consumption of seafood moves from city centres towards the tourist coastal areas.

Oysters:

Consumer demand was low during June with retail prices slightly up. Trade between Ireland and France is low; some mortalities have been reported due to stormy weather conditions and water temperature differences.

The French market will be moving towards the lucrative coastal tourist summer sales.

Mussels:

The French mussel market has now fully moved into the bouchot season. Promotional activity is high.

Rope mussels €2.40/kg. Bouchot mussels €4.30/kg in traditional 15 kg jute bags. MAP Bouchot €4.64/kg. Increasing demand and supply of Bouchot mussels.

The Dutch mussel auction opened during the last week of June with new record high prices of €3.30/kg.

Dutch production is expected to be similar to last season, therefore we will observe a similar market sceanario.

Salmon:

As predicted last month prices took a nose dive during June as increased production from Norway hit the main European markets. This increased production was predicted but reached higher levels than previously thought as Norwegian producers experienced higher growth rates as a result of increased water temperatures.

Despite claims that the main European markets continue to grow it seems that getting the balance between production and market demand is still difficult and they are subjected to these rapid declines in price.

Evidence of this imbalance can be seen in export data from Norway where the volumes of fresh salmon exports have increased by 25% up to May of this year when compared to the same period in 2006. During this same time period export prices have dropped by 13%.

Looking to next month we would expect demand to remain relatively stable in key markets such as France. There are, however, a number of factors that should prevent any further decline in prices.

Volumes exported from Norway are likely to decline due to the fact that harvesting in May and June was higher than normal and this has reduced stock levels. Secondly, mortalities due to disease related issues are reported to be above predicted levels and this will also help reduce pressure on the market.

In the French retail market, June has been a relatively stable month for salmon on a retail level as the price reductions from Norway have not been passed on. The warm Spring weather experienced in May came to an abrupt end in Northern Europe thereby ending what was beginning to look like a long and early barbeque season! A slight decreasing trend can be oberved for pre-cut salmon darnes, other retail prices have remained stable.

Rungis wholesale prices have dropped slightly, confirming indications of increased offer from Norway. This has not been fully transferred to retail level yet; however, we would expect to see more promotional prices over the summer as the increased early summer offer from Norway filters to all market levels.

Seafood is continuing to benefit from a good nutritional image especially through Omega 3 benefits as demonstrated from the major food oil manufacturer Lesieur's upcoming new product launch of fish enriched vegetable oil branded "Memo" in the French market which is supposed to maintain the vitality of the mind.

Source: Richard Donnelly, BIM Dublin.
Finnian O'Luasa, BIM Office, Paris.
www.bimb2b.com

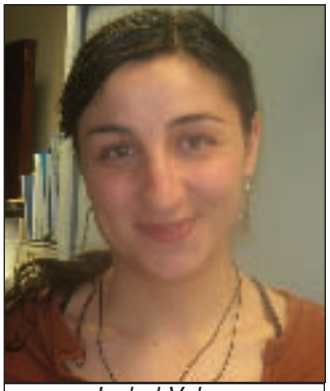
Contd. from page 3

The aquaculture industry then had their opportunity to inform scientific staff on the real world according to scallops. Jerry Gallagher from Northwest Shellfish Ltd. in Donegal gave a video presentation, highlighting a year in the life of Northwest Shellfish Ltd. from collector deployment, seeding through to harvest and was extremely informative to all in attendance.

Many countries and companies where involved in telling the tale of scallop aquaculture from their perspective including locals from Nova Scotia farming on the South shore and in Cape Breton. A novel gear technology project has just commenced on nearby Prince Edward Island.

Hello and Good Bye from the Editor

Nothing stays the same for very long, as the saying goes, and the Aquaculture Development Division has seen some changes with staff in the last couple of months.



Isabel Valera

Ciaran Caulfield

Donal Maguire, the Aquaculture Development Manager welcomed to his Division, Isabel Valera who has taken over from Louise Collins. Louise has been seconded to the Aquaculture Initiative until the end of the year. Ciaran Caulfield will now undertake the aquaculture survey previously done by Geoff Robinson and we'll be saying a brief cheerio to Mary Hannan , North West Area Officer, based in Westport. Mary will be taking leave of absence until the end of the year. Nicolas Chopin will be assisting with the UISCE project based in the South East, as will Fergal Guilfoyle, who is based in Westport.

On a personal note, it is time for me to say good bye as I am retiring from BIM but not from the Newsletter yet! You will still see me around!

However, I would like to take this opportunity to thank all the friends I have made over the years through the newsletter and thank you to those who submitted articles and photographs, for without them there would be no newsletter; to Terence O'Carroll for his suggestions and proof reading, and a special word of thanks to my printers, Typecraft Ltd.

I am looking forward to my retirement and horizons new and maybe take up my knitting again!!

Beannacht De. - Breda Smith

Above: *Minister Mary Coughlan, Minister for Agriculture, Fisheries and Food, together with Bobby Molloy and former Chairman of BIM, Mr. Brendan O'Kelly, wishing Pat Keogh, CEO of BIM every good wish for his future having stepped down from BIM on the end of June.*

Pat enjoys a light moment with some of the girls in BIM

New Irish Aquaculture Map launched.

The seventh edition of the Irish Aquaculture Map has been released by La Tene Maps. This completely redesigned map is the first aquaculture map produced by the company in six years and is packed with information. The map covers both Northern and Southern Ireland on a 700 x 1000mm colour sheet. It shows where and who is cultivating finfish and shellfish. All species and site types are shown by a unique set of symbols i.e. marine farm or onshore hatchery, and beside each symbol is the site operators name. A new feature on this map are the boundaries of the new River Basin Districts which are important for the EU Water Framework Directive as these River Basin Districts have an estuarine and coastal component.

John Coleman, Chief Executive of La Tene Maps speaking on the release of the new Irish Aquaculture map said "I am really pleased to see this map released as it shows there is confidence in the industry... I have tried to show what is happening on the ground as opposed to showing licences. If you compare the 2001 map and the 2007 version you will see that there are fewer operators shown. This is more pronounced on the shellfish side of the industry. However, aquaculture remains a significant industry in coastal areas and provides employment in remote areas where there are few alternatives for work".

The printed map is available free to Irish aquaculture operators from BIM, and a copy is enclosed with this newsletter. It is also available from La Tene maps and can be ordered directly from the website www.latene.com. A digital version can be purchased from La Tene Maps.

La Tene Maps is a Dublin based company specialising in the research and production of maps and educational posters on Aquaculture, Fisheries, Marine, Energy and Environmental subjects. See their website for further details.

Diary Guide 2007

August 5-8: Asian Pacific Aquaculture 2007, Hanoi, Vietnam. Details: WAS Conference Manager, PO Box 2302, Valley Centre, CA 92082, USA. Tel:+ 1 760 7515005; Fax: +1760 7515003. e-mail: worldaqua@aol.com; www.was.org

August 14-17: Aqua Nor 2007, Trondheim, Norway. Details: The Nor-Fishing Foundation, Klostergt 90, NO-7030 Trondheim, Norway. Tel: +4773568640; Fax: +4773568641; e-mail: mailbox@nor-fishing.no; www.nor-fishing.no

September 25-28: World Seafood Congress 07, Dublin, Ireland. Hosted by Bord Iascaigh Mhara, Enterprise Ireland and the Food Safety Authority of Ireland for the International Association of Fish Inspectors. Details: www.worldseafood-congress07.com

Nov. 6-9: Caribbean & Latin American Aquaculture Congress 2007, San Juan, Puerto Rico. Annual Conference and Exhibition of the Latin American & Caribbean Chapter. Details: www.was.org

Aug. 2008: Australasian Aquaculture 2008. Brisbane, Queensland. *"Profiting Through Sustainability and Innovation in a Global Seafood Market"* . For further information : www.australian-aquaculturereportal.com; e-mail: worldaqua@aol.com

'Offshore Aquaculture Development in Ireland – Next Steps

Lucy Watson reports

The Technical Report jointly commissioned by BIM and the Marine Institute, ***'Offshore Aquaculture Development in Ireland; Next Steps'*** was officially launched by Chief Executive of the Marine Institute, Dr. Peter Heffernan at the IFA Aqua 20/20 Conference and is available for download on the BIM webpage and as hard copy from BIM Head Office and the Marine Institute.

The document, which represents a joint initiative by technical staff in BIM and the MI, sets out a detailed Irish vision for the development of a significant offshore aquaculture capability in Ireland. Forty six sites are identified in the document and presented in the report as being worthy of further investigation. These are short listed to fifteen sites and then to the final five sites, on the basis of further and more complete analysis of water depth, shelter and proximity of landing facilities. The five most promising sites are in fact general areas of several square miles.

The five identified site areas are:-

North East of Gola Island, Donegal.
East of Inishturk Island, Mayo.
North East of Skerd Rocks, South Connemara, Galway.
North East of Inisheer Island, Galway Bay.
Dunmanus Bay, Cork.

hese opportunity sites are to be the subject of further technical appraisal by BIM and MI staff to establish and understand the broad principals of their character and suitability as potential offshore aquaculture sites. The programme of investigation is to start this year and to run over the next two to three years to accurately log and understand site dynamics such as wave energy, current speeds, temperature profiles and site bathymetry with a view to bringing about substantial inward investment to bring them into production in the future. Profiling the sites in such a way will allow BIM and MI personnel to assess the suitability of the available technologies for these sites and will focus attention on knowledge gaps. To obtain a copy of this document, please contact Lucy Watson at the Aquaculture Technical Section, BIM or Alan Drumm at the Marine Institute.

L-R: Dr. Dave Jackson, Alan Drumm, Marine Institute, Lucy Watson, BIM, Dr. Peter Heffernan, M.I. and Donal Maguire, BIM.

WORKSHOP 2008
Percid Fish Culture from Research to Production
Namur Belgium 23-24 January 2008.

Over the last five years there has been increasing interest in the farming of percid fishes such as perch and pike perch. Several new farms have been built in Member States for example Lucas Perches in France, Excellence Fish in Netherlands, Percitech in Switzerland, Danish Pike Perch in Denmark and PDS Irish Waters Perch Ltd in Ireland. Other new farms are also to be commercialised over the next years and within the framework of the European Fisheries Fund 2007 – 2013. Within the framework of two projects on percid fish funded by the European Commission (COOP 2004 – 512629, Percatech and COOP 2005 – 017646, Luciopercimprove), the project co-ordinators are planning to host a European workshop on Percid aquaculture with the co-operation of the Federation of European Aquaculture Producers (FEAP) in January 2008.

BIM is the main sponsor of this event along with Fluere Lorraine d'Aquaculture Continentale (FLAC), Dana Feed A/S, Nutreco and Gebr. Dil Import - Export b.v.. The workshop is to be hosted by the University of Namur. The workshop is three days with formal presentations over the first two days. Day three involves an optional visit to a perch farm in France or a pikeperch farm in the Netherlands. The topics to be covered over the first two days are the markets for pike and pike perch, hatchery / nursery activity including juvenile production and gamete quality and will include presentations by the producers themselves. On the second day, the grow out phase is examined and further producer's experiences are presented. The economics of production is the final topic to be covered on day two. The workshop has an international element with speakers from all the European countries producing perch and pike perch and those involved in culture in the US and Canada.

From our perspective the workshop will disseminate the findings of the €1.75m EU CFAFT funded Percatech project which PDS Irish Waters Perch Ltd was a partner in. Through PDS, both the Aquaculture Initiative and BIM were able to have a close association with this project. The project partners included Universities and other SME's in Europe working on critical areas of percid culture. Lucy Watson, BIM is on the organising committee for the workshop and Damien Toner of the Aquaculture Initiative is currently co-ordinating the writing of the companion manual for the workshop, which will disseminate the results of the Percatech project in one comprehensive document. For more information on the workshop and to register please visit the webpage: http://www.percid.be/program.htm Otherwise, contact Lucy Watson (01 2144288) or Damien Toner (042 9385074) for more information on the event.

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Martin Ryan Institute
Institiúid Mhairtín Uí Riain

Breda Smith talks to Declan Clarke, Development Manager, MRI and Manager MRI Carna.

So what is the future for MRI Carna?

The future, well I hope that it will be based on the Marine Innovation Centre Concept where we will fuse the dynamic research environment at NUIGalway with the commercial sectors with a view to creating sustainable marine based local enterprises.

Sounds interesting tell me more.

Well the Innovation Centre is a concept we developed with Údarás na Gaeltachta where we will have three functional components.

- A Research and Development Centre where we can undertake research across the range from fundamental to applied and across a wide variety of interconnected marine science applications.
- A Business Incubation Centre where we can facilitate start up companies on campus here at MRI Carna and provide technical and other supports to allow them test their concepts.
- And thirdly a purpose built Commercial Park which Údarás have agreed to develop on lands leased from the university. They have already approved the first €4.35 million for the development, so it is well on the way.

How will you interact with the companies?

There are as always a number of models, but our preferred is where we take a stake in the company through it growth years and once it is commercialised we realise this earlier investment for new ventures coming down the line.

We also hope to target a good cross section of industries to enhance the synergies that will develop. We have targeted aquaculture, marine food processing, light engineering and instrumentation, and marine biotechnology

Once we have developed this type of capacity on site I would hope that we will go for Large Scale Facility status, most likely with other partners.

So tell me about your new research facility – the Marine Innovation Building.

I suppose, it could be reflective in many ways of the standards that we aspire to. It represents a major commitment to applied marine research from the State and was part of a wider Marine Science Research Programme funded by the Higher Education Authority (HEA) under their Priority Research for Third Level Institutes (or PRTLI for short) through the HEA. The grant also addressed some infrastructural upgrades on site along with delivering the capacity of 42 litres of high quality seawater per second. We had a large design input from the team here, particularly from Dr Mark Harvey, our Chief Technical Officer, and as a result the facility has great potential and flexibility and the capacity to operate as a quarantine facility.

The type of project that will go into this new facility will reflect the overall concept for the Marine Innovation Centre. Ideally projects will be innovative by nature and have both academic and commercial partners. For example there are three projects ready to occupy this new space:

- The first is an investigation into the Breeding and rearing of Wrasse species for the provision, of an alternative, ecological and effective sea lice treatment in Irish Salmonid aquaculture. This is a partnership with Marine Harvest Ireland and BIM and also has a PhD student, Jack D'Arcy working on it.
- The second project is one that we (MRI Carna and the Irish Seaweed Centre) are working on with a number of people including Atlantic Fare, BIM, and Údarás na Gaeltachta, whereby we will explore the feasibility of replacing chemical colorant solutions in salmonid diets with extracts from sustainable Irish marine resources. We have already completed a proof-of-concept using trout under a HEA award and with the new facilities can now move to species such as salmon.
- The third of the wet laboratories in the new facility will house a High Value Aquatic Species project that I am very excited about. This one is a partnership with Mara Beo Teoranta (Dingle) and Neptune Nurseries Teoranta (Campus Company), MRI Carna and Údarás na Gaeltachta. This commercially driven project will develop the production protocols for a com-

prehensive range of marine ornamental species that will allow Ireland to establish and brand a high-value captive-bred suite of products. The people who buy these products tend to be at the higher end of the retail market and also tend to have quite a considerable knowledge of global trends, particularly environmental ones. A major marketing opportunity is now presenting itself whereby UNESCO are bringing in a raft of new legislation that will prevent the free-for-all style of harvesting of these species from tropical reefs. A branded, hand reared, environmentally sustainable range of fish species we feel will appeal to the higher end of this exploding market in the face of significantly diminished supply. There will be the added bonus of higher survival rates from cultivated stocks with the option of exploring vaccination and developing interesting colour morphs in time.

The commercial drive will come from our own campus company, Neptune Nurseries, who have successfully spawned and reared test numbers of Clown Fish (Nemo, to those of us with young kids) under a project with Údarás and also from Mara Beo Teo who have made a successful business out of the renowned Dingle Aquarium and are now in a position to expand their operations.

As many of the species are so novel the interest from the academic community is high, particularly for some of the soft coral species we plan to culture.

So are there any other plans for this year?

Always!! We hope to tackle what many people refer to as the Holy Grail of shellfish aquaculture – Crawfish Culture. It is a really innovative and novel project with an American commercial partner, Lobster Farming International and a local Irish Biologist and former colleague of ours, Ronan Browne. Taighde Mara has just recently confirmed that Údarás will fund us on this one and in essence the project will use a novel feed and innovative tank design, which in conjunction with our advanced ability to manage water quality and the live feed expertise on the site, we feel we will be able to crack the cultivation of these crayfish in a reasonably short time frame. So we have taken the challenge on.

We also plan to expand on the achievements in cod to date. Cod has been a major focus of what we have done here in the past few years, it has helped to inform much of our technology, it has helped to inform a partnership strategy, and whole range of new things. The Cod Management Group arose out of the Marine Institute post-doc fellowship that we had applied for and this group now oversees and brings together the developments in cod. All the major stakeholders are around the table, Taighde Mara, Údarás, Marine Institute, BIM the Industry and ourselves as research providers. In the context of developing a new species I think that the Cod Management Group has really made some significant achievements in a fairly short space of time:

What are the outputs from the Group?

It has proved the concept that cod can be cultured under Irish conditions and that the market very favourably received the first harvest earlier this year. On site here we have established a hatchery, with all that entails given the long dependence of juveniles on live food (we feed up to 500 million rotifers per day at full tilt!), At sea Trosc Teo (the commercial partner) have ongrown fish through a variety of sites and over differing summer conditions. So we were greatly encouraged by that. We have also secured a number of strategically important stocks for the future.

Tell me about the hatchery?

From the hatchery side we have identified and experienced a number of bottlenecks this year, but they are different ones than last year and we have come further along the culture chain. We are comfortable now with live feed, and we feel that the live feed strategies we have on site are considerably more stable and advanced. Some of the other bottlenecks and difficulties that we have seen we feel are resolved and we think that following international consultation (through programmes such as OPEL and our extended international network) and some of our own on-site observations that these bottlenecks will be fixed by next year. This means that the commercial viability of the hatchery has now very real prospects.

Also on the cod front we are at the design phase of a broodstock unit. This has already received great support from BIM and the MI and will greatly enhance our national capabilities, not just in cod but other gadoid species and potentially novel species such as wrasse. Over the past few years we have built up quite a reservoir of strategically important stocks, both from at home and abroad. Again what we are doing here is at the table of the Cod Management Group which ensures a tight focus and targeted objectives.

You also work with Seaweed?

Seaweed is very important to what we do in Carna. It is another of the MRI's applied interfaces with the commercial sector and much of the larger scale work we undertake in the Irish Seaweed Centre takes place at MRI Carna. For example Declan Hanniffy has just started his MSc under Dr. Stefan Kraan, the manager of the ISC and Dr Ian O'Connor of GMIT, and will be looking at developing hatchery technology for two species of seaweed, Laminaria and Porphyra. We work closely with colleagues in C-Mar who have developed up the techniques for Palmaria in particular. The Laminaria aspect of Declan's work is funded by Taighde Mara and BIM fund the Porphyra aspects. In line with our strategy of disseminating our developed technologies with a view to establishing viable marine based enterprises we hope that the seeded lines from these projects will find homes with groups we are working with such as the Comharchumann Forbartha an Leithtriúigh in Brandon.

A number of other projects on site include the collaboration with the MRI's Inshore Fisheries Group, a close partnership with BIM and headed up by Dr Ollie Tully of BIM. Here we are looking at testing the technological capabilities of holding high value shellfish which are relatively easily captured during the summer months. I say 'relatively' easily because I spent five years fishing lobsters off the Scairde Rocks and know the lengths fishermen go to secure a living. The concept behind the project is that the stock can be held for up to 6 months through to the higher price season around Christmas with no loss in flavour or taste. The technology is not there yet but the team on site under the guidance of Dr Mark Harvey have made some significant modifications that we hope will make it viable and we can relay to the commercial sector.

So you have a mix of short and long term projects?

Yes it is important to keep the facility varied and this means accommodating short 4th year projects, which have led to MSc such as the one being carried out by Dr Ger Fleming and his team at the Dept of Industrial Microbiology to longer term strategic programmes of research.

You mentioned 4th year projects – do you do much teaching on site?

Yes it is something we are very keen to build up and it has been greatly boosted when Dr Richard FitzGerald joined the team as our Research and Training Co-ordinator. We carry out specialised industry courses, facilitate 4th year projects and have a number of postgraduate programmes starting up. We have a very interesting array of research platforms on site and this offers great opportunities to our academic colleagues, and in turn we learn greatly from the work they carry out.

Such as?

Well a very good example was the work undertaken by three students over the past two years under the supervision of Dr Rachael Cave whereby they carried out comprehensive water testing over the range of technological platforms, and as a result this informed our water quality management on site. One of these students, Conor Mulholland, recently joined the team.

It must be a challenge to keep all of this going ?

Well yes I guess so, but we have had tremendous support from NUI Galway since Mike Guiry and I undertook to redevelop the facility. They have facilitated most of the capital works on site and also allowed for the strategic development of the team, which has now built up a wide range of nationally, and in some cases internationally, recognised expertise.

But of course the funding climate is also changing now and

there is a very welcome recognition at national level that funding programmes must be at least five to seven years to genuinely achieve results. Once the framework is right these types of programmes will, I believe, result in tangible outputs and significantly enhanced capacity and expertise within Ireland.

Are there examples of these types of programmes?

Yes the Beaufort Awards are soon to be announced and the Department selected 5 strategic areas for development of capacity. Also the Marine Institute launched its Functional Food call which I understand will be announced before the end of the year. Again one of the main aims of this programme is to build capability in the area.

So the funding is primarily for people?

Yes, there is emphasis on recruiting international experts to facilitate development in the selected areas, much of the enabling capital monies will come from other sources such as the HEA.

It is an exciting time ahead.

I then asked Declan about AquaTT which he is Chairman of.

So what is AquaTT?

This is a good question and one that we constantly ask ourselves. This helps to keep us on our toes. Essentially it is an international foundation which provides project management and training services to support the sustainable development of Europe's aquatic resources. We are owned jointly by NUI Galway and UCC and are also in the fortunate position of having a Board of eight international Directors, all of whom give their time and considerable expertise freely. We also have a special advisor's position in memory of the late great Dr Lindsay Laird which is held by Yvonne Shields of the Marine Institute and first manager of AquaTT.

And you are Chairman?

Yes, it has been a great privilege to chair AquaTT over the past while. Because of the foundations laid by former chairs such as Richard FitzGerald, Brian Ottway and Gavin Burnell we are in the enviable position of being able to grow the company and to extend the core services we offer to a wider range of relate marine industries – such as the functional food sector. This growth is of course because of the team we have in Dublin, under the very capable management of David Murphy. We have two new key appointments to join David and Marieke and facilitate the development of the very successful and collaborative Planet Aqua model and to facilitate us exploring the opportunities within Europe's growing but underdeveloped Functional Food sector.

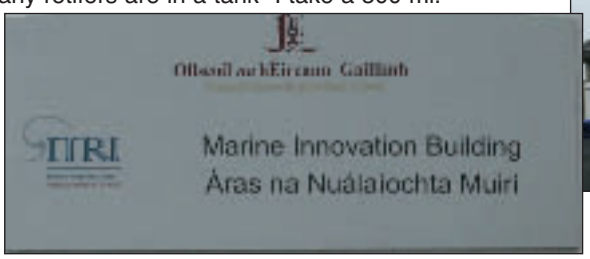
Having spoken to Declan I was then brought around the facilities by Kieran O'Halloran, Senior Technical Officer. Kieran first took me to the rotifer culture room process, then to the algae room and then on to the larval room, where he explained the different cultures to me.

Live feeds

"When we say live feeds it is to all intents and purposes for the operation here we are concentrating on Rotifers and Artemia, which is brine shrimp."

He explained that rotifers are unusual in that most of the rotifer species are fresh water and that this particular rotifer can thrive at 22 parts 1000 salinity, hence can adapted for marine fish culture. This particular rotifer is close swimming and the larvae can catch it and it can survive in saline waters. The quality of the water has to be pristine because any bacteriological contamination can be detrimental. The rotifers also have a phenomenal reproduction rate; they can reproduce almost at the rate of bacteria, not quite, but almost.

To count how many rotifers are in a tank "I take a 500 ml. sample and get a count in 500 mls. and do three to four counts



Declan Clarke, Manager MRI Carna

Cod Management Group at meeting

Ciaran O'Halloran in the Algae Room at Carna and also extracting rotifers from tank to take count of how many are in the tank.

Cod weaned on rotifers

The new building at Carna that will have state-of-the-art research facilities when furnished.

to get a good average representative and then I extrapolate it up to find how many is in a litre and consequently in a cubic metre and then that gives us roughly what is in a tank. We produce about 600m rotifers a day. Our capacity here really under optimum conditions could feasibly have a total standing biomass of up to 5 billion rotifers," said Kieran. The rotifers are all live and they are growing and multiplying and feeding on plankton. They are also fed a yeast based diet, which is an artificial feed.

These tanks hold about 1500 litres and they are normally used in a three-day cycle. They are inoculated on day zero with about 500 rotifers per ml. This multiplies up over a three-day period and then they are harvested on day three, i.e. they are suitable as feeding culture for feeding the larvae.

The rotifers on their own are low in essential poly fatty acids and they must be enriched so they go through what is called an enrichment process and then they are then fed to the larvae via an automatic feeding system.

They have a three-day cycle and in full production we have three tanks going at any one time, and we have a tank ready for inoculation. A percentage of that tank is harvested for enrichment for feeding to the cod larvae, which provides them with the nutrition that they require. "It is the highly unsaturated fatty acid (HUFA) content that is critical.

Algae Room:

Kieran then showed me to the Algae room where he explained the green algae to me. This can be called the pseudo green water effect. "To provide green algae we use nano clorioxes occulata, it's the green algae and that goes into the tank, it cleans up the water essentially but it has an anti-biotic affect as well and it controls excess nutrients in the water. It has a general positive effect for the larvae after they hatch and it is a critical component". said Kieran. The rotifers are actually fed in a suspension of another algae called Isocrices. This is used for feeding or sustaining the enriched rotifers. The enriched rotifers are fed over a 24-hour period and overnight essentially in a suspension of the Isocrices, that maintains the rotifer culture until it is distributed in the larvae tanks.

The algae system needs aeration, nutrients and vitamins. The lights are synthesising the species, as they require light to grow. The algae are grown in autoclaved water. Autoclaved water is filtered UV seawater with extra sterilising. Because the water is used when inoculating, it is critical to have pure algae culture, whereas seawater coming in may have spores. The autoclave water is completely sterile and there are no organisms in it.

We then went into a room where Kieran and Ken Maher, Senior Technical Officer showed me the cod tanks, one with cod at 2 grams, 3-4 grams and another of between 5 and 10 grams.

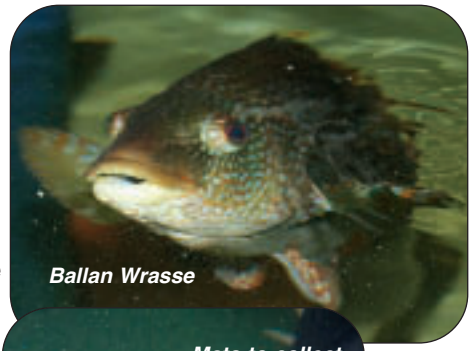
The tanks (or hoppers) are temperature controlled and the eggs are incubated at an ambient temperature of about 8 and 9 degrees and they are normally hatch after 80/90 degree days.

Ken explained some of the fish would have spawned in March/April of this year, approximately 3 days after Kieran had brought in the eggs after sourcing and milking the cod from a special derogation site off the Irish coast a collaboration with the Marine Institute and the Fishing sector. Some of the fish are as a result of larvae that were collected from fish on site and these fish in turn were fish that we would have grown on site from May '06, so they have come full cycle. These are valuable brood stock. However the quality of the eggs needs work and that is being looked at with improved conditions and conditioning diets.

Jack D'Arcy spoke on Wrasse and Ballan Wrasse. Wrasse is being cultivated as a preventative measure for sea lice on salmon. Wrasse are used on five different sites in Norway with great success. They also clean the nets as well if the nets aren't heavily fouled and they also keep mussels off the nets.

Wrasse is used proportionally to the number of salmon, i.e. 2 to every 100 or one Ballan wrasse to every 200 salmon.
The green mats at the end of the tanks are designed to collect fertilised eggs, the mats are taken out and quickly put into the larvae rearing unit in slow flowing water in stable conditions and when they hatch they are put into a similar feed regime as the cod larvae, live feed from rotifers, graduating to Artemia. They are quite a hardy fish and the farmers like them, as they are economical with less net cleaning and changing.

Ken then showed me a new degassing tower which he designed and built. He is also in the process of building a recirculation system to support the new 20 tanks that are in the Innovation building. A system is being built similar to what is in the old building but instead of having everything combined, each function will be separate. The protein skimmers will be separate, as will the bio filter and UV. These will be modular systems that can serve each individual component in isolation.
All of the rooms in the new building are designed so that if two tanks shattered, for instance, the water from the tanks would go straight out the channels on the floor and not flood out of the room.
All the water from here goes down to a centralised treatment facility, which is UV, and ozoned, although it is not in place at the moment, it will be in order secure quarantine status for the lab.


Ballan Wrasse


Mats to collect fertilised eggs.

There is also an alarm system in place whereby there is a special control panel which give 24hour security on site. If the ball valve sinks in the water it will click on the alarm that activates the valves automatically and will send oxygen to each of the tanks in turn. So in the event of water flow failure it will kick in the oxygen supply and that will give enough time until somebody gets in to sort it out. Depending on what happens, if there is a complete system failure for whatever reason and the compressed air has broken down outside as well, there is a 4 hour bottle back up as well. And if all else fails there is a generator, which kicks in after six seconds.

Then we went to a cold storage area were we saw drawers of suspended frozen lobsters.

Oliver Tully's project: The economics behind this is to keep the lobsters in storage at this reduced temperature, suspended animation, and you can actually increase the temperatures slowly at the time of marketing, bring them back to the ambient temperature and market them as live lobsters. They don't have to be fed because their whole metabolism slows down. This system has been used in Canada for the last 10/15 years. In July/August/September the price for lobster drops whereas in November/Dec. there is a huge demand for lobster,. so these lobsters will be made ready in November.

Oliver from the BIM Galway Office and Eoin Kelly of the MRI go out to Carna twice a week and they service the unit to make sure the lobsters are healthy and that there are no problems.


Lobster Store


Lobsters in suspended animation