Sea Around Us

Turning the tide is easy enough

by Villy Christensen

Tides are after all predictable: just wait for the right moment before pushing the water back. When it comes to re-directing a current, it is far more difficult – it takes climate change to shift the Gulf Stream.

To many, what is happening to the world's fisheries, at the local, regional, or global scale, appears to be more like a one-way current than a tide with ups and downs [1]. We seem to be gradually eroding the ecosystems on which our food supply from the oceans rely, even if we may not notice it individually [2]. What can we do to curb the direction of widespread degradation? It is a daunting task to embark on; one where we (like the artists *sensu* Piet Hein, see p.2-3) cannot explicitly express how we will go about solving the problem. We do, however, have an idea of, and experience with, techniques and materials we can use to deliver our small contribution to the solution.

We take as a starting point that few ministers of fisheries actually go to sea. Their agricultural colleagues appear in the evening news when there is a crisis, kicking the dirt and pretending to be farmers. How do you take a minister of fisheries on a field trip? And how can we show the minister the impact we have had on ocean resources, and those our future actions will have? We'll try virtual reality.

A necessary factor for us to even consider such an approach is that ecosystem modeling has taken some major steps in recent years, linked to the incorporation of foraging arena theory into *Ecopath* with *Ecosim* (*EwE*) [3], and making us quite capable of reproducing the known history in many marine ecosystems [4]. We are learning in the process that to explain historic trends we must, as a rule, include fisheries as well as environmental factors [5]. This provides an important component of the techniques we need to set up realistic field trips. As for materials, we have at hand a suite of global databases through the *Sea Around Us* project (see p. 5) that can be used directly to parameterize the ecosystem models we need for the field-trip simulations.

Adding to this is progress in gaming-theoretical approaches, needed to set up a realistic framework for the future scenario simulations. Going back to the 'fish wars' approach of Levhari and Mirman [6], the games of Walters and colleagues [7], and the work of Clark, Munro and Sumaila [8, 9], we now have a well-developed portfolio for including economic and human-behavior aspects.

The component to be added is visualization. We are, as scientists, inclined to communicate with other scientists. Our tools are designed to that end, and presenting figures in PowerPoint and tables in papers may well be the right media. If we examine the world where decisions of ecosystem management are made, we note,

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The Sea Around Us Project Newsletter

Issue 33 – January/February 2006

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however, that it is one dominated by people with very diverse backgrounds and experience, and we need to consider means of communication going beyond our usual repertoire. Visualizations can provide powerful messages, and, when building on the best available science, the messages may also be convincing and enabling. That's our ambition.

We have entered into partnership with the Lenfest Ocean Program (www.lenfestocean.org/) to develop a methodology for "Ocean Summits" ambitiously aimed at shifting the current. We envisage bringing together decision-makers for two days' discussion about the management of specific ecosystems. Prior to each summit, we will work with scientists from the given area to produce an ecosystem model describing the known history of exploitation. At the summit we will run through the ecosystem history visualized in 3D, above and below the surface, and emphasizing ecological as well as social impacts of our exploitation. This will set the stage for forward-looking scenarios aimed at quickly exploring how ecosystem and society are likely to react to management interactions and the resulting fishing pressure. The people at the table will represent all aspects of the management process. For this, we are developing software that incorporates multiple objectives and management options, all as part of a theoretical gaming approach.

While the visualizations and the underlying modeling approach are important for conveying impact, they will only set the stage for the deliberations around the table. The aim is to enable discussions and display results of the decisions taken, not to point to 'best solutions' to be obtained, e.g., through optimizations (though such optimizations are indeed feasible and will be used to provide reference points). We hope there will be win-win scenarios emerging (shifting the current, remember?), but realize that there are serious trade-off issues to be dealt with in a world of 'real-politik' [10].

We are currently well underway with the software development for the Ocean Summits, and one tangible initial result from it will be a re-designed and re-programmed version of the *EwE* software (for release September 2007). A new version is required in order to link *EwE* to the visualization software. The visualization software is being developed in close cooperation with the NECTAR project of the Computer Science Department of UBC and is drawing on Vancouver's status as a hub for the computer gaming industry.

We are, for the development, relying heavily on the scenario laboratory of the newly opened AERL building at UBC. This dark room (see picture, top of p. 4), which some consider the heart of the building, is designed with the intention of enabling the form for cooperation and visualization described here for the Ocean Summits: a war-room functionality. Technically, this is achieved with focus on enabling discussions around the table while allowing all participants a sense of immersion through large wall plasma screens, and a sense of control via direct access to information and management controls through the built-in

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The ***Sea Around Us*** project newsletter is published by the Fisheries Centre at the University of British Columbia. Included with the Fisheries Centre's newsletter *FishBytes*, six issues of this newsletter are published annually. Subscriptions are free of charge.

Our mailing address is: *Sea Around Us* project, Aquatic Ecosystems Research Laboratory, 2202 Main Mall, Vancouver, British Columbia, Canada, V6T 1Z4. Our fax number is (604) 822-8934, and our email address is SeaNotes@fisheries.ubc.ca. All queries (including reprint requests), subscription requests, and address changes should be addressed to Robyn Forrest, *Sea Around Us* Newsletter Editor.

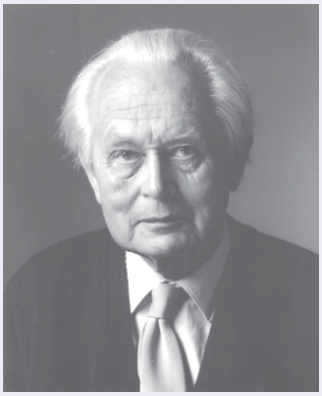
The *Sea Around Us* website may be found at saup.fisheries.ubc.ca and contains up-to-date information on the project.

The *Sea Around Us* project is a Fisheries Centre partnership with the Pew Charitable Trusts of Philadelphia, USA. The Trusts support nonprofit activities in the areas of culture, education, the environment, health and human services, public policy and religion. Based in Philadelphia, the Trusts make strategic investments to help organisations and citizens develop practical solutions to difficult problems. In 2000, with approximately $4.8 billion in assets, the Trusts committed over $235 million to 302 nonprofit organisations.

ISSN 1713-5214 Sea Around Us (ONLINE)

Piet Hein and the scenario lab table

After all, what is art?
Art is the creative process
and it goes through all fields.
Einstein's theory of relativity
- now that is a work of art!
Einstein was more of an artist in physics
than on his violin.
Art is this:
art is the solution of a problem
which cannot be expressed explicitly
until it is solved.
Piet Hein (1905-1996)



What is the simplest and most pleasing closed curve that mediates fairly between the clashing orthogonal and circular shapes that dominate our surroundings?

Piet Hein was a good friend of Einstein, as well as of Bohr and Chaplin; the mathematician Norbert Weiner dedicated a book to Hein; he studied fine arts and philosophy, then quantum physics. He invented the Soma Cube while listening to a lecture by Werner Heisenberg; he studied engineering, leading to industrial inventions and design; he spent a good part of the Second World War underground as an outspoken anti-Nazi leader, while achieving eponymous fame writing short, double-meaning poems for the leading Danish newspaper – he eventually wrote some 10,000 of such 'grooks' (see Box, p.5); he invented numerous games with a mathematical touch, one the basis for the TV game show 'Blockbusters'; he was a productive writer in philosophy, humanity and science; and … he invented the superellipse.

This came about when, in the early 1960s, he was asked to solve a design problem as part of a major city-planning project in Stockholm. He turned the problem into the intriguing question: what is the simplest and most pleasing closed curve that mediates fairly between the clashing orthogonal and circular shapes that dominate our surroundings? [11]. The search led him to discover the superellipse, a special form of an ellipse. Ellipses are mathematically defined as:

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1$$

Piet Hein, however, generalized the equation (as Lamé had done before him) by using variable exponents, and found that as the exponents were increased above 2, the shape gradually transformed toward a rectangular form. He called such shapes 'superellipses', and found the shape with exponents of 2.5 especially pleasing from an aesthetical point of view. They are a beautiful compromise between a circle and a rectangle (see right).

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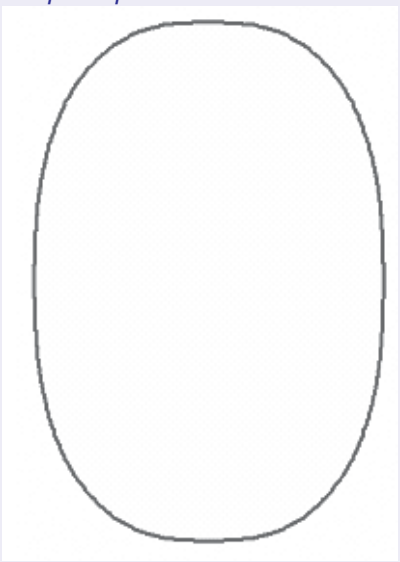
A superellipse:



Pictures of Piet Hein and the superellipse from www.piethein.com

We all wanted a table where there was no "us and them";a table that would encourage cooperation among those at it

The scenario lab., featuring the superellipse table *Photo by Calvin Lo*

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Indeed, the shape spread like wildfire and soon it was used for buildings, plazas, sport centres (notably the Olympic Stadium in Mexico City), board games, drink coolers, anti-stress balls, candle holders, lamps, dishes, trays, beds … and not the least tables.

We now have such a superellipse table in the AERL building.

It is the centerpiece of the scenario laboratory of the AERL, the new home of the Fisheries Centre. In discussions with Prof Douw Steyn, Associate Dean of Research and responsible for the AERL building process, and architect Greg Boothroyd, we considered a variety of shapes for the table. We all wanted a table where there was no "us and them"; a table that would encourage cooperation among those at it. The round table of King Arthur fame springs to mind for several reasons, but the scenario lab is rectangular and a round table would not seat enough participants. Piet Hein's superellipse provides the solution (see picture above). Expressed mathematically we have for any point along the table length (x) that the width (y) can be obtained from:

$$\left(\frac{x}{a}\right)^m + \left(\frac{y}{b}\right)^n = 1, \quad with\ m = n = 2.5\ we\ have \quad y = b \cdot \left[1 - \left(\frac{x}{a}\right)^{2.5}\right]^{0.4}$$

where the length $a = 380$ cm and the width $b = 260$ cm. With the equation in hand, Greg Boothroyd and colleagues at Patkau Architects designed the table, and Boelling Smith Design created the beautifully-crafted table, which now stands complete with 10 built-in workstations and 12 seats. Also, Renee Stewart-Smith from PJS Systems has done an incredible job connecting dozens of cables between the workstations, the adjacent control room, screens and computers to the right places.

It is a beauty of a table - everyone can see everyone else at it. There is no "us and them". Or in Piet Hein's words: "Co-existence or no existence".

"Grooks" by Piet Hein

THE ETERNAL TWINS
Taking fun
as simply fun
and earnestness
in earnest
shows how thoroughly
thou none
of the two
discernest.

LILLE KAT, LILLE KAT
Lille kat, lille kat,
lille kat på vejen
Hvis er du?
Hvis er du?
Jeg er s'gu min egen.

SOCIAL MECHANISM
When people always
try to take
the very smallest piece of cake
how can it also
always be
that that's the one
that's left for me?

For more grooks try www.chat.carleton.ca/~tcstewar/grooks/grooks.html or Google for "grooks".

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workstations as well as to the resulting impacts.

Technically, the modeling and visualizations represent a clear challenge, but it is one we are fairly certain we can meet, making it a technical and scientific challenge, rather than art *sensu* Piet Hein. Where the art comes in is in getting the summit participants to explore and adopt management options that will change the direction we have taken in most ecosystems – in shifting the current.

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For the simulations we need extensive information about environmental impact: past, present and future. For this, we are cooperating with several research groups specializing in predicting ocean productivity based on climatic drivers and incorporating it in climate models. We can mention the European Commission's Joint Research Centre in Ispra, Italy; CSIRO Hobart; Princeton University; as well as the Climate Modelling Centre at University of Victoria. Resulting from this are spatial predictions about primary and secondary productivity spanning a century from 1950.

Through the *Sea Around Us* project we have information about spatial catches back to 1950; effort data has been added through the thesis work of Ahmed Gelchu, Heather Keith and Robert Ahrens; while those of Kristin Kaschner, Line Bang Christensen and Vaso Karpouzi have added marine mammal and bird information. Information about population trends for marine organisms (3000 records globally) has been added through a database developed by Jordan Beblow. Prices (and soon cost of fishing and trade of fisheries products) are available through the work of Rashid Sumaila and colleagues. See www.seaaroundus.org for further information.

Where the art comes in is in getting the summit participants to explore and adopt management options that will change the direction we have taken in most ecosystems

Thinking big: a global look at fisheries science

May 2nd, 2006
University of British Columbia, Vancouver, Canada

A symposium to honour Professor Daniel Pauly for the 13th International Cosmos Prize and his 60th Birthday

The University of British Columbia is proud to host a celebratory symposium at the University, on the occasion of Professor Pauly's 60th Birthday. Distinguished international colleagues will give invited lectures with focus on topics representing Prof Pauly's career, with further festivities at dinner. A student forum and public lectures will follow on Wednesday May 3rd. We are pleased to be able to announce the following schedule of events. For more information visit http://thinkingbig.fisheries.ubc.ca/index.php or email us at paulysymp@fisheries.ubc.ca.

Tuesday, May 2, 2006

Time	Title	Speaker
9:00am	Welcome	
9:05am	UBC celebrating research	John Hepburn
9:15am	Issue-driven research and interdiscipliarity	Frieda Granot
Capacity building		
9:30am	Science and education: capacity building as part of the international development agenda	Gotthilf Hempel & Cornelia Nauen
9:55am	Tropical fish biology, a review	John Munro
Life in the Oceans		
10:50am	Life history strategies of marine fishes	Rainer Froese
11:15am	Evolving fisheries management	Annadel Cabanban & Jose Ingles
11:40am	Patterns of life in upwelling oceans	Philippe Cury & Andrew Bakun
12:05pm	Farming up and down	Roger Pullin
Evaluating impacts on marine life		
1:30pm	Shifting baselines: what was natural in the oceans?	Jeremy Jackson
1:55pm	Fishing down the food web	Kostas Stergiou
The human side		
2:20pm	Social research for sustainable fisheries: evaluating global impact of small scale fisheries	Ratana Chuenpagdee
2:45pm	Social science aspects of small scale fisheries	Kenneth Ruddle
Impacting policy		
3:40pm	Policy impact: linking science and conservation	Joshua Reichert
4:05pm	The scientist as communicator	Nancy Baron
4:30pm	Linking fisheries and conservation science	Carl Safina
4:55pm	Closing Remarks	

Wednesday, May 3, 2006 Student Symposium

Morning	Discussion sessions
1:00pm	Public lecture at UBC: Dr. Jeremy Jackson
5:00pm	Public lecture at Robson Square: Dr. Carl Safina

Note: Times listed are subject to change.
For details of timing of social events and meals, see http://thinkingbig.fisheries.ubc.ca/schedule/index.php .