Sea Around Us

Google Earth: going beyond finding your own backyard

by Dalal Al-Abdulrazzak

Today, freely available global satellite imagery from Google Earth (http://www.google.com/earth) is revealing areas that were once too remote or too expensive – or even prohibited – to access, and making them ripe for scientific investigation. Google Earth's potential to answer scientific questions is quickly pushing the boundaries of science and in some cases, allowing scientists to venture into new disciplines.

Ground-truthing aquaculture [1], estimating forestry biomass [2] and assessing looting at archeological sites [3] are just a handful of the types of research made possible thanks to this tool. Health researchers are also using Google Earth to tackle epidemics. In Bluefields, Nicaragua, for example, researchers have compiled and overlaid contributing factors of dengue fever, such as the locations of tire dumps, cemeteries, large areas of standing water, etc., in order to prioritize specific neighborhoods for targeted control interventions.

As for marine science research, predator/prey interactions have been studied by using Google Earth to examine "grazing halos," rings of bare substrate around patches of reef created by herbivorous fish eating the surrounding algae. In a study published in 2011, Madin and colleagues used Google Earth to locate these halos in the Great Barrier Reef and subsequently ground-truthed the areas to determine the distances herbivorous fish and urchins were willing to venture away from their refugia while risking predation [4]. The authors suggested that sequential satellite images over time could potentially be used to

An example of what one can see using Google Maps – a tool similar to Google Earth that employs the same imagery – to view the coastline of the Persian Gulf. The author, a PhD candidate with the Sea Around Us *Project, is using such satellite imagery to quantify the catches from weirs in this region. (Image: ©2012 Cnes/Spot Image, DigitalGlobe, GeoEye, U.S. Geological Survey, Map data ©2012 Google)*

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monitor the effects of predator removals, recovery and reintroductions virtually anywhere on Earth.

At the *Sea Around Us* Project, we are also harnessing this technology. Under the supervision of Dr Daniel Pauly, I am using Google Earth to estimate catches from fishing weirs in the Persian Gulf, which are often not reported due to reasons related to their scale (small), ownership (often tribal) and local forms of governance. In our work, we describe the potential of Google Earth to circumvent voluntary reporting mechanisms and provide more accurate catch data, even revealing illegal fishing in certain countries.

Perhaps the software's most important merit, however, is its cost: nothing

Beyond scientific research, nongovernmental organizations (NGOs) are using Google's compelling visuals for public outreach. By mapping the results of spatial data analysis or by creating scenic narrated flyovers, NGOs as diverse as Greenpeace, the UNDP and the Jane Goodall Institute can quickly and effectively visualize their causes for stakeholders, legislators and the public. One of the most poignant examples is that of an NGO called Shelter Associates in Pune, India. They have used the technology to communicate health and sanitation issues of slum-dwellers in order to integrate low-income settlements into urban development planning and promote participatory mapping.

Although Google Earth cannot be used everywhere – imagery resolution varies between areas and across physical conditions (due to factors such as cloud cover and glare) – the potential to rapidly survey inaccessible or what would otherwise be costly areas is huge. One such application led to the discovery of new species. Using Google Earth, scientists in Britain were able to identify a large tract of previously undocumented forest in northern Mozambique. Although Mount Mabu was known to locals, scientists had yet to explore it. After scientists "discovered" the area in 2005, initial investigations led to a full-scale expedition, which yielded a number of previously unknown species [5].

Perhaps the software's most important merit, however, is its cost: nothing. Virtually anyone with a computer and an internet connection can gain free access, making it especially valuable in countries where resource allocation towards conservation is scarce. It remains to be seen what other exciting, new applications this technology could have in helping to expand our scientific knowledge when we take it beyond our own backyards.

References

[1] Trujillo P, Piroddi C and Jacquet J (2012) Fish farms at sea: the ground truth from Google Earth. PLoS ONE 7(2): e30546. DOI: 10.1371/journal.pone.0030546

[2] Ploton P, Pelissier R, Proisy C, Flavenot T, Barbier N, Rai SN and Couteron P (2012) Assessing aboveground tropical forest biomass using Google Earth canopy images. Ecological Applications 22: 993-1003.

[3] Pringle H (2010) Google Earth shows clandestine worlds. Science 329: 1008-1009.

[4] Madin EMP, Madin JS and Booth DJ (2011) Landscape of fear visible from space. Scientific Reports 1.

[5] Jowit, J (2008) British team discovers lost Eden amid forgotten forest of Africa. The Guardian. Available at http://www.guardian.co.uk/environment/2008/dec/21/mount-mabu-mozambique-jonathan-timberlake

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The *Sea Around Us* Project website can be accessed at www.seaaroundus.org and contains up-to-date information on the Project.

The *Sea Around Us* Project is a scientific collaboration between the University of British Columbia and the Pew Environmental Group that began in July 1999. The Pew Environment Group works around the world to establish pragmatic, science-based policies that protect our oceans, wild lands and climate. Pew also sponsors scientific research that sheds new light on the dimensions of and solutions to the problems facing the global marine environment.

A journey to South America

by Robin Ramdeen

The conference was a testament to the region's commitment to the stewardship of the Gulf of Mexico and the Caribbean Sea, and the marine resources therein

In the first week of November 2012, the 65th Annual Conference of the Gulf and Caribbean Fisheries Institute (GCFI) took place in Santa Marta, Colombia. GCFI facilitates the exchange of experiences and ideas in fisheries science, management, governance, conservation and education. The conference was a testament to the region's commitment to the stewardship of the Gulf of Mexico and the Caribbean Sea, and the marine resources therein. The Caribbean Sea is a special place for me, because I grew up in Trinidad and because I discovered my niche in Caribbean fisheries while doing my Master's thesis on the fishing of queen conch in Tobago. The theme of this year's conference was "Artisanal fisheries: importance, implications and challenges for management," a topic which is familiar to many of us. Artisanal fishing is defined by the Food and Agriculture Organisation (FAO) as fishing carried out by individuals or households requiring low investment in technology and gear. By this measure, the majority of Caribbean fisheries operations are artisanal or small-scale.

The conference's keynote speaker was Dr Ratana Chuenpagdee, who is no stranger to the *Sea Around Us* Project. Dr Chuenpagdee completed her PhD under Dr Daniel Pauly's supervision in 1998 and is now the Canada Research Chair in Natural Resource Sustainability and Community Development at the Memorial University of Newfoundland, St. John's. She urged the GCFI conference participants to consider ways to elevate the profile of small-scale fisheries, which – in terms of providing employment for fishers and catches for human consumption – are simply "too big to ignore" [1]. Dr Chuenpagdee is a powerhouse, and I was eager to chat with her at a socio-economic café where I got the opportunity to ask whether we erroneously mislabel our fisheries as small.

In terms of technological capacity, small-scale fisheries are certainly "small" compared to industrial ventures, but they are rather large in terms of the employment they provide for fishers as well as the quantity of catch they supply for human consumption [2]. Undoubtedly, the dearth of quantitative catch data associated with small-scale fishing sectors perpetuates this false notion of their size. As Dr Pauly plainly states in his foreword to the book "World small-scale fisheries: contemporary visions" (edited by Dr. Chuenpagdee), "countries cannot be bothered with the logistical and administrative nightmare that monitoring and reporting on small-scale fisheries often represents" [3]. As a native of the Caribbean and a research assistant with the *Sea Around Us* Project, I feel it to be my duty to reconstruct this historical fisheries information.

During my presentation at the conference, I explained how using information on catch, effort and seafood demand (i.e., consumption, as per household surveys) allowed me and my colleagues to reconstruct total marine fisheries catches for 10 Caribbean island countries from

Taganga, a fishing village in Colombia (LEFT). Robin Ramdeen presenting "Underreporting in Caribbean fisheries catches" at the GCFI conference (RIGHT). (Photos: Robin Ramdeen)

1950 to 2010. Unsurprisingly, these catch reconstructions illustrated a substantial level of under-reporting in the Caribbean. For example, the reconstructed catches of Haiti and Jamaica were 3 and 4.3 times higher, respectively, than catches reported by these countries to the FAO, where the data become part of the world "catch" database. Overall, approximately 5 million tonnes of unreported catches were estimated for these 10 Caribbean countries during the 60-year period that we examined, with an average of 54,000 tonnes of unreported catches each year. The main discrepancy was due to unreported and under-reported catches from the artisanal, subsistence and recreational sectors. However, reporting seems to be improving as unreported catches in the early time period accounted for 80% of reconstructed catches, as opposed to 50% in the present time period.

A fishing boat at Taganga, a village in Colombia. (Photo: Robin Ramdeen)

The presentation was well-received and I had a number of scientists and fishers as well as an anthropologist interested in learning more about the *Sea Around Us* Project. Despite the English-Spanish language barrier, the GCFI spirit demonstrated that we are just one planet, working together for our precious oceans – questioning, sharing and improving things.

We are just one planet, working together for our precious oceans

References

[1] "Too big to ignore" is a research network and knowledge mobilization partnership which aims to address the issues and challenges facing small-scale fisheries; http://toobigtoignore.net/

[2] Jacquet J and Pauly D (2008) Funding priorities: big barriers to small-scale fisheries. Conservation Biology 22(4): 832-835.

[3] Chuenpagdee R, editor (2011) World small-scale fisheries: contemporary visions. Eburon, Delft. 400 p.

Sea Around Us Project 2012 publications

Journal articles

Al-Abdulrazzak D, Palomares MLD and Pauly D (2012) Gaining perspective on what we've lost: The reproducibility of encoded accounts in historical ecology. PLoS One 7(8): e43386.

Al-Abdulrazzak D and Trombulak SC (2012) Classifying levels of protection in marine protected areas. Marine Policy 36: 576-582.

Allnutt T, McClanahan T, Baker M, Lagabrielle E, McClennen C, Rakotomanjaka A, Tianarisoa T, Watson R and Kremen C (2012) Comparison of marine spatial planning methods in Madagascar demonstrates value of alternative approaches. PLoS One 7(2): e28969.

Bailey M, Flores J, Pokajam S and Sumaila U (2012) Towards better management of Coral Triangle tuna. Ocean and Coastal Management 68: 30-42.

Biery L and Pauly D (2012) A global review of species-specific shark fin to body weight ratios and relevant legislation. Journal of Fish Biology 80(5): 1643-1677.

Brotz L, Cheung WWL, Kleisner K, Pakhomov E and Pauly D (2012) Increasing jellyfish populations: trends in Large Marine Ecosystems. Hydrobiologia 690(1): 3-20.

Campbell B and Pauly D (2013) Mariculture: a global analysis of production trends since 1950. Marine Policy 39: 94-100.

Cheung WWL, Meeuwig JJ, Feng M, Harvey E, Lam V, Langlois T, Slawinski D, Sun C and Pauly D (2012) Climate change induced tropicalization of marine communities in Western Australia. Marine & Freshwater Research 63: 415-427.

Cheung WWL, Sarmiento JL, Dunne J, Frölicher TL, Lam V, Palomares MLD, Watson R and Pauly D (2012) Shrinking of fishes exacerbates impacts of global ocean changes on marine ecosystems. Nature Climate Change. DOI: 10.1038/nclimate1691

Cisneros-Montemayor AM, Christensen V, Arreguín-Sánchez F and Sumaila UR (2012) Ecosystem models for management advice: An analysis of recreational and commercial fisheries policies in Baja California Sur, Mexico. Ecological Modelling 228: 8-16.

Coll M, Piroddi C, Albouy C, Rais B, Lasram F, Cheung WWL, Christensen V, Karpouzi VS, Guilhaumon F, Mouillot D, Paleczny M, Palomares ML, Steenbeek J, Trujillo P, Watson R and Pauly D (2012) The Mediterranean Sea under siege: spatial overlap between marine biodiversity, cumulative threats and marine reserves. Global Ecology and Biogeography 21(4): 465-480.

Froese R, Kleiner K, Zeller D and Pauly D (2012) What catch data can tell us about the status of global fisheries. Marine Biology 159(6): 1283-1292.

Halpern BS, Longo C, Hardy D, McLeod KL, Samhouri JF, Katona SK, Kleisner K, Lester SE, O'Leary J, Ranelletti M, Rosenberg AA, Scarborough C, Selig ER, Best BD, Brumbaugh DR, III FSC, Crowder LB, Daly KL, Doney SC, Elfes C, Fogarty MJ, Gaines SD, Jacobsen K, Karrer LB, Leslie HM, Neeley E, Pauly D, Polasky S, Ris B, Martin KS, Stone GS, Sumaila UR and Zeller D (2012) An index to assess the health and benefits of the global ocean. Nature 488: 615-620.

Harper S, Bevacqua D, Chudnow R, Giorgi S, Guillonneau V, Le Manach F, Sutor T and Sumaila UR (2012) Fuelling the fisheries subsidy debate: agreements, loopholes and implications. Fisheries Research (113): 143-146.

Harper S, Zeller D, Hauzer M, Pauly D and Sumaila UR (2013) Women and fisheries: contributions to food security and local economies. Marine Policy 39: 56-63.

Jones T, Bostrom BL, Hasting MD, van Houtan K, Pauly D and Jones (2012) Resource requirements of the Pacific leatherback turtle population. PLoS One 7(10): e45447.

Kleisner K, Zeller D, Froese R and Pauly D (2012) Using global catch data for inferences on world fisheries. Fish and Fisheries. DOI: 10.1111/j.1467.2979.2012

Lam VWY, Cheung WWL, Swartz W and Sumaila UR (2012) Climate change impacts on fisheries in West Africa: implications for economic, food and nutritional security. African Journal of Marine Science 34(1): 103-117.

Le Manach F, Andriamahefazafy M, Harper S, Harris A, Hosch G, Lange G-M, D Z and UR S (2012) Who gets what? Developing a more equitable framework for EU fishing agreements. Marine Policy 38: 257-266.

Le Manach F, Gough C, Harris A, Humber F, Harper S and Zeller D (2012) Unreported fishing, hungry people and political turmoil: the recipe for a food security crisis in Madagascar? Marine Policy 36: 218-225.

Morissette L, Christensen V and Pauly D (2012) Marine mammal impacts in exploited ecosystems: would large-scale culling benefit the fishery? PLoS One 7(9): e43966.

Norse EA, Brooke S, Cheung WWL, Clark MR, Ekeland I, Froese R, Gjerde KM, Haedrich RL, Heppell SS, Morato T, Morgan LE, Pauly D, Sumaila R and Watson R (2012) Sustainability of deep-sea Fisheries. Marine Policy 36(2): 307-320.

Pauly D and Froese R (2012) Comments on FAO's State of Fisheries and Aquaculture, or 'SOFIA 2010'. Marine Policy 36: 746-752.

Pauly D and Le Manach F (2012) Expansion de la pêche mondiale : conséquences et perspectives. Espèces 5: 54-61.

Pikitch EK, Konstantine JR, Essington TE, Santora C, Pauly D, Watson R, Sumaila UR, Boersma PD, Boyd IL, Conover DO, Cury P, Heppell SS, Houde ED, Mangel M, Plaganyi-Lloyd E, Sainsbury K, Steneck RS, Geers TM, Gownaris N and SP M (2012) The global contribution of forage fish to marine fisheries and ecosystems. Fish and Fisheries. DOI: 10.1111/faf.12004

Srinivasan T, Watson R and Sumaila UR (2012) Global fisheries losses at the exclusive economic zone level, 1950 to present. Marine Policy 36(2): 544-549.

Sumaila UR (2012) Overfishing: Call to split fisheries at home and abroad. Nature 481(7381): 265-265.

Sumaila UR (2012) Seas, Oceans and Fisheries: A Challenge for Good Governance. The Round Table: The Commonwealth Journal of International Affairs 101(2): 157-166.

Sumaila UR, Cheung W, Dyck A, Gueye K, Huang L, Lam V, Pauly D, Srinivasan T, Swartz W, Watson R and Zeller D (2012) Benefits of rebuilding global marine fisheries outweigh costs. PLoS One 7(7): e40542.

Sumaila UR, Cisneros-Montemayor AM, Dyck A, Huang L, Cheung WWL, Jacquet J, Kleisner K, Lam V, McCrea-Strub A, Swartz W, Watson R and Zeller D (2012) Impact of the Deepwater Horizon well blow-out on the economics of US Gulf fisheries. Can. J. Fish. Aquat. Sci 69: 1-12.

Sumaila UR and Huang L (2012) Managing Bluefin Tuna in the Mediterranean Sea. Marine Policy 36(2): 502-511.

Swartz W, Sumaila UR and R W (2012) Global ex-vessel fish price database revisited: a new approach for estimating 'missing' prices. Journal of Environmental and Resource Economics 14 p. DOI: 10.1007/s10640-012-9611-1

Teh L, Lydia S, Teh C and Sumaila UR (2012) Quantifying the overlooked socio-economic contribution of small-scale fisheries in Sabah, Malaysia. Fisheries Research 110(3): 450-458.

Trujillo P, Piroddi C and Jacquet J (2012) Fish farms at sea: the ground truth from Google Earth. PLoS One 7(2): e30546.

Veitch L, Dulvy NK, Koldewey H, Lieberman S, Pauly D, Roberts CM, Rogers AD and Baillie JEM (2012) Avoiding empty ocean commitments at Rio+20. Science 336: 1383-1385.

Watson R, Cheung W, Anticamara J, Sumaila RU, Zeller D and Pauly D (2012) Global marine yield halved with increasing fishing intensity. Fish and Fisheries. DOI: 10.1111/j.1467-2979.2012.00483.x

Chapters in books and reports

Al-Abdulrazzak D (2012) Shifting baselines alter the public's perception of the environment. p. 54 In Kruczynski WL and Fletcher PJ (eds.), Tropical Connections: Facts About South Florida's Marine Environment. IAN Press, Cambridge, MD.

Al-Abdulrazzak D (2012) There has been a loss of megafauna from south Florida waters. p. 48-49 In Kruczynski WL and Fletcher PJ (eds.), Tropical Connections: Facts About South Florida's Marine Environment. IAN Press, Cambridge, MD.

Boonzaier L, Harper S, Zeller D and Pauly D (2012) A brief history of fishing in the Prince Edward Islands, South Africa, 1950-2010. pp. 95-101 In Harper S, Zylich K, Boonzaier L, Le Manach F, Pauly D and Zeller D (eds.), Fisheries catch reconstructions: Islands, Part III, Fisheries Centre Research Report Fisheries Centre, Vancouver, B.C.

Greer K, Harper S, Zeller D and Pauly D (2012) Cocos (Keeling) Island and Christmas Island: brief history of fishing and coastal catches (1950-2010). pp. 1-13 In Harper S, Zylich K, Boonzaier L, Le Manach F, Pauly D and Zeller D (eds.), Fisheries catch reconstructions: Islands, Part III. Fisheries Centre Research Report, Vancouver, B.C.

Pauly D, Belhabib D, Cheung W, Cisneros-Montemayor A, Harper S, Lam V, Mai YY, Manach FL, Mok KM, Meer Lvd, Shon S, Swartz W, Sumaila UR, Watson R, Zhai L and Zeller D (2012) Catches [of the Chinese distant-water fleet]. pp. 21-29, 81-85 In Blomeyer R, Goulding I, Pauly D, Sanz A and Stobberup K (eds.), The role of China in World Fisheries. European Parliament, Directorate General for Internal Policies, Policy Department B: Structural and Cohesion Policies - Fisheries, Brussels.

Pauly D and Yañez-Arancibia A (2012) Fisheries in lagoon-estuarine ecosystems pp. 465-482. In Day JW, Crump BC, Kemp WM and Yañez-Arancibia A (eds.), Estuarine Ecology, Second Edition. Wiley Blackwell.

Books and reports

Blomeyer R, Goulding I, Pauly D, Sanz A and Stobberup K (2012) The role of China in world fisheries. European Parliament, Directorate General for Internal Policies, Brussels. 97 p.

Pikitch E, Boersma PD, Boyd IL, Conover DO, Cury P, Essington T, Heppell SS, Houde ED, Mangel M, Pauly D, Plagányi É, Sainsbury K and Steneck RS (2012) Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs, Washington, D.C. 108 p.

Vakily JM, Seto K and Pauly D, editors (2012) The marine fisheries environment of Sierra Leone: belated proceedings of a national seminar held in Freetown, 25-29 November 1991. Fisheries Centre, Vancouver, B.C. 104 p.