Sea Around Us

Short, cold days and long, even colder nights: A successful arctic catch reconstruction workshop[1]

by Dirk Zeller and Shawn Booth

It wasn't above the Arctic Circle, but close enough for *Sea Around Us* project participants Daniel Pauly, Dirk Zeller and Shawn Booth, who presented a talk and conducted a workshop during the Alaska Marine Science Symposium in Anchorage on January 23-24, 2008. The purpose of the workshop was hinted at by the title of Dirk Zeller's symposium talk: "No fish caught in arctic Alaska? Contrasting reported data with actual catches."

The USA is a member country of the United Nations Food and Agriculture Organization (FAO), and thus commits to reporting annual fisheries catches to FAO. Interestingly, an examination of FAO data indicates that the USA does not report any catches for the arctic region of its territory (i.e., northern part of Alaska, Figure 1), as US catches for FAO Statistical Area 18 (Arctic Sea) are zero for the entire 1950-present time period. However, the two main arctic boroughs of the State of Alaska had a human population of approximately 14,500 people in 2005. The majority of this population is Iñupiaq, and is known to extensively engage in subsistence fishing and hunting. Thus, while some fisheries data for subsistence fishing are available via Alaska State agencies (e.g., Division of Subsistence, Alaska Department of Fish and Game, ADF&G), it appears that these data do not make it into the national reports of fisheries catches that the US federal government submits, on behalf of the United States of America, to FAO for global reporting.

The *Sea Around Us* project endeavors to improve global data on the impacts of fishing on marine ecosystems, and thus engages in catch reconstruction activities in which the project utilizes all available data and information sources to derive estimates that better account for likely true extractions of marine resources (see, e.g., *Sea Around Us* Issue 35). Not only do we utilize commercial fisheries data (which are generally reported by official fisheries data collection agencies), but we also incorporate non-commercial and small-scale fisheries sectors. Often these small-scale sectors are monitored by State (e.g., Alaska Division of Subsistence) and Federal (US Fish and Wildlife Service) agencies that generally do not have an

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1. This project and the workshop were funded by the Lenfest Ocean Program, with excellent workshop logistics and local contacts facilitation provided with enthusiasm by Jon Warrenchuk and Susan Murray from Oceana - Juneau, Alaska.

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exclusive fisheries mandate such as NOAA-NMFS. Until investigated in detail, it remains uncertain if, and which parts of, small-scale, non-commercial fisheries data are incorporated in federally-reported statistics. From past experience (Booth and Watts, 2007; Zeller and Pauly, 2007; Zeller *et al.*, 2007), we have found that, in general, catches for large-scale commercial fisheries are relatively well documented and reported, whereas catches for small-scale and subsistence fisheries are often neither reported to national fisheries agencies nor incorporated in national accounts as provided to the global community via FAO.

This will serve as baseline, so far missing, for the anticipated push for expansion of fisheries in the arctic region, driven by climate change

Thus, we proposed to assemble available information and data, and reconstruct historic fisheries catches for the arctic area of Alaska, for the period from 1950 to the present, based on the approach outlined in Booth and Watts (2007) and Zeller *et al.* (2007). The overall aim was to derive estimates of total removal of fisheries resources for this period. This will serve as baseline, so far missing, for the anticipated push for expansion of fisheries in the arctic region, driven by climate change. Important in this context is the present development of an arctic fisheries management plan by the Pacific Fisheries Management Council in Alaska. We hope that our reconstructed data will provide a representative baseline and input into any such plan.

Fisheries in this area fall under the mandate of the state, as they occur within 3 nm of shore. Commercial fisheries are reported annually by the ADF&G-Division of Commercial Fisheries. Subsistence catches are reported only intermittently for some communities, with estimated catches being derived mainly through household surveys. Subsistence catches are reported by the ADF&G-Division of Subsistence, but the re-construction process also used reports from other sources, especially for the earlier time periods. Having completed a preliminary time series of estimated fisheries catches, the next step was to go to Alaska and present these findings at a regionally important conference, and discuss the findings at a workshop with local experts.

The symposium presentation gained interest from a relatively large group of listeners. More importantly, judging by the questions being asked after the presentation, and the people approaching us afterwards, we had managed to target exactly the people we needed to speak to. The general impression from this input was very supportive, and the mutual feeling was that we seem to be getting it right. A few minor missing pieces in the puzzle were also pointed out, and were subsequently addressed during the workshop the following day.

The workshop participants represented a diverse group of local experts and were identified and invited with help from Susan Murray and Jonathan Warrenchuk, local representatives of Oceana. After an initial introduction on the state of global fisheries statistics by Daniel Pauly, Dirk Zeller expanded on the purposes and examples of why catch reconstructions are needed. Shawn Booth then walked participants through the details

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The *Sea Around Us* website may be found at www.seaaroundus.org 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.

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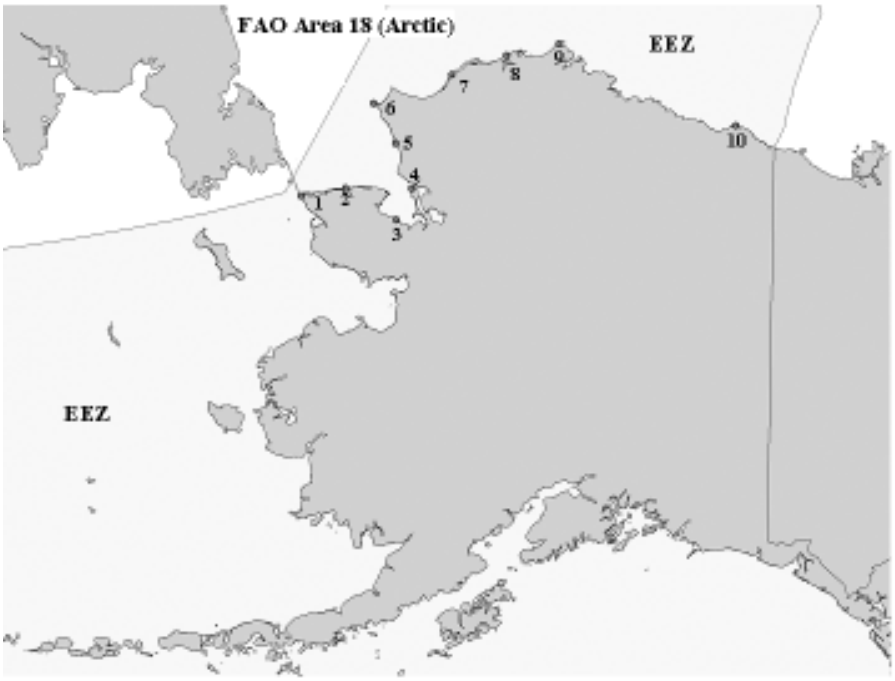

Figure 1. State of Alaska, showing the Exclusive Economic Zone (EEZ) and southern boundary of FAO Statistical Area 18 (Arctic). Indicated also are the arctic communities used in this study: 1) Wales, 2) Shishmaref, 3) Deering, 4) Kotzebue, 5) Kivalina, 6) Point Hope, 7) Point Lay, 8) Wainwright, 9) Barrow, and 10) Kaktovik.

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of the Alaskan arctic catch reconstruction, community by community (Figure 1). During the detailed explanations for each community, feedback from the local participants was sought and given. This feedback was largely related to subsistence catches, which have large data gaps due to the intermittency of studies in time and space.

Two immediate concerns were raised: one regarding species identification and the other concerning communities that were not included in the catch re-construction. The first concern arose because most of the reports describing subsistence catches used non-standardized common names. Thus, each community had to have an initial clarification of local common names, which were then assigned to a taxon. It was proposed that local Iñupiaq names be placed along with the local common name and the scientific names for each species. It was also felt that a few communities that were located further inland should also be included in estimates for anadromous and marine species. Including these other communities' catches will increase subsistence catch estimates, but will also be useful for the local agencies to have a complete picture of the fisheries catches for species that rely, for at least part of their life-history, on marine waters, rather than focusing on capture locations (i.e., fresh water vs marine or brackish water).

A side-benefit to discussing species compositions for each community was the opportunity to assess the arrival of some salmon species to places further north than their historical distributions, illustrating ecological range expansions due to climate change. It seems that chinook salmon, (*Oncorhynchus tshawytscha*), have been appearing in local waters around Barrow since the mid-1990s, but there is no local Iñupiaq name for them (Craig George, North Slope Borough-Division of Wildlife Management, pers. comm.).

Another point was raised in relation to commercial fisheries. There are basically two commercial fisheries in the area, one located on the North Slope, targeting arctic cisco (*Coregonus autumnalis*) near the mouth of the Colville River, and another fishery, largely targeting chum salmon (*Oncorhynchus keta*) around Kotzebue Sound. These fisheries began in the 1960s - however, Charlie Lean (Norton Sound Fisheries Research and Development) pointed out that despite the commercial fishery in Kotzebue Sound being deemed by government reports to have started in 1962, there were local commercial fisheries taking place prior to that date. The commercial fishery pre-1962 was an informal one, whereby local people sold their catch for dog feed to people who ran dog-sled teams, the transportation link prior to the introduction of the snow-mobile.

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Of turtles and people: 28th International Sea Turtle Symposium

by Colette Wabnitz

A landmark turtle conservation accord was signed between the Grupo Tortuguero and a local fishing co-operative

Every year the sea turtle research community gathers in more or less exotic places to share and report on the latest progress on sea turtle research and conservation. Organised by a team of intrepid and visionary folk led by J Nichols (Senior Research Scientist at the Ocean Conservancy), this year's event sought to depart from the usual format of international meetings. Instead of a cosmopolitan city, the symposium was held in the community of Loreto, Baja California Sur, Mexico (population: 12,000). The location was strategic for two reasons. First, it is on a beach in Baja that Nichols released a satellite-tagged loggerhead turtle12 years ago. Adelita, as it was nicknamed, would swim across the Pacific Ocean to its birthplace in Japan representing the first time that a turtle had been tracked across an ocean basin. Second, the international congress was meant to coincide with the annual meeting, and 10-year anniversary, of an important regional environmental organisation, the Grupo Tortuguero (GT).

The GT is a network of individuals, communities, organizations, and institutions from around the world, dedicated to sea turtle conservation. By uniting fishers, scientists, conservationists, and other stakeholders, the GT's success is built on a foundation of solid science, coupled importantly with the trust that researchers have nurtured over the years with the members of local communities.

The GT's efforts led to two notable achievements in 2007. Through an international exchange programme, local fishers from Baja California were brought together with their counterparts from Hawai'i and Japan to share information on turtle-friendly fishing methods. A landmark turtle conservation accord was also signed between the GT and a local fishing co-operative. By ratifying it, the co-operative members agreed to give up longlines in exchange for less harmful gears such as traps and surface nets.

This year's International Sea Turtle Symposium also placed emphasis on Native Oceans - seeking to recognise that indigenous communities' efforts to conserve their natural environment are a key and integral component of international initiatives. Indeed, not only are native peoples often those living closest to the natural environment, they also maintain deep cultural ties to marine species such as sea turtles, and a direct need to coexist with these species. Some of the events at

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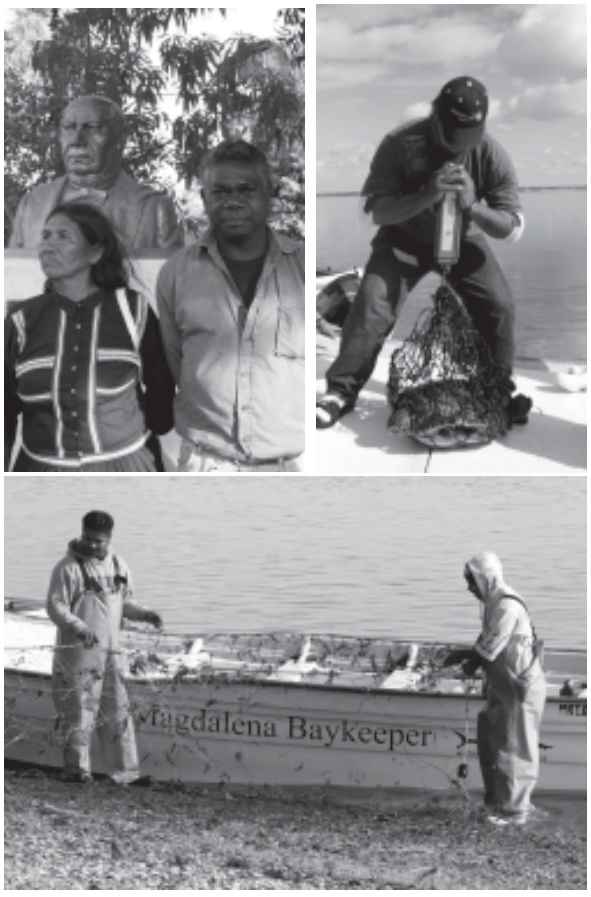

Clockwise from top left: 1) A Seri woman and Torres Strait Islander meeting here for the first time and sharing traditional knowledge and customs; 2) Adan, a local fisherman and member of the new turtle tourism initiative, seen here weighing a turtle; 3) Local fishers cleaning the nets after a night spent catching turtles in order to tag and release them. The fishermen are part of a local initiative, Magdalena Baykeeper, which promotes ecological welfare through public advocacy, environmental education and clean-up campaigns.

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the symposium that honoured indigenous initiatives included traditional Seri turtle songs and dances. The Seri, an indigenous group from the state of Sonora, Mexico, consider the leatherback turtle sacred and have strong emotional, spiritual and cultural ties to the animal. One of the most moving, powerful, and humbling events of the meeting was a roundtable and exchange of gifts between native community members from countries including Mexico, Panama, Australia (Torres Strait), Nicaragua and Palau.

In keeping with the common entreaty to "think globally, act locally", the symposium also saw the Ocean Conservancy officially launch the SEE Turtles Project (www.seeturtles.org). This initiative, currently in its pilot phase and with one of its sites in Baja California Sur, aims to promote turtle conservation through small-scale ecotourism. By working with tour operators that have strong environmental records, the project primarily seeks to help build non-consumptive alternatives to illegal fishing.

Another remarkable aspect of this meeting was the effort to keep the event's environmental footprint as small as possible: local transport was provided chiefly by our own feet, recycling bins were placed in strategic locations, and eating choices were sustainable and local. LIVBLUE Awards were given to those attendees who had travelled the greatest distance but with the lowest carbon footprint, showcasing some interesting and often rather entertaining methods of footprint reduction!

Mercury in the Chesapeake?

by Shawn Booth, Howard Townsend[1] and Villy Christensen

The Chesapeake Bay is in the backyard of those who live on the eastern seaboard of the United States. Its brackish water touches Maryland and Virginia, while its watershed extends to the states of Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia. Not unimportantly, it forms the backyard of Washington, DC, where the powers that be often struggle to demonstrate concern for the environment.

With this background, it is no surprise that very considerable effort over the years has been allocated to cleaning up the Bay, as well as to attempting to restore it to a more original state. The Bay has, in modern times, changed from having a vast abundance of oysters, that may once have kept the waters clear, to a state where agricultural run-off impacts water quality and where anaerobic conditions prevail in the deeper parts.

There is also concern about pollutants. For this, the U.S. Clean Water Act sets Total Maximum Daily Loads (TMDLs) to determine the amount of a pollutant that a water body can receive while still maintaining water quality standards. TMDLs have been or are being developed for each state impacting the Chesapeake Bay, and there is special interest regarding mercury, which is a contaminant in coal. Chesapeake states, particularly Pennsylvania, have most of their electricity generated by coal-fired power plants. With atmospheric transport, mercury is deposited into the Bay, and transformed into physiologically-active methylmercury compounds. Methylmercury can cause deleterious effects in fish (Klaper *et al.* 2006), and is also a human health concern (UNEP 2002), primarily through seafood consumption. Therefore, the individual states set consumption advisories for the amount of seafood that can be consumed where methylmercury loads are of concern. For example, the Maryland Department of the Environment recommends that the general public should avoid eating more than two standard servings of smaller striped bass (*Morone saxatilis*) per month. Larger ones should be consumed much more rarely.

Methyl mercury can cause deleterious effects in fish and is also a human health concern, primarily through seafood consumption

With this background and with TMDLs being developed for mercury, the Chesapeake Bay Program's Scientific and Technical Advisory Committee arranged a workshop to develop integrated modelling and monitoring programs for mercury in the Chesapeake Bay from Oct 2-4, 2007 – a workshop in which we participated. The workshop focused on three main topics: emission inventories, atmospheric modelling, and ecosystem modelling, with our contribution focusing on the latter.

We have been working for several years on a detailed ecosystem model of the Chesapeake Bay using

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1. NOAA Chesapeake Bay Program Office/Collaborative Oxford Laboratory

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The workshop also highlighted the utility of data 'handshakes', where the output of the atmospheric models [...] can be used as inputs within Ecospace

Ecopath with Ecosim (EwE) in a co-operative effort funded through the NOAA Chesapeake Bay Office's Fisheries Science Program. As part of this we have constructed an EwE model that describes the ecosystem, and how its resources have been used and developed since 1950. We used this model with the Ecotracer module of EwE to track how methylmercury moves through the foodweb. We fitted the model to available data on methylmercury loading for various fish species in the Chesapeake, based on loading values derived from sediment cores which reflected trends in mercury input from 1955 to 2005. We found that the model, although preliminary, was quite capable of tracking the methylmercury concentrations that have been observed for fish in the Bay.

An interesting observation was that we could see the impact of a moratorium of fishing for striped bass in the Bay. Because of stock depletion, Maryland and Delaware stopped all fishing from 1984-1990, and Virginia imposed a one-year moratorium in 1989. The ecosystem model shows how the striped bass population was severely depleted up to the mid-1980s and has since recovered to what may be historic levels. The estimated methylmercury trends closely follow the population trends: when the stock was depleted in the mid-1980s the methylmercury loads were at an all-time low, and have rebounded since the population recovered. The explanation is simple: low population size is associated with high mortality rates, and this equates to young individuals with low methylmercury loading. When fishing pressure was restricted with the moratorium, we saw the population grow older and hence have longer to accumulate the toxin, with the bottom line being that mercury loading increased disproportionately with age. For some, this is an unforeseen consequence of a moratorium impacting mortality of fish populations. It is also an interesting observation that may help explain increased susceptibility to mycobacteriosis, a bacterial disease that has affected striped bass in the bay in recent years. Overall, we found that the two main predictors of methylmercury concentrations in the 45 functional groups in the model were trophic level and longevity.

The workshop also highlighted the utility of data 'handshakes', where the output of the atmospheric models (which include point and non-point sources of mercury emissions) can be used as spatial inputs within the spatial-dynamic EwE module, Ecospace. This is an area we are now exploring further.

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The feedback gained through the symposium presentation and workshop activity will form part of the final report for fisheries catches in the Alaskan arctic. This work will extend the reconstruction to include more communities and also report the total catch of fish for both the commercial fisheries, which will be extended back in time, and for the subsistence fisheries, which will include the total catch of marine and anadromous species regardless of capture locations. This was deemed important by the local participants in light of potential lost opportunity costs for any development that might hamper the ability of the communities to participate in subsistence fishing.

Having successfully navigated arctic marine fisheries 'waters' through this workshop, we retired to a nice dinner after bravely venturing (temperature influenced) less than two blocks outside the workshop venue.

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