

Letters to the Editor

To the Editor:

I wish I could remember who wrote: "First of all, work on distilling your objectives, for by getting his down to three words —*Delenda est Carthago*—Cato the Elder pretty effectively wiped out the opposition."

If those who described their plans for a Census of Marine Life (CoML, hereafter) in a recent issue of *Oceanography* (Vol. 12 No. 3) had taken this advice, their project might be in better shape.

For Nierenberg, CoML is about counting the last undescribed species of fish, for Grassle *et al.* it is to be an Ocean Biogeographic Information System, while Levi *et al.* seek "a fundamental understanding of the way things live and die in the sea," and for Bradley the Grand Challenge is to answer "How much life can the ocean sustain?" For McGowan, what is needed is a biological WOCE. Of course, that's not the end, by any means: for the EDF, it is to be a "global marine biodiversity Census," while the Monterey Workshop nudged the thing towards "higher trophic levels." Finally for you, sir, the CoML seems to be a re-incarnation of JGOFS "understanding the complex nature of biological-physical-chemical coupling in the dynamic marine environment."

Certainly, Rome would have lost the Punic Wars with that kind of strategic planning, but since nobody seems to have rejected the critical and precise word "census," I must suppose that some kind of numeration or count remains central to the plan. But a moment's reflection will suggest that this is an illogical (as well as impracticable) objective; the ocean is nothing if not variable in space and time and any entity it contains is, literally, not only uncounted but uncountable. Estimates can be made, with error bars, which is what much of marine biology has been about from the beginning, and will continue to be, with or without a CoML to help it along. A good answer to the so-called Grand Challenge would be "When?"

But in quite a different class to hazy planning is tout-ing snake-oil. Several authors urge the deployment of new technologies in a CoML, but in at least one case "new" means "imagined," and in all there is in my opinion a lack of realism about what they measure and how they can contribute to a "census."

For a start, what do they measure? All remote sensing techniques require validation: one may infer that the blips in Jaffe's side-scan sonar are migrating salmon, but that's all, and though swim-bladder calibration may be useful for interpreting sonar techniques where pelagic

fish are of few species, this not a common situation. Then, the "reverse migrant zooplankters, possibly *Pseudocalanus* (sic)," inferred by Jaffe from his Figure 2, are entirely notional, though cited to suggest that upwards-looking anchored sonars may be useful to a CoML. What his 420 kHz TAPS image actually requires one to infer is simply an advection past the inverted sounder of a patch of sound-reflective particles lying at about 5m depth, since the "missing biomass" at the surface is inappropriately placed to support any other hypothesis. Reverse migration may well occur, but this image does not support it. *Caveat emptor!*

But in a snake-oil class all their own are the roaming "Super-Predators" of Parrish, apparently capable of "remote species detection." If you didn't know to the contrary, you would have to assume from this article that SPs are just waiting to be built and that the necessary sensors to "detect and identify marine species without capturing the organism" already exist. In fact, the table attached to this article falsely claims that they do exist, now. But anybody who believes that Optical or Video Plankton Recorders, and holographic techniques are available "now" to perform this task for "all plankton" from "all mobile platforms," must also believe in fairies. It just isn't so, and probably won't ever be.

Nor is it necessary to trash perfectly good techniques we've used since the beginning. Despite what Parrish and you, sir, seem to believe, gelatinous zooplankton are very well sampled by regular nets. Has everybody forgotten what's in the literature? To mention just a couple of examples on the bookshelves: (i) Alvarino at Scripps gathered, in 1971, about 220 references which record some thousands of localities in all oceans at which 86 species of siphonophores had been found and (ii) a heavy box file labeled "Diets, gelatinous zooplankton" stuffed with reprints—all done with nets, I'm sure, despite the raptures of blue-water scuba divers.

Then, how do these novel remote sensing techniques contribute to a census of anything? The authors seem fond of the word "global" but I fear that few of them actually grasp the real dimension of the oceans. Shipboard sonar and optical sensors certainly extend data collection between stations, and airborne sensors will assist in coastal coverage, but the central truth will not be changed: that maps of biological variables derived from any survey — even from CalCOFI — represent no more than an unverifiable approximation to the true distribution at the central moment of the survey period. This sad truth needs to be better understood and seems not to have occurred to the authors of these proposals, or

they would not have so spectacularly ignored the best (and only) hope we do have of bettering the situation. Why does nobody suggest extrapolating ecological conditions in the pelagic from available satellite imagery of sea surface temperature, elevation and chlorophyll? What about turning the concept of plankton species as indicators of surface water masses on its head? Now there's a revolution waiting to be exploited!

A thread that runs through the articles is the progressive decrease in support for taxonomic research and the need to marry taxonomic information with digital data processing techniques, as has been done so handily in FishBase. This raises a host of questions, both practical and political. Even the taxonomic data incorporated into FishBase, admirable initiative though it is, lack the depth required for real systematic study; a listing of described species and their attributes, even when exhaustive and even if reviewed by specialists, cannot replace consultation of the primary literature — most importantly of critical revisions of genera and families, like Bruce Frost's *Clausocalanus*, nor (and here's the rub) access to type specimens. I have no special knowledge of the current status of the collections in the large systematic museums: the Smithsonian in Washington DC, the BM(NH) in London, the Museum Nationale d'Histoire Naturelle in Paris, and so on, but what I read in the press doesn't encourage me. To the extent that these institutions allow their collections to deteriorate, an OBIS as proposed by Grassle and Stocks is a house built on sand. The real challenge, surely, is not to go looking for new species, except in a few really unexplored habitats, but to safeguard the knowledge already hard-won in the past 150 years. If we can get that up into our active memory banks when needed, we probably know enough already about marine biodiversity for all practical purposes. It's just a question of deploying it right. So, for my money, that is where Sloan money ought to go.

Finally, our President challenges us to "place the exciting ideas presented here into perspective." That's easy! Using the terms of classical perspective, I would place WOCE right in the foreground for its clarity in planning, efficiency of execution and the immediate value of its data to society. Back a bit, but not yet in the middle-distance, is JGOFS, more muddled as perhaps ecology must be but generating much new understanding about global carbon cycles which we shall need in a little while. In the middle-distance, perhaps because I know insufficient about it, I see GOOS glimmering out of the haze. And, way back by the vanishing point, does that little black smudge represent CoML? I'm sure it does.

Alan Longhurst
Cajarc, France

Reply

Alan Longhurst's work, including his remarkable *Ecological Geography of the Sea* (Academic Press, 1998), has helped inspire the effort to mount a worldwide Census of Marine Life. I have personally purchased several copies of the book and shared them with those helping to define and build the program. His work addresses the central question of how sound macroscopic information on the diversity, distribution, and abundance of life in the oceans can be developed and maintained.

The articles in issue 12(3) of *Oceanography*, on which Dr. Longhurst comments, were published precisely to share with the marine science community the gestational thinking about the Census. Over the past three years all the questions Dr. Longhurst raises about scope, purpose, balance, and feasibility have been much debated. Rather than hide the contending visions, those of us involved with fostering the Census felt progress would be served by making clear the several directions a Census might take, even as the international scientific steering committee, chaired by Frederick Grassle, works on a goals and strategy document that will properly and inevitably narrow and focus the program.

As for snake oils, I do feel compelled to reply that optical plankton recorders do now work, and their capacities expand year by year. More generally, the October 1998 report on Remote Species Identification edited by Julia Parrish has been the bestseller of all the documents associated with the Census of Marine Life, requiring a large press run and then reprinting. The goal of remote species identification is of immense importance and stirs new thinking by a growing network of talented people. The Census of Marine Life can unquestionably boost this field.

As for safeguarding already hard-won knowledge, a facet of the Census already proceeding is the effort to archive better, increase, and make much more accessible information on the history of marine animal populations since fishing became important. Poul Holm (U. of Western Denmark) and Tim Smith (National Marine Fisheries Service, Woods Hole) are leading the effort to make practical proposals to build and safeguard this history, and it should surely be, as Dr. Longhurst recommends, an early priority.

In the end, Dr. Longhurst's note is alternately despairing and enthusiastic, familiar moods for researchers challenged by the sea. Let us hope sharp, cooperative planning of the kind Dr. Longhurst urges triumphs over despair, and benefits from the several clever suggestions he embeds in his lively and helpful letter.

Jesse H. Ausubel
Program Director, Alfred P. Sloan Foundation
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