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tributes to numerous social and economic problems for communities dependent upon the availability and abundance of fishery resources. In the past 10 years, numerous efforts by the international community have been expended to address the root cause of overfishing — open-access and common property or the common-pool problem. A wide array of new management techniques has been advocated and implemented, some with success and some without success. Concurrently, however, numerous other, and perhaps more daunting, problems have arisen that jeopardize the realization of sustainable resources and fisheries. Increased fishing effort and the use of new technology has contributed, in part, to the destruction or degradation of habitat. Inadequate regulations have failed to address by-catch mortality, or mortality resulting from the inadvertent harvesting of non-marketable species or products. National and international regulations have been implemented to address a growing public concern about the inadvertent capture or entanglement of sea birds and sea turtles. In essence, these undesirable outputs threaten the resource and the ecosystem that supports fishery resources and often creates conflicting social goals and objectives of management, which in turn, jeopardizes fisheries and fishery-dependent communities. In this brief paper, we provide an overview and summary of the likely types of social and economic impacts that may accompany management or regulatory efforts designed to prevent undesirable outputs. We propose that communities will likely experience substantial short-run negative impacts of options designed to prevent undesirable outputs; over time, however, it is likely that communities will realize benefits from efforts designed to reduce undesirable outputs.

BENEATH THE BLUE: THE EFFECTS OF FISHING ON SEAFLOOR HABITAT. James Lindholm, Stellwagen Bank National Marine Sanctuary and the National Undersea Research Center at the University of Connecticut

Fishing has been described as the dominant anthropogenic impact to marine ecosystems worldwide. One subset of impacts is caused by fishing with mobile bottom-contact gear (such as scallop dredges and bottom trawls) on seafloor habitat and associated taxa (such as fishes and invertebrates). Several recent reviews of the scientific literature have characterized these impacts from directed studies at sites around the world. Mobile fishing gear reduces seafloor habitat complexity through the removal of emergent fauna that provide structure (e.g., erect sponges), the removal of structure-building megafauna that produce pits and burrows (e.g., crabs, fish), and the smoothing of bedforms (e.g., sand waves). Less is known about the recovery of seafloor habitat and associated taxa following impacts from fishing. The timing, severity and frequency of fishing gear impacts to the seafloor all interact to mediate processes that lead to habitat recovery. The recovery of a given habitat from disturbance by fishing will depend also on the nature of the underlying substratum and the life histories of the taxa that occur there. Ultimately, a greater understanding of the effects of fishing on seafloor habitat, as well as the recovery rates of different habitat types following disturbance, will provide managers with a suite of options for the conservation and management of the marine environment in the presence of continued human use of that environment.

SHIFTING GEARS: IDENTIFYING AND MITIGATING THE IMPACTS OF FISHING GEARS. Lance E. Morgan, Marine Conservation Biology Institute

Recent reports have documented the historical and current impacts of fishing on the marine environment. However relatively little of this effort focuses on detecting habitat alterations relative to research on overfishing. Surprisingly little attention is paid to impacts of individual gear types, with the notable exception of bottom trawling. Fishing impacts can be generally classified as: 1) direct reduction in the abundance of target or non- target organisms, 2) alteration of habitat by gear impacts on the seabed or removal of key habitat forming species, and 3) indirect effects on ecosystems through altering the structure of the community due to these impacts and removals. A first step towards ecosystem management is to use existing information to characterize ecological impacts of common commercial fishing gears.

Gear impact ratings were achieved through a review of US fisheries and an expert consultation process, using existing knowledge and information. This information was used to develop an impact scale of different commercial fishing methods. This results in a framework for discussing different methods for mitigating these fishing gear impacts (i.e. shifting gears). Shifting gears encompasses modifying gears, retiring and phasing out the most destructive methods, and reducing or shifting effort in space or time to reduce impacts. Together these mitigation strategies will help move US fisheries towards ecosystem based management. A comprehensive zoning scheme is the most likely means of incorporating these strategies. However present management must also make it a priority to collect fishery specific impacts on habitats and ecosystems – specifically, greater observer coverage and accounting of bycatch, research of specific gear impacts on different habitats, and community level responses of these previous impacts.

TECHNOLOGICAL RESTRAINT AND THE TRANSITION TOWARD SUSTAINABLE FISHERIES. Daniel Pauly, Fisheries Centre, University of British Columbia

This contribution makes the cases that marine fisheries have so far tended to be unsustainable, even when they are 'managed,' if because of indirect effects, acting through the ecosystems in which the target species are embedded. As for historically long lasting fisheries, they appeared sustainable not because of any explicit action by fishers, or governments, but because much of the resource was physically inaccessible. Given the efficacy of modern fish finding and fishing gear, fisheries management will have to be re-structured around 'technological restraint,' a notion for which there are very few historic antecedents (one of them is banning of firearms during the Tokugawa Shogunate in medieval Japan). One form of technological restraint that is culturally acceptable in the West is the creation of natural parks, within which certain technologies are banned (e.g., cars for transportation), and hence the inherent acceptability of marine reserves by the public at large. Another form of technological restraint is provided by sports, in which the way a given goal is achieved matters more than the outcome itself (try running a marathon on a bicycle!). Technological restraint in fisheries would imply convincing the public that fish caught in a manner that harmed their supporting ecosystems is morally equivalent to cheating, and more specifically cheating them. A few examples of similar 'changes of heart' in Western culture will be presented, as a background for specific recommendations regarding mode of deploying fishing gear that would help in a transition toward sustainability.

▸ The Changing View of Human Biodiversity

Organized by Michael A. Little, State University of New York-Binghamton; Cynthia M. Beall, Case Western Reserve University

Biodiversity in Homo sapiens results from evolutionary, cultural, historical, and stochastic processes. In the early 20th century, the typological concept of race, as a fixed unit with clear boundaries, dominated thinking about human population biodiversity. Now in the early 21st century, we understand that human population variation is simultaneously a complex function of evolution and adaptation linked to varying physical, biotic, and sociocultural environments, and a result of prehistoric and historic contingencies of mutation and migration. Expanding understanding of the human genome plus the global distribution of humans and the huge variety of inhabited environments means that we can address the fundamental questions: What is a trait? How do traits originate? What is an adaptation? What processes generate and produce patterns in variation? Three speakers will discuss the evolution of human taste sensitivity, diet/cuisine, and natural selection on HIV Co-Receptors. This interdisciplinary symposium addresses a topic of enduring scientific and public interest — why do humans vary? — in a fresh way, by linking approaches from human macro- and microevolution with approaches from ecology and contemporary molecular genetics. It relates to several 2003 AAAS meeting theme tracks (Evolution of Evolutionary Ideas; Beyond the Human Genome; Public Health-Public Risk) and to several general tracks (Brain, Mind, and Behavior; Environmental and Life Sciences; Anthropology and Society).

WHY DO PEOPLE LIVE IN DIFFERENT TASTE WORLDS? EVOLUTIONARY INSIGHTS. Linda M. Bartoshuk, Audrey K. Chapo, Valerie B. Duffy, Derek J. Snyder

Taste blindness to bitter compounds containing the N-C=S group (in particular, 6-n-propylthiouracil or PROP) was discovered in 1931. Early family studies suggested that those who were taste blind (nontasters) carried two recessive alleles. Others (tasters) were thought to carry either two dominant or one dominant and one recessive allele. Modern psychophysics showed that taste blindness was not limited to bitterness but rather affected all four taste qualities. Further, tasters could be divided into those to whom PROP is moderately bitter (medium tasters) and those to whom PROP is extremely bitter (supertasters). Supertasters have the most fungiform papillae (structures containing taste buds). Since taste buds are surrounded by nerve fibers mediating pain, supertasters perceive the most oral burn from irritants like chilis; since fungiform papillae contain touch receptors, supertasters perceive the most intense sensations from thickeners in foods, including fats. These sensory differences affect food preferences and thus health conditions involving diet. Health problems associated with PROP status include cancer (some bitter cancer-preventive compounds are more palatable to nontasters) and cardiovascular disease (high sweet and fat foods are less palatable to supertasters). These PROP/health associations add to earlier ideas on the evolutionary significance of PROP status: previously, focus was on the fact that many poisons taste bitter. Most recently, our work suggests that in addition to its function as a sensory system, taste input leads to inhibition in the central nervous system that reduces activities incompatible with eating; these include gagging, nausea, coughing as well as oral pain. The taste/oral pain connections, in particular, may have evolutionary significance. Taste input inhibits oral pain such that organisms, including primitive man, could have eaten with oral lesions and thus avoided starvation. Ironically, this