From: Michael Rozengurt [mailto:rozengurt@earthlink.net]
Sent: Saturday, November 05, 2011 11:51 AM
To: Minton, Jonas; Coolidge, Keith@DeltaCouncil; keith cohn; kier
Cc: winternitz; Grindstaff, Joe@DeltaCouncil; jonathan
Subject: Fw: all about of water

For else

----- Original Message -----
From: Michael Rozengurt
To: jerry shubel
Sent: Thursday, November 03, 2011 7:29 PM
Subject: all about of water

Dear Jerry,

Thank you very much for your warm and encouragement words. I am trying much to bring to attention some Delta and Bay' scientists that if there are no water, it will be no living and non-living resources, but no avail. As a result, despoliation of deltaic and Bay recourses' have become the obvious fact.
To tell the truth, I am flabbergasted by my colleagues' professional illiteracy or something else, that force them to deny the mortal reality, namely, that universal Entropy is reined over the Delta!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Consequently, to try revitalized the Delta by halved, truncated "water actions" have become the prescription to reduction ad absurdum. Do you agree?

Cordially,

Michael Rozengurt

P.S.Attached I am proposing to your highly regarded attention my first publication, which had been warning for scientific community that lurking over horizon disaster is not typical for Soviet estuaries.
Unfortunately, this cry had been overpasses by local geniuses, but it had not been overlooked by grandson of President. Roosevelt, the publisher "Oceans", and Dr. M.Hertz.

SEA SENSE

F.Y.I.

WATER, WATER EVERYWHERE

But Just So Much To Drink

by Michael A. Rozengurt & Michael J. Herz

ESTUARIES, the meeting places of fresh and salt water, are the world's most important habitats. Throughout history people have chosen to live near the world's oceans and, more often than not, close to places where major rivers flow into the sea. Such areas were critically significant because they provided fishing, transportation and recreation as well as fresh water for drinking, power, irrigation and waste disposal dilution.

Today, over half of the world's population lives within 200 kilometers of coastlines. Eighty percent of the global fish catch comes from the continental shelf area, much of which is under the influence of fresh-water inflows from rivers and streams. Thousands of tons of anadromous fishes that are caught and eaten each year migrate from the seas to their home streams to spawn. In addition, most major port cities are located on estuaries because the major rivers associated with them represent navigable routes to inland sources of raw materials and manufactured goods.

The ever increasing needs of contemporary industrialized society place growing demands upon estuarine systems. In the absence of environmental data, policy decisions have often been based upon the demands of water users who disregard the natural limits of fresh-water sources, creating irreversible damage to previously healthy ecosystems.

This attitude has helped to contribute a world-wide set of examples which document the disastrous effects of fresh-water withdrawals on the fisheries and other resources of a wide variety of estuary types. Extensive study of the circulation and hydraulics of such estuaries has led to the development of some hydraulic models and criteria for estuaries, which have yet to be verified by observations of natural conditions. In the absence of accurate models and predictions, water developers throughout the world appear to have agreed that the fresh water emptying into the bays and shallow coastal zones is wasted and that it should be used. Consequently, extensive water withdrawals have been made, primarily for agricultural uses. The cumulative effects of such withdrawals we are only just now starting to learn about. But we have already seen what can happen when the water flow is compounded by natural variations, such as the reduction of precipitation, which produced severe drought conditions in Europe in 1972 and in western North America in 1976-77.

Not only has there been a marked increase in salinity as ocean influences extend farther inland, but a second equally important impact has been the great reduction in nutrients which are removed from the estuaries as part of water diversions. Under normal conditions, estuaries are unusually rich in a variety of organic and inorganic nutrients (phosphates, nitrates and silicate) which support large phytoplankton populations, which in turn feed a multitude of zooplanktons, fishes, and benthic organisms. Moreover, such areas normally serve as home, nursery, and breeding grounds for many commercially important species. Even from a short-term economic standpoint, reductions in river flows are likely to severely threaten fisheries and other resources.

IN THE SOVIET Union's rush to develop agricultural acreage and increase yields, rivers were dammed and streams diverted with little or no thought as to the consequences. Now, years later, the results of these actions are only too evident.

The western part of the Black Sea, the Azov Sea, and some of their rivers, deltas, and bays (the Dniester and Dnieper, the Don and Kuban) are hydrographically and ecologically typical of those found throughout the world. These habitats, as with any estuary, are dependent upon the interaction of fresh-water runoff and seawater interaction, which is influenced by a variety of seasonal, annual and man-made factors such as winds, rainfall, snow thaw, and artificial obtrusions.

As a result of artificial flow management, which reduced water volume by approximately 40 percent, the structure of planktonic and benthic communities in the shallow zone of the Black Sea has been changed almost beyond recognition. Planktonic biomass was reduced 19 to 30 percent and benthic biomass 30 to 60 percent. Overall organic material was reduced 25 to 45 percent. In 1975 and 1976, in the Dniester and Dnieper estuaries, nutrients such as nitrates, phosphates, silicates and organic detritus, again with 40 percent of fresh water inflow diverted, decreased about 30 to 35 percent. And about 90 percent of the silt load is now left upstream in reservoirs.

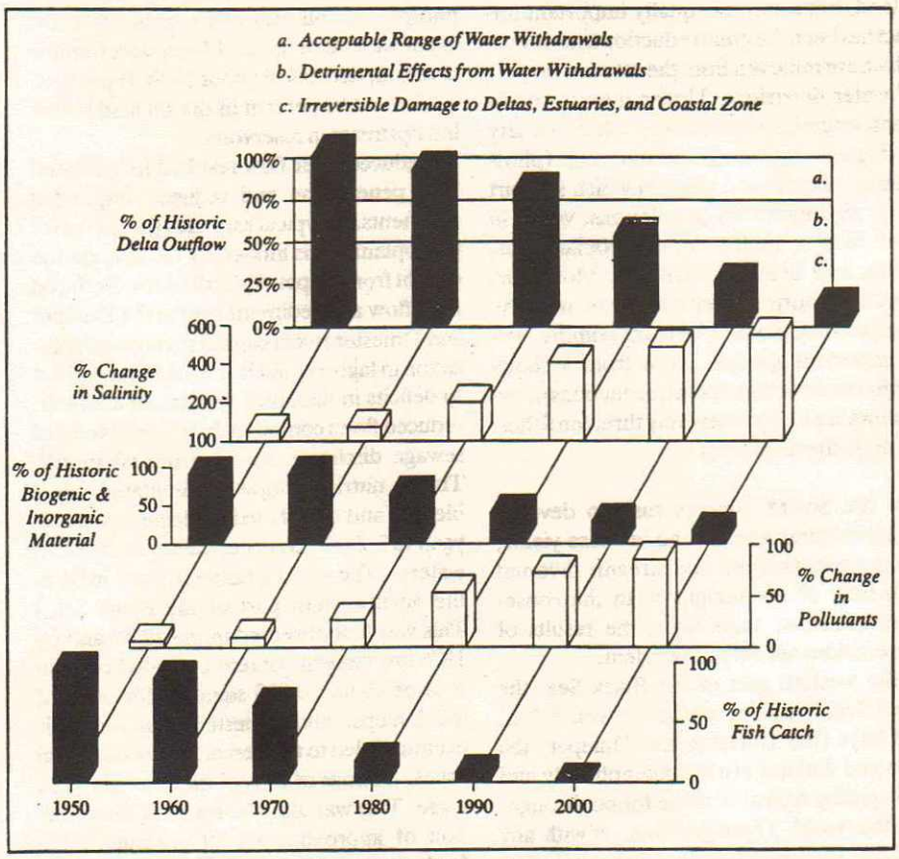
Reduced river flow resulted in increased light penetration and reduced suspended sediments. In typical estuaries the growth of phytoplankton is limited by the attenuation of light from suspended sediments. Reduced river flow and sediment load in the Dnieper and Dniester rivers caused severe eutrophication in lagoons and in adjacent sea and led to deficits in dissolved oxygen. In addition, reduced flows compounded the problems of sewage discharge and agricultural runoff. These nutrient inputs stimulated algal blooms and dieoffs led to depletion of oxygen to 0.2 milliliters per liter in the bottom waters. (The normal range is 3 to 5 m1/1 in the northwestern part of the Black Sea.) This was first observed in the 1970s and by 1976 low oxygen content extended over an area of about 10,000 square kilometers of the Dnieper and Dniester estuaries. This eventually led to the destruction of demersal fishes, millions of tons of molluscs, and red algae. This was also the result of the diversion of approximately 40 percent of the fresh-water inflow essential for dilution of sewage. Minimally, some thirty to fifty times

more water than sewage is necessary for raw sewage dilution, while six to eight times more is needed if good primary or secondary treatment is to be provided prior to discharge.

Such disastrous effects are cumulative. Additional losses of hundreds of thousands of tons of agar weed and molluscs occurred in the shallow western part of the Black Sea in the years 1974 to 1976 because of oxygen depletion. Reduction in the primary biological productivity caused the disappearance of mackerel, pelamida, and bluefish. Although the natural stock has historically provided a catch of about 100,000 to 200,000 tons per year, the fishing industry is now forced to survive on limited catches of horse mackerel and local sprat. The formerly productive sturgeon fishery has disappeared entirely from the Dniester and Dnieper estuaries.

Destruction of estuarine resources has not been restricted to the Black Sea. Almost equivalent results occurred north of it in the Azov Basin, where from 1927 to 1951 the natural annual outflow of nitrogen and phosphates into the sea was equal to 134,000 and 25,900 tons respectively (almost 70 percent of which entered during the spring floods). In this same period the commercial catch of pike, perch and sturgeon varied between 50,000 and 170,000 tons annually. Freshwater diversions eliminated 35 to 75 percent of the vital nutrients available for the spawning, breeding, and growth of fish, reducing them to only 20 to 50 percent, and fish biomass to only 40 to 70 percent of historic levels. The fish catch now ranges from 5,000 to 20,000 tons per year.

In the Azov Basin the spawning of anadromous fish has been greatly reduced as a result of extensive regulation of outflow (for the Kuban River, 80 percent!) by reservoirs which formerly were used as spawning and nursery areas. The dams have changed the pattern of seasonal runoff, in particular reducing the frequency of occurence and duration of floods in the flood plains. For example, in the Don Delta, the size of the flooded area decreased from 95,000 to 30,000 hectares, and the duration of flooding dropped from forty-nine to twelve days. It was also found that the reduction of runoff of about one cubic kilometer during the spring spawning period for anadromous fish decreased the commercial fish catch by 20 to 30 percent per year while, at the same time, the increase in salinity of about 1‰ from the average value reduced the total catch of adults that matured under increased salinity conditions by about 35 to 40 percent (up to 30,000 tons) per year. This is yet another example of how resources deteriorate as a consequence of prolonged water diversions.



The effect of unrestricted fresh-water withdrawal on estuary environments.

In 1976, the fish hatcheries of the Azov Basin released over 5.5 billion fry into the Azov Sea (about 50 percent of the total commercial fish husbandry of the USSR) in an attempt to reverse the decline of important commercial species such as sturgeon, pike and perch. They failed. The increased concentration of young and adults in the remaining limited feeding nursery areas (which have decreased about 80 percent) led to increased competition for food and degradation of habitat, and subsequent high mortality in the released fish.

Some Soviet scientists further predict that increases in sewage, and resultant oxygen depletion in combination with decreasing runoff and with increasing salinities, will soon lead to irreversible effects on the remaining fisheries of the Azov and northwestern part of the Black seas and their estuaries.

In still another body of water, the northern part of the Caspian Sea, anadromous fish catches began to decline in the 1960s when construction of immense reservoirs changed the flow of fresh water into the Volga delta during the spawning season. In addition, the dredging of a channel for deep-draft vessels between the delta and the sea (120 kilometers) produced unanticipated changes in flow, with the major portion of water moving through the dredged channel and practically no water reaching the undredged margins. As a result, the spawning and feeding areas of the Volga River's delta (approximately 300,000 hectares) did not receive enough fresh water during the spring. To solve this, a diversion ditch was dug in front of the delta to provide more water and better circulation for migrating fish. Despite this multimillion dollar attempt, migrating fish refused to take advantage of this artificial circulation and fish catches continued to be 30 to 40 percent lower than historic levels. The negative effect of man-made regulation was not a massive reduction of fresh-water inflow, but rather a moderate change in circulation patterns and a lack of sufficient water during critical periods of migration.

PUBLISHED RESULTS of research from other areas of the world show similar conclusive evidence of deterioration of estuaries once man has a hand in them. The Nile flood waters (about thirty-five cubic kilometers, mid-August to December) had provided about 125,000 tons of fish per year for centuries, caught in the coastal zone of the Mediterranean shelf (about 40 percent) and some brackish water lakes of the Nile Delta (about 50 percent). Here, as in the shallow bays of the Black Sea and the Azov Sea basin, the increased concentration of

phosphates, nitrates, silicates, and the growth of phytoplankton, coincide with the period of discharge of the annual flood water into the sea.

When the new Aswan High Dam was erected on the Nile, the fresh-water outflow dramatically dropped and the impact on marine life was severe. The catch of the Mediterranean sardinella was reduced to less than 5 percent of its historical level, the virtual end of an industry! (In the shallow shelf of the Black and Azov sea basins the decrease in landings of species such as sturgeon was similarly 92 to 96 percent.) The biological and biochemical characteristics of the Nile lakes and parts of the Mediterranean coast zone (including Israel) changed rapidly in the absence of the natural flood inputs of nutrients and silts and there were subsequent effects on temperature, salinity, and oxygen in the entire Nile River Delta system.

Similar changes have occurred in major regulated rivers in South Africa. In the Zambezi Delta, the Myobenzelini estuary, Kwa-Zulu, and four other rivers, fresh-water diversions have resulted in decreases in silt and nutrient input, increased penetration of salt water into estuaries with resulting devastating erosion of marshes and mudflats, destruction of mangrove swamps and interference with fish spawning.

Extensive withdrawals of fresh water are also linked to the gradual appearance in the estuaries of species of plankton, benthic organisms and fish which previously inhabited adjacent niches in the coastal continental shelf zone. Over a three- to seven-year period following diversions of fresh water which exceeded 30 percent of the natural flow, organisms which previously were indigenous only in the Black Sea began to populate the less saline Azov Sea. Similarly, species which historically were found primarily in the Red Sea began to appear in significant numbers in the eastern Mediterranean, following completion of the Aswan Dam. While similar changes may have occurred historically, it is unlikely that entire ecosystems have faced such radical modifications over such short periods of time, and the long-term consequences are of serious concern. Man the creator became man the destroyer with ease.

The most dramatic examples of the impact of water withdrawals are in the Amur-Darya and the Syr-Darya river basins which flow into the Aral Sea (central Asia, USSR), the fourth largest inland reservoir on earth. Since the 1960s, diversion of water from these rivers has increased to 87 percent in response to agricultural needs for cotton field irrigation. As a result, sea level has dropped approximately 6.5 meters and the previously brackish water has become hypersaline. A dying sea has been created, surrounded by stagnant saline pools and broad mudflats. The river's water mineralization has increased four to five times in response to salt intrusion, discharge of salt-saturated agricultural drainage water from the cotton fields, and evaporation. Over 80 percent of the Amur-Darya and Syr-Darya river deltas have been transformed into salt marshes and the once thriving sturgeon fishery of the Aral Sea has vanished. Adding insult to injury, 40 percent of the available irrigation water is now used in attempts to desalinate the soil through flushing out waste salts.

And now closer to home. The San Francisco Bay/Delta system combines many of the conditions found in other estuaries. Over the last thirty-five years its historic fresh-water inflow from the Sacramento and San Joaquin rivers has been reduced by 50 percent. Since 1920 salmon and striped bass catches have been reduced by 80 percent and 40 percent respectively. Nonetheless, planning continues for further water withdrawals (up to 75 percent if the proposed peripheral canal is built) and a massive discharge into the Bay of agricultural drainage water which will be high in salt and chlorinated hydrocarbon content (if the proposed San Luis drain is built). Based upon the consequences of such actions on estuaries thoughout the world, such plans will further degrade an important ecosystem which already shows the signs of impending disaster.

The universality of deterioration of estuaries in response to massive reductions in fresh-water inflow led the convener of the 1980 National Symposium on Fresh Water Inflow to Estuaries to state that "Published results regarding water developments in rivers entering the Azov, Caspian, Black and Mediterranean seas in Europe and Asia all point to the conclusion that no more than 25 to 30 percent of the historic river flow can be diverted without disastrous ecological consequences to the receiving estuary." Presentation by this article's first author at this symposium led the Texas Water Resources Department to review its studies on six estuaries. They observed that 32 percent reduction of fresh-water inflow is the maximum percentage which can be permitted if subsistence levels of nutrient transport, habitat maintenance and salinity control are to be maintained.

Unfortunately, most models of estuaries have been based upon incomplete data collected with little consistency and over too brief a period. In order to develop a usable model, it is first necessary to carry out a systematic program of special field work which investigates runoff, salinity, nutrients, phytoplankton, zooplankton, turbidity, sewage dilution, circulation and replacement of water in the estuary and fish and shellfish landings. The study must go beyond the simple cataloging of the component parts. It must include an analysis of the dynamic interactions among the components. Such a systematic investigation will make possible both short- and long-term predictions about the estuaries' future under a range of conditions.

From a wide variety of experiences, so far the results are consistent:

(1) All hydrologic processes in estuaries depend upon fresh-water outflow and sediment loads; (2) decreased fresh-water runoff, reductions exceeding 30 percent of the original flow, lead to increased effects of ocean processes (winds, tides, currents) on the estuary through devastating increases in salt intrusion and salinification of the underground basins, flood plain and the destruction of levees; (3) increased light penetration resulting from reduced silt loads produces increased eutrophication and decreases dissolved oxygen (this is aggravated by nutrients from sewage and agricultural runoff); (4) effects of pollutants increase in the absence of sufficient fresh water for adequate dilution; and (5) all of these factors result in marked reduction in biological productivity and massive decreases in landings of fish and shellfish.

The examples from around the world should suffice. It should not be necessary to continue the degradation of important systems such as the Columbia River Basin, the Fraser River (British Columbia) and the San Francisco Bay and Delta through increasing fresh-water withdrawals. These estuaries are part of our critical global resource heritage, not expendable raw materials for utilities and industries. How many irreversible changes must be endured, how many habitats around the world must be destroyed before we realize we are all subject to the same natural laws, laws whose strictures far surpass "extenuating circumstances", and the paltry politics of man?

Dr. Michael Rozengurt was trained at the Odessa Hydrometeorological Institute and the Moscow State Oceanographic Institute, and was a Senior Scientist at the Institute of the Economy of the Academy of Sciences of the Ukranian SSR. He now resides in the United States. Dr. Michael Herz is the Executive Vice President of the Oceanic Society and a member of various water quality technical advisory committees for regional and national government agencies.