RETURN TO 1998 ROD AR INDEX

53669

DCN #23

NB Estuary

STRIPERS UNLIMITED

880 Washington St., P. O. Box 3045
So. Attleboro, Massachusetts 02703
508-761-7983

SDMS DocID 53669

E/Lit/Bay comments doc. #23

Gayle Garman, (HAN-CAN3)
U.S. EPA
JFK Federal Bldg.
Boston, MA 02203

Dear Ms. Garman:

We wish to express some comments on the EPA plan to clean up PCBs in New Bedford Harbor .

The source of the contamination of the sediments in New Bedford Harbor was PCBs emmitted by industries into the Acushnet River and the New Bedford estuary. Contamination also occurred as a result of these same corporations' industrial waste deposited in the New Bedford dump located in the estuary area. Although the chemicals are no longer produced, they are intractably present in the harbor sediments.

Anaerobic bacteria, now present in the sediments and in the dump site, are releasing PCBs into the environment in still recognizable form. The PCBs are then transferred back into the food chain where they are bioaccumulated by aquatic species.

According to one member of your panel at the January 30, 1991 hearing, up to 471 ng/M^3 of PCBs were released into the air from tidally exposed sediments. Massachusetts air quality standards only allow .5 ng/ M^3.

Many species of fish are being adversely affected by these chlorinated hydrocarbons, more specifically striped bass. As you can see from the chart on the back of the enclosed paper by Robert Pond, striped bass from the eastern shore of the Chesapeake Bay system are very severely affected. (This stock spends most of its weight gaining years in the area of Cape Cod Bay and Nantucket Sound) The eastern shore stock with the valuable bouyant egg is now practically extinct. The Santee-Cooper, So Carolina stock and the stocks from the San Joaquin River in California and New Brunswick, Canada are also seriously affected. In fact all in-shore and near-shore species of fish are in trouble.

We feel that moving the sediments from the "hot spots" may do more harm than good as the bioremediation continues from the remaining sediments.

Rather than removal of the sediments, we feel that it would be preferable to investigate the introduction of genetically altered bacteria capable of separating the chlorine from the carbon in the PCB molecule. This has already been accomplished in the Hudson River in experiments now underway.

We urge you to consider this alternative for the sake of the future of the fisheries.

Sincerely yours,

Robert B. Pond
Executive Director

***
Any known data for this one?

Not sure if this comments on both Jan & May proposed plans. Yes?

POLYCHLORINATED BIPHENYLS (PCB'S) IN STRIPED BASS, *MORONE SAXATILIS* (WALBAUM) OF BUZZARDS BAY AND THE ACUSHNET RIVER

A Thesis

Presented to the Faculty of the Biology Department

of Southeastern Massachusetts University

(Master of Science)

by

Tom Frank Rusek

April, 1989

TABLE 3. Polychlorinated biphenyl concentration statistical parameters for all localities and Round Hill bass (non-transformed data). Concentrations in ug/g are not corrected for extraction efficiency or for experimental precision.

Statistical Parameter	Acushnet River	South Dartmouth	Westport	Round Hill
Fish Analyzed	20	48	37	18
Geometric Mean	16.5	0.90	0.43	0.35
Std. Error Geometric Mean	0.199	0.064	0.074	0.069
Arithmetic Mean	22.3	1.12	0.58	0.40
Std. Dev.	16.97	1.349	0.874	0.420
Std. Error	3.79	0.195	0.144	0.099
Variance	287.90	1.819	0.764	0.176
Coef. Var.	75.97	121.01	149.742	105.021
Maximum	58.4	7.4	3.9	1.3
Minimum	3.2	<0.1	<0.1	<0.1
Range	55.2	7.4	3.9	1.3
t-95%	7.94	0.392	0.291	0.209
95% Upper	30.28	1.506	0.875	0.609
95% Lower	14.39	0.723	0.292	0.191
Skewness	g_1= 0.659	g_1= 3.479	g_1= 2.104	
Transformed	N.A.	g_1= 1.43	g_1= 1.16	
Kurtosis	g_2= -0.861	g_2= 12.856	g_2= 4.501	
Transformed	N.A.	g_2= 3.433	g_2= 0.544	

POYCHLORINATED BIPHENYLS (PCB'S) IN STRIPED BASS, MORONE SAXATILIS (WALBAUM) OF BUZZARDS BAY AND THE ACUSHNET RIVER

Tom Frank Rusek

Southeastern Massachusetts University, 1989

ABSTRACT

Polychlorinated biphenyl levels (PCB-Aroclor 1254) were measured in edible muscle fillets of 123 striped bass (Morone saxatilis) acquired from three localities in southeastern Massachusetts coastal waters. Muscle samples from 20 striped bass taken from the Acushnet River contained a mean PCB concentration of 22.3 ug/g (S.E.= 3.79) and a geometric mean of 16.5 ug/g (S.E.= 0.199), the only site to contain a mean concentration over the government regulated tolerance limit of 2 ug/g. Muscle samples from 48 striped bass from South Dartmouth contained a mean PCB concentration of 1.12 ug/g (S.E.= 0.195) and a geometric mean of 0.90 (S.E.= 0.064), while 37 striped bass fillets from Westport contained a mean PCB concentration of 0.58 ug/g (S.E.= 0.144) and a geometric mean of 0.43 ug/g (S.E.= 0.074).

The PCB levels in striped bass were not normally distributed, but skewed to the right and leptokurtotic and analyses of the data were performed on Log10-transformed values.

STATEMENT FROM THE WORK SESSION

ON

"CHEMICALLY INDUCED ALTERATIONS IN SEXUAL DEVELOPMENT: THE WILDLIFE/HUMAN CONNECTION"

THE PROBLEM

Many compounds introduced into the environment by human activity are capable of disrupting the endocrine system of animals, including fish, wildlife, and humans. The consequences of such disruption can be profound because of the crucial role hormones play in controlling development. Because of the increasing and pervasive contamination of the environment by compounds capable of such activity, a multidisciplinary group of experts gathered in retreat at Wingspread, Racine, Wisconsin, USA, July 26-28, 1991 to assess what is known about the issue. Participants included experts in the fields of anthropology, ecology, comparative endocrinology, histopathology, immunology, mammalogy, medicine, law, psychiatry, psychoneuroendocrinology, reproductive physiology, toxicology, wildlife management, tumor biology, and zoology.

The purposes of the meeting were:

1. to integrate and evaluate findings from the diverse research disciplines concerning the magnitude of the problem of endocrine disruptors in the environment;
2. to identify the conclusions that can be drawn with confidence from existing data; and
3. to establish a research agenda that would clarify uncertainties remaining in the field.

CONSENSUS STATEMENT

The following consensus was reached by participants at the workshop.

1. <u>We are certain of the following:</u>

- A large number of man-made chemicals that have been released into the environment, as well as a few natural ones, have the potential to disrupt the endocrine system of animals, including humans. Among these are the persistent, bioaccumulative, organohalogen compounds that include some pesticides (fungicides, herbicides, and insecticides) and industrial chemicals, other synthetic products, and some metals[1].

- Many wildlife populations are already affected by these compounds. The impacts include thyroid dysfunction in birds and fish; decreased fertility in birds, fish, shellfish, and mammals; decreased hatching success in birds, fish, and turtles; gross birth deformities in birds, fish, and turtles; metabolic abnormalities in birds, fish, and mammals; behavioral abnormalities in birds; demasculinization and feminization of male fish, birds and mammals; defeminization and masculinization of female fish and birds; and compromised immune systems in birds and mammals.

- The patterns of effects vary among species and among compounds. Four general points can nonetheless be made: (1) the chemicals of concern may have entirely different effects on the embryo, fetus, or perinatal organism than on the adult; (2) the effects are most often manifested in offspring, not in the exposed parent; (3) the timing of exposure in the developing organism is crucial in determining its character and future potential; and (4) although critical exposure occurs during embryonic development, obvious manifestations may not occur until maturity.

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[1] Chemicals known to disrupt the endocrine system include: DDT and its degradation products, DEHP (di(2-ethylhexyl)phthalate), dicofol, HCB (hexachlorobenzene), kelthane, kepone, lindane and other hexachlorocyclohexane congeners, methoxychlor, octachlorostyrene, synthetic pyrethroids, triazine herbicides, EBDC fungicides, certain PCB congeners, 2,3,7,8-TCDD and other dioxins, 2,3,7,8-TCDF and other furans, cadmium, lead, mercury, tributyltin and other organo-tin compounds, alkyl phenols (non-biodegradable detergents and anti-oxidants present in modified polystyrene and PVCs), styrene dimers and trimers, soy products, and laboratory animal and pet food products.

- Laboratory studies corroborate the abnormal sexual development observed in the field and provide biological mechanisms to explain the observations in wildlife.

- Humans have been affected by compounds of this nature, too. The effects of DES (diethylstilbestrol), a synthetic therapeutic agent, like many of the compounds mentioned above, are estrogenic. Daughters born to mothers who took DES now suffer increased rates of vaginal clear cell adenocarcinoma, various genital tract abnormalities, abnormal pregnancies, and some changes in immune responses. Both sons and daughters exposed in utero experience congenital anomalies of their reproductive system and reduced fertility. The effects seen in in utero DES-exposed humans parallel those found in contaminated wildlife and laboratory animals, suggesting that humans may be at risk to the same environmental hazards as wildlife.

2. We estimate with confidence that:

- Some of the developmental impairments reported in humans today are seen in adult offspring of parents exposed to synthetic hormone disruptors (agonists and antagonists) released in the environment. The concentrations of a number of synthetic sex hormone agonists and antagonists measured in the US human population today are well within the range and dosages at which effects are seen in wildlife populations. In fact, experimental results are being seen at the low end of current environmental concentrations.

- Unless the environmental load of synthetic hormone disruptors is abated and controlled, large scale dysfunction at the population level is possible. The scope and potential hazard to wildlife and humans are great because of the probability of repeated and/or constant exposure to numerous synthetic chemicals that are known to be endocrine disruptors.

- As attention is focused on this problem, more parallels in wildlife, laboratory, and human research will be revealed.

3. Current models predict that:

- The mechanisms by which these compounds have their impact vary, but they share the general properties of (1) mimicking the effects of natural hormones by recognizing their binding sites; (2) antagonizing the effect of these hormones by blocking their interaction with their physiological binding sites; (3) reacting directly and indirectly with the hormone in question; (4) by altering the natural pattern of synthesis of hormones; or (5) altering hormone receptor levels.

- Both exogenous (external source) and endogenous (internal source) androgens (male hormones) and estrogens (female hormones) can alter the development of brain function.

- Any perturbation of the endocrine system of a developing organism may alter the development of that organism: typically these effects are irreversible. For example, many sex-related characteristics are determined hormonally during a window of time in the early stages of development and can be influenced by small changes in hormone balance. Evidence suggests that sex-related characteristics, once imprinted, may be irreversible.

- Reproductive effects reported in wildlife should be of concern to humans dependent upon the same resources, e.g., contaminated fish. Food fish is a major pathway of exposure for birds. The avian (bird) model for organochlorine endocrine disruption is the best described to date. It also provides support for the wildlife/human connection because of similarities in the development of the avian and mammalian endocrine systems.

4. There are many uncertainties in our predictions because:

- The nature and extent of the effects of exposure on humans are not well established. Information is limited concerning the disposition of these contaminants within humans, especially data on concentrations of contaminants in embryos. This is compounded by the lack of measurable endpoints (biologic markers of exposure and effect) and the lack of multi-generational exposure studies that simulate ambient concentrations.

- While there are adequate quantitative data concerning reduction in reproductive success in wildlife, data are less robust concerning changes in behavior. The evidence, however, is sufficient to call

for immediate efforts to fill these knowledge gaps.

- The potencies of many synthetic estrogenic compounds relative to natural estrogens have not been established. This is important because contemporary blood concentrations of some of the compounds of concern exceed those of internally produced estrogens.

5. Our judgment is that:

- Testing of products for regulatory purposes should be broadened to include hormonal activity in vivo. There is no substitute for animal studies for this aspect of testing.

- Screening assays for androgenicity and estrogenicity are available for those compounds that have direct hormonal effects. Regulations should require screening all new products and by-products for hormonal activity. If the material tests positive, further testing for functional teratogenicity (loss of function rather than obvious gross birth defects) using multigenerational studies should be required. This should apply to all persistent, bioaccumulative products released in the past as well.

- It is urgent to move reproductive effects and functional teratogenicity to the forefront when evaluating health risks. The cancer paradigm is insufficient because chemicals can cause severe health effects other than cancer.

- A more comprehensive inventory of these compounds is needed as they move through commerce and are eventually released to the environment. This information must be made more accessible. Information such as this affords the opportunity to reduce exposure through containment and manipulation of food chains. Rather than separately regulating contaminants in water, air, and land, regulatory agencies should focus on the ecosystem as a whole.

- Banning the production and use of persistent chemicals has not solved the exposure problem. New approaches are needed to reduce exposure to synthetic chemicals already in the environment and prevent the release of new products with similar characteristics.

- Impacts on wildlife and laboratory animals as a result of exposure to these contaminants are of such a profound and insidious nature that a major research initiative on humans must be undertaken.

- The scientific and public health communities' general lack of awareness concerning the presence of hormonally active environmental chemicals, functional teratogenicity, and the concept of transgenerational exposure must be addressed. Because functional deficits are not visible at birth and may not be fully manifested until adulthood, they are often missed by physicians, parents, and the regulatory community, and the causal agent is never identified.

6. To improve our predictive capability:

- More basic research in the field of developmental biology of hormonally responsive organs is needed. For example, the amount of specific endogenous hormones required to evoke a normal response must be established. Specific biologic markers of normal development per species, organ, and stage of development are needed. With this information, levels that elicit pathological changes can be established.

- Integrated cooperative research is needed to develop both wildlife and laboratory models for extrapolating risks to humans.

- The selection of a sentinel species at each trophic level in an ecosystem is needed for observing functional deficits, while at the same time describing the dynamics of a compound moving through the system.

- Measurable endpoints (biologic markers) as a result of exposure to exogenous endocrine disruptors are needed that include a range of effects at the molecular, cellular, organismal, and population levels. Molecular and cellular markers are important for the early monitoring of dysfunction. Normal levels and patterns of isoenzymes and hormones should be established.

- In mammals, exposure assessments are needed based on body burdens of a chemical that describe the concentration of a chemical in an egg (ovum) which can be extrapolated to a dose of the chemical to the embryo, fetus, newborn, and adult. Hazard evaluations are needed that repeat in the laboratory what is being seen in the field. Subsequently, a gradient of doses for particular responses must be determined in the laboratory and then compared with exposure levels in wildlife populations.

- More descriptive field research is needed to explain the annual influx to areas of known pollution of migratory species that appear to maintain stable populations in spite of the relative vulnerability of their offspring.

- A reevaluation of the in utero DES-exposed population is required for a number of reasons. First, because the unregulated, large-volume releases of synthetic chemicals coincide with the use of DES, the results of the original DES studies may have been confounded by widespread exposure to other synthetic endocrine disruptors. Second, exposure to a hormone during fetal life may elevate responsiveness to the hormone during later life. As a result, the first wave of individuals exposed to DES in utero is just reaching the age where various cancers (vaginal, endometrial, breast, and prostatic) may start appearing if the individuals are at a greater risk because of perinatal exposure to estrogen-like compounds. A threshold for DES adverse effects is needed. Even the lowest recorded dose has given rise to vaginal adenocarcinoma. DES exposure of fetal humans may provide the most-severe-effect model in the investigation of the less potent effects from environmental estrogens. Thus, the biological endpoints determined in in utero DES-exposed offspring will lead the investigation in humans following possible ambient exposures.

- The effects of endocrine disruptors on longer-lived humans may not be as easily discerned as in shorter-lived laboratory or wildlife species. Therefore, early detection methods are needed to determine if human reproductive capability is declining. This is important from an individual level, as well as at the population level, because infertility is a subject of great concern and has psychological and economic impacts. Methods are now available to determine fertility rates in humans. New methods should involve more use of liver-enzyme-system activity screening, sperm counts, analyses of developmental abnormalities, and examination of histopathological lesions. These should be accompanied by more and better biomarkers of social and behavioral development, the use of multigenerational histories of individuals and their progeny, and congener-specific chemical analyses of reproductive tissues and products, including breast milk.

Work Session participants included:

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University of California-Berkeley

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Dept. of Molecular and Cell Biology
University of California-Berkeley

Sophie Brasseur
Marine Biologist
Dept. of Estuarine Ecology
Research Institute for Nature Management
Texel, THE NETHERLANDS

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Senior Fellow
World Wildlife Fund
and W. Alton Jones Foundation
Washington, DC

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Dept. of Anatomy
University of California-San Francisco

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Research Triangle Park, NC

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Tufts University School of Medicine
Boston, MA

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University of Guelph
Ontario, CANADA

Dr. Frederick vom Saal
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Atlanta, GA

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Work Session participants included:

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IS WATER QUALITY A FACTOR IN STRIPED BASS STARVATION?

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Striped bass (morone saxatilis) have probably been indigenous to the Atlantic and Gulf coasts of North America since the passing of the ice age. In recent decades, man has adversely impinged upon the abundance of the species.

During the industrial revolution. dam building on the New England rivers and overfishing on the spawning grounds greatly affected the abundance of the striped bass brood stock from the river systems.

In Canada, the spawning populations of the St. Lawrence, Miramichi, Stewiake, Shubenacadie and Annapolis Rivers all survived the industrial revolution only to be threatened by the chemical revolution.

One of the most recent threats to the well being of striped bass is chlorinated hydrocarbons (as well as other chemicals and heavy metals) which are ubiquitous in our aquatic environment.

We have studied two different populations of striped bass isolated from each other by their different migratory behavior. The Chesapeake Bay population has a migratory pattern which encompasses the mid-Atlantic and northeast coast. The Albermarle Sound (Roanoke River) striped bass are mostly contained within their own estuary.

The systems vary in the nature of the pollutants that the striped bass encounter. In the northeast, industrial chemical pollutants predominate. In North Carolina, pulp mills were the major polluters(1) in earlier years. Recently major farming operations on Albermarle Sound have added farm chemicals to the watershed.

In the early 1970s, after research had indicated that the Chesapeake Bay population of striped bass had high levels of PCBs in their eggs, (2) Stripers Unlimited published several year books which contained information concerning the spread of these chemicals by bioremediation into fish through the food chain.

Chart A (3) was the result of research by Glenn McBay for a study instituted by the U.S. Fish & Wildlife Service to monitor the presence of chlorinated hydrocarbons in striped bass from various watersheds. The chart shows levels in the striped bass eggs from different river systems. It also shows the lipid concentrations in the eggs from different river systems.

As a manufacturer of salt water fishing lures since 1945, the most enjoyable part of my business has been the opportunity to become acquainted with fishermen and fisheries biologists who enjoy fishing. Dr. Robert Stevens was one of these. Over the years, he played a big role in striped bass culture. It was Dr. Robert Stevens (4) development of the hormone treatment of striped bass which led to the planting of striped bass in southern reservoirs and later led to the establishment of many state striped bass hatcheries. He strongly influenced me in my striped bass work with his suggestion that with his "cookbook" and a good camera, I could learn to raise striped bass.

This, in turn, led me to the University of Rhode Island and the founding of the Stripers Unlimited Transplant Program. (5)

In the beginning we worked with two populations, the Roanoke River population and that of Chesapeake Bay.

At the Weldon, North Carolina hatchery on the Roanoke River, we studied and photographed developing striped bass eggs which were obtained from brood stock caught in the river. The eggs were not buoyant and needed the 60 mile length of the fluvial river to complete the hatching cycle. In the Weldon hatchery they were hatched in McDonald jars with a flow though system. The only thing influencing the hatching process was temperature.

It was possible to select different developmental stages for photographic purposes because all eggs in the hatchery at a given time developed on a regular schedule. (6) Knowing the time of fertilization and the temperature on a given day made our photography of the eggs easy.

Eggs from the Nanticoke River in Maryland were obtained by capturing brood stock from the river. The Nanticoke River is a tidal river. The striped bass spawn where the fresh and salt water meet.(7) The eggs of these striped bass are buoyant with a large oil globule. Because of the floating egg, new methods of hatching had to be used, as they floated out of McDonald jars.

There were other differences in the eggs from the two populations as well. The cytoplasm in the Maryland egg was almost colorless and the North Carolina egg had a very dark gold cytoplasm. Cell division was another difference. In the Maryland egg, the first and second cell division only covered a small portion of the yolk, about 1/8 - 1/4 of the surface. The first cell division in the North Carolina egg covered 1/2 the surface of the yolk.

In the Maryland egg, cell division is at 180 degrees to the oil globule and cell division tends to be abnormal. Many different stages of cell division can be observed in the eggs of a single female at the same water temperature.(8)

North Carolina eggs developed more detail and developed more quickly at each stage then Maryland eggs.

In 1975 we ceased hatchery operations in Maryland. Glenn McBay had indicated that the levels of hydrocarbons in the eggs would preclude hatching success.

In 1976 we monitored the adult population in Maryland and continued studying striped bass eggs in the wild which we captured in plankton nets.

We observed very few small fish, males were appreciably larger and far fewer running ripe females were found. One female, however, left an interesting pattern of eggs and tissue on our measuring board. Green eggs were extruded followed by all the connective tissue with blood supply. It was well known that striped bass females spawned all of their eggs at once. This left only the thin tissue of the lumen to be resorbed. The fact that all the connective tissue with blood supply was lost was a surprise to us.

This phenomenon could explain the term "rock fight" used on the Roanoke River. Because the water turned red around the spawning female, the fishermen though the males were cutting her with their fins.(9)

In 1976, when the 1970 dominant year class of female striped bass returned to Chesapeake Bay to spawn, very few males were present. We were monitoring fish caught by the commercial fisherman at the various landing sites and at a wholesale house in Cambridge, Maryland. We checked length and sex of the striped bass for an entire month before and during the spawning season. Many fish from the Nanticoke River appeared immature, their eggs quite solid in the egg case. Later that spring, while sportfishing in the rips off Martha's Vineyard, Massachusetts, we found a fairly large number of female striped bass with green roe.

While we had our hatchery on the Nanticoke River, we lost a few females which we autopsied. One of the most obvious observations was the great amount of fat contained in the abdominal cavity, seemingly more than needed for eggs to develop to maturity.

By 1983, Maryland, in response to great pressure from fishermen, declared striped bass threatened and regulations were put in place to reduce fishing pressure. The reduced fishing pressure gave the fish time to recover. By 1989, the stock was much improved. Striped bass were more prevalent along the coast, fishing improved, but the bait fish were not back in sufficient quantities in many areas to support them.

Fishing with Captain Jim Price in his home waters of the Choptank River, it is necessary to fish over live oyster bars where a living community provides food for a variety of species; white perch, spot, black sea bass and striped bass. Drifting off the bar ends the fishing. Jim Price has observed that as the oyster bars die, the fishing areas become less numerous.

In late October 1990 we examined 16 fish caught at Montauk, Long Island. They ranged in size from 36" to 44.5". Most of the fish had orange eggs which were developing. One male, 38.5" had black tar colored testes. One female had black, spotted masses for egg cases which were atritic. 7 of the fish had no fat stored, 5 had fat in the intestinal area. None had much fat stored.

We observed fish from Rhode Island in late June 1991 at a sport fishing tournament. The fish ranged in size from 28" to 43". 4 were males and 5 were females, four of which were resorbing their eggs and one which had developing eggs. Only one had fat along the intestines.

At about the same time a fish was brought to us which was caught in Narragansett Bay. All of its organs were laid out neatly so that the internal structure of the fish could be easily sketched. There was nothing to hold the organs in place, no fat to cushion them.

Also in late June 1991, we examined 12 filleted fish at the Chatham Fish and Lobster Co. All the fish were females, probably Chesapeake Bay striped bass. Most of the fish were just over 36" with a lone female of 49". The egg cases varied in color and consistency. Some were dark purple and flaccid indicating a long resorption time. Others were orange, the anterior portion being pointed rather than round as in a developing egg case.

These fish had more fat around the intestines than we had observed in the fish from Rhode Island. One appeared to have an excess of fat covering the intestines. Of the rest, four had fat along the intestines and seven were lean.

In the fall of 1991, we chartered Jim Price's boat for a week. Among four fishermen we landed 21 legal fish. Of these 17 were males and 4 were females, 15 had stored no fat for the winter. One 13" male had a good supply of fat, the others had a slight amount of fat. They looked more like fish from a spring fishery. Jim Price felt that the fish might feed all winter. This should be studied further.

This spring, 1992, in May, on the Hudson River, we examined filleted fish from a sport fishing tournament. Only the largest fish were kept which skewed figures toward the largest size. 18" was the minimum size for striped bass on the spawning grounds. The fish ranged from 30 1/2" to 40" and weighed from 11.9 pounds to 26.1 pounds. All the females formed a clutch of eggs capable of being spawned all at once. No fish eggs were ripe. The color of the eggs varied from yellow to green. Opaque eggs were smaller than eggs where the oil was coalescing.

In Dr. Robert Steven's text, "The Use of Hormones to Ovulate Striped Bass,"(4) there is a series of microphotos in which the diameter of the eggs increases as the last stages of development occur. The increase ranges from 0.9 mm to 1.25 mm as the oil droplets coalesce.

The difficulty with the two problems; lack of fat and resorbing eggs in the striped bass we observed from the different

areas presented us with the chance to observe stripers with different stages of egg development and different amounts of fat storage. The two go together.

When the male fish gonads are in the resting stage, the fish should be gathering fat to provide energy for spawning. In the male population, the weight of the resting testes compared to fish weight is 1:80, at spawning it increases to 1:16, a five fold increase.(1)

In a female population, the weight of the immature gonad to fish weight is 1:43 and at spawning is 1:12, a twelve fold increase. Thus it is important for fish to be storing fat at all times.

We examined striped bass from the Cedarville, Maryland hatchery in November, 1991. We examined 47 fish ranging from 2.5" to 8" for fat content and gonad development. The fish showed heavy concentrations of fat, not only in the intestinal area, but also covering the entire body cavity. The fat had to be moved aside to observe the internal structure.

The smallest fish had no visible gonad development to the naked eye. None of the fish had any sign of gonad development, only thin strands of lumen lay loosely on the gas bladder surface. The pink color, normally associated with the presence of primary oocytes, was not visible.

The first visible signs of differentiation in gonad development in striped bass need to be studied under controlled conditions to fully describe this process. At present, the literature that exists is sketchy. There is confusion about spawning and redevelopment of a new lumen in older striped bass.

At Montauk, we encountered a spent female 44" long weighing 46 pounds. This fish was developing a new lumen similar to the lumen observed in the small hatchery raised fish. If nature repeats itself, it should take as long for this fish to develop primary oocytes, gain weight and spawn again.

Since all of these systems are controlled by the endocrine system, it must function in perfect harmony with the various developmental stages.

We contend there is some doubt about the proper functioning of the endocrine system in many Maryland and Hudson River striped bass. A case in point follows: In 1971-1973 several males and females from Maryland's Choptank River were transported to Edenton National Fish Hatchery in North Carolina. From these fish a first captive brood stock was raised. For four years these fish were grown in extensive farm culture ponds. They were then induced to spawn. In another four years, the second generation was raised and in 1982 some were induced to spawn to hopefully create a third generation. They were spawned out in natural tank spawning systems with the aid of hormone treatment. They produced viable eggs.

We photographically followed the development of the eggs and larvae. The brood fish looked fine, the eggs and larvae appeared better than those we had observed in the Nanticoke population from which the original brood stock had come. Unfortunately the larvae all died. One of the causes appeared to be the fact that the oil and yolk were not absorbed more or less simultaneously as observed in earlier years by Dr. Romeo Mansueti.(10) The oil was never absorbed. After the yolk was gone the oil globule remained and the larvae starved. Also the bone structure appeared very weak.

In 1983, more of the second generation of brood stock was induced to spawn. We transported some of these eggs to a new aquaculture facility run by Baltimore Gas and Electric Co. in Baltimore. We also transported some eggs to our headquarters in South Attleboro, Massachusetts. The rest of the eggs remained at Edenton.

In Attleboro the eggs hatched and the larvae appeared to be healthy. They were very mobile and developed well until the yolk was used up. As before, the oil remained after the yolk was gone and the larvae began to die. We, at once, contacted John Crowder of BG&E. The larvae there were also dying. He had been in touch with Edenton where the same problem was occurring. Eventually, all the larvae died. Edenton carried on with the project for a few more years, but no third generation was obtained.

There is great trouble in our environment. Striped bass live in a chemically altered environment as do all other species, including man. Removing striped bass from the chemically altered environment did not reverse the damage.

Fisheries scientists have been very cautious about making statements that would infer such a connotation.

Recently a multi-disciplinary group of scientists from around the world met at Wingspread, Racine, Wisconsin to assess what is known about this issue.

One of the conclusions dealt with fish and wildlife: "Many wildlife populations are already affected by these compounds. The impacts include thyroid dysfunction in birds and fish; decreased fertility in birds, fish, shellfish, and mammals; decreased hatching success in birds, fish, and turtles; gross birth deformities in birds, fish, and turtles; metabolic abnormalities in birds, fish, and mammals; behavioral abnormalities in birds; demasculinization and feminization of male fish, birds, and mammals; defeminization and masculinization of female fish and birds; and compromised immune systems in birds and mammals."(11)

Where the cytoplasm is abundant as in the North Carolina eggs in the early 1970s, cell division is regular and normal. Where cytoplasm is not abundant, as in the Maryland egg, probably due to a chemically damaged endocrine system, cell division is irregular and abnormal. Each generation perpetuates the damage or lack thereof.

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Chart A

PCB	Maryland	Hudson River	North Carolina
#1248	10.390 ppm	5.8 ppm	0.8 ppm
#1254	6.1 ppm	3.2 ppm	1.0 ppm
#1260	5.18 ppm	0.4 ppm	0.42 ppm
Lipids in eggs	37.18%	14.7%	7.3%

Stripers Unlimited Yearbook - 1973-1975