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Jellyfish, Theory And Facts

The spectacular scarcity of jellyfish in Chesapeake Bay during the current season has been noted by both layman and marine biologist alike. Bay residents in the past have been able to predict the invasion of jellyfish into their special coves, shores, and Bay locations with precision. They arrive late in June, reach a peak the first week in August, and disappear in early September. Summer, 1953, has witnessed conditions in the Bay in which scarcely a jellyfish has been seen by casual observers even during the peak of the season.

Marine biologists at the Chesapeake Biological Laboratory have developed a number of theories why jellyfish are less abundant this year. One of the most plausible explanations for the scarcity is that of temperature and oxygen supply. Heavy rains, coupled with a very warm spring, caused marked stratification of estuarine waters in the Bay: (a) one of fresher, less dense, oxygen-rich water on the surface; and (b) the other of saltier, denser oxygen-poor water on the bottom. Oxygen-poor bottom waters probably entered creeks and small estuaries late in the spring and summer where the vegetative polyp form and immature jellyfish occur. These stagnant waters may have affected jellyfish production by slowing down or halting their reproduction.

Jellyfish are strongly affected by changes in their environment. In order to understand how changes in weather and habitat may affect jellyfish populations, it is necessary to have a thumbnail sketch of their life history, based on studies at the Chesapeake Biological Laboratory, on the Patuxent River.

Jellyfish reproduce asexually during late May and early June from a vegetative animal like-body known as a **polyp,** which looks like a tiny trumpet. This form is found on the bottoms of estuaries and creeks in the lower portions of rivers. The polyp stage, known as a **scyphistoma,** is an attached, segmented creature. Four or five plate-like disks slough off, or strobolize from this body when temperatures reach an optimum in spring. It is this stage that is most vulnerable to the elements. The tiny young jellyfish look much like inverted saucers, and are known as **ephyra.** They are free-swimming, and, after a short time, invert and move freely. They grow rapidly into adults, resplendent with tentacles containing thousands of stinging cells. Thus, the unusual conditions this spring may have dealt the asexual reproductive stock of jellyfish a serious blow by a combination of conditions that are described below.

Records of rainfall during winter and spring indicate that excessive rains produced lower salinities at the mouths of the various rivers in Maryland. The outward flow of the fresher and lighter water at the surface was accompanied by a slow movement of denser salt water up the Bay in the lower levels. As a result of excessive run-off, more water left the estuaries and Bay, and less salt water entered, but the two layers remained well-defined. Thus the lowest salinities occurred in the spring. High spring temperatures caused the fresher upper layer to heat up quickly and to remain distinct from the lower water (stratification). Normally, estuarine and Bay waters mix until late April so that the oxygen from surface waters is transported to bottom waters which become low in oxygen during early summer. Last spring the stratification was so well defined that very little mixing was believed to have occurred. In winter, bottom waters are usually rich in oxygen, but soon after spring they become depleted due to the effects of fresh water, high temperatures, and activities of marine life. It is possible that, because of the failure of the upper and lower layers to mix, the lower layer, which started out with low oxygen content, was still further depleted by animal and bacterial metabolism. Thus, these conditions during the late spring and early summer may have had the effect of inhibiting or restraining the production of young jellyfish.

The scarcity of jellyfish is general throughout the Bay, although in certain areas the reproductive success has been more or less evident. At Solomons

TRI-STATE PROGRAM

An organizational meeting of the joint Commission on Conservation of Migratory Fin-Fish marked the initiation of an important step in cooperative conservation effort between the states of North Carolina, Virginia and Maryland. Legislative committees and scientists from the three states met at Old Point Comfort on July 16 to discuss the development of a program directed toward restoration and management of the several jointly exploited migratory species.

A chairman and two vice-chairmen were elected for the commission, a chairman representing each of the three states. A resolution was passed requesting the research agencies of the states, in cooperation with the U. S. Fish and Wildlife Service and other research groups, to draft a cooperative research program to determine the cause of decreases in quality and quantity of food fish in the tri-state area. In the week following the meeting fishery biologists of the three states conferred at Morehead City, N. C., and prepared a program for presentation at the next commission meeting scheduled for August 24, to be held in North Carolina.

one or two jellyfish were observed casually from the Laboratory pier during July by scanning the water for a radius of 100 feet. At Cove Point one was observed every 100 feet or so at the surf line along the beach. A very slight increase in numbers has been noted during August, the numbers varying with winds, tides and other factors. On the other hand, biologists working in the St. Mary's River reported relatively large concentrations of jellyfish this year, although somewhat late. In past years the population densities there have been extraodinarily high, so that it is difficult to analyze the present numbers. During 1952, from July through September, the density of jellyfish roughly averaged about 2-5 per cubic yard at Solomons during peak concentrations.

Marine biologists doubt whether low stock of jellyfish will carry over to next year. Next year's crop is dependent probably on environmental conditions at the bottom. The few jellyfish that are available this month will spawn sexually (during early August), and will probably produce sufficient offspring to become the polyp form responsible for next year's crop. Mature male jellyfish generally possess bright pink gonads, while mature females have yellowish-brown reproductive organs. The sperm from males fertilize the eggs in the digestive cavity of the female. An immature jellyfish, the ciliated **planula** larva, develops, escapes from the oral pouch under the female's umbrella-like body, swims about a while, and then settles and attaches to some hard object on the sea bottom. It becomes the flower-like animal, the polyp stage, and overwinters in creeks and estuaries. In spring the cycle that was described earlier in this paper is repeated. Spawning in August, adult jellyfishes die shortly after the waters begin to cool. They sink to the bottom, disintegrate, or are washed up on shore. Laboratory studies indicate, however, that the polyp that has produced medusae do not die in spring but. to the contrary, may live and produce young jellyfish the following spring.

The stinging cells of the jellyfish are called **nematocysts.** These are used to paralyze their small prey of invertebrates and, occasionally, small fishes. The poison discharged from the cell body is a little-known complex protein substance, and is not formic acid, as is sometimes stated. The prey is seized and paralyzed by stinging cells on the oral lobes, and then carried into the mouth and finally taken into the digestive cavity at the center of the bell. A jellyfish is essentially very backward when compared to a higher animal. It has no brain but does have a nerve net that serves to coordinate the pumping contraction of the bell and feeding activities. Except for the feeble rhythmic contractions of the bell, jellyfish are largely at the mercy of currents and waves.

There is no known method of controlling jellyfish abundance. Their habitat is so large, and their life history is so affected by a combination of such limiting factors as temperature, oxygen tension, and salinity, that man can hardly expect to alter these conditions as he can pond fishes, for example, in small, circumscribed areas. Jellyfish nets that are used in certain waterfront communities to restrict bathing areas are not as effective as desired because the small saucer-like young jellyfish can easily squeeze or are swept through the mesh during spring and early summer after the nets are set up. During late summer the nets are useful in keeping large jellyfish out of swimming areas, but tides, winds and currents pile up the bodies on the nets to the point where portions of tentacles and medusa bodies sweep into the restricted area to sting the swimmers. Regrettably marine biologists believe that jellyfish are here to stay.

NEW MEMBERS

Appointing of Mr. Theodore Boston, of Cambridge, and the reappointment of Dr. Earle T. Hawkins, of Towson, to fill vacancies on the Commission of Research and Education has been announced by Governor Theodore R. McKeldin. Mr. Boston for several years was Superintendent of Schools in Dorchester County where, through his interest, considerable progress was made in conservation education in the public schools. He, himself, has participated in an experimental study of oysters. More recently, Mr. Boston has served as Supervisor of Teachers and Higher Education in the Maryland Department of Education. Dr. Hawkins has served one full term of five years on the Commission and is its Chairman at this time, previously having been its Secretary. He is the President of the State Teachers College at Towson where conservation education is stressed.

The Commission has charge of the affairs of the Department of Research and Education, in which it fixes policies, develops programs, selects personnel, and, in general, administers the research and teaching work concerned with natural resources in the State. Serving with Messrs. Boston and Hawkins will be the members now in office, Mr. Frederick Tresselt, Fish Culturist and Grower, Dr. E. N. Cory, State Entomologist and Dr. B. H. Willier, head, Department of Biology, The Johns Hopkins University.

SPAWNING AND SETTING

With water temperatures above normal during the past winter and spring, oysters began feeding activities early and generally entered the prespawning stage in good condition. Some spawning occurred early in June, and sporadic light setting was observed on test shells during the last two weeks of that month. During July both spawning and setting increased, but the intensity of spatfall to the end of July has been less than in 1952 on test shells at stations where observations are made by the Chesapeake Biological Laboratory. The presence of considerable numbers of oyster larvae in a few areas during late July raises hopes for a substantial set in August, at which time the 1952 set reached its peak. Reports from the Chesapeake Shellfish investigations, U. S. Fish and Wildlife Service, indicate that setting in the Chesapeake Bay from the Annapolis area northward, as determined by spat counts on test shells, is higher than for several years past. Setting on test shells in Eastern Bay to the end of July has been below the level of recent years. On the whole, setting thus far has been below average. However, it is too early to predict in this issue of **The News** the ultimate success or failure of the 1953 catch.

ZOOS WHO

Captain Blurp: "Yes, Cap'n Frank, girls is funny sure-'nuff. Now there's our Sue. She screams and is frightened to death by the sight of a mouse."

Captain Frank: "Are indeed, Cap'n Blurp. And doggone-it, I've seen Sue quietly get in a car with a wolf and smile all over."

With the Editor

Governor McKeldin's action, recently announced, in appointing Professor Theodore Boston, and in reappointing Dr. Earle T. Hawkins, to the Maryland Commission of Research and Education is welcome news to conservationists and others interested in furthering the use of natural resources and in the sound conduct of study and dissemination of knowledge in this area of endeavor. These men, well qualified by training, experience and by actual contribution to the field, are recognized as being not politically inclined in their attitudes and actions. Thus Governor McKeldin has acted to assure a continuing program of impartial study and fact finding in conservation activities.

TRAWLER CONTROL

The Commission of Tidewater Fisheries is giving special attention to violations of ocean trawlers reported to be fishing within the three-mile limit off the coast. Its patrol plane and official pilot, Captain Whipp, have been assigned to this aspect of the law enforcement and, according to reports, the practice has been stopped on the coastal strip from the Delaware to the Virginia Line.

BLUE MARLIN OFF OCEAN CITY

Maryland's seaside fishermen were heartened by the landing of a record-sized blue marlin off Ocean City on Friday July 31, 1953. This tackle-buster weighed 416 pounds, and was almost 10 feet in length. It was caught by James B. Booze, of Washington, D. C., and was boated off the Cecil, piloted by Captain Bill Burbage. It was hooked about 35 miles southeast of the seashore town. According to reliable reports, this is the third blue marlin ever caught off the Maryland seaport; the other two were taken in 1941. A report in late July, 1952, stated that a blue marlin, reputed to weigh almost 600 pounds, was hooked by a woman off Jacks Spot, about 16 miles off Ocean City, but after playing the fish for sometime, it was lost. The blue marlin, known scientifically as **Makaira nigricans ampla,** occurs off the South Atlantic, in and near the Gulf Stream, north to Montauk, New York. It is occasionally more common off New York than off Florida, although there are concentration points in the southern parts of the range. It averages 200 pounds or more, but the record is 737 pounds for this fish.

Ocean City is popularly known as the white marlin capital of the middle Atlantic Coast. This somewhat smaller species, ranging from 50 to 100 pounds, is found during the warmer months in the south Atlantic Ocean, north to Martha's Vineyard, Massachusetts, where it is taken by anglers. It is common at Montauk and Fire Island, New York, and off Florida. The white marlin, **Makaira albida,** is a solitary wandering species like the blue marlin, but it is seen in schools off Ocean City beginning in late June and early July. In mid-July, 1953, a 114.5 pound white marlin was caught off Ocean City that nearly reached the world's light tackle record.

WILDFOWLING EXTENDED

Duck hunters in the Atlantic and Pacific flyways will have five more hunting days this season than last under migratory waterfowl regulations announced by the Interior Department. The regulations will give the flyways their longest season since 1945. The Atlantic flyway season will be 60 consecutive hunting days, or two periods of 27 days each. The Pacific flyways will have a 75 day consecutive season, or two periods of 34 days each. Hunting hours for ducks, geese, brant and coot are liberalized for all flyways in the new regulations to allow shooting until sunset, instead of one hour before sunset. The starting time of one-half hour before sunrise remains the same as last year. On the opening day of the season, including each first day of split seasons, waterfowl and coot may not be hunted before noon.

The Secretary of the Interior, Douglas McKay, said that field investigations indicate the full flight of duck would be better than in 1952. McKay said that the new regulations eliminate "the controversial one-half-mile clause" from the no-baiting regulation, but added that the regulation essentially "retains all other provisions which existed in prior years." For two years the regulation has prohibited shooting within one half mile of a baited area. Director John L. Farley of the Fish and Wildlife Service, when asked for an explanation, said in a statement: "Dropping the half mile provision is not intended to soften the law; shooting migratory birds by use of bait is still outlawed."

MORE ON MORTALITIES

The localized mortalities which typically affect the Bay's blue crab population in summer recurred during the second and third weeks of July, 1953. This period was characterized climatically by rather high temperatures, light winds, and in some localities, by exceptionally low tides. As a result, certain soft crab shedding pounds suffered large losses. These pounds, as might be expected, were situated in sheltered areas where wave action is kept down by natural windbreaks or by board fences constructed for the purpose. The water depth in such pounds is seldom as much as eight feet.

The same period also brought reports of dead crabs being found in considerable numbers in crab pots which are customarily placed in fifteen feet or greater depths of water. (The low oxygenated water layer which may be the cause of these deep water mortalities was discussed in some detail in the June 1953 issue of the Maryland Tidewater News). It was not surprising then to receive simultaneous reports from the crab pound operators and crab potters in the Bay.

Investigators from the Chesapeake Bay Institute and the Maryland Department of Research and Education visited the scenes of several of these occurrences as quickly as possible and have begun some experiments which may shed light on the problem. It is probable that nothing can be done to prevent a recurrence of the conditions but a prediction of impending mortalities might be of considerable value.

The conditions found at one crab pound by the investigators were as follows: Previous to the deaths, there had been three or four days of very light winds. High temperatures prevailed throughout the period. The normal depth of the water in the pound was about five feet. At the time of the mortality there had been a succession of low tides and the depth of water was less than two feet. The crabs enclosed by the floats are confined to

the upper eight to ten inches of this depth. The combination of these factors all contributed to a high death rate among the impounded crabs.

Disregarding the presence of green crabs in the floats, the investigations indicate that the conditions, in the crab floats and in the pots are fundamentally the same. In the crab pots, the crabs suffer from a lack of oxygen in the deeper waters because there is no mixing of the oxygenated surface waters due to the thermal stratification which was reported in the June issue of **The News.** In the crab pounds, low oxygen affects the crabs which are crowded in small floats in shallow, quiet, warm waters. The high temperatures decrease the water's capacity to hold oxygen in a dissolved state while at the same time increasing the oxygen requirements of all living organisms in the water. Therefore, with little aeration of the water being accomplished by wave action coupled with an increased oxygen demand, it follows that an oxygen shortage must develop with the subsequent ill effects upon the populations of animals present.

BAY SALINITY LOW

Rather surprisingly the late spring and early summer of 1953 were marked by abnormally low salinities in Chesapeake Bay. Most people, quite naturally, assume that a pronounced drought such as that recently experienced in Maryland and Virginia during June and July should be accompanied by a saltier than normal condition of the bay water. Actually the accumulated run-off of fresh water from south central New York, Central Pennsylvania, and the mountains of Maryland, Virginia and West Virginia, has a much greater influence on Bay waters than does local rainfall in tidewater Maryland and Virginia.

Daily records of salinity and water temperature have been kept at Solomons, Maryland, about midway down the Bay, since 1937. At this location salinities are little affected by local stream flow, thus they are rather representative of trends in the Bay as a whole. This year (1953) May, June and July showed the lowest average salinity for each of these months since the sixteen years of observations were begun. Actual salinity values at Solomons for 1953, expressed as parts of salt per thousand parts of water, were May, 8.2, June, 8.0 and July, 9.2. These data are for surface water. In the open ocean a salinity of about 35 parts per thousand is normal. Salinities in the Solomons area usually reach their lowest values in late spring and in previous years have run around 11 or 12 during the months under consideration. A definite upward trend now has appeared and probably will continue until early winter.

This year's unusual condition is readily explainable. The major contribution of fresh water to the Bay is from the Susquehanna River. Records of stream flow during recent months are not yet available. However, it is known that above normal rainfall was general last fall and during the winter and spring months. This kept streams above their usual level for a long period. It is the accumulated run-off over a six to nine month period rather than a single month's flow that is best reflected in bay salinity conditions. Another factor which affects surface salinity is the degree of mixing of bottom and surface waters. As reported earlier, an upstream movement heavier salt water accompanies the downstream flow of fresher surface water in the Bay. During the spring and early summer in 1953, an unusually rapid warming of the upper levels made them lighter still in comparison with the colder bottom water and so the mixing process was slower than usual. Not only does this result in fresh water movement further downstream but causes a more widespread distribution of oxygen depleted bottom water. Such a condition undoubtedly may have marked effects on marine life in certain areas where average conditions are near the limits of tolerance for the species concerned. Fortunately, however, life in the Bay has been adjusted to similar changes for many centuries so that the extent of damage to organisms in such marginal areas can be expected to be slight.

TIDEWATER POND SURVEY

A lake survey project of impounded areas about the State is being carried out at present by the Department of Research and Education and the Game and Inland Fish Commission. The field work schedule for the summer of 1953 lists eight ponds and lakes located in areas near tidewater. These are Johnson Lake, Wicomico Co.; Smithville and Garland Lakes, Caroline Co.; Wye Mills Pond, Queen Anne's Co.; Millington Pond, Kent Co.; Atkinson Reservoir, Harford Co.; Wagner's Pond, Anne Arundel Co., and California Pond in St. Mary's Co. Outline maps enlarged from aerial photographs are taken into the field where the lake mapping is completed. Depth readings, kinds and amounts of shoreline, aquatic vegetation, and types of bottom soil are recorded.

Maps will be prepared for distribution to resort owners, fishermen and interested persons. The following additional information will be incorporated on the back of each map, such as; history, development, watershed, impoundment description, recreation, management of fishery, also lake rules and regulations. During the past few months the Deep Creek Lake (Garrett County) Fisherman's Map has been published and is available upon request to the Department of Game and Inland Fish.

WATERSHED ASSOCIATION

Many citizens in the upper reaches of the Chesapeake Bay have joined forces to restore and maintain good physical, chemical and biological conditions in that region. To effect their plans, an organization has been formed, Upper Chesapeake Watershed Association, to the presidency of which Howard G. Henry, of North East, has been elected. Other officers are: Vice-President, Miss Anna Haines Brown; Treasurer, T. Joseph Reilly, and Secretary, Mrs. Emmett S. Hickman.

The primary objective of the Association, as announced, will be that of halting pollution in the upper Chesapeake drainage area, whether industrial, sewage or the deposition of eroded material. The eventual goal will be the restoration of good water condition with resultant constructive effect on recreation, fisheries and land values in the region. The organization has the good fortune to have as its advisors Clayton M. Hoff and Charles Robinson of the Brandywine Valley Association, a body that had done distinctive conservation work especially in demonstrating that through sound leadership and hardy cooperation badly polluted waters can be cleaned up and made to serve well in the public interest.

FACTUAL

One of the oddest of fish is the grunion. It not only chooses to lay its eggs on land but proceeds to do so on the principles of the Almanac in that it appears on shore during the hour or so of highest tides and only at the full or dark of the moon. The fish is found in California waters.