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Цей збірник наукових доповідей присвячень основним підсумкам виконання Стратегічного плану дій по реабілітації і охороні Чорного моря (1996-2000 рр.), підсумкового документа першого етапу виконання Міжнародної Чорноморської Екологічної Програми ООН. У цьому зв'язку надруковані матеріали відображають основні розділи Програми, а саме: швидке реагування при надзвичайних ситуаціях, моніторинг забруднення і стандарти якості навколишнього середовища, захист біологічної різноманітності, розробка загальної методології управління прибережною зоною моря, рибальство, освіта і громадська поінформованість в природоохоронній області. В статтях представлені результати раніше не надруковані результати наукових досліджень. Подані дані, їх інтерпретація і закінчення належать авторам повідомлень і ні в коєму разі не можуть бути приписані членам організаційного комітету, які склали даний збірник.
Збірник призначень для широкого кола спеціалістів у галузі біології і екології моря, океанографії, техногенної безпеки і охорони природи.

Відповідальні редактори: канд. біол. наук Б.Г. Олександров
канд. хім. наук Б.М. Кац
докт. геол.-мин. наук Т.А. Сафранов

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Present issue is devoted to the main results of Strategic Action Plan for the Rehabilitation and Protection (SAPRP) of the Black Sea (1996-2000) implementation. The SAPRP is a resulting document of the Black Sea Environmental Program (GEF/UN/UNDP) first step. The published materials have been reflected by the main Program sections: emergency response, pollution monitoring and environmental quality standards, protection of biodiversity, integrated coastal zone management, fisheries, environmental education and public awareness. These papers are the results of scientific research haven't been unpublished earlier. The findings, interpretations and conclusions expressed in papers, are in own property of the authors and should not battributed in any manner to the members of organization committee, which prepared this issue.
The issue was design for specialists in the field of marine biology and ecology, oceanology, technogenic safety and environmental protection.

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THE INFLUENCE OF LONG PERIOD CHANGES OF OCEANOGRAPHIC CHARACTERISTICS ON THE FUNCTIONING OF MARINE FARMS IN OPEN COASTAL WATERS

V. V. Adobovsky

Odessa Branch Institute of Biology of Southern Seas, National Academy of Sciences of Ukraine

The coastal zone of the northwestern Black Sea (NWBS) is in a state of active economic development. Recently, efforts have been made for developing marine farming in this area.

Marine farming in the NWBS is hindered that favorable coastal areas protected from storms are either subject to frequent mass mortalities (Tendrovsky and Egorlitsky Bays) or have been industrially developed with widespreading transport systems (Sukhoi and Grigorievsky limans).

The development of mariculture is necessary not only for obtaining food and technical raw material from sea products, but also for hydrobiological amelioration of coastal waters (Govorin, Adobovsky et al., 1992, 1994).

Experimental work has been carried out for a number of years on mussel farming using different types of collectors in open coastal waters of the NWBS near Cape Bolshoi Fontan. According to long-term investigations, waves reach a height of 4.3m during stormy weather in this area. The use of floating collectors in the surface waters layer were unsuccessful and were substituted for stationary storm resistant "Rif' modules where spat settles and mussels grow at six meters from the bottom (Vityuk et al., 1987).

The most important oceanographic characteristics, which influence this type of installation, are temperature conditions, salinity and saturation of waters with dissolved oxygen, as well as, hydrodynamic currents and wave action. Each of these parameters affects the mariculture organisms. Houwa, in certain situations their combined effect can change not only the ecological conditions for the functioning of mussel farms, but the whole ecological aquatic environment in the coastal zone.

Mass mortalities are the most hazardous phenomena for mariculture in the NWBS, and which have become more frequent lately. A stratified

bilaminar system of sea waters is formed in the coastal NWBS zone during calm weather or weak, lengthy western or northwestern winds in the period from May to September. Its formation takes place in conditions of a marked weakening of turbulent processes during a decrease in wind waves to H< 0.5m and a shift in currents to U<=3cm/sec (Faschuk, 1981). In these conditions the temperature, salinity and density gradients of water may increase per meter depth. The difference between extreme indices of surface and bottom layers towards the end July and beginning of August reaches 19-20 C for temperature and 7-8 ppt for salinity.

At present when coastal waters are considerably polluted, this leads to an intensive utilization of oxygen in the near bottom layers. If the water exchange between layers is lacking, then hypoxia occurs causing mass mortalities of hydrobionts. The thickness of the near bottom layer encompassed by hypoxia in places of installation of collectors varies from 1 to 6 meters.

At increased wind velocity and intensification of hydrodynamical processes, the stratification of water masses is weakened or is destroyed. Then the ecological state of the environment in the coastal zone is bettered.

The strength and frequency of wind waves determines the hydrodynamical activity of coastal waters. Analysis of multiyear data on wave action shows that there is a certain rhythmical frequency of storms coinciding with different phases of solar activity. These phases include growth, maximum, drop and minimum of solar activity in the 11 years cycle. The phases of the extremes include the intervals of time from the year prior to the extreme to the year following. The following year after the minimum was taken as the beginning of the phase of growth of solar activity, and the year prior to the maximum as the end of this phase (Osinskaya, 1972 a, b).

In B. Osinskaya's paper (1972 b) the tie is considered between the frequency of storm waves (H>1.0m) near the Odessa coast and solar activity from 1886 to 1969.Continuing this series to 1997,more then a hundred years of observations have been considered.

The trend of the combined values for solar activity phases of wind wave frequency and Wolf numbers are presented in Fig.1. Analysis of this graph shows the nature of the changes of frequency of wind waves.

The development of weak and moderate solar cycles coincides with periods of development of storms. During relatively low solar activity observed at the end of the last and beginning of this century, the greatest amount of storms occurred in years of minimal solar activity. Maximum coincided with a decline in storm activity.

When transferring to high 11 year solar cycles, there is a tendency forabatement of storm action and shift of maximum storm frequency to phases

of maximum solar activity. This shift occurred at the beginning of the 1920s in the 15th solar cycle and continued to the 18th. The period from 1915 to the mid 1960s was characterized by weak wave action. Only towards the late 1960s and early 1970s was there a marked increase in storms. The maximum periods shifted to the phases of decline in solar activity.

After the extremely high 19th cycle (1955-1964), the solar activity declined, although the subsequent 11 year cycles were still high. During the frequent storm waves in the period from mid 1960s to the present day the high maximums of phases of decline of phases activity are substituted by profound minimums coinciding with phases of growth.

In the 22nd solar cycle the minimum of frequency of storm wave sembrace the 1987-1990 period, that is, the whole phase of growth and maximum solar activity. During this period the frequency of waves of a height less than 0.25m, including calm weather annually made up 69.4-75.6% of all cases. The northeastern and eastern winds contribute most to the wind waves along the Odessa coast followed to a decreasing degree by southeastern, southern and northern. The frequency of storm waves in the year of maximum solar activity in the 22nd solar cycle made up 3.3%, and only in 1991 was there a tendency for growth. The moiety of waves with a height less than 0.25m dropped to 43.1% which is significantly less than for previous years.

This change in the nature of wave processes has led to an increase in the hydrodynamical activity of waters in the coastal zone and to ameliorating the ecological state. During 1991 no cases of hypoxia were observed. In the period beginning from August to mid October 1990 wide areas of mass mortalities were recorded in the NWBS with close to zero values of dissolved oxygen and local spots of hydrogen sulphide contamination occurring as a result of disintegration of dead hydrobionts.

A strengthening or weakening of storm action in the coastal zone is connected with widescale processes of atmospheric circulation. According to D.R. German and Goldberg (1981) in the zone of 35-55 north latitude, during long-term changes in wind intensity, a weakening of zonal winds connected with relatively high pressures in high latitudes is observed near the maximum of the higher (odd) solar cycle. Intensifying of the zonal wind is tied with low pressure in high latitudes which is lower than average than in years of maximum even cycles. A 22 year cycle of variation of planetary fields of pressure exists.

In the northwestern Black Sea coast the frequency of storm wave cycles with changes corresponding to 11 year solar cycles has a more lengthy period of changes. In the period under study, changes in the frequency of storms were

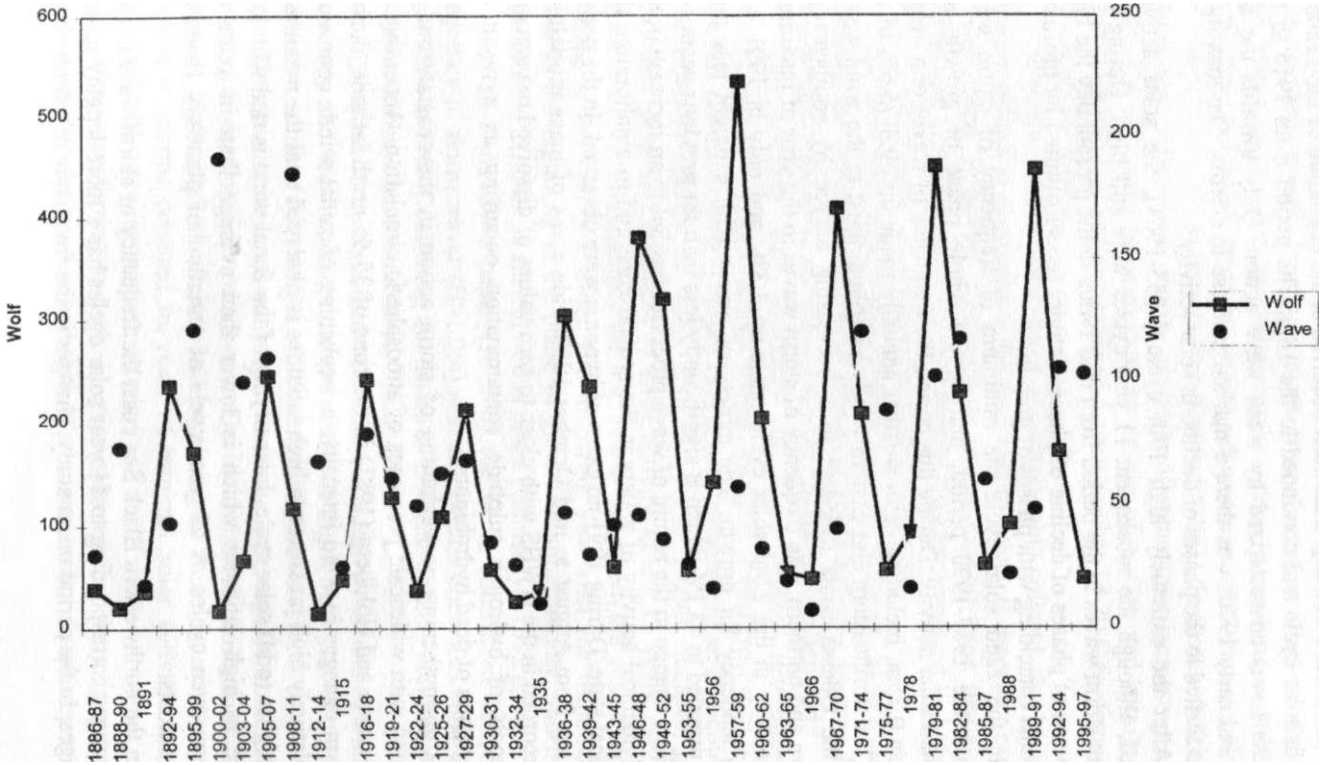

Fig. 1. Freguency of storm waves (H>1.0 m) durnig different phases of solar activity of 11 year solar cycles

observed with an amplitude of 80 years having a minimum in the 1930s (Fig.l). This amplitude has a 20 year shift from the amplitude of the 80 year cycle activity with a minimum in 1911-1913. The maximum storm action observed at the beginning of the century was repeated in the 1970-1980s.

According to Y. Vitinsky (1973) the high maximums of solar activity were replaced by an epoch of profound minimums and low maximums which will be accompanied by intensified storm action.

The account of influence oceanographic the factors is a major element at designing, construction and operation of structures marine farming.

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