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Effect of Environmental Factors on Physiology of Fin and Shellfishes

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Introduction

The organism can be taken to be open system, suitably walked off from its milieu, through which energy flow by appropriate entrances and exist

The organism uses their energy to maintain and extend its being



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Metabolism and activity

- Metabolism as used here is catabolism as ordinarily understood, that is the sum of reaction which yield the energy the organism utilizes
- Thus activities are such processes as running or fighting or other manifestations of energy released by metabolism
- Activity is fundamentally the result of transformation of energy from one form to another and the application of that energy to a given performance
- Two generalization arise from these circumstances



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- Standard metabolism is an approximation of the minimum rate for the intact organism
- It is preferably determined as the value found at zero activity by relating metabolic rate to random physical activity in fish in past absorptive
- The routine rate of metabolism is the mean rate observed in fish whose metabolic rate is influenced by random activity under experimental condition in which movement are presumably somewhat restricted and fish protected from outside stimuli



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- **Acclimation** will be used to designate the process of brining the animal to a given steady state by setting one or more of conditions to which it is exposed for an appropriate time before a given test
- **Lethal factors**
- The lethal effect of any identity may be separated into two components a) the incipient lethal level, that level of the identity concerned beyond which organism can no longer like for an indefinite period of time b) effective time, the period of time acquired to bring about at lethal effect at a given level of the identity beyond the incipient lethal



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Controlling factors

Controlling factors comprise one of two categories which govern the metabolic rate what are considered here as controlling factors are what Blackman termed 'tonic effects

Controlling factors place bound to two levels of metabolism



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Limiting factors

They are Blackman's factors of supply in his original treatment of limiting factors and the category to which Leibig's law of minimum applies

It operates by restricting the supply or removal of materials in metabolic chain



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• Masking factors

- A masking factor is an identity which modifies the operation of second identity on organism
- An organism achieves all its physiological regulation by the exploitation of marking factor through the channeling of energy by some anatomical device
- For example, deep sea fishes with swim bladder have pressures of gas in these bladder for in excess of pressure that could be generated by releasing all the atmospheric gases held in blood



Directive factors

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These allow or require a response on part of organism directed in some relation to gradient of factor in space or time

The directive factor also trigger physiological process without mediation of senses, as in effect of photoperiod on the pituitary

Directive factors operate by impingement of energy on some appropriate target

The energy absorbed initiates a signal which appropriately metabolism into the appropriate response



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Stress Related Physiology Changes

Introduction

"Stress" is defined in terms of the response of the animal with the stimulus being referred to as the stressor

The components of this response are collectively known as the General Adaptation Syndrome (GAS) which can be divided on a temporal basis into stages of alarm



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Categories of stress

- Stress may be divided into three categories. They are
a) response to cultural procedure b) response to disease c) response to water pollutants
- It is the consequence of the artificial environment itself and can include such factor as temperature, salinity change, stocking density, O₂ concentration, pH and water velocity etc
- **First groustimulus** being referred to as the stressor. The components of this response are collectively known as the General Adaptation Syndrome (GAS) which can be divided on a temporal basis into stages of alarm



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Second group

It relates to the stress of the fish that is fed and include such factors like protein quality vitamin cone., lipid type, mineral level etc .,

Third group

It consist of handling procedure like capture, anaesthesia, grading, storing by sex etc.,



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Stress response to disease and treatments

Fishes are exposed to disease related stress in both culture facilities such as density or dietary problems in the natural environment where it may also occur in conjunction with other stress such as temperature

For example

| Species | Disease |
|--------------|--------------------------|
| S. gairdneri | Myxobacterium |
| O. nerka | Copper |
| O. gorbuscha | Bacterial kidney disease |



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Stress response to water pollutants

Man's activities have increasing impact on the natural environment of salmonoids and other fishes both in freshwater and in coastal saltwater habitats

| Species | Pollutant |
|---------------------|-----------|
| <i>S. gairdneri</i> | Chromium |
| <i>O. nerka</i> | Copper |
| <i>O. kisutch</i> | Ammonia |



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Action of stresses

Besides A and NA small amount of dopamine have been found in elasmobranch plasma and auxiliary bodies and in teleost plasma. In most experimental conditions involving harsh stress the amine increase by 5-20 fold in others only 2-5 fold



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Resting level

The modulation of the adrenergic response in terms of the nature and intensity of stimulus makes it difficult to assess the resting levels of plasma A in fish

| Species | Resting value |
|-------------|-----------------------|
| Cyclostomes | 2.5×10^{-10} |
| Teleosts | 2.95×10^{-9} |



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• **Osmotic stress**

- The particular emphasis is placed on physiological effects of the osmotic stress of transferring fish from freshwater to sea some stress occurred reverse
- **Ionic stress**
- An attempt is made to define those areas of osmotic and ionic regulation which are likely to be influenced by stress. This stress is called as ionic stress



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Stress in defence mechanism

This may be advantageous or injuries. to the animal concerned depending upon the complex interaction below the stress factors and the animals physiological state which will eventually determine how well the animal will adapt to the situation

Thermal stress is defined as any temperature change that produces a significant disturbance in the normal function of a freshwater teleost



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Fishery managers should be concerned with optimizing the space of the realized performance capacity of their stocks

Mostly as stress plays a physiological load on the fish, there by reducing its capacity to perform with regard to subsequent stresses the appropriate recovery time depends upon the severity and duration of the initial stress