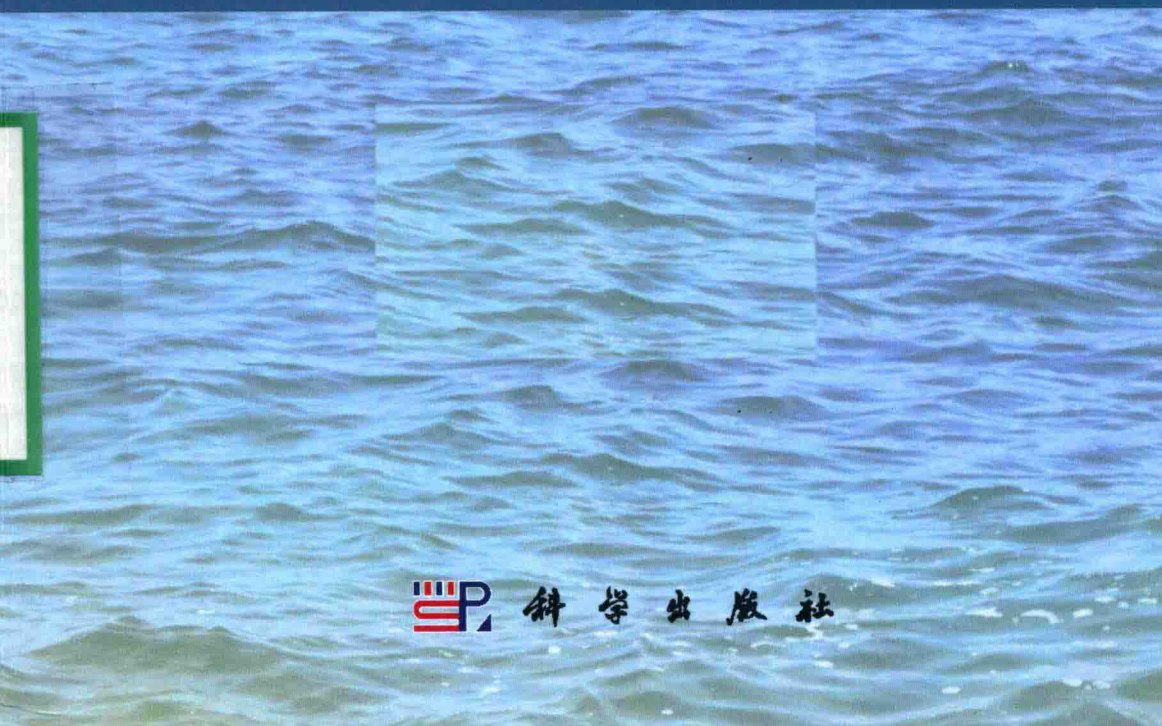
Professional English for Aquaculture

(水产养殖专业英语)

王志平　吴逸群　胡庆玲　编著



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内 容 简 介

水产养殖专业英语是水产养殖专业的重要专业基础课之一，是水产养殖工作者获取科技信息，进行科技交流和业务洽谈的重要工具。本书包括六章，内容涉及水产养殖概述、养殖水环境、基础水生生物学、养殖遗传学与育种、营养与饲料及疾病防治等。

本书可作为水产类专业专科生、本科生的教材，也可作为水产养殖工作者的参考书。

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前　言

随着我国改革开放的深入发展和外资企业的不断涌入，迫切需要掌握专业外语的实用型人才。水产养殖专业英语是以水产养殖专业的主要研究内容为载体的英语，服务于水产养殖生产和科研的需要，是水产养殖和英语两个学科相结合的交叉学科。水产养殖专业英语是水产养殖专业的重要专业基础课之一，是水产养殖工作者获取科技信息，进行科技交流和业务洽谈的重要工具，对收集国内外有关科研信息、拓宽学术思想、增强科研创造力，适应社会发展具有重要意义。

目前，我国还没有一本系统的水产养殖专业英语教材。专业英语教材应兼顾全面性、系统性、实用性和时代性，同时应难度适中。本书涵盖水产养殖的各主要领域，包括养殖水环境、基础水生生物学及遗传育种、营养与饲料、疾病防治等内容。英文素材选自一些科普性较强的、具有综述性质的英文资料，内容与专业统一、词汇丰富、语言地道、难度适中，便于学生阅读和掌握。

本书包括六章，第一章为水产养殖概述，第二章为养殖水环境，第三章为基础水生生物学，第四章为水产养殖遗传学与育种，第五章为营养与饲料，第六章为疾病与健康管理。每一章节都包括 Text、Words and Expressions 和 Translation 三个部分。Text 为英文学习素材；Words and Expressions 对书中的生词和专业术语分别给出了中英文解释，旨在创造适宜的英语学习氛围；Translation 为参考译文。另外，附录部分列出了重要词汇及其中文解释，便于学生快速查阅和学习专业词汇。

本书出版得到渭南市基础研究计划项目（2015KYJ-2-5）和渭南师范学院特色学科建设项目（14TSXK05）的资助，在此表示衷心的感谢。

由于编者水平有限，不足之处在所难免，恳请广大读者批评指正。

编　者

2015 年 11 月

Contents

Unit 1 About Aquaculture

Aquaculture is the cultivation of fish, shellfish or aquatic plants (such as seaweed) in natural or controlled marine or freshwater environments. Even though aquaculture began eons ago with the ancient Greeks, it wasn't until the 1980s that the practice finally began to expand rapidly, in part in response to overfishing and the deterioration of the world's fisheries and concerns about the effects of pollution on seafood. Aquaculture "farms" take on a variety of forms including huge tanks, freshwater ponds, and shallow-or deep-water marine environments. Carp, trout, catfish, tilapia, scallops, mussels, lobsters, and oysters are well-known species raised through aquaculture. Though most aquaculture supplies the commercial food market, many governmental agencies engage in it to stock lakes and rivers for sport fishing. It also supplies goldfish and other decorative fish for home aquariums and bait fish for sport and commercial fishing.

Among the raising and harvesting of fresh-and salt-water plants and animals, the most economically important form of aquaculture is fish farming, an industry that accounts for an ever increasing share of world fisheries production. Aquaculture provided 20 percent of global fisheries production in 1996. In 2003, the total world production of fisheries product was 132. 2 million tonnes of which aquaculture contributed 41. 9 million tonnes or about 31% of the total world production. In 2005, the total production of aquatic animals amounted to 48. 1 million tonnes with a farm-gate value of about US $70 billion. Today, aquaculture provides nearly half of the world's food fish. Considering the projected population growth over the next decades, estimates show that an additional 37 million tonnes of aquatic food will be needed by 2030 just to maintain current consumption levels (Harris, 2015). Aquaculture is perceived as having the greatest potential to meet the growing demand for aquatic food.

Aquaculture is currently the world's fastest growing food producing sector. It provides a safe and healthful food product for consumers, reduces the deficit in seafood trade, and creates jobs for farmers.

Successful aquaculture takes into consideration the biology of the aquatic species (feeding, water flow and temperature needs, disease prevention) and

engineering design (water source and water quality study, pond and tank containment systems, water filtration and aeration) as well as issues pertinent to any business.

Words and Expressions:

aquaculture ['ækwəkʌltʃə(r)](*n.*): rearing aquatic animals or cultivating aquatic plants for food 水产养殖

seaweed ['si:wi:d](*n.*): plant growing in the sea, especially marine algae 海草，海藻

eon ['i:ən](*n.*): an extremely long period of time 极漫长的时期，千万年

deterioration [di,tiriə'reʃn](*n.*): process of changing to an inferior state 恶化，变坏，退化

carp [kɑ:p](*n.*): a kind of fish that lives in lakes and rivers 鲤鱼

trout [traʊt](*n.*): a fairly large fish that lives in rivers and streams 虹鳟

catfish ['kæt,fiʃ](*n.*): a type of fish that have long thin spines around their mouths 鲶鱼

tilapia [ti'iæpiə](*n.*): a freshwater fish of the cichlid family 罗非鱼，吴郭鱼

scallop ['skæləp](*n.*): a kind of large shellfish with two flat fan-shaped shells 扇贝

mussel ['mʌsl](*n.*): a kind of shellfish that you can eat from their shells 贻贝，蚌

lobster ['lɑ:bstər](*n.*): a sea creature that has a hard shell, two large claws, and eight legs 龙虾

oyster ['ɔistər](*n.*): a large flat shellfish. Some oysters can be eaten and others produce valuable objects called pearls 牡蛎，蚝

decorative ['dekəreitiv](*adj.*): to look pretty or attractive 装饰性的，用作装饰的

aquarium [ə'kweriəm](*n.*): a glass tank filled with water, in which people keep fish 养鱼缸，水族箱

perceive [pə'si:v](*v.*): to understand or think of sb/sth in a particular way 将……理解为，将……视为，认为

deficit ['defisit](*n.*): the amount by which something is less than what is required or expected, especially the amount by which the total money received is less than the total money spent 赤字，逆差

containment [kən'teinmənt](*n.*): the act or process of keeping it under control 控制

filtration [fil'treiʃn](*n.*): the process of filtering a substance 过滤

filter ['filtə(r)](*v.*): pass it through a device which is designed to remove certain particles contained in it 过滤，透过

aeration [eə'reiʃn](*n.*): cause air or gas to pass through sth 充气，通气，曝气

pertinent ['pɜːrtnənt](*adj.*): relevant to a particular subject 有关的，相干的

Translation:

第一章 水产养殖概述

水产养殖是指在自然或人为调控下的海洋或淡水环境中养殖鱼类、贝类或水生植物(如海藻)。尽管水产养殖始于古希腊，但直到20世纪80年代才开始迅速扩大，部分原因是世界渔业的过度捕捞和恶化及人们对海产品污染的担忧。水产养殖场有大型水箱、淡水池塘、浅水或深水海洋环境等各种形式。常见的水产养殖种类包括鲤鱼、鲑鱼、鲶鱼、罗非鱼、扇贝、蚌、龙虾和牡蛎等。虽然水产养殖主要为商业性食品市场提供产品，但许多政府机构也会保留一些湖泊和河流供人们休闲垂钓。另外，水产养殖也为家庭水族箱提供金鱼及其他观赏鱼类，为休闲垂钓和商业捕鱼提供饵料鱼类。

从淡水和海水动植物的养殖与和收获情况看，最重要的水产养殖形式是养鱼，而且它在世界渔业生产中所占比例仍在不断升高。1996年，水产养殖的产量占全球渔业产量的20%。2003年，世界渔业总产量为1.322亿吨，其中水产养殖产量为0.419亿吨，占世界总产量的31%。到2005年，水产动物产量达到0.481亿吨，总产值约700亿美元。如今，水产养殖产量约占世界食用鱼的一半。根据未来几十年的人口增长率，预计2030年水产品需求量将达到3.7亿吨，这样才能维持目前的消费水平。面对人们日益增长的水产品需求，水产养殖被认为是最具发展前景的一个领域。

目前，水产养殖是世界上增长最快的食品生产行业。它不仅为消费者提供安全、健康的食品，还有助于减少海产品贸易逆差，同时也为农民创造就业机会。

成功的水产养殖要充分考虑水生生物学（如投饵、水流量和温度、疾病预防）、工程设计（水源和水质研究、池塘和水箱的控制系统、水的过滤和曝气）以及任何与业务相关的问题。

Unit 2 Water Environment for Aquaculture

Section 1 Introduction

Water quality and quantity vary from place to place, and are affected by ecological factors such as soil and air quality. On a whole, groundwater is considered more desirable for aquaculture because it has more consistent water quality than surface water, and is less likely to be contaminated by pathogens or fish.

As it may be impractical to regulate large volumes of water in open ponds or single pass flow-through culture systems, species selection is largely dependent on the kind of water available. Tropical fish, for instance, are generally sensitive to poor water quality and therefore require fish farmers to have a higher level of water quality management skills. Ornamental fish are kept in tanks more than food fish. In tank conditions where a large number of fish is kept in a small confined space, the buildup of nitrogenous waste requires additional care and measures to maintain a healthy stock.

Regardless of the kind of water available or the species chosen, all fish depend entirely on water to live, eat, grow and perform other bodily functions. Therefore, it is no surprise that the success of a fish farming establishment lies greatly on its water quality management programme. The most important parameters in aquaculture includes temperature, salinity, pH and dissolved oxygen (Wang and Sun, 2008).

Words and Expressions:

ecological [ˌiːkəˈlɒdʒikl] (*adj.*): involved with or concerning ecology 生态的，生态学的

ecology [iˈkɒlədʒi] (*n.*): the study of the relationships between plants, animals, people, and their environment, and the balances between these relationships 生态，生态学

desirable [diˈzaiərəbl] (*adj.*): worth having or doing because it is useful, necessary, or popular 值得拥有的，满意的，可取的

consistent [kənˈsistənt] (*adj.*): always behaves in the same way 一致的，始终如

一的

contaminate [kən'tæmineit](*v.*): make it dirty or harmful 弄脏，污染，损害

impractical [im'præktikl](*adj.*): not sensible or realistic, and does not work well in practice 不切实际的，无用的，不现实的

tropical ['trɒpikl](*adj.*): belonging to or typical of the tropics 热带的，有热带特征的

ornamental [ˌɔ:(r)nə'ment(ə)l](*adj.*): being attractive and decorative 装饰性的

confined [kən'faind](*adj.*): small and enclosed by walls (空间或面积) 有限的，狭小的

establishment [is'tæbliʃmənt](*n.*): a shop, business or organization occupying a particular building or place 企业，团体，机构

parameter [pə'ræmitə](*n.*): factors or limits which affect the way that something can be done or made 参数，界限，范围

dissolve [di'zɒlv](*adj.*): mix with the liquid and disappears 溶解的

Translation:

第二章 养殖水环境

第一节 引 言

不同地区的水体质量和数量存在差异，而且它还受土壤和空气质量等生态因子的影响。人们认为地下水是更为理想的水产养殖用水，因为其水质比地表水更稳定，而且不易受到病原体和鱼类的污染。

对露天池塘或单向流培养系统的大量水体进行调控是不切实际的，因此养殖物种的选择在很大程度上取决于水质状况。例如，热带鱼通常对水质比较敏感，因此要求养殖者具有更高的水质管理水平；与食品鱼相比，观赏鱼通常养在水箱里，在水箱养殖条件下，许多鱼共同生活在一个有限的环境中，需要特别注意含氮废物的积累，并采取措施保障鱼群健康。

无论水质如何或者选择什么种类，所有鱼类都完全依赖于水生活、摄食、生长并完成其他身体机能。因此，毫不奇怪，水产养殖企业的成功在很大程度上取决于水质管理方案。水产养殖中最重要的水质参数包括水温、盐度、酸碱度和溶解氧。

Section 2 Temperature

Aquatic animals take on the temperature of their environment and are intolerant of rapid temperature fluctuations. This makes water an ideal living habitat for them, because water is a bad conductor of heat, allowing large amount of heat energy to be absorbed without a corresponding temperature change.

The temperature of the water influences profoundly the lives of all aquatic animals. Many animals reproduce or feed only within certain temperature limits, which may be narrow or broad according to the species (Santiago, 1981). Temperature tolerances of fish are broadly categorized into cold water, cool water, warm water and tropical water. For each species, there is a minimum and maximum tolerance limit, as well as an optimal temperature range for growth. This optimal temperature range, also known as the standard environmental temperature (SET), may vary with each species, even those within the same temperature tolerance category, and with each development stage of the fish.

Water temperature affects the feeding pattern and growth of fish. Fish generally experience stress and disease breakout when temperature is chronically near their maximum tolerance or fluctuates suddenly. It is therefore important to acclimatize fish gradually when moving them from one location to another.

Warm water holds less dissolved oxygen than cool water. This is a point worth noting, since every 10℃ increase in temperature doubles the rate of metabolism, chemical reaction and oxygen consumption in general.

Words and Expressions:

fluctuation [ˌflʌktʃʊ'eiʃn] (*n.*): changes a lot in an irregular way 变动，波动，上下浮动

profoundly [prə'faʊndli] (*adv.*): to a great depth psychologically 深刻地

categorize ['kætəgəˌraiz] (*v.*): divide them into sets 对……进行分类，把……归类

breakout ['breikaʊt] (*n.*): suddenly starts or becomes active, usually after developing quietly for some time 爆发，突发

chronically ['krɑnikli] (*adv.*): in a slowly developing and long lasting manner 缓慢地，长期地

acclimatize [ə'klaimətaiz] (*v.*): become used to a new situation, place or climate (使) 适应或习惯于（新情况、新地方或新气候），驯化

Translation:

第二节 温 度

水生动物必须面对环境温度的挑战，而且它们难以承受温度的快速波动。这使得水成为它们理想的生活栖息地，因为水是热的不良导体，可以吸收大量热能而不引起相应的温度变化。

水温对所有水生动物的生命都具有非常深刻的影响。许多动物只能在一定的温度范围内繁殖或摄食，而该温度范围依生物种类不同或宽或窄。鱼的温度耐受性大致分为冷水、凉水、温水和热带水。任何生物都有最低耐受限度、最高耐受限度以及最适温度范围，这个最适温度范围也称为标准环境温度（SET），它可能会随生物种类而变，即使这些生物的温度耐受范围相同，另外，它还会随鱼类的个体发育阶段而变化。

水温影响鱼的摄食方式和生长。如果水温长期接近于耐受限度或者突然波动，鱼类通常会受到胁迫或暴发疾病。因此，将鱼类从一个地方转移到另一个地方时，对其进行逐步驯化是十分重要的。

温水比冷水中溶解氧含量低，这一点一定要引起重视，因为水温每增加10℃，鱼类的代谢速率、化学反应和氧气消耗量都会增加一倍。

Section 3 Salinity

Typically, the salt concentration in a fish is about 0.5% higher than its surrounding water. As a result, there is a constant influx of water into the fish through osmosis, diluting its body fluid. In order to maintain their salinity level, fish are constantly excreting a stream of urine. At the same time, they absorb salt from their surrounding via special cells in their gills. This constant exchange of mineral and water between the fish and their surrounding is crucial for their survival.

When fish are stressed, as they are when being shipped around in bags, they react by leaking bodily minerals into the water. If this condition persists for an extended period of time, the huge amount of salt lost can be fatal for the fish. The survival chances of a fish can be significantly increased by adding salt to their transport water. Since mineral leakage is directly linked to the concentration of salt between the fish and the water, increasing salinity of the water reduces salt

leakage and stress build-up for the fish.

Fish that have been imported in salted water need to be gradually acclimatized back to the salinity of their original habitat, which may be as low as 100 mg/L. Gradual acclimatization should take place over several days via a 30% daily water change.

Words and Expressions:

influx ['in,flʌks](*n.*): the process of flowing in 涌入，流入

osmosis [ɒz'məʊsis](*n.*): the process by which a liquid passes through a thin piece of solid substance such as the roots of a plant 渗透（作用）

dilute [dai'lʊ:t](*v.*): mixes with water or another liquid, and becomes weaker （使）稀释，（使）冲淡

excrete [ik'skri:t](*v.*): get rid of waste matter in faeces, urine, or sweat 排泄

urine ['jʊrən](*n.*): the liquid that you get rid of from your body when you go to the toilet 尿，小便

gill [gil](*n.*): the organs on the sides of fish and other water creatures through which they breathe 鳃

leak [li:k](*v.*): enter or escape as through a hole or crack or fissure 渗漏

fatal ['feitl](*adj.*): with very undesirable effects 致命的，后果极严重的，毁灭性的

Translation:

第三节　盐　　度

通常，鱼的盐分含量比周围水环境高 0.5%左右。因此，水会通过渗透作用不断进入鱼体内，从而稀释其体液。为了维持体内盐度，鱼类不断排出尿液。与此同时，他们通过鳃中的特殊细胞从环境中吸收盐分。鱼体和周围环境不断交换矿物质和水对于鱼类的生存至关重要。

当鱼类受到胁迫，例如把它们装入袋子进行运输的过程中，它们会做出一些反应，将体内的矿物质渗透到水中。如果这种情况持续时间比较长，大量盐分损失可能引起鱼类死亡。在运输水中加入盐分可以显著提高鱼类的生存机率。由于矿物质的渗透损失与鱼体和水环境的盐分含量直接相关，因此增加水体盐度可以减少鱼体的盐分损失并抑制胁迫加剧。

在盐水中运输的鱼类需要经过逐步驯化，使其适应新栖息环境的盐度，驯化

梯度可能要低至 100 mg/L。渐进的驯化过程要持续几天，期间每天更换 30%的水量。

Section 4 pH

The acceptable range for fish culture is usually between pH 6.3 to pH 9.0 (Santiago, 1981). When water is very alkaline (pH>9.0), ammonium in water is converted to toxic ammonia, which can kill fish. On the other hand, acidic water (pH<5.0) leeches metals from rocks and sediments. These metals have an adverse effect on the fishes' metabolism rates and ability to take in water through their gills, and can be fatal as well.

The correct pH is essential for a successful pond fertility programme, where fertilizers containing nitrogen, phosphorous and potassium are added to encourage the growth of phytoplankton. Phytoplankton breaks down waste into harmless ammonium, and is the food of zooplankton-a microscopic animal which forage fish like bluegills feed on. Phytoplankton also produces dissolved oxygen during day photosynthesis and is the most important source of dissolved oxygen in pond systems.

Words and Expressions:

ammonium [ə'məuniəm] (*n.*): the ion NH_4^+ which behaves in many respects like an alkali metal ion 铵盐，铵离子

convert [kən'vɜ:rt](*v.*): change into a different form (使) 改变，更改，(使) 转变

ammonia [ə'məuniə](*n.*): a pungent gas compounded of nitrogen and hydrogen (NH_3) 氨，氨水，氨气

leech [li:tʃ](*v.*): absorb, take in 吸收

sediment ['sedimənt](*n.*): solid material that settles at the bottom of a liquid 沉渣，沉淀物

fertility [fər'tiləti](*n.*): the property of producing abundantly and sustaining growth 育肥

phosphorous ['fɒsfərəs](*n.*): a poisonous yellowish-white chemical element It glows slightly and burns when air touches it 磷

potassium [pə'tæsiəm](*n.*): a soft silvery-white chemical element, which occurs mainly in compounds. These compounds are used in making such things as glass, soap and fertilizers 钾

phytoplankton [ˌfaitoʊ'plæŋktən] (*n.*): photosynthetic or plant constituent of plankton, mainly unicellular algae 浮游植物

microscopic [ˌmaikrə'skɑ:pik] (*adj.*): extremely small, and usually can be seen only through a microscope 极小的，微小的，微观的，极精细的

forage ['fɔ:ridʒ] (*adj.*): animal food for browsing or grazing 饲料

photosynthesis [ˌfəʊtəʊ'sinθəsis] (*adj.*): the way that green plants make their food using sunlight 光合作用

Translation:

第四节 pH

鱼类养殖可以接受的 pH 范围在 6.5 到 9.0 之间。若水的碱性过高(pH>9.0)，水中的铵会转化为有毒的氨，它可引起鱼类死亡。另一方面，酸性水(pH<5.0)会溶解岩石和沉积物中的金属元素，而这些金属元素对鱼的新陈代谢率、经鳃的水分吸收能力都是不利的，甚至会引起鱼类死亡。

合适的 pH 对于池塘育肥项目十分重要，池塘中要加入含有氮、磷、钾的肥料以促进浮游植物生长。浮游植物可以将水中的废物分解为无害的铵盐，使其成为浮游动物的食物，而浮游动物是蓝鳃太阳鱼等饵料鱼所摄食的微型动物。白天，浮游植物还可以通过光合作用产生溶解氧，这也是池塘系统中最重要的溶解氧来源。

Section 5 Dissolved Oxygen

Dissolved oxygen (DO) is by far, the most important parameter in aquaculture. Low DO levels are responsible for more fish kills, either directly or indirectly, than all other problems combined. Oxygen consumption is directly linked to size, feeding rate, activity level and temperature, and it will surprise some that large fish consume less oxygen than their smaller counterparts which have higher metabolic rates. The amount of DO in water increases as temperature reduces, and decreases when salinity and altitude increase.

Not only is DO important for fish respiration, it is also important for the survival of phytoplankton, the organism which breaks down toxic ammonia into harmless forms. To cultivate good growth, a good rule of thumb is to maintain DO levels at saturation, or at least 5 mg/L (Santiago, 1981). Warm water

species are more well-adapted to occasional low DO levels than cool water species. Portable DO meters should suffice for a quick DO check.

Words and Expressions:

counterpart ['kaʊntərpɑrt] (*n.*): another person or thing that has a similar function or position in a different place 职能或地位相当的人，对应的事物
altitude ['æltitʊd] (*n.*): the height above sea level 海拔
respiration [respə'reiʃ(ə)n] (*n.*): breathing 呼吸
cultivate ['kʌltiveit] (*v.*): foster the growth of 培养，种植，改善
occasional [ə'keiʒənl] (*adj.*): happening sometimes, but not regularly or often 偶尔的，不经常的，临时的
suffice [sə'fais] (*v.*): be enough to achieve a purpose or to fulfil a need 满足，充足

Translation:

第五节 溶 解 氧

溶解氧(DO)通常是水产养殖中最重要的一个参数。无论是直接地还是间接地，DO 对鱼体机能的影响都超过其他因素。氧的消耗水平与鱼的个体大小、摄食率、活动水平和环境温度直接相关。令人吃惊的是，个体较大的鱼氧消耗量却低于那些个体虽小但代谢率较高的同种鱼类。水中 DO 含量随温度降低而升高，随盐度和海拔的增加而降低。

DO 不仅对鱼类的呼吸十分重要，对浮游植物的生存也很重要，而后者可将有毒的氨转化为无害的形式。为促进鱼类生长，按照经验，可将 DO 维持在饱和状态或者至少 5 mg/L。温水性鱼类对临时性缺氧的适应能力低于冷水性鱼类。便携式 DO 测定仪可以实现 DO 的快速测定。

Unit 3 Basic Biology of Aquatic Species

Section 1 Characteristics of Fish Flesh

Fish flesh differs markedly from the usual mammalian and avian flesh in the markets. It is far mire diverse, because several hundred species of widely varying characteristics are used for food.

It usually provides a unique and valuable addition to human and animal nutrition.

1. Composition

Fish flesh (defined as the muscular and fatty tissues of the trunk), which is the part usually destined for human consumption, caries from about one-fourth to three-fourths of the total weight. Other aquatic usually have even less flesh.

The major chemical components of fish are water, lipids, and ash. The water and lipids (principally oils) together usually make up about 80% of total weight, the protein makeup about 17% and the ash makes up about 3%.

The most variable major component in fish flesh is the oil, which varies inversely with the water from about 11% to over 20% of body weight depending on species, seasonal fatness, and status of the gonads.

2. Nutritive Value

The kinds of oils, proteins and ash in fish make it as good a high-protein food as the flesh of mammals and birds for the general human diet, and fish is a superior food for various special diets.

Fish is desirable food primarily because of its protein, which is a major proportion of its dry eight and is of high quality. Despite the diversity of fish available for the diet, they are all similar in quality. The oil content is also of nutritional importance from the standpoint of both quantity and quality. Fish oil (except crustacean oils) is quite different in quality from that of other animal fats, principally of a higher proportion of polyunsaturated fatty acids. These have been show to be desirable in human diets because they tend to lower blood cholesterol. The other major characteristic of fish flesh is the usually low