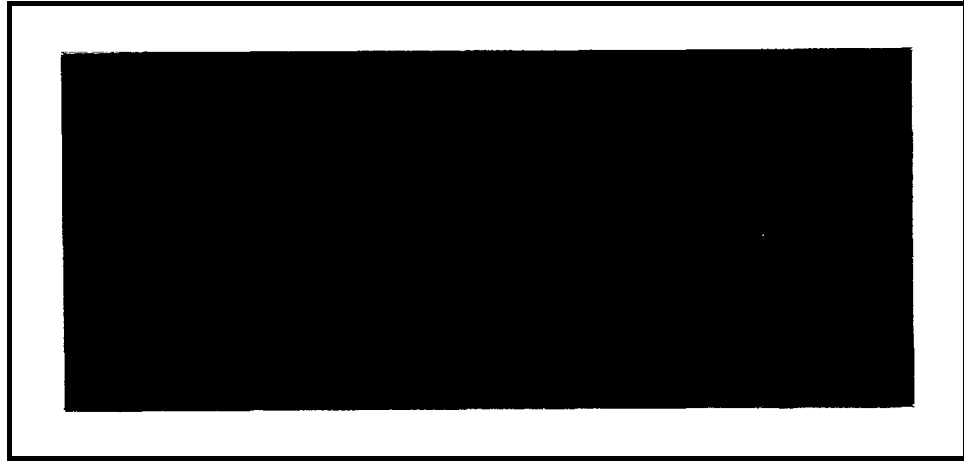


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VOLUME 111, REPORT 23.0

HEALTH, ABUNDANCE AND DIVERSITY OF BOTTOM FISH .
AND SHELLFISH POPULATIONS AT PROPOSED AND
EXISTING OFFSHORE DRILLING SITES IN THE
SOUTHERN CALIFORNIA BIGHT

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SOUTHERN CALIFORNIA BIGHT

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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
111-23.0	HEALTH, ABUNDANCE AND DIVERSITY OF BOTTOMFISH AND SHELLFISH POPULATIONS AT PROPOSED AND EXISTING OFF-SHORE DRILLING SITES IN THE SOUTHERN CALIFORNIA BIGHT.	111-23.0-1
23.1	METHODS.	1
23.2	GENERAL COMMENTS.	1
23.3	DESCRIPTION OF NOW TISSUES	1
	23.3.1 Skin	1
	23.3.2 Gill	2
	23.3.3 Spleen	2
	23.3.4 Liver.	2
	23.3.5 Pancreas	3
	23.3.6 Gall bladder	3
	23.3.7 Kidney	3
	23.3.8 Intestine.	3
	23.3.9 Gonads	4
23.4	LITERATURE CITED.	5

23.0 HEALTH , ABUNDANCE AND DIVERSITY OF BOTTOMFISH AND SHELLFISH POPULATIONS AT PROPOSED AND EXISTING OFFSHORE DRILLING SITES IN THE SOUTHERN CALIFORNIA BIGHT

2 3.1 METHODS

At the time of collection, specimens were measured and fixed whole with body cavity slit in 10% phosphate buffered formal in. At a later time, the specimens were necropsied and samples of liver, gall bladder, spleen, intestine, gonad, heart, kidney, muscle, fin, gill, and skin' (including lateral line) selected for histological examination. Selected tissues were processed using an Autotechnicon, embedded in Paraplast Plus, and sectioned at 8 μ m using an A.O. rotary microtome. Sections were stained with either hematoxylin-eosin or with more specialized stains (Periodic acid-Schiffs solution, and Masson's trichrome solution or May-Grunwald Giemsa), then examined using light microscopy.

23.2 GENERAL COMMENTS

Many of the tissues examined were fixed poorly prior to processing for histological study. It is essential that histological material be properly fixed at time of capture, as the onset of autolytic degeneration of cells can obscure many of the subtle changes that result from subacute exposure to toxic substances.

23.3 DESCRIPTION OF NORMAL TISSUES

General histological descriptions of teleost tissues are available in the published literature; therefore, the following descriptions will be brief and emphasis will be on variations between species.

23.3.1 Skin

The skin consists of three layers--the epidermis, dermis, and hyperdermis. The epidermal layer is composed of six to 10 layers of squamous epitheliums, flattened in the outer layers. The principle cell type is the Malpighian cell. Originating in the middle layers and intermixed throughout the Malpighian cells are mucus-producing cells (Bullock and Roberts 1974; Ashley 1975). The Dover sole and rex sole also have an additional cell type in the middle and basal layers of the epidermis. These cells, called eosinophilic granular cells (EGCs), have been reported in various pleuronectid species (Bullock and Roberts 1974; Wellings et al., 1976; Murchelano 1975. EGCs are occasionally seen in pathological lesions of the skin in other species (Bullock and Roberts 1974). In addition, large, mucopolysaccharide-containing cysts called multilocular cysts (Sherwood and Bendele 1975) were seen intermixed with the mucus and Malpighian cells in the Dover sole. In live teleosts, a peripheral layer called the cuticle is usually present. Composed of mucus,

sloughed Malpighian cells, and lymphocytic cells, this layer is seldom preserved by routine fixation and was not seen during this study.

The dermal layer underlies the epidermis and is separated from it by the collagenous basement membrane of the epidermis. The dermis is composed of a loose network of collagenous and reticular fibers, pigment cells, blood vessels, nerve bundles, and scale beds (Bullock and Roberts 1974). The hypodermis, which underlies the dermis and joins to the musculature, is composed of fatty tissue and reticular fibers.

The lateral canal is located in the epidermal layer. In normal tissue, neuromasts lie at the bottom of the canal atop the basement membrane (Ashley 1975). In specimens used in this study, the lateral canal tissues were poorly fixed.

23.3.2 Gill

Teleosts have five pairs of gills, the first pair either modified into a pseudobranch or absent. Gill filaments, lamellae, and rakers are supported by the gill arch. The gill filaments have an efferent and an afferent blood vessel which are separated by a collagenous rod. Squamous epithelial cells cover the filament. Lamellae arising in pairs from the filament consist of alternating pillar cells and capillaries, and are covered with a single layer of squamous epithelium. Chloride and albumen cells are found between the lamellae (Ashley 1975). EGCs were also seen between the lamellae in Dover sole and rex sole.

23.3.3 Spleen

The spleens of the examined species were similar to that described by Yoffey (1929). The intermixed red and white pulp surrounded the fibrous encapsulated blood vessels. Pigment-cell-centers resembling the melanin-macrophage centers of other tissues were associated with the blood vessels. Pancreatic tissue was occasionally seen associated with the peripheral encapsulating membrane.

23.3.4 Liver

Parenchyma cells of the liver, called hepatocytes, are arrayed in one-to-two cell thick muralia radiating from a central vein (Ashley 1975; Anderson and Mitchum 1974; Elias and Bengelsdorf 1952). Sinusoidal spaces separate the muralia and provide for interstitial blood flow. The hepatocytes in these species were regular in size and shape and displayed a single, prominent nucleolus. Dover sole, rex sole, and slender sole had small, pigment cell centers called melanin-macrophage centers (M-MCs) (Roberts 1975) associated with some blood vessels. The function of M-MCs is not understood, but

they are known to phagocytize exogenous particles from the blood. Pancreatic tissue was noted along some of the major blood vessels of the rex sole and slender sole. The hepatocytes contained varying amounts of lipid and glycogen vacuolation depending upon species and age.

23.3.5 Pancreas

The merocrine cells of the pancreas were found in acinar arrangements scattered throughout the mesentery tissue of the internal organs or as a hepato-pancreas in the rex sole and slender sole. Islets of Langerhans were present except in fish with a hepato-pancreas (Khalilov 1968).

23.3.6 Gall bladder

The gall bladder is a sac-like structure connected to the liver. Histologically, the mucosa of the lumen is extensively folded over giving a false impression of stratification. A layer of loose connective tissue (serosa) lies between the basement membrane of the epithelial cells and the encapsulating membrane (serosa). Anderson and Mitchum (1974) have described the gall bladder of the trout which is similar to the gallbladders of the species examined.

23.3.7 Kidney "

The kidneys of the Dover sole, rex sole, slender sole, and Pacific sanddab were located retroperitoneally to the spine. In the stripe-tail rockfish they were located in the anterior-dorsal part of the peritoneal cavity. In the flatfish, the kidneys were fused posteriorly. Anteriorly, two slender branches formed a distinct head kidney comprised of hematopoietic tissue. The posterior kidney contained the nephrons and supporting internal tissue. M-MCs were also found in the posterior kidney. In the rockfish, the kidneys were not fused, one lying on either side of the internal organ mass. The hematopoietic tissue of the head kidney was found associated with the junction of the two kidneys. The structure of teleost kidneys has been described by Hickman and Trump (1969). Bulger and Trump (1968) described the kidney of the English sole which is representative of most flatfishes. In this study, many of the kidneys were poorly fixed.

23.3.8 Intestine

The intestine was composed of four layers: the serosa, the muscularis, the lamina propria, and the mucosa (Dawes 1929; Bucke 1971; Anderson and Mitchum 1974). The mucosa, comprised of ciliated columnar epithelial cells, goblet cells, and migrating leukocytes, was highly folded. The lamina propria supported the mucosal folds and contained the vascular system. A circular and a longitudinal

layer of muscle forming the muscularis underlaid the lamina propria. Plexi of Auerbach, nerve bundles, were located between the muscle layers. A layer of serosa underlaid the longitudinal muscles and form the encapsulating membrane. Some of the intestinal tissues examined were not well preserved.

23.3.9 Gonads

Histologically, the testis is composed of elongate, seminiferous tubules, encapsulated and bound together by an investing, thick, connective tissue layer. Spermatozoa were developing within the seminiferous tubules.

Ovaries consist of follicles embedded in a vascular connective tissue. Ova were developing within follicles.

All gonads examined were immature and many poorly fixed. Anderson and Mitchum (1974) described the trout gonad which is representative of most teleosts.

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