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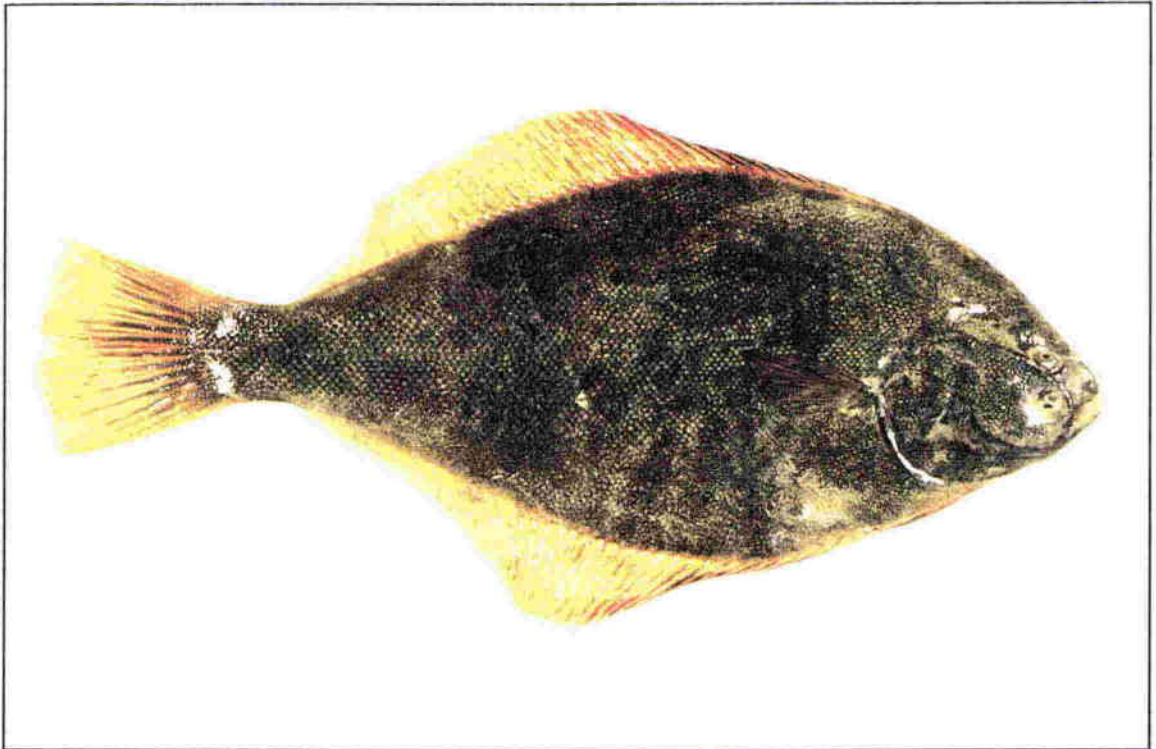
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**THE HEALTH OF YELLOWBELLY FLOUNDER**  
*(Rhombosolea leporina)*  
**FROM THE WAITEMATA HARBOUR**

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A thesis submitted in partial fulfilment of the requirements for the  
degree of Doctor of Philosophy in Biological Sciences,  
University of Auckland, June 1998.

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Yellowbelly flounder  
(*Rhombosolea leporina*)

## ABSTRACT

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This study focuses on an assessment of the health status of the yellowbelly flounder (*Rhombosolea leporina*) from two estuarine locations (site 1-the mouth of the Henderson Creek; site 2-the mouth of the Whau Creek) in the Waitemata Harbour. This harbour borders the highly urbanised and industrialised Auckland City metropolitan area. Whangaparaoa Peninsula, located approximately 30 km north of the other two collecting sites (away from the main urban area), was chosen as a reference site for comparative purposes.

Physico-chemical analyses revealed differences in water quality at the sampling sites. A lower pH, oxygen deficiency and higher temperature were recorded in both the Waitemata Harbour locations in comparison with the reference site.

Histopathological analyses revealed significantly higher prevalences and severity of pathological changes in the gills, blood, liver, kidney and gonads of the yellowbelly flounder from both harbour locations in comparison with fish from the reference site. In addition, some types of lesions (eg. neoplasms) were observed in fish from the two harbour locations only. Abnormalities in the gill structure of fish from both harbour sites included: epithelial swelling (hyperplasia and hypertrophy), necrosis, and lifting with oedema; the fusion of secondary lamellae; aneurysms; filamental deformities; mucous cell proliferation; and infestation by *Trichodina*. The abnormalities found in the blood of these

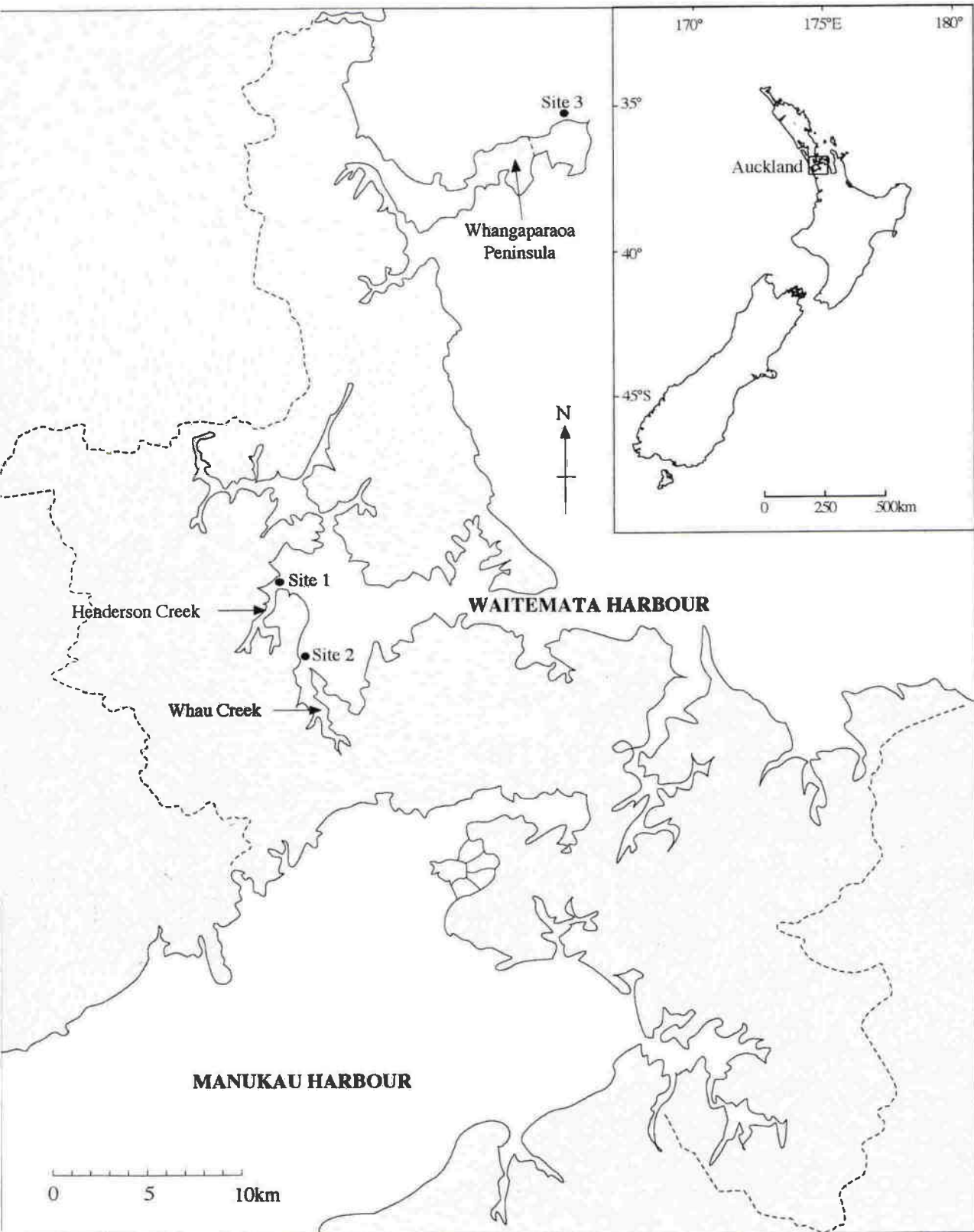
fish were manifested as: polycythaemia; erythrocytosis; erythroblastosis; leucocytosis (increased neutrophils); poikilocytosis; anisocytosis and an increased prevalence of erythrocytes undergoing necrosis. Vacuolar degeneration of the hepatocellular parenchyma due to lipid or glycogen accumulation was the most prominent liver change observed in fish from all sampling sites. The other liver abnormalities observed in flounder from the two harbour sites included: foci of cellular alterations (clear, basophilic and necrotic), congestion of the sinusoids, infestation by nematodes, and anaplastic growths (cholangiocellular carcinoma and teratoma). Pathological changes found in the kidneys of flounder collected at both harbour sites were classified as glomerular abnormalities (atrophy and dilatation of the glomerular tuft; enlargement of Bowman's space) and tubular vacuolar degeneration and necrosis. The presence of myxosporean parasites was also a common finding in the kidneys of harbour fish. Follicular atresia was the most prevalent change observed in the ovaries of flounder from the two harbour sites.

Biochemical analysis of plasma proteins and electrolytes of flounder from the three sampling sites revealed hyperbilirubinaemia, hypoalbuminaemia and uraemia in those inhabiting both harbour sites. In addition, the concentration of total liver microsomal proteins was significantly depressed in flounder from harbour sites 1 and 2 when compared to that of fish from the reference site. Concentrations of heavy metals in the livers of flounder from different sampling localities were found to decrease in the order: site 2 > reference site > site 1, and did not correlate with the prevalences of liver abnormalities.

Significantly more prominent pathological changes were thus observed in fish from both estuarine harbour sites in comparison with those from the reference open water site. The pathological changes noted are believed to occur in response to environmental changes. Contamination by different xenobiotics in the Whau and Henderson Creeks, which have been recorded in previous studies, suggest the possibility of direct toxic effects of the water contaminants on flounder from the estuarine parts of these creeks. In addition, the relatively high temperature, low pH and low oxygen levels recorded at the two sites in the

Waitemata Harbour are believed to have induced oxygen deficiency-related tissue hypoxia which could then have led to the expression of a variety of diseases of which some have been detected in this study. However, the possibility that some unknown and unmeasured causal factors may have produced the observed pattern of flounder diseases cannot be eliminated.

**Figure 1 Auckland Region Map**



----- border of the Auckland metropolitan area



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**LIST OF ABBREVIATIONS**

Abs. alc.	absolute alcohol	mm	millimetres
ATP	adenosine tri phosphate	min	minute
ALT	alanine transaminase	M	molar
ALB	albumin	N	neutrophils
AMY	amylase	n	number of
$\alpha$	alpha		observations
AST	aspartate transaminase	%	percent
$\beta$	beta	PO <sub>4</sub>	phosphate
BIL	bilirubin	PCBs	polychlorinated
BSA	bovine serum albumin		biphenyls
Ca <sup>++</sup>	calcium	PAHs	polycyclic aromatic
CH	cholesterol		hydrocarbons
CF	condition factor	K <sup>+</sup>	potassium
CK	creatine kinase	RBCC	red blood cell count
CR	creatinine	rpm	revolutions per
°C	degrees Celsius		minute
DNA	deoxyribonucleic acid	RNA	ribonucleic acid
DO	dissolved oxygen	RER	rough endoplasmic
EDTA	ethylene diamino tetra		reticulum
	acetate	sec	seconds
ER	endoplasmic reticulum	S.T.W.S.	Scott's tap water
E	erythrocytes		substitute
FACs	fluorescent aromatic	SEM	scanning electron
	compounds		microscopy
$\gamma$	gamma	SER	smooth endoplasmic
GGT	gamma glutamyl transferase		reticulum
g	gram	Na <sup>+</sup>	sodium

H/E	haematoxylin/eosin	NaCl	sodium chloride
Hct	haematocrit	s. d.	standard deviation
hr	hour	TEM	transmission electron microscopy
l	litre	TR	tryglicerides
LSI	liver somatic index	Tris HCl	tris hydrochloric acid
M/H	Mallory/Heidenhain	TPP	total plasma proteins
µg	micrograms	UA	uric acid
µm	micrometers	WBCC	white blood cell count
mg	milligrams		
ml	millilitres		

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