

CHLORINATED HYDROCARBONS IN STRIPPED MULLET
(*Mullus barbatus*) OF SARONIKOS BAY

By

J. SATSMADJIS and G.P. GABRIELIDES
Institute of Oceanographic and Fisheries Research
Aghios Kosmas, Hellinikon, Athens, Greece.

ABSTRACT

Specimens of striped mullet (*Mullus barbatus*) were collected from three areas of Saronikos Bay during September and December 1975 and for the first time were analysed for chlorinated hydrocarbons. Only PCBs, DDT and its metabolites were found in some quantities especially in those fish from the Psitalia area which is near Piraeus harbour and is polluted by the sewage and industrial effluents of the Athens Greater Area. The ratio PCBs/ Σ DDT was 1.5 for the Psitalia area and less than unity for the other two areas of St. George Island and S.W. of Aegina.

INTRODUCTION

The environmental research workers have given great importance to the chlorinated hydrocarbons due to their properties which are (a) high toxicity in small concentrations, (b) strong resistance to physical, chemical and biological alterations and (c) good ability in coming into contact with organisms. These substances accumulate in marine organisms and reach man through the food chain.

This work was performed in the framework of a GFCM/UNEP monitoring project and it is the first time that such analyses were carried out on fish from Greek coastal areas. The samples were collected by the Fisheries Research Section of the Institute of Oceanographic and Fisheries Research, Athens, from three areas in Saronikos Bay during September and December 1975 (Fig. 1). The analyses were carried out on homogenate samples composed of the flesh of a number of fish each having a total length of 10-15 cms.

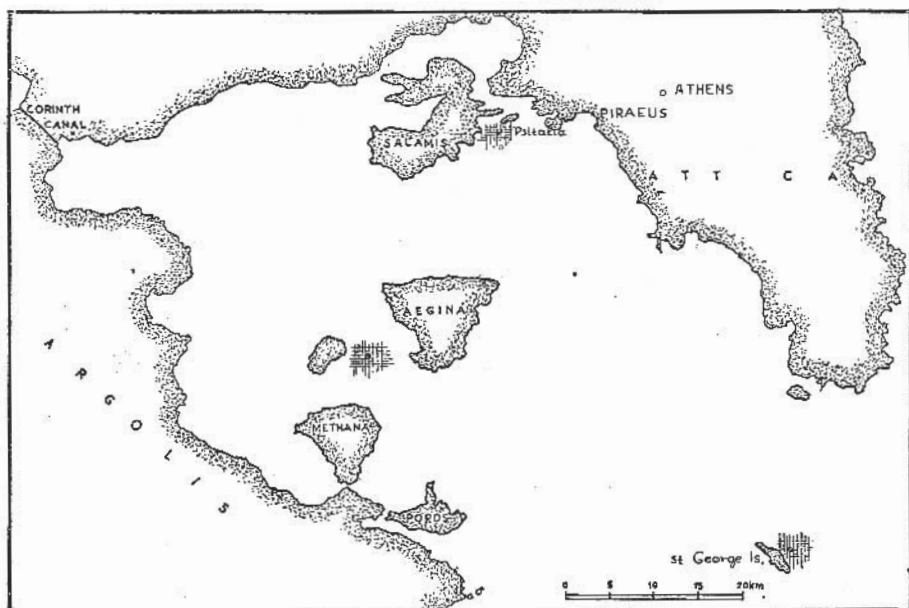


Fig. 1. Map of Saronikos Bay showing the three sampling areas

METHODS.

The method used is based on that of HOLDEN and MARSDEN (1969). About 10g of fish flesh were ground with anhydrous Na_2SO_4 and extracted with n-hexane in a soxhlet extractor. The extracts, after concentration, were passed through an alumina column to remove lipids and other interfering substances. A partial separation of the residues into groups was then achieved by passing them through a silica gel column.

Hexane was used as the elutant except in the last stage when 20% ether in n-hexane was used. The determination of the chl-HCs was made against standards on a Tracor 222 gas chromatograph using a Ni-63 electron capture detector. The quantitative determination of PCBs was made with Aroclor 1254 or 1260 depending on the sample.

RESULTS AND DISCUSSION

The results of the analyses appear in Table I. The standard deviation varied from 21-88% depending on the concentration. The highest concentrations are observed for the Psitalia area which is near Piraeus harbour and is polluted by the sewage and industrial effluents of the Athens Greater area and are followed by those for St. George Island and south-west of Aegina. The mean values for ΣDDT and

PCBs in the Psitalia area are 133 and 195 ppb respectively. The differences between the September and December values do not seem to be real. The respective values for the area S.W. of Aegina are 9 and 5.5 ppb and for that of St. George island 34 and 16 ppb. The concentrations of the other pesticides are generally small.

TABLE 1. Concentrations of chlorinated hydrocarbons in ppb on a wet weight basis

Constituent	Area and time of collection				
	Psitalia		S.W. Aegina		St. George Island
	Sept.	Decem.	Sept.	Decem.	Decem.
P'-P' - DDT	51.0	39.0	3.0	4.0	12.4
O'-P' - DDT	9.1	12.0	0.6	0.8	2.4
P'-P' - DDE	42.6	45.0	3.6	4.5	19.0
P'-P' - DDD	27.8	39.0	0.8	0.6	<0.2
ΣDDT	13.5	135.0	8.0	9.9	34.0
PCBs	209	182	4.3	6.7	16.0
Lindane	3.8	5.0	0.7	0.4	<0.2
Aldrin	0.6	<0.1	<0.1	0.1	<0.1
Dieldrin	0.4	6.0	<0.1	<0.1	<0.1
Heptachlor	0.3	0.5	<0.1	<0.1	<0.1
Hept. Epoxide	0.2	0.5	0.1	<0.1	<0.1

In the literature the concentrations which are reported for various areas range from a few ppb to a few thousand ppb. Specifically for the bay of California it was found that ΣDDT in fishes caught away from the coast and at intermediate depths varied from 13-79 ppb on a wet weight basis (COX, 1970) while in those caught near the coast of California the value ranged around 14,000 ppb (RISEBROUGH, 1969).

In a coastal area in North Adriatic the amount of ΣDDT in the flesh of fish belonging to the Sparidae family varied from 10 to 167 ppb with an average of 117 ppb while that of PCBs varied from 4-41 ppb with an average of 17 ppb. Higher values were also observed such as in *Maena maena* where ΣDDT was 553 ppb (REVELANTE and GILMARTIN, 1975). ALZIEU (1976), PORTMANN (1967), and TEN BERGE and HILLEBRAND (1974) report values varying from 5-320 ppb for ΣDDT and from 52-765 ppb for PCBs.

As PCBs are used solely by industry and pesticides (DDT etc) by agriculture, the ratio PCB /ΣDDT is sometimes used as an indication of the source of pollution. For the Psitalia area this value is 1.5 while for the other areas is less than unity.

Suggestions for permissible levels of PCBs and ΣDDT in fish vary greatly between scientists and could range from less than 1 ppm to 5 ppm.

As a general conclusion it can be said that only the Psitalia area can be considered slightly loaded with chlorinated hydrocarbons.

ΠΕΡΙΛΗΨΙΣ

Έγένοντο διά πρώτην φοράν ἀναλύσεις χλωριωμένων ὑδρογονανθράκων εἰς κουτσομούρας (*Mullus barbatus*) αἱ ὁποῖαι συνελέγησαν εἰς τρεῖς περιοχὰς τοῦ Σαρωνικοῦ Κόλπου κατὰ τοὺς μῆνας Σεπτέμβριον καὶ Δεκέμβριον τοῦ 1975. Μόνον τὰ PCBs, τὸ DDT καὶ οἱ μεταβολῖται αὐτοῦ ἀπαντῶνται εἰς ἀξιολόγους ποσότητας, ἰδίᾳ δὲ εἰς ἰχθεῖς τῆς περιοχῆς Ψυτταλείας, ἣ ὁποῖα εὐρίσκεται πλησίον τοῦ λιμένος Πειραιῶς καὶ ρυπαίνεται ἀπὸ τὰ οἰκιακὰ καὶ βιομηχανικὰ ἀπόβλητα τῆς μείζονος περιοχῆς Ἀθηνῶν. Ὁ λόγος PCBs/ΣDDT ἀνέρχεται εἰς 1,5 διὰ τὴν περιοχὴν Ψυτταλείας καὶ εἶναι μικρότερος τῆς μονάδος διὰ τὰς περιοχὰς τῆς νήσου Ἀγ. Γεωργίου καὶ Ν.Δ. τῆς Αἰγίνης.

REFERENCES

- ALZIEU, C. 1976.-Presence de diphenylpolychlores chez certains poissons de l' Atlantique et de la Mediterranee. *Science et Pêche*, No 258.
- COX, J. L. 1970.-Accumulation of DDT residues in *Triphoturus mexicanus* from the Gulf of California. *Nature*, 227: 192-193.
- HOLDEN, A.V. and MARSDEN, K. 1969.-Single stage clean-up of animal tissue extract for organochlorine residue analysis. *J. Chromatography* 44:481-492.
- PORTMANN, J.E. 1967.-Pesticide residues in fish and shellfish off the coast of Essex. I.C.E.S. paper, C.M. 1967/E-4.
- REVELANTE, N. and GILMARTIN, M. 1975.-DDT, related compounds and PCBs in tissues of 19 species of northern Adriatic fishes. *Inv. Pesq.*, 39:491-509
- RISEBROUGH, R.W. 1969.-Chlorinated Hydrocarbons in marine ecosystems. In MILLER M.W. and G.B. BERG (Eds) *Chemical Fallout*. Thomas Springfield 531 pp.
- TEN BERGE, W.F. and HILLEBRAND, M. 1974.-Organochlorine compounds in several marine organisms from the North Sea and the Dutch Wadden Sea. *Netherlands Journal of Sea Research*, 8:361-368.