HB

138

DEVOE MARINE — Produces 30% of TBT-based paints - International

Devoe Marine Coatings Co.

4000 Dupont Circle
Louisville, Kentucky
40207

Division of Grow Group, Inc.

March 17, 1987

Senate Office of Research
1100 J Street
Suite 650
Sacramento, California 95814

Attention: Ms. Mary Morgan

Subject: **TBT-Free Anti-foulings**

Dear Ms. Morgan:

I appreciated your time today to discuss the TBT issue and the availability of viable, proven and economical alternatives. Per your request, the following are TBT free anti-foulings manufactured by Devoe Marine Coatings Co.:

Devran 214 - A high performance anti-fouling based on cuprous oxide which provides up to two years protection under normal fouling conditions.

Devran 216 - An economical high performance anti-fouling based on cuprous oxide providing a long service life in normal fouling waters.

Devran 223 - A high performance controlled low ablation anti-fouling based on cuprous oxide which will provide up to two years protection in severe fouling environments.

ABC #3 - An ablative (self-polishing) high performance anti-fouling based on cuprous oxide which will provide five years + anti-fouling protection when the proper dry film thickness is applied. The ablative mechanism prevents the attachment of fouling organisms and creates a smoothing action which reduces the drag resistance of the vessel. This product is utilized where long life fouling protection in severe service is required. It provides anti-fouling properties in both the stationary and dynamic states.

As we discussed over the telephone, it is our belief that nearly all of the major marine coatings manufacturers possess a complete line of tin free anti-foulings. With respect to the copolymer or ablative technology which represents the extreme end of the high performance spectrum, there are several manufacturers marketing tin free products. Therefore, it is apparent that the claims made by the "pro tin interests" concerning the lack of viable alternatives to TBT are completely unfounded.

Should you require any additional information or wish our advice concerning this important issue, please feel free to contact the undersigned.

Very truly yours,

DEVOE MARINE COATINGS CO.

Robert H. Osmer
Vice President

RHO:lr

Official Business

COMMITTEE: House Resource

DATE: 3/27/87

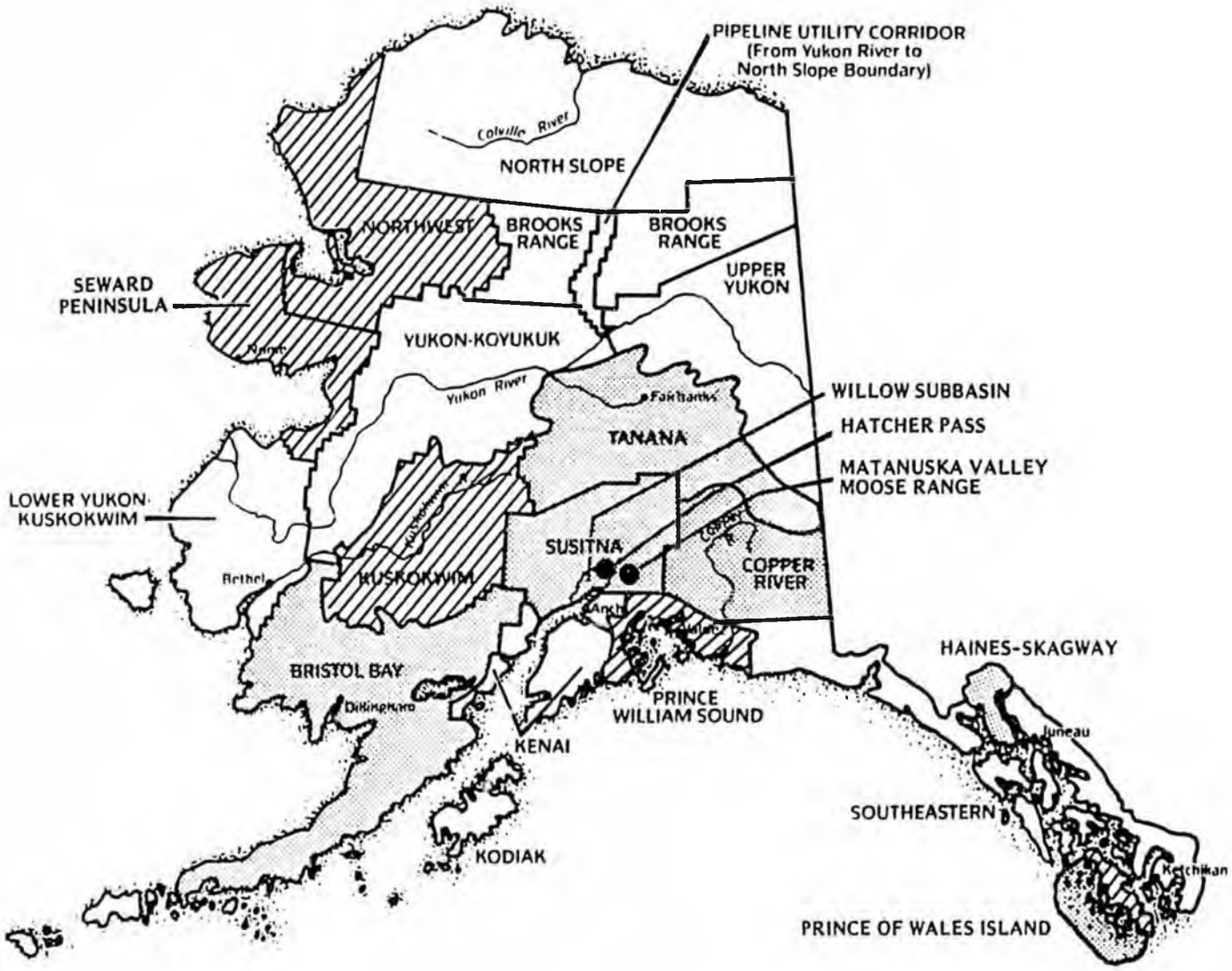
SIGN-IN

Subject of meeting:
HB 138 An Act regulating the sale & use of TBT-based marine paints
HJR 23

NAME	ADDRESS	PHONE	REPRESENTING	DO YOU WANT TO TESTIFY?
Douglas Dougan	P.O. Box 0	465-2604	DEC	YES

Alaska Department of Natural Resources

AREA PLANS



AREA PLANNING STATUS

- ☐ Completed area plans
- ▨ Area plans in progress
- ☐ Not scheduled for area planning

FEBRUARY 1987

Alaska Department of
NATURAL
RESOURCES

Why Do Area Plans?

The planning process is a way of settling differences, it is a way of deciding how to manage and use state lands. There are many different ideas on how state lands should be used, and sometimes these proposed uses have the potential to conflict with each other. However, with advance planning, many potentially conflicting uses can occur in the same area. Through the planning process, the people of the state can help choose the ways the land should be managed. The plans also make it clear to the public what choices have been made and the reasons for those choices.

The Planning Process

Public Identifies Issues - Public meetings are held to learn of local problems, interests, and concerns about state lands.

Gather Information - Information about natural resources (oil and gas, minerals, fish, forests, soils, etc.), existing land uses and ownership, and economic and social characteristics is gathered, mapped, and analyzed.

Prepare Plan Alternatives - Different land use plans are developed using public comments, resource information, and state policy.

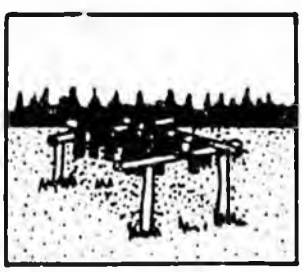
Public Reviews Alternatives - Public meetings are held to review alternatives.

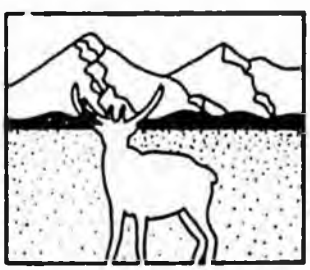
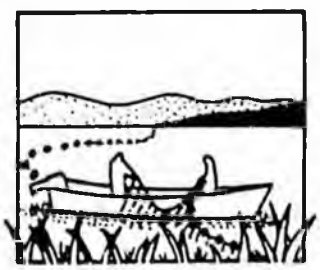
Prepare Draft Plan for State Lands - Public comments are reviewed, conflicts are resolved, a preferred alternative is selected, and a draft plan is written.

Public Reviews Draft Plan - Public hearings are held on the draft plan.

Prepare Final Plan - Changes to the draft plan are made based on public comments. Final plan recommendations are developed.

Adopt and Implement the Plan - The Commissioner of the Department of Natural Resources adopts the final plan. The plan guides the state's land management decisions.



Status of Area Plans

Bristol Bay. Adopted in September, 1984. Covers 13 million acres of state-owned and state-selected land. Copies are available at DNR Information Offices and have been sent to state depository libraries.

Copper River Basin. Adopted in November, 1986. Covers 3.3 million acres of state-owned and state-selected land. Copies are available at DNR Information Offices and have been sent to state depository libraries.

Haines/Skagway. Adopted in June, 1979. Covers 400,000 acres of state-owned or state-selected land. Superseded by the Alaska Chilkat Bald Eagle Preserve Management Plan (September, 1985) and the Haines State Forest Management Plan (February, 1986). Copies of all three plans are available at DNR Information Offices and have been sent to state depository libraries.

Kuskokwim Basin. This plan is for 16.6 million acres of state-owned or state-selected land. Alternatives have been developed and will be discussed at public meetings in late March and early April, 1987. A plan will be drafted during the spring and summer, reviewed at public meetings in the fall of 1987, and adopted by February, 1988. The plan will address such issues as land offerings, oil and gas development, mining, coal development, fish and wildlife habitat, and recreation. Special emphasis will be placed on preserving access to state lands.

Northwest. This plan is for 10 million acres of state-owned or state-selected lands in the Bering Straits region, the Northwest Arctic Borough, and the far western segment of the North Slope Borough. Alternative land use patterns have been developed and will be discussed at public meetings in late March and early April, 1987. The plan will be drafted during the spring and summer, reviewed at public meetings in the fall of 1987, and adopted in February, 1988. Subsistence is an important use of resources in the Northwest. Other issues of importance are access to state land, reindeer grazing, land offerings, trapping cabins, oil and gas development, and mining.

Prince of Wales Island. An area plan covering the southwestern part of the island was adopted in June, 1985. The remainder of the island is the subject of an ongoing plan. This plan is for 30,000 acres of state-owned or state-selected uplands and about one million acres of adjacent tidelands and submerged lands. Alternative management schemes will be discussed at public meetings in the spring of 1987. A draft plan will be distributed in the fall of 1987, with adoption of the final plan anticipated in March, 1988. The plan will address such issues as land offerings, log transfer and storage facilities, floating camps, floathomes, sea-farming, and state selections from the Tongass National Forest.

Prince William Sound. This plan is for 850,000 acres of state-owned or state-selected uplands and most of the tidelands and submerged lands in Prince William Sound. A plan will be drafted by June, 1987, discussed at public meetings in the fall, and adopted by December, 1987. The plan will address such issues as land offerings, the location of commercial and public recreation facilities, floathomes, aquaculture, sea-farming, state selections from the Chugach National Forest, mooring areas, and access to the beach, lakes, streams, and important hunting and fishing areas.

Susitna. Adopted in April, 1985. Covers 9.5 million acres of state-owned and state-selected land. Copies are available at DNR Information Offices and have been sent to state depository libraries.

Tanana Basin. Adopted in April, 1985. Covers 12.5 million acres of state-owned and state-selected land. Copies are available at DNR Information Offices and have been sent to state depository libraries.

For more information on area plans, contact:

Dept. of Natural Resources
Land and Water Mgt.
Resource Allocation Section
P.O. Box 7-005
Anchorage, Alaska 99510
(907) 561-2020

Rep Sound
Nevette - 5 pg.

SENATE OF MARYLAND

71r1540 No. 499 M1
CF 71r1545

By: Senators Winegrad, Fowler, and Garrott
Introduced and read first time: February 6, 1987
Assigned to: Economic and Environmental Affairs

A BILL ENTITLED

AN ACT concerning

Antifouling Paints - Regulation

FOR the purpose of prohibiting certain persons from distributing, possessing, selling, offering for sale, using, or offering for use any antifouling paints containing tributyltin; providing certain exceptions; defining certain items; allowing certain persons to distribute, sell, possess, and apply certain antifouling paints under certain conditions; providing for the scope and application of this Act; requiring the State Secretary of Agriculture to adopt certain regulations before a certain date; providing for seizures and penalties under this Act; requiring the Department of Health and Mental Hygiene to develop certain standards and regulate certain items in this Act; requiring the Department of Natural Resources to develop a certain program by a certain date in coordination and consultation with certain groups; requiring certain publications under this Act; providing for certain effective dates for certain provisions of this Act; and generally relating to the regulation of the distribution, possession, sale, offering for sale, use, and offering for use of antifouling paints containing tributyltin.

BY adding to

Article - Agriculture
Section 14-101 through 14-106, inclusive, to be under the new title "Title 14. Antifouling Paints"
Annotated Code of Maryland
(1985 Replacement Volume and 1986 Supplement)

BY adding to

Article - Health - Environmental
Section 11-501 and 11-502 to be under the new subtitle "Subtitle 5. Antifouling Paints"
Annotated Code of Maryland
(1982 Replacement Volume and 1986 Supplement)

EXPLANATION: CAPITALS INDICATE MATTER ADDED TO EXISTING LAW.
[Brackets] indicate matter deleted from existing law.

(C) THE DEPARTMENT SHALL DEVELOP THE EDUCATIONAL PROGRAM UNDER SUBSECTION (A) OF THIS SECTION AND THE MATERIALS USED IN THE PROGRAM IN COORDINATION WITH THE STATE DEPARTMENT OF AGRICULTURE AND IN CONSULTATION WITH THE MARINE TRADES AND WITH REPRESENTATIVES OF THE BOATING PUBLIC.

SECTION 3. AND BE IT FURTHER ENACTED, That Section 1 of this Act shall take effect December 1, 1987.

SECTION 4. AND BE IT FURTHER ENACTED, That Section 2 of this Act shall take effect June 1, 1987.

SECTION 2. AND BE IT FURTHER ENACTED, That the Laws of Maryland read as follows:

Article - Health - Environmental

SUBTITLE 5. ANTIFOULING PAINTS

11-501.

(A) THE DEFINITIONS IN § 14-101 OF THE AGRICULTURE ARTICLE APPLY IN THIS SUBTITLE.

(B) ALSO, IN THIS SUBTITLE, "WATER QUALITY STANDARD" HAS THE SAME MEANING AS PROVIDED IN COMAR 10.50.01.

11-502.

THE DEPARTMENT SHALL:

(1) DEVELOP BY DECEMBER 1, 1987 A WATER QUALITY STANDARD FOR THE CONCENTRATION OF TRIBUTYLTIN IN THE WATERS OF THE STATE THAT IS SUFFICIENT FOR THE PROTECTION OF AQUATIC LIFE; AND

(2) REGULATE POINT SOURCES OF RELEASE OF TRIBUTYLTIN IN ACCORDANCE WITH THE WATER QUALITY STANDARD DEVELOPED UNDER ITEM (1) OF THIS SECTION.

Article - Natural Resources

8-703.1.

(A) THE DEPARTMENT SHALL DEVELOP AND IMPLEMENT BY AUGUST 1, 1987 AN EDUCATIONAL PROGRAM TO ADVISE BOATERS, BOATYARDS, MARINE SUPPLIERS, AND OTHER USERS OF ANTIFOULING PAINTS ON:

(1) THE PROVISIONS OF TITLE 14 OF THE AGRICULTURE ARTICLE, TITLE 11, SUBTITLE 5 OF THE HEALTH - ENVIRONMENTAL ARTICLE, AND THIS SECTION;

(2) THE TOXIC PROPENSITIES TO MARINE LIFE OF ANTIFOULING PAINTS CONTAINING TRIBUTYLTIN COMPOUNDS; AND

(3) THE AVAILABILITY OF SUBSTITUTE PAINTS.

(B) THE DEPARTMENT SHALL:

(1) PUBLISH FOR USE BY THE PUBLIC A DETAILED LISTING OF ANTIFOULING PAINTS IN USE IN THE STATE THAT CONTAIN TRIBUTYLTIN AND THOSE THAT DO NOT; AND

(2) PUBLISH, TO THE EXTENT POSSIBLE, WHICH ANTIFOULING PAINTS CONTAINING TRIBUTYLTIN HAVE ACCEPTABLE RELEASE RATES, AS DEFINED IN § 14-101 OF THE AGRICULTURE ARTICLE.

OFFER FOR USE ANY ANTIFOULING PAINT CONTAINING A TRIBUTYLTIN COMPOUND.

(B) (1) A PERSON MAY DISTRIBUTE OR SELL AN ANTIFOULING PAINT CONTAINING A TRIBUTYLTIN COMPOUND WITH AN ACCEPTABLE RELEASE RATE TO THE OWNER OR AGENT OF A COMMERCIAL BOATYARD.

(2) THE OWNER OR AGENT OF A COMMERCIAL BOATYARD MAY POSSESS AND APPLY OF PURCHASE FOR APPLICATION AN ANTIFOULING PAINT CONTAINING TRIBUTYLTIN WITH AN ACCEPTABLE RELEASE RATE, IF THE ANTIFOULING PAINT:

(I) IS APPLIED ONLY WITHIN A COMMERCIAL BOATYARD; AND

(II) IS APPLIED ONLY TO VESSELS EXCEEDING 25 METERS IN LENGTH OR THAT HAVE ALUMINUM HULLS.

(C) THIS SECTION DOES NOT PROHIBIT THE SALE, USE, DISTRIBUTION, OR POSSESSION OF AN ANTIFOULING PAINT CONTAINING A TRIBUTYLTIN COMPOUND, IF THE ANTIFOULING PAINT:

(1) IS IN A SPRAY CAN OF 16 OUNCES OR LESS;

(2) IS COMMONLY REFERRED TO AS AN OUTBOARD OR LOWER DRIVE UNIT PAINT; AND

(3) HAS AN ACCEPTABLE RELEASE RATE.

14-103.

THIS TITLE DOES NOT INFRINGE ON INTERSTATE COMMERCE, AND OUT-OF-STATE VESSELS THAT HAVE AN ANTIFOULING PAINT CONTAINING A TRIBUTYLTIN COMPOUND IN EXCESS OF AN ACCEPTABLE RELEASE RATE MAY TRAVEL AND DOCK IN STATE WATERS.

14-104.

THE SECRETARY SHALL ADOPT REGULATIONS BEFORE SEPTEMBER 15, 1987 TO CARRY OUT THE PROVISIONS OF THIS TITLE.

14-105.

(A) THE DEPARTMENT MAY SEIZE ANY ANTIFOULING PAINT THAT IS HELD FOR SALE OR DISTRIBUTION, USED, OR POSSESSED IN VIOLATION OF THIS TITLE.

(B) ANY ANTIFOULING PAINT SEIZED BY THE DEPARTMENT UNDER THIS SECTION IS DEEMED FORFEITED TO THE STATE.

14-106.

A PERSON WHO VIOLATES ANY PROVISION OF THIS TITLE IS GUILTY OF A MISDEMEANOR AND ON CONVICTION IS SUBJECT TO A FINE NOT EXCEEDING $2,500.

BY adding ( )

Article - Natural Resources
Section 8-703.1
Annotated Code of Maryland
(1983 Replacement Volume and 1986 Supplement)

SECTION 1. BE IT ENACTED BY THE GENERAL ASSEMBLY OF MARYLAND, That the Laws of Maryland read as follows:

Article - Agriculture

TITLE 14. ANTIFOULING PAINTS

14-101.

(A) IN THIS TITLE THE FOLLOWING WORDS HAVE THE MEANINGS INDICATED.

(B) "ACCEPTABLE RELEASE RATE" MEANS A MEASURED RELEASE RATE EQUAL TO OR LESS THAN 1.0 MICROGRAM PER SQUARE CENTIMETER PER DAY AT STEADY STATE CONDITIONS DETERMINED IN ACCORDANCE WITH THE U.S. ENVIRONMENTAL PROTECTION AGENCY TESTING PROCEDURE, AS OUTLINED IN THE AGENCY'S CALL-IN NOTICE OF JULY 29, 1986 ON TRIBUTYLTIN IN ANTIFOULING PAINTS UNDER THE FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT.

(C) "ANTIFOULING PAINT" MEANS A COMPOUND, COATING, PAINT, OR TREATMENT APPLIED OR USED FOR THE PURPOSE OF CONTROLLING FRESHWATER OR MARINE FOULING ORGANISMS ON VESSELS.

(D) "COMMERCIAL BOATYARD" MEANS:

(1) A FACILITY THAT ENGAGES FOR HIRE IN THE CONSTRUCTION, STORAGE, MAINTENANCE, REPAIR, OR REFURBISHING OF VESSELS; OR

(2) AN INDEPENDENT MARINE MAINTENANCE CONTRACTOR WHO ENGAGES IN ANY OF THE ACTIVITIES UNDER PARAGRAPH (1) OF THIS SUBSECTION.

(E) "TRIBUTYLTIN COMPOUND" MEANS ANY ORGANOTIN COMPOUND THAT HAS 3 NORMAL BUTYL GROUPS ATTACHED TO A TIN ATOM AND WITH OR WITHOUT AN ANION, SUCH AS CHLORIDE, FLUORIDE, OR OXIDE.

(F) (1) "VESSEL" MEANS A WATERCRAFT OR OTHER CONTRIVANCE USED AS A MEANS OF TRANSPORTATION ON WATER, WHETHER SELF-PROPELLED OR OTHERWISE.

(2) "VESSEL" INCLUDES BARGES AND TUGS.

14-102.

(A) EXCEPT AS PROVIDED IN SUBSECTION (B) OF THIS SECTION, A PERSON MAY NOT DISTRIBUTE, POSSESS, SELL, OFFER FOR SALE, USE, OR

(9)

HOUSE COMMITTEE REPORT

1/21

Rules

Date referred: 3/25/87

FURTHER REFERRALS:

DATE: _____

The Resources Committee has considered SB 131 am

"An Act regulating the sale and use of TBT-based marine antifouling paints and coatings; and providing for an effective date."

RECOMMENDS:

[✓] replace with HCS SB 131(Res) [✓] the same title

[ ] attached amendment(s) [ ] a new title

- [✓] do pass
- [ ] do not pass
- [ ] no recommendation
- [ ] individual recommendations
- [ ] additional referral to the _____ Committee

ADOPTS: [ ] _____ letter of intent

ATTACHES NEW FISCAL NOTE(s):

- [✓] fiscal impact
- [ ] zero fiscal note
- [ ] zero with analysis
- [ ] same as previous fiscal note published _____
- [ ] same as previous zero fiscal note published _____

SIGNING DO PASS:

Adelheid Herrmann

Mike Navarre

Ben Hall

Dick Shultz

Fred Zharoff

DAVIDSON

SIGNING OTHER RECOMMENDATIONS:

Adelheid Herrmann

Chairman's signature

STATE OF ALASKA 1987 LEGISLATIVE SESSION
FISCAL NOTE

Bill Version: HCS SB 131 (Resources)
Publish Date:

REQUEST:

Revision Date:
Title: An Act Regulating to the sale and use of TBT-based marine anti-fouling paints & coatings
Sponsor: Senator Zharoff
Requestor: Senator Zharoff

Agency Affected: Environmental Conservation
BRU: Environmental Health
Components: Sanitation

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES	-0-	10.7	10.7	5.3	5.3	5.3
TRAVEL	-0-	1.4	1.4	1.0	1.0	1.0
CONTRACTUAL	-0-	2.0	2.0	1.0	1.0	1.0
SUPPLIES	-0-	1.0	1.0	1.0	1.0	1.0
EQUIPMENT	-0-	0.8	0.8	0.5	0.5	0.5
LAND & STRUCTURES	-0-	-0-	-0-	-0-	-0-	-0-
GRANTS, CLAIMS	-0-	-0-	-0-	-0-	-0-	-0-
MISCELLANEOUS	-0-	-0-	-0-	-0-	-0-	-0-
TOTAL OPERATING	-0-	15.9	15.9	8.8	8.8	8.8
CAPITAL	-0-	-0-	-0-	-0-	-0-	-0-
REVENUE	-0-	-0-	-0-	-0-	-0-	-0-

FUNDING: (Thousands of Dollars)

GENERAL FUND	-0-	15.9	15.9	8.8	8.8	8.8
FEDERAL FUNDS	-0-	-0-	-0-	-0-	-0-	-0-
OTHER	-0-	-0-	-0-	-0-	-0-	-0-
TOTAL	-0-	15.9	15.9	8.8	8.8	8.8

POSITIONS:

FULL-TIME	0	0	0	0	0	0
PART-TIME	0	0	0	0	0	0
TEMPORARY	0	0	0	0	0	0

ANALYSIS: (Attach a separate page if necessary) This fiscal note assumes that the department will only monitor the sale of TBT. This will entail on-site inspection and monitoring of wholesale and retail outlets. It will also involve the investigation and preparation of appropriate enforcement actions.
SEE ATTACHED

Prepared by: Doug Donegan
Phone: 465-2600
Division: Environmental Health
Date: 3-6-87

Approved by Commissioner: Cinn O'Kelly
Date: 3/6/87
Agency: Environmental Conservation

Distribution (by preparer):
Legislative Finance
Legislative Sponsor
Requestor
Office of Management and Budget
Impacted Agency(ies)
Senate Secretary

Adopted for HCSSB131 (Resources)

Alaska State Legislature
HOUSE OF REPRESENTATIVES
COMMITTEE ON RESOURCES

POUCH V
JUNEAU, ALASKA 99811
(907) 465-3715

Representative Adelheid Herrmann, co-Chair - 465-4942 ad
Representative Sam Cotten, co-Chair - 465-3715 SC

Committee Schedule March 23 - 27, 1987

Monday, March 23, 1987
8:30 - 10:00 a.m., Capitol 124

ADF&G: Brief Presentation regarding ANWR

* HB 149 "An Act relating to certain oil terminal operators; and providing for an effective date."

Tuesday, March 24, 1987
8:30 - 10:00 a.m., Capitol 124

TELECONFERENCE - LISTEN ONLY

* HB 108 "An Act relating to aquatic farming; and providing for an effective date."

Wednesday, March 25, 1987
8:30 - 10:00 a.m., Capitol 124

TELECONFERENCE - LISTEN ONLY

HB 108 "An Act relating to aquatic farming; and providing for an effective date."

Thursday, March 26, 1987
8:00 - 10:00 a.m., Capitol 124

8:00 a.m.

* HB 118 "An Act relating to decisions on right-of-way lease applications."

8:30 a.m.

TELECONFERENCE - LISTEN ONLY

HB 108 "An Act relating to aquatic farming; and providing for an effective date."

Alaska State Legislature
HOUSE OF REPRESENTATIVES
COMMITTEE ON RESOURCES

POUCH V
JUNEAU, ALASKA 99811
(907) 465-3715

Friday, March 27, 1987
8:30 - 10:00 a.m., Capitol 124

HB 138 "An Act regulating the sale and use of TBT-based marine antifouling paints and coatings; and providing for an effective date."

* HJR 23 Relating to tributyltin.

PENDING TRANSMITTAL:

SB 131 "An Act regulating the sale and use of TBT-based marine antifouling paints and coatings; and providing for an effective date."

5-0657Aa
Hein

A M E N D M E N T

Offered in the SENATE

By Zharoff

TO: SB 131

Page 2, line 3:

Delete all material and insert:

"(1) "TBT-based marine antifouling paint or coating" means a paint, coating, or treatment that contains tributyltin, or a tri-organotin compound used as a substitute for tributyltin, and that is intended to control fouling organisms in a fresh water or marine environment;"

3/6/87

Introduced: 2/18/87
Referred: Labor & Commerce

5-0657A

BY ZHAROFF, ELIASON, JOSEPHSON, SZYMANSKI, KERTTULA, DUNCAN, UEHLING AND STURGULEWSKI

IN THE SENATE

SENATE BILL NO. 131 am

IN THE LEGISLATURE OF THE STATE OF ALASKA

FIFTEENTH LEGISLATURE - FIRST SESSION

A BILL

For an Act entitled: "An Act regulating the sale and use of TBT-based marine antifouling paints and coatings; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 46.03 is amended by adding a new section to read:

Sec. 46.03.715. SALE AND USE OF TBT-BASED ANTIFOULING PAINT. (a) Except as otherwise provided in this section, a person may not sell or use TBT-based marine antifouling paint or coating in the state, nor may a person sell, rent, or lease in the state, or import into the state, or use in state water, a vessel, fishing gear, or other item intended to be immersed or submerged in water, if the vessel, gear, or item has been painted or treated with TBT-based marine antifouling paint or coating.

(b) TBT-based marine antifouling paint or coating need not be removed from fishing gear, or from a vessel or other item that was painted or treated before July 1, 1987, but the vessel, gear, or item may not be repainted or retreated with TBT-based marine antifouling paint or coating. Fish culture or capture nets treated with TBT-based marine antifouling coating before July 1, 1987, may not be used in state water on or after July 1, 1992.

(c) This section does not apply to

(1) a vessel of the United States government;

(2) a foreign vessel temporarily in state water;

(3) a vessel of 5,000 gross tons or more; or

(4) a passenger vessel of 3,000 gross tons or more.

(d) In this section

(1) "TBT-based marine antifouling paint or coating" means a paint, coating, or treatment that contains tributyltin, or a tri-organotin compound used as a substitute for tributyltin, and that is intented to control fouling organisms in the fresh water or marine environment;

(2) "vessel" means watercraft used or capable of being used as a means of transportation on water, including aircraft equipped to land on water.

* Sec. 2. This Act takes effect July 1, 1987.

Introduced: 2/18/87
Referred: Labor & Commerce

5-0657A

IN THE SENATE

BY ZHAROFF, ELIASON, JOSEPHSON, SZYMANSKI, KERTTULA AND DUNCAN

SENATE BILL NO. 131

IN THE LEGISLATURE OF THE STATE OF ALASKA

FIFTEENTH LEGISLATURE - FIRST SESSION

A BILL

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(b) TBT-based marine antifouling paint or coating need not be removed from fishing gear, or from a vessel or other item that was painted or treated before July 1, 1987, but the vessel, gear, or item may not be repainted or retreated with TBT-based marine antifouling paint or coating. Fish culture or capture nets treated with TBT-based marine antifouling coating before July 1, 1987, may not be used in state water on or after July 1, 1992.

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(2) a foreign vessel temporarily in state water;

(3) a vessel of 5,000 gross tons or more; or

(4) a passenger vessel of 3,000 gross tons or more.

(d) In this section

(1) "TBT-based" means tributyltin-based;

(2) "vessel" means watercraft used or capable of being used as a means of transportation on water, including aircraft equipped to land on water.

* Sec. 2. This Act takes effect July 1, 1987.

5-0470B
Hein
3/9/87

Original sponsors: Sund, Herrmann,
Koponen, et al.

IN THE HOUSE BY THE RESOURCES COMMITTEE

CS FOR HOUSE BILL NO. 138 (Resources)

IN THE LEGISLATURE OF THE STATE OF ALASKA

FIFTEENTH LEGISLATURE - FIRST SESSION

A BILL

For an Act entitled: "An Act regulating the sale and use of TBT-based marine antifouling paints and coatings; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 16.05.450(b) is amended to read:

New provision for vessel applicants to sign statement that applicants aren't using TBT

(b) The Commercial Fisheries Entry Commission shall issue a vessel license under AS 16.05.490 to each qualified vessel for which a written application has been filed, at a place in the state designated by the commission. An application shall contain a statement by the applicant that the vessel has not been painted in violation of AS 46.03.715. An application shall contain other [, CONTAINING THE] reasonable information required by the commission together with the required fee. The application shall be simple in form and shall be executed by the applicant under the penalty of perjury.

* Sec. 2. AS 46.03 is amended by adding a new section to read:

Sec. 46.03.715. SALE AND USE OF TBT-BASED ANTIFOULING PAINT. (a) Except as otherwise provided in this section, a person may not sell or use TBT-based marine antifouling paint or coating in the state, nor may a person sell, rent, or lease in the state, or import into the state, or use in state water, a vessel, fishing gear, or other item intended to be immersed or submerged in water, if the vessel, gear, or item has been painted or treated with TBT-based marine antifouling paint or coating.

(b) TBT-based marine antifouling paint or coating need not be

removed from fishing gear, or from a vessel or other item that was painted or treated before December 1, 1987, but the vessel, gear, or item may not be repainted or retreated with TBT-based marine antifouling paint or coating. Fish culture or capture nets treated with TBT-based marine antifouling coating before December 1, 1987, may not be used in state water on or after December 1, 1992.

Change from July 1,1987

Change from July 1, 1992

(c) Notwithstanding other provisions of this section, slow-leaching TBT-based marine antifouling paint may be imported into and sold in the state. A slow-leaching TBT-based marine antifouling paint may be applied in the state only to aluminum vessel hulls. Aluminum vessel hulls to which a slow-leaching TBT-based marine antifouling paint has been applied may be imported into and sold, rented, leased, or used in the state.

Allowing slow-leaching TBT for Aluminum hulls.

(d) This section does not apply to

(1) a vessel of the United States government;

(2) a foreign vessel temporarily in state water; or

(3) a vessel of 4,000 gross tons or more.

Change from 3,000 for passenger vessels & 5,000 for all others.

(e) In this section

(1) "slow-leaching TBT-based marine antifouling paint" means a TBT-based marine antifouling paint, but not a coating or other treatment, that has a measured release rate equal to or less than 1.0 microgram per square centimeter per day at steady state conditions determined under the U.S. Environmental Protection Agency testing procedure, as outlined in the agency's call-in notice of July 29, 1986, on tributyltin in antifouling paints under 7 U.S.C. 35 - 36y (the Federal Insecticide, Fungicide, and Rodenticide Act);

Define slow-leaching

(2) "TBT-based marine antifouling paint or coating" means a paint, coating, or treatment that contains tributyltin, or a triorganotin compound used as a substitute for tributyltin, and that is

Define TBT (Same as Sen. Amend.)

intended to control fouling organisms in a fresh water or marine environment;

(3) "vessel" means watercraft used or capable of being used as a means of transportation on water, including aircraft equipped to land on water and barges.

Include barges.

* Sec. 3. This Act takes effect December 1, 1987.

Change from July 1.

POSITION PAPER

Bill No: HB 138

Date: February 26, 1987
Contact: Amy D. Kyle

Title: An Act regulating the role and use of TBT-based marine anti-fouling paints and coatings.

Department's Position

The Department supports the intent of the bill to prohibit sale and use of TBT-based paints and coatings. The Department is prepared to enforce a prohibition on the sale of the coatings.

Bill Analysis

The bill would prohibit the sale and use of TBT-based anti-fouling paint. Such coatings have been shown to release TBT into waters. TBT is a harmful and toxic substance. DEC supports the ban on introduction of the substance into waters of the state. (Since 1985, DEC has prohibited use of TBT as an anti-fouling agents in hatcheries, through conditions placed on state certifications of federal permits for hatcheries.)

The bill does not propose a specific role for any agency in enforcing a ban on sale or use of TBT-based coatings. Rather, the bill establishes general prohibitions.

Effect on the Agency

DEC understands that it is the intent of the bill's sponsors primarily to prohibit the sale of TBT in the state. DEC can play an active role in enforcing this prohibition through notification to retail outlets and marketplace inspections to confirm that the ban is complied with. TBT is a pesticide under the federal pesticide laws. The ban would be imposed and enforced as an extention of the state's pesticide program. A fiscal note for resources needed to enforce this aspect of the bill is being prepared.

The Department understands that the bill's sponsors do not intend that any additional activities be undertaken by DEC in response to the legislation in order to detect or take enforcement action under other provisions. In light of this understanding, no resources beyond those required to enforce the ban on sale are included in the fiscal note.

DENNIS D. KELSO
COMMISSIONER

5-0470Ba
Hein

A M E N D M E N T

Offered in the HOUSE By Sund

TO: CSHB 138 (Resources)

Page 1, after line 19:

Insert a new bill section to read:

"* Sec. 2. AS 46.03.020 is amended by adding a new paragraph to read:

(13) inspect the premises of sellers and suppliers of paint, vessels, and marine and boating supplies, and take other actions necessary to enforce AS 46.03.715."

Renumber remaining bill sections accordingly.

Page 1, line 26:

Delete "immersed or"

Insert "partially or completely"

Page 3, line 4, after "including":

Delete all material through line 5

Insert "(A) aircraft equipped to land on water; and

(B) barges."

5-0470Ba
Hein

A M E N D M E N T

Offered in the HOUSE By Sund

TO: CSHB 138 (Resources)

Page 1, after line 19:

Insert a new bill section to read:

"* Sec. 2. AS 46.03.020 is amended by adding a new paragraph to read:

(13) inspect the premises of sellers and suppliers of paint, vessels, and marine and boating supplies, and take other actions necessary to enforce AS 46.03.715."

Renumber remaining bill sections accordingly.

Page 1, line 26:

Delete "immersed or"

Insert "partially or completely"

Page 3, line 4, after "including":

Delete all material through line 5

Insert "(A) aircraft equipped to land on water; and

(B) barges."

5-0657L
Hein
3/26/87

Note: Highlights indicate changes from the 3/9/87 House Resources CS for HB 138

Original sponsors: Zharoff, Eliason, Josephson, et al.

IN THE SENATE BY THE RESOURCES COMMITTEE

HOUSE CS FOR SENATE BILL NO. 131 (Resources)

IN THE LEGISLATURE OF THE STATE OF ALASKA

FIFTEENTH LEGISLATURE - FIRST SESSION

A BILL

For an Act entitled: "An Act regulating the sale and use of TBT-based marine antifouling paints and coatings; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 16.05.450(b) is amended to read:

(b) The Commercial Fisheries Entry Commission shall issue a vessel license under AS 16.05.490 to each qualified vessel for which a written application has been filed, at a place in the state designated by the commission. An application shall contain a statement by the applicant that the vessel has not been painted in violation of AS 46.03.715. An application shall contain other [, CONTAINING THE] reasonable information required by the commission together with the required fee. The application shall be simple in form and shall be executed by the applicant under the penalty of perjury.

Amendment made to clarify authority

* Sec. 2. AS 46.03.020 is amended by adding a new paragraph to read:

(13) inspect the premises of sellers and suppliers of paint, vessels, and marine and boating supplies, and take other actions necessary to enforce AS 46.03.715.

* Sec. 3. AS 46.03 is amended by adding a new section to read:

Sec. 46.03.715. SALE AND USE OF TBT-BASED ANTIFOULING PAINT. (a) Except as otherwise provided in this section, a person may not sell or use TBT-based marine antifouling paint or coating in the state, nor may a person sell, rent, or lease in the state, or import into the state, or use in state water, a vessel, fishing gear, or

New language to clarify that even if an object is only partially immersed it can not be treated with TBT.

other item intended to be partially or completely submerged in water, if the vessel, gear, or item has been painted or treated with TBT-based marine antifouling paint or coating.

(b) TBT-based marine antifouling paint or coating need not be removed from fishing gear, or from a vessel or other item that was painted or treated before December 1, 1987, but the vessel, gear, or item may not be repainted or retreated with TBT-based marine antifouling paint or coating. Fish culture or capture nets treated with TBT-based marine antifouling coating before December 1, 1987, may not be used in state water on or after December 1, 1992.

(c) Notwithstanding other provisions of this section, slow-leaching TBT-based marine antifouling paint may be imported into and sold in the state. A slow-leaching TBT-based marine antifouling paint may be applied in the state only to aluminum vessel hulls. Aluminum vessel hulls to which a slow-leaching TBT-based marine antifouling paint has been applied may be imported into and sold, rented, leased, or used in the state.

(d) This section does not apply to

(1) a vessel of the United States government;

New language replaces "temporarily" with "90 days"

(2) a foreign vessel in state water fewer than 90 days in a 12-month period; or

(3) a vessel of 4,000 gross tons or more.

(e) In this section

(1) "slow-leaching TBT-based marine antifouling paint" means a TBT-based marine antifouling paint, but not a coating or other treatment, that has a measured release rate equal to or less than 1.0 microgram per square centimeter per day at steady state conditions determined under the U.S. Environmental Protection Agency testing procedure, as outlined in the agency's call-in notice of July 29,

1986, on tributyltin in antifouling paints under 7 U.S.C. 35 - 36y (the Federal Insecticide, Fungicide, and Rodenticide Act);

(2) "TBT-based marine antifouling paint or coating" means a paint, coating, or treatment that contains tributyltin, or a triorganotin compound used as a substitute for tributyltin, and that is intended to control fouling organisms in a fresh water or marine environment;

(3) "vessel" means watercraft used or capable of being used as a means of transportation on water, including

Amendment made to correct grammar

(A) aircraft equipped to land on water; and

(B) barges.

Ban on further orders

* Sec. 4. Notwithstanding AS 46.03.715, as enacted by sec. 3 of this Act, after the effective date of this section a person may not import into the state a TBT-based marine antifouling paint or coating other than a slow-leaching TBT-based marine antifouling paint, except that paint or coatings that have been ordered from a source outside of the state before the effective date of this section may be imported into the state before December 1, 1987. Paint or coatings imported in violation of this section may be confiscated by persons designated by the commissioner of environmental conservation and shall be forfeited to the state.

New eff. dates for import clause

* Sec. 5. Sections 1 - 3 of this Act take effect December 1, 1987.

* Sec. 6. Section 4 of this Act takes effect immediately under AS 01.-10.070(c).

STATE OF ALASKA 1987 LEGISLATIVE SESSION
FISCAL NOTE

REQUEST: _____ Bill Version : _____ Publish Date : _____

Revision Date: _____ Agency Affected : Environmental Conservation

Title : An Act Regulating to the sale and use of TBT-based marine anti-fouling paints & coatings BRU : Environmental Health

Sponsor : Senator Zharoff Components : Sanitation

Requestor : Senator Zharoff

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES	-0-	10.7	10.7	5.3	5.3	5.3
TRAVEL	-0-	1.4	1.4	1.0	1.0	1.0
CONTRACTUAL	-0-	2.0	2.0	1.0	1.0	1.0
SUPPLIES	-0-	1.0	1.0	1.0	1.0	1.0
EQUIPMENT	-0-	0.8	0.8	0.5	0.5	0.5
LAND & STRUCTURES	-0-	-0-	-0-	-0-	-0-	-0-
GRANTS, CLAIMS	-0-	-0-	-0-	-0-	-0-	-0-
MISCELLANEOUS	-0-	-0-	-0-	-0-	-0-	-0-
TOTAL OPERATING	-0-	15.9	15.9	8.8	8.8	8.8
CAPITAL	-0-	-0-	-0-	-0-	-0-	-0-
REVENUE	-0-	-0-	-0-	-0-	-0-	-0-

FUNDING: (Thousands of Dollars)

GENERAL FUND	-0-	15.9	15.9	8.8	8.8	8.8
FEDERAL FUNDS	-0-	-0-	-0-	-0-	-0-	-0-
OTHER	-0-	-0-	-0-	-0-	-0-	-0-
TOTAL	-0-	15.9	15.9	8.8	8.8	8.8

POSITIONS:

FULL-TIME	0	0	0	0	0	0
PART-TIME	0	0	0	0	0	0
TEMPORARY	0	0	0	0	0	0

ANALYSIS : (Attach a separate page if necessary) This fiscal note assumes that the department will only monitor the sale of TBT. This will entail on-site inspection and monitoring of wholesale and retail outlets. It will also involve the investigation and preparation of appropriate enforcement actions. SEE ATTACHED

Prepared by : Doug Donegan Phone : 465-2600

Division : Environmental Health Date : 3-6-87

Approved by Commissioner : Date : 3/6/87

Agency : Environmental Conservation

Distribution (by preparer) :

Legislative Finance
Legislative Sponsor
Requestor
Office of Management and Budget
Impacted Agency(ies)
Senate Secretary

ATTACHMENT

Based on a recent survey, there are approximately 1000 wholesale and retail distributors in the categories likely to be carrying paints and coatings. In FY 88 the Department will conduct a public information campaign directed at these types of outlets.

The Department will also inspect approximately 250 establishments/per year to monitor compliance with the law. This inspection rate will decline in FY 90 to 125 inspections/year.

THE FOLLOWING PAGES WERE TREATED AS
A UNIT IN THE ORIGINAL FILE.

HOUSE BILL 138
TBT

LIST OF BACK-UP MATERIALS

1. COPY OF BILL
2. SECTIONAL ANALYSIS
3. COPY OF PENALTY, INJUNCTION, AND LIABILITY PROVISIONS
4. OVERVIEW MEMO BY REPRESENTATIVES SUND AND HERRMANN
5. FACT SHEET - PACIFIC FISHERIES LEGISLATIVE TASK FORCE
6. AUKE BAY LAB RESEARCH
7. HEALTH EFFECTS
8. NEWS ARTICLES

STATE OF ALASKA
THE LEGISLATURE

LEGISLATIVE AFFAIRS AGENCY

POUCH V STATE CAPITOL
JUNEAU ALASKA 99811
907 465 3800

2

MEMORANDUM February 12, 1987

SUBJECT: TBT-based antifouling paint
(Work Order No. 5-0470)

TO: Representative John Sund

FROM: Edward H. Hein
Legislative Counsel

Enclosed is a draft of a bill requested for you by your assistant, Nevette Bowen. Subsection (a) of the bill bans the sale and use of TBT-based (tributyltin-based) antifouling paint in the state. The bill also prohibits a person from importing into the state or selling, renting, or leasing in the state, or using in state water, any vessel or fishing gear or other item that is put into the water, if the vessel, gear, or item has already been treated with TBT paint.

Subsection (b) of the bill provides that persons who have already put TBT paint on their boats, gear, or other items before the bill becomes law do not have to remove the paint, but they may not reapply TBT paint. Fishing nets that have been treated may continue to be used for five years after the bill becomes law.

Subsection (c) exempts four classes of vessels from the TBT ban: (1) United States government vessels; (2) foreign vessels temporarily in state water; (3) vessels of 5,000 gross tons or more, which will cover commercial ships other than commercial fishing and processing vessels; and (4) passenger vessels of 3,000 gross tons, which will cover the vast majority of cruise ships. These exemptions are inserted to avoid running afoul of federal preemption, as to U.S. government vessels, and to avoid the practical problems of trying to prohibit TBT use on foreign vessels and on large commercial and cruise ships. Dr. Huggett said that 70 percent of TBT paint is used on recreational boats; 28 percent on commercial ships. He said that internationally 90

percent of ships of 5,000 gross tons or more use TBT-based paint.

Subsection (d) of the bill defines "TBT-based" and "vessel."

In order to ensure compliance with the ban on TBT use, a provision could be added to the bill amending AS 16.05.475 and 16.05.530 to require that a commercial fishing vessel license not be issued or renewed unless the applicant signs a statement, under penalty of perjury, that the applicant has complied with AS 46.03.715. A similar provision could be added to HB 94 to cover recreational boats. Barges, which may or may not be covered under the bill - depending on their weight, would have to be dealt with differently because they are not licensed or registered. The only exception is oil barges, which are regulated by DEC for pollution controls.

Another possible approach to the TBT problem that could be added to the bill would be a provision placing a surcharge or tax or additional docking fee on any vessel that docked in Alaska water with TBT-based paint on its hull. This surcharge could be set at a level designed to offset any environmental damage thought to be caused by the TBT leaching. This would obviate the need to haul people into court. There are at least two problems with this approach, however: (1) many of the docks in the state are privately owned; and (2) those that are publicly owned are locally owned, which means local governments, harbor masters, or port directors would have to collect the surcharge and send it into the state.

Note that the injunction, penalty, and liability provisions of AS 46.03.760, 46.03.765, 46.03.780, and 46.03.790 would apply to violations under this bill because the new statute is a part of AS 46.03.

EHH:mkr
m8/122

(3) "discharge of oil" means the entry of oil into or upon the water or public land of the state (except oil discharges into an enclosed and impervious oil spill containment area), regardless of causation;

(4) "intertidal" means the ocean area between highest high water and lowest low water of tidal action;

(5) "offshore platform" means an offshore structure, whether floating or temporarily or permanently secured to the floor of the ocean or other water body, which is used primarily for the exploration for or production of oil or natural gas;

(6) "oil" means petroleum, crude oil, and any substance refined from petroleum or crude oil;

(7) "operator" means the person who, through contract, lease, sublease or otherwise, exerts general supervision and control of activities at the facility; the term includes, by way of example and not limitation, prime or general contractors, the master of a vessel (and his employer), or any other person who, through himself, his agents, or contractors, undertakes the general functioning of the facility;

(8) "vessel" means any form or manner of watercraft, whether or not capable of self-propulsion, except offshore platforms. (§ 1 ch 129 SLA 1977; am §§ 1-3 ch 128 SLA 1978; am § 110 ch 59 SLA 1982; am § 19 ch 59 SLA 1986)

Effect of amendments. — The 1986 amendment, effective June 1, 1986, repealed subsection (k), concerning the "oil spill mitigation account."

Editor's notes. — The schedule of civil penalties required by (b) of this section may be found at 18 AAC 75.510 — 18 AAC 75.600. The effective date (referred to in (e) of this section) of the regulation adopting the schedules is April 19, 1978.

Sec. 46.03.760. Civil action for pollution; damages. (a) A person who violates or causes or permits to be violated a provision of this chapter other than AS 46.03.250 — 46.03.314, or a provision of AS 46.04 or AS 46.09, or a regulation, a lawful order of the department, or a permit, approval, or acceptance, or term or condition of a permit, approval, or acceptance issued under this chapter or AS 46.04 or AS 46.09 is liable, in a civil action, to the state for a sum to be assessed by the court of not less than $500 nor more than $100,000 for the initial violation, nor more than $5,000 for each day after that on which the violation continues, and that shall reflect, when applicable,

(1) reasonable compensation in the nature of liquidated damages for any adverse environmental effects caused by the violation, that shall be determined by the court according to the toxicity, degradability and dispersal characteristics of the substance discharged, the sensitivity of the receiving environment, and the degree to which the discharge degrades existing environmental quality;

(2) reasonable costs incurred by the state in detection, investigation, and attempted correction of the violation;

(3) the economic savings realized by the person in not complying with the requirement for which a violation is charged.

(b) Except as determined by the court under (f)(4) of this section, actions under this section may not be used for punitive purposes, and sums assessed by the court must be compensatory and remedial in nature.

(c) The court, upon motion of the department or upon its own motion, may defer assessment of all or part of that portion of the sum imposed upon a person under (a)(3) of this section conditioned upon the person complying, within the shortest feasible time, with the requirement for which a violation is shown.

(d) As used in this section, "economic savings" means that sum which a person would be required to expend for the planning, acquisition, siting, construction, installation and operation of facilities necessary to effect compliance with the standard violated.

(e) In addition to liability under (a) — (d) of this section, a person who violates or causes or permits to be violated a provision of AS 46.03.740 — 46.03.750 is liable to the state, in a civil action brought under AS 46.03.822, for the full amount of actual damages caused to the state by the violation, including direct and indirect costs associated with the abatement, containment or removal of the pollutant, restoration of the environment to its former state, and all incidental administrative costs.

(f) A person who violates or causes or permits to be violated a provision of AS 46.03.250 — 46.03.314, or a regulation, a lawful order of the department, or a permit, approval, or acceptance, or term or condition of a permit, approval, or acceptance issued under AS 46.03.250 — 46.03.314 is liable, in a civil action, to the state for a sum to be assessed by the court of not less than $500 nor more than $100,000 for the initial violation, nor more than $10,000 for each day after that on which the violation continues, and that shall reflect, when applicable,

(1) reasonable compensation in the nature of liquidated damages for any adverse environmental effects caused by the violation, that shall be determined by the court according to the toxicity, degradability and dispersal characteristics of the substance discharged, the sensitivity of the receiving environment, and the degree to which the discharge degrades existing environmental quality;

(2) reasonable costs incurred by the state in detection, investigation, and attempted correction of the violation;

(3) the economic savings realized by the person in not complying with the requirement for which a violation is charged; and

(4) the need for an enhanced civil penalty to deter future noncompliance. (§ 3 ch 120 SLA 1971; am § 9 ch 220 SLA 1976; am § 5 ch 266 SLA 1976; am §§ 5, 6 ch 116 SLA 1980; am §§ 5 — 7 ch 77 SLA 1984; am § 9 ch 59 SLA 1986)

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Effect of amendments. — The 1984 amendment substituted "other than AS 46.03.250 — 46.03.314, or a provision of" for "or" in the introductory language of subsection (a) and made a series of technical changes through the rest of this subsection, added "Except as determined by the court under (f)(4) of this section" at the beginning of subsection (b), and added subsection (f).

The 1986 amendment, effective June 1, 1986, in the introductory language of subsection (a) inserted "or AS 46.09" in two places.

Sec. 46.03.765. Injunctions. The superior court has jurisdiction to enjoin a violation of this chapter, AS 46.04, or AS 46.09 or of a regulation, a lawful order of the department, or permit, approval, or acceptance, or term or condition of a permit, approval, or acceptance issued under this chapter, AS 46.04, or AS 46.09. In actions brought under this section, temporary or preliminary relief may be obtained upon a showing of an imminent threat of continued violation, and probable success on the merits, without the necessity of demonstrating physical irreparable harm. The balance of equities in actions under this section may affect the timing of compliance, but not the necessity of compliance with a reasonable period of time. (§ 10 ch 220 SLA 1976; am § 6 ch 266 SLA 1976; am § 7 ch 116 SLA 1980; am § 10 ch 59 SLA 1986)

Effect of amendments. — The 1986 amendment, effective June 1, 1986, in the first sentence inserted "or AS 46.09" in two places and substituted a comma for "or" following "this chapter" in two places in the first sentence.

Sec. 46.03.770. Detention of vessel without warrant as security for damages. A vessel that is used in or in aid of a violation of AS 46.03.740 — 46.03.750 may be detained after a valid search by the department, an agent of the department, a peace officer of the state, or an authorized protection officer of the Department of Fish and Game. Upon judgment of the court having jurisdiction that the vessel was used in, or was the cause of, a violation of AS 46.03.740 — 46.03.750 with knowledge of its owner or under circumstances indicating that the owner should reasonably have had this knowledge, the vessel may be held as security for payment to the state of the amount of damages assessed by the court under AS 46.03.758, 46.03.760, and 46.03.822. If the damages assessed are not paid within 30 days after judgment or final determination of an appeal, the vessel shall be sold at public auction, or as otherwise directed by the court, and the damages paid from the proceeds. The balance, if any, shall be paid by the court to the owner of the vessel. The court shall permit the release of the vessel upon posting of a bond set by the court in an amount not to exceed the maximum amount of damages available under AS 46.03.758, 46.03.760, and 46.03.822. The damages received under this section shall be transmitted to the proper state officer for deposit in the general fund. A vessel seized under this section shall be returned or the bond exonerated if no damages are assessed under AS 46.03.758, 46.03.760, or 46.03.822. (§ 3 ch 120 SLA 1971; am § 1 ch 7 SLA 1986)

Effect of amendments. — The 1986 amendment, effective March 21, 1986, in the first sentence substituted "that" for "which," in the second sentence inserted "was" preceding "the cause of," substituted "AS 46.03.758, 46.03.760, and 46.03.822" for "AS 46.03.760(b)," made minor punctuation changes, and substituted "If" for "and if" in creating the present third sentence, in the third sentence deleted "so" preceding "assessed," in the first sentence substituted the language beginning "the maximum amount" at the end of the sentence for "$100,000," and in the last sentence substituted the present internal reference for "AS 46.03.760(b)."

Sec. 46.03.780. Liability for restoration. (a) A person who violates a provision of this chapter, AS 46.04, or AS 46.09, or who fails to perform a duty imposed by this chapter, AS 46.04, or AS 46.09, or violates or disregards an order, permit, or other determination of the department made under the provisions of this chapter, AS 46.04, or AS 46.09, respectively, and thereby causes the death of fish, animals, or vegetation or otherwise injures or degrades the environment of the state is liable to the state for damages.

(b) Liability for damages under (a) of this section includes an amount equal to the sum of money required to restock injured land or waters, to replenish a damaged or degraded resource, or to otherwise restore the environment of the state to its condition before the injury.

(c) Damages under (a) of this section shall be recovered by the attorney general on behalf of the state. (§ 3 ch 120 SLA 1971; am § 7 ch 266 SLA 1976; am § 111 ch 59 SLA 1982; am § 11 ch 59 SLA 1986)

Effect of amendments. — The 1986 amendment, effective June 1, 1986, in subsection (a) inserted "or AS 46.09," in three places and substituted a comma for "or" following "this chapter" in three places.

Sec. 46.03.790. Criminal penalties. (a) Except as provided in (d) — (f) of this section, a person who negligently violates a provision of this chapter, AS 46.04, or AS 46.09, or of a regulation, lawful order of the department, or permit, approval, or acceptance, or term or condition of a permit, approval, or acceptance issued under this chapter, AS 46.04, or AS 46.09 is guilty of a class B misdemeanor.

(b) Except as provided in (d) — (f) of this section, a person who knowingly violates a provision of this chapter, AS 46.04, or AS 46.09, or of a regulation, lawful order of the department, or permit, approval, or acceptance, or term or condition of a permit, approval, or acceptance issued under this chapter, AS 46.04, or AS 46.09 is guilty of a class A misdemeanor.

(c) Each day on which a violation described in this section occurs is considered a separate violation.

(d) Notwithstanding (a) and (b) of this section, a person who fails to provide or falsely states information required under As 46.03.755, AS 46.04, or AS 46.09 is guilty of a misdemeanor and, upon conviction, is punishable by a fine of not more than $25,000, or by imprisonment for

JOHN SUND, REPRESENTATIVE
2504 2nd Avenue
Ketchikan, Alaska 99901
(907) 225-5552

While in Juneau
P. O. Box V
Juneau, Alaska 99811
(907) 465-4919

To: Members of the House of Representatives

From: Representative Sund
Representative Herrmann

Date: February 18, 1987

Subj: House Bill 138 "An Act regulating the sale and use of TBT-based marine antifouling paints and coatings; and providing for an effective date."

4

As part of a multi-state effort, bills were introduced today in the House and Senate to ban the sale and new application of Tributyltins, a hazardous chemical found in marine paints.

Tributyltin, commonly referred to as TBT, is a highly toxic pesticide added to marine paint and coatings to prevent the growth of barnacles and algae on vessel hulls, buoys and fishing nets. It has caused fatalities and deformities in marine life. Copper-based antifouling paints are available as an alternaltive.

Bills to ban TBT were also introduced today in the Pacific coastal states -- California, Washington and Oregon. The effort was coordinated by the Pacific Fisheries Legislative Task Force made up of legislators from Alaska, California, Oregon and Idaho.

Research conducted at the National Marine Fisheries Service Auke Bay Laboratory in Juneau was largely responsible for calling attention to the TBT threat in Alaska and the nation. Scientists there discovered that sufficient accumulation of TBT can kill salmon, especially smolt. Other studies have documented that TBT causes mortality and deformities in crabs, oysters and other mollusks.

TBT is an <u>extremely</u> toxic substance, with potency in parts per trillion. Twelve drops of TBT in an area the size of an Olympic swimming pool will effectively kill marine organisms.

In October, the Pacific Coast Federation of Fisherman's Associations called for a ban on the use of TBT stating they "were willing to suffer the inconvenience of using other bottom paints and hauling-out more often to prevent this substance from entering the water and killing fish and shellfish."

The United States currently lags behind other nations in imposing controls on TBT. So far, the toxic compound has been limited or banned in France, England, Japan, Switzerland and Germany. The task force strategy is to support legislation banning TBT in the Pacific states while urging Congress to take national action.

Both Senate Bill 136 and House Bill 138 would ban the sale or use of TBT-based marine paint or coating in Alaska. Exemptions are included for large vessels outside the state's jurisdiction.

TRIBUTYLTINS/TBT

Tributyltins (TBT) have been called the most toxic compounds ever deliberately introduced by societies into natural waters.[1] A growing body of scientific research indicates that TBT may seriously affect non-target organisms and have unknown effects on humans who eat marine organisms containing TBT or are exposed to it in the workplace.

In the United States, many bodies of water have concentrations of TBT that have reached levels which may cause lethal and sublethal effects in non-target organisms. For example, TBT levels in San Diego Bay have been measured at levels which could cause lethal effects in fish, mollusks, crustaceans, and algae.[2]

TBT is used in antifouling paints and is primarily applied to boat and ship hulls to control the growth of fouling organisms such as barnacles, tubeworms, algae, bacteria, and sponges. These organisms increase hull friction and weight, which in turn increases fuel consumption by reducing vessel speed. The antifouling paints are also used to control fouling organisms on docks, buoys, and other marine structures. TBT has been used in antifouling paints for almost 10 years and replaced the copper-based antifouling paints. The paints with tributyltins last approximately 5-7 years, whereas the copper-based paints last approximately two years.

There are two types of antifouling paints containing TBT: copolymer paints and free association paints. The copolymer antifouling paints contain TBT which is chemically bonded to the paint polymer and is released through a chemical bond breaking process called hydrolysis. New TBT molecules are exposed and released by the gradual erosion of the paint as the vessel moves through the water. The release rate is slow except during the initial one month "conditioning" period and can be controlled by

altering the paint's water absorption characteristics. The free association paints contain TBT which is physically incorporated into the paint matrix; the TBT is released through diffusion as surface paint particles dissolve. This type of paint has a short time period of protection and is characterized by a high initial release.

Antifouling paints containing TBT are registered, in the United States, for use on aluminum, steel, fiberglass, wood and cement hulls.[3] These paints are used on commercial and recreational vessels and some military ships. However, the Navy is the major domestic user of antifouling paints. The Navy is planning to replace the copper-based paints it is currently using on its steelhulled vessels with antifouling paints containing TBT compounds. This Navy conversion would take approximately 5 years and add an additional 90,000 pounds of TBT active ingredients to the environment. Economically, if all the Navy ships are painted, it would annually save the Navy $150 million.[4] However, this cost does not include the cost to the marine environment.

Currently, there are 340 federally registered antifouling paints containing TBT active ingredients. U.S. domestic usage of TBT in antifouling paints range from 250,000 to 300,000 pounds.[5] In addition to antifouling paints, TBT compounds are registered for use as disinfectants, textile biocides, wood preservatives, paper and pulp mills, leather processing and as plastics stabilizers, etc. In the United States, total usage of TBT pesticides (for all uses) ranges from 730,000 to 860,000 pounds of active ingredients.[6]

In 1981 France banned the use of TBT paints on all vessels less than 80 feet in length because of shellfish deformations, particularly in Arcachon Bay.[7]

England researched and then combined their studies with France's experience and banned the use of free association paints and copolymer formulations with more than 7.5 percent TBT on January 1, 1986.[8] **Germany** and **Switzerland** have banned TBT paints for fresh water usage. **Japan** has banned the use of TBT compounds in household products such as house paints and textiles, but has not restricted its use in vessel antifouling paints.[9]

In the **United States**, Senators Cohen and Trible introduced Senate Resolution 272 in December 1985 calling for "public hearings to determine if further action is warranted with respect to the future use of TBT compounds" and "urging EPA to accelerate its investigation into the environmental and health effects of organotin bearing paints...." The resolution has been referred to the Senate Committee on Environment and Public Works.

On June 11, 1986 Congressman Parris introduced HR 5015, calling for a temporary ban on TBT-based paints on the hulls for commercial and recreational vessels until, " EPA has completed their ongoing studies to determine the safety of such paints and their impact on the aquatic environment.

Currently, only **North Carolina** has limited the input of TBT into its waters. North Carolina instituted regulations on January 1, 1985 to limit discharges from industries to 2 ppt for salt water and 8 ppt for fresh water.[10] These regulations were initiated because it was determined that hundreds of North Carolina companies were using TBT to control odor-causing bacteria in textiles or to control slime in piping. Some of the discharges from the textile mills were high enough to kill aquatic organisms.

On January 8, 1986, EPA commenced a special review of the nine most common TBT antifoulant paint formulations. EPA's support

document indicates that EPA is concerned about the acute and chronic toxicity potential of tributyltin compounds to nontarget aquatic organisms. Water samples have been found to contain TBT levels that may have direct effects on aquatic organism populations (mollusks). The TBT compounds may bioaccumulate in aquatic habitat and may pose a hazard to the food chain. Absorption of tributyltin compounds to sediment may have long-term toxicity effects on benthic browsing organisms such as crustaceans and snails. Contamination of estuarine areas at sublethal concentrations can influence the reproduction of several aquatic groups from fish to plankton, thus impacting the marine environment. The present use of tributyltin in antifouling paints presents a potential hazard to nontarget aquatic organisms.

The Pacific Fisheries Legislative Task Force, working in coordination with the Pacific Coast Federation of Fishermen's Associations, has passed three task force resolutions offered by Assemblyman Dan Hauser, the Task Force Vice Chairman, regarding TBT. The resolutions:

1. Urged and encouraged the Environmental Protection Agency to take the lead in creating a public information education brochure abcut TBT that could be distributed to every boat owner in America. The pamphlet concept is based on a similar project done in the United Kingdom entitled, Don't Foul Things Up. Short of a Congressional ban on the use of TBT, a nationwide public information awareness program is thought to be the next best alternative for controlling the amount of TBT introduced into the marine environment. It is thought by some scientists that this type of education program could reduce the amount of active TBT in the marine environment by 50%.[12]

2. Memorializes the Food and Drug Administration, the Environmental Protection Agency and the National Marine Fisheries Service to impose an immediate ban on all salmon imported into or produced in the United States in pens treated with TBT. This is important because TBT levels for safe human consumption have not been established. TBT was found in the flesh of salmon that were pen-reared in TBT-treated pens. Moreover, the study found that cooking does not remove the TBT from the fish.[13]

3. Memorializes Congress to enact an immediate ban on the use of TBT-based bottom paints on all military, commercial, and recreational vessels until such time, and if, methods of use of TBT-based bottom paints or derivatives of organotin paints are developed that pose no threat to the marine environment.

In addition to the resolutions passed by the task force, it is anticipated that the participating states may introduce state legislation to further regulate TBT usages in their states. Currently, efforts are underway to explore legislation to monitor dry docks, set water quality standards, ban or restrict the uses of TBT, or regulate the amount of TBT used in antifouling paints.

Reprinted from IEEE OCEANS '86 CONFERENCE PROCEEDINGS.
Washington, D.C., September 23-25, 1986

TRI-N-BUTYLTIN CAUSED MORTALITY OF CHINOOK SALMON, ONCORHYNCHUS TSHAWYTSCHA, ON TRANSFER TO A TBT-TREATED MARINE NET PEN

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ABSTRACT

The median lethal concentrations (LC_{50}'s) of tri-n-butyltin oxide (TBTO) to juvenile chinook salmon, Oncorhynchus tshawytscha, adapted to seawater were determined in a static renewal bioassay. LC_{50}'s were 54, 20, and 1.5 ug TBTO/l after exposures for 6, 12, and 96 h, respectively. LC_{50}'s decreased logarithmically with time for exposures between 12 and 96 h. Average tri-n-butyltin (TBT) concentrations in liver, brain, and muscle tissues of salmon that died during the bioassay were 7.0, 3.5, and 0.52 ug TBT/g wet weight tissue, respectively. TBT concentrations in liver, brain, and muscle tissues of salmon that survived until day 4 of the bioassay were 4,300, 1,300, and 200 times exposure concentrations, respectively. Average TBT concentrations in liver, brain, and muscle tissues of salmon surviving transfer to a TBT treated marine net pen that killed 8.5% of the salmon transferred were 9.56, 3.44 and 1.24 ug TBT/g wet weight tissue, respectively. Our results indicate TBT exposure was the cause of death of chinook salmon exposed to TBT-treated marine net pens at one aquaculture facility.

INTRODUCTION

Tri-n-butyltin (TBT) compounds are widely used in the salmon aquaculture industry to retard fouling of net pens by marine organisms. Salmon at aquaculture facilities are raised to market size in marine net pens for 1 to 3 years, during which they gain most of their body mass. Nets must be periodically cleaned or chemically coated to retard fouling by marine organisms; fouling will reduce seawater exchange and result in fish kills. Antifoulants are much more economical than manual cleaning and are therefore preferred by the industry. Several antifoulant formulations are used to treat nets, but TBT compounds are among the most effective active ingredients. These compounds have low solubility in seawater[1], are exceptionally toxic to marine fouling organisms[2], and can be formulated for slow release.

On several occasions, we observed high mortalities in groups of chinook salmon, Oncorhynchus tshawytscha, after transfer to newly TBT-treated marine net pens at an aquaculture research facility. The facility, operated by the National Marine Fisheries Service, is located at Little Port Walter (LPW), Alaska, near the southern end of Baranof Island. Affected fish were examined for disease agents, but none were found. Exposure to TBT was therefore suspected as the cause of the mortalities.

To determine whether exposure to TBT could cause mortalities such as those observed at LPW, we determined the median lethal concentrations (LC_{50}'s) of TBT to juvenile chinook salmon at several exposure periods, and the TBT concentrations in liver, brain, and muscle tissues of juvenile chinook salmon that died during the bioassay. These results are compared with those of juvenile chinook salmon that had survived transfer to a TBT treated net pen at LPW that was suspected of killing some of the transferred fish due to TBT poisoning. Comparisons indicate TBT exposure as the cause of the mortalities observed at LPW.

METHODS

Bioassay Animals

Chinook salmon used in the bioassay tests were raised for 1 year in fresh water and acclimated to seawater for 4 months before testing. Fish were transferred to tanks supplied with seawater (salinity, 28°/₀₀; temperature, 4°C; flow rate 23 l/min), and were fed a diet of 3 mm Oregon Moist Pellet at a rate of 4% body weight daily until 5 days before the bioassay. Average wet weight of salmon used in the bioassay was 24.5 g (standard deviation = 16.43 g), and average fork length, 25.1 cm (standard deviation = 12.1 cm).

Bioassay

The bioassay was static, i.e., no water was replaced during the exposure period. Each of six 550 l fiberglass tanks contained one dose of TBT oxide (TBTO) and 10 randomly selected juvenile chinook salmon. A seventh 550 l fiberglass tank contained 10 similar chinook salmon, but no TBTO, and served as a control. The average ratio of wet weight of tissue to exposure volume was 0.0445 g/l. The seawater temperature was 4 ± 1°C throughout the exposure period. Solutions were aerated slowly to ensure adequate oxygen concentrations (above 80% saturation).

A solution of TBTO dissolved in 5.0 ml glacial acetic acid was mixed with seawater in the six exposure tanks, and 5.0 ml glacial acetic acid was mixed with seawater in the control tank. Salmon

were then transferred by dip net to the tanks. Dead and stressed salmon were noted at 6, 12, 24, 48, 72, and 96 h of exposure. Following 96 h of exposure, clean seawater was flushed through the exposure tanks at a rate of 23 l/min, and the survivors were observed for five additional days to determine any subsequent mortality. LC_{50}'s were calculated using the method of Spearman and Karber[3].

The solutions of TBTO in glacial acetic acid were prepared to give nominal TBTO concentrations of 2, 4, 8, 16, 32, and 64 ug TBTO/l exposure water. These doses were selected on the basis of trial exposures that determined approximate lethal doses. TBTO concentrations in exposure water were measured with atomic absorption spectrophotometry (AAS) immediately before salmon were placed in the solutions and, subsequently, once every 24 h. TBTO dose concentrations decreased to about 65% of those initially measured after 48 h of exposure; therefore, TBTO dissolved in 2 ml glacial acetic acid was added to each dose to increase the concentration to the original level. The 2 ml aliquot was added dropwise to the intake of a submersible pump in the exposure tank to minimize high localized concentrations of TBT. The TBTO dose concentration was measured just before and just after this addition of TBTO. We used the average of all measurements for each dose and exposure period to calculate the LC_{50} for each exposure period.

TBTO concentrations were measured by estimating the tin concentration of hexane extracts in the exposure water. One 50 ml aliquot of seawater was taken from each dose and extracted twice with two successive aliquots of 25 ml hexane each. Hexane extracts were combined and evaporated to dryness at 25°C on a rotary evaporator. The residue was taken up in 2 to 10 ml concentrated nitric acid and analyzed on a Perkin-Elmer model 5000 atomic absorption spectrophotometer equipped with a Zeeman background corrector. Concentrations of TBTO were estimated by comparison with standard concentrations of TBTO dissolved in hexane and processed similarly. With this method, recovery of TBTO from a TBTO concentration of 3 ug/l seawater was determined to be 95%.

Animals Surviving a Suspected TBT Poisoning Incident at LPW

Chinook salmon were hatched in January 1985 and reared for 15 months before they were mistakenly transferred to a TBT coated net pen on 5 May 1986. Four hundred fish were transferred, having an average weight of 49 g. These animals had no known prior exposure to TBT. Within three days of transfer the fish displayed poor feeding response, darkened pigmentation, and tended to hang listlessly near the corners of the net pen. Thirty-four of the fish subsequently died. Personel at LPW suspected TBT poisoning and verified that the net material actually was treated with TBT by tracing invoice records. On 20 May 1986 these fish were transferred to an untreated net pen, and no further mortalities occured. Six of these fish were killed, frozen whole and sent to the Auke Bay Laboratory where they were stored frozen until analysis. Also sent were five colonies of the TBT exposed fish that had never been exposed to TBT treated net pens as controls.

Tissue Sampling and Analysis

Salmon that died during the bioassay were removed and stored frozen in glass jars. After thawing, all of the liver and brain and approximately 1 g of muscle tissue were dissected for analysis. Each tissue was mechanically homogenized and then extracted with hexane, and the tin concentration of the hexane extract was measured by AAS. Results are reported as if all the tin in the hexane extracts were tri-n-butyltin, although possibly some of the tin may be di-n-butyltin. This method is more fully reported in Short and Thrower.[4]

RESULTS

Chinook salmon died in all doses of TBTO tested, but none died in the clean water control tank during or immediately after the bioassay. Only five salmon in the lowest exposure dose survived the bioassay; of these, three died within the next 14 h in clean seawater. The logarithm of the LC_{50} decreased linearly with time between 12 and 96 h of exposure (Fig. 1). The natural logarithm of the LC_{50} fits the following equation for a straight line for this exposure time period, using linear regression analysis:

$$\mathrm{Ln}(LC_{50}) = -(0.031078)(T) + 3.363289 \qquad (1)$$

where T is the exposure time in hours. The measured 96-h LC_{50} was 1.5 ug TBTO/l seawater, whereas the measured 6-h LC_{50} was 54 ug TBTO/l seawater.

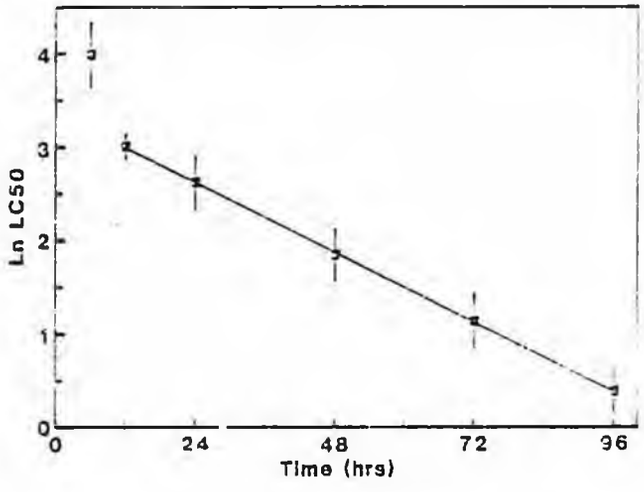

Fig. 1. Natural logarithm of TBT LC_{50} to juvenile chinook salmon, adapted to seawater, as a function of exposure time. Upper and lower ends of vertical bars indicate 95% confidence intervals. The solid line is derived from the linear regression of the natural logarithm of the LC_{50} with the exposure time.

All salmon that died during the bioassay displayed the same series of progressive signs: darkened pigmentation, apathy, loss of stability, hemorrhage of the gills and fin insertions, defecation, and finally death. Salmon in the lowest doses did not display any symptoms until near the end of the bioassay period. Death usually occurred within 24 h of the onset of darkened pigmentation. The two survivors in the lowest exposure dose had darkened pigmentation at the end of the bioassay, but they returned to normal pigmentation within 24 h after being placed in clean seawater and apparently recovered from TBTO intoxication.

Concentrations of TBTO tended to decrease at all dose levels with time (Fig. 2). Dose levels declined to an average of 80% of the initially measured levels after the first 24 h of the bioassay and to an average of 63% after the first 48 h. Dose levels resumed their decline after TBTO was added to restore the desired concentrations.

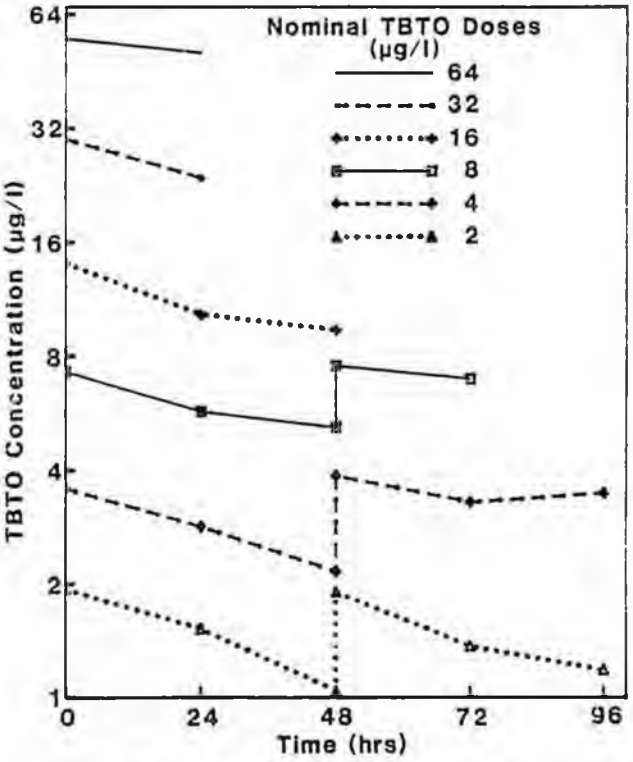

Fig. 2. TBT concentrations measured in bioassay doses as a function of time. TBT measurements were terminated in the higher doses after all the salmon in those doses died. The increase in measured TBT concentrations of the lower doses at 48-h of exposure is due to the addition of TBT to those doses at that time.

Average concentrations of TBT in tissues of salmon that died during the bioassay were highest in liver, intermediate in brain, and lowest in muscle tissues (Table 1). In liver and muscle tissues, the highest concentrations of TBT were in salmon killed by exposure to intermediate doses for intermediate exposure periods, and were about twice the concentrations found in salmon exposed to either high doses for brief periods or low doses for longer periods. In contrast, brain tissue concentrations of TBT were highest in salmon killed by exposure to high doses for brief periods.

We calculated apparent bioconcentration factors of liver, brain, and muscle tissues for salmon that died between 72 and 96 h of exposure to the lowest bioassay dose. These factors were 4,300 for liver, 1,300 for brain, and 200 for muscle tissues, calculated as the ratio of the TBT concentration in tissue to the average exposure concentration of the lowest bioassay dose (1.49 µg TBT/l).

Average concentrations of TBT in tissues of salmon that survived transfer into the TBT treated net pen at LPW are not significantly different from concentrations in corresponding tissues of salmon that died during the bioassay (Table 1). In contrast, much lower average TBT concentrations were found in tissues of salmon that were cohorts of the LPW salmon exposed to the TBT treated net pens (Table 1).

DISCUSSION

Juvenile chinook salmon are very sensitive to TBT poisoning in seawater. We found the 96-h LC_{50} of 1.5 µg TBT/l to be lower than any reported for fish in a recent survey of the literature on acute toxicity of organotins.[2] The most significant difference between bioassay conditions in our experiment and those reported in Hall and Pinkney[2] was that in ours, water temperature was lower (4°C), which may be the cause for some of the sensitivity observed.

TBT concentrations in salmon that died during the bioassay were nearly constant for all doses, suggesting that TBT continues to accumulate until a threshold concentration is reached in critical tissues and causes death. This conclusion is supported by our observation that salmon exposed to low doses of TBT displayed no intoxication symptoms until late in the bioassay. The linear relationship between the logarithm of the LC_{50} and the exposure time (cf. Equation 1) indicates that significant mortalities may occur in salmon exposed for longer than 96 h to TBT concentrations lower than 1.5 µg/l.

The bioconcentration factors we measured are not equilibrium factors. Bioconcentration factors for salmon exposed to sublethal doses of TBT would be higher if the accumulation time was longer than in our study. However, our 96-h bioconcentration factors indicate that relatively brief exposure to TBT results in the accumulation of appreciable concentrations in salmon tissues.

The similarity of tissue TBT concentrations in salmon that died during the bioassay and salmon that survived transfer to the TBT treated net pen at LPW indicates that the transferred salmon were exposed to a nearly lethal dose of TBT. These results, together with the similarity of distress signs displayed by salmon tested in the bioassay and those transferred to the TBT treated net pen at LPW, indicate that TBT poisoning was the cause of death of the thirty-five salmon that died after

being transferred to the TBT treated net pen at LPW. The salmon that died represent the most sesitive individuals of the transferred group to TBT poisoning.

Table 1. Comparison of TBT concentrations in liver, brain, and muscle tissues of juvenile chinook salmon, adapted to seawater, that were killed by TBT exposure during the TBT bioassay, with survivors of a suspected TBT poisoning incident at LPW and with salmon from LPW that were not exposed to TBT. Concentrations are given as ug TBT/g muscle tissue (wet wt.), together with 95% confidence intervals. N = number of individual salmon analyzed.

Tissue	TBT of fish killed during bioassay	N	Transferred to TBT net pen at LPW	N	Control fish at LPW	N
Liver	7.44 ± 0.84	54	9.56 ± 2.91	6	0.13 ± 0.24	5
Brain	3.46 ± 0.33	53	3.44 ± 2.54	6	0.12 ± 0.18	4
Muscle	0.52 ± 0.21	49	1.24 ± 0.25	6	0.012 ± 0.007	5

TBT leaching from treated marine net pens may cause adverse effects that are more subtle than intoxication symptoms or death. Growth in salmon could be affected by TBT; Chliamovitch and Kuhn[5] have suggested that TBT inhibits metabolic pathways in rainbow trout, Salmo gairdneri. Chinook salmon exposed for prolonged periods to sublethal doses of TBT in treated marine net pens may therefore grow more slowly than those in untreated net pens due to the additional energy required to compensate for such stress. A similar effect has been demonstrated in salmon exposed to prolonged sublethal doses of the water-soluble fraction of crude oil.[6] Low doses of TBT can impair the immune system of rats,[7] which suggests that salmon raised in TBT-treated marine net pens may be more susceptible to disease.

In summary, our results show that juvenile chinook salmon are very sensitive to TBT poisoning in seawater, that they rapidly accumulate TBT to high concentrations in tissues, and that lethal effects are dose and time dependent. For these reasons, TBT-treated net pens for salmon aquaculture applications should be used with caution.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the technical assistance of A. Moles and W. Whelan.

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Reprinted from IEEE OCEANS '86 CONFERENCE PROCEEDINGS,
Washington, D.C., September 23-25, 1986

ACCUMULATION OF BUTYLINS IN MUSCLE TISSUE OF CHINOOK SALMON REARED IN SEA PENS TREATED WITH TRI-N-BUTYLTIN

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ABSTRACT

Muscle tissue of chinook salmon, Oncorhynchus tshawytscha, reared for 3 to 9 months in sea pens treated with an antifouling biocide, tri-n-butyltin (TBT), contained organotin concentrations of 0.28-0.90 µg/g (as TBT). Organotins are present in some pen-reared salmon sold in the United States: Eleven of 15 salmon advertised as aquaculture products and purchased from public markets contained organotin concentrations of 0.081-0.20 µg/g. Preliminary anaylses by GCAA indicate that these organotin concentrations are TBT. Most common cooking practices do not effectively destroy or remove butyltins from salmon muscle tissue. We believe this is the first evidence of entry of organotins into the human diet in the United States.

INTRODUCTION

Tri-n-butyltin (TBT) compounds are emerging as the leading compounds in the effective control of marine fouling of sea pens, a serious problem in the salmon farming industry. Fouling organisms restrict water flow through the sea pens and increase the risk of dangerously low oxygen levels occurring as a result of poor water exchange in the sea pens. TBT compounds have a low solubility in seawater[1], are exceptionally toxic to marine fouling organisms[2], and can be formulated for slow release. The recent increase in the use of TBT compounds could result in an environmental hazard in marine waters. Continued uncontrolled use is being debated; the U.S. Congress has prevented the U.S. Navy from implementing plans to begin using TBT compounds as bottom paint for their fleet in 1986. Their use is banned in some countries and states.

Following the industry practice, TBT-treated sea pens were used beginning in 1983 at Little Port Walter (LPW), near the southern end of Baranof Island in Southeast Alaska, where research on improving fish farming methods is carried out by the National Marine Fisheries Service. At that time, the intent was only to minimize marine fouling of the pens and any potential effects of TBT on salmon were not considered. On several occasions, unusually high mortalities were observed in populations of chinook salmon, Oncorhynchus tshawytscha, after transfer to newly TBT-treated sea pens. In one instance, 5555 (over 50% of the population) yearling chinook salmon died within 2 weeks of transfer. These fish were carefully examined for disease agents, but none were found. As part of an effort to determine the cause of these mortalities, the survivors were analyzed for organotins. Also analyzed were the fish food and local seawater. Our results prompted us to look in the marketplace for organotin-contaminated salmon and, subsequently, to determine whether normal cooking processes destroyed these compounds.

In this paper, we present evidence that pens treated with TBT may contaminate the flesh of salmon with TBT and its metabolite di-n-butyltin (DBT). The butyltins may persist in the flesh to the marketplace, and most will not be destroyed by cooking.

METHODS

Four groups of chinook salmon reared at LPW were examined for organotins after mortalities associated with transfers to TBT-treated sea pens were observed in two of the groups, 1981 and 1982 brood-year salmon. LPW is a pristine area, unaffected by pollutants from industrial or urban sources: The only population centers within a 75 km radius are fishing villages of less than 500 people each, and less than 100 000 people live within a 1000 km radius. The 1981, 1982, and 1983 brood-year fish had different histories of exposure to TBT. The fourth group, cohorts from the 1983 brood, was a control group which had no exposure to TBT.

The 1981-brood fish had been placed in newly TBT-treated sea pens in May 1983 and subsequently transferred to newly TBT-treated sea pens in October 1983 and May and August 1984. The 1982-brood fish had been placed in newly TBT-treated sea pens in October 1983, and again in May and August 1984. The 1983-brood fish had been placed in used TBT-treated sea pens in October 1984. The control group had been reared in ordinary, untreated sea pens.

On 6 November 1984, two salmon were randomly taken for organotin analysis from each of two sea pens containing 1981-brood fish (average body weight 1700 g) and from each of four sea pens containing 1982-brood fish (average body weight 1200 g). Seven 1983-brood fish (average body weight 20 g) were randomly sampled from a single sea pen on 28 January 1985.

Twelve control fish (average body weight 160 g) were randomly taken for organotin analysis on 1 November 1985.

Muscle tissue samples were analyzed for organotin compounds. The sampled salmon were killed, frozen whole, and stored at -20°C for up to 2 months. One to 5 g of muscle tissue was dissected from each, and care was taken not to include any skin, fat tissue, or portions of the lateral line. The dissected tissue was homogenized with a glass homogenizer in 10 ml of pH 7.5 phosphate buffer solution ($[PO_4^{-3}]$ = 1.0 mM), and the homogenate was extracted with two 25 ml aliquots of hexane. Hexane extracts were combined and centrifuged at 10 000 x g, and supernatant was evaporated to dryness under reduced pressure on a rotary evaporator at 25°C. The residue was taken up in a solution of 0.1 ml concentrated nitric acid diluted to 5.0 ml with glacial acetic acid.

Tin concentration in the acetic acid solution was measured by flameless atomic absorption (AA) on a Perkin-Elmer model 5000 spectrophotometer equipped with a Zeeman background corrector and an electroceless discharge tin lamp. The manufacture's suggested conditions and instrument settings were used for the analysis of tin in the acetic acid solutions. For the purpose of calculating organotin concentrations, we assumed that all tin found in the hexane extracts was present as TBT.

The method of standard additions was used to estimate organotin concentrations in muscle tissue. Our method is similar to that of M&T Chemicals Ltd. for the analysis of butyltins in fish tissues (Standard Test Method AA-33, M&T Chemicals, Inc., Rahway, NJ 07065). The M&T method involves hexane extraction of a hydrochloric acid digest, followed by solvent resolution of individual butyltins. The M&T method finds that only TBT and DBT are extracted by the hexane. Our method differs in that mechanical homogenization was used instead of acid digestion, the pH of our homogenate was higher (7.5), and we did not attempt to separate TBT from DBT. Use of mechanical homogenization may significantly lower the extraction efficiency of TBT and DBT, causing butyltin concentrations to be underestimated. Salmon muscle tissues spiked with 0.60 ug TBT/g and with 0.52 ug DBT/g have recoveries of 55% and 37%, respectively. The limit of detection was 0.013 ug TBT/g muscle tissue.

To determine whether organotins were inorganic tin complexed with ligands, three salmon from the control group were selected, and a 2 g portion of muscle tissue from each fish was processed using the modified M&T method described above, except that the buffer solution contained 10 (II) (as $SnCl_2$), and the homogenate was allowed to rest at room temperature for 4 h. This procedure was repeated using Sn (IV) (as $SnCl_4$). No organotins were detected in either case. This rate of addition of inorganic tin is equivalent to 10 ug Sn/g muscle tissue, which is more than 10 times higher than the highest organotin concentrations found in the muscle tissue of LPW salmon reared in the TBT-treated sea pens. It is therefore very unlikely that the organotins were derived from inorganic tin.

To verify the source of the organotins in LPW salmon, we analyzed the fish food and the seawater inside the sea pens. We extracted one 1.5 l. seawater sample from each of six TBT-treated sea pens with 0.5 l. methylene chloride and analyzed the tin content of these extracts. The extracts were all evaporated to dryness, and the residue was taken up with 5 ml of the acetic acid solution, which was analyzed by flameless AA as previously described. In seawater recovery experiments, 15 ng TBT/l. gave an average response of 0.009 absorbance-seconds on our instrument. We also analyzed three surface-seawater samples from Chatham Strait, Alaska, about 2 km east of LPW and, using the modified M&T method, analyzed muscle tissue samples from 10 wild chinook salmon caught by hook and line near Auke Bay.

To determine whether pan frying, boiling, or using a microwave oven destroys accumulated butyltins, we cooked a single 20 to 30 g portion of muscle tissue from a single LPW 1981 brood-year chinook salmon that had been analyzed for organotins, using each cooking method. Muscle tissue was cooked to an internal temperature of 100°C. Each cooked portion was subsampled five times for organotins and analyzed by the previously described method.

RESULTS AND DISCUSSION

All samples from the three groups of fish reared in TBT-treated sea pens, but none from the untreated sea pen, contained readily detectable concentrations of organotins (Table 1). Organotin concentrations (0.70-1.1 ug/g) in the 1981 and 1982 brood-year salmon were not significantly different ($P = 0.81$) as determined by analysis of variance comparing all results from the 1981- and 1982-brood fish, suggesting that the time scale for accumulation in these fish is less than a year. The average organotin concentration in the 1983-brood fish was 0.28 ug/g. This lower concentration may result from the relatively brief exposure to the TBT-treated pen, which had in fact been soaking in seawater for more than 6 months before the 1983-brood fish were transferred to it. In contrast, no organotins were detected in the muscle tissue of the control group.

Table 1. Concentrations of butyltins in the muscle tissue of 1981, 1982, and 1983 brood-year chinook salmon reared in TBT-treated and untreated sea pens at Little Port Walter, Alaska. Butyltin concentrations, together with 95% confidence intervals, are based on wet tissue weights. Each fish was analyzed in triplicate. ND = none detected (detection limit is <0.013 µg TBT/g muscle tissue).

Brood year	Duration of residence in TBT-treated sea pens (months)	Muscle tissue concentration of butyltins, as TBT (µg/g)	Number of salmon analyzed
1981	19	0.90 ± 0.10	4
1982	13	0.82 ± 0.05	8
1983	3	0.28 ± 0.04	7
1983	0	ND	12

No organotins were detected in the fish food samples or in any of the 10 wild salmon caught by hook and line near Auke Bay, nor were any organotins detected in the three surface-seawater samples from Chatham Strait. However, organotins were detected in all six seawater extracts from the sea pens, at concentrations of 18-65 ng TBT/l.

Our results indicate that the source of the organotins in muscle tissue of LPW salmon was the TBT-treated sea pens. The only naturally occurring organotin compounds are methyltins[3], and their concentrations in unpolluted seawater are probably less than 1 ng/l.[4] If naturally occurring or anthropogenic organotins from sources remote from LPW were significant, we would have expected to detect them in the control group or in the 10 wild chinook salmon. A local source is indicated because organotins were detected in all the marine water samples from inside the sea pens, but in none of the samples from Chatham Strait. At LPW, organotin compounds were only used to treat the sea pens.

The organotins present in our hexane extracts probably include TBT and DBT. The half life of TBT in water exposed to the environment is about 3 months.[4] Juvenile chinook salmon rapidly accumulate TBT immediately upon exposure to low concentrations: We have observed that juvenile chinook salmon exposed to 2 µg TBT/l. seawater for 72 h accumulated 0.3 ± 0.1 µg TBT/g muscle tissue (wet wt).[5] It is therefore likely that the salmon were exposed to only TBT and not to significant concentrations of any TBT degradation products. Once absorbed, TBT may be catabolized to DBT.[6] The organotins in our hexane extracts of muscle tissue from LPW salmon are therefore probably TBT and DBT (See footnote).

Our results imply that TBT is bioconcentrated to a great extent in the muscle tissue of chinook salmon. We cannot determine a bioconcentration factor with any precision from our data because LPW salmon were probably exposed to TBT concentrations higher than those found in the seawater samples. The leaching rate of TBT is highest when the treated nets are first placed in seawater and decreases roughly exponentially with time.[7] By the time we sampled the seawater in the sea pens at LPW, the nets had already been in seawater for at least 5 months. The 1981 and 1982 brood-year groups, on the other hand, had been repeatedly transferred into newly TBT-treated sea pens. However, chinook salmon probably bioconcentrate TBT in their muscle tissue to a greater extent than do sheepshead minnows, Cyprinodon variegatus, which bioconcentrate TBT by factors ranging from 740 to 1600.[8] Greater bioconcentration factors for chinook salmon are expected, because their muscle tissue is relatively high in lipids[9] and TBT has a high octanol-water partition coefficient.[4]

Market Survey

The readily detectable TBT concentrations found in the 1983 brood-year salmon, after a relatively brief exposure to a used TBT-treated sea pen, caused us to speculate whether organotins are present in aquacultured salmon in the U.S. marketplace. TBT compounds are widely used as a sea pen antifoulant in the salmon aquaculture industry. Therefore, we thought it likely that salmon reared in commercial aquaculture operations using TBT-treated sea pens may be subjected to a TBT exposure similar to that of the 1983-brood salmon reared at LPW.

We purchased eight salmonids from four markets in Seattle, Washington, and seven from one market in Portland, Oregon, in February 1985. All the Seattle fish, consisting of chinook salmon; silver salmon, Oncorhynchus kisutch; and Atlantic salmon, Salmo salar, were advertised as imported products of aquaculture. The seven fish from Portland were silver salmon reared in the United States at a facility that used TBT-treated sea pens. Fish were analyzed for organotin concentrations in muscle tissue, using the previously described method; concentrations were 0.072-0.20 µg/g in four of the eight fish from the Seattle markets, and 0.059-0.10 µg/g in all seven Portland fish (Table 2). Fish from the Seattle markets that did not contain organotins were probably not reared in TBT-treated sea pens. Although the exact history of these market fish is unknown, our results from the LPW fish suggest that the market fish acquired their organotin burdens while being reared in TBT-treated sea pens (See footnote).

Table 1. Concentrations of organotins in salmonids purchased from fish markets in Seattle, Washington, and Portland, Oregon and advertized as products of aquaculture. Organotin concentrations, together with 95% confidence intervals, are based on wet tissue weights. Each fish was analyzed in triplicate. ND = none detected (detection limit is <0.013 ug TBT/g muscle tissue).

Species	Number of fish analyzed	Muscle tissue concentration of organotins, as TBT (ug/g)
	Seattle Market	
Silver salmon	1	0.20 ± 0.11
Silver salmon	1	ND
Chinook salmon	2	ND
Atlantic salmon	3	0.081 ± 0.031
Atlantic salmon	1	ND
	Portland Market	
Silver salmon	7	0.081 ± 0.009

Three common cooking methods for salmon did not eliminate butyltins from the cooked portions. Average percentages of butyltins remaining were 55%, 67%, and 76% for the microwave, pan frying, and boiling methods, respectively. These percentages are corrected for the loss of water that occurred during cooking. Results indicate that cooking is ineffective in eliminating butyltin concentrations in food.

SUMMARY

Rearing salmon in sea pens treated with antifoulant containing TBT compounds resulted in the accumulation of organotins in the muscle tissue of salmon. Organotins were detected in several fish from different countries purchased from the marketplace and advertised as products of aquaculture. Additionally, cooking was found to be ineffective in destroying or removing accumulated organotins. We believe this is the first evidence of entry of organotins into the human diet in the United States.

Footnote

Analysis of the samples on which the results presented in this paper are based have recently been repeated by one of us (JWS) using a gas chromatograph interfaced with an atomic absorption spectrophotometer (GCAA). Results of the GCAA analyses showed TBT concentrations in chinook salmon muscle tissues that were quantitatively similar to the organotin concentrations (expressed as TBT) presented in tables 1 and 2. In particular, DBT accounted for less than 2% of the TBT found by GCAA. A manuscript reporting these results more fully is in preparation.

ACKNOWLEDGEMENTS

We thank R. James Maguire, Vernon Hodge, and Stuart C. O'Ren for their review of the manuscript and helpful discussions, and A. Moles and W. Whelan for their technical assistance.

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COOPERATIVE EXTENSION SERVICE

UNIVERSITY OF ALASKA
FAIRBANKS ALASKA 99701

Marine Advisory Program
2651 Providence Avenue
Anchorage, Alaska 99504
(907) 263-1890

June 29, 1981

MEMORANDUM

TO: Brian Paust, Agent

FR: John Ball, Safety Specialist

RE: Tributyl-Tin-Fluoride (TBF)

This is a response to your question about the toxicity and special handling of this anti-fouling compound. Since it is not uncommon and is a nasty item, I am taking the liberty of circulating this information to other friends in MAP/CES/Sea Grant.

For more information on this or other compounds there are several places to turn to in the future:

1. Carl Harmon, Environmental Engineer with the State Department of Environmental Conservation in Anchorage (the person who helped me with this)--phone: 274-2533.

2. Environmental Protection Agency (EPA)--phone: 271-5083.

3. Poison Center at Providence Hospital in Anchorage--phone: 274-6635.

4. Chemical Transportation Emergency Center (CHEMTREC)
Phones: (800) 424-9300 (supposedly toll free)
(202) 483-7616 (call collect 24 hours a day).

I did not have the occasion to call the Coast Guard on this, but on materials that are recognized hazardous materials, the Coast Guard does have some references.

[illegible] is not unrelated to 2,4-D and agent orange. ②It functions as an anti-fouling agent by breaking down the cell walls of living tissue. It will do this in people too. ③It can be absorbed through the skin, inhaled, ingested, etc. ④If it gets into the eyes and remains there for any appreciable period of time, it can affect vision and cause blindness. ⑤Using this materia in a confined space can lead to unconsciousness and presumably death. ⑥For physical as well as health reasons this material should not be applied in a spray. It should be painted onto the surface to be protected (and I would go try to find my worst enemy to do the work).

The material collects in fatty tissue and therefore has a considerable impact upon kidneys and livers.

If one is going to use it, it is recommended that this work [illegible] under controlled conditions, in open air (so others can breathe in the vicinity), with a respirator, protective clothing, gloves, etc.

I did not get the recommended solvent, but at all cost one ought to avoid getting this material in contact with the skin and it might be a good idea to be prepared with the recommended solvents and eye washes.

Basically, the stuff sounds almost too dangerous to use. The only other thing to add is that several brands have been removed from the market, and one ought to check with the CHEMTREC number above to see if specific brands are even allowed in the market anymore. Apparently, many of the earlier editions have been recalled. Keep the stuff in Petersburg, eh?

Hope this helps.

ee

J[illegible]ry 5, 1987

University of Hawaii Sea Grant Extension Service would like to contact anyone in the Sea Grant network familiar with the environmental and biological effects resulting from use of organotin (i.e., tributyltin or TBT) antifouling paint. US Navy plans to experiment with TBT application on ship hulls at [illegible], [illegible]rida, and Pearl Harbor, Hawaii. Purposes of the study are to track and measure leaching of TBT into marine e[illegible]onment and assess environmental effects. USN claims TBT would be more cost-effective than copper-based paints. US Environmental Protection Agency is presently conducting a lengthy review of TBT use on vessels, triggered by recent ban of TBT in United Kingdom and France due to "malformations" observed in shellfish.

State Department of Health is presently reviewing existing information and obtaining views of local agencies including NMFS, USFWS, state CZM program, and UH Sea Grant. A meeti[illegible] is being planned for January 15, 1987 in Honolulu at which the US Navy will brief [illegible] agencies about their plans and address concerns.

If there is any researcher or extension agent/specialist familiar with TBT, please contact Ray Tabata, marine extension specialist, UH Sea Grant Extension Service, 1000 Pope Rd., MSB 205, Honolulu, HI 96822; phone -- (808) 948-8191.

[illegible] — Thank you [illegible] [illegible] [illegible] [illegible] Computer network to Hawaii — Thanks. [illegible]

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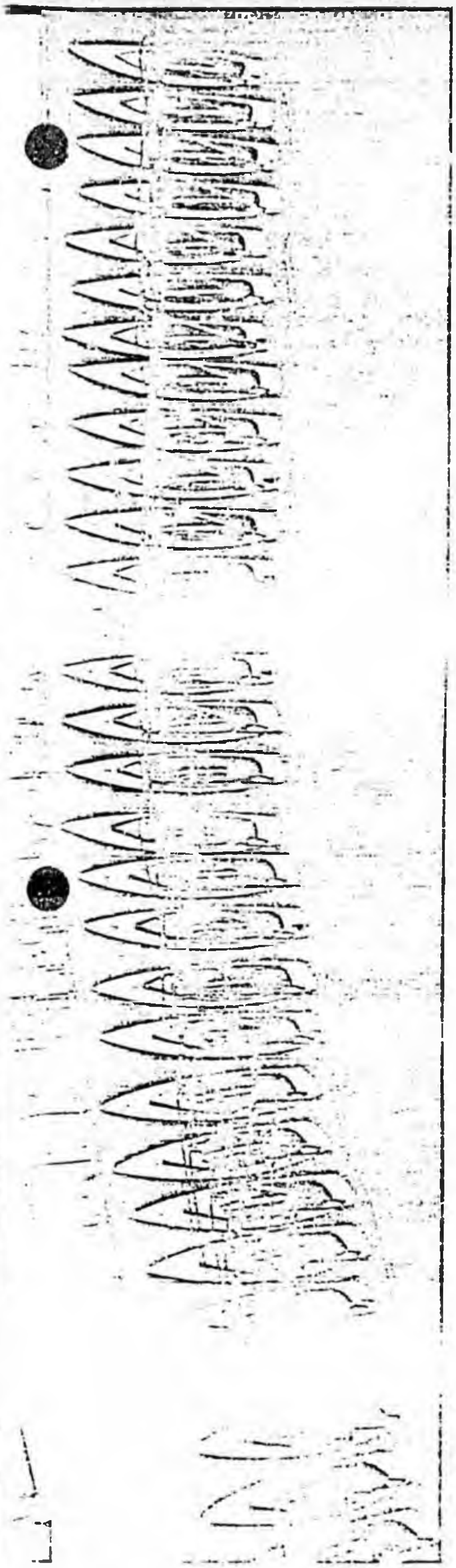

TBTs: Acronym For Poison?

French oystermen say anti-fouling paints are responsible for the demise of a once lucrative shellfishery near Bordeaux.

The Navy says a new version of the anti-fouling paints, designed to keep barnacles from clinging to ship hulls, can save them millions of dollars annually. They dispute claims that use of the paints will decimate the already threatened marine life in Chesapeake Bay.

Anti-fouling paints contain a toxic compound, tributyltin. (TBT) Until recently no reliable test existed that would measure its presence in the tin that leaches out of the paints. Now, funding from the National Science Foundation, the Environmental Protection Agency, and the National Sea [illegible] Program has enabled a [illegible] at the University of New Hampshire to develop just such a test.

Jim Weber is a chemist whose work has taken him to Bordeaux, near Arcachon Bay, an important source of oysters in France. In recent years, however, the oysters in Arcachon Bay have been ailing, Weber says. "They're definitely sick. There is less flesh. In some cases, the shells adhere to the flesh. They're not edible."

Boats, from fifty meter yachts to small outboards, are also abundant on Arcachon Bay, and the French government suspected that tributyltins were leaching from anti-fouling paints on boats and poisoning shellfish.

Tin itself is harmless. After all, Weber points out, we store much of our food in tin containers. Only when tin is combined with butyl is it lethal, and then it is lethal in very small parts per billion. It doesn't take much tributyltin to harm or kill something, but there has been no way to measure small amounts of the compound and prove that [illegible] dangerous levels in [illegible] The anti-foul[illegible] the French banned [illegible] paints on all vessels [illegible] meters long or under, the paint manufacturers protested a lack of [illegible] verification.

[illegible] situation parallels one being [illegible] out on the James River and Chesapeake Bay in this country. The Navy, according to an Associated Press report, wants to paint 450 surface ships at the Newport News, Virginia, shipyard with a paint formula that contains tributyltin. Since the formula requires less frequent re-painting, the estimated savings to the Navy would be some $200 million each year.

The Navy says that its formula contains less tributyltin than commercially available paints, but the shipyard in question is located near a prime Chesapeake spawning ground for oysters and crabs. Anti-fouling paints are intentional biocides: they are meant to kill the marine life that attaches to boat hulls. The issue is whether, after killing seaweeds and barnacles, they continue down the water column, injuring non-target organisms [illegible] mussels, clams, crabs, and oysters.

Weber's test [illegible] used to [illegible] a determination [illegible] development of a Sea Grant-[illegible] project sought to discover [illegible] happens [illegible] substances [illegible] hydrocarbons [illegible] New Hampshire's Great Bay estuary [illegible] on earlier techniques, Weber [illegible] has a system that [illegible] assess the presence in shellfish [illegible] but [illegible] amounts of tributyltin and do [illegible] fewer steps than previously needed.

"Other techniques [illegible] deal of sample manipulation," Weber says, noting that [illegible] handled, the [illegible] contamination [illegible] "All we do is take [illegible] add one chemical [illegible] and measure butyltins."

Weber has been [illegible] present technique at a September [illegible] symposium on organotin compounds [illegible] held in Washington, D.C. [illegible] symposium part of "Oceans '8[illegible]" [illegible] conference sponsored by the Marine Technology Society, the Institute of Electrical and Electronic Engineers' Oceanic Engineering [illegible] and the National Geographic Society.

The UNH [illegible] past year to [illegible] chemist who visited [illegible] specifically to learn [illegible] apply it to the Arcachon [illegible] Weber is also continuing [illegible] his own research to determine how much tributyltin [illegible] New Hampshire's Great Bay [illegible]

Already there [illegible] evidence that anti-fouling paint [illegible] local contributors [illegible] did sampling in March and June," Weber says, "and [illegible] showed up only in June [illegible] he points out, comparing [illegible] out on the estuary in March.

8

EPA Warns Vessel Owners of TBT Paint

The Environmental Protection Agency has begun a special review of the use of the pesticide tributyltin (TBT) in antifoulant paints to determine whether it should be banned or restricted because of its toxicity to fish and shellfish. Between 250,000 and 300,000 pounds of TBT is used in vessel paints each year. Water samples taken in several U.S. ports contained relatively high concentrations of TBT prompting the investigation. While no decision has been made EPA is advising all vessel operators that:

"It would be most prudent to use copper-based antifoulant paints containing no TBT."

HEARING HELD ON TRIBUTYLTIN

The use of tributyltin (TBT) in antifoulant marine paints was the subject of a U.S. House of Representatives, Merchant Marine and Fisheries Sub-Committee hearing on Sept. 30. Three expert panels from academia, the TBT and TBT paint producing industries and the Environmental Protection Agency provided testimony. The objective of the hearing was to explore the facts about TBT, issues requiring further study and possible action to be taken.

Scientists from John Hopkins University and VIMS presented data indicating that TBT levels in water samples taken from several sites in in-shore Maryland and Virginia waters were higher than those levels found to be toxic to shellfish larvae in laboratory experiments. They further noted that shellfish are known to bioaccumulate TBT. Although acknowledging the existence of certain data gaps, including some in the area of public health implications, the researchers recommended immediate restrictions on TBT paint use.

Testimony from industry representatives pointed out that no real problems have been observed that can be directly attributed to TBT. It was noted that two types of TBT-based paints are produced and marketed: a "copolymer" type, which has been observed to leech TBT very slowly, and a "free associated" type, which has a quicker release. It was suggested that the latter could be restricted or banned, alleviating much of TBT release into waters.

The EPA representative testified that the EPA is currently undertaking a complete review of TBT antifoulant paints. While completion of the entire study may require three to five years, EPA could rule on restrictions regarding usage of high release paints by spring 1987. Congressman William Carney (NY) noted that there is little chance that legislative action on TBT use could be taken before June 1987, and requested that the EPA official keep the Committee advised on the progress of its review.

Source: National Fisheries Institute "Flashes" October 1986

MD Maulaner (Cal. Sea Grant)

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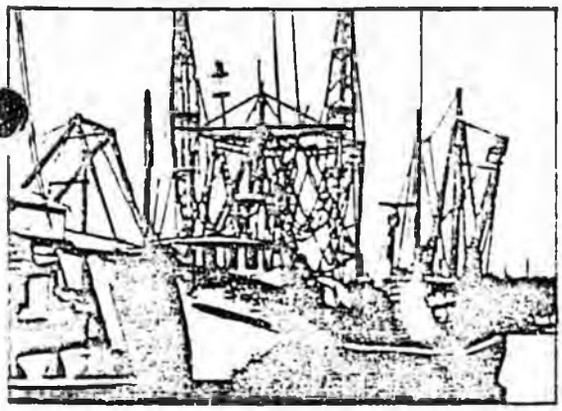


Commercial Fishing Newsletter

VIRGINIA SEA GRANT COLLEGE PROGRAM AT
VIRGINIA INSTITUTE OF MARINE SCIENCE

Vol. 5, No. 4 Fall 1985

VIMS Contests Navy Plan to Use TBT Until Scientific Studies Prove Its Safety

by Susan Schmidt

Dr. Frank Perkins, director of the Virginia Institute of Marine Science (VIMS), recommends against the use of tributyltin (TBT) to paint Navy ships until better data on environmental effects are assembled.

The Navy says that mixing organotin with copper-based paint to kill barnacles and retard algal slime could save $150 million a year in maintenance and fuel costs. VIMS is concerned that there is insufficient scientific data on the environmental impacts of TBT and has started testing toxic effects of this chemical on oysters and clams.

VIMS is charged with advising the Commonwealth on protecting estuarine resources, and in particular, species for commercial and recreational harvest in the Chesapeake Bay. At the same time, VIMS is uniquely qualified to study a toxic chemical, because of the experience of chemists at the Institute and their sophisticated testing equipment.

Dr. Robert Huggett, head of the chemical oceanography department at VIMS, says TBT is one of

Virginia Protests Naval Plan

In an environmental assessment released in June 1985, the Navy said that TBT is 7 to 40 times more toxic than the copper-based paint now is use. After consultation with VIMS, the Virginia Council on the Environment responded to the Naval proposal in August, requesting more research.

Keith Buttleman, administrator of the Council, said, "We believe that the protection of human health and the high economic value of recreational and commercial fishing warrant the postponement of this program until the risks can be fully assessed."

Surf breaking over the VIMS Ferry Pier during the November 4th storm washed away several scientific experiments.

In August a Virginia Congressional delegation wrote a letter protesting the Naval plan to use TBT. In September Sen. Paul Trible set up a meeting with Navy Secretary John Lehman, attended also by Sen. John Warner, and Reps. Herbert Bateman, William Whitehurst, and Norman Sisisky. They asked the Navy to stop its plan to use paint containing TBT until VIMS' intensive study of environmental effects could be completed. Dr. Perkins and Dr. Huggett of VIMS attended the meeting.

Citing VIMS' concerns, in October the U.S. House of Representatives Appropriations Committee has encouraged the Navy to postpone fleetwide implementation until impacts on estuarine marine life and on human health are determined.

Risks to Environment and Human Health

One of VIMS' concerns is the effect of TBT on shellfish. Naval vessels are concentrated in only a few harbors, one of which is Norfolk, Va. Norfolk Naval facilities and the Newport News Shipbuilding and Dry Dock Company are within a tidal cycle of major oyster seed beds in the James River and crab spawning areas in the mouth of the Chesapeake Bay. The Navy report does not list the effect of TBT on shellfish species near Norfolk harbor.

The Virginia Department of Health says TBT accumulates in aquatic organisms. In oysters, TBT can be magnified 1000 to 6000 times, and in mussels, 2700 times over water concentrations. Experimental tests on rats indicate TBT causes skin sores and severe eye damage. Possible effects on workers exposed to TBT are problems with eyes, skin, lungs, liver, nervous system, abdominal pain, nausea, headaches, and unconsciousness. Because of the risk to workers, the Newport News Shipbuilding and Dry Dock Company says it will not use TBT in the future until its effects on workers and the environment are known.

History of Anti-foulants

Three thousand years ago Phoenicians used copper on [illegible] Archimedes [illegible] and pitch. In the 20th century arsenic and mercury enhanced the activity of copper until environmental concerns banned their use.

Fifteen years ago organotins were added to marine paint, because they were thought to be less toxic than mercury and arsenic and more effective than copper. This paint is efficient at protecting against fouling because the poison is released slowly over time. In some of the newer co-polymer paints, hulls do not have to scrubbed or repainted for years. Furthermore, a layer of paint sloughs off when the vessel is underway. In fact, the Navy says no better alternative exists to the co-polymer mixture of tin and copper.

Naval Readiness

By increasing fuel efficiency with cleaner hulls, the Naval fleet can travel farther and faster. By reducing time in drydock, the Navy can respond more quickly in an emergency. Initial Naval tests say that ships may be able to stay out of drydock for five years. In addition to using TBT to kill barnacles and algal slime that retard ship speed and increase fuel consumption, the Navy says it needs to use TBT on aluminum hulls to avoid corrosion caused by copper-based paints.

The Navy started using TBT in the late [illegible] discontinued use in the mid-1970s and resumed use again in 1977. So far 19 Naval vessels have been painted with TBT. On a continuing test basis, the Navy wants to paint two to five more ships with TBT in the next year. The Navy proposes that all 550 vessels would be painted with TBT marine paint by the 1990s.

Recreational and Commercial Use of TBT

For about 10 years TBT has been used on private and commercial boats in the United States. However, in France and Great Britain its use is restricted on [illegible] pleasure craft. France has banned use of marine paint with more than 3 percent organotins on boats less than 25 meters (about 80 feet). Great Britain forbids TBT on small, shallowdraft vessels, and Japan bans TBT in household textiles and paints.

TBT is a biocide, which literally means killer of life. Besides marine paints, the other uses of TBT are in textiles to kill fungus, in cooling water to kill slime, in plastics and foam to control mildew, and in [illegible] preservatives and disinfectants.

Standards and Testing

The Navy sets allowable levels at 50 parts per trillion (ppt). North Carolina has set standards for TBT at [illegible] and 8 ppt in freshwater. [illegible] water sample from a small creek [illegible] several pleasure craft marinas. VIMS scientists found a potentially dangerous level of 40 TBT [illegible] or 190 ppt as TBT. Similar preliminary samples [illegible] Elizabeth River near the Norfolk Naval Base yielded concentrations exceeding the Navy's proposed [illegible] of TBT.

Over the next year VIMS scientists [illegible] intensive study of the impacts of TBT [illegible] resources, so that the assessment as to whether [illegible] advisable for the Navy to paint its fleet with TBT based [illegible] accurate scientific evidence.

Government studying TBT-paint hazards

The U.S. Environmental Protection Agency has begun a review of some tributyltin (TBT) pesticide compounds after determining they may endanger mussels, clams, oysters and fish. There is no evidence that TBTs harm humans who eat seafood contaminated [illegible], and the EPA has not banned their use.

TBTs have been used for 20 years in the manufacture of antifoulant paints applied to ship and boat hulls to inhibit the growth of barnacles, tubeworms and other marine life considered harmful to vessels. Small quantities of TBT paints also are used on lobster pots and buoys.

The EPA's review was prompted by laboratory studies showing that TBT at minute levels is highly toxic and potentially lethal to marine and freshwater organisms. Data measuring TBT in the Great Lakes and coastal waters show levels at concentrations that adversely affect laboratory animals.

Until the EPA investigation is concluded, the agency recommends using copper-based antifoulant paints containing no TBT, even though copper-based paint, while effective against the same organisms as TBT-based paint, tends to be corrosive to metal, especially aluminum, and doesn't protect as long. At the minimum, [illegible] TBT [illegible] paints [illegible] TBT; such paints generally release the TBT toxicant slower.

Fish Boat [illegible]

TBT bottom paints face EPA action

Lawmakers in the U.S. House of Representatives have agreed to consider imposing restrictions on the use of popular tin-based bottom paints that contain tributyltins, or TBT. Such anti-fouling coatings are believed to pose serious environmental threats, particularly to shellfish.

In a hearing Sept. 30, House members agreed to ask the Environmental Protection Agency (EPA) to decide if TBT paints should be restricted or banned from use while further scientific studies are performed.

Two scientists from the Virginia Institute of Marine Science (VIMS) and Johns Hopkins University told a House Merchant Marine and Fisheries subcommittee that early scientific analysis showed that highly toxic TBT residues from the boat paints are increasingly being found in the sediment and water column of productive estuaries like Chesapeake Bay. These scientists, whose testimony was disputed by representatives of two marine paint companies, recommended immediate restrictions on the use of TBT paints.

Since the 1970s, TBT paints have become very popular, with estimates showing that upwards of 70% of all recreational vessels and more than 30% of all commercial vessels now use the product.

In the past six years, however, scientific studies have shown that the TBT paints are leaching into the environment, particularly in areas of heavy boat traffic. In Europe, where the pesticide is used to ward off aquatic growth on boat hulls, it has been found to impede the growth of shellfish, particularly oysters.

In this country, EPA opened a massive national study into TBT's effects just last January (see NF March '86, p. 10). The investigation is expected to continue through the end of the decade.

But Thomas J. Gibbons, director of marine marketing for International Paint Co. in Union, N.J., said significant questions about the allegedly harmful effects of TBT use must be answered before any restrictions are imposed.

He noted that two forms of TBT paints are currently being used: one is a "free-association" mix, which has a higher rate of release into the water, and the second is a copolymer, which leaches very little into the environment.

"A ban on all TBT-based paints in U.S. waters would create economic havoc as well as great enforcement problems," said Gibbons, "since some 70% of all oceangoing vessels are coated with TBT copolymer anti-fouling paints."

John A. Moore, assistant administrator for pesticides and toxic substances at EPA, said the agency might take interim steps — such as imposing limited restrictions on TBT use — before its lengthy federal studies are completed.

— Christopher Simpson

Toxic chemical detected in farm salmon

A spokesman for B.C.'s ministry of the environment confirmed Nov. 7 that there are no controls in this province on the use of a toxic anti-fouling agent that has been detected in farmed salmon.

The substance is called tributyltin, or TBT, and is one of the most toxic substances known to man. Popular as an anti-fouling paint for boat bottoms, it has been banned in a number of European countries because of the damage it inflicts on the environment.

Now TBT has been detected in pen-reared salmon sold in U.S. seafood markets. According to *Friday*, the publication of the Pacific Coast Federation of Fishermen's Associations, aquaculture products from Puget Sound and Norway purchased in public markets contained concentrations of .28 to .9 micrograms per gram of TBT.

TBT, sometimes used to treat netting used in salmon pens, can be toxic in levels as low as five parts per trillion. Two scientists working for the National Marine Fisheries Service found the substance in baby coho sold in public markets.

"We have no controls on the use of anti-fouling agents," B.C. environment ministry spokesman Michael Coon told *The Fisherman* Nov. 7. "We're in the process of collecting samples. We're trying to assess the problem. It's something we don't know very much about."

Evidently the pan-sized fish are not exposed to the TBT for long enough to die from its effects. The chemical concentrates over time in certain parts of the body.

Coon said the toxic effects of anti-fouling agents are a concern. "It's in everyone's interest to make sure fish aren't contaminated."

UFAWU secretary-treasurer Bill Procopation said the threat of TBTs is another example of the chaos surrounding the B.C. fish-farming issue. "We'll need more than a 30-day review to establish regulations to prevent this kind of damage," he said.

The two American researchers also studied the effect of low concentrations of TBT on juvenile salmon, concluding that exposure to low doses may increase susceptibility to disease.

The Fisherman, BC

• UFAWU secretary-treasurer Bill Procopation, (left) and Gibsons troller Gary Russell (right) were among fishermen who appeared at hearings of the B.C. Finfish Aquaculture Inquiry chaired by David Gillespie, a Kamloops lawyer.

Province, DFO to probe TBT contamination from fish farms

Both the federal and provincial governments have undertaken studies of the impact of tributyltin anti-fouling paints on farmed salmon in the wake of a UFAWU call for a ban on the use of the chemical.

In a supplementary brief to the B.C. Finfish Inquiry, UFAWU researcher Geoff Meggs reported that tributyltin, or TBT, was in widespread use in the salmon farming industry under the brand name Flexguard.

TBT is extremely toxic, especially to marine organisms like mollusks. It has been detected in farmed fish on sale in the United States.

In a telegram to Fisheries Minister Tom Siddon, the union called for an immediate investigation to ensure no TBT-contaminated salmon is for sale in Canada.

The union also called for a freeze on the shipment of any salmon from farms using TBT-treated pens and permanent inspection and labelling regulations to ensure that farmed fish is marked as such at the retail level.

In an interview Dec. 9, provincial fisheries branch director Gordon Halsey said "we've advised and met individual farm site owners. We think there is an interest in the fish to stop using" TBT.

Meanwhile, the province has at last committed funds complete a study on TBT that was begun during the summer. Halsey said the province has "general concerns about TBT" although "no one has said for certain TBT is a problem."

TBT is banned in France for use on most vessels and under strict controls in several other countries.

Rudy Chang, of the federal fisheries inspection branch, said Dec. 9 his department is developing studies to allow regular inspection of farmed fish for TBT.

He said there are no plans to require the labelling of farmed fish. Siddon told the UFAWU earlier this year the department does not believe such regulations are necessary.

Anti-fouling paint scare in England

A SHOCK report by British Ministry of Agriculture, Fisheries and Food scientists that certain anti-fouling paints can be deadly to many types of fish and shellfish is causing growing concern to shellfish growers and inshore fishermen in England.

Ministry scientists have established a fatal link between anti-fouling paints containing toxic TBT (tributyl tin) compounds and the death or deformity of thousands of estuarine fish or shellfish.

South Devon fishing communities are worried that this new source of pollution is causing poor growth of oysters in the River Dart and at Salcombe — areas now used for mooring yachts.

The claim is now being made that the livelihoods of local fishermen are being threatened.

One shellfish farmer at Salcombe estimates that he has lost stock worth more than £25,000 and Captain Philip Gibbon of Offshore Farms, Totnes, has been moving thousands of threatened oysters to unpolluted rivers.

Local men also claim that the disappearance of winkles, cockles, mussels and shrimps from certain Devon estuaries may have been caused by the chemicals from anti-fouling paints.

Ministry experts have been quick to point out that, while small concentrations can prove fatal to marine life, it is harmless to humans when it is so diluted. But they have no doubt that it is toxic to fish and shellfish. Mike Waldock of the MAFF Fisheries Laboratory, Burnham-on-Crouch, confirmed that even 0.1 milligrams of TBT in one litre of water can be deadly to many kinds of marine life.

Oyster samples taken from the Dart showed a high level of TBT and this might explain the poor growth rates experienced in recent years. Pacific oysters are particularly sensitive to this chemical which causes shell thickening and slows down growth, and the local oyster industry — once expanding — seems to be affected by this toxic paint.

The Shellfish Association of Great Britain was hard at work last month lobbying government departments and certain MPs to ban the use of paints containing TBT. Protest letters have been sent to Westminster from river users, conservationists and anglers.

Devon Euro-MP Lord O'Hagan is being asked to back the case for banning TBT and to investigate the case made by the French who banned its use in 1982.

British government departments concerned with fishing, pollution and the environment are holding joint talks about whether changes in the legislation are necessary

WATCH ON TIN

THE fisheries departments in Britain recognise that there is evidence to show that tributyl tin in anti-fouling paints can inhibit the cultivation of shellfish.

Asked in the House of Commons what steps will be taken to ban tributyl tin compound in anti-fouling paints, the minister responsible for fisheries, John MacGregor, said that the Ministry of Agriculture, Fisheries and Food was considering with other government departments what action might be appropriate.

On the shellfish scene

With Dr. Eric Edwards, Director, Shellfish Association of Great Britain

FROM January 13, boatowners in Britain are not able to buy certain types of antifouling paints which contain high levels of organo-tin compounds, including tributyl tin (TBT).

Scientists now agree that TBT — the active ingredient of many yacht paints — is one of the most toxic substances deliberately discharged by man into the marine environment.

The British government through its Department of the Environment, aware of these dangers, has introduced some curbs on the use of TBT under the Control of Pollution (Anti-fouling Paints) Regulations 1985.

It is now a criminal offence to use the worst offenders among the organo-tin paints including those copolymer paints containing more than 7.5 per cent tin.

"Free association" paints in which the tin is not bound to resin have also been withdrawn.

Until recently the case against TBT paints centred on their stunting effect on the growth of Pacific oysters (*Crassostrea gigas*), which today form the basis of commercial oyster fisheries in Britain.

Scientists from the Fisheries Laboratory, run by the Ministry of Agriculture, Fisheries and Food at Burnham-on-Crouch, Essex, carried out field and laboratory trials from 1982 to 1984.

Their work has shown conclusively that even low levels of TBT in an estuary can cause shell thickening and malformation in Pacific oysters to such an extent that they become unsuitable for sale.

But there is growing evidence that TBT pollution has wider effects. Researchers at the University College of North Wales have found that the growth of phytoplankton is severely retarded and barnacle larvae can only survive a very short time in minute traces of TBT. (1 microgram of TBT per litre of seawater).

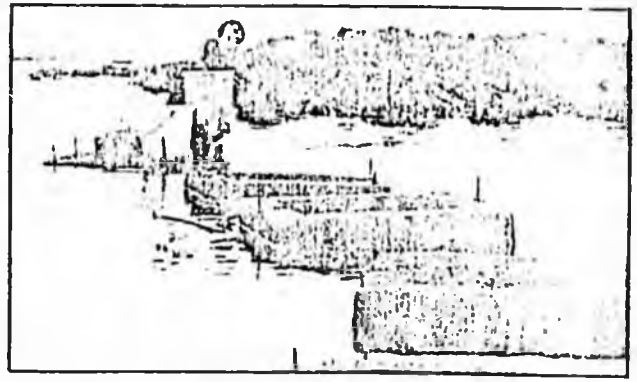
Enough

Some marine larvae were affected at one tenth of this concentration and a level of 0.5 micrograms of TBT per litre — a concentration found in estuaries with plenty of pleasure craft — was enough to reduce the population of the common mussel and to kill shrimps.

Environment Minister William Waldegrave, explaining the problem to yachtsmen, said: "Less than *one* teaspoonful of TBT in a million gallons of water is sufficient to stop the growth of phytoplankton — the marine equivalent of grass."

The Shellfish Association campaigned hard to press for controls on the use of TBT in anti-fouling paints. The French, greater connoisseurs of shellfish than the British, banned the use of TBT on boats that are less than 25 metres long in 1982. Biologists there had found that oyster shells were deformed, reproduction rates were reduced, and larvae stood less chance of surviving close to marinas and boat moorings.

Despite France's three-year-old ban, Britain has decided to move slowly. But the introduction of controls under the new anti-fouling rules is a start. Mr Waldegrave has promised parliament that these levels "will be reviewed in time for the 1987 yacht painting season" and a Government seawater monitoring programme is underway.



Concrete cages for rearing ormers off Guernsey.

What has disappointed me is the general lack of interest in protecting the marine environment shown by the yachting fraternity. Their main concern was to ensure that their favourite brand of paint would be on sale in their chandlery. Why should they bother if their boats kill the phytoplankton or reduce the life expectancy in mussel larvae?

Sea dump

As I wrote last month, the sea is too often used as a dumping ground for toxic wastes. At least the UK has made some attempt to begin controlling lethal organo-tins now proven to affect the marine environment.

In tropical and warm climes gastropods such as conchs or abalones are a favourite seafood. The northern European cousin of the Californian abalone and the Japanese awabi is the ormer (*Haliotis tuberculata*) found around the Channel Islands and parts of the north Brittany coast. In Guernsey and Jersey the ormer is a favourite seafood but unfortunately, since the late sixties, this large grey sea-snail has been mysteriously disappearing from their beaches.

Overfishing is blamed. The shore-gatherers accuse the divers of robbing islanders of their birthright by scooping up large hauls of the shellfish which are sold for high prices in France. In turn, the divers claimed that unrestricted shore-gathering had hit the shore population but there were plenty left in deep water.

In 1983 Guernsey's parliament decided to put a three-year ban on ormering and the island's Sea Fisheries Committee brought over a Japanese expert, Ikuo Hayashi, to study the biology and life cycle of this elusive gastropod.

Diving for ormers is now banned and Guernsey only allows them to be caught on 24 days in the year. But, despite these controls, *Haliotis* continues to get scarcer and some experts believe that a temperature drop in the English Channel over the past 20 years is causing ormers to retreat south to warmer areas.

Channel Islanders must have their ormers and fortunately Dr. John Mercer, of Galway University's Shellfish Research Laboratory at Carna, Ireland, is now rearing them in a pilot scale hatchery. He has supplied over ten thousand juveniles for the Channel Islands' farming trials.

Nurseries

On Guernsey, Sea Fisheries Officer John Lintell has set up ormer nurseries at five sites and one of his routine jobs is to ensure these vegetarians have plenty of tender seaweeds to graze upon.

As far as I know, the Guernsey ormer trial has been successful and the survival rate, to edible size, is between 80 and 90 per cent. The aim now is to encourage a private investor to start farming ormers commercially. No doubt some of the farmed animals will be used to restock the island's natural population but others will be exported to France where they fetch prices of £12-14 a dozen.

This is another example of how marine farming under controlled environmental conditions can help boost natural stocks. Well done to the Carna Shellfish Laboratory and the Guernsey Sea Fisheries Committee for this initiative!

TRIBUTYL TIN ANTI-FOULING AND OYSTERS
or
"There's tin on them thar hulls"
▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲

Recent work in Europe and the United States has indicated that recently developed tin based anti-fouling paints may have deleterious effects on oyster larvae development and shell growth. These new paints use bis-tributyltin oxide (flouride, sulphide) as the active ingredient. These substances are highly toxic, with a half-life in seawater of 2-3 weeks.

Alzieu et al (1982), stated that "anomalies of calcification, show an obvious correlation between the extent of malformation and the vicinity of boat concentrations". Experimental work by Waldock and Train (1983) showed C. gigas spat grew less well and exhibited pronounced thickening of the upper valve compared to controls. As well, at low concentration levels, (0.15 ug/l) bioaccumulation factors of 10000 times were recorded.

Earlier work by Waldock showed that, generally, concentrations of TBT in the water column were related to the intensity of use by boat traffic levels of organotin which resulted in growth irregularities (0.15 ug/l) were found to occur commonly while levels as high as 2.25 ug/l were recorded. Waldock suggests that levels of TBT which would have no effect on C. gigas would be below 0.08 ug/l.

Currently TBT anti-fouling paints are banned on vessels <25m in France and are also restricted in California.

In recent years, spatfall in Pendrell Sound has become less reliable than in the past and post-settlement mortalities appear to be increasing. While no accurate records are kept, Pendrell Sound is a popular stopover point for recreational boaters. During peak periods, 50-60 boats anchor at the head alone.

In light of the problems occurring in Europe and Pendrell Sound, Marine Resources carried out a small survey of anti-fouling paint use on boats anchored at the head of Pendrell. The following results were obtained:

Type of Bottom Paint:

Copper based	30
Tin based	7
Antimony based	2
Unknown	11
None used	2
	52

Ratio of use
by percent (n=39): 77 (copper): 18 (tin): 5 (antimony).

Mean length of stay for boats with tin based anti-fouling: 1.5 days.

Water line (wetted length) for boats with tin paint: x 30 feet.

It seems unlikely that the relatively low percentage of vessels utilizing tin based paint are alone sufficient to have major deleterious effect on spatfall success in Pendrell Sound. Whether tin based paints are one of a number of interactive factors affecting spatfall is a question outside the scope of current financial and staff availability.

Robert K. Cox
Shellfish Unit
Marine Resources Section

Oysters in danger from paint

RECENT research at the MAFF Fisheries Laboratory in Burnham-on-Crouch, England, has shown that tributyl tin (TBT) compounds unused in anti-fouling paints can cause excessive shell thickening in Pacific oysters.

Native oysters *(O.edulis)* do not appear to be affected in this way but toxicity tests indicate that the larval stages of oysters and crustacea can be killed with low concentrations of TBT.

Reporting this in its latest newsletter, the Shellfish Association of Great Britain, says that the work has established that TBT levels in some estuaries, used for mooring pleasure craft, are at a level which can cause problems to certain shellfish.

FFI

Britain may move on killer paints

TOUGHER controls on certain antifouling paints containing tributyl tin (TBT) compounds, which can kill or retard the growth of estuarine fish and shellfish, are being consiuered in Britain.

Consultation is now taking place between government departments, the Shellfish Association and environmental groups. The plan is to include all antifouling paints in new pesticide regulations, and to bring in tighter screening procedures.

Manufacturers of antifouling paints would have to have them tested to ensure limited toxicity to the environment, putting them on the same footing as pesticides used by farmers.

The shellfish industry has already suffered badly from this antifouling pollution with many growers facing financial losses due to poor shell growth in oysters and mussels.

Research has also proved that toxic antifoulants can cause a wide range of environmental problems, especially in shallow enclosed estuaries where even minute traces of TBT are known to kill the young larvae of most estuarine fish or shellfish. Tests have also shown that phytoplankton — the 'grass of the sea' — is destroyed by TBT.

Regulations, which came into force in January, make the retail sale of most yacht antifouling paints, which contain high levels of TBT, illegal. But because of the complexity of finding acceptable antifouling replacements, it seems likely that there will be a long lead-in time before the new regulations come into operation.

Paint curb welcome

THE British Department of the Environment's new regulations to limit the use of antifouling paints containing tributyl tin (TBT) have been well received by the shellfish industry.

The industry has suffered badly because dangerous levels of TBT in antifouling paints is accumulated by oysters and can cause shell thickening to such an extent as to make oysters unsaleable. Growth rates of oysters have also been adversely affected in some estuaries.

Additional evidence proves that even minute levels of TBT can kill the young stages of soles, shrimps, crabs, and mussels, as well as oysters.

Plans to expand the UK production of Pacific oysters, and the struggle to maintain beds of native oysters, have been seriously affected by TBT contamination. At least one specialised oyster and clam nursary in a recreational area has had to close and employment in the industry has suffered.

The Shellfish Association of Great Britain has urged both the Ministry of Agriculture, Fisheries and Food and the Department of the Environment to ban the use of TBT in antifouling paints sold in the UK. The French government took action in 1982 when it prohibited its use in boats less than 25 metres in length and reports confirm that their shellfish industry has already benefitted from this control.

Navy studies paint risks

TWO-PACK and 'coal tar' epoxy paints, which are widely used aboard ships, have recently attracted some suspicion about their possible effects on users' health. These effects may not be permanent, but they are very unpleasant and it is best to adhere strictly to the paint manufacturers' instructions.

The latest issue of the *Journal of the Royal Naval Medical Service* discusses a study of work-related symptoms and lung function in a group of painters working in a British naval dockyard. They were exposed to organic solvents and epoxy-resin-containing paints used during refitting work.

The study was triggered by complaints of asthma in another dockyard, and it was suggested that the organic solvents and epoxy resins could be a health hazard.

There are several possibilities involved. For example, the epoxy resins can cause dermatitis, and the curing agents, such as ethylene amines, alipnatic polyamines, phthalic anhydride and trimellitic acid anhydride, have been associated with occupational asthma. Also, chronic low exposure is thought to have produced harmful neuropsyhiatric effects.

These possibilities are made more ominous by reports that almost three quarters of the men involved at some time had to stop work and get into fresh air. It was not surprising that smokers did not come out of the tests too well and were found to suffer more from shortness of breath, phlegm and cough. But a large proportion of almost 100 men involved said that they regularly suffered from irritations, coughing and stomach trouble while painting.

Figures show that 65 per cent suffered from eye irritation, 70 per cent lightheadedness, 50 per cent throat irritation and 40 per cent nausia. Also 71 per cent complained of a taste of solvents in their mouths, and many suffered from a combination of these unpleasant effects.

The critical symptoms affecting the men who were forced to stop work were lightheadedness and sore or runny eyes.

It was very likely that the levels of solvents were quite high in the confined quarters where the paint was being applied. Most paint makers do advise that there is proper ventilation and that breathing apparatus is used when necessary.

Many of the painters disliked the full-face air-fed masks which were supplied, saying they were too heavy and bulky for comfort. When they used half-face masks they suffered problems with irritants getting into their eyes.

The survey concluded that several approaches could be made to the problem. These included making the painters aware of the risks involved in not using the face-masks, using paints with less volatile solvents, and improving ventilation.

One leading paint maker said that it would be difficult to make paints with less solvents, and the only way to cut down on curing agents would be to use heat to cure the paint. This would be unsatisfactory in a confined space.

Obviously there has not been strict enough control of painting practices in the particular dockyard concerned, and although things are now being tightened up there it is clear that other painters will also suffer unless they are very careful.

Similar problems have been found in the past with welders in dockyards. They have suffered from metal fume fever, and a study by the Institute of Naval Medicine showed that this was largely due to their reluctance to wear suitable protective masks.

According to the officer who conducted the paint survey, it is likely that the effects are only temporary, but this is not guaranteed.

Boat paints are killing estuaries and fisheries

by Andrea Granahan

Scientists are warning fishermen and pleasure boaters that the bottom paints they are using on their boats is highly toxic and is killing off life in marinas, and estuaries.

"This is not environmental red flag waving. This is serious. The compounds we are looking at are much worse than DDT and may be the environmental problem of the 1980s and 1990s," said Paul Siri, manager of the Bodega Marine Laboratory in California.

The culprit is tin. Anti-fouling boat paints have switched from a copper base to tin in recent years. Now there is evidence that the tin based paints are responsible for the death of a major oyster fishery in Europe. Britain and France have already severely curtailed the use of the paints.

A report funded by the California Department of Water Resources and the Environmental Protection AGency has been issued by Scripps Institute of Oceanography. Dr. E. Goldberg, a leading marine chemist, studied a number of American marinas and determined tin compounds, tributyltin and bibutyltin, are turning estuaries into "sterile deserts."

A general alert has gone out to those who use the paints. Some marine suppliers have appealed to paint companies to come up with a substitute. The EPA is reviewing Goldberg's alarming report. Marine scientists are calling for a ban of the product.

Fish. News 1986 #[illegible] 3

Antifoulant search takes a new turn

ATTEMPTS to find an alternative to the toxic organotins used in antifouling paints have taken a new turn, reports ROBIN BURTON. Scientists in the USA and Britain are beginning to concentrate on formulae which deter foulants from settling, rather than poisoning them and the surrounding water.

A British research team from the oil company Shell last year announced the development of silicone rubber coating impregnated with ordinary mineral oil. It is about 5 mm thick, and marine life is unable to get a grip on it and goes away.

It is open to question whether bacteria will develop to beat the repellant, but after six years of testing there has been no sign of the necessary genetic mutations.

The US Naval Research Laboratory has developed an experimental coating of powdered polytetrafluoroethylene, more widely known as Teflon, dispersed in fluorinated polymers. It is meant to have the same effect as a non-stick frying pan.

A sample coating was applied to the hull of a tug [illegible] to take a grip.

This paint is said to have several advantages. Apart from being non-poisonous and long-lasting it can be easily cleaned off underwater with a power brush.

Further research at the University of Delaware has studied the rate at which bacteria attach to various plastic, glass and metal surfaces, and how foulants protect themselves from each other. It has been found that sessile organisms, such as sponge, which cannot move, protect themselves by producing secondary metabolities.

Several natural marine products have also been found to contain halogen elements, such as bromine, chlorine and iodine. These halogens are known as poisons, but are proving effective as antifoulants at low concentrations which have a minimal affect on the marine environment.

Overall, scientists are hoping that their efforts at 'stealing' chemical systems from the natural world will result in better ways of controlling fouling on ships' hulls.

ADDITIVE MAKES PAINT SAFER

THE Star Brite Corporation claims to have developed an antibiotic marine paint additive which will satisfy the demands of skippers and environmentalists. Compound X increases the life of antifouling paints without giving off the toxic materials which can be harmful to marine life and to humans.

Despite being a very costly operation, bottom painting is important to fishing vessels as it provides a safeguard against fouling, which ultimately increases drag and fuel consumption, and reduces profits. But a constant problem with antifoulants is that their toxic materials are not biodegradable and continue to create a menace.

Dr. Ralph Grams of the Department of Pathology at the University of Florida has been working on these problems for several years. He selected a series of compounds thought to be active underwater and added them to existing paint formulae. One of these compounds proved to be highly active, adding six or seven months to the lifespan of most antifoulants in the tidal flow areas off Florida.

Further tests on the compound showed that what toxicity it possessed self-destructed in 12 to 24 hours, and although it does not work indefinitely it has been proved to double the life of most antifouling paints.