

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	3
OVERVIEW PAPERS	17
J. M. Coe	19
A review of marine debris research, education, and mitigation in the North Pacific	
B. Heneman	50
Overview: Marine debris in the northwest Atlantic Ocean	
M. R. Gregory	55
Plastics: Accumulation, distribution, and environmental effects of meso-, macro-, and megalitter in surface waters and on shores of the southwest Pacific	
P. G. Ryan	85
The marine plastic debris problem off southern Africa: Types of debris, their environmental effects, and control measures	
M. F. Tillman	103
International efforts to control marine debris in the Antarctic	
J. E. Corredor and J. M. Morell	115
Cooperative research on petroleum pollution in the Caribbean: The CARIPOL program [Abstract]	
SESSION I. AMOUNTS, TYPES, DISTRIBUTION, AND SOURCES OF MARINE DEBRIS	117
J. Cantin, J. Eyraud, and C. Fenton	119
Quantitative estimates of garbage generation and disposal in the U.S. maritime sectors before and after MARPOL Annex V	
R. H. Day, D. G. Shaw, and S. E. Ignell	182
The quantitative distribution and characteristics of marine debris in the North Pacific Ocean, 1984-88	
S. Mio, S. Takehama, and S. Matsumura	212
Distribution and density of floating objects in the North Pacific based on 1987 sighting survey	
R. H. Day, D. G. Shaw, and S. E. Ignell	247
The quantitative distribution and characteristics of neuston plastic in the North Pacific Ocean, 1984-88	

S. Matsumura, Y. Wakata, and Y. Sugimori	267
Movements of floating debris in the North Pacific	
J. A. June	279
Type, source, and abundance of trawl-caught marine debris off Oregon, in the eastern Bering Sea, and in Norton Sound in 1988	
C. A. Ribic and L. J. Bledsoe	302
Estimating the density of floating marine debris: Design considerations	
W. R. Trulli, H. K. Trulli, and D. P. Redford	309
Characterization of marine debris in selected harbors of the United States	
M. Yukinawa and S. Mio	325
Preliminary report on the distribution of small-sized marine debris in Suruga Bay	
S. W. Johnson	331
Distribution, abundance, and source of entanglement debris and other plastics on Alaskan beaches, 1982-88	
A. M. Manville II	349
A survey of plastics on western Aleutian Island beaches and related wildlife entanglement	
R. H. Podolsky	364
Entrapment of sea-deposited plastic on the shore of a Gulf of Maine island [Abstract]	
R. L. Swanson and R. Zimmer	365
Washups of floatable waste materials and their impact on New York Bight beaches [Abstract]	
K. V. Koski	366
Plastic debris and derelict fishing gear on Shackleford Banks, North Carolina [Abstract]	
A. F. Amos and P. T. Plotkin	367
Anthropogenic and natural debris on a south Texas barrier island beach [Abstract]	
A. Golik and Y. Gertner	369
Solid waste on the Israeli coast--composition, sources, and management	
K. J. O'Hara	379
National marine debris data base: Findings on beach debris reported by citizens	

C. A. Ribic and S. W. Johnson	392
Guidelines for the design of beach debris surveys	
D. J. Slip and H. R. Burton	403
The composition and origin of marine debris stranded on the shores of subantarctic Macquarie Island	
SESSION II. ENTANGLEMENT OF MARINE LIFE AND GHOST FISHING	417
N. Baba, M. Kiyota, and K. Yoshida	419
Distribution of marine debris and northern fur seals in the eastern Bering Sea	
D. P. French and M. Reed	431
Potential impact of entanglement in marine debris on the population dynamics of the northern fur seal, <i>Callorhinus ursinus</i>	
C. W. Fowler, R. Merrick, and J. D. Baker	453
Studies of the population level effects of entanglement on northern fur seals	
A. E. Kuzin	475
A study of the effects of commercial fishing debris on <i>Callorhinus ursinus</i> from breeding islands in the western Pacific	
C. A. Ribic and G. L. Swartzman	483
An index of fur seal entanglement in floating net fragments	
R. L. DeLong, P. J. Gearin, J. L. Bengtson, P. Dawson, and S. D. Feldkamp	492
Studies of the effects of entanglement on individual northern fur seals [Abstract]	
K. Yoshida, N. Baba, M. Kiyota, M. Nakajima, Y. Fujimaki, and A. Furuta	494
Studies of the effects of net fragment entanglement on northern fur seals. Part 1: Daily activity patterns of entangled and nonentangled fur seals	
K. Yoshida, N. Baba, M. Kiyota, M. Nakajima, Y. Fujimaki, and A. Furuta	503
Studies of the effects of net fragment entanglement on northern fur seals. Part 2: Swimming behavior of entangled and nonentangled fur seals	
G. L. Swartzman, C. A. Ribic, and C. P. Huang	513
Simulating the role of entanglement in northern fur seal, <i>Callorhinus ursinus</i> , population dynamics	

M. Nakajima, H. Yasuda, and K. Yoshida	531
Histological observation of damage to dermal tissue of fur seal caused by net entanglement	
J. R. Henderson	540
Recent entanglements of Hawaiian monk seals in marine debris	
B. S. Stewart and P. K. Yochem	554
Pinniped entanglement in synthetic materials in the Southern California Bight	
S. S. Sadove and S. J. Morreale	562
Marine mammal and sea turtle encounters with marine debris in the New York Bight and the northeast Atlantic	
P. A. Breen	571
A review of ghost fishing by traps and gillnets	
T. Gerrodette, B. K. Choy, and L. M. Hiruki	600
An experimental study of derelict gillnet fragments in the central Pacific Ocean	
S. Mio, T. Domon, K. Yoshida, and S. Matsumura	615
Preliminary study on change in shape of drifting nets experimentally placed in the sea	
SESSION III. INGESTION BY MARINE LIFE	621
P. G. Ryan	623
The effects of ingested plastic and other marine debris on seabirds	
H. Ogi	635
Ingestion of plastic particles by sooty and short-tailed shearwaters in the North Pacific	
D. G. Ainley, L. B. Spear, and C. A. Ribic	653
The incidence of plastic in the diets of pelagic seabirds in the eastern equatorial Pacific region	
L. Sileo, P. R. Sievert, M. D. Samuel, and S. I. Fefer	665
Prevalence and characteristics of plastic ingested by Hawaiian seabirds	
D. G. Ainley, W. R. Fraser, and L. B. Spear	682
The incidence of plastic in the diets of Antarctic seabirds	
R. H. Podolsky and S. W. Kress	692
Plastic debris incorporated into double-crested cormorant nests in the Gulf of Maine [Abstract]	

D. E. Hoss and L. R. Settle	693
Ingestion of plastics by teleost fishes	
T. Kubota	710
Synthetic materials found in the stomachs of longnose lancetfish collected from Suruga Bay, central Japan	
G. H. Balazs and B. K. Choy	718
Ecological aspects of marine turtles impacted by ocean debris: A 1989 perspective [Abstract]	
P. L. Lutz	719
Studies on the ingestion of plastic and latex by sea turtles	
P. Plotkin and A. F. Amos	736
Effects of anthropogenic debris on sea turtles in the northwestern Gulf of Mexico	
I. Uchida	744
On the synthetic materials found in the digestive systems of, and discharged by, sea turtles collected in waters adjacent to Japan [Abstract]	
R. J. Tarpley	745
Plastic ingestion in a pygmy sperm whale, <i>Kogia</i> <i>breviceps</i> [Abstract]	
N. B. Barros, D. K. Odell, and G. W. Patton	746
Ingestion of plastic debris by stranded marine mammals from Florida [Abstract]	
W. A. Walker and J. M. Coe	747
Survey of marine debris ingestion by odontocete cetaceans	
 SESSION IV. ECONOMIC IMPACTS ON VESSELS AND SHORELINES	 775
N. F. Meade, K. M. Drazek, and V. R. Leeworthy	777
An economic perspective on the problem of marine debris	
S. Takehama	792
Estimation of damages to fishing vessels caused by marine debris, based on insurance statistics	
R. E. Weisbrod	810
New York State marine debris program [Abstract]	
K. D. Wagner	811
Medical wastes and the beach washups of 1988: Issues and impacts	

SESSION V. SOLUTIONS THROUGH TECHNOLOGY	825
G. Scott	827
The philosophy and practice of degradable plastics	
A. L. Andrady	848
Environmental degradation of plastics under land and marine exposure conditions	
M. Xanthos, P. G. Kelleher, A. Patel, and W. G. Gordon	870
Recycling of marine plastics debris through melt reprocessing: A case for lost or abandoned fishing gear	
C. S. Alig, L. Koss, T. Scarano, and F. Chitty	879
Control of plastic wastes aboard naval ships at sea	
L. A. Martinez	895
Shipboard waste disposal: Taking out the trash under the new rules	
T. J. Chang	915
Low technology (burn barrel) disposal of shipboard-generated (MARPOL V) wastes	
F. Recht and S. Lasseigne	921
Providing refuse reception facilities and more: The port's role in the marine debris solution	
M. Aizawa and A. Satou	935
Disposition and recycling of plastic products including used nets	
 SESSION VI. SOLUTIONS THROUGH LAW AND POLICY	 945
D. P. Redford	947
Status of the U.S. Environmental Protection Agency marine debris activities and programs	
D. T. Edwards and E. Rymarz	956
International regulations for the prevention and control of pollution by debris from ships	
M. J. Bean	989
Redressing the problem of persistent marine debris through law and public policy: Opportunities and pitfalls	
R. E. Seebald	998
Implementation and enforcement of Annex V of MARPOL 73/78 in the United States [Abstract]	
C. A. Crampton	999
The Coast Guard's Annex V compliance report: A case study	

J. Sawaki and I. Yamaguchi	1008
Control regulations for discharge of onboard wastes from ships	
R. Rose	1020
Marine plastic debris: What Washington State has done	
G. Peet	1034
The protection of specific sea areas against marine debris	
L. M. Paul	1045
Using the protective principle to unilaterally enforce transnational marine pollution standards	
 SESSION VII. SOLUTIONS THROUGH EDUCATION	 1075
R. G. Bruner	1077
The plastics industry and marine debris: Solutions through education	
T. R. Dixon	1090
MARPOL 73/78 information, education, and training: Meeting the challenge	
P. Debenham	1100
Education and awareness: Keys to solving the marine debris problem	
B. Wallace	1115
Shipping industry marine debris education plan	
N. Yagi and Y. Otsuka	1123
Cleanup program in Japan	
L. Koss, F. Chitty, and W. A. Bailey	1132
U.S. Navy's plastics waste educational efforts	
B. Wallace	1140
How much do commercial and recreational fishermen know about marine debris and entanglement? Phase 1	
J. Neilson	1149
The Oregon experience--four years later	
A. Farias	1154
The Texas Adopt-A-Beach Program: A public/private approach to clean beaches	
J. Humphreys and P. Mullin	1165
Marine debris demonstration and education project at Squalicum Harbor, Bellingham, Washington, U.S.A.	

S. Friday	1174
Marine debris: North Carolina's solutions through education	
S. Laska	1179
Designing effective educational programs: The attitudinal basis of marine littering	
 POSTER PRESENTATION	 1191
G. J. Vauk and E. Schrey	1193
Animals as litter victims at the German North Sea coast	
J. N. Kushima and R. P. Clarke	1194
Marine debris and epipelagic fishes	
 VIDEO PRESENTATION	 1195
A. F. Amos	1197
Portrait of a barrier island beach	
Offshore Operators Committee	1198
U.S. oil industry efforts in addressing beach debris problem	
Government of Japan	
Plastic pollution: The sea is crying	
Government of Japan	
Cleanup operation of the sea floor	
Government of Japan	
Japanese research activities on marine debris	
 WORKING GROUP REPORTS	 1199
Report of the working group on methods to	1201
assess the amount and types of marine debris (C. A. Ribic, Chair)	
Report of the working group on entanglement	1207
of marine life (W. R. P. Bourne, Chair)	
Report of the working group on ghost fishing	1216
(P. A. Breen, Chair)	
Report of the working group on ingestion	1226
(L. Sileo, Chair)	

Report of the working group on economic aspects of marine debris (K. E. McConnell, Chair)	1235
Report of the working group on technology (W. G. Gordon, Chair)	1240
Report of the working group on law and policy (D. Cottingham, Chair)	1249
Report of the working group on marine debris education (K. J. O'Hara, Chair)	1256
APPENDIXES	1261
Appendix A. Steering group	1263
Appendix B. Agenda of the workshop	1264
Appendix C. List of participants	1265